

Effect of Seed Mycoflora in Producing Abnormal Seedling in Rice (*Oryza sativa*) Hybrids and its Parental Lines

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ABSTRACT Two rice hybrids and their parental lines were collected from Haryana and Andhra Pradesh of India in 2003. These seed lots were used to study the role of *Bipolaris oryzae* in producing abnormal seedlings. At the end of germination test, abnormal seedlings were separated and classified into different categories of abnormal seedlings according to their external morphology. These abnormal seedlings were transferred to the top of wet blotters in Petri dishes and incubated at 20°C under 12 h alternating cycles of NUV light and darkness. Generally, 3 to 4 days were optimal for the fungus to sporulate for recording the fungus associated with the different categories of abnormal seedlings.

Key words: Seed mycoflora, abnormal seedlings, rice hybrids

Brown spot of rice, a fungal disease is caused by *Bipolaris oryzae* Breda de Haan that is prevalent in all the rice growing countries of the world and most of the cultivars grown in the world are susceptible to this pathogen. Though it is considered as a minor disease, it is known to cause considerable economic losses during normal years and at times like the great Bengal famine of 1942 [1].

The pathogen is known to cause damage at different stages like: storage, seed germination and seedling establishment, vegetative growth and reproductive phase. The nature of damage caused by the pathogen differs with different stages. At the time of storage it affects seed quality parameters like germination, viability, and vigor while at the time of germination test, it affects both root and shoot system, thereby causing seedling blight. Due to formation of brown spots and blight symptoms on leaves, total photosynthetic area gets reduced during vegetative phase. At reproductive phase, the nature of damage is in the form of grain discoloration, poor grain filling and reduced yield.

Hence, the present study of role of *Bipolaris oryzae* in producing abnormal seedling of rice needs to be undertaken to confirm its potential damages.

MATERIALS AND METHOD

There were two rice hybrids along with their parental lines viz. PRH 10, P6-A, P6-B, PRR-78 and DRRH 1, IR 28025-A, IR 28025-B, IR40750-R were collected from Karnal (Haryana) and Hyderabad (Andhra Pradesh) respectively in Kharif 2002 and used in the study.

The role of *Bipolaris oryzae* in producing abnormal seedlings was determined by using the between paper method and standard blotter method [2]. Four hundred seeds in four replicates of hundred seeds each were incubated at 25° C for 7 days' and were evaluated for normal, abnormal seedlings, fresh ungerminated and dead seeds according to the International Rules for Seed Testing [2]. Abnormal seedlings were further classified into different categories of abnormal seedlings according to their external morphology [3].

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- Category 1: No root(s)
 Category 2: No root, decay in shoot
 Category 3: Short root
 Category 4: Decay in shoot (shoot usually weak and showing decay near the point of attachment to the seed)
 Category 5: Decay in shoot and root
 Category 6: Primary root showing browning, no branching or secondary development, usually shoot appearing weak
 Category 7: Coiling or twisted shoot (shoot appearing weak and showing browning)
 Category 8: Spindly, pale or watery shoot
 Category 9: Weak, spindly primary roots

Abnormal seedlings had no mycelial growth and also those having only mycelium of a fungus, were transferred to the top of wet blotters in Petri dishes and incubated at 20°C under 12 h alternating cycles of NUV light and darkness for the detection and identification of associated mycoflora.

RESULTS AND DISCUSSION

Nine categories of seedling abnormality were recorded after germination test are as follows: No

root(s); decay in shoot; short root; decay in shoot; decay in shoot and root; browning primary root and weak shoot; coiling or twisted shoot; spindly, pale or watery shoot; and weak, spindly primary roots. Seedlings with decay in shoot and seedlings with decay in both root and shoot were encountered most frequently in 33.33 per cent and 21.17 per cent of the total abnormal seedlings respectively. Incidence of *Bipolaris oryzae*, *Alternaria padwickii* and *Curvularia lunata* on the abnormal seedlings was 43.2 per cent, 48.7 per cent and 50.9 per cent respectively. *Bipolaris oryzae*, *Alternaria padwickii* and *Curvularia lunata* were present in 61.7 per cent, 68.1 per cent and 53.6 per cent respectively of the seedlings with decay in shoot and root, and in 56.8 per cent, 55.6 per cent and 55.4 per cent respectively of the seedlings with decay in shoot.

Majority of the seed of all the parental lines fell in 4th and 5th category where the decay was recorded either in shoot alone (33.3%) or root and shoot both (21.17%) followed by 2nd, 8th, 7th and 9th category representing 13.5, 11.7, 9.9 and 5.4 per cent seeds respectively.

Associated fungi and their role

Ten seedborne fungi were detected by using the blotter method in the study. They were *Bipolaris*

Table 1. Distribution of abnormal seedlings (AS) in eight seed lots (400 seeds)

Categories of abnormal seedlings	Rice hybrids/parental lines								Total	Total (%)
	IR 58025 A	IR 58025 B	IR 40740 R	DDR H-1	P6-A	P6-B	PRR-78	PRH-10		
No root(s)	1	0	0	0	1	1	1	0	4	1.80
No root, decay in shoot	3	8	0	4	0	7	8	0	30	13.51
Short root	2	0	0	0	0	0	0	0	2	0.90
Decay in shoot	16	14	1	11	5	10	7	10	74	33.33
Decay in shoot and root	8	6	0	3	2	10	13	5	47	21.17
Browning primary root	3	6	0	2	5	3	2	1	22	9.91
Coiling or twisted shoot	0	0	0	1	0	0	2	2	5	2.25
Spindly, pale or watery shoot	1	1	0	1	6	7	5	5	26	11.71
Weak, spindly primary root	2	1	1	1	1	1	4	1	12	5.41
Total abnormal seedling	36	36	2	23	20	39	42	24	222	
Per cent	9	9	0.5	5.75	5	9.75	10.5	6	55.5	

Table 2. Number of fungal infected seeds on different categories of abnormal seedlings

Categories of abnormal seedlings	No. infected seeds per sample (400 seeds)									
	Bo	Ap	Fm	Fp	Cl	Rhi	Asp	Aa	Pen	So
No root(s)	0.00	0.38	0.00	0.00	0.25	0.00	0.00	0.00	0.00	0.00
No root, decay in shoot	1.50	2.50	0.00	0.00	1.88	0.00	0.13	0.63	0.13	0.25
Short root	0.13	0.13	0.00	0.00	0.13	0.00	0.13	0.00	0.00	0.00
Decay in shoot	5.25	4.13	0.00	0.00	5.13	0.63	0.38	1.13	0.25	0.38
Decay in shoot and root	3.63	4.00	0.13	0.13	3.50	0.13	0.13	0.50	0.13	0.50
Browning primary root	0.38	1.00	0.00	0.13	1.00	0.00	0.00	0.25	0.25	0.00
Coiling or twisted shoot	0.13	0.25	0.00	0.00	0.25	0.00	0.00	0.00	0.00	0.00
Spindly, pale or watery shoot	1.00	1.00	0.00	0.50	1.63	0.00	0.00	0.38	0.00	0.00
Weak, spindly primary root	0.00	0.13	0.13	0.00	0.38	0.00	0.00	0.25	0.13	0.00
Total	12.0	13.50	0.26	0.76	14.1	0.76	0.77	3.14	0.89	1.13

Table 3. Incidence of seedborne fungi associated with the different categories of abnormal seedlings

Categories of abnormal seedlings	Incidence of seedborne fungi									
	Bo	Ap	Fm	Fp	Cl	Rhi	Asp	Aa	Pen	So
No root(s)	0.00	75.00	0.00	0.00	50.00	0.00	0.00	0.00	0.00	0.00
No root, decay in shoot	40.00	66.67	0.00	0.00	50.00	0.00	3.33	16.67	3.33	6.67
Short root	50.00	50.00	0.00	0.00	50.00	0.00	50.00	0.00	0.00	0.00
Decay in shoot	56.76	44.59	0.00	0.00	55.41	6.76	4.05	12.16	2.70	4.05
Decay in shoot and root	61.70	68.09	2.13	2.13	59.57	2.13	2.13	8.51	2.13	8.51
Browning primary root	13.64	36.36	0.00	4.55	36.36	0.00	0.00	9.09	9.09	0.00
Coiling or twisted shoot	20.00	40.00	0.00	0.00	40.00	0.00	0.00	0.00	0.00	0.00
Spindly, pale or watery shoot	30.77	30.77	0.00	15.38	50.00	0.00	0.00	11.54	0.00	0.00
Weak, spindly primary root	0.00	8.33	8.33	0.00	25.00	0.00	0.00	16.67	8.33	0.00
Per cent abnormal seedling infected	43.24	48.65	0.90	2.70	50.90	2.70	2.70	11.26	3.15	4.05

Ap: *Alternaria padwickii*; Bo: *Bipolaris oryzae*; Fm: *Fusarium moniliforme*; Fp: *Fusarium pallidoroseum* [*Fusarium semitectum*]; Cl: *Curvularia lunata*, Rhi: *Rhizopus spp.*; Aa: *Alternaria alternata*, So: *Sarocladium oryzae*; Asp: *Aspergillus spp.*; Pen: *Penicillium spp.*

oryzae, *Alternaria padwickii*, *Fusarium moniliforme*, *Fusarium pallidoroseum*, *Curvularia lunata*, *Alternaria alternata*, *Sarocladium oryzae*, *Rhizopus sp.*, *Aspergillus sp.*, and *Penicillium sp.* The most predominant seedborne fungi were *Bipolaris oryzae*, *Alternaria padwickii* and *Curvularia lunata*. *Bipolaris oryzae* appeared on 43.24 per cent of abnormal seedling, *Alternaria padwickii* and *Curvularia lunata*

appeared on 48.65 per cent and 50.90 per cent respectively of abnormal seedlings, while other seedborne fungi occurred in the range of 0.9-11.26 per cent (Table 2 and Fig. 2). Zad and Khosravi [4] also reported similar association of seedborne fungi with abnormal seedlings of rice, which supports our studies. *Bipolaris oryzae*, *Alternaria padwickii* and *Curvularia lunata* caused 56.76, 44.59 and 55.41

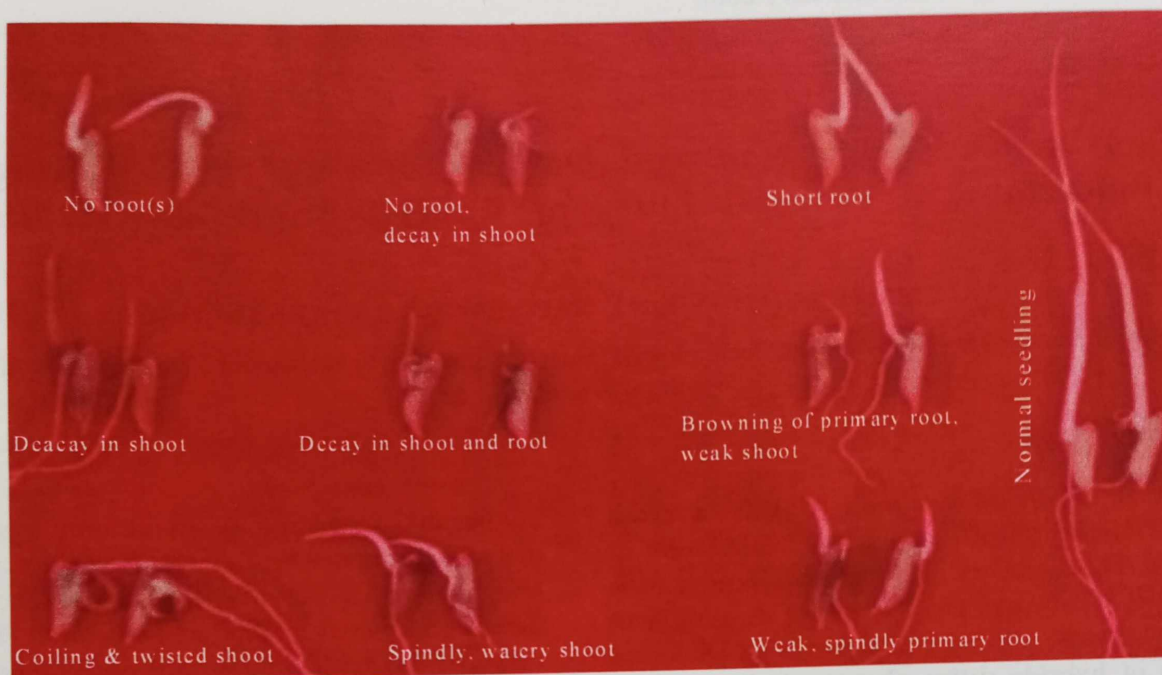


Fig. 1. Different categories of abnormal seedlings

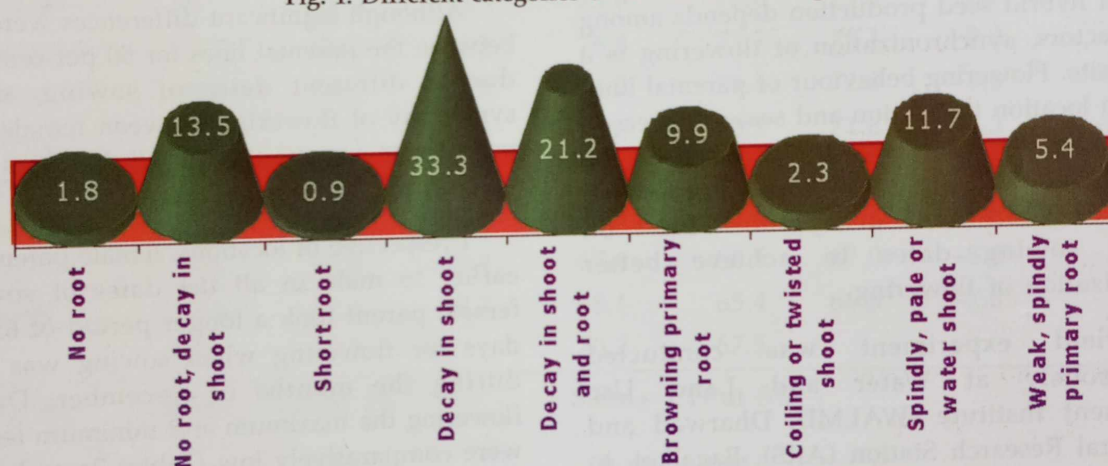


Fig. 2. Distribution of abnormal seedlings in seed lots

per cent shoot decay and 61.7, 68.09 and 59.57 per cent shoot and root decay of the seedlings respectively (Table 3). The results of the study was also confirmed by Guerrero *et al.* [3]. Hence, three seedborne fungi *Bipolaris oryzae*, *Alternaria padwickii* and *Curvularia lunata* were considered as the important agents in producing the abnormal seedlings. This is because they were found associated consistently with the abnormal seedlings in general and with abnormal seedlings with decay in shoot and abnormal seedlings with decay in shoot and root in particular.

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