

Influence of seed associated mycoflora on germination of maize and rice crops

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ABSTRACT

Maize (*Zea mays*) and Rice (*Oryza sativa* L.) are the major grain crops of the India, which is cultivated in different regions of country. During harvest and post-harvest phases several fungi have been reported that include *Fusarium* spp., *Aspergillus* spp., *Penicillium* spp., *Rhizopus* spp, *Mucor* spp. and *Alternaria* spp. in Maize and *Rhizopus stolonifer*, *Aspergillus* spp. *Fusarium moniliforme*, *Phoma* sp. *Bipolaris oryzae*, *Curvularia lunata*, *Penicillium* sp. *Alternaria tenuissima*, *Nigrospora oryzae*, *Chaetomium globosum* and *Tilletia barclayana* in rice. With a view to analyze the seed lots for possible use in seed multiplication, present investigation was undertaken, that were serve as a base for improvement and enhancement of quality of seed lots. The study was conducted at department of plant pathology, JNKVV, Jabalpur (Madhya Pradesh). The results obtained from the study revealed that a fair difference in the seed germination was found when the seeds were placed between the blotter as compared to top of the blotter papers as per protocol of ISTA. The discoloured and shriveled seed had lesser germination as compared to apparently normal seeds.

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INTRODUCTION

Insufficient availability of seed is one of the key concerns for present water deficit agriculture, to feed the ever increasing human being. Due to stringent certification measures, a substantial part of the produce is not considered suitable for sowing purpose and is not accepted for seed multiplication chain of crops by law enforcement agencies. The quantity of physically identified seed is a lot and a lot that does not fulfill the desired requirements is designated as *substandard lot*

(Khare and Bhale, 2010). Requirements regarding genetic purity, physical purity, germination, vigour and freedom from seed associated micro-organisms are considered for sowing seed quality of a crop (Agrawal and Dadlani, 1995). Seed borne diseases are caused by associated micro-organisms affecting seeds quality. Seeds are attacked by various fungi, bacteria and viruses at different stages *viz.*, in the field, during processing, at the time of transportation, and during storage. In the present investigation seeds of maize and rice crop from

different sources were obtained. Based upon seed morphology, samples were prepared for detection of associated mycoflora. With a view to analyze the seed lots for possible use in seed multiplication, present investigation is undertaken, that will serve as a base for improvement and enhancement of quality of seed lots. The investigation was undertaken to study the influence of seed associated mycoflora on germination of seeds from substandard lots.

MATERIAL AND METHODS

The present studies were undertaken to investigate the association of mycoflora with sub-standard seed lots of maize (*Zea mays*) and rice (*Oryza sativa* L.) crops. The impact of associated mycoflora on germination of seeds from substandard lots. The studies were conducted at Jabalpur that lies between 22°49' and 20°80' North latitude and 78°21' and 80°58' East longitude at an altitude 411.78 metre above the mean sea level. Seed sample of six crops were obtained from the Seed production unit of the University, local mandi and traders and local farmer. Seed samples, so received were numbered and kept in paper envelopes. The samples were stored under low temperature conditions (4°C) to avoid further deterioration.

Detection of mycoflora associated with seeds :

Mycoflora associated with rice and maize were detected by examination of dry seed, standard blotter method (ISTA, 2005) and standard Agar-plate method (ISTA, 2005). Standard Ragdoll method (ISTA, 2005) was used for the testing germination of seed and associated mycoflora. In this method, seed of the each crop were used. The towel (blotters) papers were sufficiently moistened with sterilized water. The excess water were, removed the wet towel were stretched over

the flate and cleaned surface of the table. Fifty seed were arranged on the half portion of the wet paper. Seed were covered with the other half portion of the paper and rolled over. A piece of wax paper was wrapped on the rolled paper towel and the both ends were titened with rubber bands. It prevented the run-off of water as well helped in maintenance of the humidity required for germination. The rolled towel papers were kept in a slanting position. The seeded towel were placed in a seed germinator at 25°C with RH about 85 per cent. The seedlings were examined on the 14th day of incubation and germination was calculated.

Standard grow on test :

In the method, counted seed were sown in the tray filled with sterilized soil and sand, kept under laboratory condition. Seed emergence was recorded. The trays were irrigated with sterile water whenever required. Light was provided by horizontally hanged day tube light.

RESULTS AND DISCUSSION

Investigations were made on the association of mycoflora with substandard seeds of major *Kharif* and *Rabi* crops. The impact of associated mycoflora on seed germination and seed vigour was determined. Data presented in Table 1 indicate the association of *Helminthosporium sativum* (1.0 to 3.0%), *F. oxysporum* (2.0 to 6.0%) and *Aspergillus* spp. (5.0%) in five seed samples of maize in category I (apparently normal healthy seed) obtained from farmers and tested by standard blotter method. The germination per cent ranged from 63.0 to 70.0 per cent. The shriveled and deformed maize seeds (category II) indicate the association of *H. sativum* (3.0 to 10.0%), *F. oxysporum* (3.0 to 9.0%) and *Aspergillus* spp. (2.0 to 7.0%), the germination percent of shriveled and deformed seed ranged from

Table 1 : Association of mycoflora with 3 categories of maize seeds obtained from farmers saved seed and tested by standard blotter method

Sample	Per cent association of mycoflora											
	Category - I				Category - II				Category - III			
	HS	FO	AS	GP	HS	FO	AS	GP	HS	FO	AS	GP
1	2.0	5.0	0.0	63	5.0	5.0	7.0	58	9.0	7.0	4.0	59
2	3.0	6.0	0.0	69	10.0	6.0	3.0	55	5.0	6.0	4.0	60
3	0.0	4.0	0.0	69	10.0	9.0	2.0	56	7.0	8.0	3.0	60
4	0.0	0.0	5.0	70	3.0	5.0	2.0	56	5.0	3.0	2.0	63
5	1.0	2.0	0.0	70	5.0	3.0	2.0	56	6.0	4.0	2.0	62

HS : *Helminthosporium sativum*, FO: *Fusarium oxysporum*, AS: *Aspergillus* spp., GP : Germination per cent

55.0 to 58.0 per cent. The discoloured maize seeds (category III) exhibited the association of *H. sativum* (5.0 to 9.0%), *F. oxysporum* (3.0 to 8.0%). The association of *Aspergillus* spp. ranged from 2.0 to 4.0 per cent. The germination per cent of discoloured maize seed (category III) ranged from 59.0 to 63.0 per cent (Table 1). The discoloured maize seeds (category III) exhibited the association of *H. sativum* (3.0 to 4.0%), *F. oxysporum* (3.0 to 9.0%), *Aspergillus* spp. (4.0 to 7.0%). The germination of discoloured seeds ranged from 54.0 to 61.0 per cent. The apparently normal healthy seeds of maize were tested for association of mycoflora by employing standard blotter method. The association of *Aspergillus* spp. ranged from (3.0 to 7.9%), *F. oxysporum* (1.0 to 3.0%) and *H. sativum* (1.0%). The seed germination ranged from 60.0 to 62.0 per cent (Table 2). The seed samples obtained from seed production plots were analysed for associated mycoflora. It was observed that association of *H. sativum* was not present in category I seeds while it ranged from 3.0 to 8.0 per cent in shriveled seeds and in discoloured seeds (category II) the association ranged from 5.0 to 9.0 per cent. The association of *F. oxysporum* was upto 2.0 per cent in apparently healthy seeds (category I) and 5.0 to 7.0 per cent in category II while 6.0 to 9.0 per cent *F. oxysporum* was recorded in discoloured maize seeds

belonging to category III. The germination per cent of discoloured maize seeds ranged from 59.0 to 60.0 per cent while it was 55.0 to 59.0 per cent in shriveled and deformed seeds (category II). The germination per cent of apparently healthy maize seeds obtained from seed production plots ranged from 61.0 to 69.0 per cent (Table 3). The rice seed obtained from local farmers indicated the presence of four dominant mycoflora as tested by standard blotter method. The association of *F. oxysporum* ranged from 5.0 to 12.0 per cent, *Dreschlera* spp. 7.0 to 11.0 per cent, *Curvularia lunata* 6.0 to 9.0 per cent and *Aspergillus* spp. 7.0 to 12.0 per cent. The germination per cent of discoloured seed (category III) ranged from 58.0 to 63.0 per cent (Table 4). The association of *F. oxysporum* ranged from 5.0 to 13.0 per cent, *Dreschlera* spp. 5.0 to 10.0 per cent, *C. lunata* 5.0 to 9.0 per cent and *Aspergillus* spp. 7.0 to 11.0 per cent in category II seeds. The seed germination per cent ranged from 59.0 to 63.0 per cent. The germination per cent of apparently normal healthy rice seeds ranged from 70.0 to 75.0 per cent of category I seeds. The association of *F. oxysporum* ranged from 3.0 to 9.0 per cent, *Dreschlera* spp. (4.0 to 11.0%), *C. lunata* (3.0 to 9.0%) (Table 4). The apparently normal rice seed were examined for the associated mycoflora. The association of *F. oxysporum* ranged from 2.0 to 6.0 per cent,

Table 2 : Association of mycoflora with 3 categories of maize seeds obtained from local mandi and tested by standard blotter method

Sample	Per cent association of mycoflora											
	Category - I				Category - II				Category - III			
	HS	FO	AS	GP	HS	FO	AS	GP	HS	FO	AS	GP
1	0.0	3.0	3.0	62	2.0	5.0	4.0	56	3.0	9.0	4.0	60
2	0.0	2.0	7.0	62	2.0	4.0	7.0	58	3.0	3.0	5.0	61
3	0.0	0.0	3.0	62	1.0	3.0	3.0	58	3.0	7.0	5.0	60
4	0.0	0.0	3.0	60	4.0	0.0	7.0	56	3.0	8.0	7.0	60
5	1.0	1.0	5.0	60	5.0	3.0	7.0	56	4.0	7.0	7.0	54

HS : *Helminthosporium sativum*, FO: *Fusarium oxysporum*, AS: *Aspergillus* spp., GP : Germination per cent

Table 3 : Association of mycoflora with 3 categories of maize seeds obtained from seed production plots and tested by standard blotter method

Sample	Per cent association of mycoflora											
	Category - I				Category - II				Category - III			
	HS	FO	AS	GP	HS	FO	AS	GP	HS	FO	AS	GP
1	0.0	2.0	5.0	61	0.0	5.0	3.0	55	0.0	9.0	7.0	59
2	0.0	2.0	5.0	65	3.0	0.0	4.0	58	5.0	8.0	7.0	60
3	0.0	0.0	6.0	69	3.0	0.0	7.0	59	5.0	6.0	7.0	60
4	0.0	0.0	3.0	69	4.0	7.0	7.0	58	5.0	7.0	9.0	59
5	0.0	0.0	3.0	68	8.0	7.0	7.0	59	9.0	7.0	9.0	59

HS : *Helminthosporium sativum*, FO: *Fusarium oxysporum*, AS: *Aspergillus* spp., GP : Germination per cent

Dreschlera spp. (3.0 to 7.0%), *C. lunata* (3.0 to 7.0%) and *Aspergillus* spp. 2.0 per cent. The germination per cent ranged from 70.0 to 74.0 per cent (Table 5). The analysis of shriveled and deformed seed indicate the presence of *F. oxysporum* (4.0 to 9.0%), *C. lunata* (6.0 to 10.0%), *Aspergillus* spp. (5.0%) and *Dreshclera* spp. (4.0 to 9.0%). The germination per cent of rice seed obtained from local mandi and categorized as deformed and shriveled ranged from 65.0 to 69.0 per cent. The discoloured rice seeds (category III) exhibited the association of *F. oxysporum* (7.0 to 9.0%), *Dreschlera* spp. (5.0 to 8.0%), *C. lunata* (5.0 to 9.0%) and *Aspergillus* spp. 5.0 to 7.0 per cent. The germination per cent of discoloured seeds ranged from 63.0 to 66.0 per cent (Table 5). The germination per cent of rice seed obtained from seed production plots ranged from 70.0 to

74.0 per cent (category I), 60.0 to 63.0 per cent (category II) and 60.0 to 68.0 per cent (category III). The discoloured seeds of rice category III) exhibited the association of *F. oxysporum* in range of (2.0 to 5.0%), *Dreschlera* spp. (2.0%), *C. lunata* (2.0 to 5.0%) and *Aspergillus* spp. (4.0 to 7.0%) (Table 6). The shriveled and deformed seed of rice (category II) had association of *F. oxysporum* in the range of 1.0 to 3.0 per cent, *Dreschlera* spp. 2.0 per cent, *C. lunata* 1.0 to 3.0 per cent and *Aspergillus* spp. 1.0 to 7.0 per cent. In category I, seeds association of *Aspergillus* spp. ranged from 1.0 to 5.0 per cent *C. lunata* 1.0 to 3.0 per cent and *F. oxysporum* 1.0 per cent (Table 6). Influence of seed associated mycoflora on seed germination and emergence was determined in the present investigation. The germination test was performed by placing the seeds on

Table 4 : Association of mycoflora with 3 categories of rice seeds obtained from farmers saved seed and tested by standard blotter method

Sample	Per cent association of mycoflora														
	Category - I					Category - II					Category - III				
	FO	DS	CL	AS	GP	FO	DS	CL	AS	GP	FO	DS	CL	AS	GP
1	3.0	4.0	3.0	3.0	71	5.0	5.0	5.0	8.0	63	11.0	7.0	6.0	12.0	63
2	6.0	7.0	3.0	3.0	73	8.0	7.0	5.0	10.0	59	12.0	8.0	7.0	11.0	60
3	5.0	7.0	9.0	7.0	75	13.0	7.0	8.0	11.0	59	10.0	9.0	7.0	11.0	58
4	9.0	11.0	8.0	6.0	70	10.0	10.0	9.0	7.0	61	7.0	10.0	8.0	7.0	58
5	7.0	8.0	8.0	8.0	70	7.0	9.0	9.0	8.0	60	5.0	11.0	9.0	7.0	58

FO: *Fusarium oxysporum*, DS: *Dreschlera* sp., CL: *Curvularia lunata*, AS: *Aspergillus* spp., GP : Germination per cent

Table 5 : Association of mycoflora with 3 categories of rice seeds obtained from local mandi and tested by standard blotter method

Sample	Per cent association of mycoflora														
	Category - I					Category - II					Category - III				
	FO	DS	CL	AS	GP	FO	DS	CL	AS	GP	FO	DS	CL	AS	GP
1	2.0	4.0	7.0	2.0	74	4.0	4.0	10.0	0.0	69	8.0	6.0	9.0	0.0	65
2	2.0	4.0	6.0	0.0	72	6.0	7.0	7.0	5.0	68	7.0	8.0	8.0	7.0	63
3	5.0	6.0	5.0	0.0	70	8.0	8.0	6.0	0.0	68	8.0	5.0	5.0	7.0	66
4	4.0	3.0	4.0	0.0	70	7.0	5.0	10.0	5.0	65	8.0	8.0	8.0	5.0	63
5	6.0	7.0	3.0	0.0	70	9.0	9.0	7.0	5.0	66	9.0	0.0	7.0	5.0	63

FO: *Fusarium oxysporum*, DS: *Dreschlera* sp., CL: *Curvularia lunata*, AS: *Aspergillus* spp., GP : Germination per cent

Table 6 : Association of mycoflora with 3 categories of rice seeds obtained from seed production plots and tested by standard blotter method

Sample	Per cent association of mycoflora														
	Category - I					Category - II					Category - III				
	FO	DS	CL	AS	GP	FO	DS	CL	AS	GP	FO	DS	CL	AS	GP
1	1.0	0.0	3.0	5.0	71	3.0	0.0	3.0	4.0	63	4.0	0.0	5.0	7.0	63
2	1.0	0.0	0.0	2.0	70	3.0	2.0	1.0	7.0	61	0.0	0.0	5.0	5.0	63
3	1.0	0.0	1.0	1.0	70	0.0	0.0	3.0	3.0	60	5.0	2.0	5.0	5.0	60
4	0.0	0.0	1.0	0.0	73	1.0	0.0	0.0	3.0	60	0.0	0.0	2.0	5.0	60
5	0.0	0.0	2.0	1.0	74	1.0	0.0	0.0	1.0	60	2.0	0.0	0.0	4.0	68

FO: *Fusarium oxysporum*, DS: *Dreschlera* sp., CL: *Curvularia lunata*, AS: *Aspergillus* spp. , GP : Germination per cent

the top of the blotters (standard blotter method) and between the blotter (standard ragdoll method) and the emergence was determined by sowing the seeds in sterile sand kept under laboratory conditions. A fair difference was recorded in the germination of seeds when placed between the blotters. Influence of different categories was also recorded. The discoloured seeds and shriveled seeds had inferior germination as compared to apparently normal seeds. The germination of maize and rice recorded maximum in seeds from category II, II and I. Impact of seed deformation, discolouration on germination of various crops has been discussed (Agrawal *et al.*, 1972; Amin *et al.*, 1985; Wu *et al.*, 1964; Singh, 2004; Shetty and Shetty, 1985; Sharma *et al.*, 1987; Singh and Guraha, 1980; Reddy and Reddy, 1989; Poharkar, 1992; Owolade *et al.*, 2000; Manabe *et al.*, 1988; Martin, 1989; Khare and Singh, 1981 and Kulwant *et al.*, 1986).

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