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SEED-BORNE FUNGAL PATHOGENS OF MAIZE IN PAKISTAN

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Most fungal pathogens of maize are seed-borne and cause rotting and discolouration of corn seed. In view the importance of the maize seed and maize based starch industries, studies of the seed-borne fungal pathogens of maize were initiated in 1985-86 by the Federal Seed Certification Department, Islamabad. Fifty seven seed lots were tested by blotter paper method during 1985-86. Seven seed-borne pathogens were recorded. The incidence of seed-borne fungal pathogens varied in individual cultivars in different years. *Fusarium moniliforme* was recorded in all the seed lots at percentage up to 98.5%. *Cephalosporium acremonium, Drechslera maydis* and *Fusarium semitectum* were found in proportions of 14.0, 6.0 and 11.0 percent in the varieties, Akbar, Neelum and Sarhad white respectively. Other pathogens such as *Fusarium equiseti; F. oxysporum, Macrophomina phaseolina* and *Nigrospora oryzae* were recorded at low incidence (2.5%). For establishing disease tolerances in Pakistan, a study of the biology of the pathogens is needed.

Key words: Seed-borne pathogens, Blotter paper method, Maize.

INTRODUCTION

Maize (*Zea mays L.*) is used for fodder, food and industrial use. The maize production area during 1987 was 0.8 million hectares with annual production of one million metric tons [3].

Despite the development of high yielding maize cultivars and improved hybrid maize seed, diseases still significantly reduce maize crop yield. Numerous pathogenic fungi, bacteria and viruses infect maize, causing combined world wide annual yield losses of 9.4% [4]. Hafiz [1] reported 33 fungal, three bacterial and five viral diseases of the maize crop. He considered stalk rots, *Helminthosporium* blight, smut, seed rots and seedling blight followed by kernel and ear rots as the most economically significant diseases of maize in Pakistan while rust, downy mildews and leaf spots are of minor importance. Studies of Hassan [7] showed that *Aspergills niger, Pencillium corylophilum, Helminthosporium turcicum, Fusarium oxysporum, Mucor strictus, Sclerotium sp. and Nigrospora oryzae* were associated with rotting and discolouration of maize seed. Recently, Akhtar and Ali [2] isolated 14 species of fungi from seeds of selected maize cultivars. *Fusarium moniliforme* was isolated from all samples studied.

Because of the number of seed-borne fungi occuring on maize seed and their ultimate effect on seed germination and crop yields Federal Seed Certification Department initiated maize seed health testing in 1985 to facilitate advising seed agencies and appropriate disease control measures. The results of 57 maize seed lots tested for seed-borne fungi during 1985-88 by standard technique (blotter methods) are presented.

MATERIALS AND METHODS

Collection of samples. Fifty seven seed samples of six maize cultivars were collected from Punjab and NWFP maize growing areas of Pakistan through the Federal Seed Certification Department's laboratories network. In 57 seed samples, 10 were tested in 1985-88 at the Danish Government Institute of Seed Pathology, Copenhagen, and 47 were tested in 1986-87 and 1987-88 at Central Seed Health Laboratory of the Federal Seed Certification Department, Islamabad.

Detection of fungi by the blotter method. The standard blotter method as recommended by ISTA [5] was used for the detection of seed-borne fungi. Four hundred seeds were used for each sample. In each petri dish, ten seeds were plated. The plates were incubated for eight days at 20° (± 2°) under an alternating cycle of 12 hours days and nights using flourescent light. Seeds were examined under the stereoscopic microscope and fungal species were confirmed with the aid of a compound microscope.

RESULTS AND DISCUSSION

The results of 57 maize seed lots tested in 1985-86, 1986-87 and 1987-88 are presented in Table-1. Infection percentage ranges are given only for those fungi which have been reported as pathogen on maize [6].

Table 1. Percentage incidence and range of seed-borne pathogens recorded in different cultivars of maize seed lots during 1985-88.

Testing period	Pathogens	Culverts						Remarks
		Akbar	Neelum	Sultan	Ahsan	Azam	Sarhad white	
1985-86	*Cephalosporium acremonium*	1.5-10.5	3.0-12.0	—	—	—	—	Seed sample
	Drechslera maydis	1.0-2.0	0.5-6.0	—	—	—	—	tested at DGISP,
	Fusarium equiseti	2.5-3.0	1.5	—	—	—	—	Copenhagen.
	F. moniliforme	18.0-98.5	52.0-95.5	—	—	—	—	
	F. semitectum	1.0-8.0	0.5-2.5	—	—	—	—	
	Nigrospore oryzae	1.5	0.5-1.5					
1986-87	*Cephalosporium acremonium*	1.5-14.0	0.5	0.5-4.0	2.5	1.5	0.5-7.0	Seed sample
	Drechslera maydis	0.5-1.5	0.0	1.0-1.5	0.0	0.0	0.5-1.0	tested at Central
	F. moniliforme	5.0-14.5	7.5	4.5-27.0	2.5	9.5	5.5-21.0	Seed Health
	F. oxysporum	0.5	0.0	0.0	0.0	0.0	0.0	Laboratory, FSCD,
	F. semitectum	0.5-3.0	0.5	0.5-2.0	0.5	0.0	2.5.11.0	Islamabad.
	Macrophomina phaseolina	0.0	0.0	0.5	0.0	0.0	0.0	
	Nigrospora oryzae	0.0	0.0	1.5	0.0	0.0	0.5	
1987-88	*Cephalosporium acremonium*	—	1.0	2.0	0.5	0.0	0.5-2.0	
	Drechselra maydis	—	1.5-5.0	0.0	0.0	0.0	0.5	
	F. moniliforme	—	0.5-4.5	3.5	5.0	2.0	2.0-21.0	
	F. semitectum	—	0.5	1.5	0.0	0.0	0.5	

Note: (—) Samples were not available.

Fusarium moniliforme sheld. was observed in all 57 seed lots at high level. Maximum percentages recorded were 98.5, 27.0 and 21.0 on cultivars Akbar, Sultan and Sarhad white respectively during the 3 year period. The minimum incidence of *F. moniliforme* was 0.5, 2.0 and 2.5 on varieties Neelum, Azam and Ahsan respectively. Studies carried out at Crop Diseases Research Institute, Islamabad, indicated that *Fusarium moniliforme, F. graminearum* and *Macrophomina phaseolina* were found to be most destructive causing agents of stalk rot, and reduced yield up to 20% in combinations of pathogens [9]. *Macrophomina phaseolina* (Tassi) G. Goid. was also recorded in this study but in low percentage (0.5) in one sample of the cultivar Sultan from D.I. Khan in 1986-87. *Cephalosporium acremonium* Corda. was found in almost all seed lots with a maximum incidence of 14% on variety Akbar in 1986-87 from Sahiwal areas. This is not an important pathogen in Pakistan but it can cause infections in combinations with other micro-organisms. Shurtleff [4] indicated that this fungus has a wide host range including maize, sorghum, soybean, cotton, wheat and oats.

Drechslera maydis (Nisik) Subram and Jain. occurred at incidence of 5.0% and 6.0% on variety Neelum in 1985-86 and 1987-88 respectrively, while its incidence in other cultivars was below 2.0%. Cassini and Cotti [8] reported that *Drechslera maydis* along with *Fusarium* and *Diplodia* spp. caused seed rots and seedling blight. They also reported that *Nigrospora oryzae* can cause serious ear or kernel rot in the presence of these pathogens under favourable crop conditions. In this study, the *Nigrospora oryzae* (Berk. and Br.) petch. ranged from 0.5 to 1.5 percent on variety Akbar, Neelum, Sultan and Sarhad white.

In view of the high incidence of *Fusarium moniliforme, Cephalosporium acremonium* and *Drechslera maydis* in combinations with other important pathogens, infected seed lots must not be planted for seed production. These pathogens can cause epidemics in susceptible cultivars under conducive environmental conditions. Effective control of these seed-borne pathogens require establishment of tolerance limits in a seed certification programme and seed treatment must be advised at the level of pre-basic and basic seed in Pakistan.

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