

FUNGI CAUSING SEED AND SEEDLING DISEASES IN PIGEON PEA

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One hundred fifty five seed samples of pigeon pea (*Cajanus cajan* L.) from Uttar Pradesh revealed 52 fungal species of 33 genera in addition to *Xanthomonas campestris*, *Alternaria alternata*, *A. tenuissima*, *Aspergillus flavus*, *A. niger*, *Chaetomium globosum*, *Cladosporium cladosporoides*, *Curvularia lunata*, *Drechslera halodes*, *Fusarium moniliforme*, *F. oxysporum*, *Penicillium* sp., *Phoma betae*, *Rhizopus nigricans* and *Trichothecium roseum*, which were dominant and affected seed germination, seedling vigour and caused seedling diseases.

Keywords : *Cajanus cajan*; Seedling Diseases.

Introduction

Pigeon pea (*Cajanus cajan* L.) is an important pulse crop and grown all over India. The pods while green are exposed to many field fungi. The seeds are infected and contaminated by many serious seed-borne fungi while in field or during seed processing or transit. Richardson¹ has enlisted 19 fungi on pigeon pea seeds. Gupta *et al.*² from Tarai region of Nainital, Maharashtra³ from Rajasthan, Pande and Varma⁴ from Maharashtra have reported 6, 3 and 22 seed-borne fungi. Kumar and Srivastava⁵ reported seventeen fungal species of which nine were pathogenic and caused seed rot, seedling mortality and leaf spots. Lokesh *et al.*⁶ isolated nine fungi, the most common were *Aspergillus flavus*, *A. niger*, *Alternaria alternata* and *Fusarium moniliforme*. The effects of different seed-borne fungi in deteriorating seed quality and causing seedling diseases have not been well studied, hence the present investigation taken up.

Materials and Methods

One hundred fifty five seed samples of pigeon pea from Uttar Pradesh were collected during the crop seasons, 1997, 1999 and subjected to dry seed examination and standard blotter test. For dry seed examination four replicates of 100 seed per sample taken at random was studied. Percent incidence of different deformities, inert matter and insect damaged seeds were estimated. For incubation both untreated and 2% chlorine pretreated seeds (400 seed/sample) for 5 min were sown on moistened blotters and incubated for 8 days⁷. The discoloured or

diseased seeds were also plated separately to identify the specific fungi associated with such seeds. Seed germination, seedling symptom and incidence of fungi were recorded.

Results and Discussion

Dry seed examination : The seed samples revealed various kinds of seed diseases like seeds with white mycelial growth (0.25-26.75%), black discolouration (0.25-24.50%), mouldy (3.0-22.75%), shrivelled (0.5-24%) and deformities like broken or cracked and insect damaged seeds (0.25-46.75%), seeds with insect egg (0.25-63.25%) and inert matter (0.25-4.0). Seeds with white mycelial growth and black discolouration on incubation yielded *Fusarium oxysporum* and *Alternaria tenuissima* respectively. *A. alternata* was occasionally found associated with such seeds. *Aspergillus flavus*, *A. niger* and *A. candidus* were the main causal agent of mouldy seeds whereas broken or cracked and insect damaged seeds were mostly associated with *Aspergilli* and *Penicillium* sp. Seeds with insect eggs carried high incidence of *Aspergilli* spp., *Penicillium* sp., *Rhizopus nigricans*, *Trichothecium roseum* and *Mucor* sp. (Table 1).

The inert matter like soil clods, gravel, stone pieces, broken seed coats and plant debris especially the pod debris were contaminated with *Alternaria alternata*, *Aspergillus flavus*, *Curvularia lunata* and *Fusarium oxysporum*. Seeds infected with the bacterium *X. campestris* were small sized and shrivelled. Its incidence varied from 0.5-24%.

Table 1. Incidence of various seed disorders in dry seed examinations, microorganisms associated and seedling diseases caused by them in standard blotter method.

Type of seed discolouration	Total RPO and Range	Important microorganism associated with seed	Seedling symptoms
Seed with white mycelial growth	20.64 (0.25-26.75)	<i>Fusarium oxysporum</i>	Yellowing, dropping of leaves and wilting of seedling
Black discoloured seeds with or without mycelial crust	33.54 (0.25-24.50)	<i>Alternaria tenuissima</i>	Browning of radicle and hypocotyl and brown necrotic spots on the cotyledonary leaves
Mouldy seeds	42.58 (3.0-22.75)	<i>Alternaria alternata</i> <i>Aspergillus candidus</i> <i>A. flavus</i>	Brown spot on plumule tip. Yellow to brown discolouration of radicle, rotting and mortality of seedlings
Shrivelled seeds	49.67 (0.5-24%)	<i>A. niger</i> <i>Xanthomonas campestris</i>	do Brown, black necrotic spots and mucilaginous bacterial ooze on cotyledons.
Broken or cracked and insect damaged seeds	30.96 (0.25-46.75)	<i>Aspergillus</i> sp. <i>Penicillium</i> sp.	Black streak on radicle and hypocotyl, browning of secondary root tip
Seed with insect egg	29.67 (0.25-63.25)	<i>Aspergillus</i> spp. <i>Penicillium</i> sp. <i>Rhizopus nigricans</i> <i>Trichothecium roseum</i> <i>Mucor himelis</i>	- Yellowing of leaves and radicle rot.
Inert matter		<i>Alternaria alternata</i> <i>Aspergillus flavus</i> <i>Fusarium oxysporum</i> <i>Curvularia lunata</i>	Seed and seedling rot
Soil clods, broken seed coats and plant debris	28.38 (0.25-4.0)		- - - - - - - Light brown spots and streaks at the base of root and later on coleoptile.

Table 2. Percentage range of important microorganisms in untreated and pretreated seeds in standard blotter method (SBM).

Microorganisms	Untreated (%)	Pretreated (%)
<i>Alternaria alternata</i>	0.5-36	0.5-32
<i>A. tenuissima</i>	1-59	1-22
<i>Aspergillus candidus</i>	0.5-29	0.5-19
<i>A. flavus</i>	3-88	4.5-57
<i>A. niger</i>	2-80	1-35
<i>Botrytis cinerea</i>	1-8	0.5-5
<i>Chaetomium globosum</i>	0.5-14.5	1-7.5
<i>Cladosporium cladosporoides</i>	1-19	1-9
<i>Fusarium oxysporum</i>	0.5-43	0.5-33
<i>Penicillium</i> sp.	0.5-12	0.5-10
<i>Rhizopus nigricans</i>	0.5-25	2-9
<i>Trichothecium roseum</i>	0.5-27	0.5-21
<i>Xanthomonas campestris</i>	0.5-18	0.5-24

Incubation Tests : A total of 52 fungal species belonging to 33 genera, saprophytic as well as pathogenic were observed on pigeon pea seeds in blotter test. *Alternaria alternata* (0.5-36%), *A. tenuissima* (1-59%), *Cladosporium cladosporoides* (1-19%), *Curvularia lunata* (0.5-4%), *Drechslera halodes* (0.5-4%), *Fusarium moniliforme* (0.5-7%), *F. oxysporum* (0.5-43%), *Phoma betae* (0.5-29%) and *Trichothecium roseum* (0.5-27%) were dominant pathogenic fungi (Table 2). *Aspergillus candidus* (0.5-29%), *A. flavus* (3-88%), *A. niger* (2-80%), *Chaetomium globosum* (0.5-14.5%), *Rhizopus nigricans* (0.5-25%) and *Penicillium* sp. (0.5-12%) were also recorded in high incidence. Host specific pathogens viz. *Alternaria dianthicola* (1-2%), *A. raphani*. (1%) and *Melanospora zamiae* (1.5%) which are serious pathogen of *Dianthus*, *Raphanus sativus* and *Helianthus*

annus occurred occasionally¹.

Chlorine pretreatment generally reduced saprophytic fungi and increased seed germination as also observed by Anonymous⁷. The percent range of *Aspergillus flavus* and *A. niger*, decreased from 3-88% to 4.5-57%, 2-80% to 1-35%, that of *Alternaria alternata*, *A. tenuissima* from 0.5-36% to 0.5-32%, 1-59% to 1-22% and *Cladosporium cladosporoides*, *Penicillium* sp. from 1-19% to 1-9%, 0.5-12% to 0.5-10%. Of the total fungi recorded, *Alternaria alternata*, *A. tenuissima*, *Aspergillus flavus*, *A. niger*, *Cladosporium cladosporoides*, *Fusarium oxysporum*, *Penicillium* sp. and *Trichothecium roseum* were important and showed high incidence. Beside the fungal infection, mucilaginous growth of *Xanthomonas campestris* (0.5-24%) was observed in 77 samples.

Phytopathological Effects : Fungi associated with seed affected germination as well as

vigour and also produced symptomatic seedlings. *Actinomyces* sp., *Alternaria alternata*, *A. tenuissima*, *Aspergillus flavus*, *A. niger*, *Chaetomium globosum*, *Cladosporium cladosporoides*, *Curvularia lunata*, *Drechslera halodes*, *Fusarium moniliforme*, *F. oxysporum*, *Penicillium* sp., *Phoma betae*, *Rhizopus nigricans* and *Trichothecium roseum* mostly rendered poor or failure of seed germination.

Most of the fungi except *Drechslera halodes*, *Fusarium* spp., *Phoma* sp. and *Curvularia lunata* are condensed as common saprobes and seed contaminants. But in present study they caused serious seed diseases, seed rot produced infected seedlings.

Infection of *Alternaria tenuissima*, *A. alternata* caused browning of radicle and hypocotyl and brown necrotic spots on the cotyledonary leaves. *Aspergillus flavus* and *A. niger* infected seedlings produced yellow to brown discolourations of radicle and the heavy infection resulted in rotting and mortality of seedlings. *Fusarium oxysporum* caused yellowing and drying of seedlings. *Trichothecium roseum* mostly caused seed and seedling rot. Loss in seed germination and seedling vigour has been reported by

Lokesh *et al.*⁶ due to *A. flavus*, *A. niger*, *Alternaria alternata*, *Fusarium moniliforme* and their metabolites. As per results of Kumar and Srivastava⁵, *Aspergillus candidus*, *Botrytis cinerea*, *Cladosporium cladosporoides*, *Colletotrichum graminicola*, *Curvularia pallescens*, *Fusarium semitectum*, *Penicillium rubrum*, *Rhizopus arrhizus* and *R. nigricans* are pathogenic and cause seed rot, seedling mortality and leaf spots.

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