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 cladosporioides, Curvularia lunata, Drechslera halodes, Fusarium moniliforme, F. oxysporum, Penicillium sp., Phoma betae, Rhizopus nigricans and Trichotheicum 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. Richardson has enlisted 19 fungi on pigeon pea seeds. Gupta et al. from Tarai region of Nainital, Mahrashra and Saskatchewan have reported 6, 3 and 22 seed-borne fungi. Kumar and Srivastav reported seventeen fungal species of which nine were pathogenic and caused seed rot, seedling mortality and leaf spots. Lokesh et al. 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 days. 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 discoloration (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 discoloration 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 Aspergillus and Penicillium sp. Seeds with insect eggs carried high incidence of Aspergillus spp., Penicillium sp., Rhizopus nigricans, Trichotheicum 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.

<table>
<thead>
<tr>
<th>Type of seed discolouration</th>
<th>Total RPO and Range</th>
<th>Important microorganism associated with seed</th>
<th>Seedling symptoms</th>
</tr>
</thead>
<tbody>
<tr>
<td>Seed with white mycelial growth</td>
<td>20.64 (0.25-26.75)</td>
<td><em>Fusarium oxysporum</em></td>
<td>Yellowing, dropping of leaves and wilting of seedling</td>
</tr>
<tr>
<td>Black discoloured seeds with or without mycelial crust</td>
<td>33.54 (0.25-24.50)</td>
<td><em>Alternaria tenuissima</em></td>
<td>Browning of radicle and hypocotyl and brown necrotic spots on the cotyledonary leaves do</td>
</tr>
<tr>
<td>Mouldy seeds</td>
<td>42.58 (3.0-22.75)</td>
<td><em>Alternaria alternata</em> <em>Aspergillus candidus</em> <em>A. flavus</em></td>
<td>Brown spot on plumule tip.</td>
</tr>
<tr>
<td></td>
<td>49.67 (0.5-24%)</td>
<td><em>A. niger</em> <em>Xanthomonas campestris</em></td>
<td>Yellow to brown discolouration of radicle, rotting and mortality of seedlings do</td>
</tr>
<tr>
<td>Broken or cracked and insect damaged seeds</td>
<td>29.67 (0.25-63.25)</td>
<td><em>Aspergillus</em> flavus <em>Fusarium oxysporum</em></td>
<td>Yellowing of leaves and radicle rot.</td>
</tr>
<tr>
<td>Seed with insect egg</td>
<td>28.38 (0.25-4.0)</td>
<td><em>Trichothecium roseum</em> <em>Mucor himelis</em> <em>Alternaria alternata</em> <em>Aspergillus flavus</em></td>
<td>Seed and seedling rot</td>
</tr>
<tr>
<td>Inert matter</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Soil clods, broken seed coats and plant debris</td>
<td></td>
<td></td>
<td>Light brown spots and streaks at the base of root and later on coleoptile.</td>
</tr>
</tbody>
</table>
Microorganisms & Untreated (%) & Pretreated (%) 
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*Alternaria alternata* & 0.5-36 & 0.5-32 
*A. tenuissima* & 1-59 & 1-22 
*Aspergillus candidus* & 0.5-29 & 0.5-19 
*A. flavus* & 3-88 & 4.5-57 
*A. niger* & 2-80 & 1-35 
*Botryis cinerea* & 1-8 & 0.5-5 
*Chaetomium globosum* & 0.5-14.5 & 1-7.5 
*Cladosporium cladosporoides* & 1-19 & 1-9 
*Fusarium oxysporum* & 0.5-43 & 0.5-33 
*Penicillium sp.* & 0.5-12 & 0.5-10 
*Rhizopus nigricans* & 0.5-25 & 2-9 
*Trichothecium roseum* & 0.5-27 & 0.5-21 
*Xanthomonas campestris* & 0.5-18 & 0.5-24 

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

**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 dianthica* (1-2%), *A. raphani* (1%) and *Melanospora zamioides* (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, Fusarium oxysporum, 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 cladosporides*, *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 discolorations 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. due to *A. flavus*, *A. niger*, *Actinaria alternata*, *Fusarium moniliforme* and their metabolites. As per results of Kumar and Srivastava, *Aspergillus candidus*, *Botrytis cinerea*, *Cladosporium cladosporoides*, *Colletotrichum graminicola*, *Curvularia pallescens*, *Fusarium semitectum*, *Penicillium rubrum*, *Rhizopus arhizus* and *R. nigricans* are pathogenic and cause seed rot, seedling mortality and leaf spots.

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References