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# DISEASES IN SOME VEGETABLE SEEDLINGS DUE TO STORAGE FUNGI OF THE SEEDS COLLECTED FROM BIHAR STATE

**RAJNISH, R. N. SINGH, S. P. SINGH* and B. K. PRASAD****

T.P.S. College, Patna-800020, India.

* University Department of Botany, V.K.S. University, Ara-802001, India.

** University Department of Botany, Magadh University, Bodh-Gaya-824234, India.

Altogether 17 spp of fungi were isolated from stored tomato seeds, 21 spp from lablab bean and 23 spp from cabbage. The frequency of *Aspergillus flavus* was the highest. All the storage fungi inflicted seedling diseases, and a single type of symptom was caused by many storage fungi. Foot rotting, water soaked lesions in the foot, browning of the foot, yellowing, stunting, drying of apical bud, damping - off and failure of expansion of cotyledonary leaves are common symptoms. Seedlings were shorter in root and shoot length. Cotyledonary leaves were smaller and reduced in fresh weight due to the storage fungi. IAA oxidase was found to be stimulated in stunted seedlings. The seedlings showing yellowing had less total chlorophyll, total soluble sugar and total free amino acid.

***Keywords :*** Seedling diseases; Storage fungi; Vegetable seeds.

## Introduction

Vast account of seedborne storage fungi has been documented todate along with their effect on seed decay, deterioration in various ways including the suppression of seed germination and change in the seed physiology[1-10] but little attention has been paid to the infliction of diseases in the seedlings due to storage fungi of the seeds except few ones[8,11-14] who worked mainly on the diseases in the seedling of crop plants and biochemical changes therein due to storage fungi. The present paper deals with the isolation of seedborne storage fungi of some vegetables, diseases caused by them in the seedlings and biochemical changes therein.

## Materials and Methods

The seed of tomato *(Lycopersicon esculentum* Mill) var money maker, lablab bean (*Lablab purpureus* (L) Sweet) var $FD_5$ and cabbage (*Brassica oleracea* var *capitata* L), var pusa giant stored with the farmers of Bihar State were collected in sterilized polyethylene pockets and fungi were isolated adopting blotter technique[15]. The fungi were isolated in pure form on potato dextrose agar medium. The fungi were infested to the surface sterilized seeds with 0.1% $HgCl_2$ for 1 min and thoroughly washed with sterilized tap water[8]. For this purpose, 10.0g of tomato, 150.0g of lablab bean and 10.0g of cabbage seed possessing 98, 100 and 99% germinability respectively were taken and stored over saturated solution of ammonium sulphate to maintain 80% RH at 30±1°C in sealed desiccators for a period of 30 days. 20 seeds stored as above in five replicates were taken for germination in autoclaved garden soil[13] and the same numbers and replicates of seeds were taken for germination in sterilized towels[11]. After 15 days of culturing in soil and 7 days in towel, the seedlings were observed for infliction of disease, if any. The seedlings showing less root and shoot length, area of cotyledonary leaves and fresh weight were analysed for IAA oxidase activity[16] and those showing yellowing were analysed with respect to total chlorophyll[17], total soluble sugar[18] and total free amino acid[19].

## Results and Discussion

Altogether 17 spp of fungi were isolated form stored seeds of tomato, 21 spp from lablab bean and 23 spp from cabbage. The frequency of *Aspergillus flavus* was the highest among all. All the storage fungi inflicted seedling diseases. Of them foot rotting, water soaked lesions in the foot, browning of foot, yellowing, stunting, drying of apical bud, damping-off and failure of expansion of cotyledonary leaves are common. It is also evident that a single type of symptom of disease was caused by many storage fungi in all the three types of seeds (Table 1) The seedlings raised from the

**Table 1.** Range of various types of pathological symptoms in the seedlings of tomato due to the involvement of seedborne storage fungi.

| Pathological symptoms | Range (%) | Storage fungi involved |
|---|---|---|
| 1. Foot rotting | 11 | *Rhizopus nigricans*, and *Fusarium moniliforme* |
| 2. Diminution of area of cotyledonary leaves | 3-18 | *Aspergillus flavus, Aspergillus niger, Aspergillus sydowi, Aspergillus terreus.* |
| 3. Browning of foot | 3-9 | *Alternaria alternata* |
| 4. Stunting | 7-26 | *Alternaria alternata, Alternaria lunata Aspergillus niger, Aspergillus flavus, Aspergillus sydowi* |
| 5. Yellowing | 3-15 | *Aspergillus flavus, Aspergillus sydowi, Aspergillus niger, Aspergillus terreus, Alternaria alternata* |
| 6. Water soaked lesions in the foot | 3-10 | *Chaetomium globosum, Aspergillus niger, Aspergillus sydowi, Aspergillus terreus, Fusarium moniliforme* |

**Table 1.** (Contd.) Range of various types of pathological symptoms in the seedlings of lablab bean due to the involvement of seedborne storage fungi.

| Pathological symptoms | Range (%) | Storage fungi involved |
|---|---|---|
| 1. Foot rotting | 5-10 | *Rhizopus nigricans, Aspergillus flavus, Fusarium moniliforme* and *Aspergillus niger* |
| 2. Brown lesion in the foot | 8-13 | *Aspergillus flavus, Aspergillus niger,* and *Alternaria alternata* |
| 3. Brow lesion in the root | 7-17 | *Aspergillus flavus, Aspergillus niger, Aspergillus candidus, Aspergillus sydowi, Penicillium oxalicum* and *Alternaria alternata* |
| 4. Water soaked leson in the foot | 7-12 | *Aspergillus candidus* and *Fusarium moniliforme* |
| 5. Smaller first leave | 9-18 | *Aspergillus flavus, Aspergillus niger, Penicillium oxalicum* and *Curvalaria lunata* |
| 6. Stunting | 8-17 | *Aspergillus flalvus, Aspergillus niger, Aspergillus candidus Aspergillus sydowi, Penicillium oxalicum, Curvularia lunata,* and *Alternaria alternata* |
| 7. Failure of growth of Cotyledonary leaves | 10-18 | *Aspergillus flavus, Aspergillus niger, Aspergillus sydowi, Penicillium oxalicum.* |
| 8. Drying of apical bud | 20 | *Alternaria alternata* |
| 9. Damping-off | 7 | *Aspergillus flavus* |

**Table 1.** (Contd.) Range of pathological symptoms in the seedling of cabbage due to the involvement of seedborne storage fungi.

| Pathological symptoms | Range (%) | Storage fungi involved |
|---|---|---|
| 1. Water soaked lesion in the foot | 7-17 | *Aspergillus nidulans, Aspergillus flavus, Aspergillus niger, Aspergillus candidus, Aspergillus sydowi, Penicillium oxalicum Cladosporium herbarun, Curvularia lunata,* and *Curvularia pallescens.* |
| 2. Brown lesions in the foot region | 6-13 | *Alternaria tenussima, Curvularia lunata* and *Curvularia pallescens.* |
| 3. Smaller cotyledonary leaves | 11 | *Aspergillus nidulans* |
| 4. Failure of expension of cotyledons and their yellowing | 3-13 | *Aspergillus nidulans, Aspergillus flavus, Aspergillus niger, Aspergillus sydowi* and *Penicillium oxalicum.* |
| 5. Damping-off | 4-16 | *Aspergillus nidulans, Aspergillus flavus, Aspergillus niger, Aspergillus candidus* and *Cladosporium herbarum.* |
| 6. Stunting of whole seedling | 4-17 | *Aspergillus nidulans, Aspergillus flavus, Aspergillus niger, Aspergillus candidus, Aspergillus sydowi, Penicillium oxalicum, Cladosporium herbarum, Curvularia lunata.* |

| Pathological symptoms | Range (%) | Storage fungi involved |
|---|---|---|
| | | *Curvularia pallescens*, and *Alternaria tenuissima.* |
| 7. Drying of apical bud | 6-8 | *Aspergillus flavus, Penicillium oxalicum* and *Alternaria alternata.* |
| 8. Brown lesions in the foot | 6-13 | *Curvularia lunata, Curvularia pallescens, Alternaria tenuissima.* |

**Table 2.** Physiological/biochemical charactistics of the seedlings* showing stunting and yellowing in comparison to the symptomless seedlings raised from the control seeds.

| Crop Plants | Physiological/ biochemical characteristics | Stunting | Control | Yellowing | Control |
|---|---|---|---|---|---|
| Tomato | RL | 1.4 - 1.7 | 1.9 - 2.8 | | |
| | SL | 1.3 - 1.5 | 1.7 - 2.2 | | |
| | FW | 0.56 - 0.77 | 0.66 - 0.90 | | |
| | ACL | 51 - 61 | 68 - 82 | | |
| | TC | | | 0.73-0.81 | 1.45 - 1.62 |
| | TSS | | | 12.8 - 15.2 | 17.2 - 20.5 |
| | TFAA | | | 8.2 - 10.3 | 11.7 - 13.8 |
| | IAA - OX | 56-62 | 36-41 | | |
| Lablab bean | RL | 4.6 - 5.6 | 5.9 - 7.3 | | |
| | SL | 3.4 - 4.2 | 4.6 - 5.8 | | |
| | FW | 9.8 - 10.7 | 12.6 - 14.7 | | |
| | ACL | 6.6 - 7.8 | 8.8 - 10.7 | | |
| | TC | | | 0.92 - 1.25 | 1.62 - 1.75 |
| | TSS | | | 14. 6 - 17.3 | 18.5 - 20.8 |
| | TFAA | | | 17.7 - 21.4 | 19.2 - 25.4 |
| | IAA-OX | 49 - 56 | 32 - 36 | | |
| Cabbage | RL | 1.5 - 1. 7 | 2.1 - 2.9 | | |
| | SL | 1.3 - 1.6 | 1.8 - 2.1 | | |
| | FW | 0.58 - 0.82 | 0.72 - 0.88 | | |
| | ACL | 64 - 82 | 75 - 96 | | |
| | TC | | | 0.68 - 0.78 | 0.92 - 1.45 |
| | TSS | | | 13.5 - 15.7 | 17.3 - 21.2 |
| | TFAA | | | 7.3 - 10.2 | 11.2 - 15.6 |
| | IAA-OX | 52 - 61 | 35 - 41 | | |

* RL = Root length (in cm), SL = Shoot length (in cm), FW= Fresh weight (in g), ACL = Area of cotyledonary or first leaf (in $mm^2$), TC= Total chorophyll (in mg/g fresh weight of leaf), TSS= Total soluble Sugar (mg/g fresh weight of leaf), TFAA=Total free amino acid (mg/g fresh weight of leaf), IAA-OX= Indole acetic acid oxidase (μ g IAA oxidase/g fresh weight/30 min.).

control seeds were symptomless.

The growth and biochemical characteristics of the seedlings indicate less root length, shoot length, fresh weight and area of cotyledonary leaves due to storage of seeds with fungi than the control. The range of the minimum and maximum value has been recoreded (Table 2). IAA oxidase activity in the seedlings showing stunting was found to be stimulated in comparison to the sluggish activity in the control. The seedlings exhibiting yellowing due to fungi had less total chlorophyll, total soluble sugar and total amino acid as compared to the control.

The variation in the frequency of storage fungi of the seed might depend upon the agricultural handlings, storage conditions and physico-chemical characteristics of the seed which themselves behave as an ecologica nich[20].

The symptom of diseases such as water soaked lesions in the foot, foot rotting, root rotting and damping-off all might result

due to high ability of storage fungi to secrete cutinolytic[21], cellulolytic[22] and pectinolytic[23] enzymes. Brown lessions in the root might result due to oxidation of phenolic compound in the exposed area by enzymic dissolution of the surface. In course of growth some toxic principles have been reported to be secreted by the storage fungi[5,8] which have been found to restrict the synthesis of chlorophyll resultantly soluble sugars were found to be deficient. Also, sluggish activity of nitrate reductase and urease[24] in the seedlings of wheat and as observed excited amino acid oxidase, decarboxylase and deaminase in the seed of lablab bean $FD_5$[25] might operate in the seedlings and reduce the amount of amino acids there. IAA oxidase a factor to destroy IAA involved in inducing growth, being stimulated, may reduce the growth of the seedlings coupled with hindered synthesis of biochemicals. The failure of expansion of cotyledonary leaves and their yellowing and drying of the apical bud all seem due to the toxic principle secreted by the storage fungi, as observed earlier due to *Memnoniella echinata* in radish[8]. Actually the whole physiology of the seedlings might be crippled also due to the leaching of cations from the seed and exuding from the roots and the higher respiratory activity than the control.

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