Effect of Common and Dominant Seed-Borne Fungi on Protein Content of Pulses

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To cite this article:
Ashok S. Kandhare. Effect of Common and Dominant Seed-Borne Fungi on Protein Content of Pulses. American Journal of Biological and Environmental Statistics. Vol. 2, No. 4, 2016, pp. 41-43. doi: 10.11648/j.ajbes.20160204.13

Received: August 1, 2014; Accepted: August 29, 2014; Published: January 16, 2017

Abstract: Seeds are inhabited by seed mycoflora. Seed mycoflora influence seed texture, physiology and content. Some seed-borne fungi may be symbiotic to the seed germination where as some cause pathogenesis. Similarly, seed-borne fungi affect adversely to nutritive value of pulses. Biodegradation of protein content of pulses by their common and dominant seed-borne fungi like Aspergillus flavus, A. niger, A. fumigatus, Drechslera tetramera, Fusarium moniliforme, Rhizopus stolonifer etc. has been reported through artificial infestation of the pulses Green gram, Black gram, Chick pea and Pigeon pea. Results reveal considerable degradation in protein content of the test pulses.

Keywords: Seed-Borne Fungi, Seed Content, Pulses

1. Introduction

Pulses are rich in protein, essential amino acids, and micronutrients. Green gram, Black gram, Chickpea, and pigeon pea are rich in protein content i.e. 24g, 24g, 20.5g, and 20.4g/100g of seeds respectively.

Total seventeen fungi (Alternaria tenuis, Alternaria alternate, Aspergillus carbonarius, A. flavus, A. niger, A. nidulans, A. fumigatus, Cladosporium spp., Colletotrichum truncatum, Chaetomium globosum, Curvularia lunata, Drechslera tetrameria, Fusarium moniliforme, Fusarium oxysporum, Penicillium spp., Rhizopus stolonifer, Macrophomina phaseolina) were isolated from the test pulses, on agar plates and moist blotters. Among seventeen fungi isolated and identified, the common and dominant fungi were A. flavus, A. fumigatus, A. niger, Drechslera tetrameria, Fusarium oxysporum and Rhizopus stolonifer. Pulses are artificially infected by fungal pathogens common and dominant seed-borne fungi. These fungi are found to be adversely affecting protein content of the pulses. Seed of Green gram, Black gram were degraded due to Aspergillus flavus and Fusarium semitectum [1]. There was loss in protein content due to seed-borne fungi of groundnut [2]. Aspergillus niger, A. flavus, Fusarium moniliforme caused decrease in protein content of the Arhar seeds [3]. Seed germination and seedling growth was retarded due to seed-borne fungi in vigna radiate L. [4]. Similarly, changes in sugar content of mango pulp due to different isolates of Aspergillus niger [5].

2. Materials and Methods

2.1. Collection of Samples

Seed samples of Green gram, Black gram, Chickpea, and Pigeon pea were collected from field, market places from market; field of district Nanded; Maharashtra, India by following standard methods of sampling [6]. A composite seed sample for each of the pulse crop was made by mixing the individual seed sample together and preserved in gunny bags at room temperature during the studies.

2.2. Preparation of Spore Suspension

The isolated seed-borne fungi of test pulses were identified on the basis of colony character, texture, color and sporulation with naked eye and microscopically. Identifications were confirmed with the help of authentic manuals [7-10]. Pure cultures of the identified fungi were made and maintained on potato dextroxa agar (PDA) slants. Spore suspension of common and dominant seed-borne fungi of pulses were prepared separately by adding 10 ml of sterile
2.6. Extraction and Estimation of Protein Content of Seeds

Black gram, Chickpea and Pigeon pea were ground into fine flour with mortar and pestle separately. The powder of each pulse was extracted separately with an aliquot of ethanol and petroleum ether (2:1 v/v) mixture with constant stirring for few minutes. The sediments thus obtained were washed again with ether. The solvents of each seeds of pulses were filtered in conical flasks separately. The residue was collected and filtrated contents; containing lipids, carbohydrates and other non-proteinaceous compound was discarded. The collected residues of each pulses seeds was dried at room temperature to remove all traces of ether and dissolved in 10 ml of 20% Trichloro acetic acid (TCA). The resultant mixture was kept at 4°C for four hours. After cold treatment, the mixtures were subjected to centrifugation at 8000 rpm for ten minutes The precipitates obtained after centrifugation was dissolved separately in 5 ml of 0.1 N NaOH and made up to 50 ml with distilled water. These were treated as protein extracts of each of the test pulses. 0.1 ml and 0.2 ml protein extracts thus obtained were taken in different test tubes and similar procedure was followed as used earlier for standard proteins. Protein content of each test pulse was deduced from the standard graph of protein.

3. Result and Discussion

The results in the Table show that all common and dominant seed-borne fungi of pulses caused reduction in protein content of all test pulses in more or less quantity. In all test pulses, Fusarium moniliforme caused maximum reduction in protein content followed by Aspergillus niger, A. flavus. Minimum loss in protein was reported in Green gram, Chick pea, and Pigeon pea by Rhizopus stolonifer, in Black gram by Aspergillus fumigatus and Drechslera tetramera. This reduction in protein content of test pulses by the seed-borne fungi proves their proteolysis efficacy. Srivastava Sweta reported maximum protein content of Jatropha curcas L. was reduced by the seed-borne fungi Fusarium chlamydosporum [8]. Seed-borne fungi Aspergillus flavus, A. niger, Macrophomina phaseolina, Fusarium oxysporum caused reduction in carbohydrates and proteins [9]. Vegetable seeds were affected adversely due to association of seed-borne fungi during storage [10]. A gradual loss of carbohydrate (both soluble and insoluble) content and loss of protein was recorded due to storage fungi of maize, groundnut and soybean [11]. A dominant fungi Aspergillus flavus on Arachis hypogea caused quantitative and qualitative damage, reducing sugar and oil content of the seeds [12].

4. Conclusion

Seed mycoflora of pulses is responsible for seed degradation and especially in deterioration of the seed content. Protein content degradation naturally makes seed low in protein rendering seed feeble for germination and seedling emergence. Such enfeebled seeds may lose vigor and may not show normal germination. In order to protect seeds from adverse effects of seed mycoflora natural biochemicals are relevantly desirable. Some botanicals could be harnessed as pre treatment of seeds before sowing;
phytochemicals could be used as seed mycoflora protectant.

### Table 1. Effect of common and dominant seed-borne fungi on total protein content of pulses. (After ten days of incubation).

| Sr. No. | Infestation by common and dominant seed-borne fungi | Total protein content of seeds (mg/g of seeds) |
|---------|-----------------------------------------------------|---------------------------------------------|
|         |                                                     | Green gram | Black gram | Chick Pea | Pigeon pea |
| 1       | Aspergillus flavus                                  | 121        | 120        | 107       | 136        |
| 2       | Aspergillus fumigatus                               | 130        | 136        | 158       | 159        |
| 3       | Aspergillus niger                                   | 124        | 123        | 146       | 153        |
| 4       | Drechslera tetramera                                | 122        | 136        | 153       | 160        |
| 5       | Fusarium moniliforme                                | 120        | 100        | 104       | 125        |
| 6       | Rhizopus stolonifer                                 | 133        | 131        | 162       | 170        |
| 7       | Control                                             | 136        | 140        | 168       | 173        |

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