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Effect of Common and Dominant Seed-Borne Fungi on Dry Weight Content Of Pulses

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Abstract: Seed mycoflora of the pulses grow on the seeds infecting the endosperm and embryo of the seed. Seeds of Green gram, Black gram, Chickpea and Pigeon pea were subjected to their common and dominant seed-borne fungi. After incubation the seeds of the pulses tested for their dry weight. The overall holistic content of the seeds were recorded. The dry weight of the test seeds were found to be reduced variably according to the fungal capacity of the seed-borne fungi of the pulse.

Key words: dry weight, seed mycoflora

Introduction: Over 800 million people having no access to adequate food and about two billion faced with hunger and malnutrition (Oladipo et al., 2015).

Green gram (*Vigna radiata* L.) is an annual plant with herbaceous bushy appearance. It attains a height of 1-3 feet, being more or less erect. The seeds are usually green in color but the cotyledons are used as *dal*. The plant could be cultivated in rainfall ranging between25-35 inches. It is a Kharif as well as Rabi crop. The Kharif crop is sown around June or July and Rabi crop in September or October. Within three months, the plant is harvested. Seeds show 24 g protein, 56.7 g carbohydrate/100g of edible part of the seeds, thiamin (0.47mg), and riboflavin (0.27mg), iron (7.3mg). (Shakuntala Manay and M. Shadaksharaswamy, 1987).

Black gram (*Vigna mungo* L.) is an herbaceous annual plant with spreading procumbent branches, commonly referred as 'wooly pyool' due to presence of brown hairs covering stem. It is commonly grown as a Kharif crop where rainfall ranging between 30-35 inches. Usually cultivated in June -July and harvested within 3-4 months. The states under cultivation are Madhya Pradesh, Uttar Pradesh, Punjab, Maharashtra, West Bengal, Andhra Pradesh and Karnataka. Black gram is important for its high phosphoric acid content. It contains 24g protein/100g of seeds and carbohydrates 59.6g/100 g of seeds show that it is nutritious pulse. It also has good amount of phosphorus (385mg) iron (10.2mg), thiamin (0.42 mg), riboflavin (0.20mg), niacin (2mg) and vitamin C (3mg) (Shakuntala Manay and M. Shadaksharaswamy, 1987).

Chick pea (*Cicer arietinum* L.) is small much branched plant attaining height of about 2 feet. It is a crop grown in dry cool climate during Rabi season in the regions with low to moderate rainfall. It may be cultivated as intercrop along with Jowar, Wheat, and Bajra etc during October-November in Marathwada region. The crop is harvested after about 3-4 months in February – March. Uttar Pradesh, Punjab, Rajasthan, Madhya Pradesh, Bihar, Maharashtra, Andhra Pradesh, West Bengal, Tamil Nadu and Karnataka states are under cultivation of this pulse. The prime content of the pulse are malic and oxalic acids from the leaves of Chick pea are useful in intestinal disorders. It contains protein 20.5g/ 100g of seeds and carbohydrates 59.6 g/ 100g of seeds with thiamin (0.30mg), riboflavin (0.15mg), niacin (2.9mg), vitamin C (3mg) and phosphorous (312 mg) (Shakuntala Manay and M. Shadaksharaswamy,1987).

Pigeon pea (*Cajanus cajan* L.) is an annual shrub. Mainly cultivated as a mixed crop with Kharif cereals in low rainfall areas of Maharastra. Sowing is done in June – July and harvested after 6-8 months, between January- February. It is cultivated in the states like; Uttar Pradesh, Orissa, Rajasthan, Maharashtra, Bihar and Tamil Nadu. It contains protein 20.4 g/100 g of seeds and carbohydrates are 60.4 g/100 g of seeds suggesting that it is also good source of protein and carbohydrates, it also contain thiamin (0.45mg), niacin (2-9mg) and riboflavin (0.19mg). It has better quality of fiber (7g/ 100g of seeds). (Shakuntala Manay and M. Shadaksharaswamy, 1987).

Materials and methods:

Collection of seed samples.

The methods prescribed by Paul Neergaard (1977) have been adopted for the collection of seed samples. Seed samples of Green gram, Black gram, Chick pea and Pigeon pea were collected from field, market places from Nanded. A composite seed sample for each of the pulse crop was made by mixing the individual seed sample together, preserved in gunny bags at room temperature during the studies.

Detection of seed mycoflora:

The seed-borne fungi of different pulses, different categories and stored seeds of pulses were detected by moist blotter (B) and agar (A) plate methods as recommended by ISTA (1966), De Tempe (1970), Neergaard (1977) and Agrawal (1981). The procedure of moist blotter (B) and agar (A) plate methods is described as below.

Moist blotter plate method:

In moist blotter plate method; a pair of white blotter papers of 8.5 cm diameter was jointly soaked in sterile distilled water and placed in pre-sterilized borosil glass Petri-plates of 10 cm diameter. Ten seeds were placed at equal distance aseptically on the moist blotter paper. The plates were incubated at room temperature for ten days. On eleventh day the seeds were examined under microscope for the preliminary determination of seed mycoflora. The seed-borne fungi found on each and every seed were isolated and identified, brought into pure cultures and maintained on PDA (Potato Dextrose Agar) slants for further studies.

Agar plate method:

In agar plate method; 25 ml of sterilized PDA medium of pH 5.6 was poured in pre-sterilized borosil glass Petri-plate of 10 cm diameter. The Petri-plates were allowed to cool at room temperature; then ten seeds of test pulses were placed at equidistance under aseptic condition. The plates were incubated at room for ten days. On eleventh day the seeds were examined under microscope for the preliminary determination of seed mycoflora. The seed-borne fungi found on each and every seed were isolated and identified, brought into pure cultures and maintained on PDA (Potato Dextrose Agar) slants for further studies.

Preparation of spore suspension

Spore suspension of common and dominant seed-borne fungi of pulses were prepared separately by adding 10 ml of sterile distilled water into the sporulating pure cultures of seed-borne fungi of pulses; maintained on PDA slants for seven days at room temperature. The slants were shaken and content was filtered through muslin cloth to separate mycelium and spore. The filtrate thus obtained was used as spore suspension.

Infestation of test pulses seeds with spore suspension

In order to study the effect of common and dominant seed-borne fungi of pulses on the seed health of pulses, the test pulses like Green gram, Black gram, Chick pea and Pigeon pea were surface sterilized with 0.1% $HgCl_2$. then washed repeatedly with sterilized distilled water to remove traces of $HgCl_2$. After washing, the seeds were separately treated with spore suspension of the common and dominant seed-borne fungi of pulses. Such artificially infested seeds were used to study percent seed germination, shoot, root length and percent seedling emergence separately. The seeds treated with sterile distilled water served as control.

Results and discussion:

In all seventeen seed-borne fungi were reported in the study. From seventeen fungi six were found to be common and dominant seed-borne fungi of the four test pulses that are selected for their action on the dry weight of the test pulses. The data in the Table show that, all the common and dominant seed-borne fungi of pulses caused reduction in dry weight of seeds of all test pulses in more or less quantity.

Table 17: Effect of common and dominant seed-borne fungi on dry weight of pulses. (After ten days of incubation).

Sr. No.	Infestation by common and dominant seed-borne fungi	Dry weight of infested seeds of pulses (initial weight of seeds 25g)			
		Green gram	Black gram	Chickpea	Pigeon pea
1	Aspergillus flavus	6	10	10	18
2	Aspergillus fumigatus	21	10	12	10.20
3	Aspergillus niger	10	13	18	17
4	Drechslera tetramera	20.30	18	15	12
5	Fusarium moniliforme	20	15.60	18	22
6	Rhizopus stolonifer	22	20	19	17
7	Control	24.3	23.6	22.2	23.5

Aspergillus flavus caused maximum dry weight loss in case of Green gram and Chickpea, *Aspergillus fumigatus* in case of Pigeon pea and *Aspergillus flavus* and *Aspergillus fumigatus* in Black gram. *Rhizopus stolonifer* caused minimum dry weight loss in case of Green gram, Black gram and Chickpea and *Aspergillus flavus* in Pigeon pea.

Biodeterioration in terms of loss in seed content due to activities of seed-borne fungi have been reported by different workers. Vidyasekaran and Kandaswamy (1972) studied seed mycoflora of Green gram and found that starch degradation was due to *Aspergillus* spp. Wu (1973) studied enzymatic biodeterioration of Mung bean due *Rhizoctonia solani* and found that mycelial macerate of the fungus is responsible for the degradation. Christensen (1974) reported that, losses in food

grain have been found to be more severe due to *Aspergillus* than any other fungi. Manners (1974) studied degradative effects of seed-borne fungi associated with different seeds. Biligrami *et al* (1976) studied seed mycoflora of Green gram and Black gram and found that, there was decrease in protein content of the pulses due to fungi like *Aspergillus flavus* and *Fusarium semitectum.* Nager and Chouhan (1977) reported loss in protein content due to seed-borne fungi of groundnut. Sinha *et al* (1977) Studied Arhar seeds and found decreased protein content of the seeds due to seed-borne fungi like *Aspergillus niger*, *Aspergillus flavus* and *Fusarium moniliforme*. They also noted that, *Aspergillus niger* was found to be more effective in reducing protein content than other fungi. Sinha *et al* (1981) Studied Pigeon pea seeds and reported reduction in starch content due to *Aspergillus flavus* and *Aspergillus niger.*

Similar results were obtained by Vijay kumari and Karan (1981) Studied seed-borne fungi of cowpea and noticed starch reduction in cowpea due to its seed mycoflora. Panchal (1984) Studied Jowar and found seedling rot was caused by *Fusarium moniliforme*, *Fusarium semitectum* and *Aspergillus flavus*. Kin *et al*. (1984) investigated rice seed mycoflora and found *Fusarium moniliforme* caused rotting in seeds. Singh and Gupta (1984) studied seed-borne fungi of *Medicago sativa* and found that rot was caused by the seed-borne fungi *Aspergillus flavus*. Premlata and Sinha (1985) Carried out investigations of cereal seeds and observed that, there was reduction in starch content of cereal seeds due to species of *Aspergillus*. Kharinar and Gambhir (1985) studied fungi that caused seed rot of jowar were *Aspergillus carbonarius, Aspergillus flavus* and *Aspergillus niger*. Khairnar (1987) Studied seeds of Bajra and found that, starch degradation of bajra seeds was due to *Aspergillus niger*, *Aspergillus flavus, Curvularia lunata*, *Fusarium moniliforme* and *Drechslera tetramera*. Singh and Prasad (1988) Studied seed mycoflora oil seeds and reported loss in protein content of seeds by different fungi that were associated with seeds. Bhikane (1988) studied seed mycoflora of Green gram and observed that rot was caused by *Aspergillus niger*. Bhikane (1988) Studied seeds of pulses and found that, loss of dry weight in seeds was due to *Aspergillus niger* and *Aspergillus flavus.* Similarly loss in seed weight has also been reported in other crop seeds due to seed-borne fungi Sandhikar (1990), Kumar and Prasad (1993), Waghmare (1996). Umechuruba *et al* (1992) found that, seed-borne fungi *Aspergillus niger*, *Aspergillus flavus*, *Macrophomina phaseolina* caused adverse effects on content of seeds of groundnut. Danai (1994) Studied Bajra, Black gram, groundnut and neem seeds and reported that, species of *Aspergillus* caused maximum loss in seed weight in case of bajra, Black gram, ground nut, while it was less in Neem seeds. Waghmare (1996) investigated Jowar seed mycoflora and reported seed rotting in jowar due to *Fusarium moniliforme*, *Fusarium oxysporum* and *Fusarium avenacuri*. Gupta and Sharma (1998) observed in case of soybean that, *Aspergillus terreus, Aspergillus niger* and *Aspergillus flavus* completely reduced root length and affected roots showed browning. Bodke (2000) studied cereals and reported rot, caused by the fungi like *Alternaria tenuis, Aspergillus flavus, Curvularia lunata, Drechslera tetramera* and *Fusarium moniliforme*. Khairnar (2015) reported forty one fungal species from Maize, Bajra, Wheat and Paddy. Among these fungi *Aspergillus flavus* and *Curvularia pallescences* were pathogenic. Dry weight loss was maximum by A. flavus at 45˚C. Halla et.al. (2018) studied Legume seed deterioration due to eleven fungal species, predominant of these were *Alternaira alternata, Aspergillus flavus, A. niger, A. parasiticus, A. terreus* etc. that reduced dry weight up to 68.20%-76%.

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