REVIEW OF LITERATURE
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Many fungi are serious parasites of seed primordia and maturing seeds and reduce yields both quantitatively and qualitatively. Other fungi including saprophytes and very weak parasites may lower the quality of seeds by causing discolouration, which may seriously depreciate the commercial value of seeds, particularly of grain when graded for consumption. The presence of microorganisms has tremendous influence over the grade and conditions of seeds.

Mycoflora of Oil seeds:

Broadly the microorganisms carried on and in the grains can be classified as external and internal ones. Externally seed borne mycoflora are mostly saprophytes but a few parasites are also occurring along with them. The internal seed mycoflora composed of parasitic as well as saprophytic.

Rautenstein (1939) reported the occurrence of *Aspergillus versicolor*, *Cladosporium herbarum*, and *Penicillium lanosum* on wheat as external flora. Wilson (1947) reported that genera of *Penicillium*, *Aspergillus*, *Trichoderma*, *Rhizopus*, *Mucor* and species like *Sclerotium rolfsii*, *Sclerotium bataticola*, *Diplodia theobromae*, *Rhizoctina sp* and *Fusarium sp*. were among the soil borne fungi occurring on groundnut seeds. Whitehead *et al.*, (1948) reported *Microascus* as a seed borne fungi from barley, oats, wheat and soybeans. Ghosh (1951) reported that species of *Aspergillus* and *Penicillium* were the major groups of fungi of stored rice but the species of *Alternaria*, *Cladosporium*, *Fusarium*, *Mucor* and *Oidium* also occurred commonly. Govindaswamy (1955) reported on the occurrence of *Helminthosporium*, *Curvularia*, *Fusarium* and others as external flora in different varieties of rice.
Diener (1960) reported that mycoflora were associated with groundnut having high initial moisture levels. The predominant fungi were *Aspergillus glaucus*, *Aspergillus tamarii* and *Penicillium citrinum*. *Aspergillus ruber*, *Aspergillus repens* and *Aspergillus restrictus* occurred more frequently and in a greater number. Kennedy (1964) isolated *Alternaria*, *Aspergillus*, *Fusarium* and *Penicillium* on four varieties of Jowar as external flora and they varied with variety. Grewal and Pal (1965a & b) found the presence of *Helminthosporium nodulosum* and species of *Alternaria*, *Aspergillus*, *Curvularia* and *Fusarium* on ragi seeds. Christensen and Kaufmann (1965) stated that stored grains comprise mainly storage fungi such as *Aspergillus amstelodame*, *Aspergillus candidus*, *Aspergillus chevalieri*, *Aspergillus flavus*, *Aspergillus ochraceous*, *Aspergillus restricts*, *Aspergillus ruber* and *Penicillium*. Christensen and Dorworth (1966) reported that *Aspergillus halophilicus*, *Aspergillus repens* and *Aspergillus restrictus* invaded soybeans with less than 13 per cent moisture content. Sharma and Agnihotri (1969) reported that *Penicillium*, *Curvularia*, *Rhizopus*, *Aspergillus*, *Fusarium* were predominant on groundnut pods. Jain and Patel (1969) detected the presence of *Alternaria*, *Aspergillus*, *Chaetomium*, *Cladosporium*, *Fusarium*, *Mennoniella*, *Nigrospora*, *Penicillium*, *Rhizopus* and *Stemphylium* for castor seeds. The fungi *Alternaria*, *Aspergillus* and *Fusarium* found to be pathogenic. Hanlin (1969) reported that the pods of peanut contained *Fusarium*, *Penicillium* and *Phoma*, while the seed contained *Penicillium* and *Gliocladium*. Narasimhan and Rangaswami (1969a) reported species of *Alternaria*, *Aspergillus*, *Botrytis*, *Chaetomium*, *Cladosporium*, *Curvularia*, *Fusarium*, *Helminthosporium*, *Mucor*, *Penicillium* and *Rhizopus* as external fungal flora of different varieties of sorghum grains.

Porter and Garren (1970) reported that *Chaetomium*, *Fusarium*, *Penicillium*, *Trichoderma* and *Rhizoctonia* invaded freshly dried pods of groundnut on the pericarp.
Agarwal et al., (1972) encountered *Colletotrichum truncatum*, *Macrophomina phaseoli* and *Phomopsis* sp were the important major seed borne pathogens in soybean. Dubey (1972) studied fungal deterioration of linseed under conditions of storage and concluded that oil content of seeds increased with the length of storage. Jhamaria et al., (1975) detected seven fungi viz; *Alternaria*, *Aspergillus*, *Chaetomium*, *Cunninghamamella*, *Curvularia*, *Rhizopus* and *Rhizoctonia* from the seeds of sunflower. Agarwal and Singh (1975) detected *Alternaria lini*, *Alternaria linicola*, *Ascochyta linicola*, *Botrytis cinerea*, *Colletotrichum linicola*, *Curvularia lunata*, *Cephalosporium* sp. and *Helminthosporium* associated with Linseed. In India Majumdar et al., (1976) reported rice seeds infected with *Helminthosporium oryzae*, *Curvularia lunata*, *Cochliobolus unatus*, *Alternaria tenuis* and *Epicoccum*. Chohan and Kaur (1975) isolated seed mycoflora of sunflower. Sinha and Khare (1977) detected more fungi on untreated seeds than on pre-treated seeds. They found maximum percent incidence of *Aspergillus* sp., *Aspergillus niger*, *Fusarium equiseti*, *Macrophomina phaseolina* and *Alternaria* state of *P. infectoria* on untreated seeds of cowpea. Michail et al., (1979) revealed that the blotter method was preferable than the agar method for the detection of *Cephalosporium*, *Fusarium moniliforme*, *Fusarium semitectum* and *Myrothecium verrucaria*.

Raut et al., (1983) reported that pretreatment may not be useful when accurate account of seed borne infection is to obtained and also pretreatment reduced the infection of 12–21 per cent seeds. Vijayalakshmi and Rao (1985) isolated 38 fungal species on stored sunflower seeds of which 38 per cent belong to the category of storage fungi that include species of *Aspergillus* and *Penicillium*. Chandra and Srivastava (1981) recorded the association of a number of fungi with the seeds of oil crops collected from different areas of India. Chandra et al., (1985) reported of the nine fungal forms included in
their studies *Aspergillus niger* and *Rhizopus* sp infected widest host range and pathogenic to the majority of oil seeds. Popoola & Kueshi (1986) reported that most of the microorganisms isolated as seed borne have been established as potential pathogens of soybean on the field and in the storage conditions. Kumhar *et. al.*, (1987) revealed that *Aspergillus niger, Aspergillus tamarii* and *Aspergillus flavus* were common as external mycoflora by blotter technique and agar plate method. Gowda and Sullia (1987) reported that fungi infected 96–98 % of seeds of cowpea and soybean. Paul (1989) investigated soybean grown in Himachal Pradesh by various methods for externally and internally seed borne fungi and reported 26 fungal species of which *Fusarium roseum, Colletotrichum dematium* and *Phoma* sp were associated with decaying seeds and *Aspergillus, Penicillium* and *Fusarium* were predominant on ungerminated seeds.

Arun and Mathew (1991) studied seed mycoflora of Pigeon pea in freshly harvested and one year old seeds and isolated a total of 14 species of fungi using blotter method. El-Naghy *et. al.*, (1991) isolated eleven genera and 31 species from stored cotton seeds collected from different localities in Egypt. The most common species encountered using the dilution and the seed plate method were *Aspergillus niger, Aspergillus flavus, Aspergillus terreus, Aspergillus tamarii, Mucor racemosus* and *Rhizopus stolonifer*. Kanchan lata (1991) studied on stored grains of wheat, maize, barley and paddy and isolated seventy species and one variety belonging to 38 genera representing 16 species of Zygomycetes, 7 species of Ascomycetes and 47 species of Hyphomycetes. Pandey *et. al.*, (1991) studied on microfungi associated with stored seeds of lentil and showed the association of *Alternaria alternata, Aspergillus flavus, Aspergillus fumigatus, Aspergillus nidulans, Aspergillus niger, Aspergillus sulphureus, Chaetomium globosum, Curvularia lunata, Curvularia*
pallescens, dark sterile mycelium, Drechslera australiensis, Fusarium semitectum, Fusarium solani, Macrophomina phaseolina, Mucor racemosus, Penicillium citrinum and white sterile mycelium with seed coat.

Jyotsana et. al., (1994) revealed saprophytic as well as pathogenic fungi belonging to 70 species of 24 genera on rape seed. Srinivasulu et. al., (1994) reported ten different species of fungi belonging to seven different genera in which Cladosporium herbarum, Aspergillus flavus, Aspergillus niger and Botrytis ricini were the most frequent ones. Anshubhatia et. al., (1995) reported fortysix fungi on 175 Gaur seed samples of local cultivars, of which Alternaria alternata, Alternaria tenuissima, Aspergillus flavus, Aspergillus niger, Cladosporium oxysporum, Colletotrichum dematium, Fusarium oxysporum, Rhizoctonia bataticola and Scopulariopsis breviaculis were dominant.

Vishwanathan (1996) reported first time the presence of 12 species of Alternaria, 5 species of Fusarium and 4 species of Drechslera on seed and kernel of Sunflower. Kanak Manjari et. al., (1996) reported studies on seed mycoflora of fennel, black caraway and ammi in relation to storage period. The dominant species they isolated throughout the year from unsterilized seeds of all the three spices were Alternaria alternata, Aspergillus flavus, Aspergillus niger, Aspergillus sydowi, Aspergillus terreus, Cladosporium cladosporioides, Curvularia lunata, Drechslera state of Cochliobolus spicifer, Penicillium citrinum, Rhizopus nigricans and white sterile mycelia.

Rauf et. al., (1997) studied on naturally infected seed samples and reported Alternaria alternata, Emericelopsis terricola, Fusarium moniliforme, Fusarium semitectum, Fusarium solani, Macrophomina phasidolina, Phoma oleracea, Stemphylium helianthi and Verticillium dahliae in these infected seeds. Godika et. al., (1999) reported the incidence of Rhizoctonia bataticola was 1-33 % in untreated seeds of Sunflower grown in Rajasthan.
Mady (2000) reported a total of 36 genera and 84 species of fungi associated with peanut seed. Kashinath and Raha (2002) reported on the study of air spora in the storage places using culture plate method. They isolated different species of Alternaria, Aspergillus, Curvularia, Fusarium, Penicillium, Rhizopus etc on maize, groundnut and soybean. Nasreen Nasir (2003) detected a total number of 39 species of fungi belonging to 15 genera from the six month old seeds of Soybean by means of four incubation methods and also reported surface sterilized seeds yielded lesser number of fungi than from seeds without sterilization.

Singh and Swami (2004) detected eight different fungi namely Alternaria alternata, Aspergillus flavus, Aspergillus niger, Curvularia lunata, Curvularia penniseti, Fusarium equiseti, Fusarium moniliforme and Rhizopus stolonifer from Pearl millet by Standard blotter and Agar plate method. They also reported from their findings these fungi cause damage to stored seeds and also cause field diseases. Wani et. al, (2004) reported that Aspergillus spp. was detected both internally and externally from the paddy seed samples in two methods employed. Rajasekhara and Sandhya (2005) reported different fungal species on maize among which Aspergillus flavus was of the highest incidence.

**Effect of culture filtrate on seed germination and seedling vigour.**

Many seed borne fungi are known to produce metabolites, which in several cases adversely affect seed germination and seedling vigour. They are also known to produce toxic metabolites, which may be lethal when consumed.

Effect of culture filtrate on germination of red gram seed was studied by Kamal and Verma (1980). They reported that 100% inhibition in seed germination was obtained by culture filtrate of Aspergillus flavus, Aspergillus nidulans, Aspergillus niger, Trichoderma viridiae while Alternaria alternata caused 60% pre-emergence ioss.
Anahosur and Bidari (1974) found that culture filtrate of *Alternaria tenuis*, *Aspergillus flavus*, *Aspergillus niger*, *Fusarium solani* reduced the root growth and seedling vigour in Soybean. They further stated that the seed mycoflora produced toxin, which affected the seed germination and seedling vigour. Natarajan (1975) showed the effect of culture filtrate of *Aspergillus flavus* and *Aspergillus niger* in black gram, red gram and chick pea. He noticed considerable reduction in seed germination and root elongation. Seedling vigour of field bean was affected adversely by toxic metabolites produced by *Trichothecium roseum* (Siddaramaiah & Desai 1980).

Similar results have been reported in oil seeds and cereals. Germination of oil seed such as *Brassica campestris* L. was affected by culture filtrate of *Aspergillus flavus*. Higher concentration caused considerable decrease in seed germination and growth of the radicle (Mishra & Kanauja 1973).

Mishra & Singh (1969) noticed that the culture filtrate of *Helminthosporium nodulosum* and *Helminthosporium leucostylum* reduced the germination and elongation of root and shoot in seedlings of 12 varieties in Ragi. Singh and Swami (2004) reported the culture filtrate effect of eight different fungi on seed germination and seedling vigour of Pearl millet. Singh (2004) reported the role of six different culture filtrate of radish seed borne fungi upon seed germination and seedling vigour.

**Biological Control:**

Several antagonistics compounds of fungal, bacterial and higher plant origin were found to be effective in controlling plant diseases. The increasing awareness on ecosystem is growing interest in pesticides free agricultural products and the biological control of plant pathogenic fungi has received considerable attention.
Plant Extract (Botanicals):

Biological screening of higher plants has shown that many of these plant contain highly potent inhibitors of plant pathogens. Some of these inhibitor provide complete protection against the diseases and many cases the antipathogenic activity obtained with crude extract could be confirmed by purified preparation also. The natures of inhibitors characterized from higher plants were found to be variable. Majority of inhibitors showed proteins of polypeptide nature. Several plant diseases caused by fungi, bacteria and viruses could be controlled by plant products.

During recent years use of plant products for the control of plant diseases is gaining importance (Anandraj and Leela, 1996). The ecofriendly approaches do not encourage the use of chemical fungicides, which cause problems of residual toxicity, environmental pollution and development of resistance in pathogens. Due to economical and ecological reasons, use of plant extracts for the control of plant diseases is desirable (Raju, 2003).

Tiwari and Premalatha Dath (1984) tested the effect of leaf extracts of 23 plants on growth, sporulation and sclerotial production of three pathogens namely Pyricularia oryzae, Drechslera oryzae and Corticium sasakkii. Singh et. al., (1979) reported the effect of Garlic leaf extract on Fusarium oxysporum, f. sp. ciceri and Sclerotia sclerotiorum was ideal at higher concentration while at lower concentration the growth of both the pathogens was inhibited considerably. Avdhesh and Satapathy (1977) showed that leaf, flower, stem and root extract of two varieties of Vinca rosea were antifungal to Helminthosporium nodulosum, Sclerotium rolfsii, Pestalotia sp., Fusarium oxysporum, Collecotrichum sp. and Aspergillus niger which parasitize Ragi, Green Gram, Brinjal, Tobacco and Groundnut respectively. They also reported that extract inhibited spore germination, sporulation and mycelial
growth of the test fungi. Natarajan and Lalithakumari (1987) showed the effect of the leaf extract of *Lawsonia inermis* on the control of *Drechslera oryzae* infection in rice seedlings was observed both by seed treatment and foliar application.

Anandraj and Leela (1996) studied on aqueous leaf extracts of *Azadirachta indica, Chromolaena odorata, Lantana camere, Piper colubrinum* and *Strychnos nuxvomica* against vegetative and reproductive phases of *Phytophthora capsici* causing foot rot disease in Black pepper. Gerard Ezhilan *et al.*, (1994) studied on the effect of six selected plant products and oil cakes on the sclerotial production and germination of *Rhizoctonia solani*. Thribhuvanamala and Narasimhan (1998) studied the effectiveness of 22-plant extract belonging to 17 families against three seed borne fungal pathogens of sunflower namely *Alternaria helianthi, Macrophomina phaseolina* and *Fusarium solani*. Chattopadhyay (2001) reported first time on inhibition of *Alternaria carthami* by bulb extract of *Allium sativum* and leaf extract of *Azadirachta indica*. Nwacheckwce & Umechuruba (2001) studied the efficiency of leaf extracts of 5 different plants (*Ocimum basilicumo, Vernonia amygdalina, Cymbopogen citrates, Azadirachta indica* and *Carica papaya*) on major seed borne fungi *Aspergills niger, A. Flavus, Botryodiplotia theobromae* and *Fusarium moniliforme* of African yam bean seeds.

Rangarajulu and Balasubramanian (2003) reported that ethonolic root extract of *Abrus precatorius* showed significant inhibitory effects on growth, biomass, and the total protein DNA & RNA content of *Colletotrichum capsici*. Surender Singh and Harichand (2004) studied on the effect of leaves of different plants viz; *Calotropis procera, Datura stramonium, Eucalyptus indica* on spore germination of *Fusarium oxysporum f sp. Ciceri*, a wilt pathogen of chickpea.
Sharma and Ashwani (2004) reported the efficacy of five different plant leaf extracts on wheat. Ragasa et. al., (1999) studied the antimicrobial compounds from *vitex negundo*. This extracts inhibit the growth of the fungi *Candida albicans* and *Aspergillus niger*. Vanitha and Ramachandran (1999) studied that the leaves extract of *V. negundo* gave the lowest disease incidence in late blight of tomato caused by *Phytophthora parasitica*. *Ocimum basilicum* inhibited the mycelial growth and spore germination of *Fusarium oxysporum* (Bansal and Gupta, 2000).

Due to high cost of fungicides and the worldwide awareness regarding environmental pollution and residual problems, the excessive use of fungicides is discouraged.