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Soybean *(Glycine Max (l.) Merril)* and its Biological Control – A Review

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Abstract - The soybean (Glycine max (L.) Merril) is a commercially significant leguminous seed crop for feed and food applications, containing 40% seed protein and 20% oil. Among the major oil crops, soybean ranks first in world production in international trade markets, followed by cottonseed, groundnut (peanut), sunflower seed, rapeseed, linseed, sesame seed, and safflower. Many oilseed crops' seeds are known to have substantial mycoflora. Seed-borne microorganisms have a substantial influence on agricultural production in the field and reduce seed shelf life. Oilseeds are susceptible to fungal attack due to unsanitary storage conditions. The fungus degrades the grains both qualitatively and quantitatively. Numerous studies have been conducted to investigate the quantitative and qualitative characteristics of the oilseed seed mycoflora. The paper discusses the changes in seed contents caused by seed infection with seed-borne fungus. According to the current research, Glycine max seeds usually contain a variety of pathogenic fungus that can cause serious infections in the field.

Keywords - Glycine max (L.) Merril, Soybean, Oilseeds, Mycoflora

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INTRODUCTION

Soybean *(Glycine max (L.) Merril)* is an Asiatic leguminous plant used around the world for its oil and protein, which are widely employed in the production of animal and human diets. Soybean is the most important crop grown in Brazil in terms of planted area and production, and it is extremely important for the state of Paraná, which is one of the key Brazilian soybean-growing areas producing soybeans for export. Soybean monoculture may occasionally cause environmental difficulties and also promotes the exponential rise of pest populations, resulting in crop losses of roughly 30%, due to soybean's susceptibility to insect attack during its whole life cycle (Pimentel et.al., 2006).

India is one of the world's top producers of oilseeds. Nearly 84 percent of the 20 million hectares dedicated to oilseed cultivation are rainfed. Nine cultivated oilseed crops, including groundnut, rapeseed/mustard, sesame, safflower, soybean, and sunflower, are used to make vegetable oil. Linseed and castor seed are used for non-edible purposes.

90% to 95% of the area used for oilseeds is still rainfed, with around 80% of that area being dry plains with no irrigation systems at all. It has been shown that kharif oilseed crops frequently experience a considerable loss in yields and oil content at crucial development stages before maturity when rains are absent.

The Marathwada area of Maharashtra State grows a lot of essential oilseeds. Most oilseed crops are cultivated in Marathwada as rainfed crops during the strange weather conditions of the Kharif (rainy) season. Except for the monsoon season, the Marathwada area is characterised by scorching summers and year-round dryness. The eight districts that make up the Marathwada area are Aurangabad, Beed, Hingoli, Jaina, Latur, Nanded, Osmanabad, and Parbhani.

It is well known that the seeds of many oil seed crops contain significant mycoflora. Microorganisms that are carried by seeds have a significant impact on agricultural productivity in the field and shorten the shelf life of seeds. Numerous instances show that such mycoflora has a negative impact on seed germination, vigour, and the quality and amount of oil (Ward and Diener, 1961; Kadian and Suryanarayana, 1971).

Several mycoflora commonly cause seed degeneration, which causes loss of viability, and numerous fungus to grow on stored seed (Lalithakumari, 1970).

10% of the overall production of grains and oilseeds is lost in our nation. Unhygienic storage conditions, excessive seed moisture levels, or moisture absorption during storage might be blamed for the losses. The agencies' and farmers' seed storage facilities are often rudimentary.

So the storage location's wetness or relative humidity has an impact on the prevalence of fungus on seeds. Similar to this, temperature has a significant impact on how fungus associate with stored seeds.

Oilseeds are vulnerable to fungal assault because of the unclean storage conditions. Both qualitatively and quantitatively, the grains are deteriorated by the fungus. Changes in the amounts of lipids, proteins, and carbohydrates are caused by storage fungus. As a result, the use of the nutrients contained in seed by fungi and conversion into CO_2 and water reflect variations in seed quality and gross weight.

Major oil seed crops in Marathwada include soybean, groundnut, sunflower, safflower, and sesame. The primary supply of vegetable oil comes from these oil seeds. Since soybean contains 40% protein and is a great source of edible oil, it is grown as both an oil seed and a pulse crop. In the recent years, it has been noted during our assessment that the crop has had a variety of illnesses, mostly brought on by fungus. These affected plants produce aberrant and subpar seeds. So, a research of the soybean seed mycoflora was conducted. The research was mostly broken down into two components. First, attempts were undertaken to separate, identify, and determine the type of seed mycoflora from standing crop.

Numerous researchers have looked closely at the quantitative and qualitative aspects of the oilseed seed mycoflora. The screening, isolation, and identification of the seed-bome fungus connected to the chosen oil seeds are the subject of a section of the thesis. The three common farmer-grown cultivars of safflower, soybean, and Nigeria had the seed-bome fungal. From the nine distinct types of the three different oilseeds, more than twenty fungi were isolated. *Altemaria tenuis, A. altemata, Aspergillus niger, A. flavus, A. fumigatus, Curmlarialunata, Rhizopusnigricans, R. stolonifer, Fusariumoxysporum, and F. moniliforme* were the most prevalent and dominating fungus. These mushrooms were brought in as pure cultures and kept in a lab for additional research.

According to the literature, storage of seeds significantly altered their biochemical makeup. The bio-deterioration of seeds is thus included in the second section of the study endeavour. The mycoflora of seeds was examined under various storage circumstances. It is generally known that mycoflora causes grains to deteriorate during storage, and one of the elements affecting grains during storage is the storage structure. This topic was the subject of systematic research. Study was done on the occurrence germination percentage data. The rate of germination gradually decreased.

This study also shown that fungicidal seed treatment considerably boosted seed germination, with the exception of seeds treated with Busan. However, the maximum seed germination rates were achieved with seeds that had been treated with benomyl and dithane M45. Benomyl was shown to be most efficient at lowering the frequency of total fungal recovery and boosting seed germination by Bolkan et al. (1976). When compared to germination on PDA, Ellis et al. (1975) discovered that seed germination was somewhat diminished in vermiculite and soil. Comparing the soybean seeds that germinated on the blotter to those that were cultured on PDA, our findings revealed a similar pattern. It is impossible to fully explain these variations. It could be because PDA's nature and content tend to promote better soybean germination than blotter, vermiculite, or soil.

The alterations in seed contents brought on by seed infection with seed-borne fungus are discussed in the study. Safflower, soybean, and Nigerian seed infestations were shown to have a significant negative impact on the oil and protein content. The extracellular synthesis of lipases and proteases by seed-borne fungus was blamed for the degradation of oilseeds rich in oil and protein. Studies on the predominant fungus of the oilseed's extracellular production of lipases and proteases have been conducted.

Altemarmaltemata, A. tenuis, Aspergillus niger, A. flavus, Fusariumoxysporum, F. moniliforme, and Rhizopusstolonifer were some of the seed-borne fungus whose lipases were examined under various dietary and climatic circumstances.

Although the quality of soybean seed rapidly declines, there has been interest in keeping seed after the initial sowing season. On the germination, vigour, and field emergence of seeds during two carryover storage years, the impact of lowering summer warehouse storage temperatures was determined. Sea! lots were stored in an uncontrolled warehouse environment at two different sites with adequate standard germination (>80%), but varying levels of vigour, mechanical damage, and *Phomopsislongicolla* seed infection (Kentucky and Indiana). For more than two years, samples of the seed were taken every three months and examined for vigour and germination (accelerated ageing, AA). When summertime temperatures rose above these levels, 17 seed lots were transferred from warehouses to constant temperatures of 13 (IN) or 6 (KY) °C and then restored to the warehouse when summertime temperatures fell below the same level.

Tropical storage of soybean (Glycine max) seed can result in degradation that affects the flavour and appearance of the product. A research was created to determine how harsh storage conditions affected the soluble sugars' ability to degrade and how this affected the way seeds deteriorated. Six different soybean cultivars' seed was kept in storage for nine months at controlled (4°C, 45% RH) and simulated tropical (30°C, 82% RH) temperatures. Under control circumstances, the soluble sugar concentration remained steady or little changed. However, in simulated tropical circumstances, significant amounts of stachyose, raffinose, and verbascose were hydrolyzed. According to the degree of oligosaccharide hydrolysis and the subsequent release of glucose and galactose, soybean seed quality appeared to be closely related to seed germination. The dependence of storage behaviour on cultivars highlights the significance of choosing cultivars for storability in tropical areas (Locher and Bucheli, 1998).

Numerous diseases, many of which are seed-borne, target grain legumes, particularly soybean. According to Sinclair (1977), at least 66 fungi, 6 bacteria, and 8 viruses have been linked to soybean seeds. These microorganisms found in seeds have negative impacts on soybean seeds. They can harm mature plants by causing blights, leaf spots, and other diseases as well as reducing seed germination and seedling emergence. *Cercosporakikuchii, Colletotrichumdematiumf.s.p. truncata, Corynesporacassicola, Diaporthephaseolorum, Macrophominaphaseolina, Myrothecium roridum, Peronosporamanshurica, and Pseudomonas glycinea* are a few of the microorganisms that have been linked to soybean seeds.

About 20 diseases have been identified on crops in Malaysia (Singh, 1973; Geh and Lim,1975; Nik Yusuff, 1977, Abu Kassim, 1979). *Ascochyta sp., Cercosporacanescens, Choanephoracucurbitarum, Mycosphaerella sp., Myrothecium roridum, and Periconiabyssoides* are some of the fungi that have been linked to leaf spot illnesses. *Phakopsorapachyrhizi and Phakopsoravignae*induced rust, whereas *Rhizoctoniasolani, Sclerotiniasclerotiorum, and Sclerotiumrolfsii* caused collar rot and stem rot, respectively. Only Wan Zainun et.al comprehensive's analysis of the microorganisms connected to soybean seeds has been published, nevertheless (1979). This study examines the prevalence of pathogenic and saprophytic fungi in 14 soybean cultivars as well as the impact of seed treatments on seed germination and seed-borne fungi.

The current investigation has shown that Glycine max seeds commonly include a variety of pathogenic fungus that can lead to major illnesses in the field. All save *Fusariumfusarioides, F. wmiliforme, Nodulisporium sp., and Zygosporiumechinosporium* have been identified in the United States.There were 27 different types of fungi that were identified, 12 of which were possible pathogens. Species including *Aspergillus, Chaetomium, Curvularia, Nigrospora, and Rhizopus* have been linked to soybean seed illnesses (Sinclair and Shurtleff, 1975). Mycotoxicoses have also been linked to other organisms, such as *Fusarium, Penicillium*, *Cladosporium, and Pithomyces* species, in animals given contaminated grain (Brook and White, 1966).

It was discovered that the blotter approach produced more isolates than the PDA method, but that there were more genera identified using the blotter method—18 as opposed to 15. This is predicted because PDA is more sensitive to detecting even minute levels of infection and because seeds that were plated on it had been exposed to surface sanitation (Neergaard, 1977). However, the agar technique failed to isolate one species, *Myrothecium roridum*. This is to be expected as the fungus only affected the testa's surface, hence it is eliminated by surface sterilisation (Wan Zainun and Parbery, 1977).

Seed-borne fungus is one of the elements that reduces seed quality and seed germination. According to the results of our study, 14 distinct cultivars of soybean had a total of 18 different genera of fungus, of which six were possible diseases. These genera included *Colletotrichum, Diaporthe, Fusarium, JV1acrophomina, Myrothecium, and Phoma.* In Selangor, 34 varieties of soybean were planted. Wan Zainun et al. (1979) recorded 13 species of diseases, the majority of which were new records for Malaysia.

The establishment of grain legumes in this nation may be threatened by the frequent presence of such potentially harmful fungus on soybean cultivars. The development programmes for grain legumes in this country are based on cultivars imported from elsewhere, including the United States of America and the Asian Vegetable Research and Development Center (AVRDC), Taiwan. Therefore, failing to follow stringent quarantine guidelines while importing such seeds might result in the introduction of a number of harmful illnesses.

The proportion of fungus on soybean seeds was lowered by all fungicide applications and hot water treatment. Only benomyl, one of the five fungicides employed, was successful in getting rid of the four possible infections, *Colletotrichumdematium, Corynesporacassicola, and Macrophominaphaseolina*. The complete eradication of the aforementioned diseases from the benomyl-treated seeds can be attributed to Ellis et al (1975).'s demonstration that benomyl was absorbed by both seed coats and embryo tissues. Ellis et al. (1975) discovered that other fungicides, such as thiram and captan, moved into the seed coats of treated seeds but not the embryo tissues. Because of this, captan and thiram were ineffective against pathogens including *Colletotrichum, Diaporthe, and Macrophomina* that are internally seed-borne. However, *Aspergillus, Chaetomium, and Penicillium* were resistant to captan and thiram.

CONCLUSION

The soybean *(Glycine max (L.) Merril)* is an economically valuable leguminous seed crop with 40% seed protein and 20% oil for feed and food purposes. Various researches on the quantitative and qualitative characteristics of the oilseed seed mycoflora have been done. The study covered the variations in seed content caused by seed-borne fungal infection. As a result, it can be concluded that

Glycine max seeds typically carry a kind of pathogenic fungus that can cause serious infections in the field.

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