Chapter I

Introduction

Seed is fundamental unit of plant. Improvement and propagation of agricultural crops depends on healthy seeds. Infected and abnormal seeds are a major limiting factor in crop production. Un-healthy seeds lead to poor germination, growth, vigour and yield. Seed harbors a considerable high amount of load of several fungi responsible for various seed–borne diseases and damage (Varshney, 1990). The knowledge of pathogens, saprophytes and other aspects of seed-borne diseases is useful to minimize losses due to such pathogens during seed production and storage. Studies on seed-borne mycoflora therefore have achieved great importance in modern agriculture.

Study of transmission of plant pathogen through seeds came relatively late in the history of plant pathology. A French botanist, Tillet (1775) showed that stinking or hill bunt (*Tilletia caries*) of wheat caused by a "Poisonous substances" contained in the dust sticking on seed surface. Prevost (1807) proved that sticking bunt was caused by a parasitic fungus. Chen (1920) published a monograph on internal fungal parasites of agricultural seeds. Dorogin (1923) published a system for detection of seed-borne pathogens associated with various crop seeds in the Russia. In 1924, analysis of crop seeds for plant pathogens was made compulsory in the Russia. Orton (1931) and Porter (1949) published a list of seed-borne pathogens from the U.S. and the damage caused by them. An annotated list of seed-borne diseases was published by Noble *et al.* (1958). Until the 1970's seed pathology was restricted to isolation and identification of fungi, bacteria and viruses associated with seeds and the development of uniform seed analysis techniques for seed certification and quarantine. Paul Neergaard is considered the father of seed pathology. Neergaard (1977) defined seed pathology as the science and technology dealing with seed-borne diseases. An annotated list of seed-borne diseases was revised in 1979 by Richardson. The science of seed pathology has more attention and appreciation since 1980 and is recognized as an important discipline within plant pathology.

According to Agarwal and Sinclair (1993), any infectious agent which is associated with seeds having the potential of causing diseases of a seedling or

plant should be termed as "seed-borne pathogen". This term includes all plant pathogenic fungi, bacteria, viruses, nematodes and other microorganism which are carried in or on seeds & diseases caused by them are called as "seed-borne diseases" and fungi associated with the seeds are called "seed-borne mycoflora".

Seed borne mycoflora is a term indicating the association of fungi, with the seed, easily penetrating into the seed to cause instant death or delayed systemic infestation of the emerging seedlings (Neergaard, 1977).

The terms "externally" and "internally" seed–borne mycoflora refer to the location of the pathogen in relation to seed. If the pathogen is located on the outside of the functional part of seed, it is externally seed-borne. If pathogen is inside the seed, it is internally seed-borne. Depending upon their location, the seed borne fungi can be classified in two groups, externally seed–borne and internally seed-borne. The first group includes species of *Botryosphaeria, Botrytis, Fusarium, Mucor, Phialophora, Rhizopus* and *Trichothecium* etc. They are not usually host specific and ~~involve~~ colonize more than one species. Some of the well known internally seed–borne fungi include species of *Alternaria, Aspergillus, Botrytis, Botryodiplodia, Caloscypha, Cephalosporium, Fusarium, Phoma, Schizophyllum* and *Sirococcus*. These may cause deterioration of seed quality and pre or post emergence mortality of seedling (Mittal and Mathur, 1993). According to Christensen (1957), microorganisms fall under two major categories, first is Field microorganisms and second is Storage microorganism, this grouping is based on the fungi that occur in seeds. Field fungi are those which get deposited from field on a seed that are exposed right from the time of fertilization, this group is mostly reported on cereals, pulses, oil seeds and vegetable seeds. Storage fungi are those that develop on seeds during the process of storage of seed. The seeds of leguminous crops do have exclusively storage microorganisms, since their seeds are enclosed in pods. It is only when they are shelled and stored, that fungal and other microbial inoculua get deposited on their surface. The seeds of cereals, pulses, oil seeds and vegetable seeds contain both field and storage fungi. During

storage, other factors like the conditions of storage, e.g. temperature, moisture etc. also play a significant role in the seed microbial population (Thoke, 1989).

The pathogens are molds and develop on seed surface only and some cause internal infection too. Nearly all seeds carry spores of various microscopic fungi either on surface or within the seed. A superficial mycoflora is almost always found because of the ready adhesion of spores to the uneven surface of the seed. Under favourable conditions some spores germinate, mycelium is formed, penetrating into the cotyledons of the seed and feeding on the embryo (Mittal and Mathur, 1993).

Examples of damage due to seed-borne infection are well known. In India, due to kernel smut of sorghum, up to 60 percent heavy losses have been reported in some fields (Mehta *et al.*, 1953). Wallen (1965) found that *Ascochyta pisi* caused a reduction of the yield by 11 percent and *Phoma medicaginis* var *pinodella* (*Ascochyta pinodella*) caused a reduction of the yield by 25 percent. In field experiments, Chenulu, Singh and Joshi (1970) reported yield losses of wheat from 36 to 93 percent depending on the time of inoculation and maximum losses occured when the plants are infected at the boot stage. According to Lalithakumari, Govindaswamy and Vidhyasekaran (1971) seed infecting fungi may have a considerable impact on the quality of groundnut. *Aspergillus flavus*, *Blotryodiplodia* sp. and *Cladosporium herbarum* were found to cause reduction in oil content altering its colour and making it rancid.

Neeregaard (1977) has described various diseases as disorders of seeds. They are:-

1. Seed abortion;
2. Shrunken seeds, reduced seed size;
3. Seed rot;
4. Sclerotisation or stromatisation of seed;
5. Seed necroses;
6. Seed discoloration;
7. Reduction or elimination of germination capacity and

8. Physiological alterations in seed.

1. Seed abortion: In this disorder seeds formed are abortive. Smut fungi and ergot fungi cause seed abortion. Important pathogen causing seed abortions are *Gloeotinia temulenta* and *Fusarium* sp. in cereals like wheat, maize and rice.

2. Shrunken seeds, reduced seed size: This disorder is characterised by poor development of seeds in size (reduced seed size) and seeds remain shrunken. It is common in oil seeds. Due to high incidence of *Fusarium moniliforme* the seed size is reduced in sorghum.

3. Seed rot: It is characterised by rotting of seed, either on the crop or during germination. Seed rot in cereals is caused by *Fusarium* and species of *Drechslera* caused seed rot in different crops.

4. Sclerotisation, stromatisation of seed: It is the transformation of floral organs or seed into sclerotia or stromatisation of seed. e. g. Ergot produced by *Claviceps purpurea.*

5. Seed necroses: It is in the form of necrotic patches. *Collectotricum* spp., as well as *Ascochyta* spp., often penetrate into the fleshy cotyledons, producing conspicuous necrotic lesions in seeds of bean, soybean, pea, chickpea, cowpea and other host.

6. Seed discoloration: It is nothing but discoloration of seed. It is a very important degrading factor. Such disorders may indicate that seed is transmitting pathogens and hence are not good for planting. There are three categories of seed discoloration, a) Superficial necrotic lesions. b) Fungus coatings and c) Pigmentation.

7. Reduction or elimination of germination capacity: It is the effect of seed pathogen. Necroses or deeply penetrating rots reduce the seed viability, longevity in storage and emergence in field.

8. Physiological alterations in seed: Primary as well as secondary metabolites of seed–borne microorganisms affect the seed. These might cause toxicity to human and animals. *Aspergillus flavus* which produces aflatoxins in groundnut and other seeds is toxic and carcinogenic.

It is necessary to know the seed borne mycoflora and its proper control measures to increase the crop production and to fulfill the requirement of food. In the seed certification schemes the main purpose of seed treatment should be to control infections or contaminations. It is simple technique to assess seed health. The botanists and agriculturists study seed borne mycoflora and their effect on seed production and control measures of seed borne mycoflora. By using the standard seed health testing methods farmers can improve production and quality of plants.

Title of present investigation is "**Study of mycoflora associated with some crop seeds around Satara**." Satara tahsil includes 58669 hectares area suitable for cultivation. 53600 hectares area is under Kharif while 18900 hectares area is under cultivation of rabi crops. Major crops of the area are cereals, pulses, oil seeds and vegetables etc. Seeds selected for these studies were *Sorghum bicolor* L. Moench. (Sorghum), *Triticum aestivum* L. (Wheat), *Zea mays* Linn. (Maize), *Cajanus cajan* (L.) Millsp. (Pigeon pea), *Cicer arietinum* L. (Gram), *Pisum sativum* L. (Pea), *Vigna mungo* (L.) Hepper. (Urdbean), *Arachis hypogaea* L. (Groundnut), *Glycin max* L. Merril. (Soybean), *Helianthus annus* L. (Sunflower), *Abelmoschus esculentus* L. (Okra), *Capsicum annum* L. (Chilli), *Cyamopsis tetragonoloba* Taub. (Cluster bean), *Phaseolus vulgaris* L. (French bean). These are the major crop cultivated around the satara so these crop seeds were selected for present study. There is need to study the seed borne mycoflora to assess the seed quality and seed health.