**Unit 1st Aerobiology and seed Pathology:**

**Aerobiology**

Term aerobiology came in use since 1930 term was coined by Fred Campbell Meyer.

**Def.**

**Edmond**(1973): it is scientific and multidisciplinary approach focused on transport of organism and biological significant materials.

It is concerned with

1. Source of an organism and material.
2. Their release in atmosphere.
3. There dispersion and deposition.
4. Their impact on animals and human systems.

According (**IBP**) **International Biological Programme** in 1954. It is investigation of all air borne material of biological significance.

 **Scope of aerobiology**:

1. **Plant pathology:**

Majority of plant diseases are Airborne in origin. They harm our agricultural productivity programme in aerobiological information obtained regarding release of pathogen, dispersal, infective ability and seasonal variation. This will help reducing losses in crops. aerobiology starts with release of various spores and ends with their deposition on surfaces.

1. **Veterinary science:**

Some of domestic animal diseases are contagious and number of animal diseases is Airborne and transferred to long distances. Airborne diseases such as FMD, ephemeral fever in cattle, Fowl pest of poultry, asperogilosis etc. Are common diseases. the aerobiological investigation has scope to protect domestic animals**.**

1. **Biodeterioration:**

This is new and challenging field. there is biodeterioration of materials in stores, equipment , paintings and Library books. In which substrate and organism interact. aerobiology has scope to show effect of toxic bio pollutants of wall paintings of Ajanta and sculptures of Ellora and Taj Mahal of Agra**.**

1. **Metrology:**

Aerospora also changes with change in Environmental conditions. Aerobiological service indicated that, some spores in Air indicate possible weather conditions. while some other give hint of future metrological conditions to follow. Such type of microorganisms is called **Marker**s or **biological indicators**. This is important for metrologist, that helps in forecasting weather condition**.**

1. **Forestry:**

Forest trees are suffering from number of diseases. There is great scope in aerobiological investigations pertaining to diseases of forest trees and help in reducing losses of forest production.

1. **Human diseases:**

 The air sampling show different organisms, some of them cause allergic diseases in man. The Pollen of plant and fungi are aero allergens. House dust contains mites, which are important allergence.

1. **Palynology:**

It helps in surveying Pollen grain from different localities.

**Importance of Aerobiology:**

1. **Allergy** :

10% of Indian population suffer from allergic diseases. The fungal allergy and Pollen allergy effect mucus and respiratory tract. Allergic pollen in India, are mainly from Families like graminae, compositeae, amarantheceae etc. The Pollen Grain cause respiratory track diseases like bronchitis, hay fever, asthma, cough and cold. By studying catches of different seasons pollen calendar can be made which help in identification of pollen grains which causes allergy.

The spore of fungi, also become allergen and cause diseases of upper respiratory track, dermatitis, etc. the spore calendar helps in treatment of allergy.

**b. In pollination:**

 The plant breeders have interest in Pollen structure, Pollen production, dispersion and deposition. If he will take help from aero biologist he can solve many problems of plant breeding.

**C. Forecasting of plant diseases:**

 Forecasting is prediction of occurrence of diseases in an epidemic form in particular area. Plant diseases very in incidence from season to season, due to differences in nature and among the inoculums, environmental condition and other factors which affect development and spread of pathogen.

Early forecasting gives crop growers sufficient time to rearrange their crops schedule and to avoid susceptible crop in a season, When disease is likely to be serve. The aim of disease forecasting is also to arrange control measures before infection to crop. It is thus very important that disease forecasting should be correct, so that an effective disease warning system is available to crop grower.

1. **Weather based prediction**

These are predictions based on weather conditions. According to **Shanta** (1960), severity of Tikka disease of groundnut caused by cercospora species depend on prevalence of high humidity and low temperature, During crop season. **Mayee** (1986) developed **temperature** based forecasting system for the control of Tikka disease of groundnut in the Marathwada region of Maharashtra.

1. **Inoculum based predictions:**

Forecasting of many diseases is based on amount of initial inoculums likely to infect host plant at beginning of Crop season. The forecasting can be based on amount of inoculum available in air, soil, planting material etc.

Inoculum based predictions are useful for many soil borne diseases. The severity of Apple scab caused by bacteria *Venturia inaequalis* is related to amount of perithecia and release of ascospores. Prediction of **blister blight of tea** has been developed which based on number of spores in tea garden in air and duration of surface wetness on leaves.

1. **Host physiology based predictions:**

The Study of physiology of plant is important for forecasting plant disease Epidemics. The pathogen attack their host plant at certain period of its growth, plant infections may cause infection of either sprout on Tuber or crop at its later stage of growth. Potato plant during intermediate stage of their growth does not so much susceptibility to the pathogen.

**Seed Pathology**

Seed Pathology is study of seed Borne pathogens.

**Seed borne pathogens:**

It is any pathogen present in seed sample that causes either failure of seed germination or rotting of emerged Seedling or producers this is symptoms on adult plant. important seed Borne pathogens are various fungi, bacteria, viruses etc.

A seed Borne pathogen has a very good chance of being transmitted to next generation therefore a particular plant is susceptible to a pathogen.

**Importance of seed Borne pathogen:**

Seed Borne pathogens play an important role in human welfare.

1. Reduction in seed germination
2. Chemical changes in seed.
3. Production of mycotoxins
4. Respiratory diseases.
5. Introduction of new diseases.

**Types of seed Borne pathogens:**

Seed Borne Pathogens are of two types i.e. external and internal.

1. **External:**

These pathogens are superficial and associated with surface of seed. The pathogen commonly born (present) on surface of seed. This includes alternaria, helminthosporium, fusarium and many smut and rust fungi. Diseases like grain smut of Jawar are caused by external seed Borne pathogen.

**II. Intenal:**

This pathogen is present inside seed. They live within tissue of seed. This pathogens may lie in seed coat, endosperm or embryo.

The internal seed Borne pathogens include Ustilago, colletotrichum, alternaria, bean mosaic virus etc.

Diseases like loose smut of wheat are caused by internal seed Borne pathogens.

**Methods of detection of seed Borne pathogens:**

1. **Blotter method:**

**Doyer (1938)** blotter method is most convenient method and efficient to Doyer suggested this method. in blotter test, according to International seed testing Association (ISTA) generally 400 seeds are used. The seeds are placed on two or three layer on moist blotter paper in petriplates. The number of seeds per plate may varies from 10 to 200 depending upon size of seed. The petriplates are incubated for 7 days at suitable temperature (20 +/- 1 Degree Celsius). The fungi are identified on basis of morphological characters.

1. **Agar plate method;**

This method was suggested by **Muskett and Malone** (1941). In this method potato dextrose Agar and malt extract Agar media are generally used. Any other suitable media may also be used. 5 to 10 seeds are placed in each plate. The fungi are identified on basis of morphological characters.

**Seed treatment:**

Seed treatment is an age old practice for control of plant diseases. variety of compounds such as copper, sulphur, Mercury, organomercurial are available. The systemic fungicide where introduced in 1966. The seed treatment is of following types.

1. **Hot water treatment:**

The seed material is generally soaked in water for 4 hours to activate pathogen and make it more sensitive to heat. The seed is then transferred to hot water at 49 to 56 0C. The period for which, hot water treatment is to be given varies from seed to seed. The seed is then dried and used for sowing.

 **Example**. In case of loose smut of wheat seed is dipped in hot water at 54 0C for 10 minutes.

 **2) Solar energy treatment:**

In this method, seed is soaked in water for about 4 hours in morning and then spread in thin layers under sunlight. The seed is then Store under dry conditions till plantation. This method is also used for control of of loose smut of wheat.

**3) Chemical treatment:**

In this method dry seed treatment is given with systemic fungicide. The fungicide is obsorbed during process of germination and inactivates pathogen inside seed. Loose smut of wheat and barley can be controlled by vitavax, bavistin, benlate, benomyl, etc.

**Seed certification:**

In general, seed certification is a process designed to maintain and make seed available to the farmers. Continuous supply of high quality seeds and propagating materials of notified kinds and varieties of crops, so grown and distributed to ensure the physical identity and genetic purity. Seed certification is a legally sanctioned system for quality control of seed multiplication and production.

### **History of Seed Certification in India**

The field evaluation of the seed crop and its certification started with the establishment of National Seeds Corporation in 1963.

A legal status was given to seed certification with the enactment of first Indian Seed Act in the year 1966 and formulation of Seed Rules in 1968. The Seed Act of 1966 provided the required impetus for the establishment of official Seed Certification Agencies by the States.

Maharashtra was the first State to establish an official Seed Certification Agency during 1970 as a part of the Department of Agriculture, whereas Karnataka was the first State to establish the Seed Certification Agency as an autonomous body during 1974.

At present 22 States in the country have their own Seed Certification Agencies established under the Seed Act, 1966.

In India, seed certification is voluntary and labelling is compulsory.

### **Objective of Seed Certification**

The main objective of the Seed Certification is to ensure the acceptable standards of seed viability, vigour, purity and seed health. A well organized seed certification should help in accomplishing the following three primary objectives.

1. 1. The systematic increase of superior varieties;
2. 2. The identification of new varieties and their rapid increase under appropriate and
3. generally accepted names.
4. 3. Provision for continuous supply of comparable material by careful maintenance.

### **Certification agency**

Certification shall be conducted by the Certification Agency notified under Section 8 of the Seeds Act, 1966.

### **Eligibility requirements for certification**

Seed of only those varieties which are notified under Section 5 of the Seeds Act, 1966 shall be eligible for certification. Any variety to become eligible for seed certification should meet the following requirement:

1. **General requirements**
 - Should be a notified variety under Section-5 of the Indian Seed Act, 1966.
 Should be in the production chain and its pedigree should be traceable.

Field standards - Field standards include the selection of site, isolation requirements, spacing, planting ratio, border rows etc.

Specific requirements - Presence of off-types in any seed crop, pollen-shedders in Sorghum, Bajra, Sunflower etc., Shedding tassels in maize crosses, disease affected plants, objectionable weed plants etc., should be within the maximum permissible levels for certification.

Seed standards - Minimum seed certification standards have been evolved crop-wise.

### **Process followed in Seed certification**

1. An Administrative check on the origin of the propagating material:

Source seed verification is the first step in Seed Certification Programme. Unless the seed is from approved source and of designated class certification agency will not accept the seed field for certification, thereby ensuring the use of high quality true to type seed for sowing of seed crops.

**Field Inspection :**

Evaluation of the growing crop in the field for varietal purity, isolation of seed crop is to prevent out-cross, physical admixtures, disease dissemination and also ensure crop condition as regards to the spread of designated diseases and the presence of objectionable weed plants etc.

Sample inspection: assessing the planting value of the seeds by laboratory tests. Certification agency draws representative samples from the seeds produced under certification programme and subjects them to germination and other purity tests required for conforming to varietal purity. Bulk Inspection: Under certification programme provision has been made for bulk inspection. Hence, the evaluation of the lot for the purpose of checking homogeneity of the bulk seed produced as compared with the standard sample is carried out. This gives an idea about the genuinity of lot and sample.

**Control plot testing**:

Here the samples drawn from the source and final seed produced are grown side by side along with the standard samples of the variety in question. By comparison it can be determined whether the varietal purity and health of the produced seed are equal to the results based on field inspection.

Grow-out test: Evaluation of the seeds for their genuineness to species or varieties or seed borne infection. Here the samples drawn from the lots are grown in the field along with the standard checks. Growing plants are observed for the varietal purity. Grow-out test helps in the elimination of the sub-standard seed lots.

### **Phases of Seed Certification**

Seed Certification is carried out in six broad phases listed as under:

Receipt and scrutiny of application.

Verification of seed source, class and other requirements of the seed used for raising the seed crop.

Inspection of the seed crop in the field to verify its conformity to the prescribed field standards.

Supervision at post-harvest stages including processing and packing.

Drawing of samples and arranging for analysis to verify conformity to the seed standards; and

Grant of certificate, issue of certification tags, labelling, sealing etc.

**Validity Period of the Certificate**

The validity period shall be nine months from the date of test at the time of initial certification. The validity period could be further extended for six months provided on retesting seed conforms to the prescribed standards in respect of physical purity, germination and insect damage for all seeds except vegetatively propagating material for which lot shall be re-examined for seed standards specified for respective crop. A seed lot will be eligible for extension of the validity period as long as it conforms to the prescribed standards.