

**CHAPTER- 1**

**INTRODUCTION**

The earth's region in which living organisms are present is called as biosphere. The biosphere contains soil, water, and air. Soil is the outermost layer of the earth's surface consisting of materials composed of inorganic and organic constituents. The soil formation processes are slow, gradual and continuous. For the formation of soil, different types of parent materials of rocks are available. Weathering of rocks forms it. Each type of soil shows different horizons distinguished as 'A', 'B' and 'C'. These horizons can be seen when a soil profile is obtained. Throughout the world, there are 6 distinct zones, which are, 1) The Tundra soils 2) The podzolic soils 3) The Chernozemic soils 4) The desert soils 5) The latsolic soils 6) The stony mountain soils. Mineral matter, water, air, organic matter, and microorganisms are the five major components of soil. The quality and quantity of these components varied in different soil types in different localities. The depth, colour, PH and chemical composition of the different horizons are different from place to place. Rane (2002). The soil is classified as sand, silt, and clay. The texture of soil depends upon the percentage of sand, silt, and clay in it. On the basis of this, soils are designated as clay, sandy clay, clay loam, silty clay, silty clay loam, sandy loam, silty loam, loamy sand, sand and silt.

Soil is suitable medium for plants, animals and microorganisms. From the soil, plants derive their nutrients. The organic matter in soil is a potential source of N, P and S for the plant growth. The fertility of soil depends not only on its chemical composition, but also on the qualitative and quantitative nature of microorganisms inhabiting it. Microbial decomposition of organic matter is an essential step to release the bound nutrients in organic residues into an available form. Subba Rao (1977).

The soil microorganisms can be classified into bacteria, actinomycetes, fungi, algae and protozoa. Besides these, the soil also contains some lower animals such as insects, nematodes and rotifers etc. Most fungi are heterotrophic in nutrition. Fungi are dominant in acidic soil, because other organisms like bacteria and actinomycotina cannot live in acidic environment. They are also present in neutral or alkaline soils. Generally they are found in the upper soil profile. The fungal species distribution can also be affected by the composition of vegetation. As the fungi are aerobic organisms, their

population decline in anaerobic soil. Often the waterlogged and compacted soils cause anaerobic conditions. Subba Rao (1977).

The most common genera occurs in soil are *Acrostalagmus*, *Aspergillus*, *Botrytis*, *Cephalosporium*, *Gliocladium*, *Monilia*, *Penicillium*, *Scopulariopsis*, *Trichoderma*, *Verticillium*, *Alternaria*, *Fusarium*, *Cunninghamella*, *Mucor*, *Rhizopus*, *Chaetomium* etc. Subba Rao (1977) Mushrooms are also found in the soil. Mushrooms are a group of macroscopic fungi.

Mostly soil fungi have filamentous organization. But the hyphal organization is absent in lower forms such as Chytridiales, Slime moulds. Mostly the hyphal aggregates form rope like structure called rhizomorph, while some forms exist in the form of chlamydospores or sclerotia as dominant propagules. Generally the soil fungi belong to one of the three classes, which are Phycomycotina, Ascomycotina and Deuteromycotina. Mostly the strains belonging to fungi imperfecti are frequently isolated.

Based on how they get energy, the soil fungi are grouped into three functional groups, which are as follows -

Decomposers or saprophytic fungi. These are organic matter decomposers. They attack cellulose, lignin and gums. They secrete some substances that help in the formation of water- Stable soil aggregates. The hyphae of fungi bind the soil particles together, which create stable aggregates that help in increase soil water holding capacity and increase in water infiltration. There are certain species of *Alternaria*, *Aspergillus*, *Cladosporium*, *Dematium*, *Gliocladium*, *Humicola* which produce the substances, which are similar to the humic substances in soil and hence may be important in maintenance of soil organic matter. There are some fungi called "Sugar fungi", because like bacteria, fungi help in retaining the nutrients in the soil.

Mutualists are the second group of fungi- Mutually the fungi develop beneficial relationship with plants. They are called as mycorrhizae. There are two types of mycorrhizae they are ectomycorrhizae and endomycorrhizae. Ectomycorrhizae generally grow on the surface of roots. Commonly they are associated with trees. The second group that is endomycorrhizae. Commonly they grow within the cells of roots and are generally associated with shrubs, vegetables and grasses etc. These fungi colonize plant roots. They

help to obtain nutrients to the plants from soil such as phosphorus. They help in hiding the roots of plants from pathogens and pests. They provide large area for roots by which plants can get nutrients. The endomycorrhizae has a type that is Arbuscular mycorrhizal (AM) fungi).

The third group is pathogens or parasites, which are dominant in the soil. These cause death or reduced production. There are various soil fungi that cause economic losses in agriculture. For example; *Fusarium*, *Pythium*, *Verticillium* and *Rhizoctonia* etc. Seed rot, damping off and vascular wilts of vegetable, ornamentals etc. are losses caused by *Fusarium oxysporum*. *Fusarium solani* causes root rot, decline in vigor but it is non-specific. The species of *Pythium* cause seed rot, damping off of young seedling. *Rhizoctonia solani* causes seed decay, damping off, root and stem rot, sheath blight and canker etc. In absence of host plant it remains saprophytically in soil. It is most destructive plant pathogen. There are many fungi that control diseases. For example, nematode-trapping fungi. These fungi parasitize disease-causing nematodes. There are some fungi, which infect insects known as entomogenous fungi. The insects having larval stage, show terrestrial habitat. They get contaminated with the soil fungi. For example, *Aspergillus flavus*. This fungus attacks many insects and is particularly active at a larval stage of insect.

Soil organisms are generally present around roots, in litter, on humus and on the surface of soil aggregate. The narrow region around the roots is the rhizosphere region. Many bacteria are present here. They feed on proteins and sugars, which are secreted by roots. Fungi are commonly present in litter as they are plant litter decomposers. Fungi are also common on humus. Some bacteria and fungi decompose the organic matter in soil that is passed through the guts of earthworms. This results in the formation of complex humic compounds in humus.

Generally the soil fungi are found in the organic matter having hard, carbon-rich wood. That may be dead, rotting trees in forests, leaf litter on the surface of orchard soils. Mycorrhizal fungi are commonly found in all types of soils.

About one million fungi can be present in a gram of soil. Fungi lack chlorophyll, hence are not able to photosynthesize. As a source of carbon, they cannot use

atmospheric carbon dioxide. Hence they cannot use light as an energy source like plants. Mostly they are parasitic. Fungi cause various diseases to living host plants, while some fungi develop beneficial relationship with plants. Some are saprophytes, which live on dead or decaying organic matter to convert it to different forms, which are available to higher plants. There are different food sources for soil organisms. For example; dead plant material, organic material, detritus, surface residue, root exudates, lignin, active fraction organic matter, labile organic matter, recalcitrant organic matter and humus etc.

**Topography, climate and vegetation: -**

The soil is formed by geological and ecological weathering of rocks. Chemically and physically the soil material differs from place to place. Various factors are responsible for the formation of soil such as parental rock, vegetation, time and climate. Climate is most important factor in soil formation. The climate of Maharashtra is monsoonal in nature. It shows hot, rainy and cold weather seasons. The months showing maximum heat are March, April, and May. The South-west monsoon starts in the first week of June. The wettest month is July. August shows substantial rain. South-west monsoonal current becomes low in the month of September. October shows transition from the rainy season to winter. The month from November to February shows cool, dry spell. In this period the sky is clear, gentle breeze and pleasant weather.

The most dominating structure of Maharashtra is the Western Ghats. In the states of Maharashtra, Karnataka and Malbar region it is also known as Sahyadri ranges which form the backbone of the state. The northern part of the state shows the higher altitude of the ranges (1438 m).

The most peninsular part of India is the Deccan Plateau. In west it is bordered by Western Ghats and in east by Eastern Ghats. The cities of Maharashtra comes in Deccan Plateau are Pune, Nagpur and Solapur. Basalt and granite rocks are dominant in this region. Maharashtra covers the northern part of Deccan. The altitude of this region may vary from 450-750 m.

Satpura ranges and Tamhini, Varandha and the Sawantwadi Ghats are the main hills and ranges of the region. These are the divisions of the Western Ghats. In the

eastern part of the state there is a chain of mountain. These mountains are the Satpura range and the Bhamragad- Chiroli- Gaikhuri. The region from Gujarat to Kerala shows the konkan coastal region. The region between the Arabian sea and the Sahyadri ranges shows the konkan region. This region shows maximum altitude below 200 m.

The plateaus are dissected by the main rivers and their tributaries. The rivers forming important features on the land surface are Krishna, Bhima, Godavari, Tapi- Purna and Wardha- Wainganga. The konkan river basin, the Tapi river basin and Narmada river basin are located at Western part. Krishna and Godavari are present at the eastern side. The Deccan plateau shows black cotton soil, which is rich in humus. In the Wardha- Waliganga river valley the old crystalline rocks and saline soils are present. This makes the soil infertile.

In Western Ghats, Satpura ranges and Chandrapur region the vegetation is of forest. The vegetation of the coastal region of the konkan coast consists of paddy fields. The eminent trees like Mango, coconut and shrubs are present in the coastal belt. As the forests yield teak, bamboo, myrobylan, the forests are valuable. The areas showing good rainfall shows rich vegetation. About 17 % of the land of Maharashtra is covered by thick evergreen deciduous forests.

Satara is located at the Western part of Maharashtra. To the east of Satara is Solapur, to the west is Ratnagiri district. Pune is to the north of the district and towards South is Sangali district. The major part of the plain comes to the east of Satara whereas the Sahyadri ranges stand towards the west. The height of which is 4500 feet. The geographical dimension of the district is 10484 sq. kms. Forest covered area is 137900 hactres. The absolute sowed area of the district is 570300 hactres and the absolute area under the crop is 706500 hactres and the total absolute orchard area is 222500 hactres.

About 708.77 hactres area is under the cultivation of *Citrus*, of which, 247.46 hactres area is productive area while 486.25 hactres area is under the cultivation of grapes. The productive area of Grape is 409.70 hactres. This clearly indicates that, the total area under cultivation of *Citrus* is larger than grape while, productive area of grape is larger than *Citrus*. grapes are cultivated in 142 villages in Satara district. The major area of grape cultivation in Satara district is Khatav and Karad.

The above short review shows that the soil fungi is an important component of soil microorganisms. The soil fungi play an important role in the fertility of soil. Maharashtra state has not received sufficient attention of study of soil fungi. Whereas in other states of country, the soil fungi have been extensively studied. By considering these facts, the investigations were undertaken to study the effect of soil type and physico-chemical factors of soil on distribution of soil fungi.