INTRODUCTION

Notwithstanding the fantasy of existence of extra-terrestrial life, we should believe, until proved otherwise unequivocally, that only the planet earth in the entire universe supports life. This celestial planet has been endowed with an atmosphere that is so conducive for origin, existence and evolution of living organisms that it has become a beehive of innumerable creatures ranging from ultramicroscopic viruses to the gigantic trees and animals. The regions of the globe in which living organisms thrive, collectively constitute the biosphere. The biosphere chiefly consists of soil, water and air. Soil is the uppermost layer of earth's crust. It is produced as a result of weathering of rocks over the millions of years and varies in depth from few centimeters to several meters. The soil is not a single unit and shows distinct characteristics.

The soil harbours a vast number of microorganisms. Most of the living organisms are thriving in the uppermost layer of soil. In fact, life begins in the soil and eventually it ends in the soil. Entire human population depends upon the soil for its food requirement such as cereals, pulses and vegetables grown as crop plants. The soil microorganisms play a vital role in the recycling of nutrients and also in the growth and development of these crop plants as well as the other wild plants by making available many minerals. They start their life in soil and with

the help of the hydrolytic enzymes decompose and degrade the complex nutrients and materials from the dead remains of plants and animals and derive energy for their own growth and development. They eventually end their life cycle in the soil itself.

According to the information available from literature the soil consists of large number of Bacteria, Actinomycetes and fungi and comparatively less number of algae. Being autotrophic, algae are mostly found in the superficial layer of soil. In addition, the soil has a varied population of animals such as amoebae, flagellates, ciliates, nematodes, worms, rotifers and various insects. A spoonful of soil contains billions of microorganisms. The number and kinds of microorganisms found in soil depend upon the nature of soil, depth, season of the year, state of cultivation, reaction, organic matter, temperature moisture, aeration etc.

Most of the fungal organisms present in soil have filamentous organization but lower forms such as slime moulds, chytridiales do not possess typical hyphal organisation. Often the fungal hyphae are aggregated into rope-like structure called rhizomorph, while some fungal forms exist in soil as chlamydospores or sclerotia as dominant propagules.

Most of the fungi isolated from soil belong to one of the three classes viz. Phycomycetes, Ascomycetes and Deuteromycetes. The most frequently isolated fungal forms on

agar media are strains belonging to fungi imperfecti. The commonest members of Deuteromycetes isolated from soil are : Aspergillus, Cephalosporium, Monilia, Penicillium, Trichoderma, Verticillium, Alternaria, Cladosporium, Fusarium, Phoma etc. Among Phycomycetes the species of Mucor, Mortierella, Absidia, Cunninghamella, Rhizopus etc. have been recorded. The Ascomycetes recorded from soil seem to be more closely related to dung and animal droppings than with natural soil. Among them Chaetomium spp. are most common. A worldwide comparative study of the data obtained by several workers reveals that there is a striking similarity between the various lists of fungi isolated by them independently. It has given rise to a widely accepted view that there is a sort of uniform flora occurring in almost all soil types in most of the countries (Burges, 1958).

Adametz (1886) studied the fungi from soil for the first time. The earliest major study of fungi in soil was in 1901 by Oudemans and Koning who described fungi isolated from soil in Holland. Later on, number of workers showed keen interest in the study of soil fungi. As the workers knew more about soil fungi they were spontaneously attracted to study fungi growing around living roots of cultivated plants because they were more interested in exploring the interrelationships between crop plants and fungi growing around their roots. In fact, the study of soil fungi is a prelude to the study of rhizosphere fungi. Study of rhizosphere fungi focusses on interrelationships among the various microorganisms growing in the rhizosphere and

positive and negative effects of these organisms on the growth and development of plants. In reality, the study of rhizosphere fungi constitutes a more intensive and applied discipline of soil fungi.

It is a well known fact that soil in the vicinity of the root exhibits intensive biological activity. This phenomenon is referred to as "Rhizosphere effect". Several workers from Soil Chemistry, Geology, Agronomy and Biology have studied rhizosphere with various objectives such as occurrence of strains with prospective application in diverse fields, succession of fungi, seasonal variation, floristic composition, effects and interrelationships of rhizosphere fungi and plants.

Hiltner (1904) was the first to notice the enhanced microbial activity near the vicinity of plant roots and introduced the term 'Rhizosphere'. Since then it has been reported that rhizosphere soil harbours more microorganisms than non-rhizosphere soils. During this century several scientists have studied rhizosphere fungi and tried to give salient features of this phenomenon. The notable contributions in this field are made by Perotti (1926), Graf and Poschenreider (1930), Timonin (1940), Lochhead and Timonin (1948), Tyner (1948), Katznelson et al., (1948), Harley and Waid (1955), Peterson (1961), Parkinson and Clarke (1961), Ordin (1961) and Rovira (1965). They have studied the different aspects of rhizosphere fungi such as role of rhizosphere microflora in relation to development

of crop plants, relation of rhizosphere microorganisms to the formation of stable soil structure, seasonal variation in rhizosphere fungi, succession of rhizosphere fungi, study of rhizosphere fungi under different ecological and physiological conditions and rhizosphere fungi of medicinal plants.

Many Indian workers have also made significant contributions to our knowledge of rhizosphere microbiology of various plants, localities and under different ecological, physiological and pathological conditions. The noteworthy Indian contributors are Agnihotrudu (1955), Bhuvaneshwari and Rao (1957), Sadasivan (1960), Rangaswami and Venkatesan (1964), Gujarati (1965), Gadgil (1965), Bagyaraj and Rangaswami (1966), Mujumdar (1968), Mishra and Srivastava (1969), Ranga Rao (1972), Gupta (1974), Khanna and Singh (1974), Ursekar (1975), Mishra (1978), Prakash et al., (1979), Arya and Mathews (1993). Most of them have studied significance of rhizosphere microflora in relation to plant disease control, root and shoot growth, effect of foliar application of chemicals on rhizosphere mycoflora, rhizosphere microflora of amended soils, rhizoplane microflora, effect of solarization on quality and quantity of rhizosphere microflora.

The enhanced growth of microorganisms in rhizosphere region is believed to be affected by the activities of roots. The exudates from the root and dead remains of roots in the soil are believed to be chiefly responsible for the vigorous

growth and activities in the rhizosphere region. The effect of root exudates on rhizosphere microflora has been studied by many workers viz. Rovira (1956), Parkinson and Clarke (1961), Vancura (1964), Mishra and Srivastava (1969) and Ursekar (1975).

A review of literature indicates that most of the work has been focussed on rhizosphere microflora of cultivated lands with an obvious objective of finding out some beneficial interrelationships between rhizosphere microbes and crop plants that would benefit the mankind in terms of gains in agriculture. With the similar intentions workers have concentrated more on the physiological activities of rhizosphere fungi than on their taxonomy. Similarly more work has been done on the rhizosphere study of root infected and virus infected plants than that of healthy plants. Study of changes in rhizosphere mycoflora after foliar application of fungicides and effect of solarization have also been attempted.

In the present investigation study of rhizosphere fungi of two Solanaceous fruit-vegetable crops viz., Tomato : Lycopersicum esculentum Mill. and Brinjal : Solanum melongena L. has been carried out at two different localities in the Kolhapur District (M.S.).

Vegetables are important as an essential and indispensible item in our diet. They are rich in vitamins, minerals and fibres and increase the taste and flavour of our food. Tomato and brinjal are well known fruit vegetables used by humanbeings

since time immemorial. They are grown on large scale in different parts of world. In India in recent years, the advent of new hybrid cultivars of both these vegetable crops has enormously increased their yield qualitatively and quantitatively. On this backdrop, the study of rhizosphere mycoflora of these two vegetable crops has been undertaken.

For the purpose of study two different localities were selected with an intention of comparing the rhizosphere mycoflora in two different agrocliamtic conditions. The fungi have been isolated by dilution plate method on Waksman's special soil medium and M_2 Agar medium. It has been observed that species of Aspergillus are dominant and species of Penicillium and Cladosporium occur as subdominants. Paecilomyces and Trichoderma have also been found growing remarkably.

Fruits and Vegetables are indispensible for the normal health of human beings and there is an urgent need to increase the per capita consumption of fruits and vegetables in our country. This, however, will depend on the net increase in the production of these agricultural products which at present is far from satisfactory vis-a-vis the ever increasing population of our country. The demand is far more in excess than the supply and the prices are too exorbitant for the poor to afford. The quality of fruits and vegetables is often substandard due to diseases such as rots, blemishes etc. The menace of diseases of fruits and vegetables in transit, storage and marketing poses

a serious threat to the commerce of fruits and vegetables in world in general and in India in particular because of its agroclimatic conditions.

Study of the diseases of fruits and vegetables in transit, storage and marketing or post-harvest diseases is, therefore, an important applied discipline of plant pathology and is known as Market Pathology. These studies will give us invaluable information about agroclimatic conditions involved in the conservation of perishable fruit and vegetable products against fungal infections.

This important discipline has, however, not received the due attention from the workers in India where much emphasis has been given to investigations of diseases of field crops which constitute the conventional Field Pathology.

Market pathology has assumed great significance of late, not only because of the enormous losses inflicted upon these perishables in transit and storage but also because they serve as important foci and sources of infection which is carried from market to homes and from homes to field through seeds and house refuse. In this way field pathology and market pathology are complementary to each other.

Market pathology aims at combating the losses incurred due to various diseases to fruits and vegetables. Therefore,

a comprehensive knowledge of occurrence of various diseases in the given area, prevailing agroclimatic conditions, relationship between disease incidence and phenological conditions, nature and virulence of pathogens, the host specificity and host-range of pathogens, their mode of nutrition, biochemical changes occurring in the infected fruits and vegetables during pathogenesis, physiology and other physical factors controlling pathogenesis, spread and reproduction in store-houses and the possible preventive and control measures that can be empployed to protect our agricultural products, is of paramount importance.

The early extensive work in market pathology has been done by workers in U.S.A. on temperate fruits and Wardlaw (1961) on tropical fruits mainly banana in Trininad. Indian workers have also made significant contributions to the knowledge of market pathology. Dastur (1915 and 1916) has worked on rot of bananas; Mann and Nagpurkar (1920) and Ajarekar and Kamat (1923) on Fusarium rots of potatoes in Mumbai; Mitter and Tandon (1929) on rots of pears and apples; Chona (1933) on diseases of banana from Western India; Pushkarnath (1935) on apple diseases in Kashmir; Singh (1942) on diseases of fruits in the Kumaun region; Sinha (1946) on diseases of apple, pear, peach, orange, pomegranate etc. from Agra; Chowdhury (1950) on Ascochyta rot of papaya; Bhargav and Gupta (1957) on Rhizopus rot of plums from Kumaun; Chattopadhyaya and Mustafee (1967) on various fruits from West Bengal and Rao (1968) from Maharashtra on various diseases of fruits and vegetables.

The occurrence of storage diseases has been recorded in every country of the world and these maladies are responsible for severe losses whether measured in monetary terms or in men hours. Smith et al. (1964) have recorded more than 250 diseases of fruits and vegetables that caused rotting during storage and marketing and occasionally causing annual economic losses to the magnitude of several million dollars. Economic losses caused by post-harvest diseases are more considerable than often realized because the prices of fruits and vegetables increase manifold in unit value while passing from the field at the harvest to the consumer. A survey by U.S. Department of Agricultural Research in 1965 reported that annual loss of fresh fruits and vegetables due to deterioration from harvest to marketing in U.S.A. is approximately 200 million dollars. Comparatively there are greater losses due to post-harvest diseases in India because of its warm climate and lack of sanitation, fast transportation and other facilities. It has been estimated that there is an average loss of 20-30% due to post-harvest diseases of fruits and vegetables in India (Mehta, 1975).

Investigation in post-harvest diseases have revealed that main causes of spoilage of fruits in transit and storage are the high temperature, high humidity, high moisture content of fruits and injuries sustained by the fruits during the process of marketing. High moisture content and rich nutrients of fruits and various injuries caused during harvesting, packaging and

transportation facilitate entry of certain pathogens which may develop devastating rots in storage. It is observed that harvested fruits are more vulnerable to attacks by microorganisms and even a single infected fruit in a lot can act as a focus of infection and spread the disease to other fruits.

Soil-infesting bacteria or fungi that cause decay of fleshy tissues generally infect plants at the time of or just before harvesting. The infection may, however, develop during post-harvest handling or storage. Some common air-borne moulds such as Penicillium spp. may get entry into susceptible tissues and cause damage during the packing and storage.

The studies in pathogenesis reveal that all important rot pathogens initiate disease in same general way; by producing extracellular hydrolytic enzymes which bring about degenerative process in advance of the fungal hyphae. Most of the storage disease organisms are saprophytic and in general ripened fruits are more vulnerable to microbial attacks than the green fruits (Simmonds, 1963). The injury caused by severing of the fruits from the plant is a frequent point of initiation of post-harvest disease by wound pathogens viz., crown rot of banana (Stover, 1972; Srivastava and Tandon, 1971; Green and Goos, 1963), pedicel rot of pineapple (Frossad, 1970) stem end rot of mango (Pathak and Srivastava, 1957) and papaya (Hunter and Buddenhagen, 1972). Penicillium, Rhizopus, Geotrichum and Thielaviopsis are not capable of penetrating the intact surfaces of the host but they

readily enter through injuries and natural openings and cause devastating damages.

It has been observed that in addition to the mechanical injuries, the fruits and vegetables are also prone to post-harvest diseases due to physiological injuries caused by cold, heat, oxygen deficiency and other environmental vagaries (Friedman, 1960). Tomatoes are predisposed to Alternaria black rot and bacterial soft rot due to physiological injuries caused by storage conditions (Segall, 1967; McColloch and Worthington, 1952). Bananas are also vulnerable to rot incited by Nigrospora through physiological injuries.

Many fruit rots are attributable to wounds caused by insects. The green and blue mould rots of Citrus fruits, incited by Penicillium digitatum and P. italicum respectively, are closely associated with the punctures made in the skin by fruit fly (Mehrotra, 1980).

A review from literature reveals that a large number of fungi are responsible for storage diseases of fruits and vegetables. Rhizopus spp. which produce soft rot of fleshy parts especially rapidly at high tempperatures cause severe losses to peach, grapes, strawberries, sweet potatoes, cucurbits, crucifers, tomatoes and brinjal. Species of Sclerotinia cause brown rots of stone and pome fruits. Bananas are most vulnerable

to rots caused by Gloeosporium musarum (Wardlaw, 1961). Potato tubers are commonly attacked by Fusarium caeruleum. The stored grains are damaged by Aspergillus spp. (Christenson and Kaufman, 1965). Aspergillus flavus produces aflatoxin, a fungal toxin, in groundnut kernels.

The atmosphere is having a plethora of propagules of fungi and bacteria. It is observed that they are also abundent on the surfaces of fruits and vegetables as they approach maturity in the fields (Jarvis, 1962; Baker, 1938; Lukesic et al., 1967; Roth, 1967). Moderately high temperatures cause fresh produce to decay. Tuber crops, if exposed to direct sunlight for longer time become susceptible to rot inciting infections. Temperature, humidity and ventilation determine to a large extent, the rate of disease development during transit and storage.

In the present investigation, alongwith the study of rhizosphere mycoflora of two vegetable crops as indicated in the foregoing section, study of some post-harvest diseases of fruits and vegetables has been attempted. For the purpose of study, the diseased samples have been collected from some important markets in the Kolhapur District.