GENERAL
INTRODUCTION
India is a predominantly agricultural country and a greater proportion of its population is entirely dependent on agriculture. India's economy mainly depends (75%) on plant products for food. It is unfortunate that agricultural production in our country is not increasing with the same magnitude as the human population. At the same time it is equally important to protect plant products in the fields and during transit, storage and marketing, against diseases.

Plant diseases are important to man because they cause damage to plants and plant products. For millions of people all over the world who still depend on their own plant produce for their existence, plant diseases can make the difference between a happy life and a life haunted by hunger or can even result in death from starvation. For countries where food is plentiful, plant diseases are important because they cause economic losses to growers, which result in increased prices of products to consumers.

The study of plant disease continues to be of paramount importance in maintaining and improving our food supplies. Although disease control remains the primary objective of pathologists, the body of knowledge concerning other aspects of disease has increased dramatically, in recent years.

The economic losses caused by post harvest diseases are always found heavier than generally realized, because
fresh fruits and vegetables increase several fold in value while passing from the field at harvest to consumer (Eckert and Sommer, 1967). There has been a considerable difference in the quantities of gross production and the net production available to consumers which is due to various reasons, i.e. inadequate transport, packing and storage conditions. Protection of the farm produce from diseases is of prime importance and deserves considerable attention and concerted efforts. Plant pathologists have devoted and still continue to devote, their efforts on the study of diseases of crop plants.

Fruits and vegetables often get spoiled by the microorganisms during plucking, packing, transportation and many times in the field. Fruits and vegetables also provide quite suitable substrate for many microorganisms to thrive well. India, being a tropical country suffers from a greater loss as compared to the temperate countries. Diseases, not only destroy the tissues completely or partially, but also lower the nutritional value of the fruits and vegetables. These products are well known for having rich nutrition and they also form a major part of human food due to reserve products. It has been noticed that many pathogens for their growth consume nitrogenous compounds, carbohydrates and vitamins from the host.

The diseases destroy the tissues of the fruits and also reduce the quality and nourishment. The estimation
of the loss from such diseases have been made in some cases, e.g. survey of Jabalpur market has shown a loss ranging from 13.96 to 26.26% for tomato, 10-15% for brinjal and 8-15% for cucurbits (Choudhary, 1968). In Delhi Chenulu and Thakur (1968) estimated the losses of fruits by various diseases. They reported 10.68% loss for apple, 31.49% for banana, 17.7% for mango, 19.32% for tomato and 24.02% for potato. Many workers (Walker, 1952; Bhargava and Gupta, 1957; Hingorani et al., 1960; Sommer, 1982) have carried out a detailed study on post harvest diseases of fruits and vegetables which occurred during transit and storage.

In soft rot diseases, the affected tissues die, decompose to greater extent and turn brown. This condition is brought about by fungi and bacteria which dissolves the cell walls more or less completely by means of enzymes produced by them. Many workers (Bateman, 1964 and Hancock et al., 1964) have attributed the role of cell wall degrading enzymes secreted by the pathogens during pathogenesis. Due to the break-down of cell wall of the host, the cells become separated from each other. However, the exact role of cell wall degrading enzymes is not clearly understood. Many nonpathogenic and less virulent pathogens also produce good amount of these enzymes and hence there may or may not be any correlation found between pathogenic potentiality of the organisms and their ability to produce cell wall degrading enzymes in vitro / in vivo.
The concept of relulation by controlling the production of enzymes involved in pathogenesis by addition of various chemicals has acquired a great deal of fundamental and applied importance. These chemical substances not only induce the resistance of the host against the action of various enzymes of the pathogen but they can also be used for the control of various plant diseases. Early transport of fruits also minimize the fruit diseases, despite the absence of fungicides, by careful sorting, temperature management, expeditious handling and assurance of proper fruit maturity. Much work of a physiological, biochemical and ecological nature about disease reactions is therefore necessary before a clear understanding of the genetic and biochemical control of host-parasite interactions can be gained. This will help in evolving suitable methods for the control of diseases. Control practices are desirable only when the cost, in terms of money and effort, is materially less than the loss from disease.

During (1990-1991) the survey of local market and fields, diseased fruits and vegetables (apple, mango, guava, pear, cheeku, orange, grapes, plums, sem, kundru, parwal, brinjal, gilkil, french bean and chilli) were collected. Later, after noting their symptoms their causal organisms were isolated and identified.

Among above fruits, chilli (*Capsicum annuum* L.) is the most common ingredient in Indian diet. People all
over India are addicted to chilli and at times, specially the villagers, take chilli as the major preparation in their diet. Since ages, chilli has been used not only as a food additive or preservative but also as a herbal medicine for maladies ranging from itch, pain to constipation. Smearing of a drop or two of hot chilli juice was recommended as a cure for sore throats by the Dublin Press as early as 1850. In India, the use of chilli extract in Ayurvedic medicine for treatment of inflammation, boils and toothache is also very common. Though chilli itself is an irritating substance and cause a variety of disturbances on application, but the fact remains that its extracts have been used in medicine as 'counter irritants' to relieve pain.

Chilli (*Capsicum annuum* L.) is locally grown and abundantly available throughout the year. This fruit is often exported to other parts of the state and the country. Amongst other microorganisms, *Alternaria alternata* and *Galactomyces geotrichum* were found as most pathogenic to chilli fruits causing soft rot disease. In nature, this disease is found to be very serious and common. Moreover, while *G. geotrichum* has been recorded as a new yeast fungus to cause disease on chilli fruits no work has been done on *A. alternata*.

Therefore, the present problem was undertaken with a view to evaluate the pathogenic nature of the organisms, role of environmental conditions and the production of various
cell wall degrading enzymes during pathogenesis of this fruit rot disease caused by *A. alternata* and *G. geotrichum*. A trial has also been made to control the disease in vivo conditions using various substances, in both the cases.

The present work has been planned as follows:

**PART I : General**

In this part general introduction of the host and its common diseases have been mentioned.

**PART II : Pathogenicity**

This part includes isolation of the pathogens, pathogenicity test and various types of inoculation experiments. Effect of temperature and age of culture on disease development has also been studied.

**PART III : Enzymological studies**

This part consists of detailed study of pectolytic and cellulolytic enzymes produced by both the test pathogens in vivo and in vitro conditions. Effect of native carbon sources, carbohydrates, organic nitrogen sources and plant growth regulators on enzyme production has also been seen.

**PART IV : Control measures**

In this part, various fungicides, antibiotics, homoeopathic drugs and trace elements have been tested on the radial growth, fruit rot development and on the
production of different cell wall degrading enzymes \textit{in vivo}.
Effect of some phenols and stem extracts has been studied
against the radial growth of both the test pathogens.