SECTION A

GENERAL INTRODUCTION
Ever since the discovery of the wonder drug 'penicillin' by Alexander Fleming in the year 1929, Penicillia have occupied an important place in the minds of scientists of various disciplines such as Mycology, Plant pathology and Industrial and Clinical microbiology. The species of Penicillium are well known for their ubiquitous nature, abounding in a variety of natural substrates of which soil is one of the chief habitats. Their large number in soil and possible significance in the realm of microbial ecology has been studied from time to time but definite ecological role has not been assigned to this group of fungi so far.

Apart from the wonder drug 'penicillin' many other antibiotics have been discovered from this group of organisms such as citrinin, claviformin, clavacin, gliotoxin, notatin, pentatin, penicillic acid, griseofulvin, corylophylin etc. Penicillia are also well known for the production of other metabolites like organic acids, alcohols, enzymes, vitamins etc. The penicillia are also industrially important since the highly prized flavour of roquefert and camembert cheeses and the Danish blue cheese and Italian gorgonzola are also derived with their help.

Production of antibiotics by microorganisms which inhibit the growth of other organisms can play an important
role in explaining the phenomenon of antagonism which is so prevalent among the microorganisms. This phenomenon can be utilized in the control of diseases by suitable manipulations. Today, there is a wide application of these antibiotics in medicine, which are inimical to bacteria, the cause of disease in man. Recent reports concerning the role of stimulators and inhibitors in the widespread phenomenon of soil fungistasis has opened up a new dimension to the role of penicillia in this and other related ecological phenomena. The interactions become more important when one views the fact that this group of fungi are potent producers of non-volatile antibiotics and other metabolites and of late have also been reported to be capable of elaborating volatile sporostatic factors (Robinson and Park, 1968; Singhai, 1973; Satyanarayana and Johri, 1974). Volatile metabolites from anaerobic bacteria, particularly ethylene have recently been suggested to play an important role in the biological balances of soil fertility and little emphasis has been placed so far on similar substances emitted by fungi. An attempt is therefore made in the present investigations to survey all the available species of penicillium and to study how this important group of fungi exerts its influence on other microflora through the production of non-volatile and volatile stimulators and inhibitors.
Further, a good enzyme producing equipment of microorganisms can bring about a rapid degradation of organic substrates and help the organisms for their active colonization. The fertility of soil can thus be maintained by the breaking down of organic matter into simpler compounds which can be utilized as food by microorganisms. Competitive saprophytic ability of any fungus as defined by Garrett (1950) is the measure of the proportion of organic substrate colonized by the fungus in the soil. Also, the extracellular enzymes produced by microorganisms are well known for their wider application in the fields of brewery, textile, dairy, pharmaceutical and leather industries. Hence, an attempt in this direction has also been made to focus the species of penicillium for their ability to produce certain extracellular enzymes in their culture filtrates.

The present study, therefore, has been planned to investigate the production of non-volatile and volatile antibiotics and certain enzymes produced by penicillia. Efforts have been made to implicate the role of such metabolites on their own survival and their significance in competition, colonization, antagonism, fungistasis and such other ecological phenomena in the soil.

Briefly, following are the main themes of this work:
Section A

General Introduction

Section B

Recovery of penicillia from soil and other organic sources using selective techniques; study of their morphological and identifying characters; their classification and systematic arrangement.

Section C

Study of non-volatile antibiotics produced by penicillia and their inhibitory effect on bacteria and fungi; their role in the phenomenon of antagonism.

Section D

Study of volatile inhibitors produced by penicillia and their significant role in the phenomenon of soil fungistasis; inhibitory effect of volatiles in terms of spore germination, culture growth and mycelial weight of test fungi; assessment of inhibition index of fungistatic penicillia.

Section E

Study of certain enzymes produced by penicillia such as cellulases, proteases and amylases; their role in the degradation of organic materials; quantitative analysis of these enzymes by suitable techniques.

Section F

General summary