CHAPTER I
INTRODUCTION

Introduction:

About 18 million kinds of living organisms are known to exist on the earth's surface, of which fungi have been estimated to constitute 1.5 Million species (Hawksworth, 1991; Janzen and Hallwachs, 1994). Being heterotrophs, the fungi play several distinctive roles in the functioning of ecosystems: as saprophytes they subsist on dead and decaying organic remains, as parasites they exploit living plants and animals and as symbionts they cooperate and adjust with many phototrophic organisms (Kendrick, 1992). The saprophytic fungi are very versatile organisms and exist in a wide range of habitats; for example, as aquatics in fresh water and sea, as terrestrials in soil, air and plant litter, as coprophilous on dung of herbivores, as entomogenous on living insects, as endophytes in living plant and animals and so on. It is well known that with their amazingly diverse species composition, ability to produce a variety of extra-cellular enzymes and breaking down of organic substances and from simple to complex ecological association with plants and other organisms, the fungi act as regulators of the structure, function and dynamics of plant and animal community in nature (Dix and Webster, 1995).

Diversity of fungi:

An extensive and elaborate record of studies carried out on saprophytic, parasitic and mutualistic microfungi associated with plants is available. Such studies have resulted in the making of several monographic treatments of fungi (Ellis, 1971, 1976; Ingold, 1975; Lundqvist, 1972; Matsushima, 1971, 1975; Sivenesan, 1984; Subramanian, 1971, 1987; Sutton, 1980). A few studies were directed at measuring the abundance and diversity of microfungi that inhabit the plant litter (Heredia, 1993; Wicklow and Carroll, 1981). Several investigations were carried out to elucidate the process of decomposition of plant litter in a variety of habitats (Barlocher, 1992; Dickinson and Pugh, 1974).

Recent studies have revealed that plant litter and habitats in the tropics harbour diverse microfungi in abundance (Hyde, 1997; Bills and Polishook, 1994). Being in the tropical belt, the natural substrates and habitats in our country are said to accommodate a very rich fungal gene pool. Relative to the understanding of the extent of biotic diversity, ecology, biogeography and biochemical functioning of terrestrial plants and animals, knowledge on the microfungi however remained underdeveloped.

Ecology of Litter fungi:

Studies on the succession of fungi on leaf-litter of angiosperms conifers and lower plants have been carried out (Dix and Webster, 1995). The pattern of development of the fungus flora on conifer needles and angiosperm leaf-litter is that the leaf-inhabiting phylloplane fungi persist on the needles/leaves for several months after needle/leaf fall and later produce their sexual stages. A small group of leaf-inhabiting fungi which appear first on the living leaves in low numbers become more abundant once the leaves reach the ground. The decaying leaves are further invaded by true litter-inhabiting fungi which facilitate complete decomposition of the leaves. The decaying leaves are also colonized by typical soil-inhabiting fungi and these become more dominant as time passes and when the decomposed litter gets embedded in the deeper layers of the soil. It is not known, however, besides the epiphytes and endophytes of the living leaves, which other components in the vicinity of the plants contribute for the litter mycoflora.

Studies have been carried out on the fungi associated with decomposing plant litter in India. Yadav (1966) examined the frequency of occurrence of fungi on decaying stems of *Heracleum sphondylium*. Vittal (1973) undertook qualitative and quantitative analyses of the fungi associated with *Atlantia monophylla* and *Gymnosporia emarginata*.. Rai (1974) studied the succession of fungi on tropical grasses. Sudha (1978) examined the mycoflora associated with the leaf litter of *Ixora parviflora* and *Glycosmis cochinchinensis* and Dorai (1987) carried out investigations on the fungi associated with 13 species of *Eucalyptus*.

The qualitative and quantitative analyses of the structure of fungal communities have been worked out using theoretical models (Shearer and Webster, 1985). Aoki and Tokumasu (1995) attempted to analyze the dominance and diversity of fungal communities on fir needles using mathematical models and explained the community structure of microfungi.

Endophytic fungi:

Though initial researches on endophytic fungi were mainly explorative and taxonomic in nature, recent studies were aimed at search for novel and bioactive compounds (Bills, 1995b). These efforts have resulted in the documentation of endophytes from a large number of phanerograms, ferns, lichens and mosses (Petrini 1986, 1991). Endophytic fungi have now been reported from hosts as diverse in habitat and taxonomy as those from the tropics, the mangroves, the freshwater macrophytes, the desert plants, the arctic mosses and the angiosperms and conifers of temperate regions (Redlin and Carris, 1995). Endophytic fungi have been recovered and analyzed from aerial plant parts such as leaves, stem, bark, fruit, flower and seed and underground roots (Bills, 1995b).

Importance of fungi:

The fungi are considered important in the degradation and subsequent conversion of relatively indigestible cell wall substances of vascular plant tissues into carbohydrates and protein sources which are utilized by consumers in the food web. It is well known that the fungi, with their ability to secrete a variety of extracellular enzymes, play an important role in the decomposition process (Dix and Webster, 1995). Various enzymes such as amylase, cellulase, protease, pectinase, ligninase, laccase and xylanases play significant part in the degradation of cellulose and other polysaccharides.

It is now becoming clearer that microfungi of the tropics are potential sources of biotechnologically significant and pharmaceutically valuable organic molecules (Bills, 1995a; Cuomo *et al.,* 1995). Besides, the fungi are recognised as economically and ecologically sustainable biocontrol agents of harmful insects and pests, mycorrhizal biofertilizers and nutritionally rich food additives (Kendrick, 1992). Realizing these exciting revelations on the diversity, creativity and associations of fungi, Hawksworth (1991) and Rossman (1994) advocated for urgent and comprehensive inventory, recovery and investigations of the mycobiota of the tropical belt, since this region of the world is presently under serious ecological stress.

The Present Work:

Many gaps exist in our knowledge on the possible source and extent of fungal diversity and density on aerial leaves and fallen plant litter, ecological relation between the leaf endophytes and fungal gene pool in the litter and the possible activities of the mycota in this environment. In order to understand these complex interactions, the present investigation was carried out during the last two years with an aim to elucidate the diversity, ecological association and activity of the fungi associated with two plant species commonly found growing in the State of Goa, *Ficus benghalensis* Linn. (F: Moraceae) and *Carissa congesta* Wight (F. Apocynaceae) and their environment. The results of the study are presented in three parts and compiled in the form of a thesis.

The Chapters II and III of the thesis cover the review of relevant literature and materials and methods used in the study. The findings of the investigation are presented and discussed in Chapter IV and summarized in Chapter V. An exhaustive bibliography is given at the end of the thesis.

It is believed that studies such as this, where the diversity, ecology and activity of the fungi associated with evergreen or deciduous plants elucidated over a period of time, are likely to throw some light on the role of saprophytic, endophytic and other fungi after senescent leaves reach the ground as leaf.