Chapter-1

Introduction
Forestry systems are based on a combination of tree and/or animal species simultaneously or sequentially in the same area, and have as their major aim, the optimization of beneficial ecological interactions among ecosystem components. Among the interactions that occur in soils of forestry systems, interactions between plants and microbiota, especially those formed by roots and mycorrhizal fungi, are of great importance. The importance of mycorrhizal fungi and their associations with plants is evidenced by the observation that they are ubiquitous in tropical soils. They have been present since the conquest of the terrestrial environment by higher plants (Brundrett, 2002). Mycorrhizas are mutualistic associations between the roots of plants and certain soil fungi. A large part of the soil microbial biomass is constituted of AM fungal material (Olsson et al., 1999). These fungi live on and in the root system of plants and provide nutrients to the plant in exchange for carbohydrates exuded by the plants. Some of the ecological uses of mycorrhizae include enhancing plant growth and disease resistance, improving transplant success, building soil structure, reducing fertilizer dependency, and accelerating revegetation of degraded lands.

Mycorrhizae are highly evolved, mutualistic associations between soil fungi and plant roots. AM fungi can colonize virtually all plant types among Angiosperms and Gymnosperms. Some Pteridophytes and Bryophytes are also colonized by AM fungi (Smith and Read, 2008). According to Siqueira et al., (2007) studies dealing with mycorrhizal associations in tropical tree species have been conducted in increasing number over recent decades, and about 500 noncrop species have been investigated for the occurrence or the effect of mycorrhizal association.

The most obvious role of AM fungi in ecosystems is to increase the soil volume exploited by the host plant. This leads to increased water and nutrient uptake, which in turn may enhance acquisition of other nutrients, for instance through associated nitrogen (N) fixation (Bolan, 1991, Smith and Read, 2008). Other roles of AM fungi concern protection of the root system against pathogens (Pozo and Azcon-Aguilar, 2007, Elsen et al., 2008), salinity, phytotoxic elements such as Al (Rufyikiri et al., 2000) or heavy metals (Andrade et al., 2003). These fungi are also involved in the formation and maintenance of soil structure (Rillig and Mummey, 2006) and increase C input to soils (Rillig et al., 2001, Zhu, 2003), both of these effects contributing to reduce erosion. Finally, AM fungi also play a role in the maintenance of plant
biodiversity (Van der Heijden et al, 1998) Mycorrhizal associations, therefore, are multifunctional in agro-ecosystems (Newsham et al, 1995) They have the potential to improve physical, chemical and biological soil quality, including feedbacks between soil biota and plant communities.

The results of mycorrhizal inoculation on growth and nutrient uptake of various *Dipterocarps* species have been demonstrated in the laboratory and nursery (Supnyanto *et al*, 1993, Yazid *et al*, 1994) Fertilizers are routinely applied to plants in the nursery and during planting and, presently no particular consideration is given to the use of inoculation of planting material with selected AM fungi Studies using controlled inoculation are necessary for a better understanding of the physiology of *Dipterocarps* mycorrhizae and their application in forestry In the last three decades, there are lot of reports on the use of AM fungi to increase the plant growth and yield of agricultural crops and forestry species AM fungi are obligate biotrophs that benefit the plant in several ways, viz, by increasing nutrient capture, drought resistance, pathogen protection, beneficial alterations of plant growth regulators and synergistic interactions with beneficial rhizosphere microorganisms (Bagyaraj, 1991) Although, these fungi are not host specific, recent studies have clearly brought out host preferences in AM fungi thus, emphasizing the need for selecting efficient AM fungi for inoculating a particular host.

Western Ghats, one of the 34 global biodiversity hotspots, extending along the west coast of India, covers an area of 180,000 square kilometers harbours many endemic and endangered species Some of the forests of Western Ghats have been declared either as National Parks or as Reserve Forests such as Kudremukh National Park and Mokambika Reserve Forest Some small patches of reserve forest of Western Ghats are considered as secondary semi evergreen forests The Pillarkhan Reserve Forest and Kodyamale Reserve Forest having good biodiversity similar to that of Western Ghats There are about 4,500 to 5,000 species of flowering plants of the total estimated 17,000 species (Ahmedulla and Nayar, 1987) Nearly, one third of identified endemic species of the region are rare and threatened and several are believed to be extinct.
The family Dipterocarpaceae has 680 species belonging to 16 Genera, distributed in Malaysia, South East Asia, India, Sri Lanka and Africa (Meher-Homji, 1979). In India, 31 species of *Dipterocarps* have been reported, mostly confined to North India. The Western Ghats contains 14 species belonging to five Genera (RAPA Monograph 1985). Dipterocarpaceae is one of the main components of the evergreen forests of Western Ghats and is represented by six species viz., *Dipterocarpus indicus* Bedd, *Hopea canarensis* Hole, *H ponga* (Dennst) mabberly, *H parviflora* Bedd, *Vateria indica* L and *Vatica chinensis* L (Bhandary and Chandrashekar, 2003, Shivaprasad et al., 1999, 2002, Vasanthraj et al., 2005, 2006). Except *Vatica chinensis*, all are endemic to Western Ghats *Dipterocarpus indicus* is an endangered species while *V chinensis* is a critically endangered species (Bhat, 2003).

Inefficient and poor seed dispersal mechanisms are responsible for gregarious formations of *Dipterocarps* (Muralikrishna and Chandrashekar, 1997). *V chinensis* is restricted to the North-East part of Udupi Taluk (Bhat, 2003), *H canarensis* is found in its type locality *i.e.* Andar Reserve Forest and in a few patches of Kudremukh region (Krishnakumar and Kaverappa, 1999) while *D indicus* occurs in high altitude of Charmardy and Kudremukh forests. Because of its high percentage of germination and light tolerant nature, *H ponga*, enjoys a very wide distribution spreading into new areas. Similarly, *H Parviflora* and *V indica* are found in almost all forests.

A striking feature of many *Dipterocarps* forests is the phenomenon of mass flowering followed by mass fruiting. Large *Dipterocarps* may produce up to four million flowers and 120,000 fruits. Although, the fruits are poorly protected with large quantities either eaten by wild pigs or heavily parasitized by weevils, the management of *Dipterocarps* for seed production is difficult (Ashton, 1988). Flowering commonly does not occur until trees are 20 to 30 years old, by which time most of the trees grow to a height that makes the task of management and seed harvest difficult. Fruit production is episodic and the seeds of most species are recalcitrant (Sasaki, 1980).
Considering the importance and demand for *Dipterocarps* in forestry, the present study on AM diversity in *Dipterocarps* of Daskma Kannada Districts and the inoculation effect of selective AM fungi on growth of *Dipterocarps* was undertaken with the following objectives

1. To survey the AM diversity in *Dipterocarps* of Western Ghats

2. To determine AM colonization in the roots and spore density in the rhizosphere of *Dipterocarps*

3. To correlate the mycorrhizal status with nutrients

4. To study the effect of AM inoculation on growth and development of *Dipterocarps*

5. To identify the AM species encountered in *Dipterocarps* using molecular techniques
Plate 1.1: *Dipterocarpus indicus* Bedd.
Plate 1.2: *Hopea canarensis* Hole
Plate 1.3: *Hopea parviflora* Bedd.
Plate 1.4 *Hopea ponga* (Dennst.) Mabb.
Plate 1.5: *Vateria indica* L.
Plate 1.6: *Vatica chinensis* L.