GENERAL INTRODUCTION
Mycorrhizal association is symbiotic association between the roots of plants and fungi. The term mycorrhiza was first introduced by Frank in 1885. All plants in nature develop mycorrhiza to varying degree with only few exceptions. Wilhelm (1966) stated that under field conditions plants do not strictly speaking have roots but they have mycorrhizae. Three different types of mycorrhiza have been recognised namely, ectomycorrhiza, endomycorrhiza and ectendomycorrhiza (Harley, 1969).

Endomycorrhizae are mainly formed by two types of fungi i.e. those with septate hypha and non-septate hypha. The former type are common in orchidaceous and ericalean group of plants. Whereas, fungi of the later group are commonly called vesicular-arbuscular type. VA mycorrhiza are common in bryophytes, pteridophytes, gymnosperms and angiosperms. VA endophytes develop arbuscules and vesicles. They also produce azygospores, chlamydospores and sporocarps. Infection of host root takes place by germinating spores or preinfected root segments. The VA endophytes are phycomycetes and belong to the family Endogonaceae (Gerdemann and Trappe, 1974). Nine genera of these fungi have been recognised (Trappe, 1982). These fungi are obligate symbiont and are cultured on host plant (Gilmore, 1968; Allen et al., 1979; Macdonald, 1981). Attempts to grow them in-vitro have yielded poor results (Daniel and Trappe, 1980).

Endomycorrhiza of VA type helps in growth, development and yield of plants (Gerdemann, 1968; Mosse, 1973a).
Growth stimulation is more marked at low soil fertility (Csinos, 1981; Banister and Norton, 1974). Plants growing in nutrient deficient habitats frequently form VA endomycorrhiza. Growth improvement of plants is attributed to increased nutrient inflow into plants helped by VA endophyte (Rhodes and Gerdesmann, 1980). VA endophyte increases the absorption area and the rhizospheric zone of the root (Bethlenfalwy et al., 1982). Growth stimulation may also be due to interaction of one or more of metabolites of the fungus which alters the physiological processes of the host which may directly or indirectly affects its growth (Plenchette et al., 1983). The activity of some enzymes like phosphatases has been related to the development of mycorrhiza in roots (Gianninazzi-Pearson and Gianninazzi, 1978; Allen et al., 1981). The process may enhance nutrient uptake by endomycorrhizal roots.

The development of VA mycorrhiza and growth of host are inter-related processes and the relationship depends on various ecological factors. The interaction between VA endophyte and the host at species level in relation to ecological factors needs to be investigated. The studies are important in natural forest ecosystem where nutrient requirement of the plants can not be managed through artificial means and dependence on mycorrhiza for sustained growth of plants is a vital force. Poor growth of the tree seedling was attributed to the lack of endomycorrhizal infection of
roots and when seedlings were inoculated with endomycorrhizal fungi, growth was enormously increased (Bryan and Ruehle, 1976; Schultz et al., 1981; Kormanik et al., 1982; Furlan, et al., 1983; Pope, 1980). Endomycorrhiza may be an obligate physiological requirement of the seedlings for their establishment and growth (Bryan and Kormanik, 1977). Development of mycorrhiza is important in production of high quality seedling in the nursery before they are planted into fields (Kormanik et al., 1982). Techniques for increasing fungal inoculum in forest nursery soils have been evolved (Kormanik, et al., 1980). An assessment of ecological factors and their impact on mycorrhiza in tree species is warranted for the better understanding of the indigenous natural forest ecosystem.

VA mycorrhiza helps in uptake of nutrients (Rhodes and Gerdemann, 1980). The most accepted hypothesis is that hypha of VA endophyte absorb and translocate nutrients directly to the roots of the host. The hypothesis has been repeatedly demonstrated with several types of plants. The absorption and translocation of nutrients to the host root via hypha of VA endophyte is an active process which can not be explained on the basis of mass flow or diffusion of phosphorus in the soil (Sander and Tinker, 1971). Rapid movement of phosphorus takes place through VA endophyte in mycorrhizal roots than non-mycorrhizal ones. The use of radioactive in split-plate culture technique had also supported the translocation of phosphorus from soil to host through fungal
hypha which may either be due to protoplasmic streaming or as bulk flow of hyphal contents. However, polyphosphate granules in external hypha have also been observed (Cox et al., 1975; Linglee et al., 1975). Most of the studies have been devoted to phosphorus uptake, perhaps, because it is a limiting factor for growth of plants in soils. Endomycorrhiza also helps in uptake of other important nutrients like sulphur, nitrogen, potassium, zinc and copper (Rhodes and Gerdemann, 1978; Bagyaraj, 1980; Banister and Norton, 1974). It is still unanswered whether VA mycorrhizal fungi are involved in solubilization of insoluble phosphates. Studies indicated that mycorrhizal plants have better utilization of relatively insoluble form of phosphorus than non-mycorrhizal ones (Mosse, 1977; Powell and Daniel, 1978; Pairunan et al., 1980).

Studies on enzymes at different stages of mycorrhizal infection, during absorption and translocation of nutrients are meagre (Gianinazzi-Pearson and Gianinazzi, 1983). Activitie of some enzymes like phosphatase and nitrogenase have been reported to be stimulated by VA mycorrhizal infection of roots (Gianinazzi-Pearson and Gianinazzi, 1978; Assimi et al., 1980; Allen et al., 1980). Understanding of phosphatase activity may provide a clue for mechanism of phosphorus uptake by plants. Most of basic VA mycorrhizal studies have been accomplished with herbaceous plants with emphasis on agronomic plants. Many species of
forest trees form VA mycorrhiza and in natural vegetation like forest ecosystem it may be an important ecological requirement of the trees. However, little is known about the species of VA endophytes involved and the nature of interaction in forest ecosystem. Some workers have investigated the role of VA mycorrhiza in forest tree species (Kormanik et al., 1982; Furlan et al., 1983; Pope, 1980). Studies are needed to investigate mycorrhiza at species level with respect to indigenous ecological conditions.

In India, Bakshi (1974) emphasised the role of ectomycorrhiza in various tree species. North-Eastern region which possess luxuriant growth of broad leaved tree species remained untouched. Sharma (1981) studied the ectomycorrhiza of pine (Pinus kesiya). Other important tree species of commercial timber value needed to be examined.

*Exbucklandia populnea* is a successful competitor and grows luxuriantly in pine forest of North-Eastern India. It is commercially important timber tree. The tree form endomycorrhiza of VA type. For the natural regeneration and successful plantation and to meet the increasing demand for production has stimulated interest to take up mycorrhizal studies of this tree species.

The present investigation was aimed to study

- The distribution and association of mycorrhizae with certain important tree species in natural
forest ecosystem of N.E. India.

- Isolation, identification and establishment of VA mycorrhizal fungi in culture.
- Effect of vesicular-arbuscular mycorrhiza formation on establishment, growth and yield of tree seedlings.
- Effect of VA mycorrhiza on uptake of nutrients with special reference to phosphorus.
- Effect of VA mycorrhiza formation on activity of enzymes of tree seedlings.