Chapter I

INTRODUCTION
Peninsular India has a vast stretch of coast where, agronomic and climatic conditions differ from those of interior regions. Salinity of the soil is one of the agronomic factors affecting the growth of the plant in the coastal region. Very often the normal soil supporting the agricultural crops in this region becomes saline due to poor water management, improper usage of fertilizers etc. According to International Institute for Environment and Development and World Resource Institute (I I E D&R, 1987) 25% to 40% of the 220 million hectares or even more of irrigated land is subjected to salinization and showed a 70% loss in crop yield.

Salinity plays an important role in the existence, behaviour and distribution of plants. It interferes with the competition among the plants and also affects colonization and growth of microorganisms both in the soil and in the plants. The sensitive plants when adversely affected by salinity grow more slowly and show stunted growth (Roy et al., 1992). It has been well documented that, the salt in the medium generally alters a wide array of metabolic processes leading to decline in yields (Reddy and Vora, 1985). Increasing concentration of salts in the soil affects seed germination; seedling vigour and plant growth and such effects differ according to the nature and concentration of salts as well as growth stages of plants. (Sheoran and Garg, 1979; Krishnamurthy et al., 1987; Remadevi and Gopalakrishnan, 1997).

Knowledge of plant physiology and biochemistry is essential for mass screening programmes and also to understand the basic mechanisms of stress resistance in plants (Maas and Nieman, 1978; Greenway and Munns, 1980). Enzymes play an important role during germination of seeds and establishment of the seedlings. Salinity, by imbalancing the ionic concentrations in the medium may alter the functional aspects of many enzymes. Salinity inhibits seedling germination by lowering water uptake and inhibiting the activities of hydrolytic enzymes such as α amylase, protease and
ribonuclease in the rice endosperm (Dubey and Rani, 1990). Plants growing under salinity stress show stunted growth and altered the levels of enzyme activities in various metabolic pathways in rice (Dubey, 1984), and lentil (Singh et al. 2001a). Seedlings of rice genotypes differing in salt tolerance when raised under increasing levels of salinity showed distinct morphological differences as well as enzymatic activities (Dubey, 1984). As these enzymes play a dominant role in hydrolyzing the complex food reserves and making them available to the growing seedlings, many a times the growth of the seedlings may be affected. Thus, it is very important to study the influence of salinity on the activities of certain enzymes during germination and growth of the plant.

The species of the family Leguminosae is one such group, which shows wide range of adaptations to saline conditions. Cowpea, *Vigna unguiculata* (L.) Walp. belongs to the family Leguminosae, sub family Fabaceae (Papilionaceae) and genus *Vigna* is a vigorously growing annual legume with a strong taproot, bearing numerous horizontally spreading laterals. Stems are prostrate and more or less erect varieties also occur. Flowers are shortly pedicelled, white to pale white in colour, borne on axillary racemes, two to three flowers to each peduncle; carrying three bracts at the base, calyx is glabrous or more or less plicately wrinkled with the small lobes, triangular and acute; corolla standard whitish to violet with the wings violet and truncate at the base. Pods are 10 to 30 cm long, cylindrical and slightly curved with a thick obtuse beak pendent and slightly constricted between the seeds. There are five distinct subspecies of cowpea, two are wild and three are cultivated (Steele, 1976). The subspecies *V. unguiculata* (L.) Walp. syn *V. sinensis* Engl. (Common cowpea) includes a large number of varieties. It has been under cultivation in India from ancient time. The annual area under cultivation and its total production in India are difficult to estimate since it is rarely grown as a single crop. However, the total production and yield per unit area has increased over the past decade. The tender pods are being used as vegetables and dried grains as pulses. Among
the grain legumes cowpea is economically important with nutritive and medicinal value (Remadevi and Gopalakrishnan, 1997).

In Mangalore, cowpea is one of the important vegetable crops grown during rainy and summer seasons. It is grown in the coastal belt and interior regions also. During summer season, soil salinity is the major agricultural problem in coastal areas of Mangalore. It is further aggravated due to the use of saline underground water. Use of saline and sodic water reduces the yield of crop and also causes soil deterioration (Maliwal and Paliwal, 1982). Some of the cowpea genotypes have higher seed yield in saline than non-saline soils (Dua, 1993).

Although, there are some studies on qualitative and quantitative changes in enzymes during germination and early seedling growth of cowpea, there is no literature on the influence of salt stress on the activities of enzymes either in the germinating seeds or in cowpea plants growing in saline and non-saline soils.

There are some reports on the VAM colonization in cowpea genotypes. Vesicular arbuscular mycorrhizal fungi (VAM) occur naturally in most of the soils and often greatly improve the growth of many agronomic crops in fertile soils. (Mosse, 1973). The role of vesicular arbuscular mycorrhizal fungi in enhancing plant growth and yield, resistance to drought and salinity and tolerance to pathogens is well documented (Smith and Gianinazzi-Pearson, 1988). However, the occurrence of VAM in saline soils and their influence on the plant growth and nutrient uptake has received little attention by researchers. There are no reports relating to the mycorrhizal association and growth and differentiation of cowpea plants growing in saline and non-saline areas.
In view of the aforesaid factors, the present study was undertaken with the following objectives:

(i) To study the effect of NaCl on the germination of seeds of cowpea genotypes collected from saline and non-saline areas.

(ii) To determine the activities of certain enzymes viz. amylase, protease, acid and alkaline phosphatases and peroxidases during germination of seeds of cowpea genotypes under NaCl stress.

(iii) To estimate starch, total soluble sugars, proteins, inorganic phosphates, proline and aminoacids, sodium and potassium in the germinating seeds of cowpea under NaCl stress.

(iv) To find out the levels of enzyme activities, food materials, sodium, potassium, proline and total aminoacids in different parts of germinating seeds under saline and non-saline conditions.

(v) To elucidate the effect of NaCl on growth and the enzyme activities during the growing period of cowpea by performing pot experiment.

(vi) To study the variations in cowpea leaves with regard to the enzymes and stored food materials and mineral elements in saline and non-saline soils.

(vii) To identify the arbuscular mycorrhizal fungi, associated with the root system during the growth of cowpea in saline and non-saline areas.