Introduction

INTRODUCTION

Increasing soil salinization has become one of the serious threats to agricultural systems throughout the world. This problem is not new. Early cililizations in the Indus and Nile valleys and in the Peruvian coastal region were all apparently drastically affected as the buildup of salts in their fields gradually led to yield losses and eventually to crop failure. A similar phenomenon is thought to have contributed to the collapse of the early Mesopotamian civilization in the Tigris-Euphrates valleys. Although of ancient nature, the problem is becoming more acute in modern times in view of the great population pressure. Not less than about 400 million ha and perhaps as much as 950 million ha of land in arid and semi-arid regions may be salt-affected from natural and anthropogenic causes (Massoud, 1974; Ponna-mperuma, 1977). In a heavily populated country like India, over 6 million ha, of a national total of only some 40 million ha of irrigated farmland, have been made useless by salinity and waterlogging, while about 40 thousand ha are being abandoned each year (Chapman, 1975a). According to Rains (1979) salinity may become the ultimate limitation to irrigated agriculture.

The serious problem of soil salinity can be solved by physical manipulation of environment in which the plant grows or (and) by biologically manupulating the plant. Physical manupulation of the soil environment consists of the procedures that reduce the level of salts in the soil, leaching salts from the soil, or altering the level of salts in the irrigation water. Biological manupulation of the plant involves identification of plant genotypes capable of increased tolerance to salt and incorporation of such traits into economically useful crop plants. The physical approach more commonly known as engineering approach, usually requires high immediate and long term investments and hence is not feasible in a developing country like India. In such a situation the biological approach is more promising. There are two valid components of this approach, One is to increase the salt tolerance of our currently used crop plants. This has been, is now and will continue to be an important area of agricultural research. This will permit use of water having lower quality and thereby reduce some of the demand on the decreasingly available, higher quality water. It also will extend the time before a given area becomes unable due to salinity buildup, and it may even open up some marginal, presently unused, agricultural land. This will reduce the impact of the loss of farmland to urbanization and salinization. The second approach is to develop new crops to meet the needs of mankind, new crop that have high productivity when provided with highly saline water, even seawater. That is rather than increasing the salt tolerance of relatively saltsensitive, contemporary crop plants, we should improve the crop characteristics, through selection and breeding, of highly salt-tolerant plants. There is no reason to believe, or even suspect, that among those wild plants whose water sources are highly saline, representatives would not also be found with desirable quanlities, such as high food value, high potential for fiber or fuel use, significant amounts of valuable chemicals, and so on, and would be good candidates for domestication. Thus those highly salt-tolerant plants, or halophytes, represent a large valuable, unexploited resource.

Halophytes are the plants found growing under naturally saline conditions. According to Jefferies (1981) halophytes are characterized by having a high internal ionic concentration but with a marked asymmetry in distribution within cells, a large pool of soluble organic compounds located mainly in the protoplast and an ability to divert sufficient energy, to maintain these solute asymmetries in order to achieve growth, development, and reproduction at low osmotic potentials. It is logical to believe that the halophytic plants growing satisfactorily in saline environment, exploit various strategies at the whole plant as well as at the cell level that allow them to overcome the salinity stress, which has two components, ion toxicity and osmotic stress. Our understanding of these mechanisms of survival would be extremely valuable in the development of salt-resistant crops. With this view extensive work has beer done on the ecophysiological aspects of halophytes in last 30 years in different laboratories in the world and these studies have revealed that the halophytes may follow different eco-physiological strategies to deal with the saline envircnment. Thus identification of these strategies in different types of halophytes is a task of great importance. With this view the present investigation on leguminous halophyte Derris has been undertaken.

The present investigation can be regarded as a continuation or extension of the extensive work performed on salinity tolerance in our laboratory for last 25 years. In our laboratory an attempt has been made to understand the mechanism of salinity tolerance and photosynthesis in several marine algae and mangrove species under the leadership of late Prof. G.V.Joshi. The marine algae include Ulva, Sargassum, Enteromorpha, Caulerpa and Gracillaria. The work on mangrove species has been mainly centered around Aegiceras corniculatum (L.) Blanco; Excoecaria agallocha L., Bruguiera gymnorrhiza Lamk; Rhizophora mucronata Lamk; Sonneretia acida L., Avicennia officinalis L., Ceriops tagal (Perr.), Lumnitzera racemosa Willd., Ipomea pescapra (Soot) Linn., Sesuvium portulacastrum L. Aleuropus lagopoides (L.) and Thespesia populnea Soland. The sea grasses like Halophila *baccarii* Aschers are also included in these studies. Further investigations by Dr.L.J.Bhosale and coworkers have added a new dimension to this research work. It must be mentioned here that *Derris trifoliata,* the plant selected for the present investigation is one of the common component of the mangrove ecosystem in coastal saline areas throughout India. Further, this species has got several economically important aspects.

There is another important implication of the present investigation. *D. trifoliata* belongs to family leguminosae which yeilds several important leguminous crop species. The extensive studies on salinity tolerance of these legume crop species in different laboratories in the world including our laboratory have indicated that most of the legume crops are highly salt sensitive. Thus in order to develop strategies for inducing salt tolerance in these crop species, the mechanisms underlying salinity tolerance in leguminous halophytes are needed to be studied. It is with this additional objective the present investigation on *Derris* has been undertaken.

The thesis is divided into three chapters. In the first chapter an attempt has been made to review the literature on salinity problem and halophyte distribution in general and *Derris* species in particular. The economic importance of various *Derris* species has been also described in detail in this chapter. The second chapter deals with the methodology followed for present investigation. The findings of the present investigation are discussed in the light of available relevant literature and this forms the substance of chapter III "Result and discussion". This chapter mainly encompasses the observations about ion regulation, osmoregulation and anatomy of D. trifoliata in relation to the saline environment to which the plant is exposed. Another species of Derris, D. scandens has been also included in the present investigation for comparative study.

The author is fully aware of the preliminary nature and the limited significance of the present study. At the same time it must be mentioned here that this study will open an interesting field of research in ecophysiology of leguminous halophytes because very little work has been carried out on leguminous species. A more detailed study of the various aspects covered in present investigation will be undertaken in future so as to have a better idea about mechanism of salt tolerance in halophytic legumes.