CHAPTER 1

Introduction

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Mangroves are particularly interesting subjects for studying adaptation, ecological as well as biochemical. These adaptations enable mangroves to get distributed on coastal saline soils. Mangrove forests grow best along estuaries, deltas, backwaters and lagoons of the tropical humid coasts throughout the world. Medium tidal amplitude (upto 3-4 m), gentle slope of the coastal plain, deltaic islands, abundant silt load in the water, average minimum air temperature not below 17^{o}C and shelter from wave action and strong currents, prograding estuaries and extensive mixing of fresh with sea water, produce ideal conditions for maximum development of mangrove tree species in height and rate of growth.

The species composition and structure of the 'best' mangrove forests vary as a function of the biogeographical location and of the environmental conditions. Thus the low salinity of the waters of Sundarbans, which is due to low salinity of the surface water of Bay of Bengal further diluted by a large amount of land run off, have species composition and pattern of dominance and zonation quite different form, the forests of Papua New Guinea where Rhizophoraceae members are dominant while <u>Heritiera</u> is the most abundant in the Sundarbans. The total biomass of the forest itself is also very diverse, as is also the root to trunk ratio even when the species composition is similar. The reason is that the development and size of each tree varies with environmental conditions, specially sediment characteristics and composition, rainfall pattern etc.

It is difficult to say, what a typical mangrove forest is because the variety is almost as great as number of forests and parts of the same forest differ from one another (Vannucci, 1989). Each one is unique.

The morphological and physiological characteristics of plants and animals of the mangroves show convergent adaptations to the peculiar environment in which they live which give to the ecosystem its unique appearance. Dissimilarities among mangroves are due to biogeographical location and due to variation of ecological factors in space and time. Scientists have studied many aspects with regard to salinity. However, adapting to salinity is not the only problem that vascular plants had to face, there are several more quite unique environmental restrictions to which plants and animals have to adapt. Many of the aspects are very poorly known and there is urgent need for scientific research, the result of which will provide important information in accumulating baseline data.

From the ecological point of view, mangrove plant species are salinity tolerant where tolerance is achieved by different morphological and physiological features and mechanisms that can be grouped into several categories :

a) By excluding the penetration of sodium chloride and other salts at root level

b) By secreting excess salts through special glands usually at leaf level

c) by accumulating and immobilizing salts at different tissue levels.

Mangrove plant species appear to have a particularly plastic genome that enables them to adapt quickly to changing environmental conditions, both at the individual phenotypic level, as is required to survive under contineously changing environmental conditions, caused by tidal and monsoonal cycles, and at the genotypic level, in a more permanent manner. They react both by "speciating" into new forms and by refining and changing their morphological and physiological adaptations. They hybridize with relative facility. All this is areal puzzle for the taxonomist and ecologist. It is still being debated whether many morpyhological forms are phenotypic variations, varieties, hybrids or good species. This confusion is greatest in India and Australian genera like Avicennia and Rhizophora, respectively. Whereas in other countries of the world it is with Sonneratia and Lagunularia. Most of these forms react in a different manner to a changed or changing envoronmental conditions; in the afforestation work of Kogo, Director of the Al. Guem Foundation, different strains that recognizably belong to the same species grow better, worse or not at all in his experiments in Pakistan and different places in the Persian Gulf. The morpho-physio and ecological adaptation of mangrove plant species have been repeatedly described and have recently summarized by Hucthings and Saenger (1987).

A basic task confronting the mangrove ecologist is to explain the development of mangrove communities through time. This problem has been approached in several different ways depending on the background of the researcher, the conceptual models prevailing at a given time, and the existance and quality of information on environment in any given area of study. Knowledge of habitat change in an area involving changing patterns of sedimentation would clearly strengthen the hand of an ecologist seeking to study community dynamics. In order to explain the phenomenon through time, it is very necessary to develop an understanding of past as well as present conditions.

Reproductive and metabolic adaptations are also interesting. Such as plants living in unusual environment of necessity have developed unique protective mechanisms. One remarkable adaptation is the photo-periodicity of Avicennia marina (Vannucci, 1989). Snedakar and Perkinson (1986) pointed out that the mangrove forests occur in a large variety of structural types with different species composition and levels of productivity. Further, Vannucci (1989) mentioned about zonation only along prograding coasts where year classes of one and the same species are clearly distributed in bands parallel to the coast or in places where the topography, soil pH and other conditions delineate jigsaw like patterns. This is the distribution pattern of species that are linked to some environmental factor and therefore, their presence indicates characteristics of the environment.

Under very unfavourable conditions, when stress is at its maximum, specimens of ecologically polivalent species able to survive under stress, spend most of their energy just to keep alive without much being left for growth. In many places 'dwarf trees' which reduces its life form to shrubby height are formed, with scanty rainfall, little inundation or excess of toxic elements in the soil or other forms of pollution. Over exploitation by looping the plants for firewood or fodder may produce the same type of deformed dwarfs. Species of the genus Avicennia, specially A. marina are probably the species that can take the maximum number of environmental insults and still survive (Vannucci, 1989). The various forest species have different ecological limits of tolerance and optima for the various ecological parameters, thus some of them are restricted to small ecologically monotonous areas, while others like A. marina have wide limits of tolerance for most factors and therefore, have a very wide geographical distribution.

Detailed field studies of A. marina reveals that many morphological attributes reflect eco-environmental gradients. However, several observations together suggest a more complex situation with corresponding genetic differences (Duke, 1990).

It reveals that, the study of Avicennia species in relation to its environment is of prime importance. Thus, the present investigation is planned to study autecology which includes morphological characteristics (including vegetative and reproductive organs) of the plant species, spatial variation in relation to environment and the species systematic position in the ecosystem. Because the species of Avicennia that grow best along coast of Maharashtra are all of economic importance and they are vital for the survival of local people and their domestic animals, because these are the producers of fodder, firewood, poles, and also medicinally important.

There is lot of variation observed in Avicennia along estuaries of Maharashtra. In view of solving the problem whether they are different species or varieties or ecotypes, hybrids, present work has been undertaken.