Introduction

I N T R O D U C T I O N

The physiological processes in plants are totally depend up on the water which is the important factor limiting plant life. Water is major constituent of plant tissue, a reagent in photosynthetic and hydrolytic processes, the solvent for and mode of translocation for metabolities and minerals within plants, and is essential for cell enlargement and growth. Water deficit occurs in the plant, whenever transpiration exceeds water absorption; or both. Drought has generally been accepted as a deficiency of available soil moisture which produces water deficiency of available soil moisture which produces water deficits in plants sufficient to cause a reduction in growth. The problem of drought is particularly serious and severe in the desert areas which are found in different regions of the world. It is observed that even under these extremes of environment, some plant species can successfully grow and complete their life cycle. The most prominent among these species are the succulents.

The classification of a plant as succulent is based exclusively on morphological criteria and does not implicate a special taxonomic status, because we can find succulent members in several families of higher plants as well as in ferns and gymnosperms. The single morphological criterion which classifies a plant as succulent is the possession of voluminous water storing tissues resulting in an increase in volume relative to surface area. In succulents, all basic organs of the plant

can function as water reservoirs. Thus, a thick, fleshy, juicy habit results which is envisaged as "succulence" and which results in a form tending towards a spherical shape rather than disc shape typical for most of the leaves. Hence, succulents are generally characterised by their ability to store relatively large amounts of water. Thus the succulents are able to maintain favourable water balance even under the conditions of severe drought by means of several anatomical and physiological adaptations related to control of transpiration. Besides this, succulents are able to maintain a positive carbon balance or at least to prevent a negative carbon balance even during extended periods of drought. This is achieved with the help of crassulacean Acid Metabolism (CAM).

The acid metabolism of certain succulent plants, now know as CAM has fascinated plant physiologists and biochemists for the last one and a half centuries. It is now very well realised that CAM is characterised by two segmental major metabolic sequences separated in time, one occurring in the night and the other during the day (Kluge and Ting, 1978). During dark period the stomata in CAM plants remain open and the CO_2 Fixation takes place through the activity of a carboxylating enzyme PEP - carboxylase coupled with malic dehydrogenase (MDH). As a result of this process large amount of malic acid is synthesized and it is stored in the vacuoles during night hours. During day time the stomata remain mostly closed and the stored malic acid enters in the metabolic

compartment and it undergoes decarboxylation through the activity of malic enzyme. The CO_2 thus liberated is refixed by the action of RuBP- carboxylase and through the subsequent operation of Calvin cycle. Major part of pyruvic acid produced during malate decarboxylation is converted into carbohydrates by reversal of glycolysis and some pyruvate enters in the TCA cycle. Thus in CAM plants a typical stomatal behaviour can be easily noticed. Similarly the diurnal fluctuations in organic acids (especially malate) with a definite rhythmycity are also evident in these plants. This is further accompanied by diurnal fluctuations in storage carbohydrates, the fluctuations occurring in exactly a reverse phase. The physiological investigations on succulents in last fifty years have been mainly concentrated on the biochemistry and control of CAM and it is now very well established that CAM has got a marked ecological significance. However, not much attention has been paid on the other aspects of physiology of succulents such as mineral nutrition of secondary metabolism.

Among the succulents we can find only few species which have got some economic importance and they have been exploited on a limited basis. Among these species Sansevieria is the most prominent because it is one of the very important garden and indoor succulent fiber plant in the world. There are few attempts to understand ecological adaptations and physiological processes (particularly CAM) in some succulent species

have been made at Shivaji University, Kolhapur in the laboratory of the Botany Department during last twenty five years. The carbon metabolism and the enzymology of CAM in succulents like Bryophyllum pinnatum, Aloe barbandesis, Portulaca olerecea and Agave Cantala have been studied in considerable details (Karmarkar, 1965, Bartakke, 1977, Kardage, 1981 and Landge 1988). Similarly an attempt was also made to study influence of salinity on CAM behaviour in these plant species except Agave. The present work can be regarded as a continuation of above work on succulents. However the present studies have been performed with rather different angle. In the present investigation an attempt is made to study monthly variation in the organic and inorganic constituents during a complete year in Sansevieria trifasciata. Similarly influence of different seasons on CAM behaviours in S. trifasicata, (cv) during light and dark periods is also studied.

This dissertation is divided into four chapters. In order to understand basic problems involved in the Sansevieria plant, brief resume of current status of literature has been made, to take a brief review of, distribution, morphology, cytology, cultural practices, physiology and economic importance of Sansevieria species.

The second chapter deals with the methodology followed for present investigation. The methodology includes titrometric and spectrophotometric

determination of organic constituents. The flamephotometer and atomic absorption spectrophotometer have been employed for determination of inorganic constituents.

The third chapter "Result and Discussion" cover the major finding of present investigation and they have been discussed in the light of available literature.

The significant findings have been briefly summarised in the fourth chapter "Summary and conclusions."

The literature cited in dissertation is property presented in the "Bibliography" part of the thesis.

The author is fully aware of the limited significance of the present investigation because it is only of preliminary nature. At the same time it should be mentioned that these studies, for the first time, throw light on various physiological processes (especially CAM) in Sansevieria trifasciata (cv). Laurentii, as influenced by different climatic conditions. Thus these studies can offer starting point for further detailed investigations on Sansevieria species in relation to CAM involved in it.