INTRODUCTION

Crop production in modern agriculture is always threatened by extreme environmental conditions such as high temperature, freezing temperature, drought and salinity. Among these extreme environments drought and salinity are extremely connected with water and these are the two stresses of concern to the crop productivity. When water is not available for plants to absorb the condition developed is called physical drought, water stress or moisture stress. On the other hand when even there is ample amount of water available in the medium it cannot be absorbed by the plants e.g. saline conditions, then this drought is called as physiological drought. Such a situation is very common in arid and semi-arid regions of the world.

Water loss from plant tissue may cause a number of changes in the plant metabolism. It can lead to a reduction in hydrostatic pressure inside cells. It can result in an increase in concentration of micro molecules and solutes of low molecular weight. The spatial relations of cellular membranes may be altered. In addition, a reduction in the chemical potential activity of plant water occurs. All these effects can influence metabolic processes. When plants are subjected to water stress, it is thus not surprising that many plant processes are affected. Cell expansion, cell division, cell wall and protein synthesis and activity of several enzymes are

some of the processes most sensitive to water stress. It is also well known that water stress inhibits stomatal opening and photosynthesis.

In an excellent review on plant response to water stress Hsiao (1973) has suggested a tentative scheme of the development of these effects in tissues with water stress. The first change suggested is the reduction in shoot and leaf growth followed very closely by a decrease in cell wall and protein synthesis. With a further decrease in water potential, cell division may decline and the levels of some enzymes such as nitrate reductase decrease, stomata may then close with a consequent reduction in transpiration and CO_2 assimilation. These changes are followed by a decline in respiration and translocation of photosynthates. Accumulation of sugars and proline are observed and CO_2 assimilation falls to a very low level. These physiological effects are accompanied by anatomical changes including the cavitation of xylem and blockage by vapour space. Older leaves become senescent and are shed as the process continues and finally the plants die.

Response of plants to drought however, varies from plant to plant and species to species. Some of the plants have well developed mechanism to resist water stress and make use of available water efficiently. Xerophytes and succulents are some of the good examples of drought resistant plants. In spite of several studies regarding the mechanism of drought resistance,

the exact nature of the mechanism is not yet clear. To face the problem of drought then it is highly essential to identify drought resistant strains of crops and to study their physiology for mechanism(s) of drought resistance.

The present critical situation in world food supplies demands that all our agricultural resources are to be utilized to the full. Pulses form an essential part of the Indian diet, and are grown commonly as pure crop, in rotation or mixed with cereals. Pulses are rich in proteins, minerals and Vitamin-B.

The study of physiology of individual pulse crop has an important role to play in guiding the efforts of agronomists, plant breeders, plant pathologists and others who are actively engaged in the business of improving efficiency of production. It is important to know e.g., the extent to which the physiology of a crop can be moulded to fit a particular set of environmental conditions or production practices and conversally the extent to which the techniques need to be modified to accomodate unalterable physiological processes. This has been very well achieved in soybean and peanut and to some extent in other grain legumes. Minor grain legumes which are cultivated in smaller scale and have received, however, a scant attention from the scientific community, have not been studied for their physiology.

P.aconitifolius is one of the important minor grain legume crops of semi-arid regions. In India it is grown as a hot season crop. It is the most drought resistant of the Kharip pulses and is largely grown on dry, light, sandy soils in the arid and semi-arid regions of the country. It is certain, therefore, that this will be an ideal material for the study to understand the mechanism(s) of drought resistance in plants. We thought worthwhile, therefore, to investigate the effect of water stress on the physiology of this very important but rather neglected pulse crop.

In the present investigation an attempt has been made to study the effect of water stress on biomass production, some organic constituents such as carbohydrates, total nitrogen, proline, chlorophylls and polyphenols; inorganic constituents, some enzyme systems and rate of transpiration and diffusive resistance. For this, plants were raised from seeds in soil culture and water stress was induced by withholding water from the pots. For plant analysis with respect to above parameters recent methodology was followed. Flamephotometry and spectrophotometry were extensively used.

For convenience and presentation, the thesis has been divided into different parts. To have an idea of drought problem a brief review of physiology of plants under water stress and some aspects of agronomy and physiology of moth

bean (P.aconitifolius) has been given in Chapter-I of the thesis. Chapter-II deals with the material obtained and the methodology adopted for culture and plant analysis. The important findings of the investigation have been statistically analysed and discussed critically in the light of recent literature collected in the form of reprints, research articles, research papers, reviews, monographs and books. This has been included in Chapter-III of the thesis. The problem perspectives and significant findings of the investigation have been summarized briefly in the last Chapter-IV of the thesis. The research papers, articles, monographs, reviews and books used extensively for discussion have been listed in "Bibliography", the last part of the thesis.