SUMMARY

India ranks second among silk producing countries after Peoples Republic of China. It 1997-98 production of raw silk has reached 15236 tonnes. Sericulture today presents a picture of an established, flourishing and well organised labour oriented agro-based industry with fairly high potential for export, employment and income generation. It is labour intensive industry providing full time and part time employment to about six million people. Sericulture industry has been identified as one of the important sections of the economy. Mulberry is grown as a foliage crop in sericulture and it responds well through luxuriant growth to optimum agronomic inputs with sufficient irrigation. Limited irrigation potential, depleting ground water sources and frequent drought spells are the major constraints for further spread of sericulture. The soil moisture operates as a limiting factor, the growth is stunted and the leaf yield is considerably reduced. The utilization of a improved variety, application of manure, inorganic fertilizers and better cultural practices are not satisfying the thirst and hunger of sericulturist under these conditions. A widely biotic approach to overcome these limitations, is selection of drought tolerant lines from the existing varieties and further using these lines in the improvement programmes, is seems to be effective and economic.

Several crop species have provided a significant information concerning their adaptability or tolerance to water deficits and genotype variation exists in

many plant species. Hitherto, this aspect of mulberry has received a little attention and hence the present investigation has been undertaken.

Preliminary studies have been conducted to screen some of the promising mulberry cultivars (ANANTHA, RFS-175, S-34, RFS-135, S-30 and M-5). Morphological, physiological and bio-chemical investigations were conducted in these selected mulberry cultivars in order to identify the traits which contribute for better performance during periods of water stress.

The experimental plants were raised through cuttings in pots (soil and manure in 3:1 ratio) for three months. The pots were maintained in the departmental garden irrigating daily to the field capacity. Plants were divided into four sets and arranged in Randomized Complete Experimental Block Design (REBD). One set of pots received water daily to field capacity and served as control. The remaining three sets received water daily to 75, 50 and 25% of field capacity and characterized as mild, moderate and severe stresses respectively. The data were collected at different time intervals (5, 10 and 15th day) after induction of stress. Morphological parameters, protein and proline levels and enzyme activities were determined by adopting standard protocols. Enzyme extracts were partially purified by using sephadex columns. The data were subjected for statistical analysis to derive significance.

Propagation parameters

Experiments on the propagation parameters, the sprouting ability and rooting performance which have a significant bearing in vegetatively propagated plant species revealed a better adaptive potential of the cultivar Anantha and

RFS-175 under mild and moderate stress conditions when compared to the other varieties studied.

Morphological and physiological parameters

Morphological and physiological studies were conducted in three-month-old plants (ANANTHA, RFS-175, S-34, RFS-135, M-5 and S-30) subjected to different regimes of water stress. Shoot growth and dry mass accumulation of leaves and leaf area under water stress conditions were measured. These parameters declined in stressed plants compared to respective control ones. Leaf moisture and moisture retention capacity are considered as the leaf quality parameters in mulberry which influence the palatability of silkworm. A better values in respect of moisture content and moisture retention capacity were noticed in leaves of Anantha and S-175 compared to S-30 under stressful conditions.

Water relations

Leaf water potential is the primary index of plant water status. In the present study, leaf water potential decreased in all six cultivars during periods of water stress. The magnitude of decline was found to be dependent on the degree and duration of stress. However, the per cent decrease was less in Anantha when compared to RFS-175 and S-30.

Relative water content is considered as a alternative measure of plant water status, reflecting the metabolic activity in tissues. Leaf relative water content in all six cultivars decreased at all treatments.

Protein

The total protein content decreased over controls in all stress treatments. The decreased protein content during stress conditions may be due to decrease in the synthesis of proteins or may be due to accelerated hydrolysis of proteins into amino acids, which may contribute for osmotic adjustment.

In general, drought stress inhibits plant growth and productivity of crop plants. The inhibition in growth is due to alterations in nitrogen metabolism, particularly in total protein content which is closely related to production of new tissue.

Proline

The proline levels in roots and leaves significantly increased over control in all stress treatments. There was a linear increase in proline accumulation with increasing severity and duration of stress. Free proline accumulation under stress can be due to an increased synthesis or to an inhibition in the oxidation of proline. In several investigations, a positive correlation between magnitude of free proline accumulation and drought tolerance has been suggested as an index for determining drought tolerance potentials different crop plants. The present study also confirms the substantial levels of proline during stress conditions. Further, the proline accumulation in response of water stress was greater in cultivar Anantha when compared to other five cultivars studied.

Antioxidative enzymes

One of the important biochemical changes posibly occurring when plants are subjected to stress conditions, is the production of activated oxygen species which are cytotoxic and seriously disrupt normal metabolism through oxidative damage of lipids, proteins and nucleic acids (Fridovoch, 1986).

Peroxidase and Catalase

Plants with high levels of antioxidants, reported to have greater resistance to this oxidative damage. Plants have evolved specific mechanisms involving antioxidants (tocopherol, carotene, ascorbate, glutathione etc.) and antioxident enzymes (peroxidase, catalase, superoxide dismutase, gluatathion reductase etc.) that protect against the toxic activated oxygen.

A significant elevation in the activities of peroxidase and catalase was recorded in both cultivars during stress conditions. Further, the degree of increase was found to be dependent on severity and duration of stress. Furthermore, the degree of elevation in enzyme activities was relatively high in drought tolerant cultivar (Anantha, RFS-175 compared to sensitive one S-30).

Lipid peroxidation in terms of melondialdehyde content was increased during stressed conditions when compared to control in all three cultivars. The level of melondialdehyde significantly increased by stress treatment. However, the degree of increase was lesser in Anantha cultivar than RFS-175 and S-30, which suggests that extent of membrane damage caused by water stress was

limited in Anantha cultivar, further indicates the tolerant nature of this cultivar to water stress.

From the preliminary results on propagation parameters, morphological data, physiological and biochemical studies such as higher biomass accumulation, greater levels of proline and better antioxidative enzyme efficiency, clearly indicate the relative tolerance potential of Anantha when compared to RFS-175 and S-30 to water stress conditions. Hence, biomass accumulation, proline and antioxidant efficacy could be considered as an important traits to evaluate tolerance potential of mulberry cultivars to drought or water stress conditions.