INTRODUCTION

Plants are the means for human survival and comforts, starting from food, home to most other requirements. The world's present population will double within the next 40 years if it continues to grow at its present annual rate of 1.6% (Hare *et al.*, 1996). If such forecasts are correct current technology will be unable to sustain the level of food production needed to support such numbers. The earth resources of arable land are finite. For the planet's approximately 150 billion hectares of land surface only 22% is considered to be agriculturally productive (Buringh, 1989). Of this productive land, 85% is classified as being of low or medium productivity. Environmental stress is the leading cause of sub-optimal crop yields internationally. Environmental stresses may be abiotic, biotic or anthropogenic. Whereas biotic factors such as insect diseases and weeds are responsible for losses representing less than 20% of the potential harvest of most species, abiotic factors including unfavorable soils and weather accounts for the vast majority of potential crop losses with drought commonly being the most destructive factor. The increasing effects of anthropogenic modification of the environment are a further source of concern for sustainable agricultural production in the future.

Among the different plantation crops of India, tea occupies a prime position as it contributes significantly and substantially to national economy. Tea, the common man's drink, is produced from the plant *Camellia sinensis* (L.) O. Kuntze. Its cultivation is spread over more than 3,96,000 hectares of land divided into two distinct regions – the North Indian tea belt located between 22^0 –27^0 N and the South Indian tea belt at 7^0 N. North–East India produces 75% of the total Indian tea in three different land scapes- the hilly terain of Darjeeling up to an elevation of 2000m (Plate I)., yielding the world's finest quality of teas; the extensive riverine flat plains at the base of Himalayan range i.e. Terai and Dooars; and the Brahmaputra valley of Assam located at 100m. above sea levels which is the largest flat plains of the world and which accounts for more than half of Indian production (Jain, 1991). Further, with great emphasis being given to increase productivity in tea, more and more non-conventional areas are being brought under tea cultivation, coupled with replanting old sites with vigorous and highly productive tea.

The tea plant is a perennial and as such, encounters a large number of environmental stresses throughout its life span. The main climatic variables influencing the growth and yield of tea are temperature, and the saturation vapour pressure deficit of the air and through their influence on plant and soil water deficit, rainfall and evapotranspiration (Ng'etich, 1997). Clonal responses of tea to these environmental variables are known to vary (Carr, 1997). The tea plant would obviously respond to these environmental stresses by shifts in biochemical processes which would give them greater adaptibility. Considering the importance of tea as a plantation crop in this area, along with the influence of environmental stresses on its growth and yield, the present study has been undertaken with the following objectives:

- To subject various tea clones obtained from different regions and being maintained in the experimental garden to different stresses i.e. abiotic - elevated temperature and drought, anthropogenic - fungicide and insecticide spray and biotic- blister blight infection.
- To determine morphological changes following different stress treatments.
  To determine following biochemical responses of tea plants subjected to different stresses;
- Changes in activities of three enzymes phenylalanine ammonia lyase (PAL), polyphenol oxidase (PPO) and peroxidase (PO).
- Changes in isozyme patterns of peroxidase.
- Changes in chlorophyll contents.
- Quantitative changes in protein content as well as protein patterns.
- Accumulation of proline.
- Accumulation of phenolics.
- Determine the presence of antifungal phenolics in the tea leaves and their characterization by bioassays and UV-spectrophotometry.
- HPLC analysis of catechin extracts.

The materials used and methods applied to achieve the above objectives have been outlined in the following pages along with the results achieved. In the beginning a review of literature along lines pertaining to the present work has also been presented.

Plate I : An overview of a Tea Estate of Darjeeling hills