Indian Journal of Natural Rubber Research, **16 (1 & 2) : 93-101, 2003**

ANTIOXIDANT DEFENCE SYSTEMS AND DROUGHT TOLERANCE IN *HEVEA BRASILIENSIS*

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Sreelatha, S., Jacob, J., Prakash, G., Simon, S.P., Annamalainathan, K. and Chandrasekhar, T.R. (2003). Antioxidant defence systems and drought tolerance in *Hevea brasiliensis*. *Indian Journal of Natural Rubber Research*, **16 (1 & 2) : 93-101.**

The dry rubber yield, girth of the trees, biochemical composition (phenols, aminoacids, sugars, protein and glutathione) and the activities of antioxidant enzymes peroxidase (PER), ascorbate peroxidase (APOX), superoxide dismutase (SOD) and polyphenol oxidase (PPO) in the leaf and bark tissues of ten rubber (*Hevea brasiliensis*) trees each belonging to low and high yield and low and high girth categories were determined during summer (peak drought) and post-monsoon (drought free) seasons during 1996–1998. During this period, the mean dry rubber yield of low yield category trees ranged from14.4 to 34.9 g/tree/tap and for the high yield category it was 32.3 to 107.7 g/tree/tap, depending upon the seasons. The mean girth ranged from 27.5 to 30.2 cm and 76.5 to 82.9 cm for the low and high girth category trees, respectively. The biochemical composition and enzyme activities of the leaf and bark tissues of the four categories showed wide variations. The glutathione content in the bark was higher in the high yielding than in the low yielding trees, irrespective of the seasons. The high yielding trees showed greater PER and APOX activities in the leaves and lower PPO activity in the bark than the low yielding trees. High girth trees consistently showed increased leaf PER activity compared to low girth trees during both the seasons indicating their intrinsic drought tolerance capacity. The possibility of using the above parameters as markers for drought tolerance is discussed.

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Key words: Active oxygen species, Antioxidants, Drought tolerance, Environmental stress, *Hevea brasiliensis*.

INTRODUCTION

Expanding natural rubber (NR) cultivation to newer areas and increasing the productivity of the existing plantations are the two ways to bridge the gap between the demand and supply of NR. But, adverse environmental conditions such as drought, high and low temperatures, high solar radiation, low atmospheric humidity, poor soils *etc.* limit the expansion of cultivation to newer areas in several rubber producing countries (Pushparajah, 1983; Sethuraj *et al.*, 1989; Jacob *et al.*, 1999). Stressful environment caused by conditions such as drought is a productivity limiting factor even in the traditional rubber growing areas. Under conditions of abiotic stress like drought or low temperature and biotic stress such as over exploitation, the plants experience oxidative stress (Krishnakumar *et al.*, 1996). Oxidative stress is defined as the cumulative and accumulated effects of the potentially lethal reactions initiated by various forms of active oxygen species (AOS). Evidences suggest that many environmental stresses have their effects directly or indirectly through the production of active oxygen species (AOS) such as superoxide (O_2^-), hydrogen peroxide (H_2O_2) and hydroxyl radicals (OH^-) following impairment of electron transport systems (Elstner, 1982; Smirnoff, 1993; Mc Kersie and Lesham, 1994; Jacob and Nataraja, 2000). In many plants drought and associated high intensity of light leads to diversion of photosynthetic electrons for the production of AOS which cause inactivation of enzymes,