

BRIEF COMMUNICATION

Water stress-induced oxidative damage and antioxidant responses in micropropagated banana plantlets

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Abstract

Oxidative injury and antioxidant responses were investigated in two banana genotypes (*Musa* AAA 'Berangan' and *Musa* AA 'Mas') subjected to 40 % PEG-induced water stress. PEG treatment resulted in oxidative injury, as expressed in increased lipid peroxidation and reduced membrane stability index, in both cultivars; however, greater oxidative injury was detected in 'Mas'. Under PEG treatment, catalase activity and glutathione reductase activity were enhanced in both cultivars, but were higher in 'Mas'. Ascorbate peroxidase activity was enhanced in 'Berangan' under water stress, but was unaffected in 'Mas'. Meanwhile, superoxide dismutase activity was inhibited in both cultivars under water stress, but higher activity was detected in 'Berangan'. Higher ascorbate peroxidase and superoxide dismutase activities were associated with greater protection against water stress-induced oxidative injury.

Additional key words: oxidative stress, ascorbate peroxidase, superoxide dismutase, glutathione reductase, catalase, lipid peroxidation.

Plants are immobile and therefore unable to escape stressful environments. In higher plants, exposure to abiotic stresses, e.g. water stress and high salinity, often results in oxidative injury (Smirnoff 1993, Fadzilla *et al.* 1997). Plants have evolved various antioxidative mechanisms that alleviate oxidative stress through the detoxification of reactive oxygen species (Alscher *et al.* 1997). Studies on sorghum and wheat revealed that stress-tolerant plants are usually endowed with efficient antioxidant defence systems (Jagtap and Bhargava 1995, Zhang and Kirkham 1996). Meanwhile, over-expression of genes encoding antioxidant enzymes in transgenic plants has been associated with enhanced stress tolerance (Allen *et al.* 1997).

Banana is a commercial crop in the tropical and

subtropical regions of the world (Robinson 1996). As in other plants, the growth and productivity of the banana plant are adversely affected by water stress (Adam and Barakbah 1990). The role of antioxidative mechanism in the banana plant in relation to water stress, however, is largely unexplored; hence, this study was conducted. In this study, we investigated the antioxidant responses in micropropagated banana plantlets under water stress.

Micropropagated plantlets of *Musa* AAA 'Berangan' and *Musa* AA 'Mas' were prepared based on the procedure described by Vuylsteke and De Langhe (1985) and Novak *et al.* (1985) with some modifications. Sword suckers collected from Plantation Field 2, Universiti Putra Malaysia were the source of shoot tips used in culture initiation.

Received 2 February 2004, accepted 14 September 2004.

Abbreviations: APX - ascorbate peroxidase; BAP - 6-benzylaminopurine, CAT - catalase; GR - glutathione reductase; IAA - indole-3-acetic acid; MDA - malondialdehyde; MSI - membrane stability index; PEG - polyethylene glycol; PPFD - photosynthetic photon flux density; SOD - superoxide dismutase.

Acknowledgement: This work was funded by a research grant from the Ministry of Science, Technology and the Environment of Malaysia.

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