

Cell membrane integrity and proline content of *Rhizophora mucronata* Lam. seedlings under hypersaline and drought conditions

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The planted mangrove seedlings and propagules experience low soil water potential and hypersaline conditions when plants are introduced beyond and deeper in the intertidal area respectively. Severe leaf necrosis in planted mangroves is also commonly observed under these conditions. Based on this, it was hypothesized that the cell membranes of mangrove plants are critically damaged under hypersaline and drought conditions leading to extensive cell deaths in leaves and stem. We investigated the cell membrane stability of *Rhizophora mucronata* Lam., a commonly used species in mangrove restoration in Sri Lanka, by using electrolyte leakage method and assessing the proline content of leaves under three levels of moisture stress; 25% water holding capacity (WHC), 50% WHC and 100% WHC (control) and salinity levels; freshwater, high salinity (33-36 psu) and moderate salinity (13-15 psu: control treatment) where salinity and moisture treatments were separately maintained. Survival rate and growth performances like cumulative height, total leaf area of the plants were also studied. Both low survival (< 50%) and poor growth performances (dwarf plants with smaller leaf area) were observed in 25% WHC, 50% WHC and high salinity treatment levels, in which, significantly higher electrolyte leakage (>40%) and higher proline content (30-35 μmolg^{-1}) were further observed compared to the control and to the freshwater treatments ($p < 0.05$). The lowest proline content was, however, recorded in control treatments; moderate salinity ($8.8 \pm 1.5 \mu\text{molg}^{-1}$) and 100% WHC ($6.5 \pm 1.2 \mu\text{molg}^{-1}$). This indicates that, as a tolerant strategy, *Rhizophora* plants increased the proline content to protect cellular membrane, more likely from free radical activities. However, the high electrolyte leakages indicate that the membrane permeability of *Rhizophora* plants is collapsed. This cell disintegration results in cell deaths (small leaf necrotic regions) which are further developed to larger necrotic regions with time. The resultant dead tissues reduce photosynthetic capacity of the plants weakening the tolerant mechanisms further.

Keywords: Substrate dryness, hypersaline, cell membrane damage, proline, *Rhizophora*

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