Sensitive indicators of *R. mucronata* Lam. to abiotic stress conditions; early-detection of stressors in mangrove restoration fields

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Early detection of dysfunctional mangrove seedlings in planting sites offers higher chance to enhance their survival potential. Therefore, this study was aimed at investigating the early detectable stress indicators of *Rhizophora mucronata* seedlings under different salinity levels and soil water stress conditions. The propagules of *R. mucronata* were maintained in a plant house (Three replicates per each treatment level according to completely randomized design) under three salinity conditions i.e., high salinity (>30 psu), moderate salinity (15 psu) (control) and fresh water (~ 0 psu) and three soil water contents as 25% of WHC (water holding capacity), 50% of WHC and 100% of WHC (control). Leaf characters and some selected anatomical features of seedlings in each treatment were studied over a period of 8 months. All plants were dead in 25% of WHC. Leathery texture, very thin waxy layer (>2% of the total thickness of the leaf) and severe necrosis were common under high salinity and water stress conditions. Leaf area, size of the epidermal cells, length of guard cells, chlorophyll content and leaf thickness of plants under the salinity and water stress conditions were reduced significantly by 75%, 72%, 50%, 57% and 52% respectively, compared to their respective controls ($p<0.05$). In contrast, stomata density showed a significant increase in response to these abiotic stresses ($p<0.05$). Among them, leaf area, their appearance and chlorophyll content appeared to be more reliable stress indicators as standards for those parameters can be established easily by selecting 2nd fully expanded leaf exposed to full sunlight and keeping age-specific reference for the mangrove seedlings. Early-detection of stress level of seedlings helps restoration practitioners to take early actions to rescue dysfunctional seedlings and eventually to uplift the survival potential of planted mangroves.

Keywords: Stress, leaf characters, high salinity, soil water stress, mangrove restoration

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