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Exploring the Spatial Variation of Morpho-Anatomical Traits of True Mangrove and Mangrove Associates in the Southern Province of Sri Lanka in Accordance with Climatic Adaptation

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Abstract

As salt-tolerant species, mangrove vegetation has evolved special characteristics to survive in its harsh environment. Since leaves are the most productive organs and are exposed to the external environment, they are highly sensitive to environmental changes. Although many studies on Sri Lankan mangrove flora have been focused on mangrove physiology, conservation etc., only a few studies have focused on leaf morpho-anatomical characteristics in relation to different climatic conditions. The present study is aimed to determine the spatial variation of morphological and anatomical characters of leaves of true mangrove and mangrove-associate species in the Southern Province of Sri Lanka. Seven mangrove sites in the Southern Province covering the three principal climatic zones were selected. Mature leaves were collected at each site along with soil salinity measurements. Leaf morphological traits such as specific leaf area (SLA) and leaf anatomical traits including leaf thickness with cuticle (LT), palisade thickness (PT), spongy mesophyll thickness (ST), palisade to spongy ratio (PSR) and water storage tissue thickness (WST) were measured. ANOVA test and Cluster Analysis were carried out using RStudio software to determine whether there is a significant morpho-anatomical trait variation in relation to different climatic zones. The study observed varied leaf trait values for different true mangrove and mangrove associate species that emphasized the varying degrees of ability to cope with different environmental conditions. For instance, a lower leaf area and SLA were observed in true mangrove species compared to mangrove associates. *Lumnitzera racemosa* Willd. had significantly higher LT (481.56 µm±53.74b) and WST (221.14 µm±47.9a) which facilitates osmoregulation. In addition, high PSR was observed in *Acrostichum aureum* (L). which would enhance the photosynthetic efficiency. Furthermore, a variation in laminar traits was observed in relation to different climatic zones. Some species including *Bruguiera sexangula* (Lour) Poir*, Rhizophora* spp., *Hibiscus tiliaceus* (L). and *Clerodendrum inerme* (L) Gaertn. showed significantly higher SLA in the wet zone. The presence of salt glands on the adaxial surfaces of the leaves of *Acanthus ilicifolius* (L)., a mangrove associate species, revealed similar adaptations as in true mangrove species. A spatial variation in clustering was observed with members of the same family clustering together, indicating a genetic influence. *A. ilicifolius* (L)*.,* a mangrove associate species, exhibited similar adaptive responses as true mangroves whereas *Excoecaria agallocha* (L). showed adaptations to inhabit different climatic zones. In conclusion, both true and mangrove associate species are likely to adapt to environmental changes under climate change scenarios. This study would aid in the identification of climate-resilient species for mangrove restoration programs.

Keywords*:* Mangrove, Morpho-anatomical traits, Adaptation, Mangrove associates, Spatial variation, Climate change