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Diversity and Distribution of Lichen and Flora Species in Serpentine Soil in Ussangoda, Sri Lanka

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Abstract

Serpentine soils, which form from ultramafic rocks such as peridotite and serpentinite, are chemically severe environments with low nutrient levels, high magnesium-to-calcium ratio, and high concentrations of heavy metals (nickel, chromium, and cobalt). These conditions preclude most organisms from colonizing but select for the growth of specially adapted plants and microbial life. This research investigates lichen and plant species diversity and their distribution within the serpentine soil ecosystem of Ussangoda National Park, Sri Lanka and their relationship to succession. The study aims to catalog the flora and lichen species, their ecological roles, and the interaction between soil chemistry and biological adaptation in this specialized edaphic habitat. Field surveys were conducted across ten randomly selected 25,000 m² sampling plots, and 10 composite soil samples, macro-lichen, and macro-floral datasets were collected using standardized ecological and sampling methods. Lichen and plant species were identified to species level based on morphological characteristics using dichotomous keys, while biodiversity indices such as Shannon-Wiener, Margalef's richness, and species evenness were calculated to ascertain ecological diversity. Soil testing was done for phosphorus, potassium, EC, OM and pH. Three macro-lichen species, *Pyxine soredata*, *Bacidia circumspecta*, and an unidentified crustose species, were found to be predominant on serpentinite rock surfaces, indicating their pioneering nature in the colonization of metal-rich substrates. These lichens are significantly involved in the weathering of rocks, soil formation, and bioindication of environmental stress. Similarly, the main serpentine-tolerant plant species such as *Fimbristylis falcata* (Vahl.) Kunth., *Evolvulus alsinoides* (L.) L., and *Eragrostis ciliaris* (L.) R. Br. were encountered, which displayed prominence in the sampled areas. These are adaptive responses that are evolutionary responses to edaphic stress imposed by serpentine. With that newly identified three plant species *Chlorophytum* sp., *Phyllanthus wheeleri*, *Veronica peregrina* were not recorded earlier in the Ussangoda serpentine ecosystem. As soil analysis results, obtained pH:5.47±0.14, OM:3.28%±0.255, P₂O₅:1.26±0.22 ppm, K₂O: 137.76±15.87 ppm and EC as 0.041±0.0095 dS/m. The results emphasize the ecological role played by plant communities in the maintenance of stability and function in serpentine ecosystems. Their roles include nutrient cycling, prevention of erosion, and ecosystem facilitation. Identifying and understanding macro-lichen and flora species offer critical insights for ecological restoration in degraded or metal-contaminated environments. Their physiological resilience and adaptive strategies can guide the selection of species for reforestation and soil rehabilitation in extreme habitats and sustainable land management toward succession.

Keywords: Primary succession, Toxic habitats, Serpentine ecosystem, Toxic tolerability, Land degradation