M.Sc. Degree in Environmental Science

DIVERSITY AND DISTRIBUTION OF LICHEN AND FLORA SPECIES IN SERPENTINE SOIL IN USSANGODA, SRI LANKA

A dissertation submitted

by

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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 such as 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 which related to the succession. The study aims to catalog flora and lichen species composition, 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 25,000m^2 sampling plots, and soil, lichen, and macro-floral datasets were collected using standardized ecological 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 in order to ascertain ecological diversity. Furthermore, 2020 and 2025 NDVI satellite data were used to detect changes in vegetation across the landscape and soil testing were done for phosphorous, potassium, EC, OM and pH. Three macro-lichen species, *Pyxine sorediata*, *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* which were not recorded earlier in Ussangoda serpentine ecosystem. As soil analysis results, obtained pH: 5.47 ± 0.14, OM: 3.28% ± 0.255, P_2O_5: 1.26 ± 0.22 ppm, K_2O: 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 these 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. This knowledge enhances the ability to design nature-based solutions for climate change mitigation and sustainable land management toward succession. The specializations of these organisms shed light on resilience under conditions of extreme adversity and can guide environmental strategies in the management of metal-contaminated lands and the creation of sustainable agricultural systems in challenging environments.