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# Interrelationship between Ambient Air Pollution and Lichen Diversity Urban, Semi-Urban and Rural Landscapes in Ratnapura

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## Abstract

Ambient air pollution has become a global issue. Industrialisation and urbanisation are the main contributing factors for air pollution. Therefore, air quality monitoring is essential for detecting air pollution levels in different environmental conditions. However, the development of indirect indicators of air quality is essential for assessing air pollution levels. Lichens have been identified as effective air quality monitors in worldwide. The objective of the study is the evaluation of ambient air pollutant levels and lichen diversity in urban, semi-urban and rural landscapes in the Ratnapura DSD. $NO_2$ and $SO_2$ play major roles as air pollutants and a passive air sampling technique was used to measure air pollutant levels. Lichen diversity was calculated by Simpson and Shannon-Wiener index. Atmospheric purity index was also calculated. DISTLM procedure and PCA analysis were also used for community based analysis. Nine locations in the Ratnapura district were selected representing the urban, semi-urban and rural landscapes. Univariate and multivariate statistical approaches were used for analyzing related to the levels of air pollutants and lichen species composition in each category. The results of this study have detected that urban areas showed significantly higher ($p<0.05$) $NO_2$ and $SO_2$ levels than semi-urban and the rural areas while rural areas showed the lowest concentrations of $NO_2$ and $SO_2$ levels. There is a decreasing tendency of air pollutants in urban to rural areas. Further study has detected that some urban landscapes have reached an unhealthy level for sensitive groups with $NO_2$ level according to the WHO air quality index. There is a negative relationship between lichen diversity and atmospheric purity index with ambient average $NO_2$ and $SO_2$ concentrations. Analysis of lichen species indicated some lichen species are more vulnerable to air pollution such as *Physcia* sp, *Herpothallon* sp, *Arthonia* sp, *Cryptothecia* sp, and sterile crust species while some species are tolerant of air pollution such as *Graphis* sp, *Drinaria picta*, *Leprocaulon* sp and some species of Graphidaceae family. Further study has revealed that high lichen diversity could be observed in some urban areas in Ratnapura which reveals more lichen species have survived in high pollution conditions. There is a tendency of lichen species to adapt to high air pollution conditions. The findings of the study revealed that other environmental factors have affected the relationship of air pollutants and changes of community composition of lichen species along a gradient of urban, semi-urban and undisturbed landscapes in Rathnapura.

***Keywords:*** Ambient air pollution, Atmospheric purity index, Lichen diversity, Nitrogen dioxide, Sulfur dioxide