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Importance of Leaf Micro Morphological Trait Combinations of Trees to Capture Atmospheric PM10.5 and PM2.5: A Study on 11 Selected Tropical Roadside Tree Species in Colombo, Sri Lanka

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Abstract

Roadside trees can increase the surface roughness of the ground and reduce wind speeds and provide considerable amount of time for pollutants like Particulate Matter (PM) to be blocked and filtered. This study was designed with the objective of understanding the most effective tree species to accumulate outdoor atmospheric PM10.5 and PM2.5. As a specific objective of the study, which is to understand this phenomenon in a tropical urban setting, 11 street tree species which are frequently distributed in roadsides of Colombo Municipal Council, Sri Lanka were selected; *Tectona grandis* (Teak), *Cassia fistula* (Ehala), *Terminalia catappa* (Kottamba), *Polyalthia longifolia* (False Ashoka), *Plumeria obtusa* (Araliya), *Madhuca longifolia* (Mee), *Ficus benjamina var. benjamina* (Walu Nuga), *Mangifera indica* (Mango), *Pongamia pinnata* (Karanda), *Ficus religiosa* (Bo), and *Acacia pycnantha* (Acacia). The study was conducted in two sites as Beddagana wetland forest; the least polluted site and busy roadsides of Sri Jayawardenepura Kotte, Kolonnawa and Colombo Municipal Council; the highly polluted site. PM10.5 and PM2.5 trapped on both surface and wax layer of leaves were measured using a gravimetric method. Leaf micro morphological traits were identified and their abundance were analyzed using Scanning Electron Microscope (SEM) images of the leaves. Standard MANOVA was followed to identify the relationship among each morphological trait and the PM amount. High PM values were recorded in polluted site. According to the study results it can be concluded that leaf size and leaf shape were the major determinants of capturing PM from the atmosphere. Compared to the other traits considered, only leaf size showed negative correlation with the capturing of both PM10.5 and PM2.5. Although trichomes, hairs, epi-cuticular waxes and texture of leaves showed positive relationship it can be concluded that they are not crucial properties in immobilizing PM in leaves.

Keywords: PM10.5, PM2.5, Leaf micro morphological traits, SEM images