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Metabolomics Fingerprinting Analysis of Melastoma malabathricum L. Leaf of Geographical Variation Using HPLC-DAD Combined with Chemometric Tools

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Abstract : Melastoma malabathricum L. is an Indo-Pacific herb that has been traditionally used to treat several ailments such as wounds, dysentery, diarrhea, toothache, and diabetes. This plant is common across tropical Indo-Pacific archipelagos and is tolerant of a range of soils, from low-lying areas subject to saltwater inundation to the salt-free conditions of mountain slopes. How the soil and environmental variation influences secondary metabolite production in the herb, and an understanding of the plant's utility as traditional medicine, remain largely unknown and unexplored. The objective of this study is to evaluate the variability of the metabolic profiles of M. malabathricum L. across its geographic distribution. By employing high-performance liquid chromatography-diode array detector (HPLC-DAD), a highly established, simple, sensitive, and reliable method was employed for establishing the chemical fingerprints of 72 samples of M. malabathricum L. leaves from various geographical locations in Indonesia. Specimens collected from six terrestrial and archipelago regions of Indonesia were analyzed by HPLC to generate chromatogram peak profiles that could be compared across each region. Data corresponding to the common peak areas of HPLC chromatographic fingerprint were analyzed by hierarchical component analysis (HCA) and principal component analysis (PCA) to extract information on the most significant variables contributing to characterization and classification of analyzed samples data. Principal component values were identified as PC1 and PC2 with 41.14% and 19.32%, respectively. Based on variety and origin, the high-performance liquid chromatography method validated the chemical fingerprint results used to screen the in vitro antioxidant activity of M. malabathricum L. The result shows that the developed method has potential values for the quality of similar M. malabathrium L. samples. These findings provide a pathway for the development and utilization of references for the identification of M. malabathricum L. Our results indicate the importance of considering geographic distribution during field-collection efforts as they demonstrate regional metabolic variation in secondary metabolites of M. malabathricum L., as illustrated by HPLC chromatogram peaks and their antioxidant activities. The results also confirm the utility of this simple approach to a rapid evaluation of metabolic variation between plants and their potential ethnobotanical properties, potentially due to the environments from whence they were collected. This information will facilitate the optimization of growth conditions to suit particular medicinal qualities.

Keywords : fingerprint, high performance liquid chromatography, Melastoma malabathricum l., metabolic profiles, principal component analysis
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