



Physicochemical, Melissopalynological, and Antimicrobial Characterization of Natural Bee Honey from Diverse Agroecological Regions in Sri Lanka

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Honey's characteristics and health benefits depend on its botanical and geographical origin—factors poorly understood in Sri Lankan honey. This study characterised floral sources, geographic origin, physicochemical properties, and antimicrobial activity of honey from diverse agro-ecological regions in Sri Lanka. The bee honey samples were obtained from 14 diverse locations including Low Country Wet, Low Country Dry, Low Country Intermediate, Mid Country Wet, and Up Country agro-ecological regions of Sri Lanka, along with a commercial bee honey market sample to use as a reference. Evaluation of physicochemical, melissopalynological, and antimicrobial properties were carried out according to the previously published standard methods for each sample. The pH range in honey samples varied from 2.59 ± 0.02 to 4.44 ± 0.05 ; Brix value ranged from 71.63 ± 0.21 to $78.40 \pm 0.60^\circ\text{Brix}$, and water activity ranged from 0.61 ± 0.00 to 0.73 ± 0.00 . In melissopalynology analysis, 28 pollen species were identified from 20 plant families. The pollen of plants from family Asteraceae, Myrtaceae, Fabaceae, Rubiaceae, Poaceae, and Malvaceae contributed predominantly. The honey samples obtained from Low Country Intermediate Zone 01, Low Country Dry Zone 03, and Up-Country Wet Zone 03 were of unifloral honey and others were multifloral honey. The bee honey samples from Low Country Intermediate Zone 02 and Low Country Dry Zone 01 had a high pollen density, with an absolute pollen count of more than 1,000,000/10 g. Antimicrobial testing indicated that honey samples obtained from Low Country Dry Zone 01 and Low Country Dry Zone 03 samples had a significant inhibitory effect on *Staphylococcus aureus* and *Staphylococcus epidermidis*. However, tested bee honey samples were not effective in inhibiting the activity of *Candida albicans*. This study demonstrates that morphological and quantitative pollen analysis reliably verifies the botanical and geographical origin of honey, enhancing its commercial value through the exploration of antimicrobial properties.

Keywords: Antibacterial, Bee honey, Physicochemical, Pollen analysis, Pollen morphology