

Abstract

The fragrant leaves of *Cinnamomum tamala* (Indian bay leaf), belonging to Lauraceae, are extensively employed in medicinal and culinary applications due to its rich aroma and therapeutic properties across Asian subcontinent and beyond. Fluctuation in environmental factors like temperature, rainfall, humidity influences variability in composition and contents of essential oils. Besides, harvesting time, age of leaves, and season shape the quality and content of essential oils. This work evaluated the impact of seasonal and diurnal variations on the composition and contents of aroma volatiles in the mature leaves of *C. tamala*. Summer and winter were identified as the highest and lowest yielding seasons for specialized metabolites. The summer profile was primarily characterized by phenylpropanoid compounds while winter profile was dominated by monoterpene and monoterpenoids. Diurnal study showed highest accumulation of volatiles and primary metabolites (except sugars) in summer evening while diurnal winter profile did not show any significant differences due to lower metabolic activity. Histochemical investigation confirmed the presence of lipid and terpene moiety in the essential oil present in the secretory oil cell. The deposition of lignin, pectin, aldehyde and phenolic components were also elucidated through histochemical analyses. Ultrastructural study described the development of secretory oil cells from an early idioblastic cell with the help of transmission electron microscopy. To increase the storage lifespan and to decrease the biological degradation, postharvest drying of targeted plant materials (leaves) is necessary. Selecting the ideal drying method is vital to ensure the best preservation of aroma. Out of five different practices tested in this study, leaves when oven dried at 60°C performed best in terms of free-radical scavenging capacities, internal volatiles content and yield of essential oil. In a parallel study conducted on *C. verum* (another important aromatic essential oil yielding member of Lauraceae) from two different geographical locations in India (Kharagpur, West Bengal and Mamit, Mizoram), showed differences in essential oil content and composition. The essential oil profile of Mamit ecotype was dominated by linalool while the profile of Kharagpur ecotype was dominated by eugenol. Histochemical investigation did not show any notable differences between these two ecotypes except for significant difference in mesophyll thickness and starch granule accumulation as these were more in the leaves of Kharagpur ecotype. Besides, crystals considered as a notable taxonomic character was present only in Kharagpur ecotype. Based on their chemical differences, these two ecotypes were considered as chemotypes.

Keywords: *Cinnamomum tamala*, *Cinnamomum verum*, essential oils, seasonal and diurnal variations, ecotype variations, anatomy, histochemistry, ultrastructure