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PhD Thesis Abstract

Combretum indicum (L.) DeFilipps is a popular ornamental plant bearing vibrant, colour changing flowers with a soothing fragrance. White flowers open at dusk which gradually change colour to pink and then red only in daylight. This study was designed to investigate previously unresearched physiological and cell biology elements of flower colour change along with scent volatiles synthesis and emission in *C. indicum*. Cyanidin 3-*O*-glucoside was identified as the major anthocyanin prompting petal colour change in this species. Microscopic observations demonstrated that much of the pigment is accumulated along the advertised adaxial surface of the petal tissue and indicated vesicular trafficking to be the primary method of anthocyanin sequestration. Evident synchronization exists between developmental differences in colour change and rhythmic scent volatiles synthesis in this species. Maximum scent emission was observed at night in the white colourless stages suggesting a temporal resource allocation of the precursor molecules allowing the diurnal color formation in petals. The examination of floral volatile organic compounds (VOCs) using gas chromatography-mass spectrometry (GC-MS) determined terpenoids and their oxides as the major VOCs of the floral bouquet. The adaxial epidermal layers of petal tissues also particularly responded to histochemical testing, demonstrating that they are actively involved in the biosynthesis, accumulation, and emission of VOCs. Transcriptome sequencing from two major stages of floral maturation (white and red) were carried out in order to better comprehend the molecular mechanisms regulating floral colour transitions and scent biosynthesis in *C. indicum*. Transcript abundance of major genes identified from the transcriptome assembly were examined to recognize vital regulations of the specialized metabolic pathways. A dynamic movement of sugars from the source tissue ultimately drives the complete morphological and biochemical changes in the floral tissue. Furthermore, a probable route of nectar synthesis, transport, and exudation was also traced along the nectariferous floral tube. Thus, this research offers a holistic understanding of the coordinated changes in the displayed coloured and scented metabolites, which when combined with compositional changes in nectar rewards serve as sensory billboards to entice pollinators for the reproductive benefit of *C. indicum* flowers.

Keywords: *Combretum indicum*, Specialized metabolism, Anthocyanin, VOCs, Transcriptomics, Gene expression, Microscopy, Nectar.