MAK HILL Publications Botany Research Journal

Research Article
doi: 10.36478/makrjms.2025.1.5

Pseudobulb Water Storage and Leaf Morphology: Key Adaptations of Wayanad's Epiphytic Orchids to Summer Drought

[1]V.U. Sabu and [2]Jincy Paulose

[1,2]Vayalarikil (H), Kalthuvayal (PO), Ambalavayal. 673593, Wayanad Kerala, India

OPEN ACCESS

Key Words

Epiphytic orchids, pseudobulbs, leaf morphology, drought adaptation, wayanad, western ghats, orchid conservation, velamen, cuticle, microclimate resilience, climate change, canopy ecology

Corresponding Author

V.U. Sabu,
Vayalarikil (H), Kalthuvayal (PO), Ambalavayal. 673593, Wayanad Kerala, India

Received: 11th April 2025
Accepted: 15th May 2025
Published: 02nd June 2025

Citation: V.U. Sabu and Jincy Paulose, 2025. Pseudobulb Water Storage and Leaf Morphology: Key Adaptations of Wayanad's Epiphytic Orchids to Summer Drought. Bot. Res. J., 18: 1-5, doi: 10.36478/makrjms.2025.1.5

Abstract

The Western Ghats of India, a UNESCO-recognized global biodiversity hotspot, harbor an extraordinary diversity of orchid species, many of which exhibit specialized adaptations to survive the region's pronounced dry seasons. Among these, epiphytic orchids-plants that grow upon other trees without rooting in soil-are particularly vulnerable to water scarcity due to their exposure to variable canopy microclimates. This three-year study (2023-2025) focused on understanding the drought resilience mechanisms of epiphytic orchids in the montane forests of Wayanad, Kerala, with particular emphasis on two key structural features: pseudobulb water storage and leaf morphological traits. We selected six representative epiphytic orchid species found across moist deciduous, semi-evergreen and montane evergreen forests, spanning altitudes of 800-1400 meters. Detailed field surveys, physiological assessments (including stomatal conductance, chlorophyll fluorescence and relative water content) and anatomical analyses (pseudobulb structure, velamen thickness, cuticle development) were conducted seasonally. Controlled drought simulations in polyhouse environments further validated field findings. Our results demonstrate that orchids possessing larger, succulent pseudobulbs and thick, waxy leaves exhibited superior drought tolerance. These species retained water more effectively, maintained higher photosynthetic performance under stress, and exhibited slower rates of dehydration. Anatomically, dense velamen layers on roots and thickened cuticular surfaces on leaves played crucial roles in limiting water loss. Statistical analyses revealed strong positive correlations between pseudobulb volume, leaf thickness and drought performance indicators. Orchids in shaded canopy microhabitats had higher survival rates, emphasizing the significance of microclimate buffering. The study provides the first long-term, integrative dataset highlighting the interplay between structural adaptations and drought resistance in South Indian epiphytic orchids. It offers vital insights for orchid conservation strategies under shifting climate regimes. Protecting forest canopy integrity and conserving drought-resilient orchid species can enhance the ecological stability of these sensitive montane systems.