

Abstract

The evolutionary success of orchids is to a large extent driven by the ability to colonize epiphytic habitats. This ability is based on a number of adaptations at different levels, and the adaptive features of aerial roots can play a key role because the roots are practically the only organ providing water and nutrient uptake. The main aim of this work is to review available information about roots of epiphytic orchids (*Orchidaceae*), especially their adaptations to the epiphytic way of life. The roots of epiphytes must deal with a periodic lack of water and nutrients, often in conjunction with high irradiation. The roots of epiphytic orchids adapt to these conditions on many levels. Rhizodermis forms a velamen capable to retain water and nutrients and protecting roots against environmental conditions including UV radiation. Root cortex contains chloroplasts, which can perform photosynthesis at least in some orchid species. Exodermis is well differentiated with thick secondary cell walls and acts as a selective barrier for the transport of substances with the use of passage and aeration cells. The function of some adaptive structures is still unclear, for example, tilosomes could regulate transpiration. Epiphytism evolved multiple times in orchids, and some root adaptations therefore originated repeatedly likely as a result of convergence.