

Abstract:

The photosynthesis of the aerial roots of epiphytic orchids has been the subject of numerous studies. However, the roots are always evaluated as a homogeneous structure, even though they actually consist of significantly different areas. This work deals for the first time with the possibility of the spatial distribution of photosynthesis between the root layers, specifically the cortex and the stele. A combination of various microscopic techniques, the histochemical characterization of the apoplastic barriers and the immunohistochemical localization of the photosynthetic enzyme phosphoenolpyruvate carboxylase has been used. The results show that well-developed chloroplasts in the stele probably occur in the subfamily *Epidendroideae* in all epiphytic representatives, while in the subfamily *Vanilloideae* they occur occasionally. The ultrastructure of chloroplasts from both areas is systematically different, so it is likely that their functions also differ. Apoplastic barriers are prominent in the roots and differentiate early during root development, which can effectively isolate chloroplasts in the stele from the cortex. Chloroplasts also occur in the sclerenchyma cells of the stele, where were identified hitherto unknown pits in cell walls that could provide gas exchange within the stele. Surprisingly, the PEP-carboxylase enzyme is localized within the endodermal passage cells and their surroundings, indicating the further heterogeneity of the photosynthetic functions of the chloroplasts along the radial direction of the root.