Photosynthesis in mangrove seedlings ceases underwater

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Abstract

Flooding and tidal highs are common phenomena in mangrove habitats. Often in such cases underwater stress becomes a survival factor for mangrove seedlings which experience whole plant submergence and the shoots remain obstructed underwater. The present study was set to investigate whether and how variable selected mangrove seedlings survive underwater photosynthesis in different salinity media of 100% seawater (SW100), 66% seawater (SW66), 33% seawater (SW33) and freshwater (SW0). Survival and photosynthesis variably declined to cessation accompanied by leaf decay, indicating considerable tissue degeneration with increase in salinity and underwater duration. *Bruguiera gymnorrhiza* seedlings were superior surviving 7 days of underwater photosynthesis in SW100. *Avicennia marina* seedlings survived 7 days of underwater photosynthesis only in salinities of up to SW66. *Heritiera littoralis* seedlings did not survive underwater in salinities beyond SW33 in which photosynthesis collapsed within the first days. There were significant differences in maximum variable quantum yield (Fv/Fm) both within different salinity treatments over the duration of underwater stress and interactively between salinities and underwater duration. *A. marina* seedlings had decreasingly higher values of Fv/Fm in all salinity treatments over the duration of underwater, followed by *B. gymnorrhiza* and *H. littoralis* which had the least performance. But, *B. gymnorrhiza* survived photosynthetically longer underwater. Upon reliving from underwater on the 21st day, one of each three seedlings of *B. gymnorrhiza* from SW0 and SW33 and *A. marina* from SW0 indicated signs of recovery following a seven day course of normal watering twice a day as they sustained green stems and new buds were forming. This restricted performance of underwater photosynthesis may explain the immediate effect of sub-lethal conditions that mangrove seedlings face in events of unprecedented flooding and consequent subsidence with an ultimate degeneration of the succession niche.

Keywords
leaf decay, photosynthetic yield, salinity, submergence, survival