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Differential localization of ethylene receptor OsERS1 and OsETR2 in rice and the expression of OsETR2 during submergence

Wing Kin Yip[1] and **Manda Yu**[2]
[1]University of Hong Kong, Hong Kong
[2]Institute of Plant and Microbial Biology, Taiwan

Plant hormone ethylene regulates many aspects in plant growth, development and responses to environmental stresses. These regulatory functions of ethylene generally start with the increase or decrease of its biosynthesis, receptor binding, signal transduction and changes in gene expression leading to various physiological responses. The signaling pathways in model plant *Arabidopsis*, which is a dicotyledonous species, is well characterized starting with the binding of ethylene to its five receptors localized to ER membrane. Rice is the model for monocotyledonous species and an important crop, containing same number of ethylene receptors as in *Arabidopsis*, but believed to have more complicated network in ethylene regulation. OsERS1 and OsETR2 are the two major ethylene receptors in rice and have different regulatory functions as revealed by many studies. We tagged GFP to the N-terminal transmembrane domain of both OsERS1 and OsETR2 and examined their subcellular localization in onions cells by confocal imaging. We conclude that OsERS1 is localized to plasma-membrane, whereas OsETR2 is localized to endoplasmic reticulum. This is the first report of ethylene receptors shown to be localized to different subcellular compartments in the same species, implicating separate functions of these receptors in rice. Previous studies on OsETR2 showed that its mRNA levels in tissues could undergo rapid changes in various treatments, including exogenous application of IAA, silver ion, ethylene, GA; and when submerged in water. We further show in this study that, light growth seedlings express higher levels of OsETR2 mRNA compared to dark-growth seedlings when submerged; 1-MCP pre-treatment was effective to block the increase of OsETR2 mRNA induced by ethylene and submergence; and that 1-MCP pre-treatment can promote ethylene biosynthesis in both green seedlings and submerged green seedlings. Based on our results and others, we speculate that OsERS1 and OsETR2 could have differential roles during rice plant submergence.

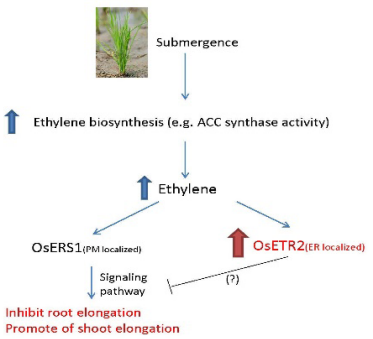

Figure 1. Differential roles of OsETS1 and OsETR2 ethylene receptors when submerged. Submergence increases ethylene biosynthesis and trigger the submergence responses such as inhibiting root growth and promoting shoot elongation. These responses are speculated via the signalling pathway associated with OsERS1 at the plasma-membrane (PM); whereas the rapid increase in OsETR2 expression at endoplasmic reticulum (ER) is thought to act negatively at the early signalling pathway associated with OsERS1.

Biography

Wing Kin Yip is an Associate Professor in the School of Biological Sciences at the University of Hong Kong. His research interests are in the Physiology, Biochemistry and Molecular Biology related to Plant Hormone Ethylene. He has published papers on the biosynthesis of ethylene; catalytic function of ACC synthase; tomato ACC synthase gene family; rice ethylene receptors; and works on cyanide detoxification related to ethylene biosynthesis.

wkyip@hku.hk