

# **Regulation of aquaporins in plants under stress**

**Ranganathan Kapilan**

Department of Botany, University of Jaffna, Jaffna, Sri Lanka

**Maryam Vaziri**

Department of Renewable Resources, University of Alberta, Edmonton, AB, Canada

**Janusz J. Zwiazek**

Department of Renewable Resources, University of Alberta, Edmonton, AB, Canada

## **Abstract**

Aquaporins (AQP) are channel proteins belonging to the Major Intrinsic Protein (MIP) superfamily that play an important role in plant water relations. The main role of aquaporins in plants is transport of water and other small neutral molecules across cellular biological membranes. AQPs have remarkable features to provide an efficient and often, specific water flow and enable them to transport water into and out of the cells along the water potential gradient. Plant AQPs are classified into five main subfamilies including the plasma membrane intrinsic proteins (PIPs), tonoplast intrinsic proteins (TIPs), nodulin 26 like intrinsic proteins (NIPs), small basic intrinsic proteins (SIPs) and X intrinsic proteins (XIPs). AQPs are localized in the cell membranes and are found in all living cells. However, most of the AQPs that have been described in plants are localized to the tonoplast and plasma membranes. Regulation of AQP activity and gene expression, are also considered as a part of the adaptation mechanisms to stress conditions and rely on complex processes and signaling pathways as well as complex transcriptional, translational and posttranscriptional factors. Gating of AQPs through different mechanisms, such as phosphorylation, tetramerization, pH, cations, reactive oxygen species, phytohormones and other chemical agents, may play a key role in plant responses to environmental stresses by maintaining the uptake and movement of water in the plant body.

**Keywords** – Aquaporin, Gating, Gene regulation, Environmental stresses, Phosphorylation, Water transport