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Plant Abiotic Stress Responses and MicroRNAs

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Abstract: Small endogenous RNAs, namely, microRNAs and small-interfering RNAs are key modulators for differential expression of genes which effect plant growth and abiotic stress responses. MicroRNAs are defined as twenty to twenty four non-coding, single stranded nucleotides, formed by Dicer-Like complex, from imperfectly folded hairpin-like precursors. The miRNAs targets the mRNAs – either it cleaves the mRNA or mediates translational repression of the particular mRNA. The gene regulation by miRNA affects various physiological processes like identification of floral organs, morphogenesis of leaves, development of roots, etc. Moreover, miRNAs are critical factors for stress responses and help the plant to withstand adverse environmental circumstances such as, drought, salinity, extreme temperatures, toxicity of metals, etc. There is an involvement sophisticated cell signalling mechanisms governed by complex genetic expressions, whenever plants face insults from natural environment. Newer technologies like Next Generation Sequencing (NGS) has been employed to identify and study the role of miRNAs in different plant species. This chapter deals with some most common miRNAs which are expressed during particular stress condition in plants.

Keywords: Abiotic stress, drought, salt, temperature stress, microRNA

1. Introduction

Stress can be any change in environmental conditions which exerts a negative effect on normal physiological state of plants (Levitt, 1974). The plants have capacity adaptation which help them to withstand certain conditions that are not favourable for normal growth. The un-adapted plants die in most of the time in stress conditions. Abiotic stress in plants includes moisture stress, high salinity of soils, drought, extreme temperature conditions, oxidative damage and toxicity by heavy metals