Rice bZIP48, an ortholog of AtHY5, plays novel roles in regulating plant development

Jitendra P. Khurana

Interdisciplinary Centre for Plant Genomics & Department of Plant Molecular Biology, University of Delhi South Campus, New Delhi, India

Email: khuranaj@genomeindia.org

Light has a profound effect on plant growth and development all through their life cycle. Some of the major plant responses regulated by light include the onset of seed germination, cessation of stem growth, leaf expansion, plastid differentiation, chloroplast relocation, stomatal movement, phototropism, entraining biological clock and transition to flowering. Plants have thus evolved an intricate network of light perception and signaling machinery. The light sensory photoreceptors include phytochromes, cryptochromes, phototropins, UVR8 and zeitlupes. The photo-activated receptors then relay the signal downstream to early signaling factors like HFR1 and central integrators such as COP1 (a component of E3 ligase involved in protein turnover). Next in hierarchy are are effectors like HY5, a bZIP transcription factor, which regulates the expression of a rather large number of downstream genes in *Arabidopsis* that eventually regulate diverse plant responses. *Arabidopsis* HY5 has been the most well worked out downstream effectors for the central role it plays in light signaling. Some years ago, while characterizing bZIP gene family in rice, based on homology search and phylogenetic analysis, we identified three homologs of HY5, i.e. OsbZIP1, OsbZIP18 and OsbZIP48. As of now, we have functionally characterized OsbZIP48 in some detail.

The expression of *OsbZIP48* is developmentally regulated both in terms of transcript abundance and protein accumulation. Unlike *Arabidopsis* HY5, bZIP48 is not degraded in dark, both in rice and even when over-expressed in *Arabidopsis*; interestingly, in Y2H assay too we did not find any interaction between OsCOP1 and OsbZIP48. The T-DNA insertion line of OsbZIP48 and RNAi transgenics of rice were seedling lethal, although seedling roots of T-DNA insertion line were more proliferative. OsbZIP48 was able to functionally complement the *hy5* mutation in *Arabidopsis*. Although earlier works claim that HY5 does not alter seedling height when over-expressed in *Arabidopsis* but OsbZIP48 overexpression caused semi-dwarfism in rice transgenics. The microarray analysis revealed alteration in expression of genes associated with many hormonal pathways in these rice transgenics. One of the genes, *OsKO2*, encoding ent-kaurene oxidase 2 involved in early steps of GA biosynthesis, was found to be down-regulated in OsbZIP48^{OE} and up-regulated in OsbZIP48^{KD} transgenics as compared with the wild type. Electrophoretic mobility shift assay showed that OsbZIP48 binds directly to a conserved LRE in the OsKO2 promoter. These data provide credible evidence that OsbZIP48 performs more diverse functions in rice, a model monocot system, as compared to its *Arabidopsis* ortholog, HY5, in light regulated plant development.