

Identification and Characterization of Pleiotropic Drug Resistance (PDR) transporters in *Salix purpurea* and their Roles in Response to Various Heavy Metal Stresses

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Abstract: Pleiotropic Drug Resistance (PDR) transporters belonging to the ABCG subfamily of ATP - binding cassette (ABC) transporters are identified to involve in heavy metal tolerance. Willow is an ideal candidate for the phytoremediation of heavy metals due to its large biomass, high tolerance, and extraordinary accumulation of heavy metals. However, the definitive phylogeny and heavy metal transport mechanisms of the PDR family in willow remain unknown. Here, 21 PDR genes in *Salix purpurea* were identified and classified into three major clades according to phylogenetic relationships. The SpPDRs usually varied in exon-intron distribution patterns and gene lengths in different clades. The distributions of motif and domain composition were found relatively conservative value in all SpPDRs. The cis-acting elements related to drought induction, low temperature response, defense and stress response were detected in the promoters of SpPDRs. Under heavy metal stress, the transcription levels of different PDR genes varied greatly in different tissues, and most of PDR genes were induced by at least two metal ions. In addition, PDR5 and PDR16 displayed the strongest positive correlation, while PDR3 and PDR9 exhibited the strongest negative correlation. These findings will provide an important foundation to elucidate the biological functions of PDR genes, and especially their role in regulating heavy metal tolerance in willow.