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UV-B-Induced Transcriptomic Accumulation of Secondary Metabolism, Tryptophan and Pectin Biosynthesis during Sink/Source Transition in Rice Leaves

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An increase in UV-B radiation greatly influences molecular-, biochemical-, physiological- and morphological-events from cellular to whole plant level. Although there is much information on an alteration of UV-B-induced secondary and cell wall metabolisms, it is not clear how plants respond during the phase transition, i.e. sink to source. Rice seedlings, 3rd leaf stage, were exposed at the supplemental UV-B irradiance for 5 days (4hrs/d), growing leaf blades (4th leaf) from approximately 30 rice seedlings were harvested at 1(sink), 3(sink -> source) and 5(source) days after UV-B radiation. Differential gene expression and metabolites by UV-B radiation were analyzed. An emerging leaf blade, considered as a sink leaf, after 1 day of UV-B radiation strongly induced gene expression of flavonoid biosynthesis, chalcone synthase (6 FC) and chalcone isomerase (107 FC). During the phasic transition from sink and source (3 days of UV-B radiation), leaf blade led to an acceleration of tryptophan and cell wall metabolisms. The levels of gene expression of anthranilate synthase, anthranilate phosphoribosyltransferase, indole-3-glycerol phosphate lyase, indole-3-glycerol phosphate synthase and tryptophan synthase closely associated with tryptophan biosynthesis increased 10-, 10-, 19-, 174- and 25-fold change (FC) after 3 days of UV-B radiation, respectively. Also, gene of glycosyl transferase, UDP-GalA -> pectin, was abundant up to 7 FC. From the present study, we carefully suggest that rice leaves under phasic transition from sink to source seem to preferentially consume the cellular energy (photosynthates) for cell growth (tryptophan biosynthesis) and protection (secondary metabolism) to cope with UV-B stress.

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