OAS responsive repressor proteins linking sulfate metabolism and glucosinolate biosynthesis

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The SDI1 and SDI2 genes have been identified in early transcriptomics studies as being highly expressed in response to sulfate depletion in Arabidopsis and wheat. Later we linked their induction to the accumulation of O-acetyl-serine (OAS), which highly accumulates in response to reduced sulfate availability, but also in response to other stresses. Both genes belong to a cluster of OAS responsive genes. We identified that in Arabidopsis SDI1 (At5g48850) and SDI2 (At1g04770) are involved in down-regulating glucosinolate biosynthesis. Overexpression of both, SDI1 and SDI2, result in a reduced accumulation of aliphatic and to a lesser extent indolic glucosinolates. We could show that this is achieved through a direct protein-protein interaction of SDI1 with the transcription factor MYB28. This complex prevents the transcription of genes controlled by MYB28, previously identified to play a role in controlling glucosinolate biosynthesis. SDI1 and SDI2, thus, down-regulate the expression of the glucosinolate pathway controlling transcription factors MYB29 and MYB76, and MYB28 itself and, hence, their downstream target genes. As glucosinolates provide a substantial sink for sulfate this regulatory step allows plants under sulfate starvation conditions to reduce or stop de novo glucosinolate biosynthesis in favor of plant primary metabolism.