The pea branching *RMS2* gene encodes the PsAFB4/5 auxin receptor and is involved in an auxin-strigolactone regulation loop

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Control of shoot branching involves auxin, cytokinin and strigolactones (SLs). In pea, most of the high branching *ramosus* (*rms*) mutants show high expression of the SL biosynthesis *RMS1/CCD8* gene and low xylem-sap cytokinin content. In contrast, the high branching *rms2* mutant displays very low expression of *RMS1* and high xylem-sap cytokinin content. Previous physiological characterization of the pea *rms2* mutant suggested that *rms2* was affected in a shoot-to-root feedback signal controlling both SL biosynthesis and cytokinin level in the xylem sap.

The nature of the feedback signal was investigated by cloning the pea *RMS2* gene. We showed that *RMS2 encodes* the pea ortholog of the Arabidopsis auxin receptor belonging to the AUXIN-SIGNALING F-BOX4 (AFB4)/AFB5 clade suggesting that the shoot-to-root feedback signal is very likely auxin. To investigate whether the pea RMS2 and AFB4/5 from Arabidopsis have the same functions, we analyzed *rms2* phenotypes (e.g. shoot branching, high IAA levels) in the Arabidopsis *afb4, afb5* and *afb4 afb5* double mutants and reciprocally, we tested whether the pea *rms2* mutants showed the high selective resistance to the herbicidal auxin picloram of the *afb5* mutant. Complementation studies and biochemical analysis were also performed.

The *rms* branching mutants, rather than being depleted in IAA levels, contained elevated IAA levels. We proposed a model where a non-response to SLs, which occurs in SL-biosynthesis or in SL-response *rms* mutants, stimulates the synthesis of a feedback signal, auxin, which controls via RMS2, CK levels in the xylem sap and SL biosynthesis gene expression. We tested this model by quantifying IAA levels after SL treatment using the pea SL *rms* mutants. We demonstrated that SLs repress IAA levels by down-regulating transcript levels of auxin biosynthesis genes in stem (*TAR2* and *YUC1*) independently of polar auxin transport.