**Root architecture is regulated by miR2111 and TML in response to soil Pi**

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Plants control their root system architecture in response to irregular and fluctuating nutrient availability in the rhizosphere. This includes localised morphological changes and drastic shifts in overall root system structure to enhance soil foraging and nutrient acquisition. Previously, we reported that enhanced miR2111 expression led to an increase in the density of emerged lateral roots (Zhang et al., 2021). Such a phenotype is often observed in Pi-deplete plants. This prompted us to hypothesise that the miR2111 and TML regulatory module that controls nodule organogenesis may have been hijacked and evolved from a pre-exiting regulatory mechanism that acts to alter root development in response to environmental factors, such as nutrient availability. We tested this hypothesis by functionally characterising miR2111 and TML in the context of Pi deprivation-induced root adaptive responses. Three *GmmiR2111* encoding genes were transcriptionally upregulated in leaves, but not roots, of Pi-starved plants, resulting in increased accumulation of mature miR2111 and a concomitant decrease in the transcript abundance of *GmTML1* homologous in roots. Overexpression of *GmTML1* encoding genes reduced lateral root density and root thickness. This was consistent with phenotypic alternations observed in Pi-starved root systems, which exhibited diminished root growth, enhanced root branching and increased root diameter compared with control plants. Collectively, these findings demonstrate that miR2111 and TML have a critical role in the systemic manipulation of root system architecture in response to Pi availability, and subsequently appear to have been co-opted into the nodulation control mechanism of legumes.

***References:***

Zhang MB, Su HN, Gresshoff PM, Ferguson BJ (2021) Shoot-derived miR2111 controls legume root and nodule development.Plant, Cell & Environment 44: 1627-1641.