Vascular hijack by parasitic plants

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Parasitic plants retrieve different molecules from host plants, which can result in severe growth penalties for the host. This is of particular interest, when parasitic plants of the Orobanchaceae family infect crops such as maize, sorghum (*Striga* sp.) or sunflowers (*Orobanche sp.)*.
Molecular studies on these obligate parasites are hampered by the lack of genetic resources and efficient transformation protocols. We therefore established *Phtheirospermum japonicum* (Pj), a hemi-parasitic Orobanchaceae species, native to East Asia, as model plant to study parasitic plant-host interactions. Like many other hemi-parasitic plants, Pj has a relatively wide host-range, which enabled us to use *Arabidopsis thaliana* as host species. Pj taps into the host vasculature by a so called xylem bridge. The xylem bridge is imbedded in a specialized feeding organ of the parasite, the haustorium. While nutrient fluxes to parasitic Orobanchaceae were studied previously, there is only very limited information on transfer of parasite-derived molecules to host plants.
We used fluorescent dyes to visualize long-distance transport from host to parasite across the haustorium. Rapid accumulation of fluorescent dye in the haustorium suggests high conductivity of haustoria. We further observed that host plants reciprocally also received signalling molecules from the parasite. These molecules are well studied plant hormones and entered the vascular system of the host to be then transported towards the host shoot apex. Arabidopsis mutants were used to study the source of these hormones and to characterize their effect. Our experiments provide evidence that these hormones are actively perceived by the host and provoke enhance secondary growth of host roots above haustoria.
In conclusion, we show that vascular transport between parasitic plants and host plants can be studied at the molecular level using the parasitic plant *Phtheirospermum japonicum* and *Arabidopsis thaliana.* Transport across haustoria is bidirectional and actively reshapes root morphology and size of parasitized plants.