How the parasitic plant dodder steals sucrose from its host

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Parasitic lifestyles exist in all kingdoms of living organisms. Even among higher plants there are a considerable number of parasitic species that rely on the supply of nutrients from a host organism. Species of the genus *Cuscuta*, also called dodder, are parasitic plants that attack a wide variety of plants, including many crops. The parasite develops thin threads that wind around the host plant. A special organ, the haustorium, penetrates the host's stem tissue and connects to phloem cells or xylem vessels in the vasculature of the host. Once the contact is established, the parasite gains water, nutrients and carbohydrates through the contact areas. The infection is obligatory because the parasite itself has no roots and no leaves and is unable to photosynthesize.

We are interested in the way Cuscuta obtains nutrients from its host. Detailed structural analyses were performed using histological dyes as well as marker lines to monitor host-parasite contact sites. Phloem-mobile fluorescent dyes were used to visualize nutrient transfer from host to parasite. Theses analyses demonstrated that *C. reflexa* establishes a symplasmic connection to the host phloem 7-8 days post infection. We also studied nutrient distribution inside the parasite. Interestingly, no symplasmic distribution of phloem mobile dyes could be observed into sink tissues like the apical meristem, flowers or young haustoria in *C. reflexa*. To analyze nutrient transfer during early stages of infection, we performed quantitative RT-PCR analyses, which indicated that infection induces the transcription of genes for SWEET-type sucrose export proteins as well as SUT-type sucrose-H⁺ cotransporters. In situ hybridization analyze substrate specificities of the transport proteins.

In summary, our data suggest that Cuscuta interferes with the sink-source balance of the host plant by establishing a new sink that may be supplied through an apoplasmic strategy during early phases of infection. In later stages, nutrient transfer from host to parasite switches to a symplasmic pathway through the formation of interspecific plasmodesmata. Our data further suggest that phloem unloading in Cuscuta sink tissues may follow an apoplasmic pathway.