Populus trichocarpa encodes small, effector-like secreted proteins that are highly induced during mutualistic symbiosis

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Funding Source: DOE Office of Biological and Environmental Research, Genomic Sciences Program

Background

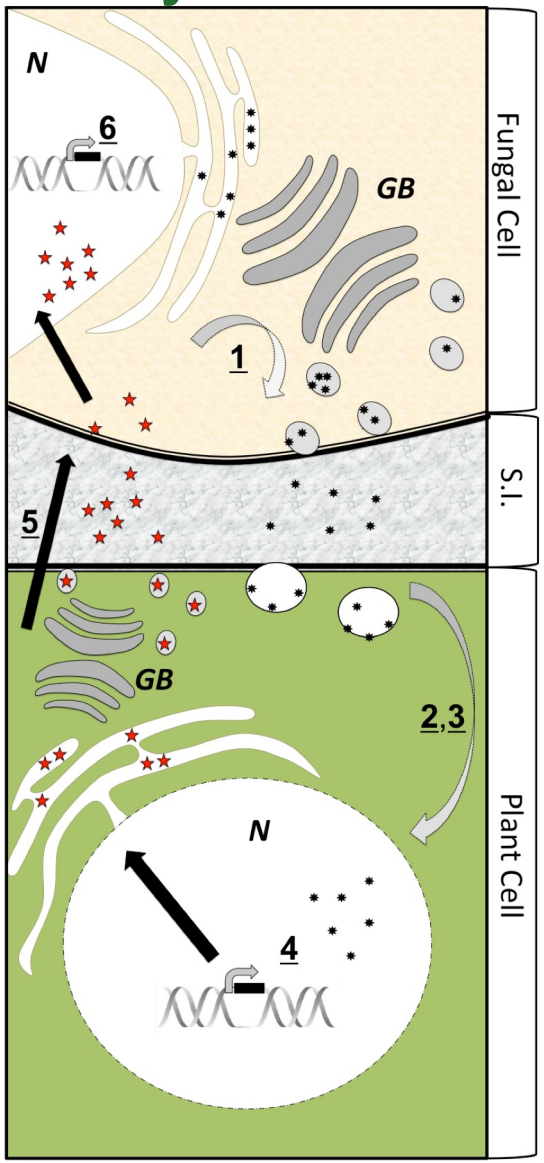
- Mutualistic fungi have evolved elaborate protein-based signals (effectors) in order to communicate their metabolic requirements to their plant hosts.
- There exist plant small secreted proteins (SSPs) that are present in root exudates of plants, which influence mutualistic interactions between plants and microbes and could function as effector proteins during symbiotic interactions.

Science

- Computational prediction and experiments were used to identify *Populus trichocarpa* SSPs and their effect during mutualistic symbiosis with the ectomycorrhizal fungus, *Laccaria bicolor*.
- Computational analysis of the *Populus* transcriptome identified 2,819 *Populus* protein-encoding genes that exhibited differential transcript abundance across all stages of mycorrhizal root tip development during symbiosis between *P. trichocarpa* and *L. bicolor*. Of these, 417 were predicted to be SSPs (≤250 aa in length).
- Further experiments verified that a subset of the *Populus* SSPs were able to enter *L. bicolor* hyphae and accumulate in the nucleus and could alter the development of multiple ectomycorrhizal and pathogenic fungi.

Significance

- This study demonstrates that SSPs in *Populus* can be secreted and function as effector proteins during symbiotic interactions.
- This study highlights a novel avenue by which plants communicate with (or control) their mutualistic microbial partners.



Proposed Model of reciprocal SSP feedback between ectomycorrhizal fungi and their plant host. Fungal SSPs (black stars); Plant SSPs (red stars); S.I. = symbiotic interface)

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Plett J.M. *et al*. (2017). *Populus trichocarpa* encodes small, effector-like secreted proteins that are highly induced during mutualistic symbiosis. *Sci. Rep.*, 7(1): 382.