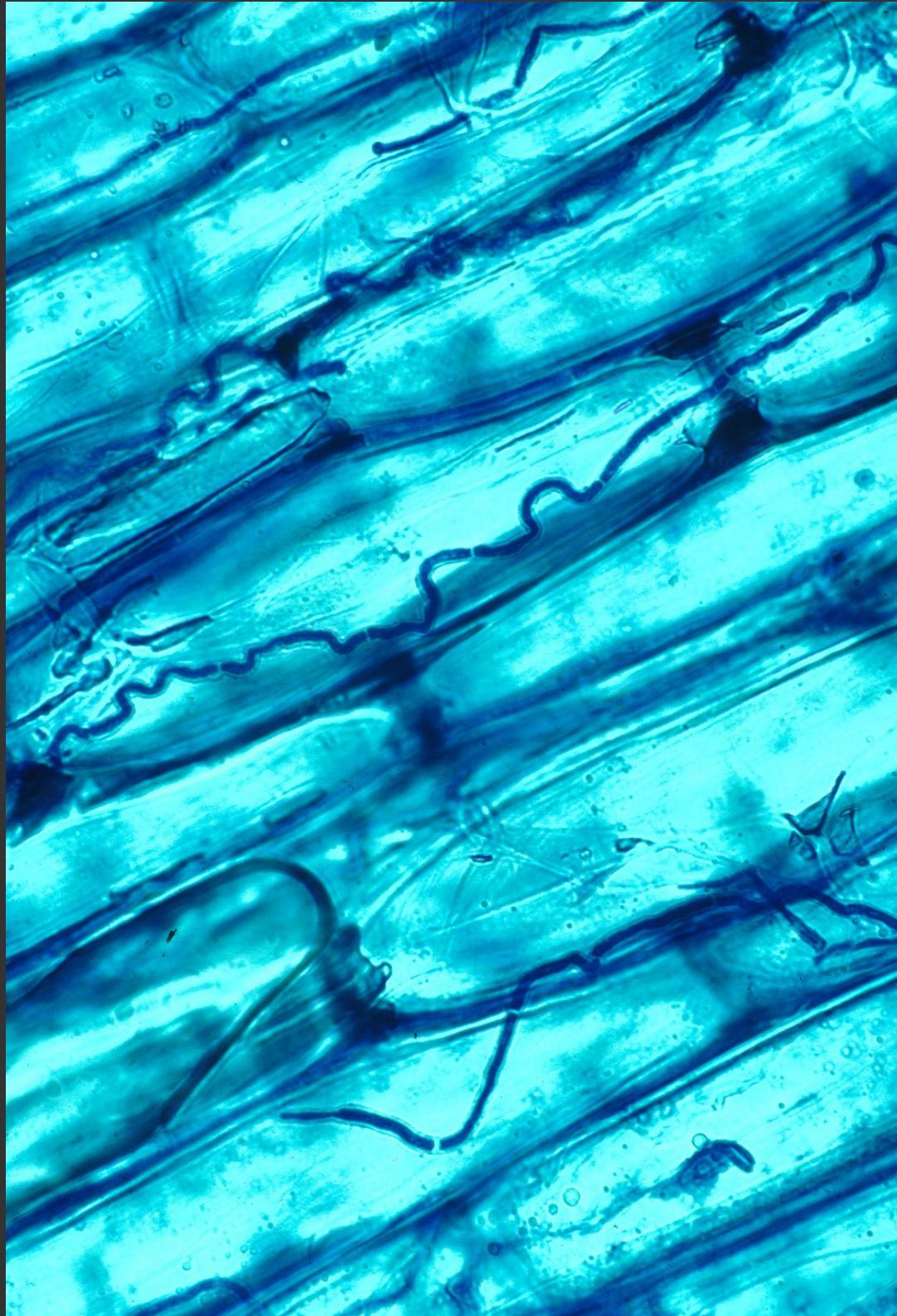


Symbioses: Endophytes

Topics (just the very basics):

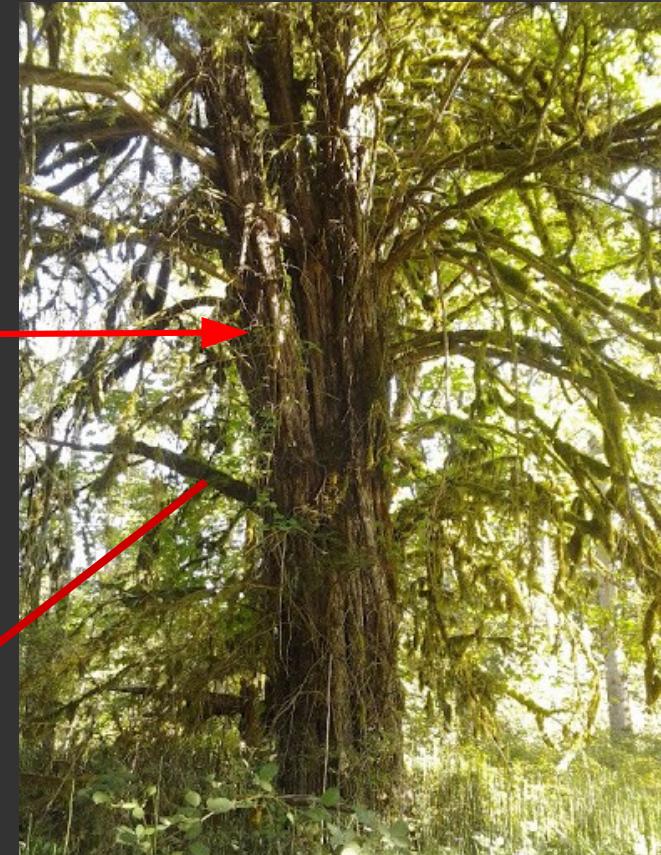
- How is an endophyte different from a biotroph or necrotroph?
- What are they doing? Latent decomposers?
- Endophytes as modifiers of plant disease
- Ecological roles
- Vertical vs horizontal transmission (monocot vs dicot)



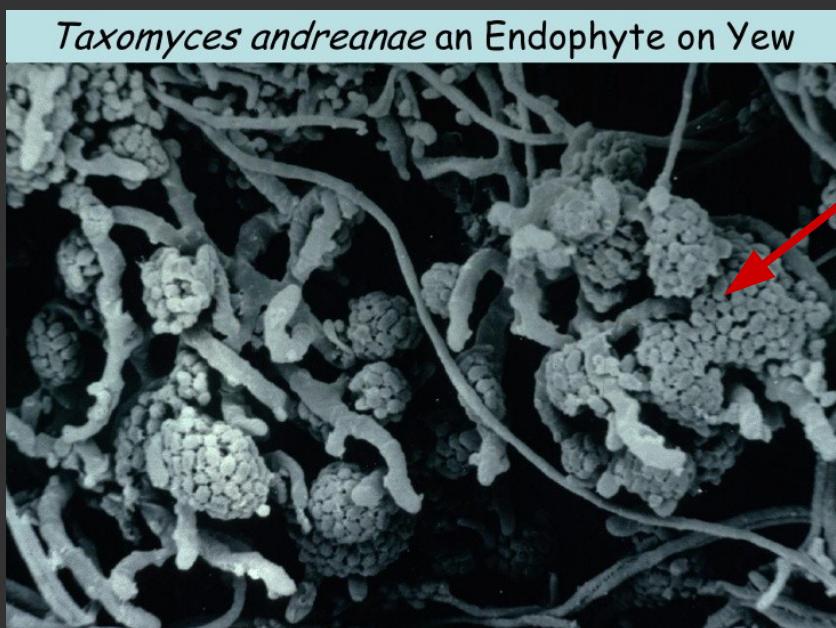


Bristol-
Myers
Squibb

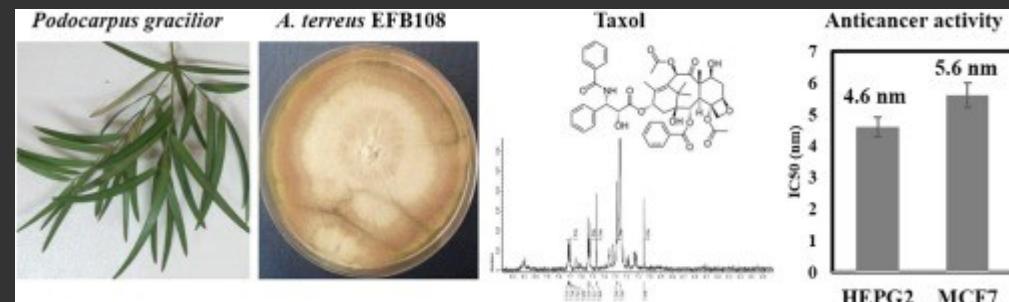
Comes from...



but really...



Taxomyces andreanae an Endophyte on Yew



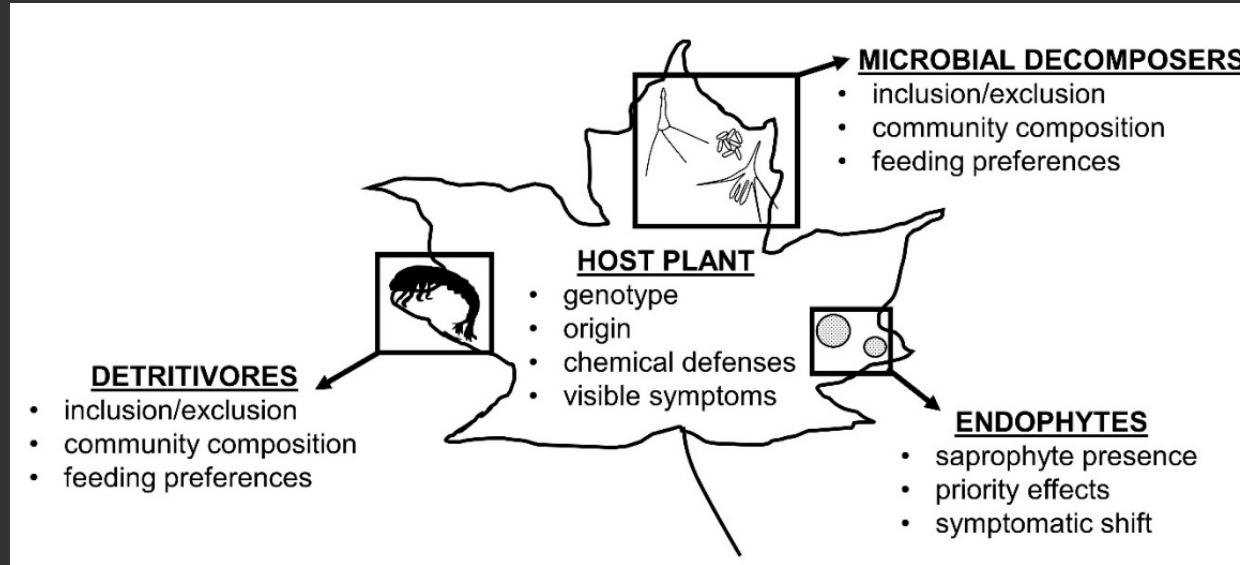
Fungal Endophytes: live *within* plant tissues without causing disease symptoms

What's the point?

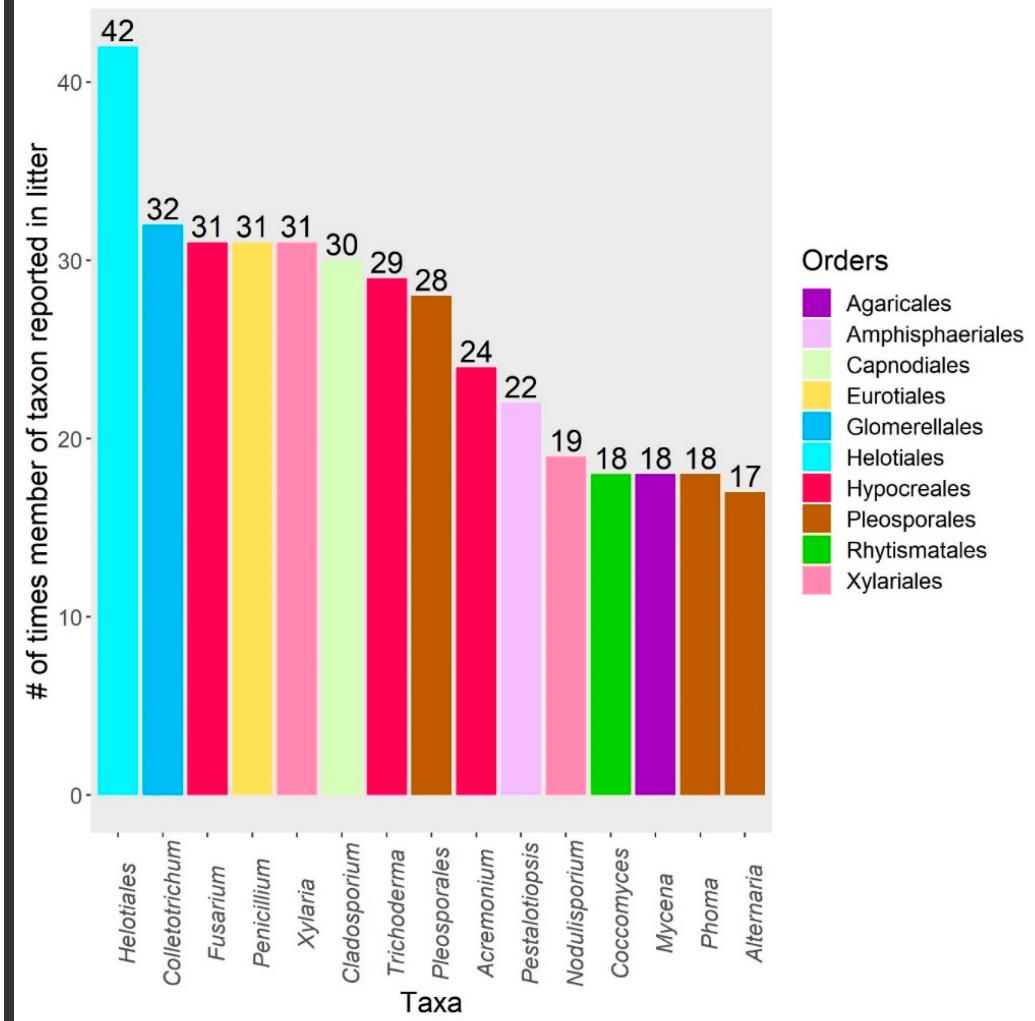
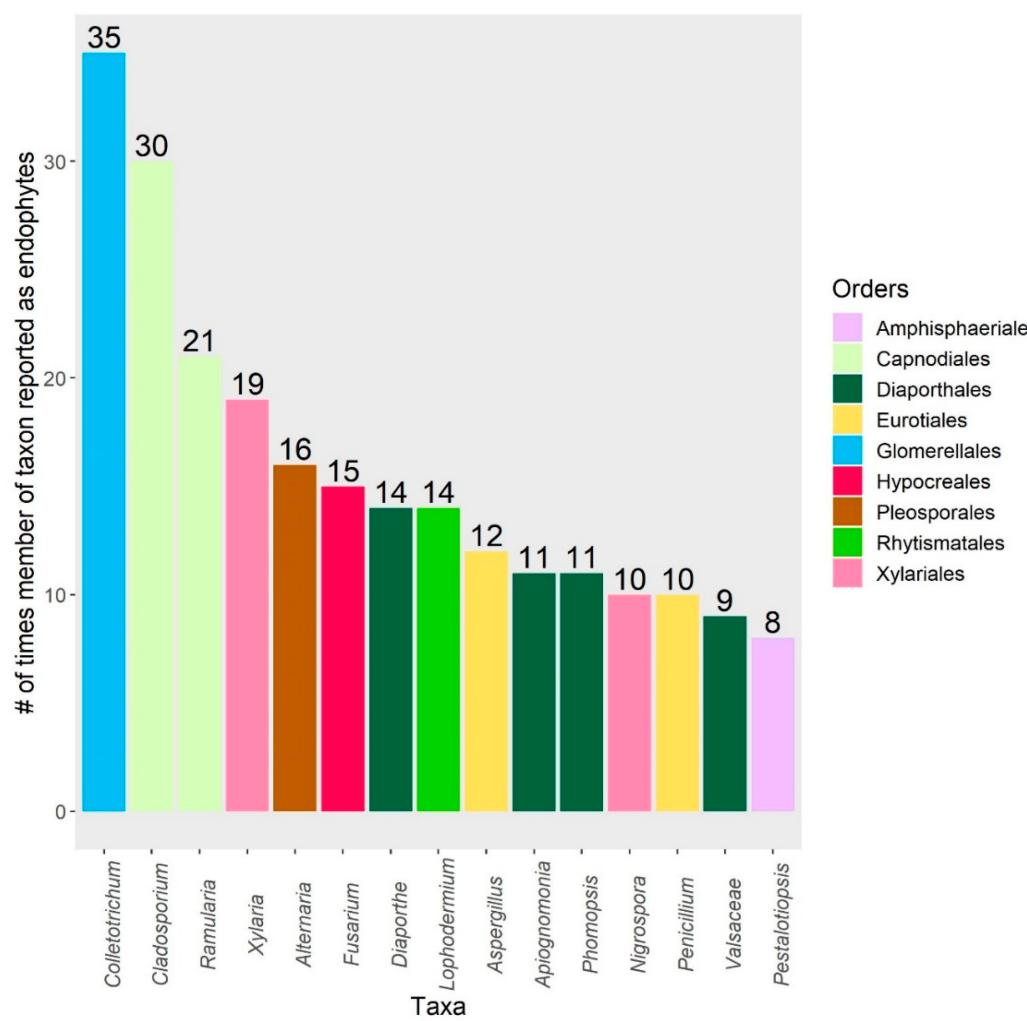
Fungal Endophytes: live *within* plant tissues without causing disease symptoms

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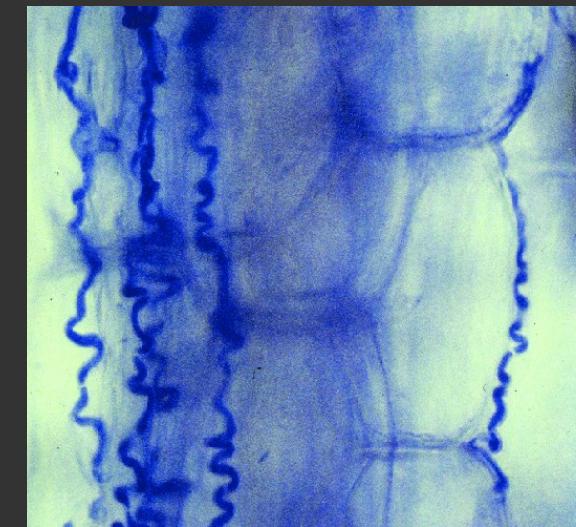
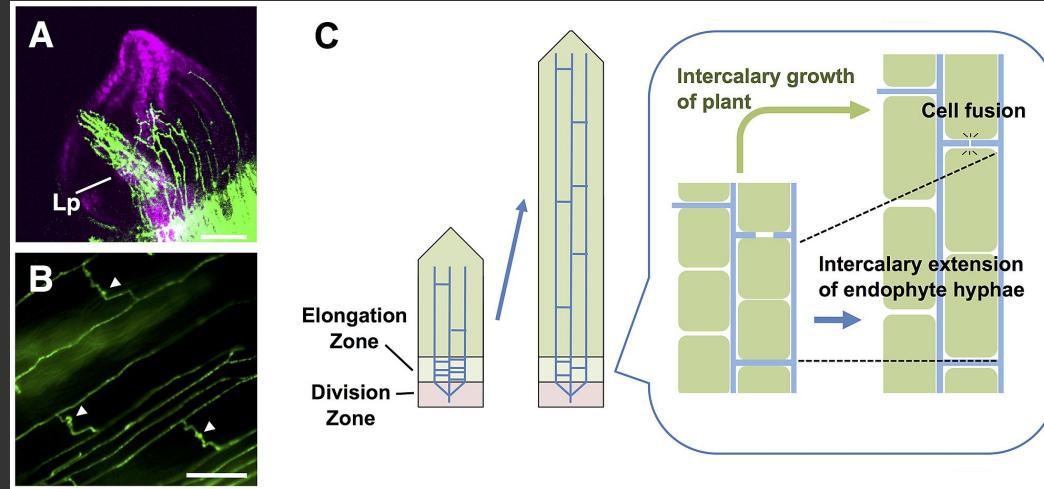
Latent decomposer hypothesis



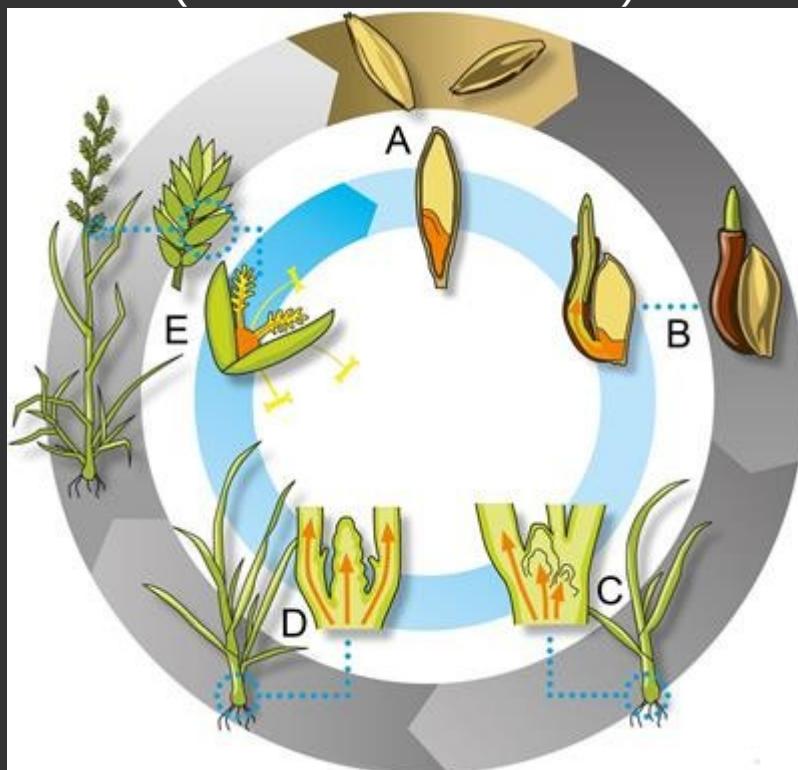
Common endophytic taxa vs common leaf litter taxa



Endophytes in grasses: Epichloë



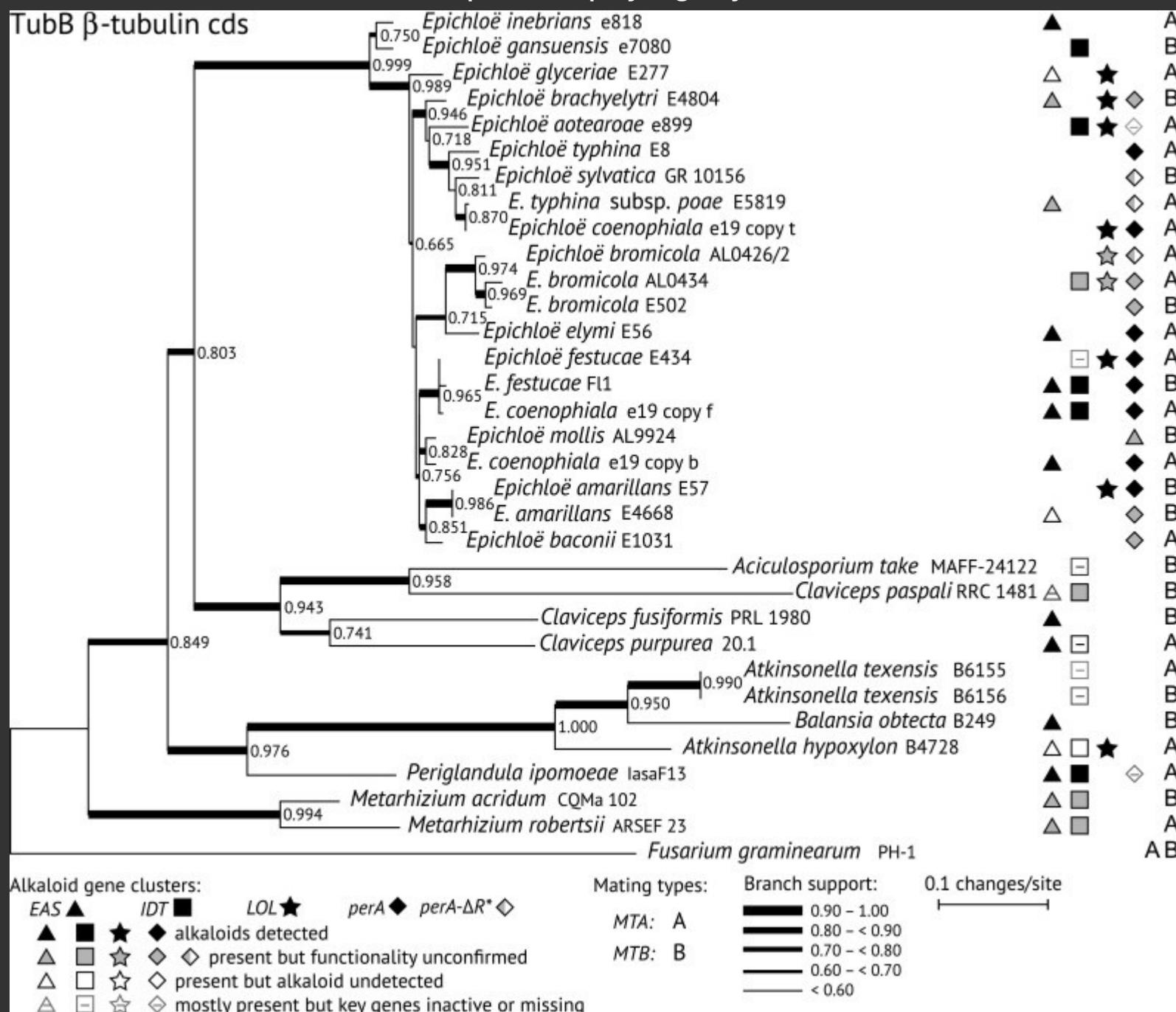
Transmitted to offspring in seeds
(vertical transmission)



A- No endophytes; B- Endophyte



Epichloë phylogeny



Same/similar alkaloids as found in ergot (*Claviceps purpurea*)

For dicots, what determines which endophytes they get?

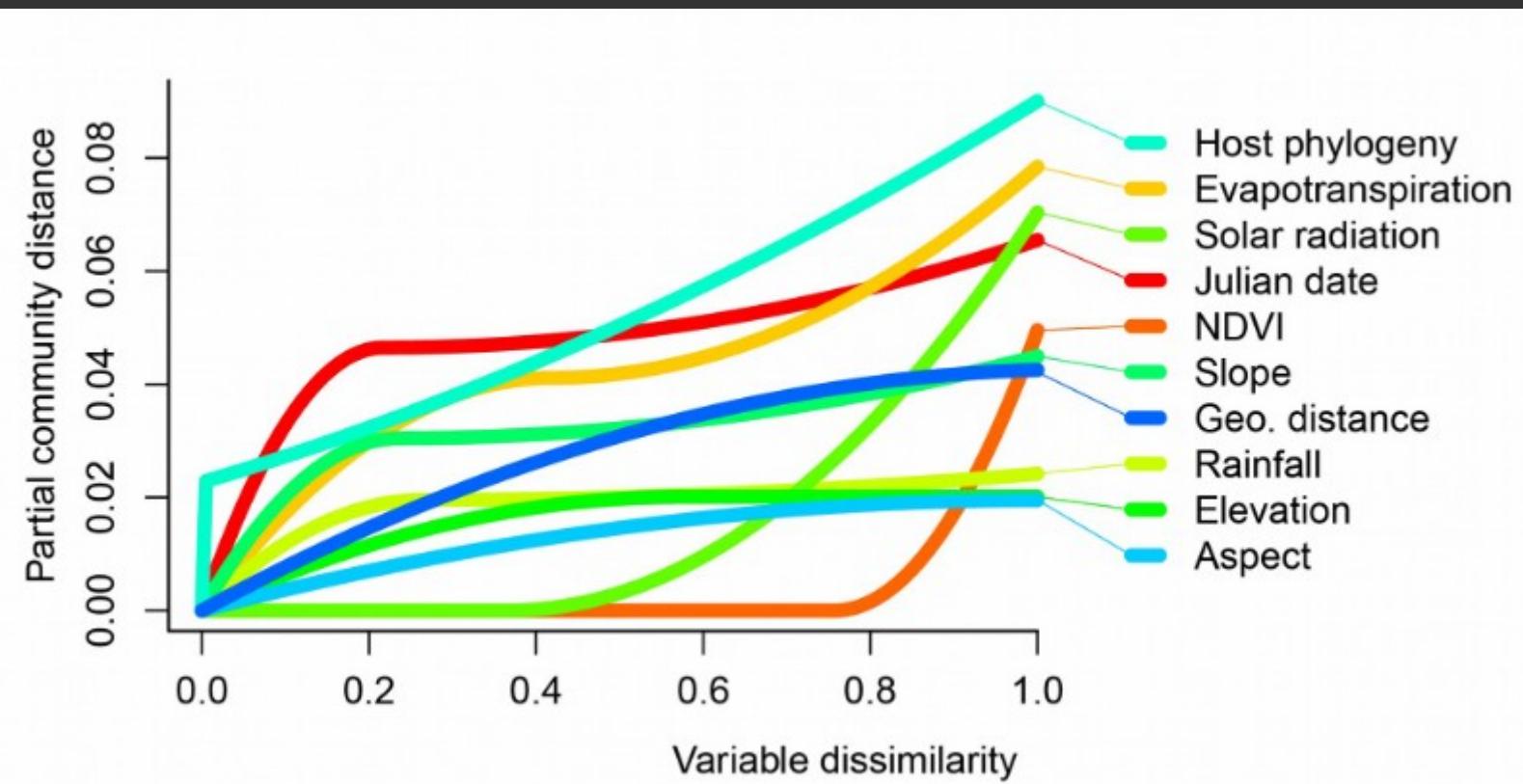
MOLECULAR ECOLOGY

ORIGINAL ARTICLE

Fungal communities living within leaves of native Hawaiian dicots are structured by landscape-scale variables as well as by host plants

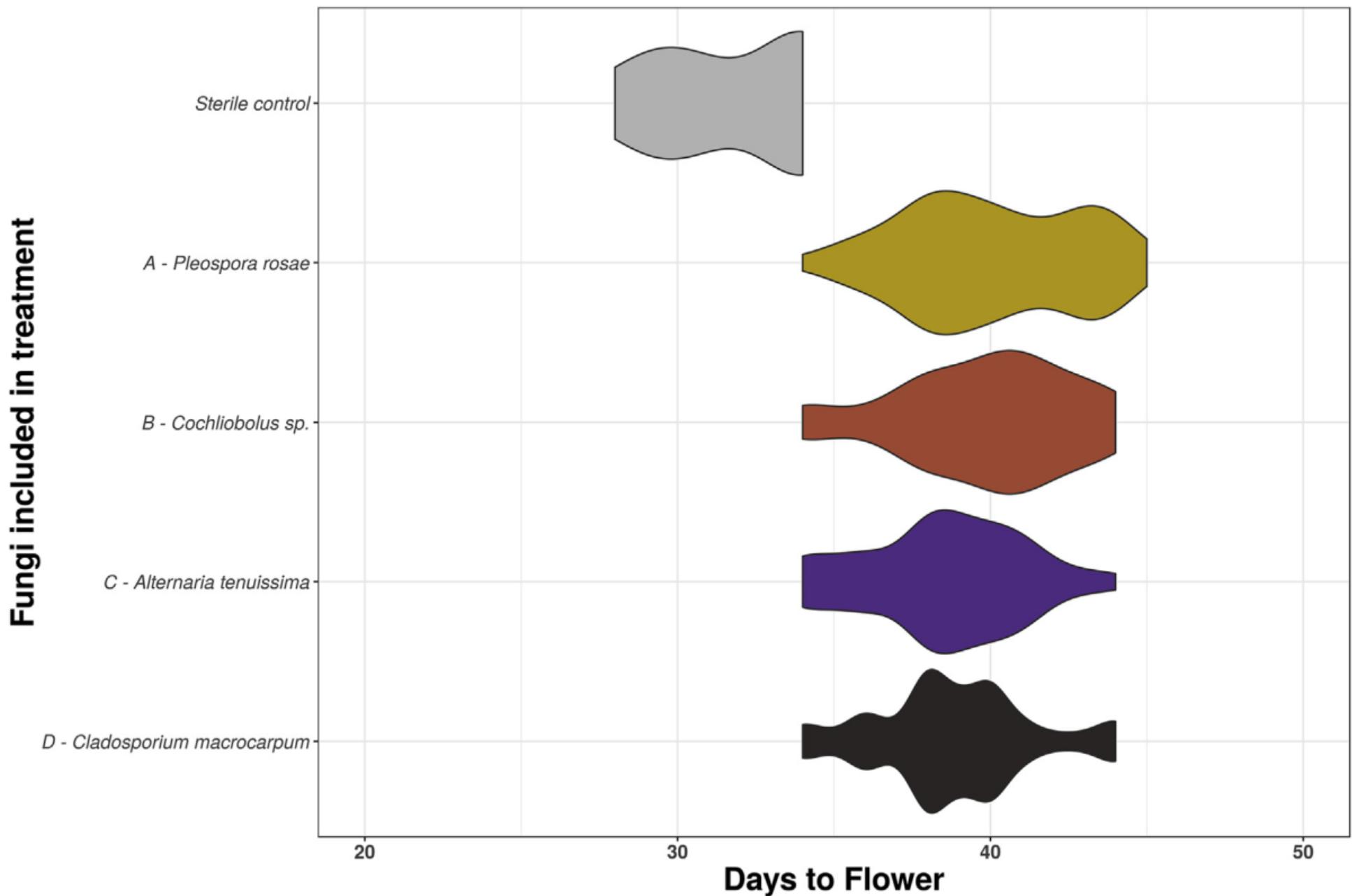
John L. Darcy✉, Sean O. I. Swift, Gerald M. Cobian, Geoffrey L. Zahn, Brian A. Perry, Anthony S. Amend

First published: 08 July 2020 | <https://doi.org/10.1111/mec.15544>



Some "plant traits" might actually be fungal endophyte traits... like flowering phenology, as seen in *Arabidopsis thaliana*.

G. Zahn, A.S. Amend / Fungal Ecology 41 (2019) 101–106



Sometimes, the story is simple... Usually it isn't.

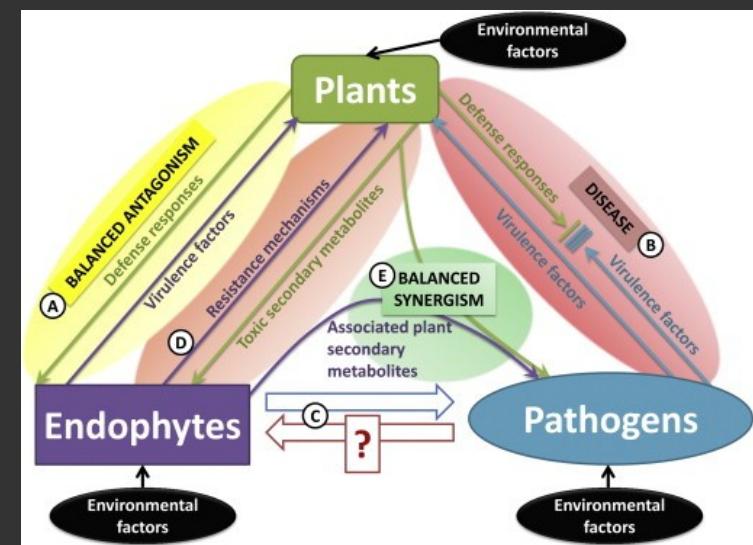
Which endophytes are contributing to disease modification?

Synergistic effects

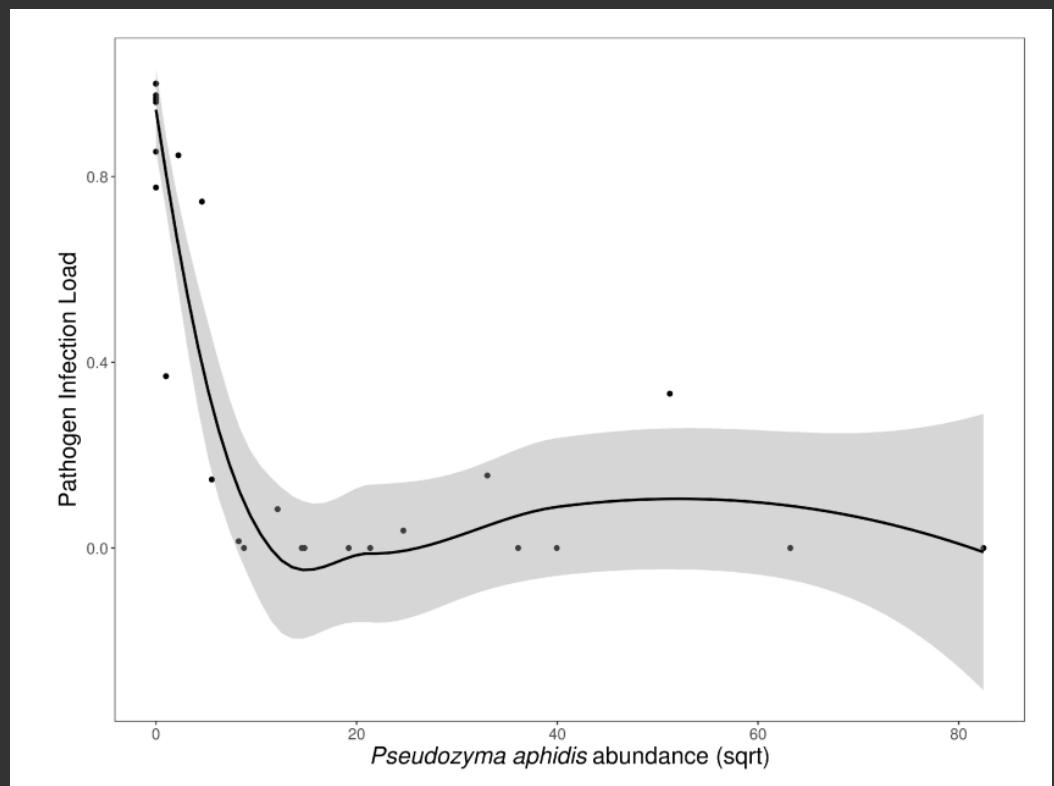
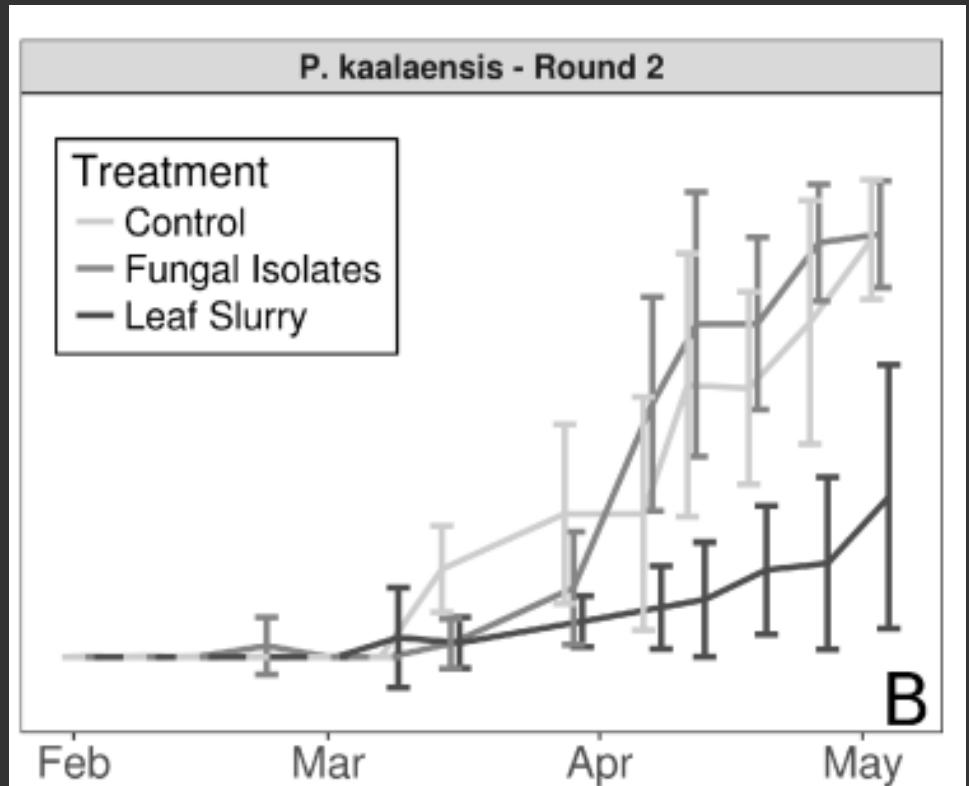
Arrival order

Host genotype

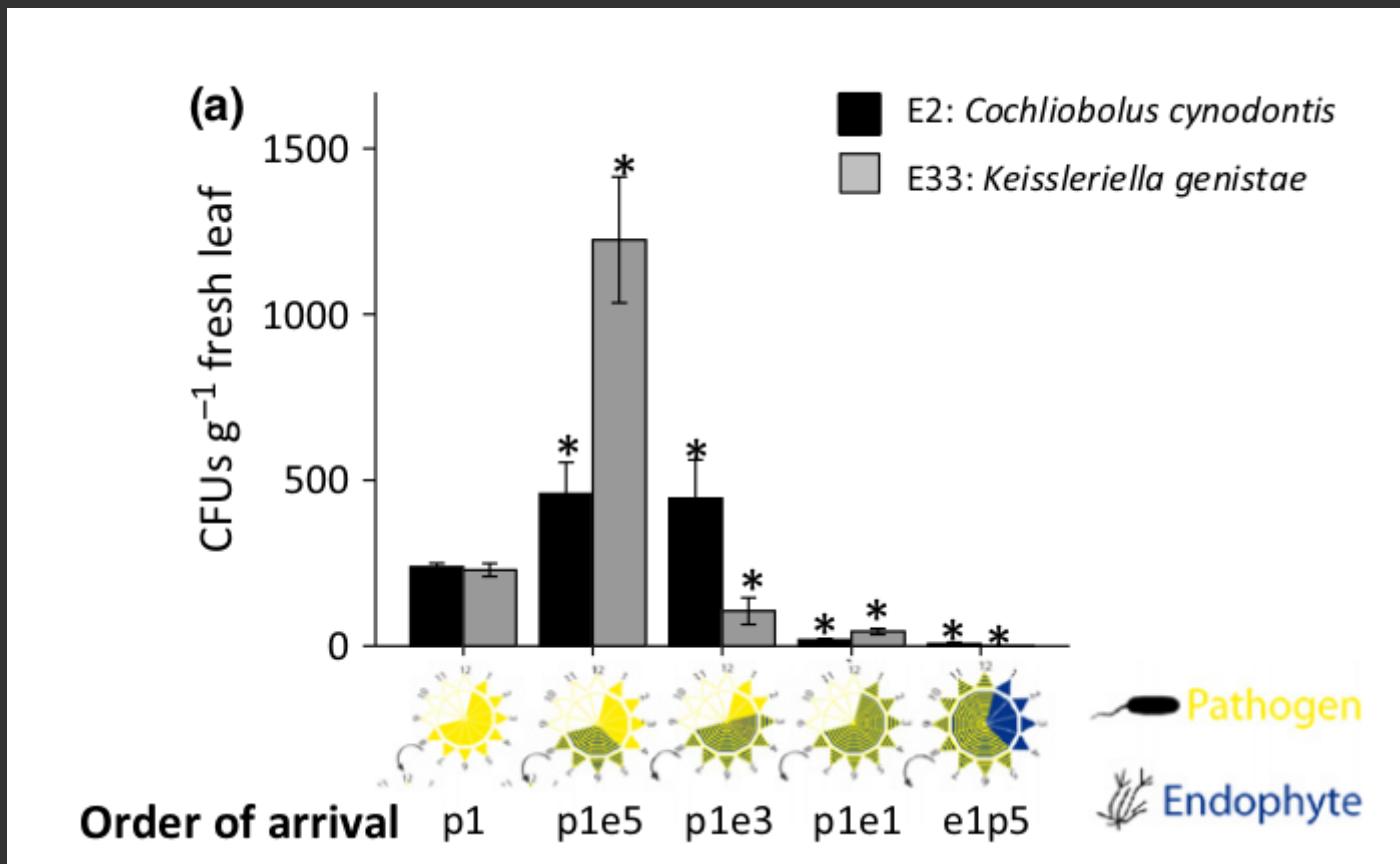
Environmental modifiers



Rare example of a simple, obvious answer:

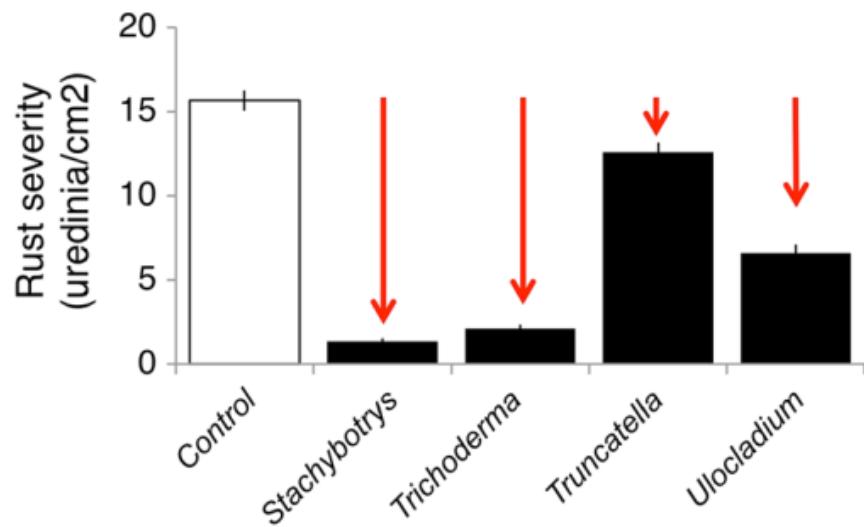


Disease modification is context-dependent!

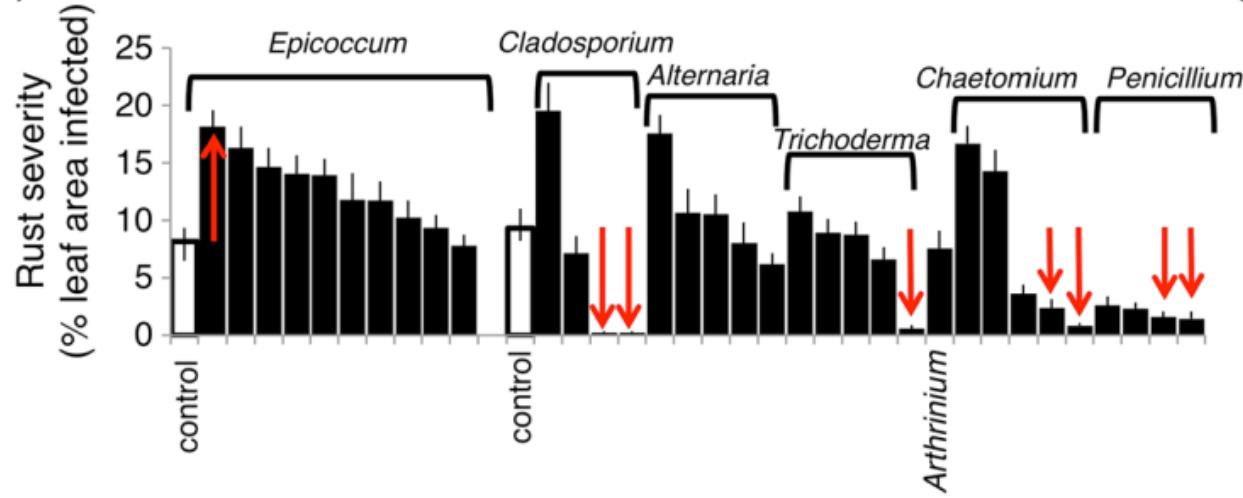


In this case, if pathogen got there first, disease was made worse by the endophyte. If endophyte got there first, disease was nearly prevented entirely.

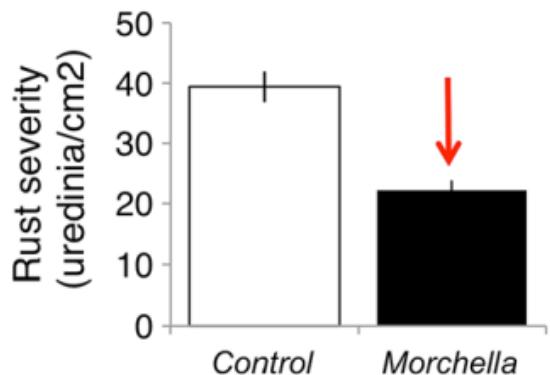
(A)



(B)

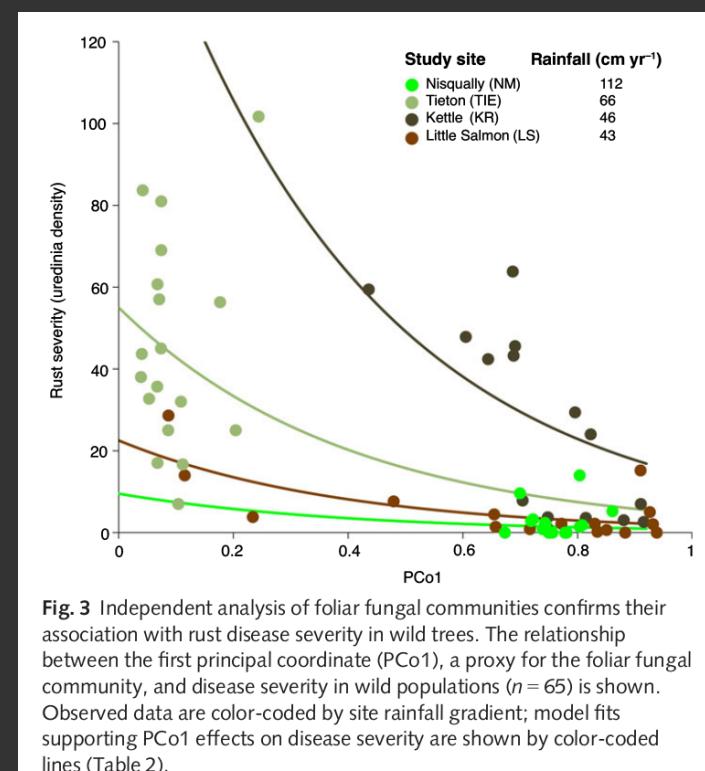


(C)



(D)

Fungal endophytes as modifiers of plant disease



(F)

The new frontier: harnessing endophytes
Loophole in the disease triangle?
Reduction of pesticide use?
Improved conservation of endangered plants?

FEATURE

AGRICULTURE

How plant microbes could feed the world and save endangered species

Digging into the plant microbiome could help future farmers and conservationists



PLANT PARTNERS *Phyllostegia kaalaensis* grew on Oahu's Koolau Range (above) until about 1970. Researchers are looking to microbes to help reestablish the mint plant.

DAVID L. MOORE-HI/ALAMY



Indigo Ag's microbial treatment for cotton seeds results in bigger, bushier plants under low-water conditions compared with untreated plants.



Powdery mildew attacks *Phyllostegia kaalaensis* (left), preventing the plant from taking hold in the wild. But a beneficial yeast (rods, right) found on the leaf of another species of *Phyllostegia* sends out filaments that attack the mildew (blob in inset) and protect the plants.

BOTH: G. ZAHN AND A. AMEND/PEERJ 2017

Assignments

1. Read Christian, et al., 2017

- This is a look at how endophytes affect plant disease in a real system

2. You will have a Canvas quiz on the assigned reading and will also have to participate in a Slack discussion about it.

3. Keep working on your lab assignments