



Mycorrhizal inoculations of willows affect leaf chemical properties important for herbivory resistance

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Mycorrhiza of willows

Literally “fungus-root” - a symbiotic relationship between fungus and plant

An exchange of carbohydrates from the plant and nutrients the fungus takes up from the surrounding soil

Willows can host two types: ecto- and arbuscular mycorrhiza



Ectomycorrhiza

The fungal hyphae form a hydrophobic mantle around the root tip

The nutrient exchange occurs inside the root, between epidermal and cortical cells

The mycelium extends into the soil from the root, increasing the area for uptake

How may mycorrhiza affect leaf resistance to herbivory?

Mycorrhiza is important for plant **N-uptake**

N status of the plant affects palatability and resistance to herbivores

Mycorrhiza is a **carbon sink** to the plant

Affects allocation of photosynthate for growth and defense

The mycorrhizal infection can **induce systemic resistance** in the plant

Focus of this study is on leaf phenolics

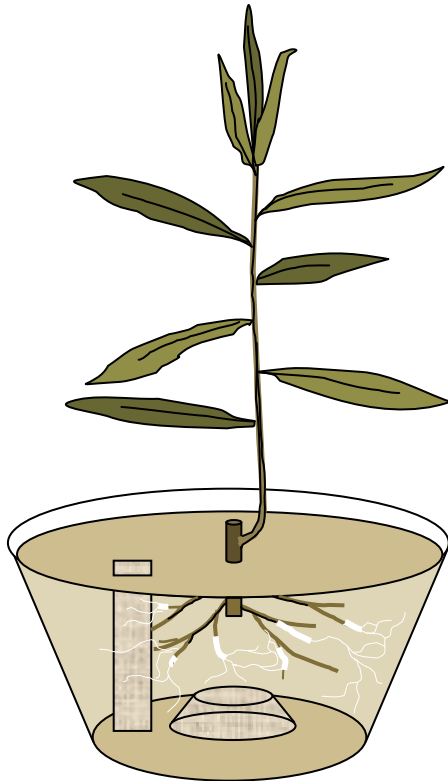
known to affect survival, development and performance of the leaf beetles



Adults and neonate larva of P. vulgatissima

How may mycorrhiza affect leaf resistance to herbivory?

Experiment set-up



Plant species

Salix dasyclados
'Loden'

S. schwerinii × *S.*
viminalis 'Tora'

Fungal species

Hebeloma fastibile

Tricholoma cingulatum

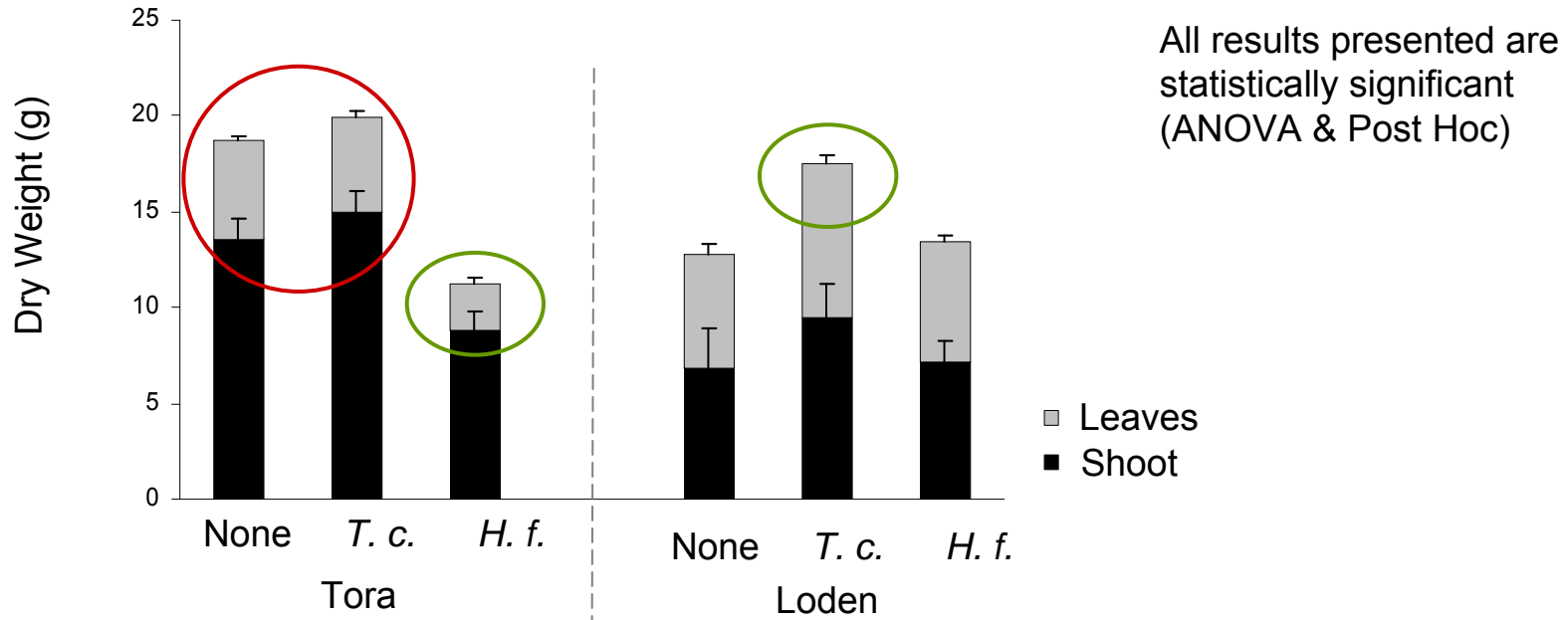
Non-mycorrhizal

Phytotron

- Controlled T, light, humidity
- Gamma sterilised soil
- No pests or pathogens
- 2 harvests (3 & 4 months)

Results, Late harvest (4 months)

Above-Ground Biomass

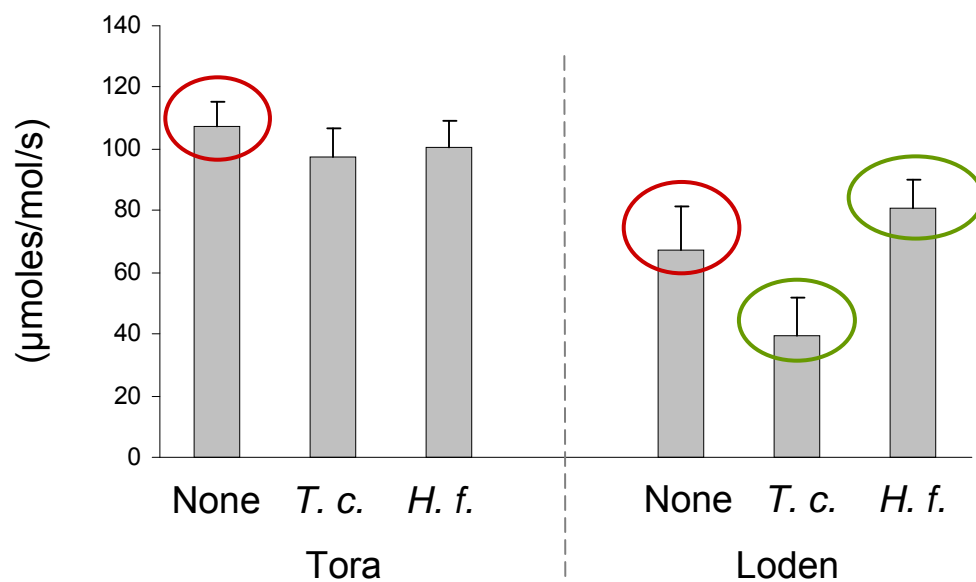


The total aboveground biomass as well as the proportion shoot/leaves differ between the *Salix* species

Non-mycorrhizal Tora and Tora – *Tricholoma cingulatum* have a large total above-ground biomass

Tora - *Hebeloma fastibile* has a smaller leaf mass than all others and Loden – *Tricholoma cingulatum* a larger than all other

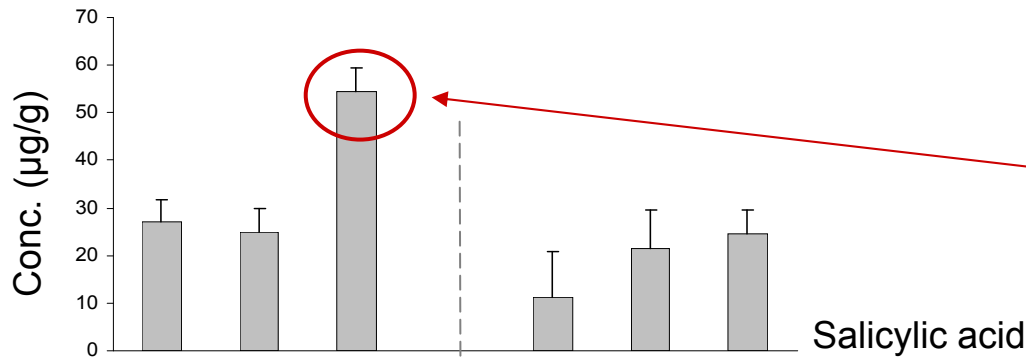
Photosynthetic Nitrogen-Use Efficiency (PNUE)



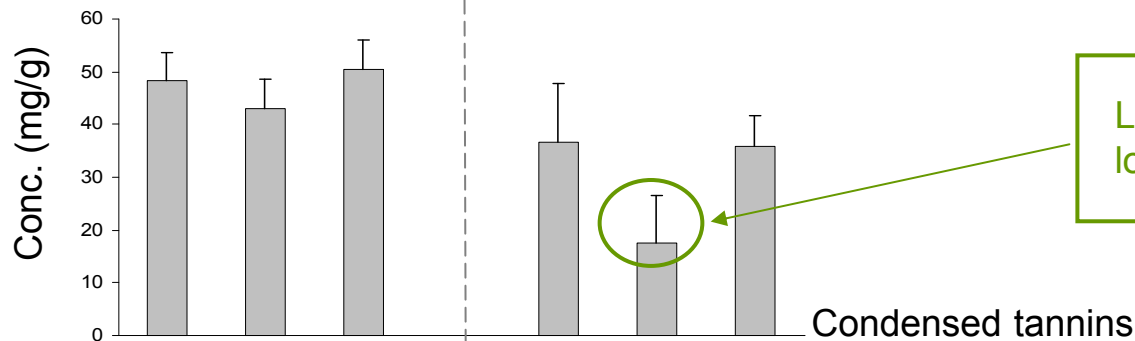
The *Salix* species differ significantly in PNUE without mycorrhiza

There are no differences between the Tora treatments

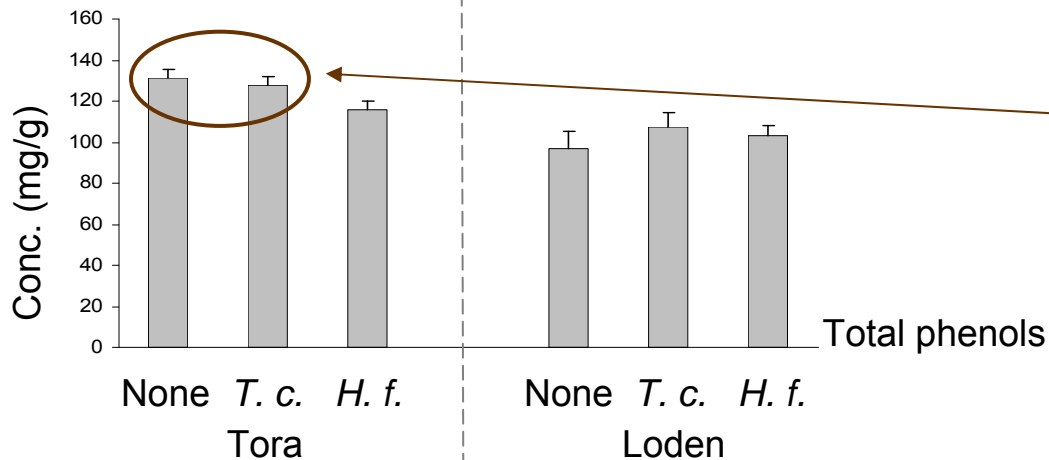
In Loden, however, the *Tricholoma cingulatum* and the *Hebeloma fastibile* treatments differ



Tora - *Hebeloma fastibile*
high in salicylic acid



Loden - *Tricholoma cingulatum*
low in condensed tannins



Non-mycorrhizal Tora and
Tora - *Tricholoma cingulatum*
high in total phenols

How do the *Salix* varieties differ without mycorrhiza?

Tora

Salix schwerinii × *S. viminalis*

Large total above-ground biomass accumulation

Large shoot mass

High photosynthetic nitrogen use efficiency (PNUE)

High leaf conc of total phenols



Loden

Salix dasyclados

Small above-ground biomass accumulation

50/50 mass proportion between shoots and leaves

Low PNUE

Lower leaf conc of total phenols

What are the mycorrhizal effects on 'Tora'?



Non-mycorrhizal

Large total above-ground biomass accumulation

High leaf conc of total phenols



Tricholoma cingulatum

Large total above-ground biomass accumulation

High leaf conc of total phenols



Hebeloma fastibile

Small total biomass accumulation
Small leaf mass

Lower leaf conc of total phenols

Very high conc of salicylic acid

What are the mycorrhizal effects on 'Loden'?



Non-mycorrhizal

Small above-ground biomass accumulation

Low photosynthetic nitrogen use efficiency (PNUE)



Tricholoma cingulatum

Larger total above-ground biomass
Large leaf mass

Lower PNUE

Low levels of condensed tannins



Hebeloma fastibile

Small above-ground biomass accumulation

Higher PNUE (Very low N conc)

Some interesting effects of mycorrhiza:

Tricholoma cingulatum & Loden

T.c. has beneficial effects on plant growth in Loden.



The *T. c.* inoculations however lead to low leaf conc. of condensed tannins.



The plants prioritise growth over defence.

Hebeloma fastibile & Tora

H.f. acts more as a parasite, hampering growth in Tora.



The *H.f.* inoculations lead to very high conc. of salicylic acid.



The plants respond to the mycorrhizal infection with induced defence.

In conclusion: Mycorrhizal effects differ and are species specific for both plant and fungal species



***Thank you for your
attention!***