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# Fungal Communities in Sea Buckthorn Plant Material

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# Sea Buckthorn in Germany

Economic Relevance: Plantations

Ecological Relevance: Wild plants



- 1980s: Breeding of yield and pollinator varieties

- Cultivation area:           2021: 750 ha  
                                      2022: 595 ha   ↓

Statistisches Bundesamt 2021/ 2022

# Sea Buckthorn Dieback

Economic Relevance: Plantations

Ecological Relevance: Wild plants



Plantations and wild plants increasingly affected: **Losses up to 100 %**



# Sea Buckthorn Dieback

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Plantations and wild plants increasingly affected: **Losses up to 100 %**

**Cause of  
disease  
?**



# Sea Buckthorn Dieback

Economic Relevance: Plantations

Ecological Relevance: Wild plants



Plantations and wild plants increasingly affected

Effect of Cultivation Techniques and Site Conditions on Sea Buckthorn Disease Incidence in Northern Germany



**Cause of disease**  
**?**



# Sea Buckthorn Fungal Pathogens



## Complex of fungi

### Dieback in Northern Germany:

- *Hymenopleella hippophaeicola*
- *Diaporthe* spp. (syn.: Phomopsis)

## SEA BUCKTHORN DISEASES CAUSED BY PATHOGENIC FUNGI

Kristine Drevinska and Inga Moročko-Bičevska

Institute of Horticulture, Latvia University of Life Sciences and Technologies, 1 Gau

Drevinska & Moročko-Bičevska 2022

Wilt: *Verticillium* spp., *Fusarium* spp.

Dried-shrink disease: *Fusarium* spp., *Diaporthe* spp.

Canker: *Stigmina* sp., *Cytospora hippophaes*, *Eutypa* sp.

Bracket fungus: *Fomitiporia hippophaeicola* (syn.: *Phellinus hippophaeicola*)

Further: *Alternaria*, *Botrytis*, *Fomes*, *Rhizoctonia*, *Pythium*, *Phytophthora*



Prokkola 2003, Ruan et al. 2010, Xia et al. 2021, Zalewska et al. 2023

# Age and Tissue



## Ruan et al. 2010 DSD:

### Age:

- Plants are  $\geq 3$  years
- no disease in 1-2 year old plants observable

### Tissue:

- infected parts often occur at the base of the plant
- Ramets can develop if infected parts are removed

# Age and Tissue



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## Questions:

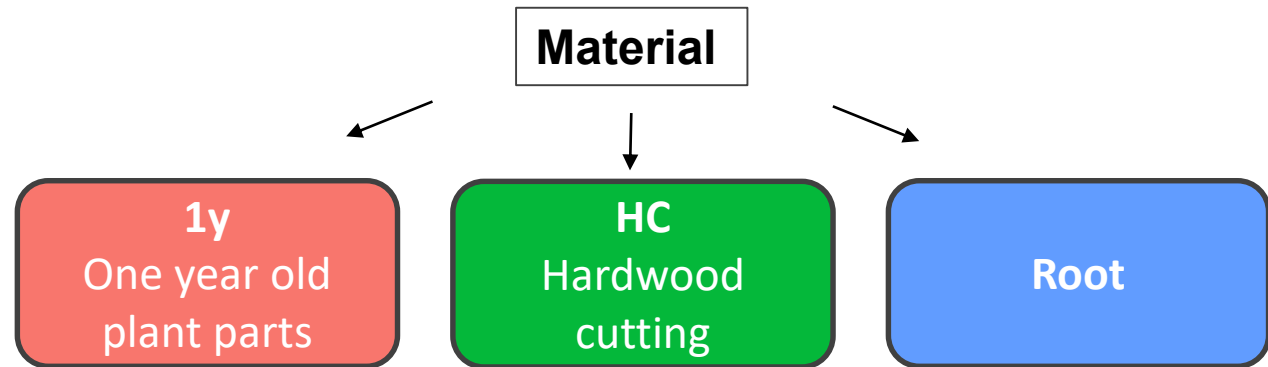
1. Are there differences in the fungal community in regard to Material (1 year old vs. hardwood cutting vs. root)?
2. Do cultivars differ in the fungal community?
3. Can potentially dieback/ DSD associated fungi already be found in nursery plants?



# Method

## Cultivars:

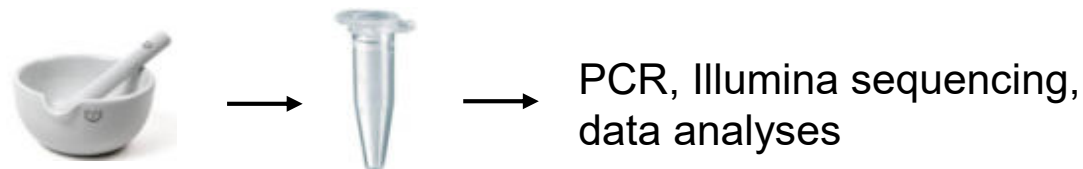
Leikora, Habego, Hergo, Pollmix 3+4  
3 plants each, 1-2 years old from 3 nurseries



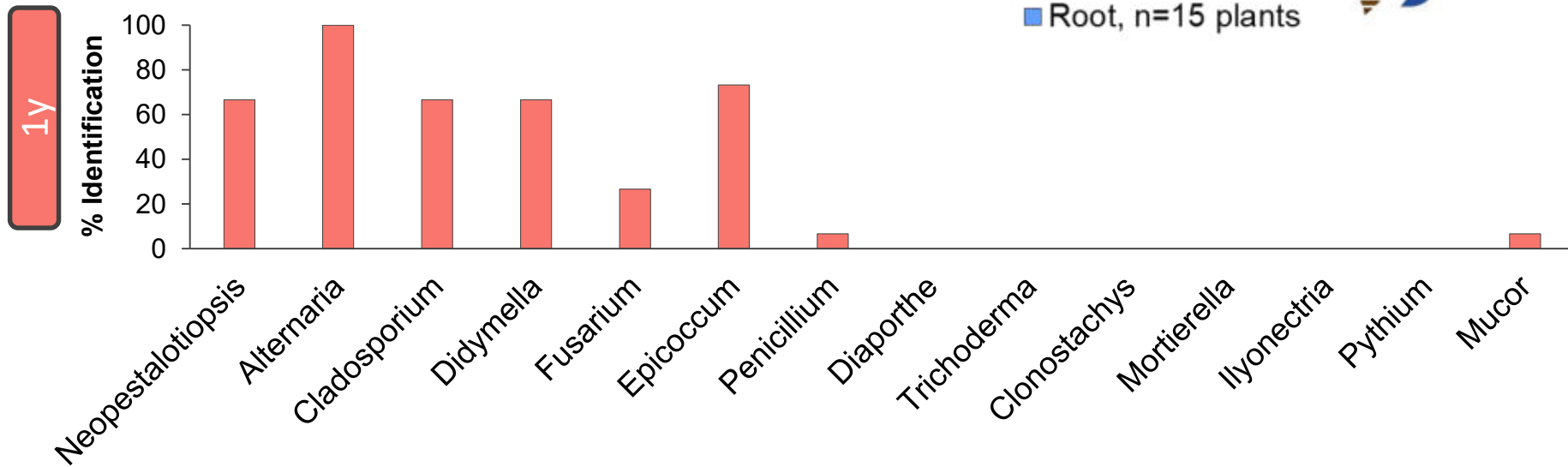
## Isolation (only Leikora):



## Amplicon sequencing ITS1



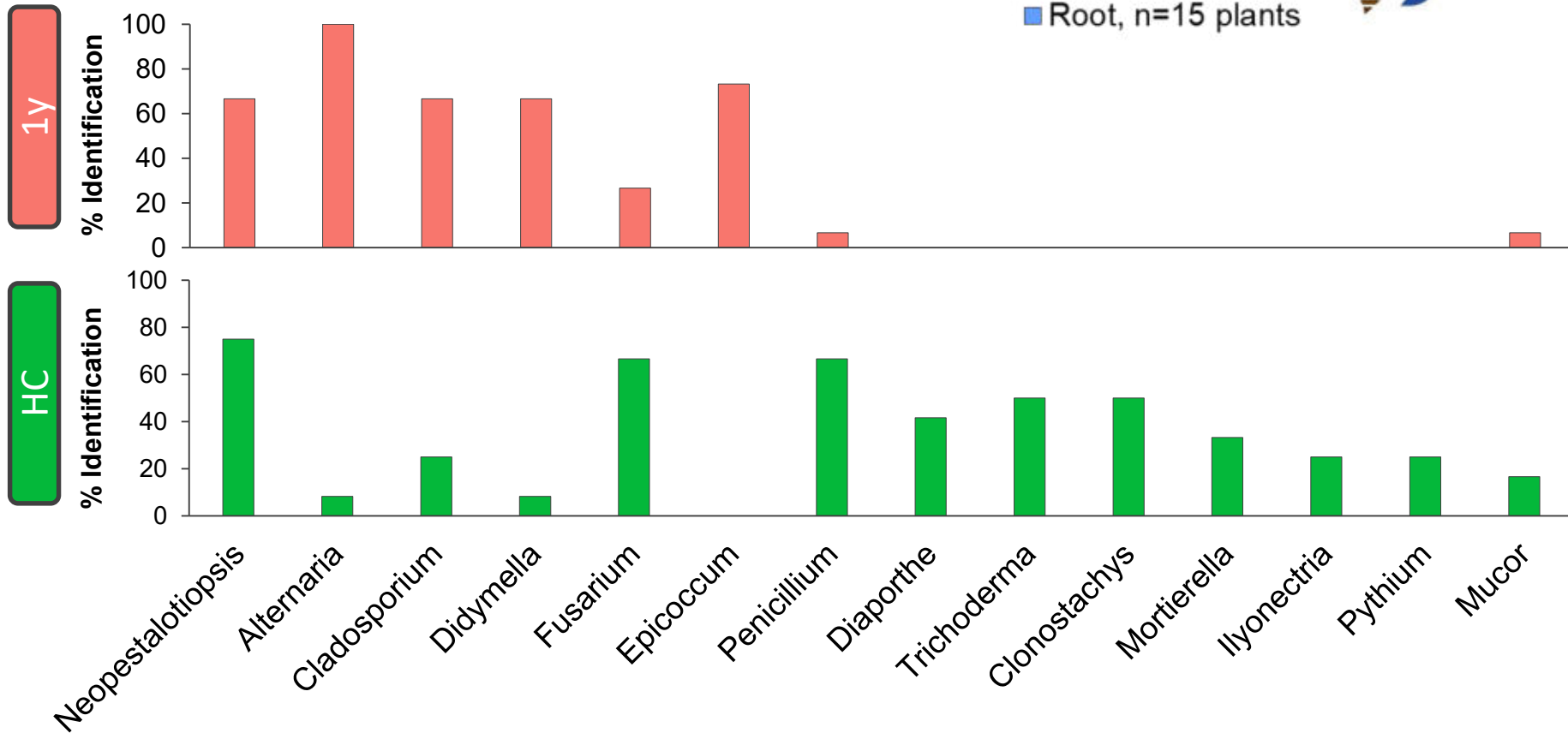
# Isolation Leikora



# Isolation Leikora



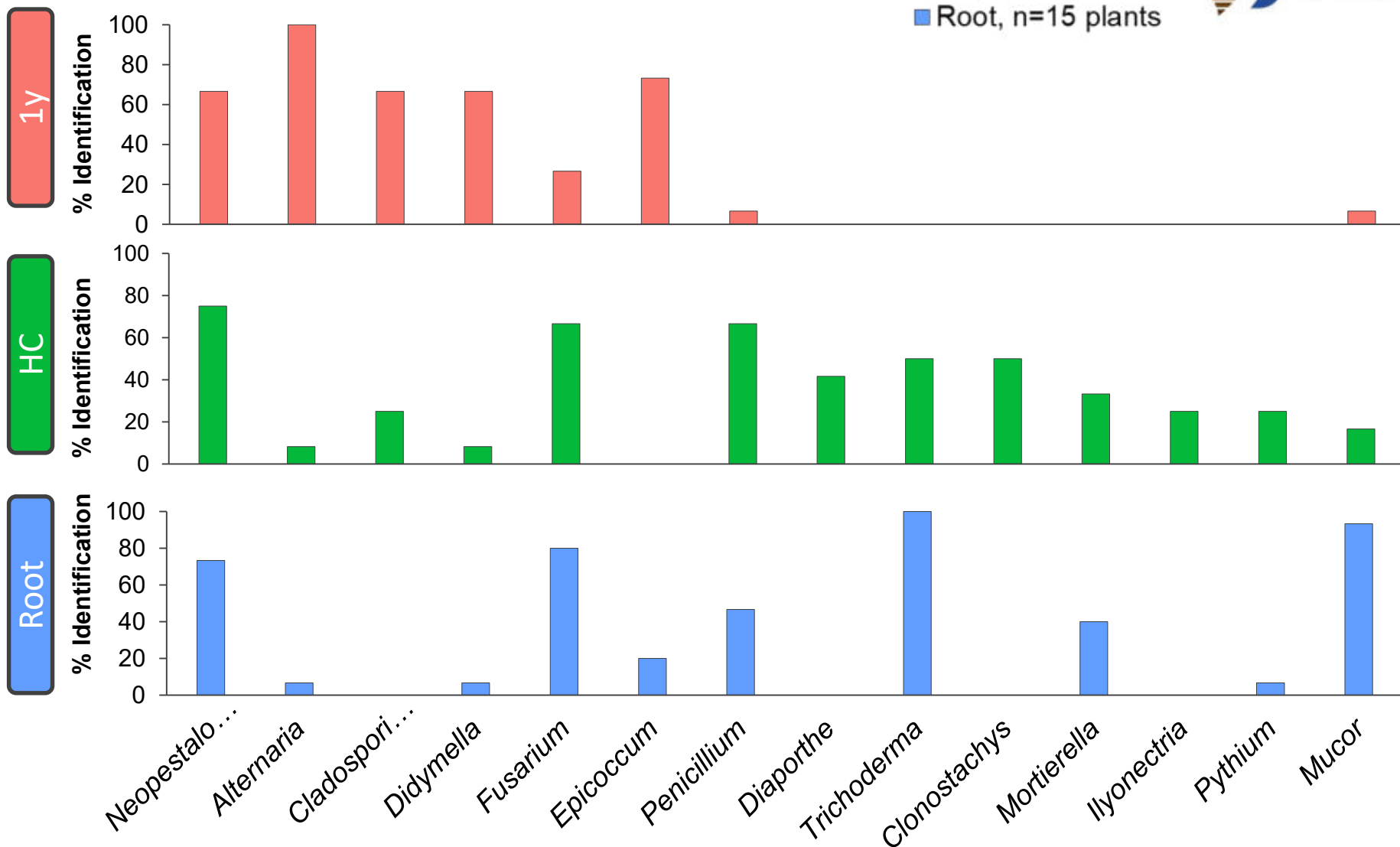
1y, n=15 plants  
HC, n= 12 plants  
Root, n=15 plants



# Isolation Leikora



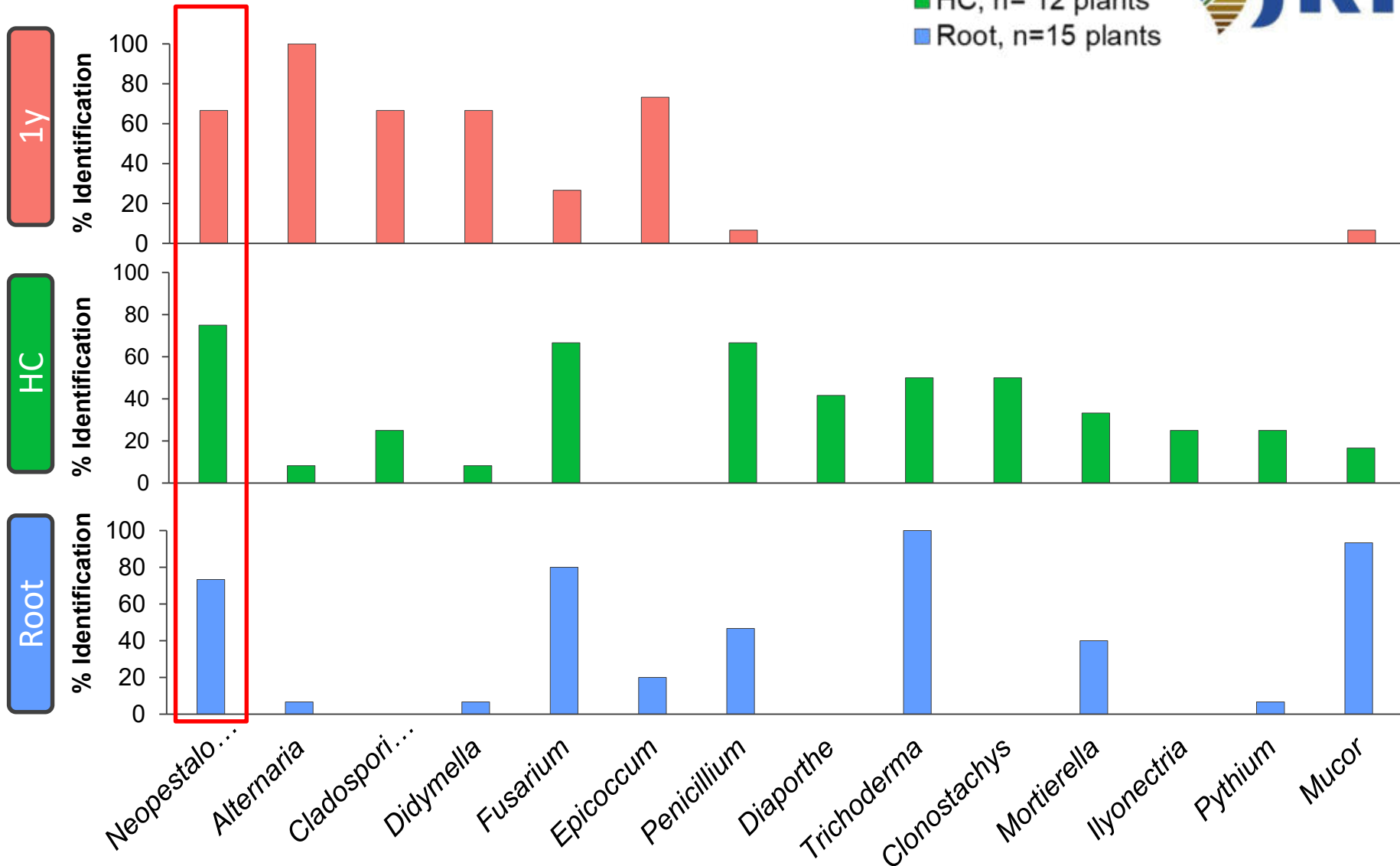
■ 1y, n=15 plants  
■ HC, n= 12 plants  
■ Root, n=15 plants



# Isolation Leikora



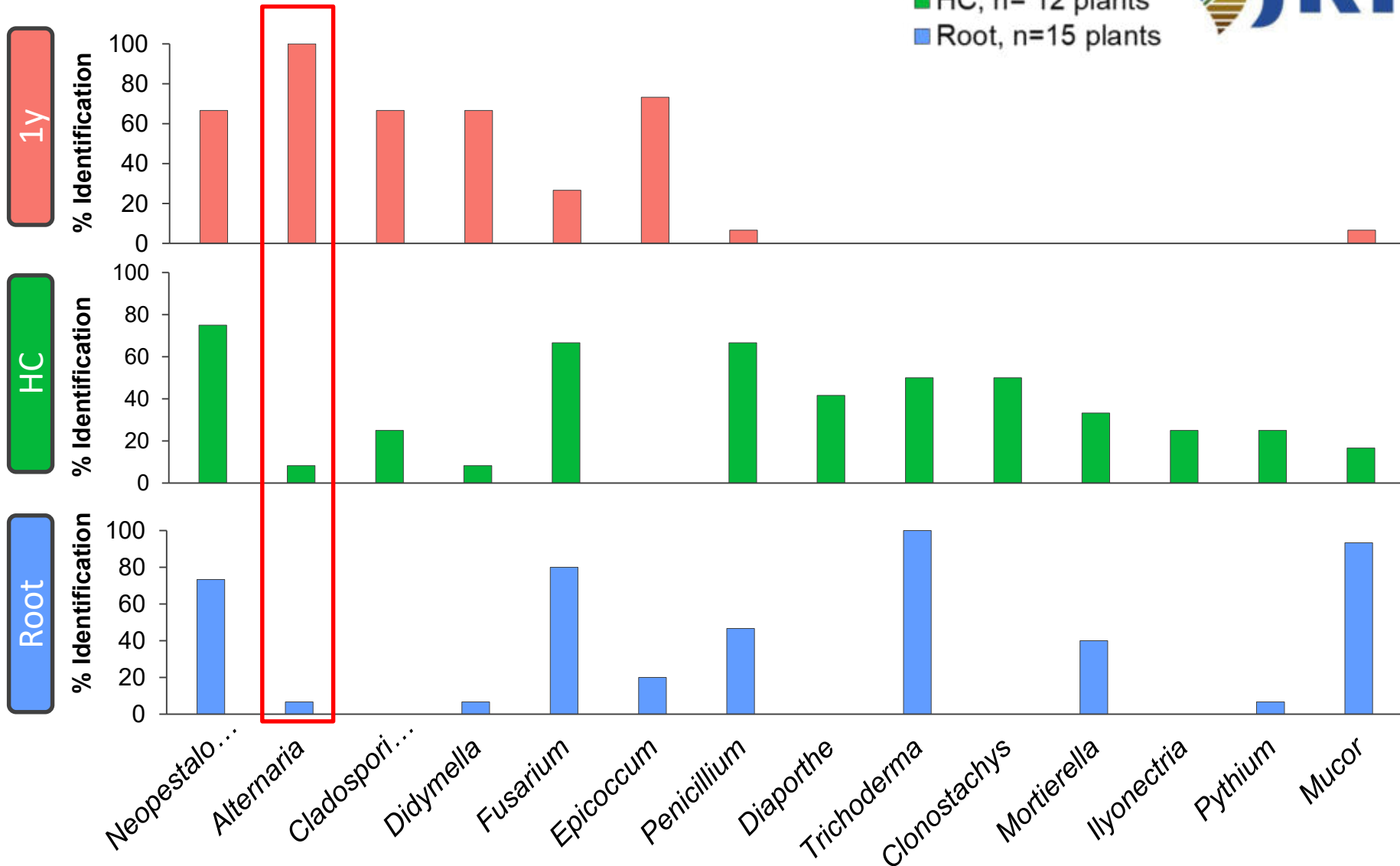
■ 1y, n=15 plants  
■ HC, n= 12 plants  
■ Root, n=15 plants



# Isolation Leikora



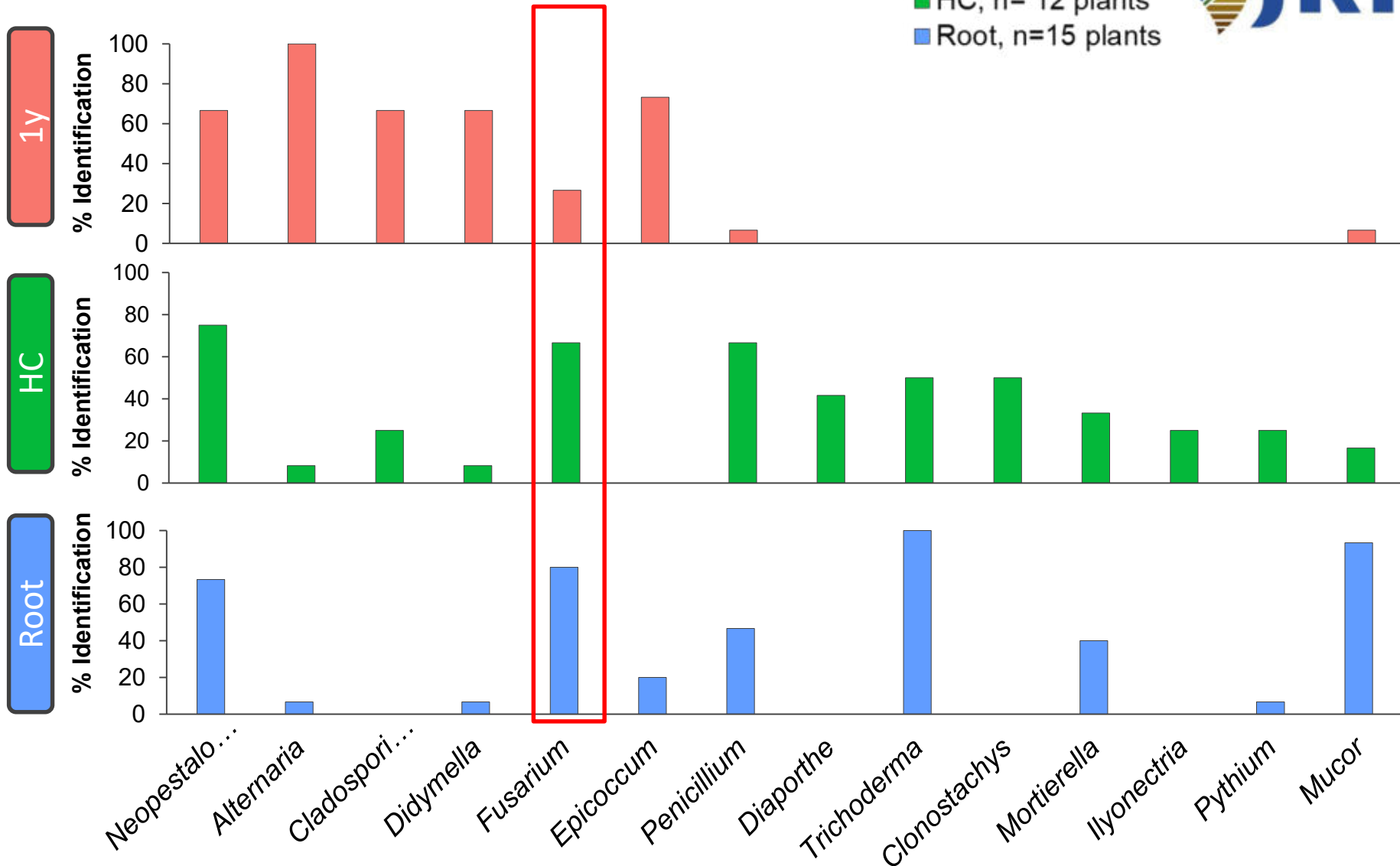
■ 1y, n=15 plants  
■ HC, n= 12 plants  
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# Isolation Leikora



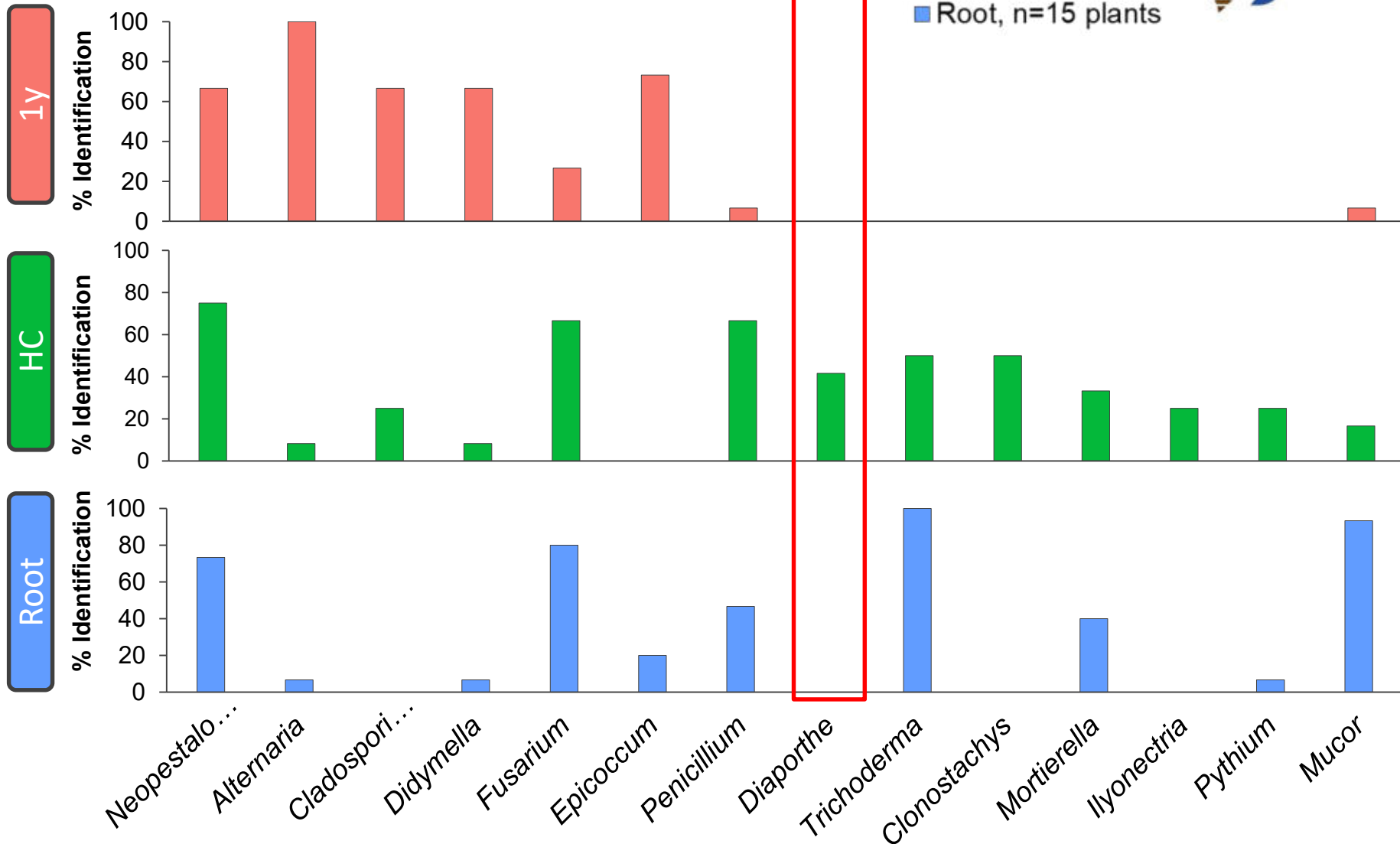
■ 1y, n=15 plants  
■ HC, n= 12 plants  
■ Root, n=15 plants



# Isolation Leikora

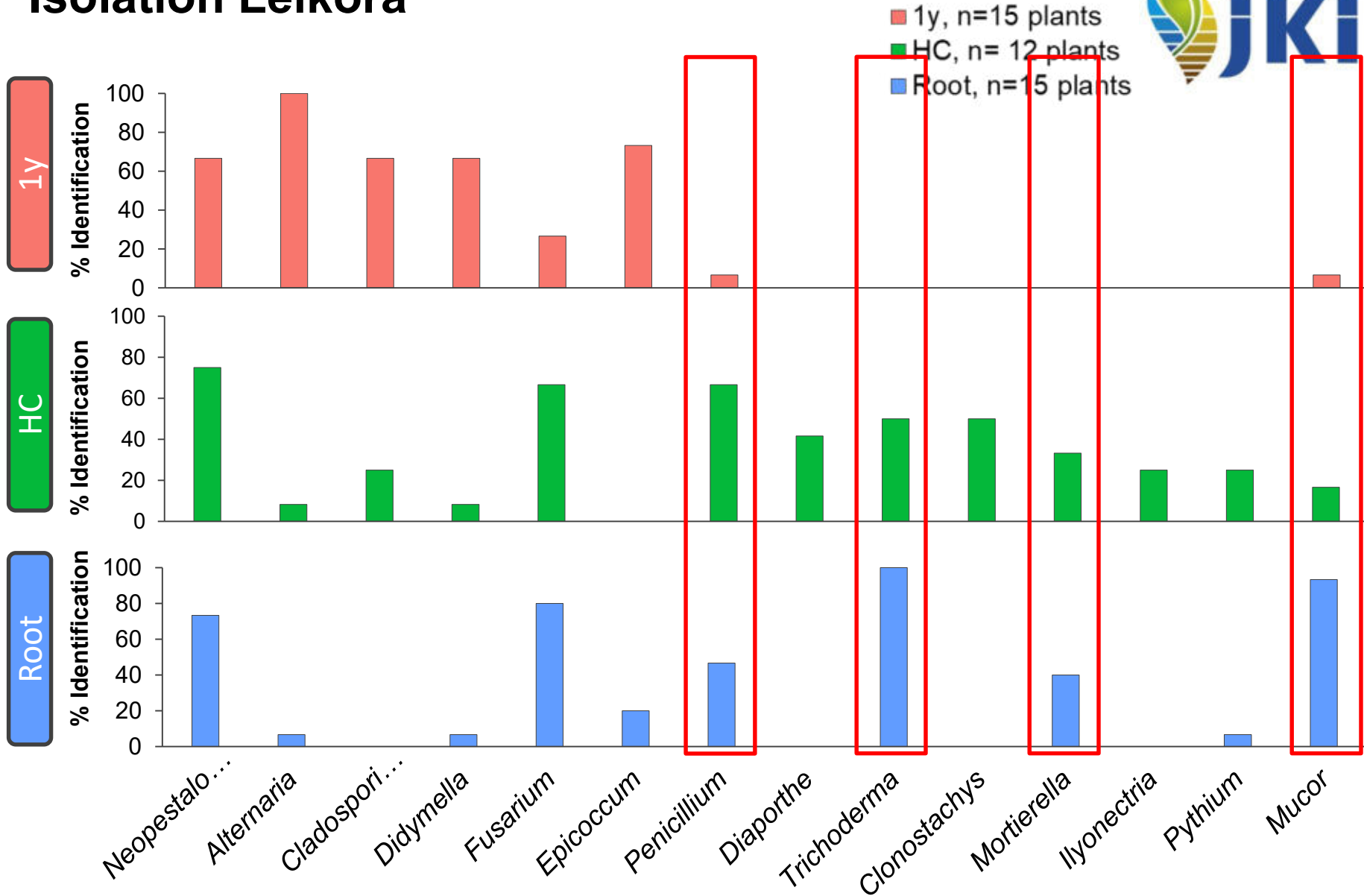


■ 1y, n=15 plants  
■ HC, n= 12 plants  
■ Root, n=15 plants

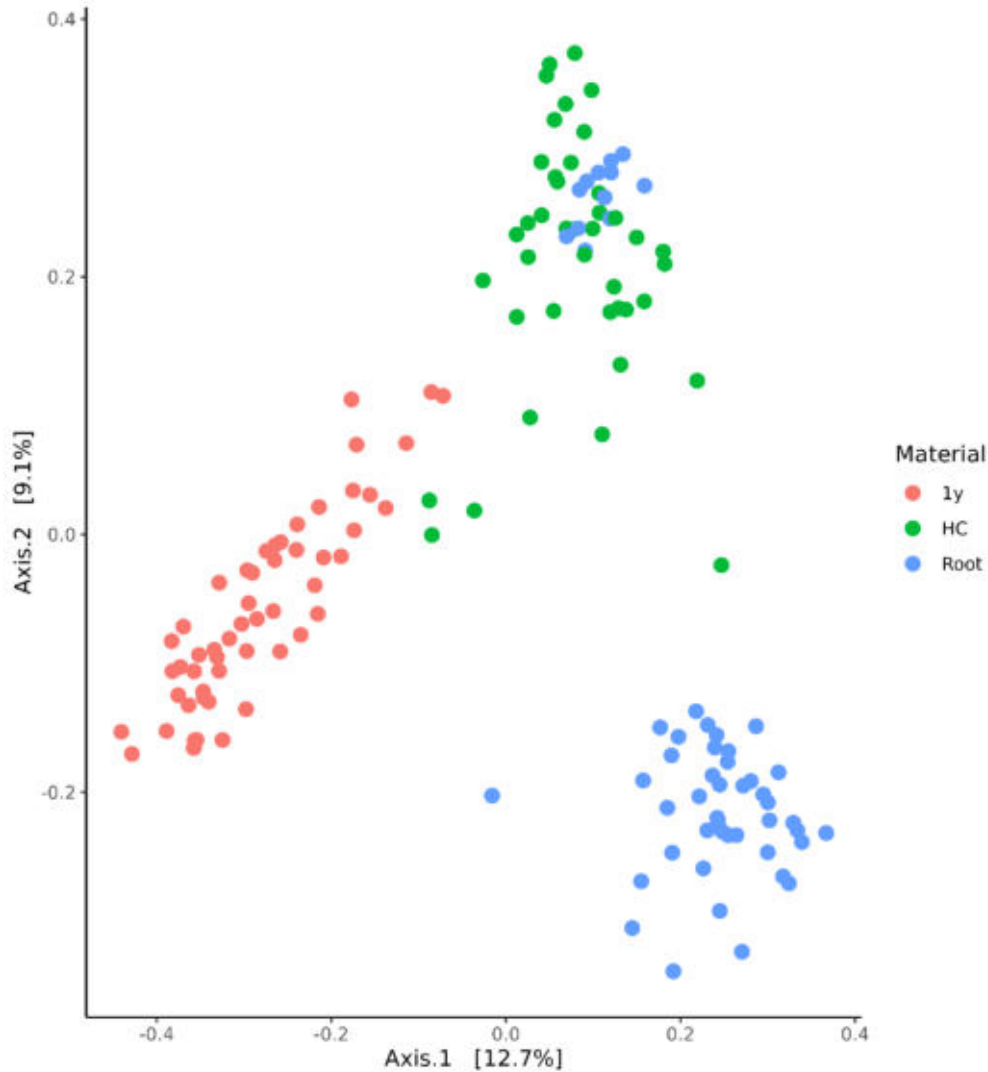




# Isolation Leikora



# PCoA Material



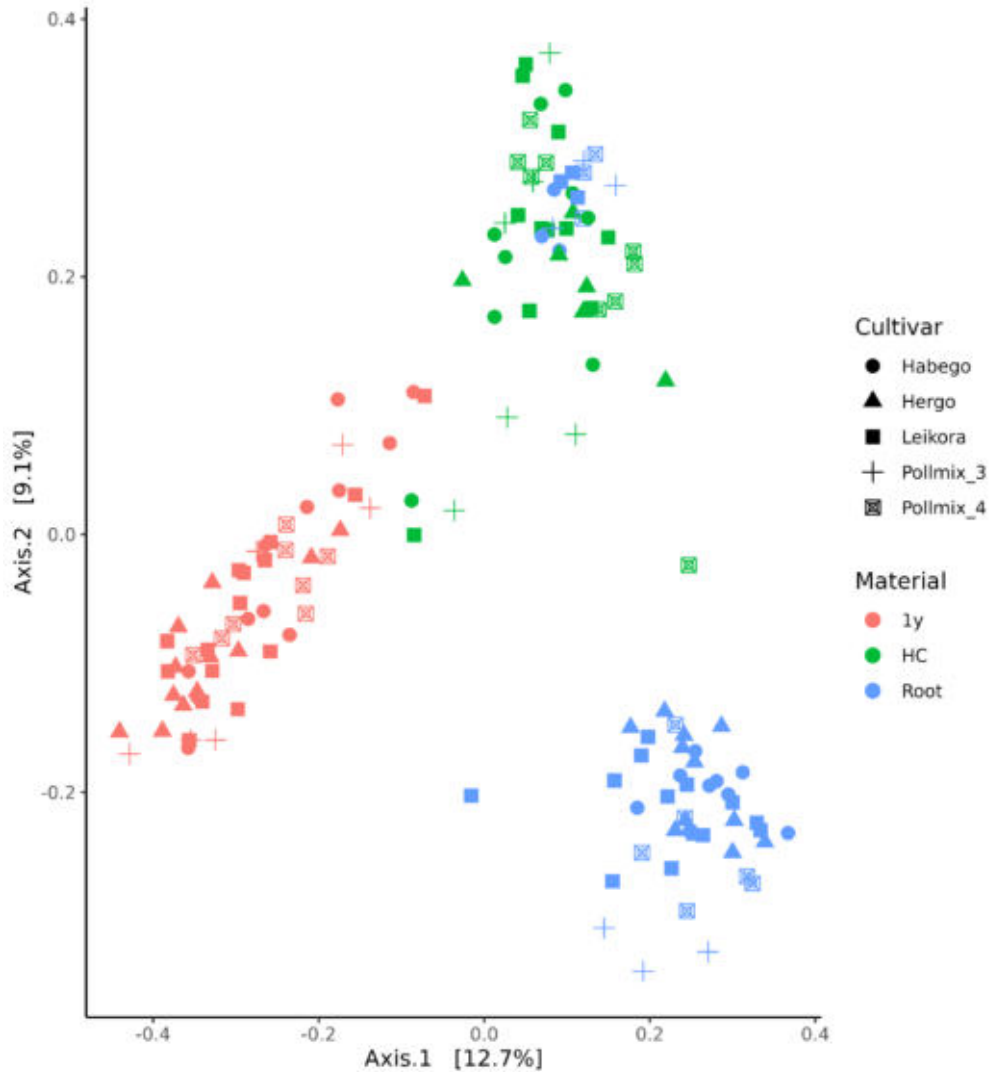
PERMANOVA

R2 Material: 0.17 \*\*\*

R2 Cultivar: 0.03 \*\*\*

$p \leq 0.001$  \*\*\*  
 $p \leq 0.01$  \*\*  
 $p \leq 0.05$  \*

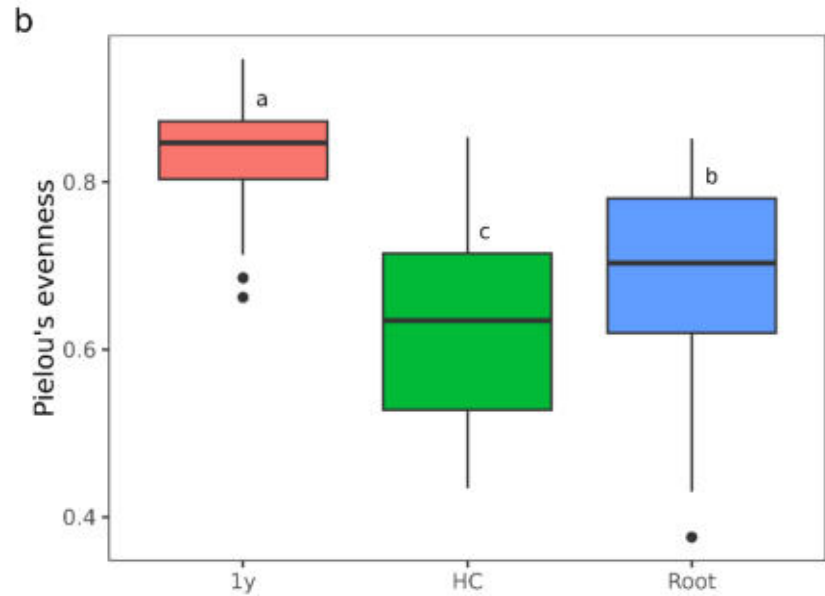
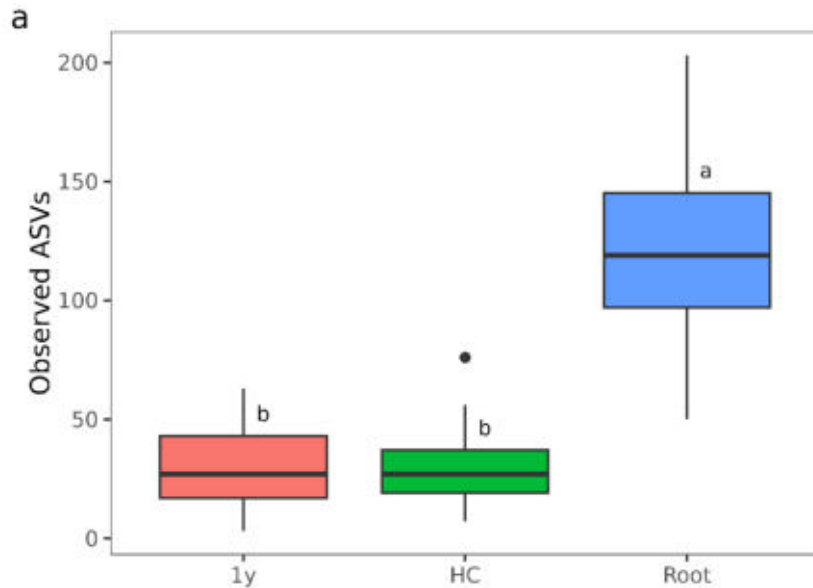
# PCoA Material + Cultivar



PERMANOVA  
R<sup>2</sup> Material: 0.17 \*\*\*  
R<sup>2</sup> Cultivar: 0.03 \*\*\*

$p \leq 0.001$  \*\*\*  
 $p \leq 0.01$  \*\*  
 $p \leq 0.05$  \*

# Alpha diversity Material



# Age and Tissue



## Ruan et al. 2010 DSD:

### Age:

- Plants are  $\geq 3$  years
- no disease in 1-2 year old plants observable

### Tissue:

- **infected parts often occur at the base of the plant**
- Ramets can develop if infected parts are removed

## Questions:

1. Are there differences in the fungal community in regard to Material (1 year old vs. Hardwood cutting vs. root)
2. Do cultivars differ in the fungal community?
3. Can potentially dieback/ DSD associated fungi already be found in Nursery plants?

# 4 years old plants 'Leikora' JKI

n= 4 plants



## Ruan et al. 2010 DSD:

### Age:

- Plants are  $\geq 3$  years
- no disease in 1-2 year old plants observable

### Tissue:

- **infected parts often occur at the base of the plant**
- Ramets can develop if infected parts are removed

# 4 years old plants 'Leikora' JKI

n= 4 plants



Tip

Bottom

Phloem



Wood



Phloem



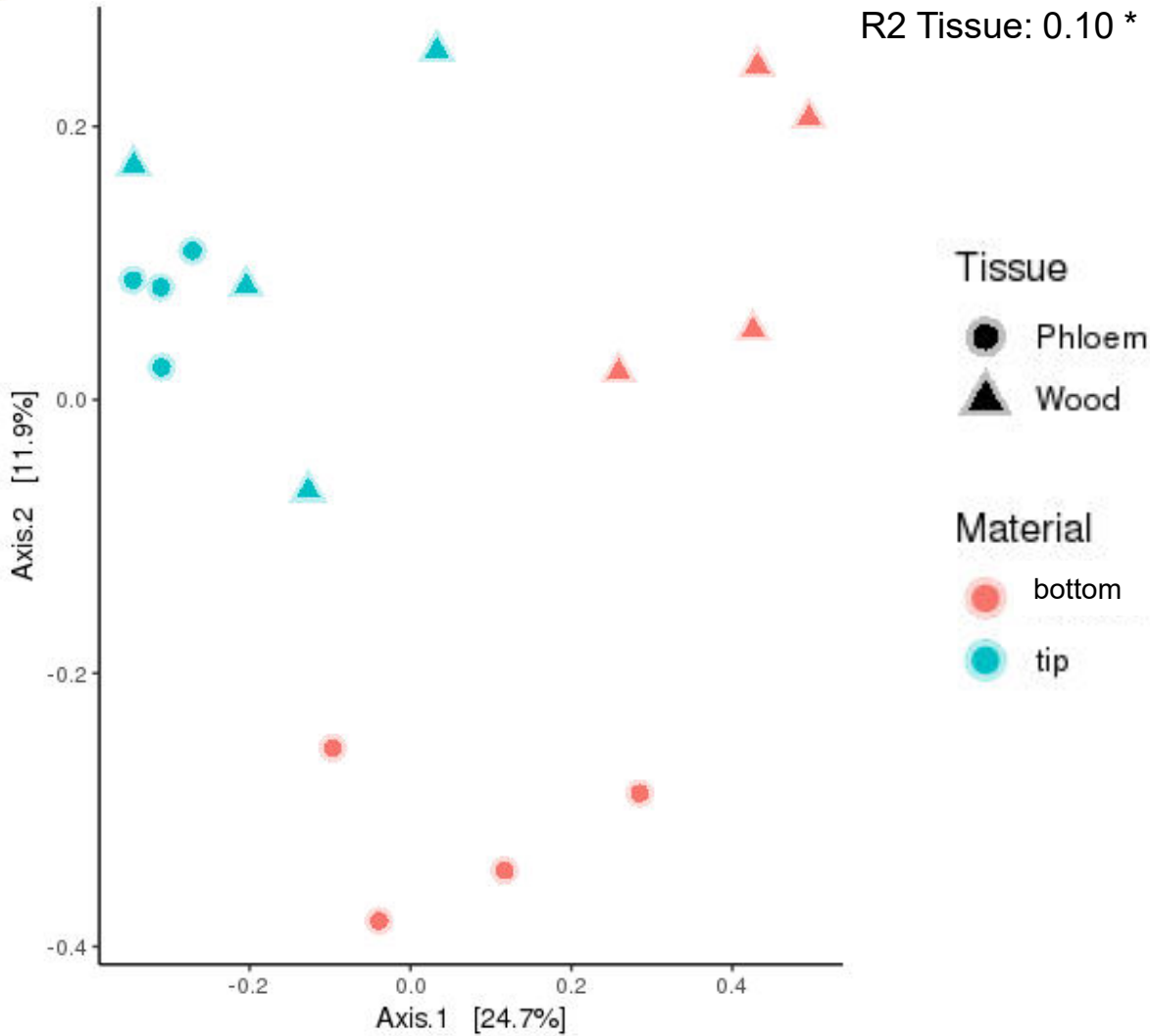
Wood



# PCoA 'Leikora' 4 years old plants



PERMANOVA  
R2 Material: 0.19 \*\*\*  
R2 Tissue: 0.10 \*



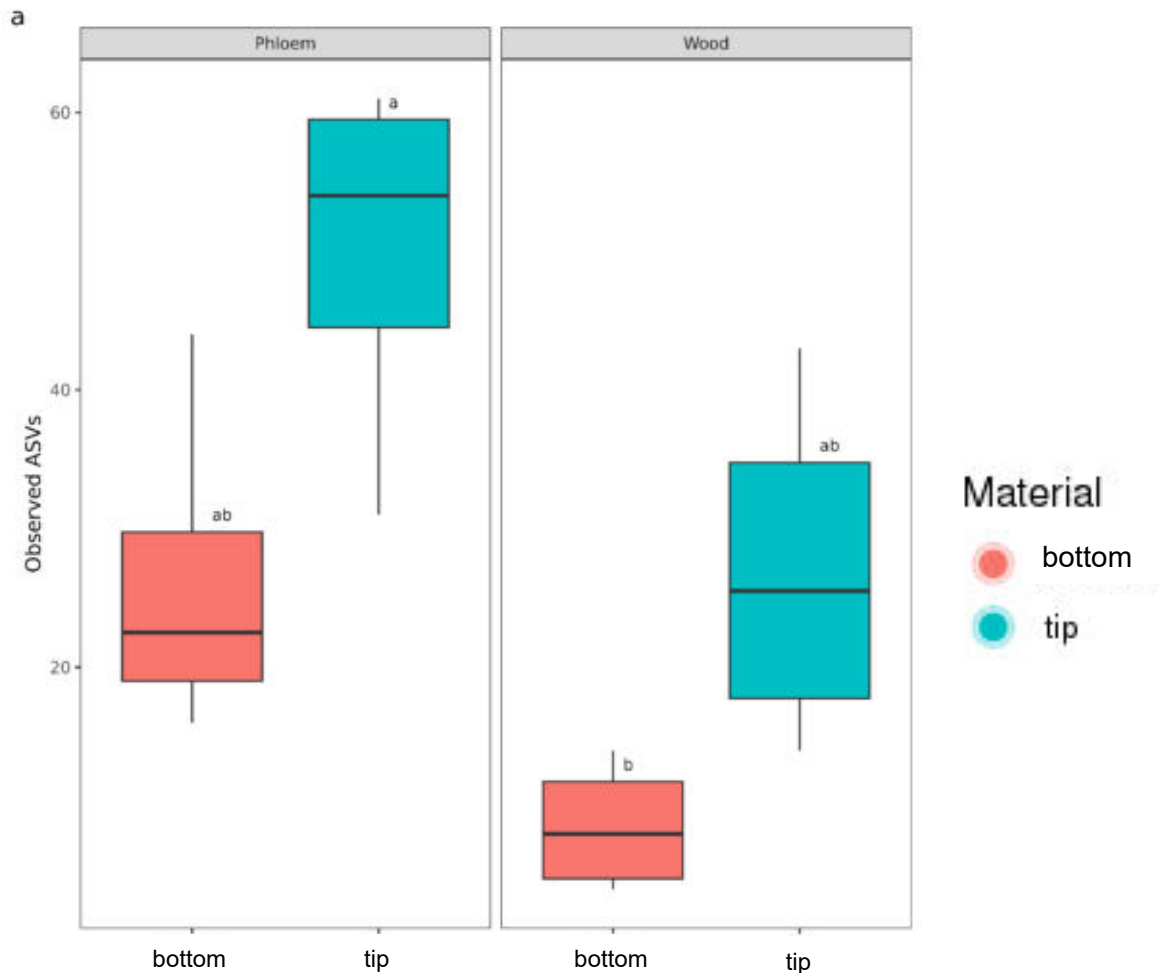
- EUROWORKS 2024 Pruszkow -

$p \leq 0.001$  \*\*\*  
 $p \leq 0.01$  \*\*  
 $p \leq 0.05$  \*

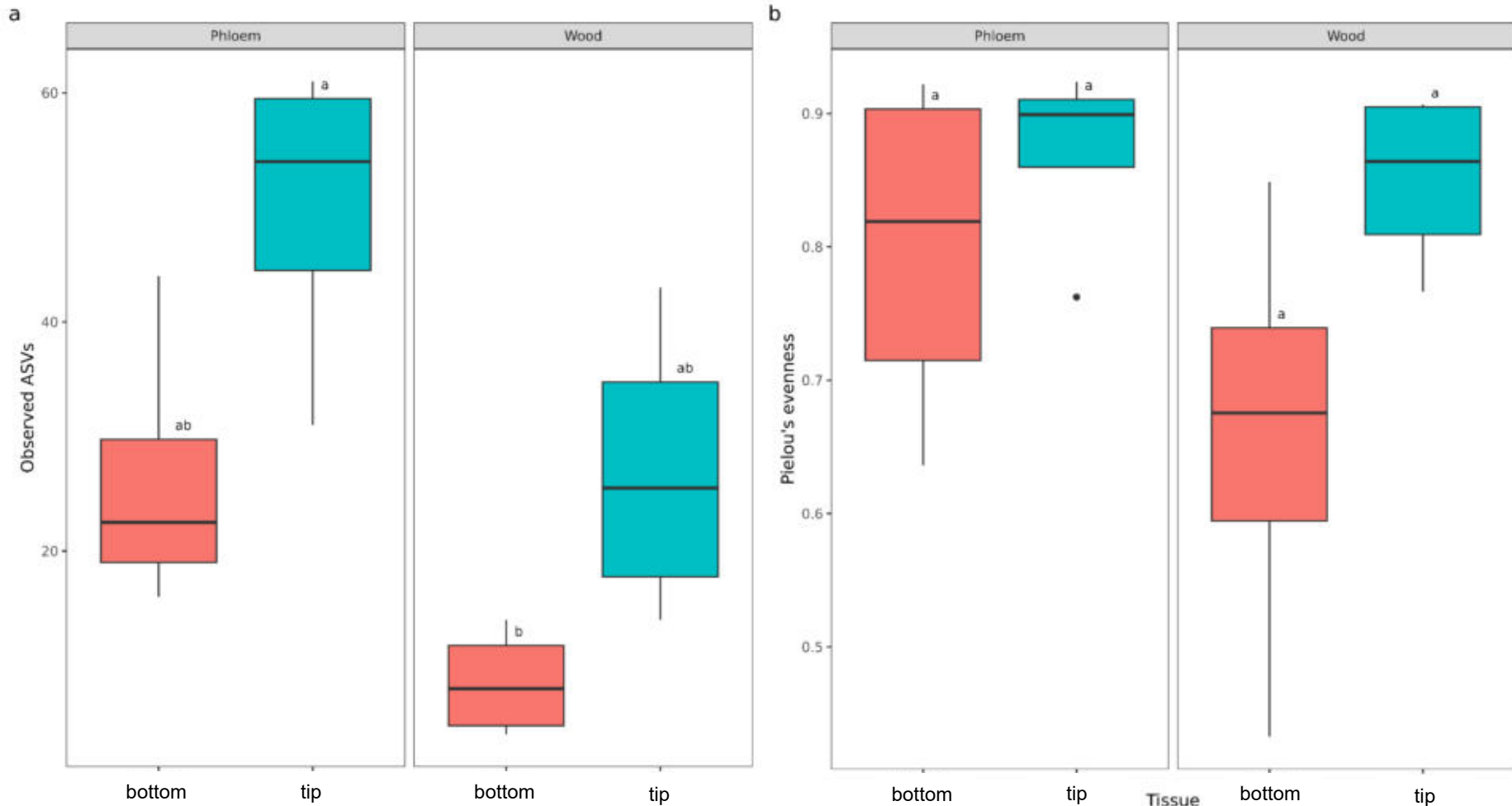


# 'Leikora' 4 years old plants

## Alpha diversity



# 'Leikora' 4 years old plants



# Age and Tissue



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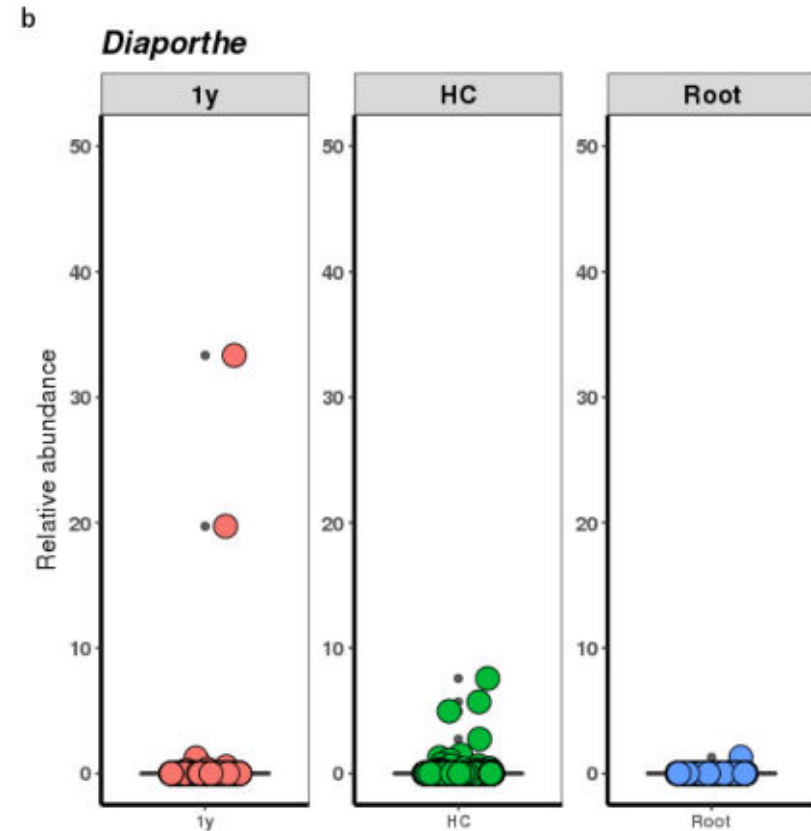
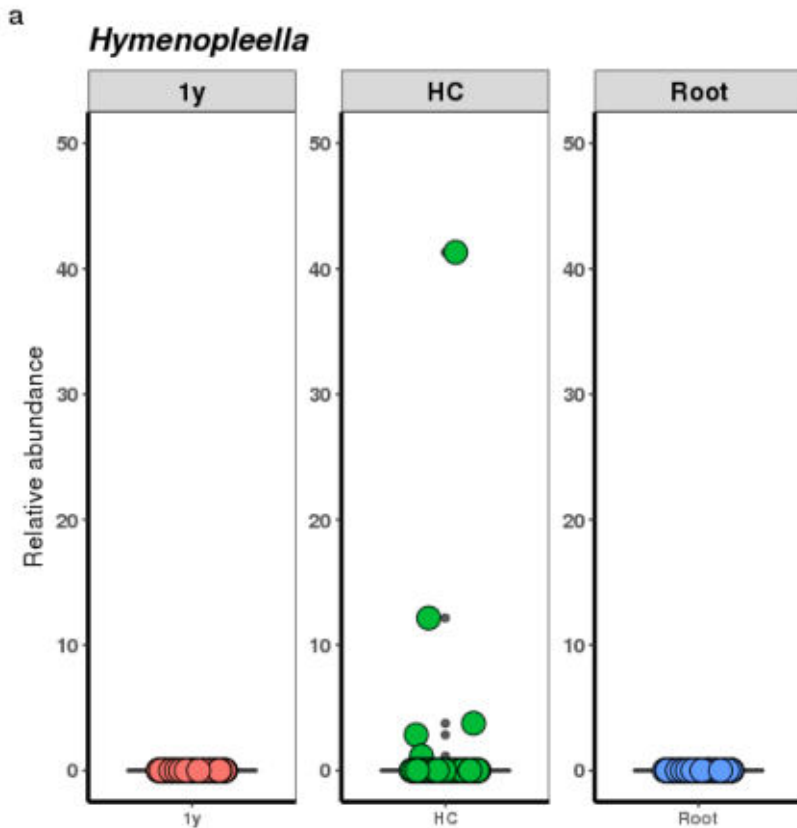
## Tissue:

- infected parts often occur at the base of the plant
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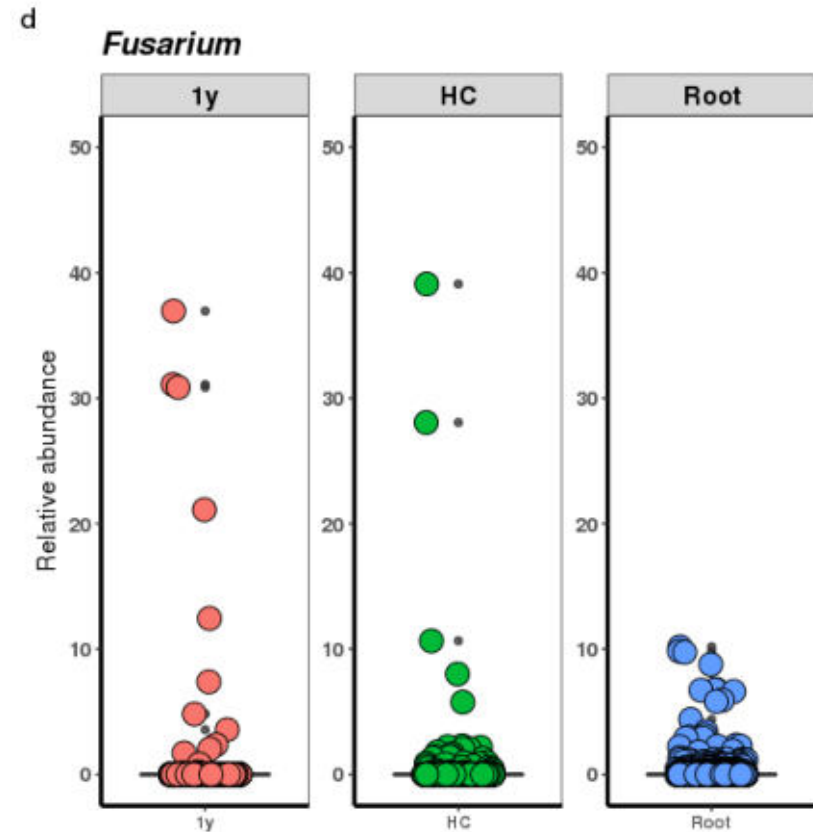
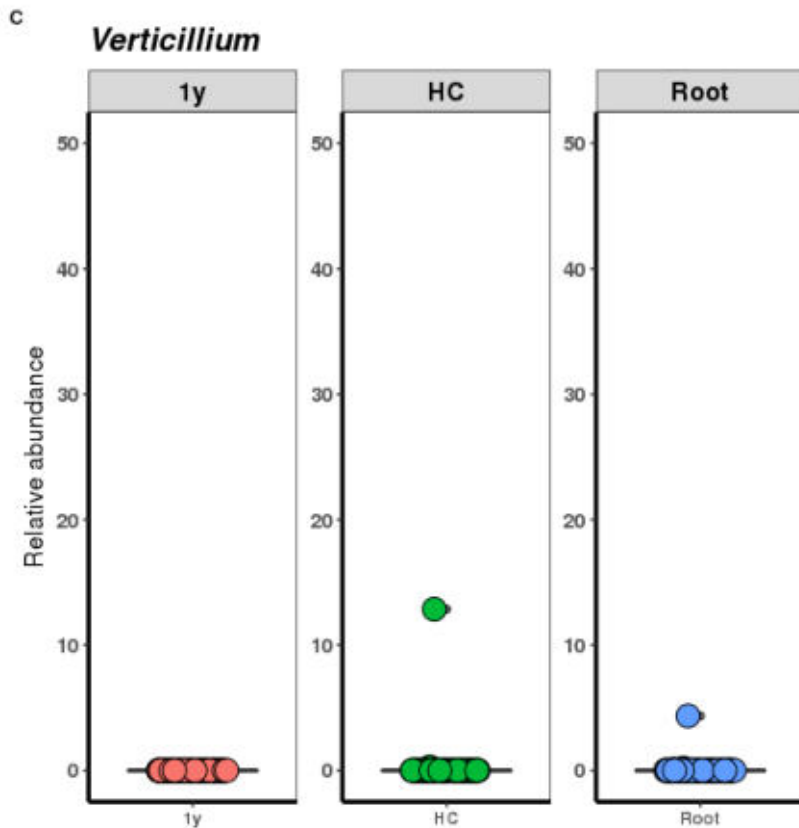
## Questions:

1. Are there differences in the fungal community in regard to Material (1 year old vs. Hardwood cutting vs. root) **YES!**
2. Do cultivars differ in the fungal community? **Only small difference, effect of Material is more pronounced.**
3. Can potentially dieback/ DSD associated fungi already be found in Nursery plants?

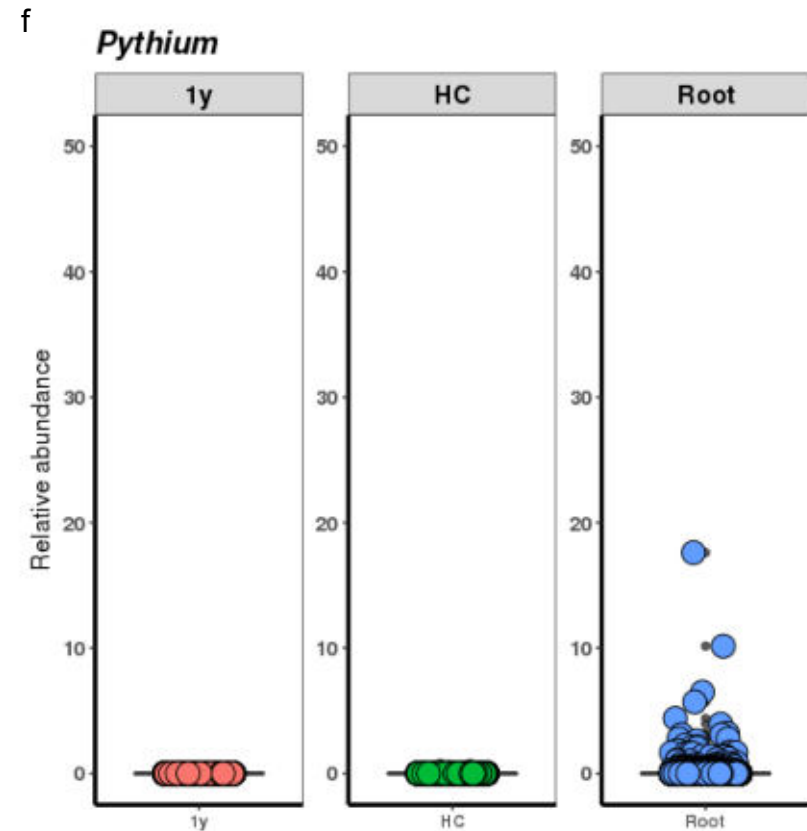
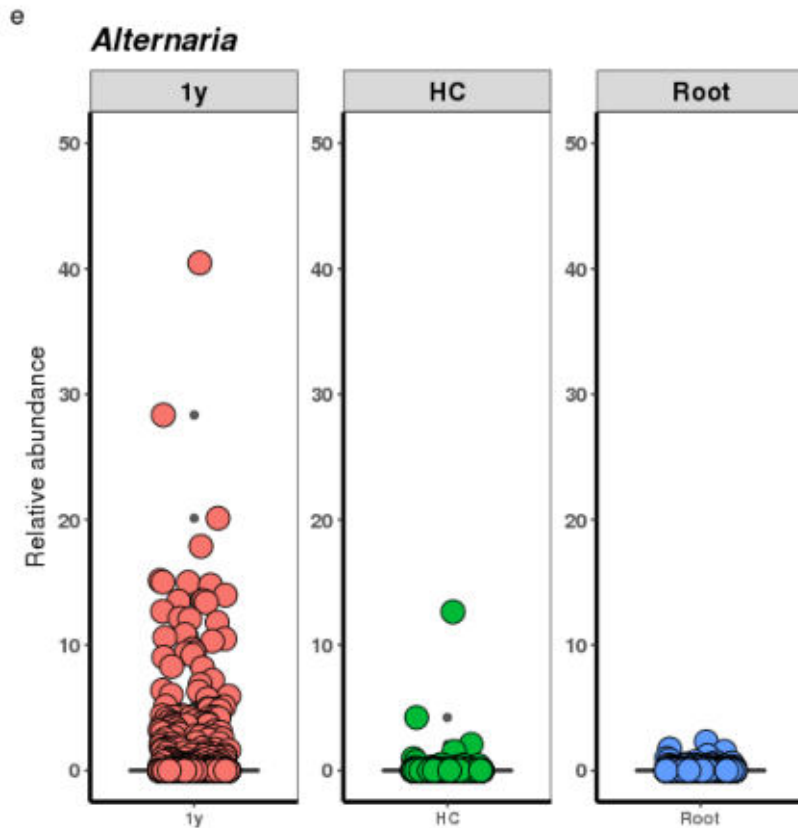
# Potential Pathogens



# Relative abundance fungal taxa



# Relative abundance fungal taxa



# Sea Buckthorn Fungal Pathogens



## Complex of fungi

### Dieback in Northern Germany:

- *Hymenopleella hippophaeicola*
- *Diaporthe* spp. (syn.: Phomopsis)

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Kristine Drevinska and Inga Moročko-Bičevska

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Drevinska & Moročko-Bičevska 2022

Wilt: *Verticillium* spp., *Fusarium* spp.

Dried-shrink disease: *Fusarium* spp., *Diaporthe* spp.

Canker: *Stigmina* sp., *Cytospora hippophaes*, *Eutypa* sp.

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Further: *Alternaria*, *Botrytis*, *Fomes*, *Rhizoctonia*, *Pythium*, *Phytophthora*



Prokkola 2003, Ruan et al. 2010,  
Zalewska et al. 2023

# Sea Buckthorn Fungal Pathogens



## Complex of fungi

### Dieback in Northern Germany:

- *Hymenopleella hippophaeicola* → few HC
- *Diaporthe* spp. (syn.: Phomopsis) → few HC

## SEA BUCKTHORN DISEASES CAUSED BY PATHOGENIC FUNGI

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Wilt: *Verticillium* spp. (2), *Fusarium* spp. → some, all tissues

Dried-shrink disease: *Fusarium* spp., *Diaporthe* spp.

Canker: *Stigmina* sp. (3), *Gytospora hippophaes*, *Eutypa* sp. (1)

Bracket fungus: *Fomitiporia hippophaeicola* (syn.: *Phellinus hippophaeicola*)

Further: *Alternaria* → plenty 1y, *Botrytis sporadic*, *Fomes* (1),  
*Rhizoctonia sporadic*, *Pythium* some, root, *Phytophthora*

Prokkola 2003, Ruan et al. 2010,  
Zalewska et al. 2023





# Summary



- Fungal community in SBT plants differs in regard to material
- Community in 4 year old plants differs between tip and bottom → Sampling!
- Communities comparing German cultivars quiet similar
- Dieback associated and other pathogens were rarely detected in this trial SBT plant material 😊

# Acknowledgement

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