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Relevance of canker and wood rot pathogens on stone fruit propagation material and nursery trees

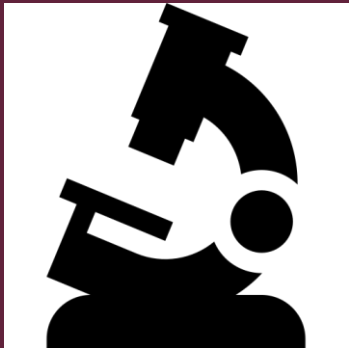
Lizel Mostert, Rhona van der Merwe, Vernon Jacobs, Francois Halleen

HORTGRO Symposium

8 June 2022

Canker and wood rot of stone fruit trees

Plant
Disease
Clinic



Propagation
material
Nursery
trees

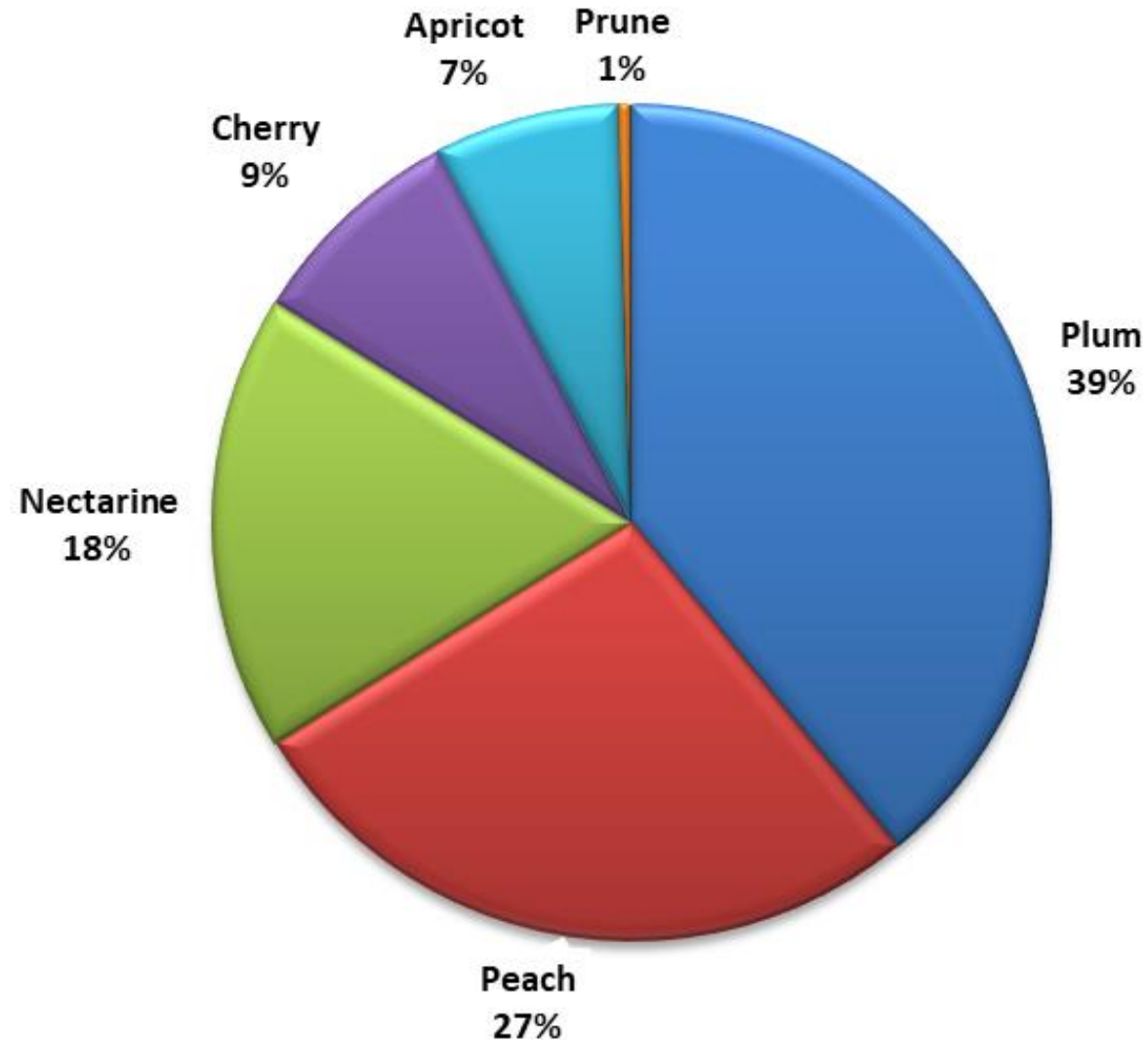


Management
practices



SU Plant Disease Clinic

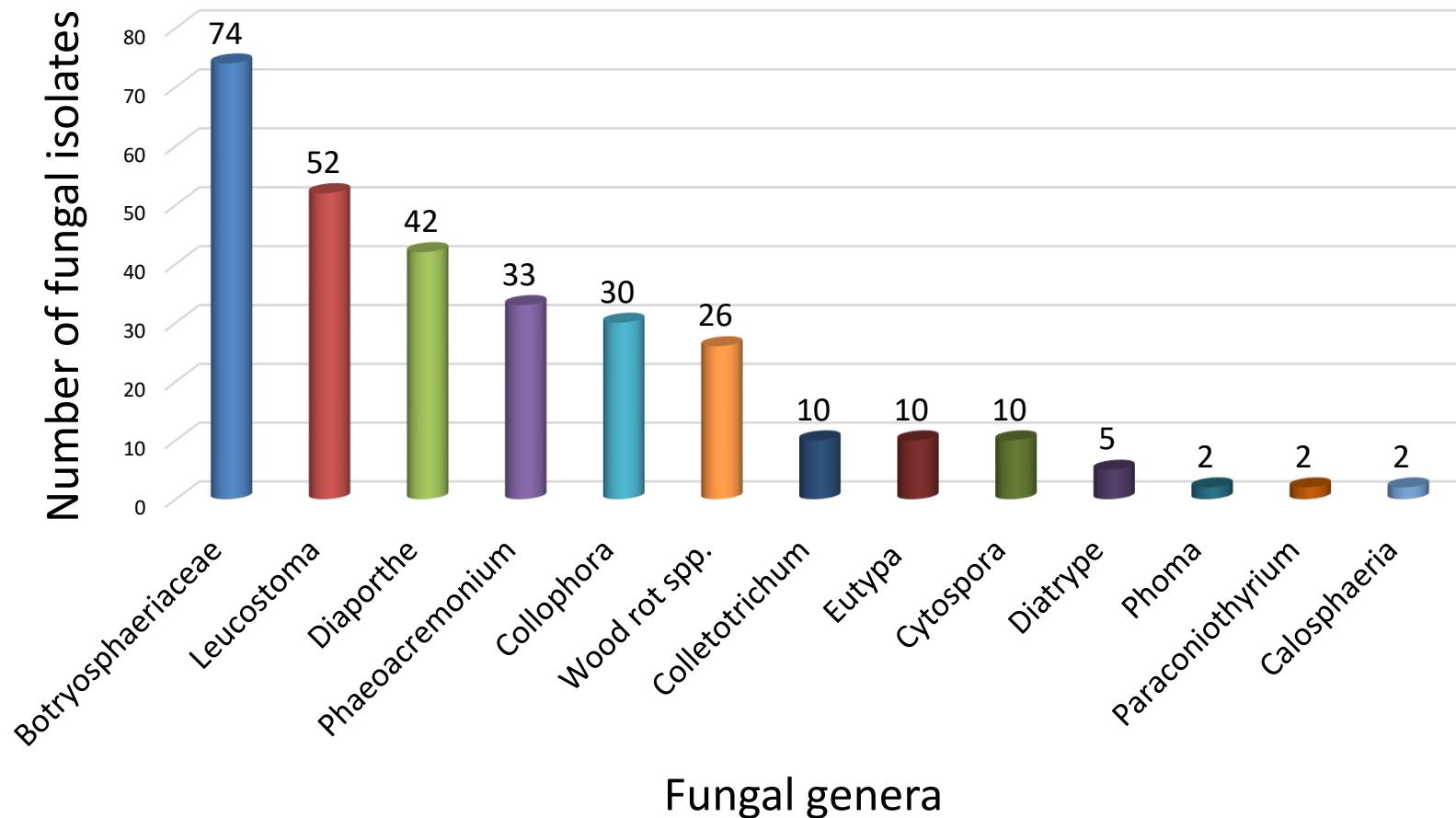
210 stone fruit trees analysed 2007 – 2022
(above ground symptoms due to cankers/wood rot)



Plant Disease Clinic samples (2007-2022)



Fungal species isolated from diseased stone fruit trees





Economic impact?



HORTGRO project

- **Occurrence of canker and wood rot pathogens on stone fruit propagation material and nursery stone fruit trees: 2017-2019**
- **Aim: Evaluate the phytosanitary status of stone fruit propagation material and nursery stone fruit trees**
- **Objectives:**
 - Occurrence of fungal canker and wood rot pathogens in:**
 - scion and rootstock stone fruit propagation material
 - nursery stone fruit trees
 - Determine pathogenicity of species found**

Scion material

120 shoots per cultivar

Green scion shoots

3 plum cultivars

1 nectarine cultivar

Dormant scion shoots

3 plum cultivars



Isolations

8 buds per shoot



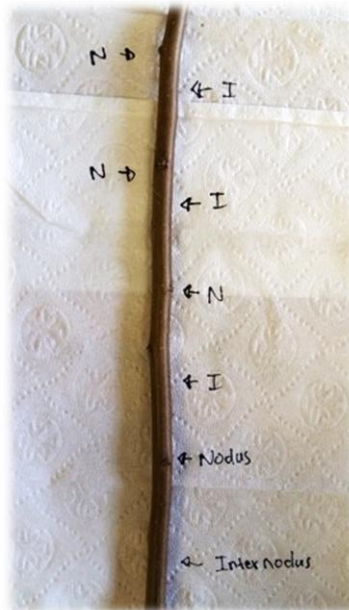
Rootstock material

Dormant rootstock shoots

180 shoots per cultivar
3 plum cultivars
1 nectarine cultivar

Isolations

8 disks per shoot



Node



Internode

Rootstock material



Ungrafted, rooted rootstock plants

120 plants per cultivar
3 plum cultivars
2 nectarine cultivars

Isolations

Tip



Crown



Wounds



Results: Scion material

Green scion buds

0.4% out of 3840 buds

Coniochaeta prunicola

Dormant scion buds

1.2% out of 2880 buds

Truncatella angustata

- Higher infection in dormant buds versus green buds
 - Longer exposure to aerial inoculum

Results: Rootstock material

Dormant rootstock shoots

600 shoots

6.2% canker pathogens

Cytospora leucostoma

Ungrafted, rooted rootstock plants

378 plants

10.6% canker and
wood rot pathogens

6.4% *Cylindrocarpon*-like
fungi

Cadophora luteo-olivacea

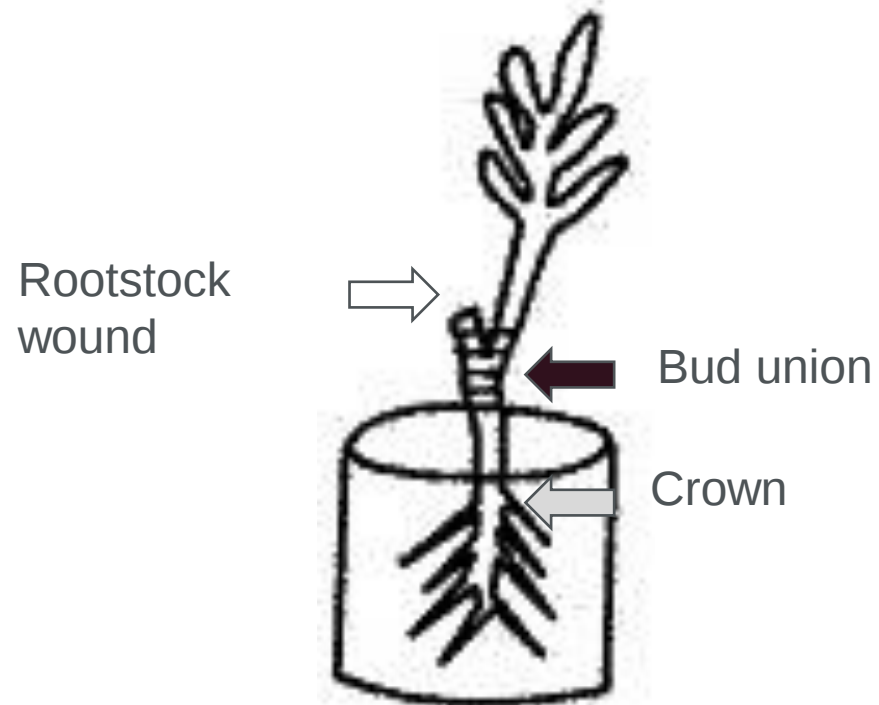
- Dormant shoots from mother trees already infected
- Most infection were observed from the crown of ungrafted, rootstock plants

Nursery trees

120 trees per scion/rootstock combination

3 plum scion on 3 rootstock cultivars

1 nectarine scion on 2 rootstock cultivars



Isolations

8 wood pieces per
plant part

Nursery tree symptoms



Vascular streaking

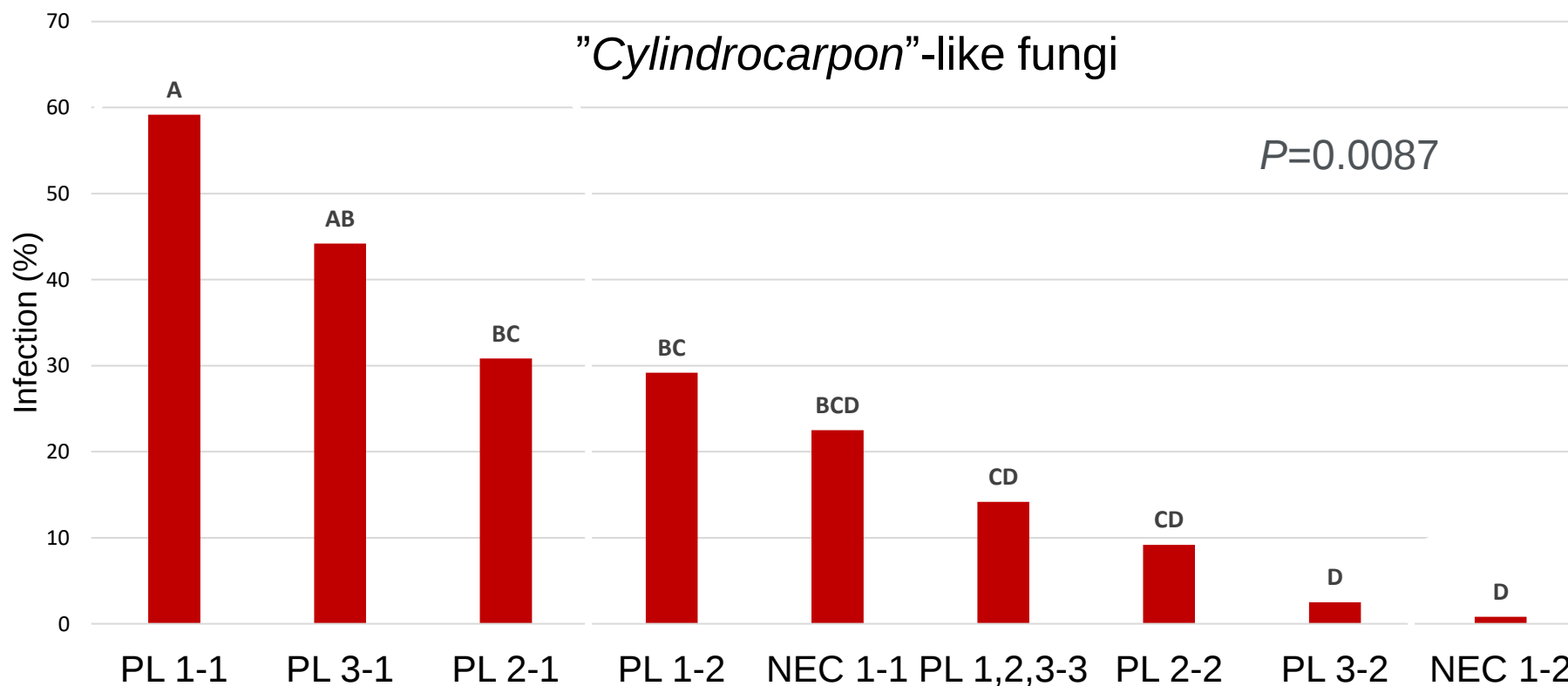


Results: Nursery trees

Total 1080 trees

Canker and wood rot
pathogens
22%

Cylindrocarpon-like fungi
24%



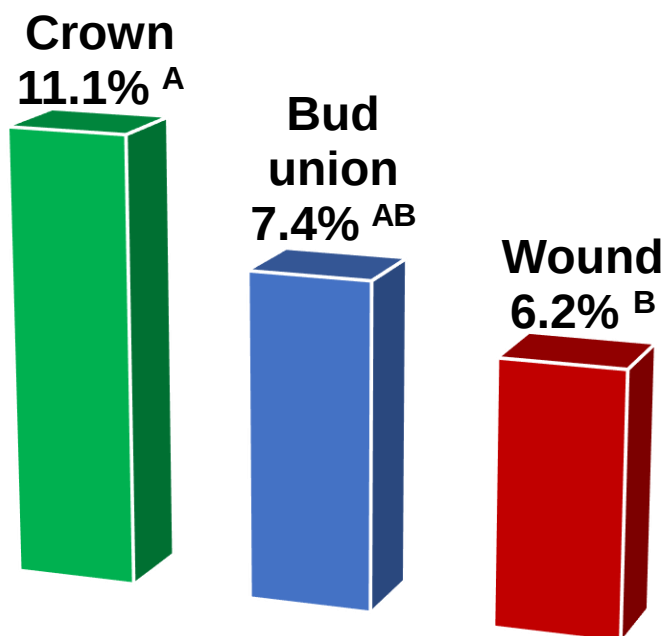


Results: Nursery trees

Plant parts infected

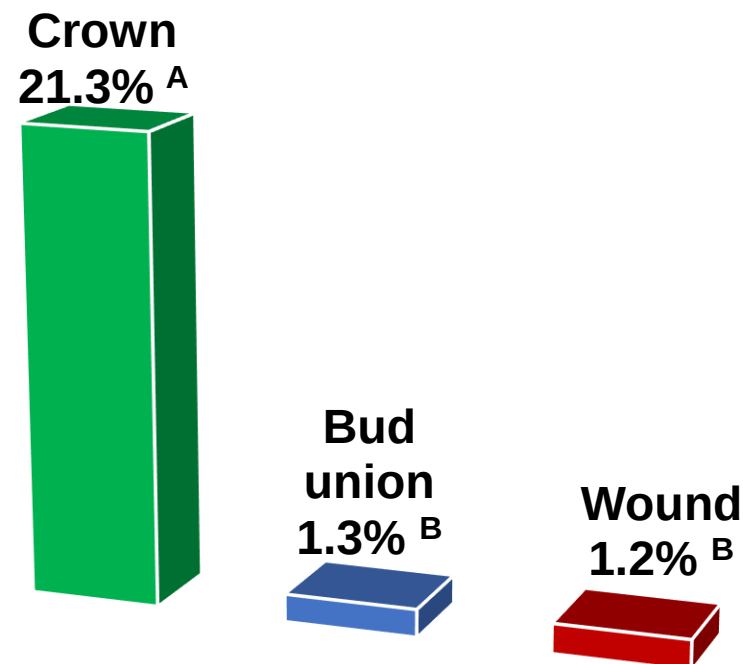
(Total 1080 per part)

Canker and wood rot pathogens



$P=0.0596$

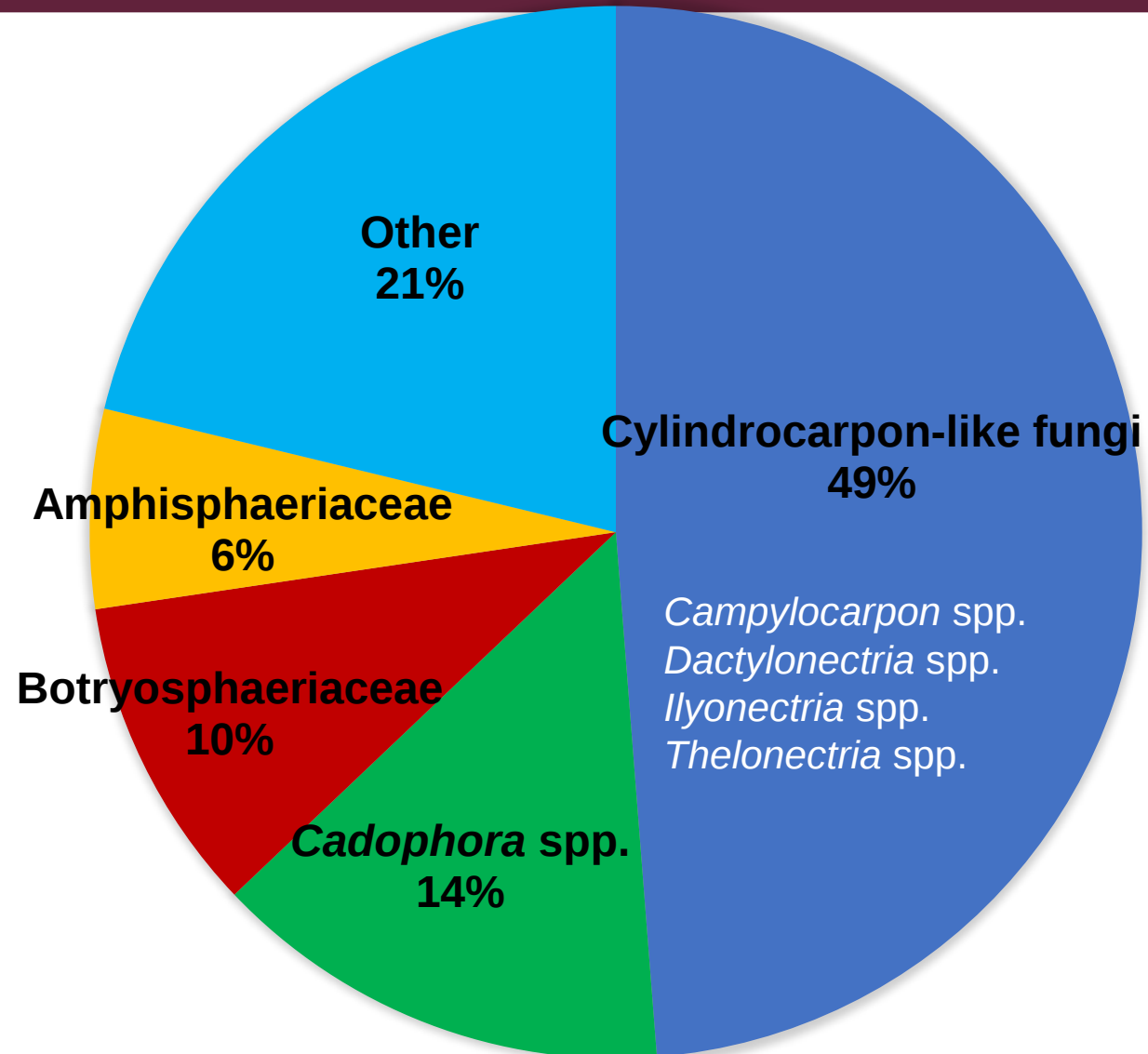
Cylindrocarpon-like fungi



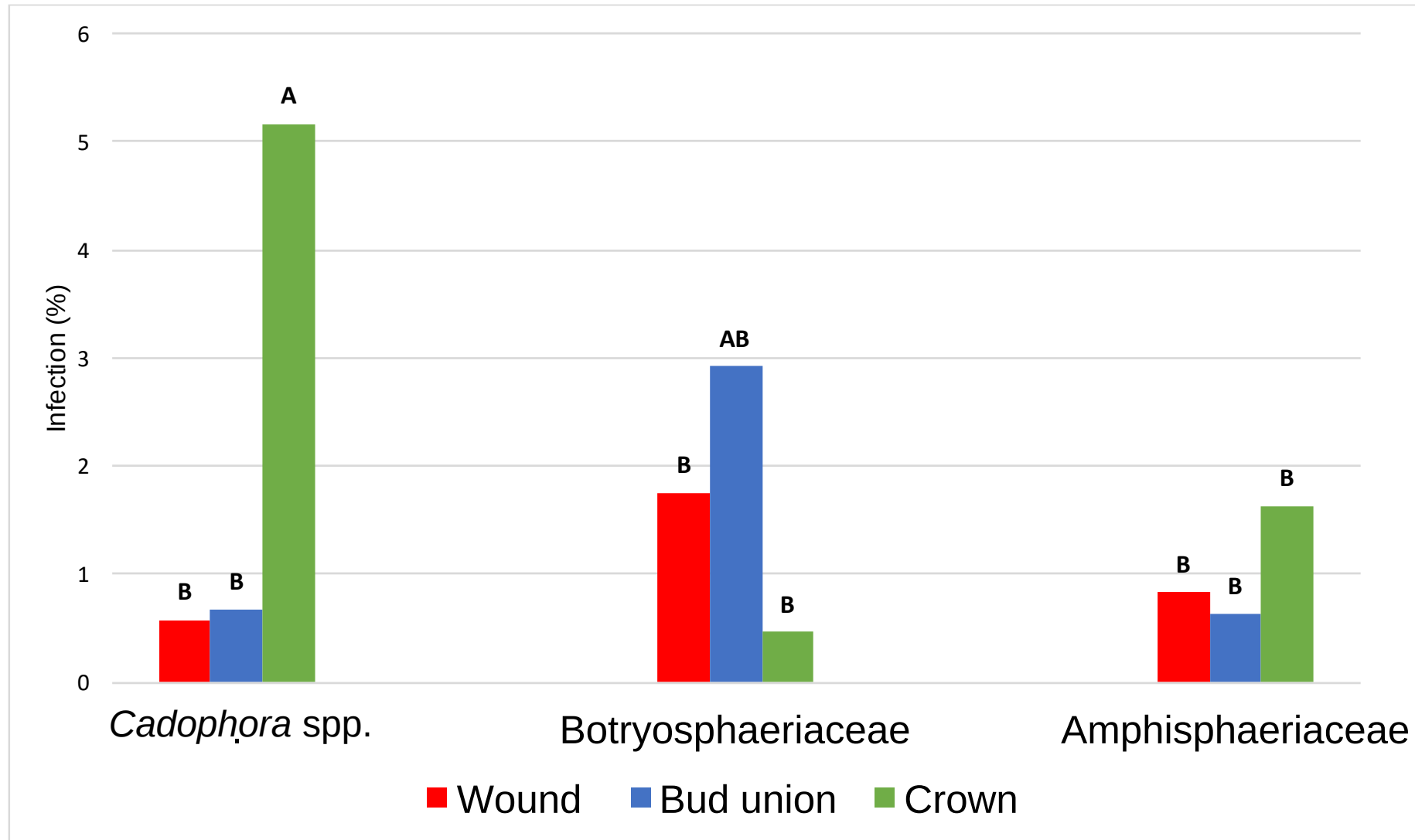
$P < .0001$



Fungal groups – Nursery trees infected



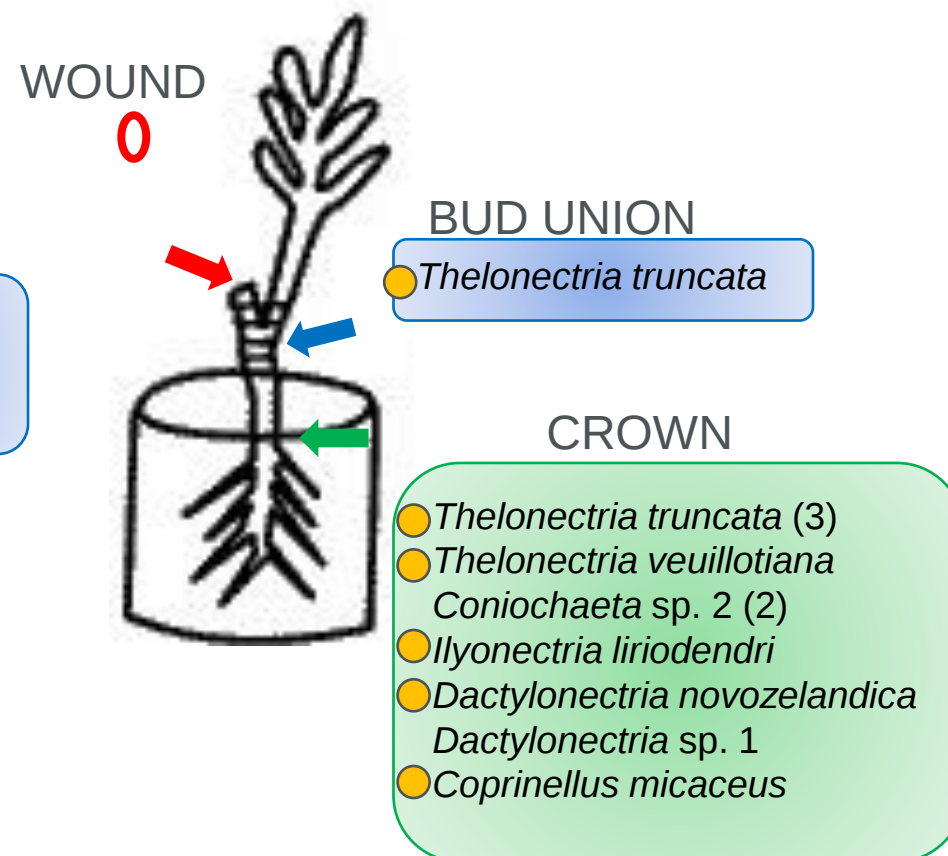
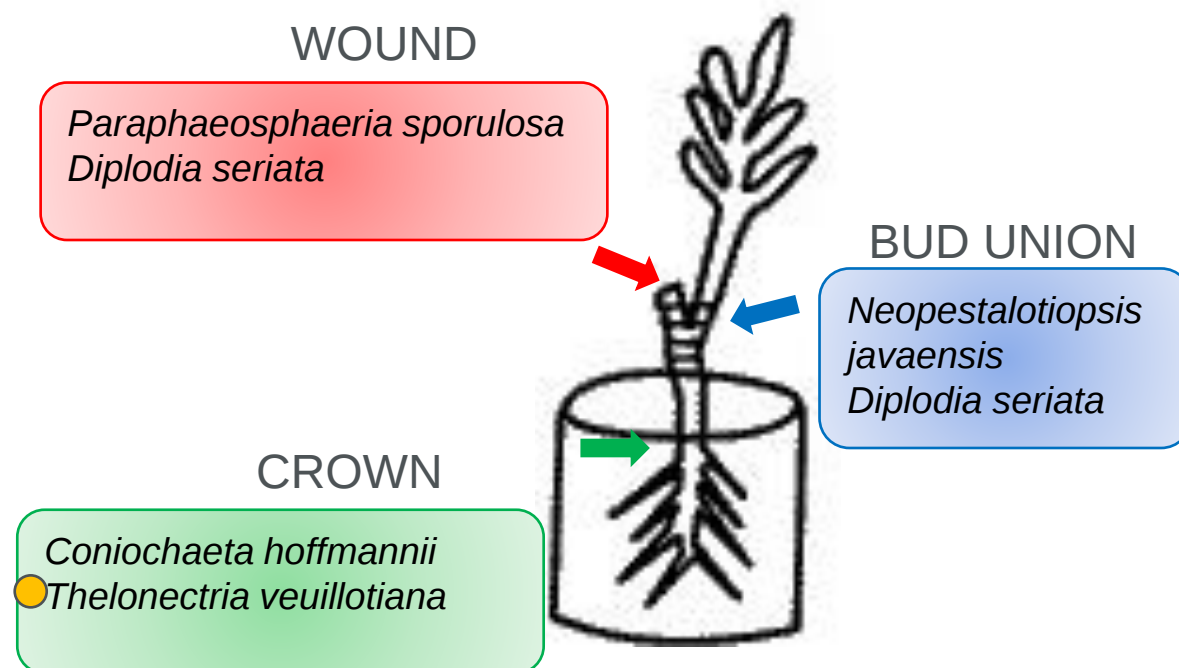
Canker fungal groups – Plant parts



Additional nursery tree trial

Tissue culture

Hard wood



● Cylindrocarpon-like fungi

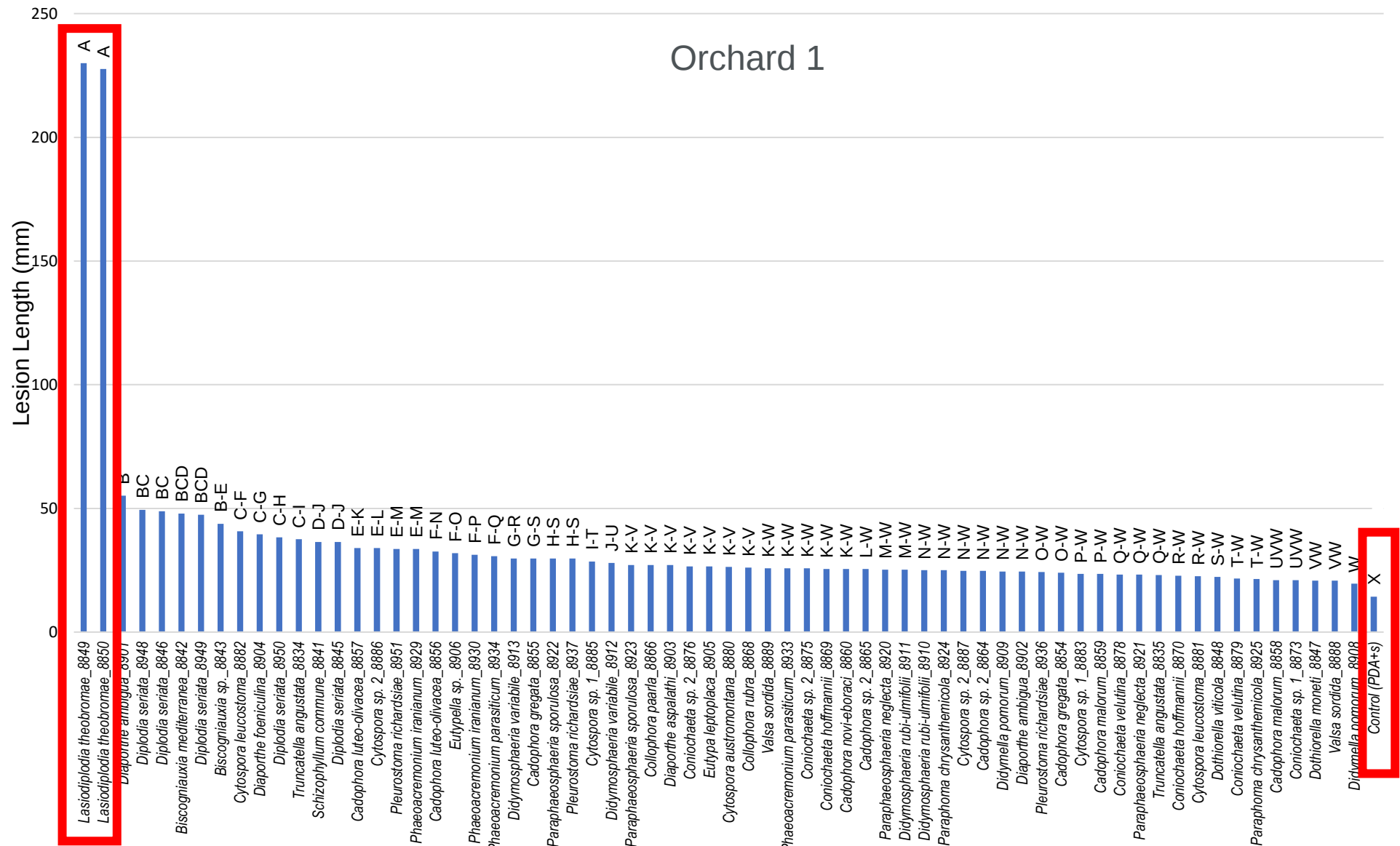
Pathogenicity test: canker pathogens

- 2 plum orchards
 - 2-3 year-old shoots
- Each isolate inoculated on 10 shoots
- Wound inoculated
- Shoots cut after 4 months





Pathogenicity test: canker pathogens



Pathogenicity test: canker pathogens



- All the isolates were pathogenic to plum
- *Lasiodiplodia theobromae*
 - Cankers on almonds in California (Chen *et al.*, 2013)
 - Dieback on nectarines in Turkey (Endes *et al.*, 2016)
 - Gummosis on peaches in China (Wang *et al.*, 2011)
- *Biscogniauxia* spp. - Charcoal Canker on Oak
 - Plum - *B. rosacearum* (Raimondo *et al.*, 2016)
 - Current study: *B. mediterranea* - Pathogenic to plum

Pathogenicity: Cylindrocarpon-like

Detached rootstock shoot assay

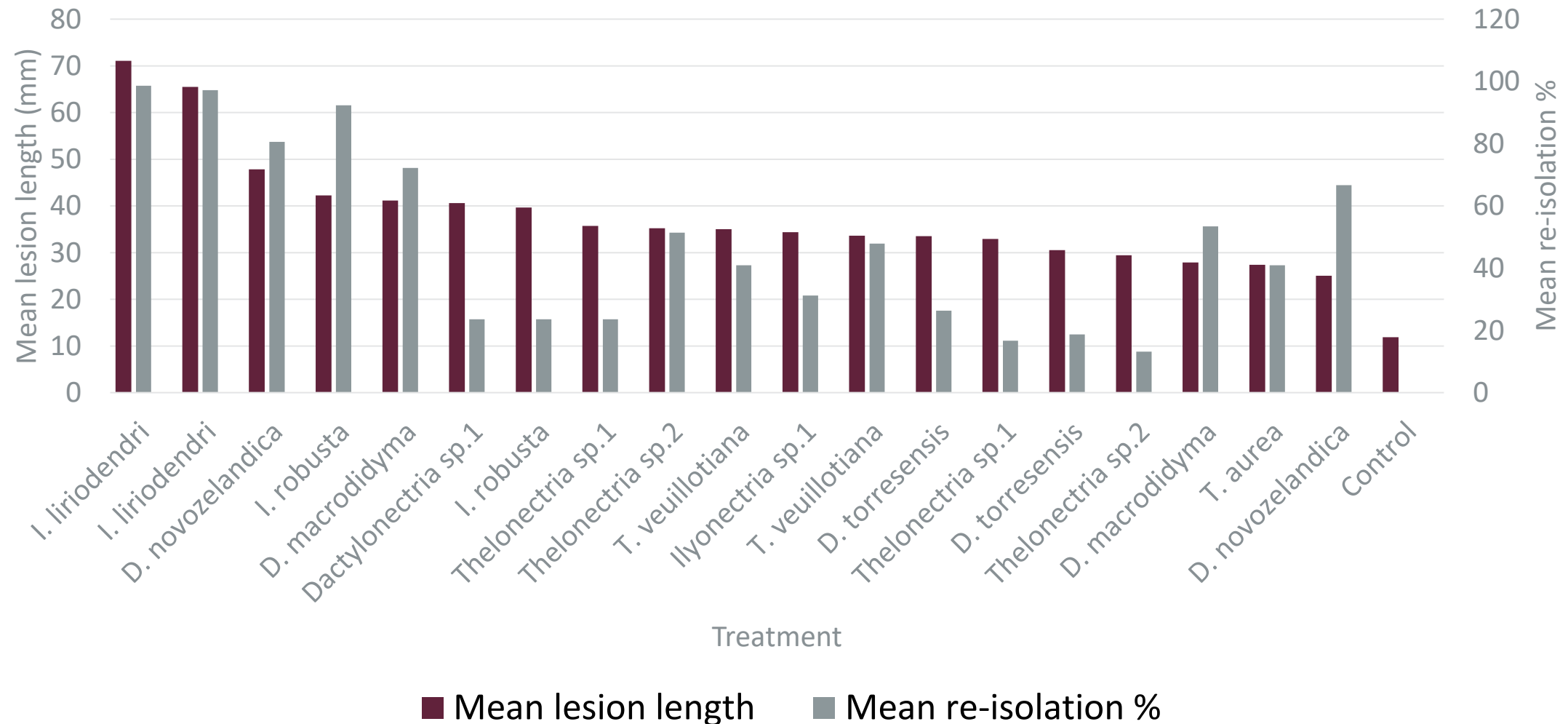
- Plug inoculation
- 3 shoots per treatment, two cultivars of plum (Maridon and Mariana)
- Lesions measured after 7 weeks



Pathogenicity testing: Cylindrocarpon-like



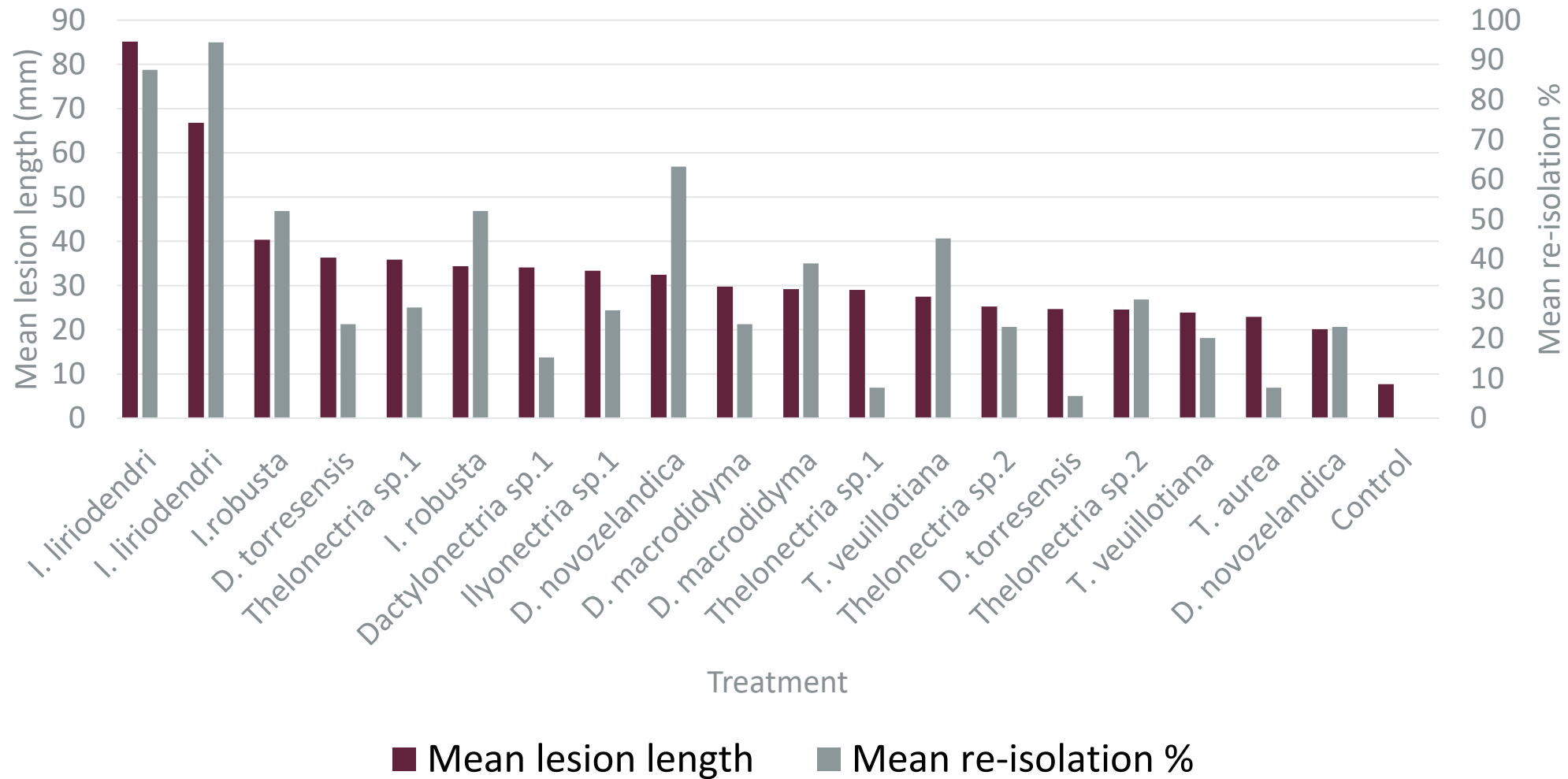
- Mean lesion length and re-isolation % (Maridon)



Pathogenicity testing: Cylindrocarpon-like



- Mean lesion length and re-isolation % (Mariana)

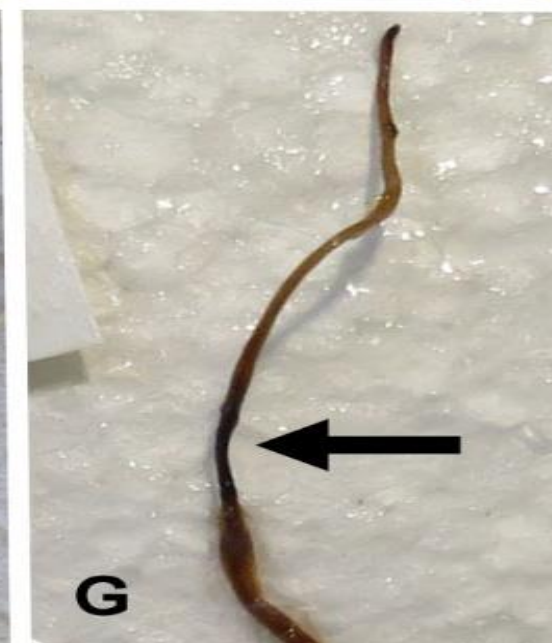
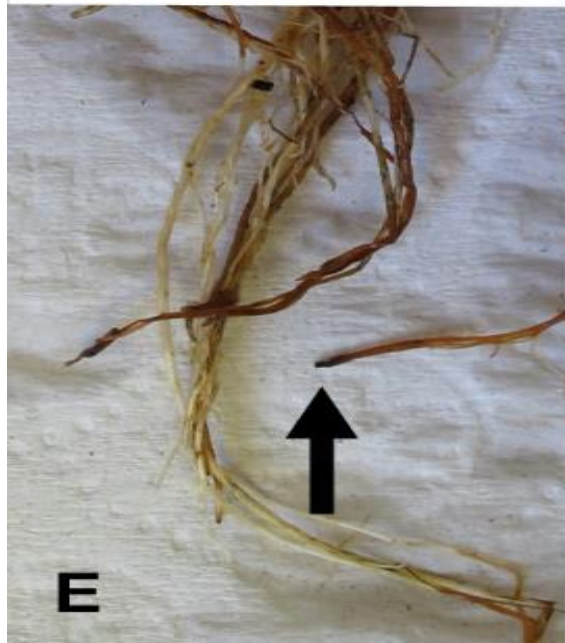
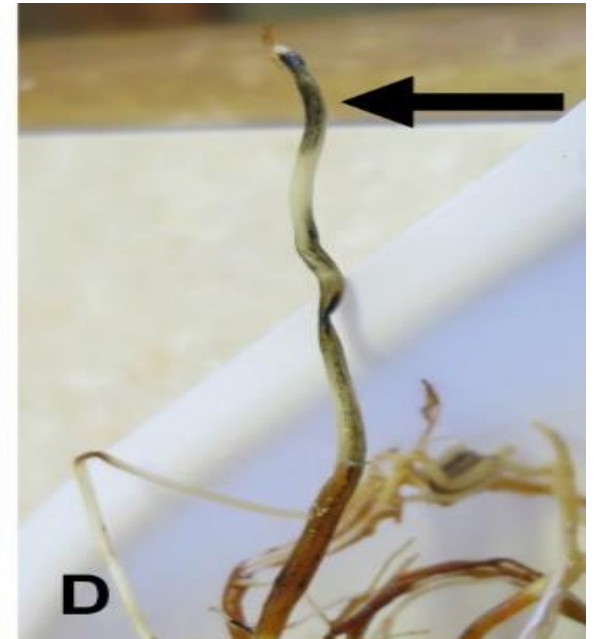
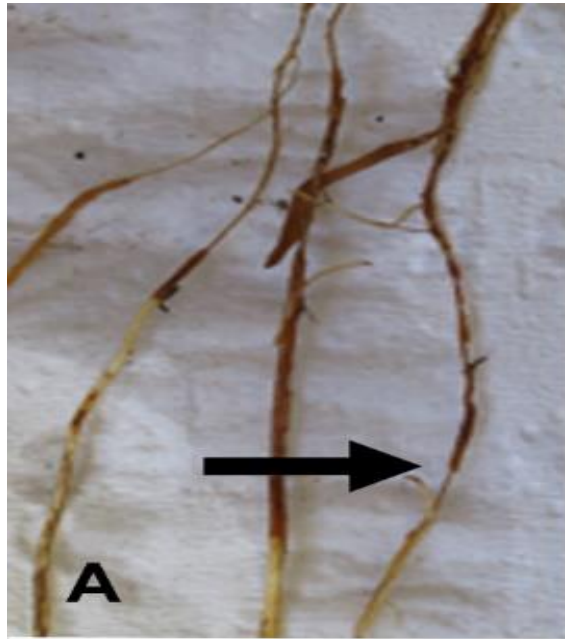


Pathogenicity testing: *Cylindrocarpon*-like

Millet seed, whole plant assay (Protocol by Strauss and Labuschagne, 1995)

- 6 plants per treatment, two peach cultivars (GF677 and Atlas tissue culture rootstock plants)
- Waterlogging stress induced during week 3 to 5



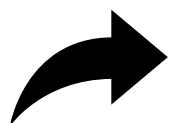


Pathogenicity testing: Cylindrocarpon-like



- **Millet seed whole plant assay**
 - Cultivar Atlas assessed after 8 weeks and GF677 after 12 weeks
 - No significant differences between root weight of treated plants versus control plants
- **Relevance of Cylindrocarpon-like fungi in young stone fruit orchards should be determined by;**
 - Longer pathogenicity trials

In summary



- **Stone fruit nursery trees** and **propagation material** can harbor latent infections of canker and wood rot pathogens.



- Different **management practices** need to be evaluated to prevent these infections and ensure cleaner stone fruit nursery trees.

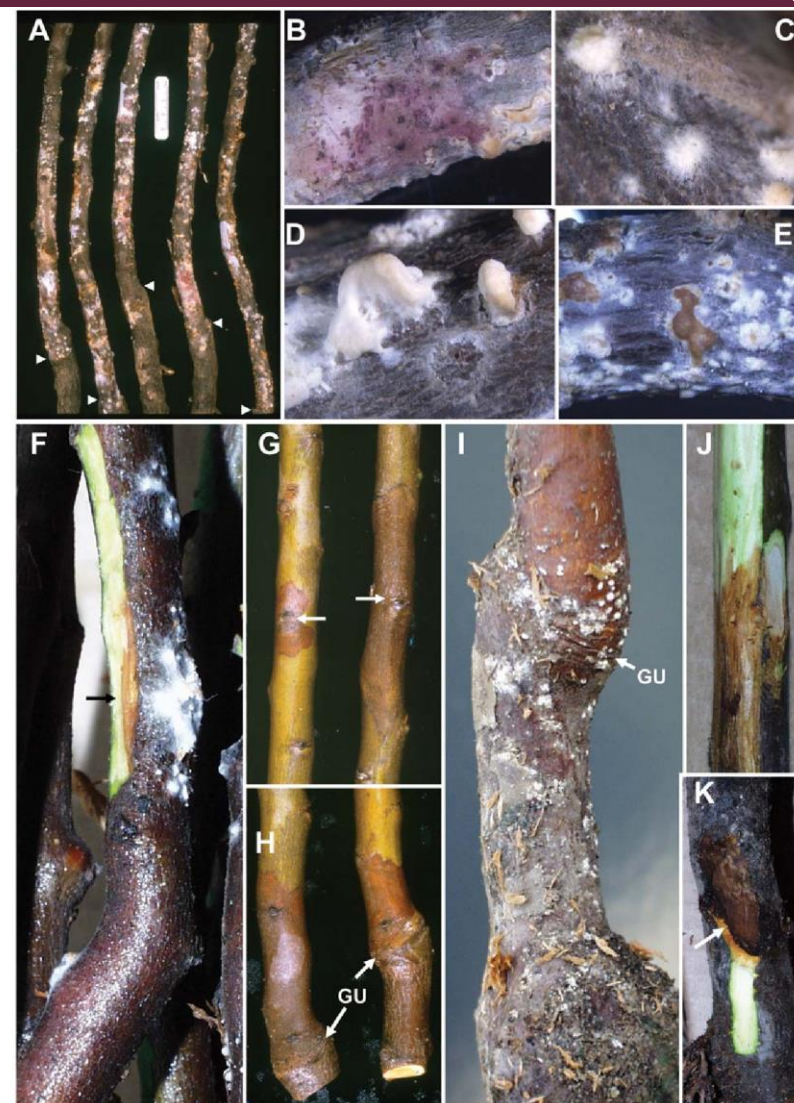
Management practices: nurseries



- Crown protection
- Tissue culture rootstock plants – **game changer**
- Cleaner buds; **budding practices**
- **Rootstock wound protection**
- **Sanitation** (remove dead wood/shoots)

Management practices: nursery/on farm

- Handling of trees – cold storage
- Marek et al. (2013): **Cold storage canker disease** in dormant stone fruit and apple tree seedlings maintained in refrigerated storage (California)
- *Fusarium*, *Cylindrocarpon*, *Ilyonectria*



Cold storage signs and symptoms of almond and apple trees

Management practices: nursery/on farm



Predisposing stresses can be minimized (Marek et al. 2013):

- lifting trees from the fields prior to hard frosts,
- maintaining storage temperatures between 0 and 4°C,
- keeping trees well hydrated without excessive free water,
- and transplanting trees quickly to the growers' fields after removing from cold storage.

Management practices: in orchard

- Planting practices in orchards



Outcome: DPA Schedule 1 amended

PART 3: PHYTOSANITARY REQUIREMENTS [section 11.3, 12.1.2]

October 2019

3.1.1.2 Plant material and plants shall be visually free of the following pathogens/diseases:

Pseudomonas syringae pv. *syringae* (Bacterial canker)

Pseudomonas syringae pv. *morsprunorum* (Bacterial canker)

Xanthomonas campestris pv. *pruni* (Bacterial spot)

Agrobacterium tumefaciens (Crown gall)

Agrobacterium rhizogenes (Crown gall)

Chondrostereum purpureum (Silver leaf)

Diaporthe spp., *Diplodia seriata*, *Cytospora* spp., *Eutypa lata*,
(Cankers)

Schizophyllum commune, *Trametes versicolor* (Wood decay)

Armillaria, *Cylindrocarpon*, *Dactylonectria* (Root and crown rot organisms)

Phytophthora

Pythium

Rhizoctonia

Rosellinia

Verticillium



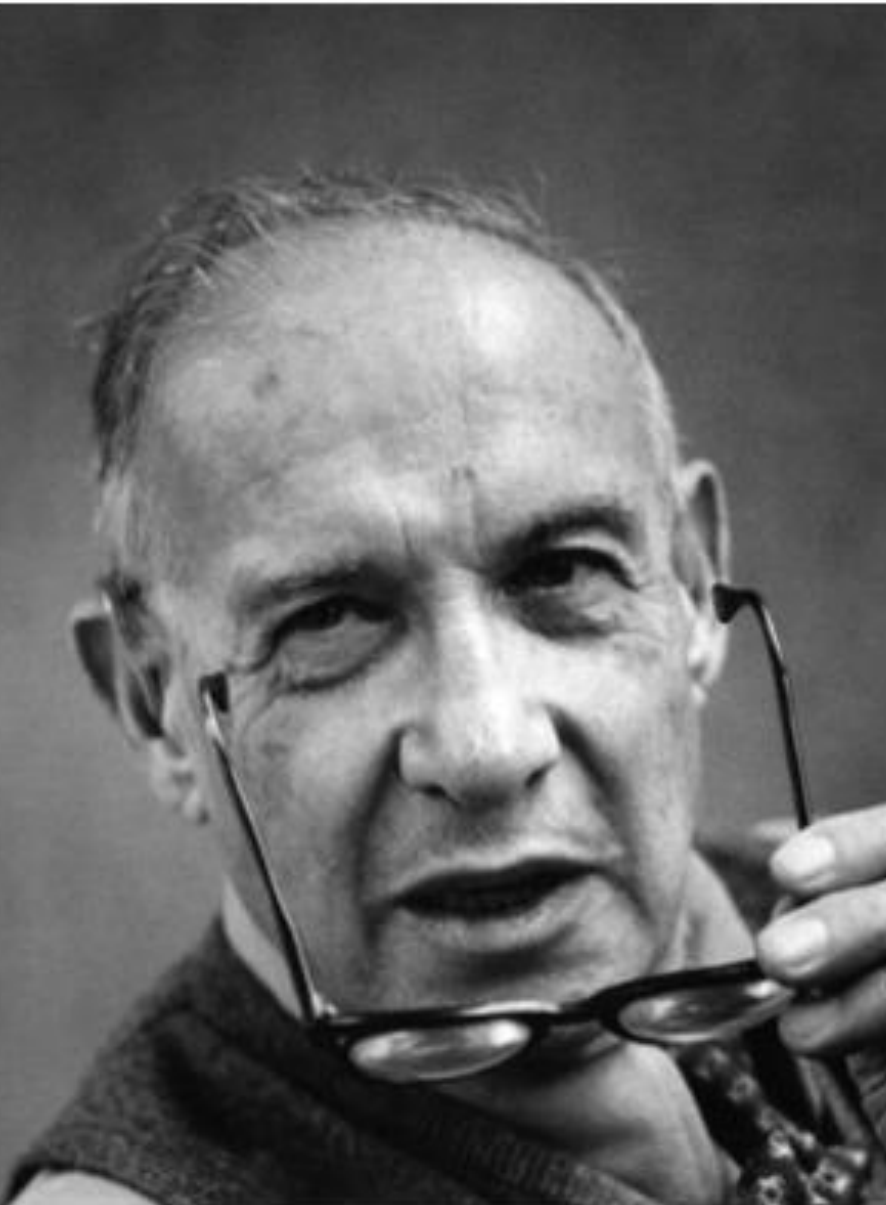
spv | dpa

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You can't manage what you don't
measure.

— *Peter Drucker* —

AZ QUOTES



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saam vorentoe

thank
you

enkosi

dankie

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Growing Fruit IQ



science