

# EPIDEMIOLOGY OF FUNGAL CANCKER DISEASES OF SWEET CHERRY

Florent Trouillas

UC Davis, Department of Plant Pathology

Collaborators:

**Sampson Li**, Graduate Student, Dept. of Plant Pathology, UC Davis

**Renaud Travadon**, Project Scientist, Dept. of Plant Pathology, UC Davis

**Daniel Lawrence**, Project Scientist, Dept. of Plant Pathology, UC Davis

**Mohamed Nouri**, Farm advisor, UCCE San Joaquin County

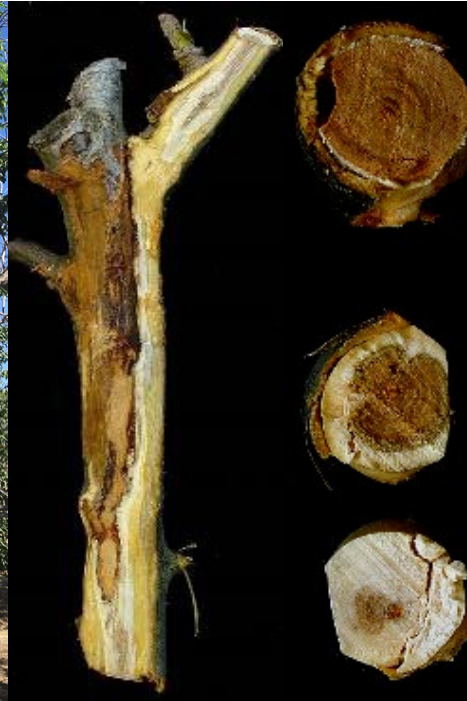
**Kari Arnold**, Farm advisor, UCCE Stanislaus County

**Mohammad Yaghmour**, Farm advisor, UCCE Kern County

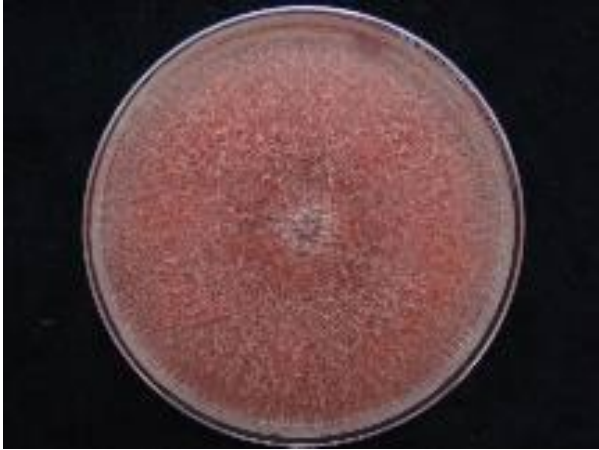
**Objective 1**: Determine the seasonal susceptibility of pruning wounds (winter vs summer pruning) to fungal canker pathogens

**Objective 2**: Investigate the infection pathways of fungal canker pathogens

# Symptoms: canker and dieback



## Causal agents: fungal pathogens (Trouillas et al. 2012)



*Calosphaeria pulchella*



*Cytospora sorbicola* (Syn.=  
*Leucostoma personii*)



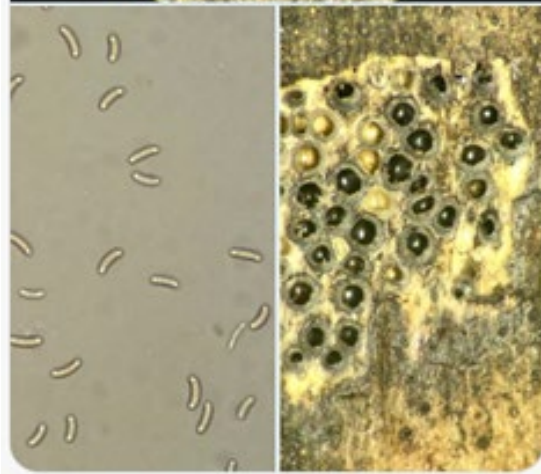
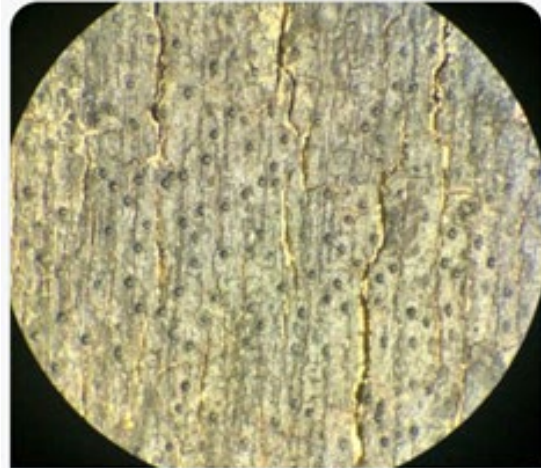
*Eutypa lata*



*Calosphaeria pulchella*



*Cytospora sorbicola*



*Eutypa lata*

UCDAVIS

# Investigating the main infection pathways of canker pathogens



# Pruning wound infection:



# Canker diseases epidemiology:

- Shoot and spur dieback in the absence of pruning wounds



# Disease epidemiology:

- Dead spurs are common in cherry orchards



# Canker diseases epidemiology:

- Field surveys and tree sampling

Shoot dieback (no pruning wound)



Spur dieback (no pruning wound)

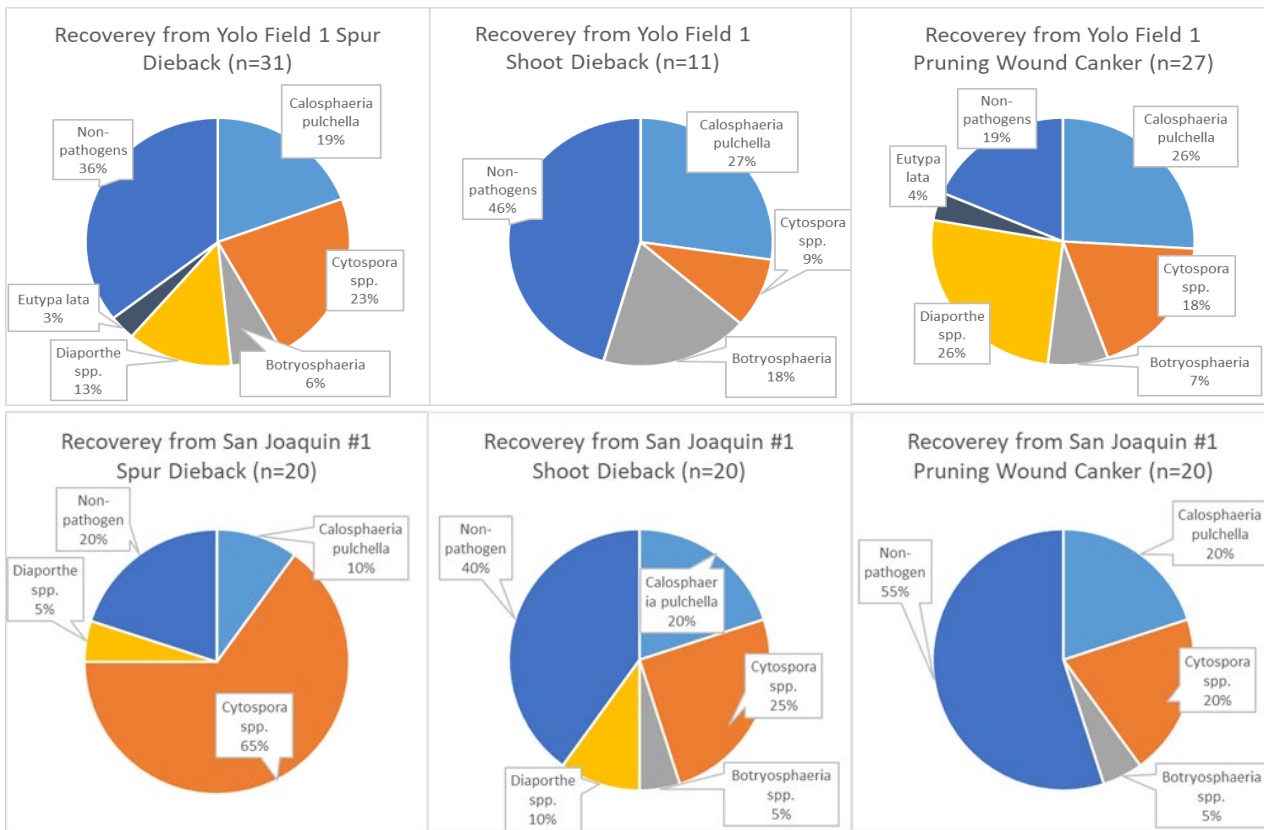


Cankers below pruning wounds



# Canker diseases epidemiology:

## ➤ Orchard surveys and tree sampling



Recovery of canker-causing fungi from spurs and shoots showing dieback (no pruning wound), and from branch cankers below pruning wounds

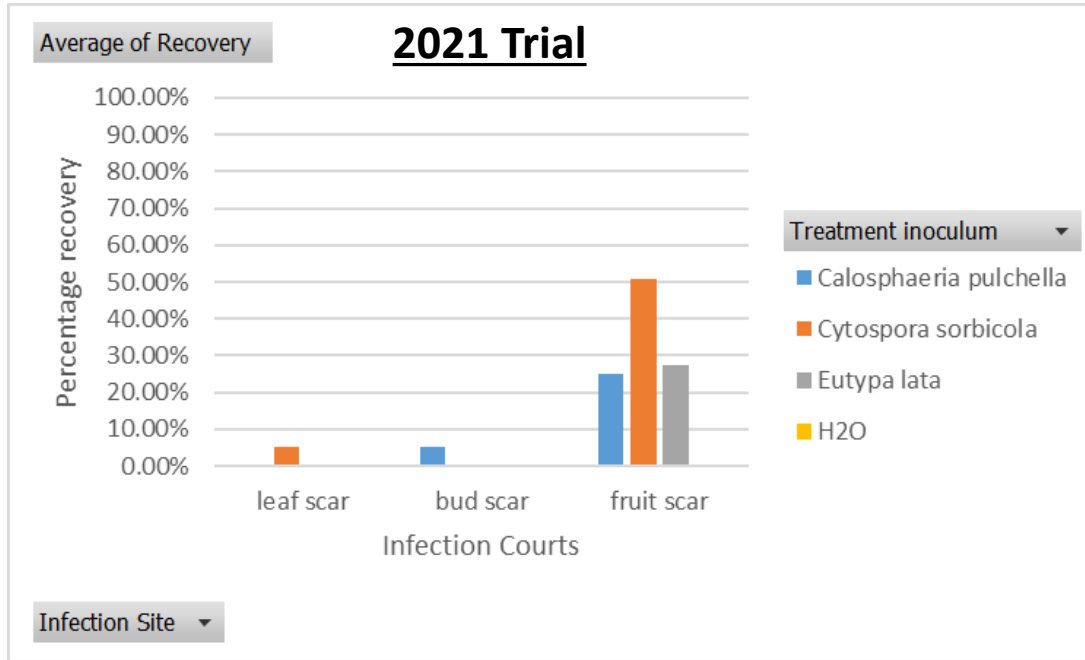
# Canker diseases epidemiology:

➤ Determine alternative infection pathways, other than pruning wounds

- Leaf scars (fall)
- Bud scars (bloom)
- Fruit scars (harvest)



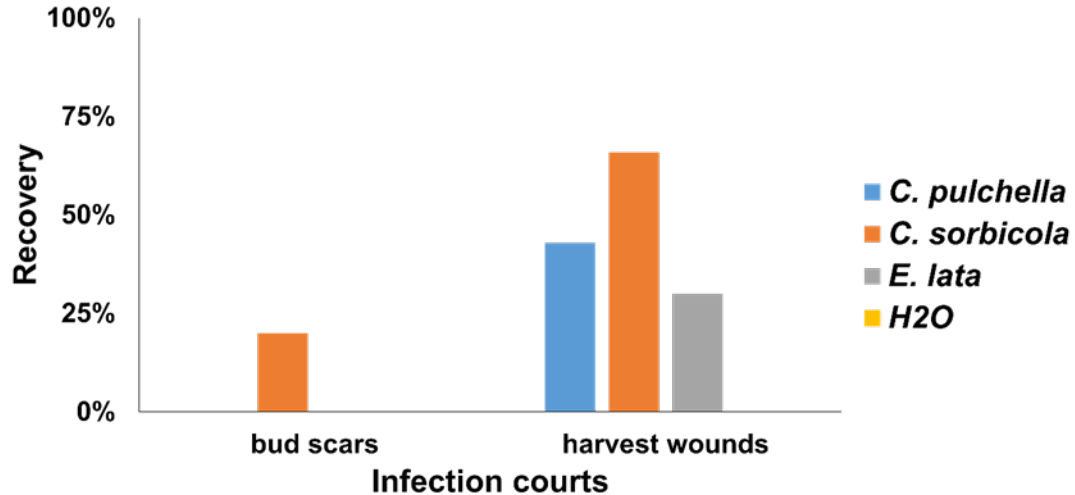
# Recovery of fungal pathogens (*Calosphaeria*, *Cytospora*, *Eutypa*) from inoculated, putative infection courts



# Recovery of fungal pathogens (Calosphaeria, Cytospora, Eutypa) from inoculated, putative infection courts

## 2022 Trial

Recovery of canker pathogens from various infection courts

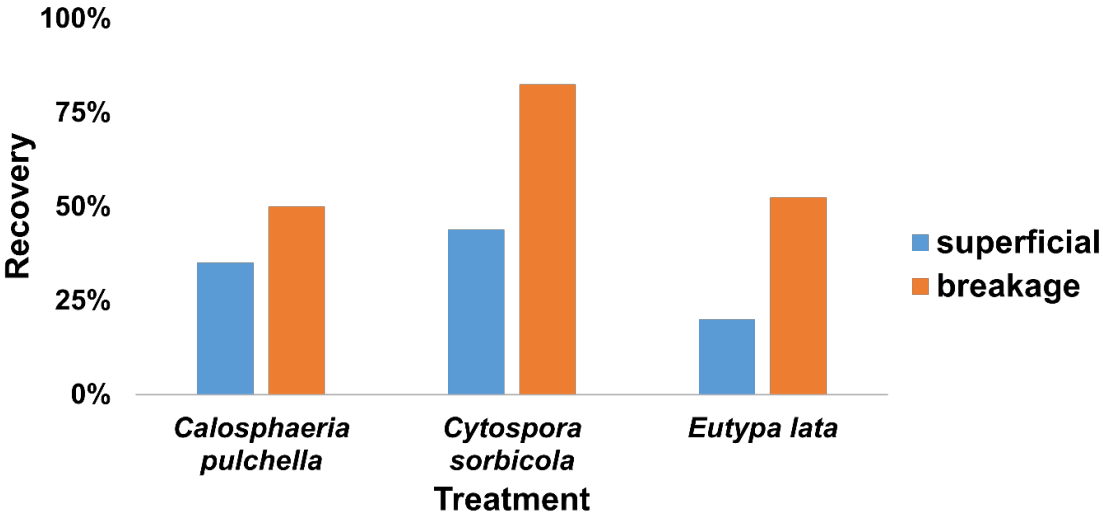




# Recovery of fungal pathogens (*Calosphaeria*, *Cytospora*, *Eutypa*) from inoculated, putative infection courts

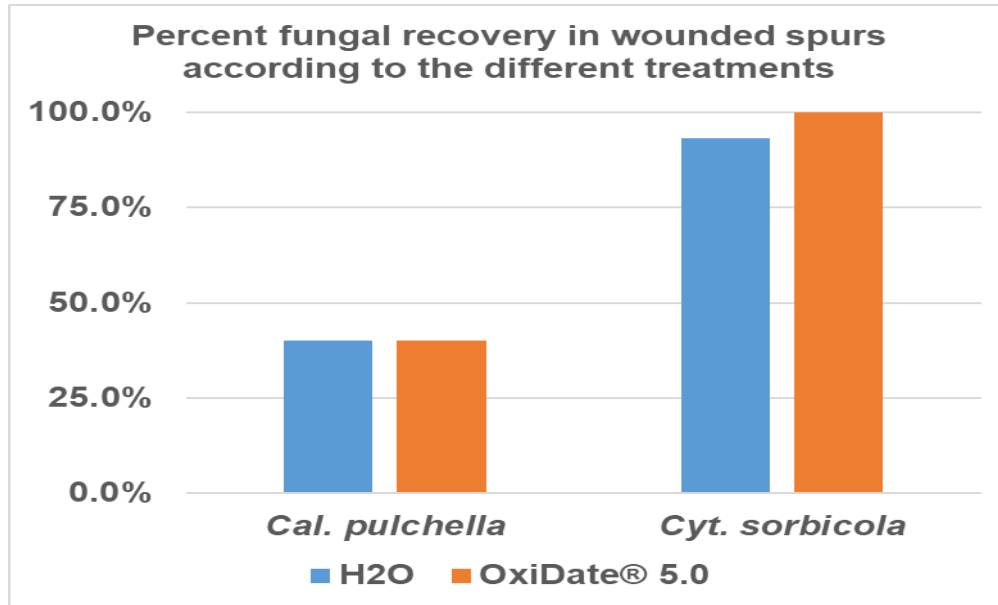
## 2022 Trial

Recovery of canker pathogen from two types of harvest wounds (on fruiting spurs)



# Are there any benefits from spraying peracetic acid/hydrogen peroxide following harvest?

## 2022 Trial



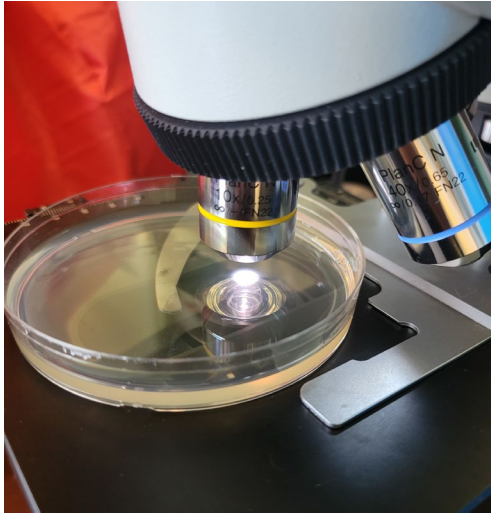
## Main conclusion:

Growers should consider a protective spray following harvest to protect wounded fruit spurs and shoots from infections by fungal canker pathogens especially if rain is in the forecast

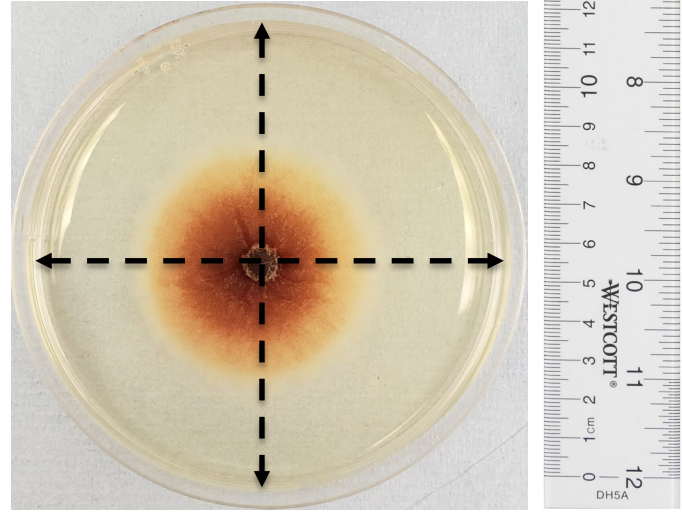


# Effect of temperature on infection by *Calosphaeria pulchella*

# Spore germination and mycelial growth



Water agar, 36 hours



PDA (4, 8, and 12 days)

5

10

15

20

25

30

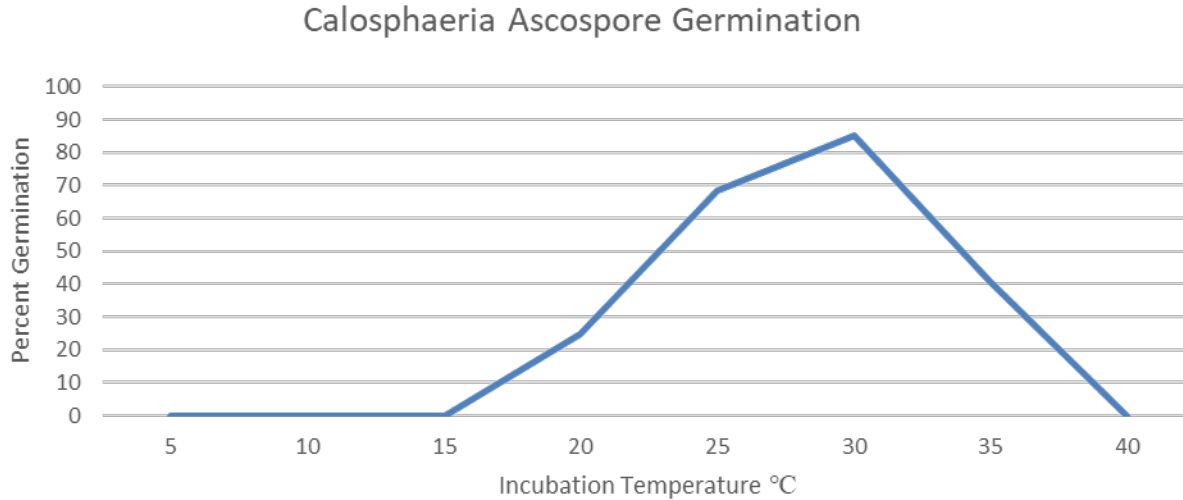
35

40

Incubation Temperature °C

# Disease biology:

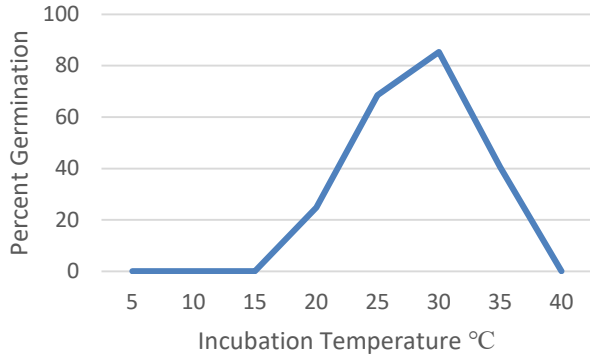
- Effect of temperature on ascospore germination for *Calosphaeria pulchella*



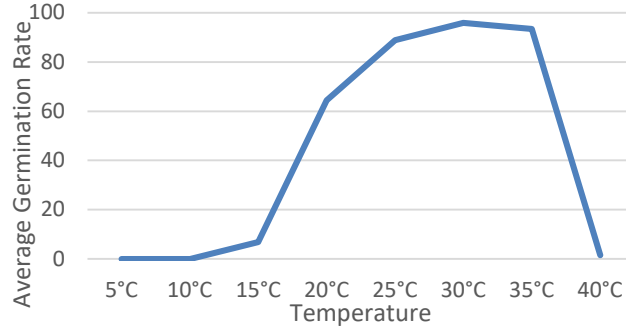
Ascospore germination rates after incubation for 36 hours in a range of temperatures. Values show an average of two repeated trials.

# Effect of temperature on spore germination for *C. pulchella*

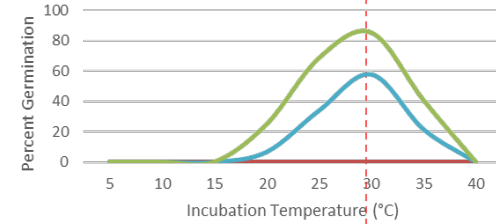
Ascospore Germination after 36 Hours



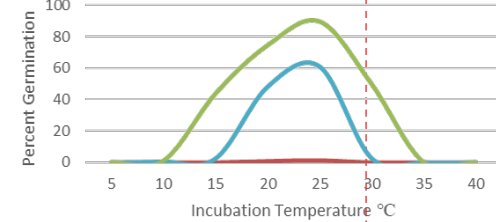
Conidial Germination after 24 Hours



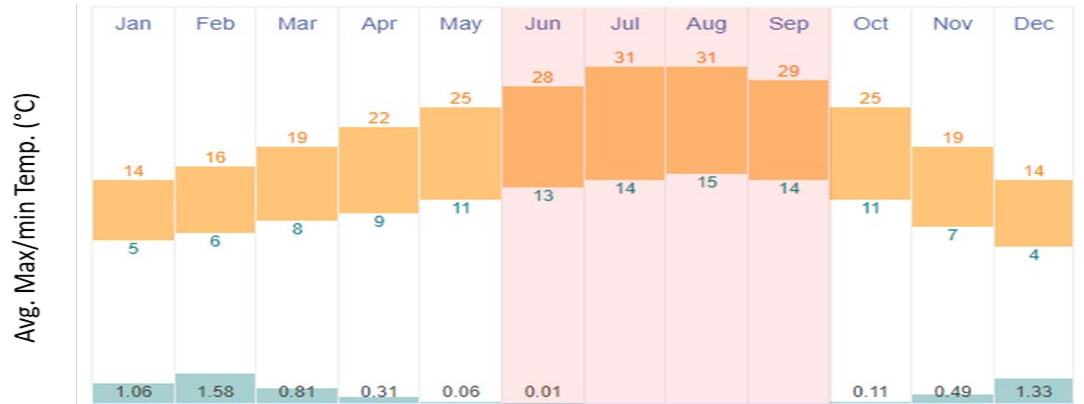
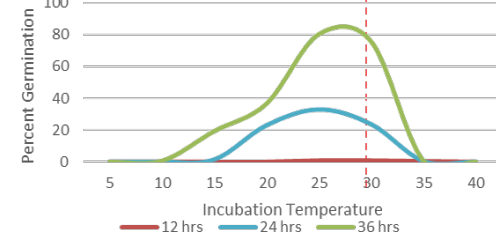
Calosphaeria Ascospore Germination



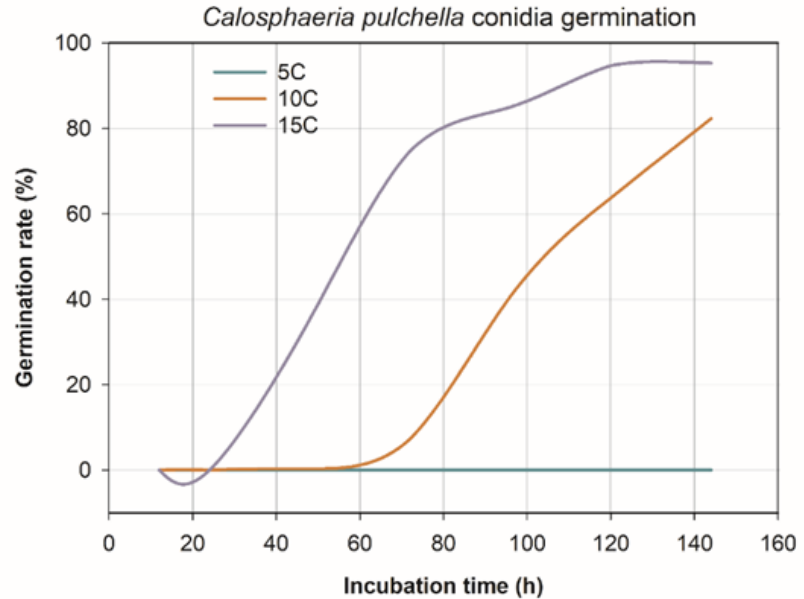
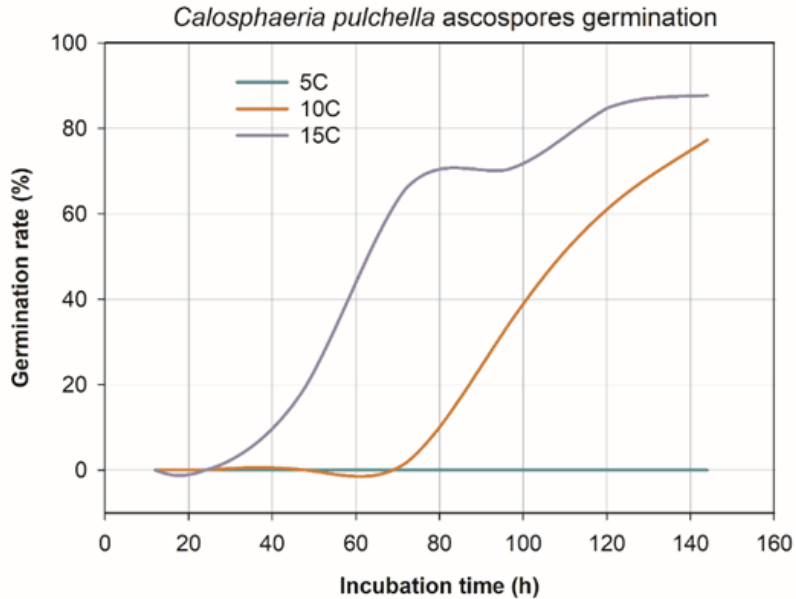
Eutypa Ascospore Germination



Cytospora Conidia Germination

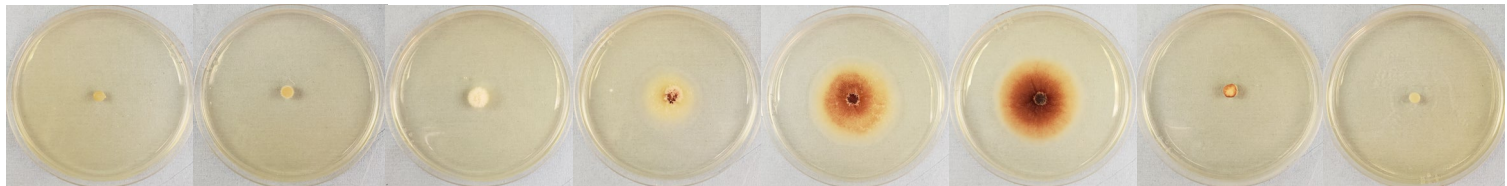
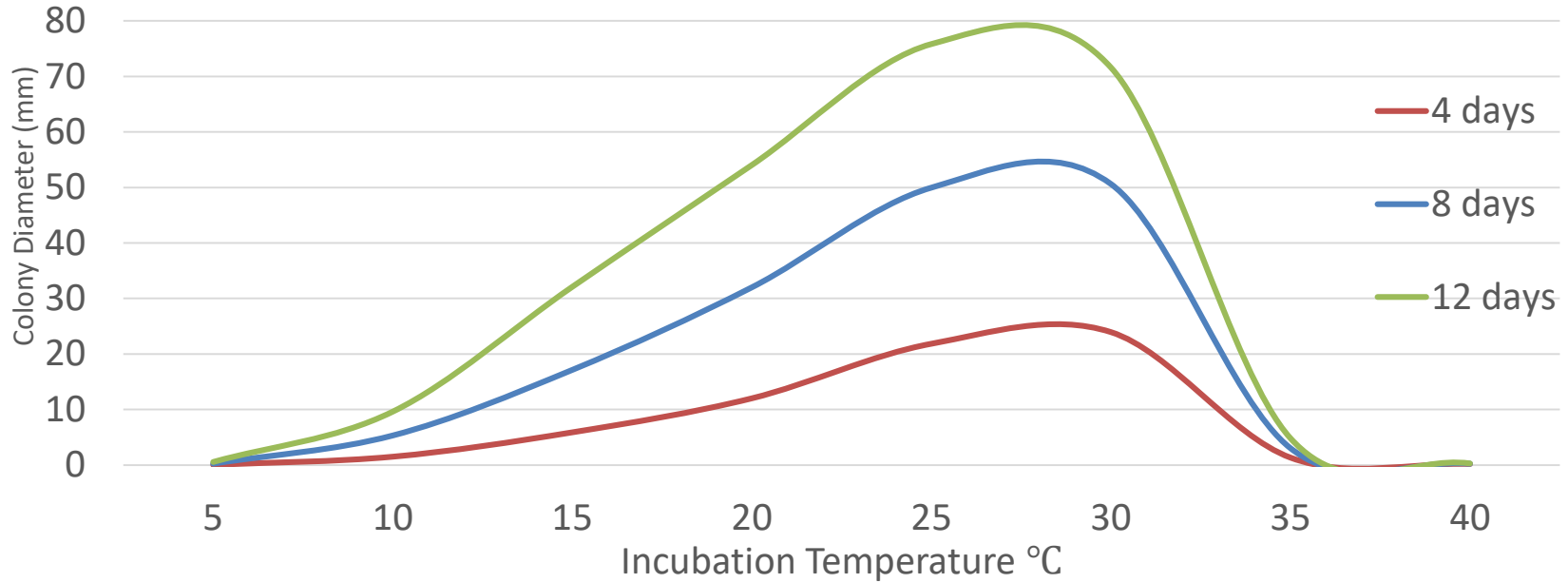


# Effect of temperature on spore germination for *C. pulchella*





# Mycelial growth



# Seasonal susceptibility of pruning wounds

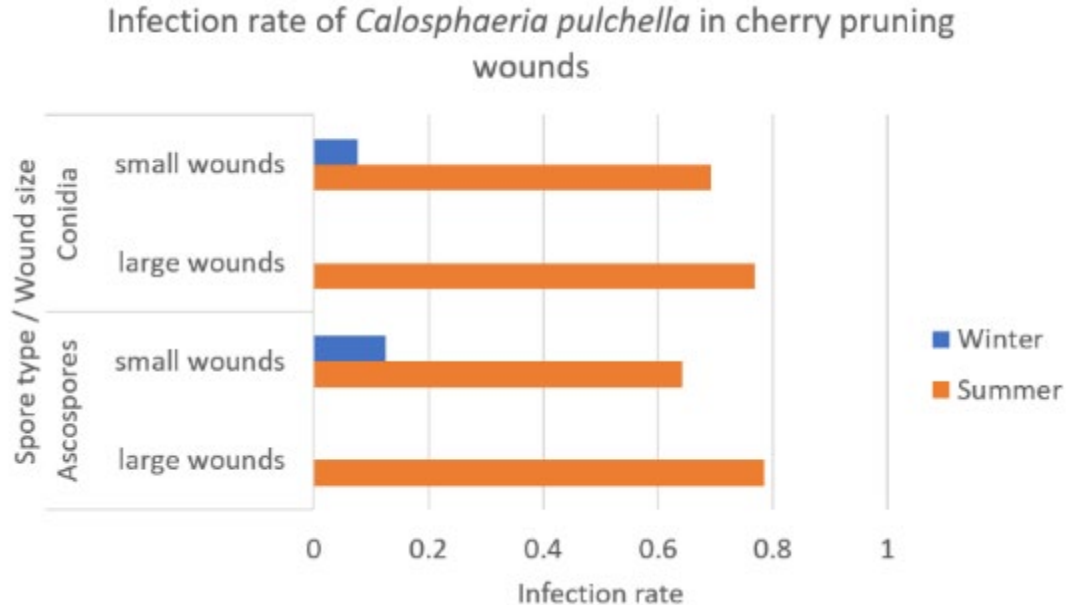
## ➤ Summer and winter pruning

- ❑ Ascospores
- ❑ Conidia
- ❑ 1 year-old branches
- ❑ 2-3 years-old branches
- ❑ 1000 spores/wound
- ❑ 10 tree replicates



# Pruning wound susceptibility according to the time of pruning:

- ❑ Winter (January 2020) vs Summer (July 2020) pruning

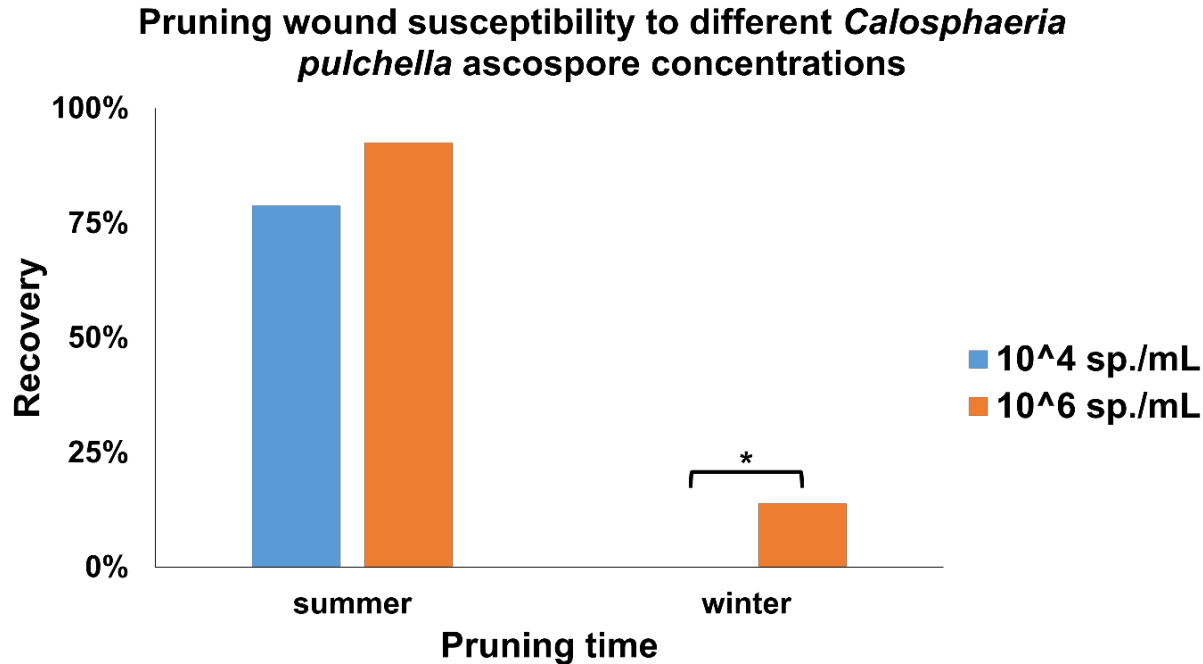


Infection of *C. pulchella* is most likely to occur during summer months (June)

**The disease may be avoided by pruning in cold (and dry) winter months**

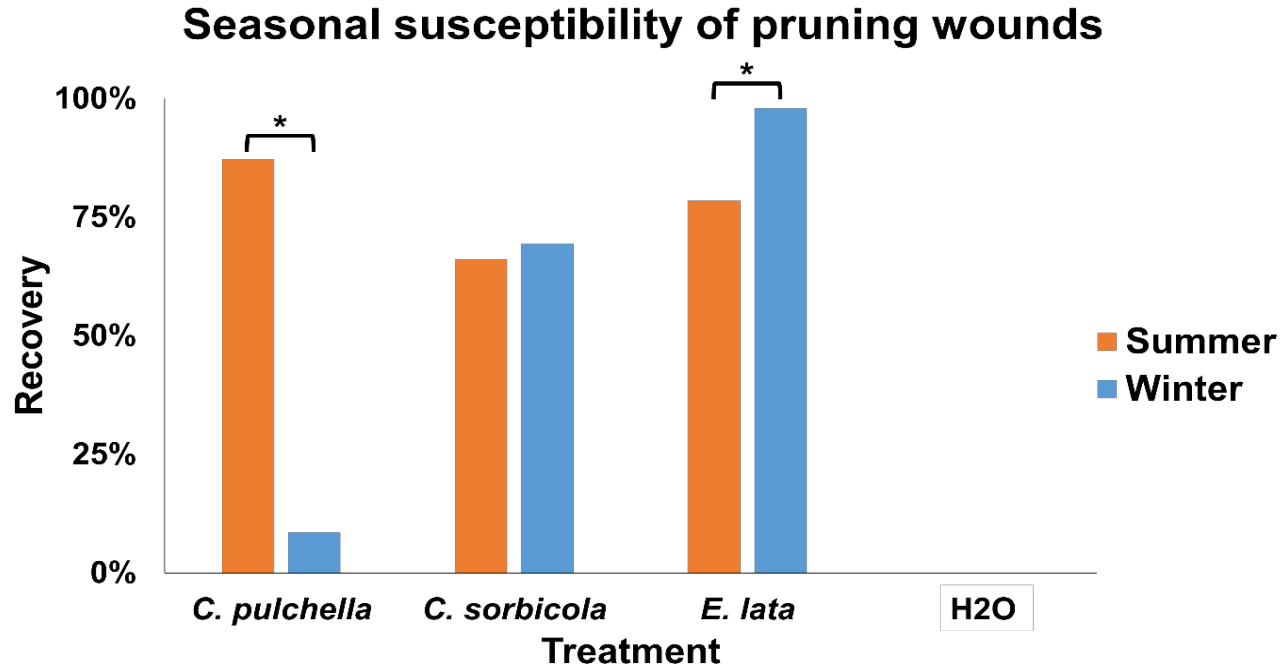
# Pruning wound susceptibility according to the time of pruning:

- ❑ Winter (January 2022) vs Summer (July 2022) pruning



# Pruning wound susceptibility according to the time of pruning:

❑ Winter (January 2022) vs Summer (July 2022) pruning



# Pruning wound protection

# Pruning wound infection:



# Pruning wound protection: active ingredients

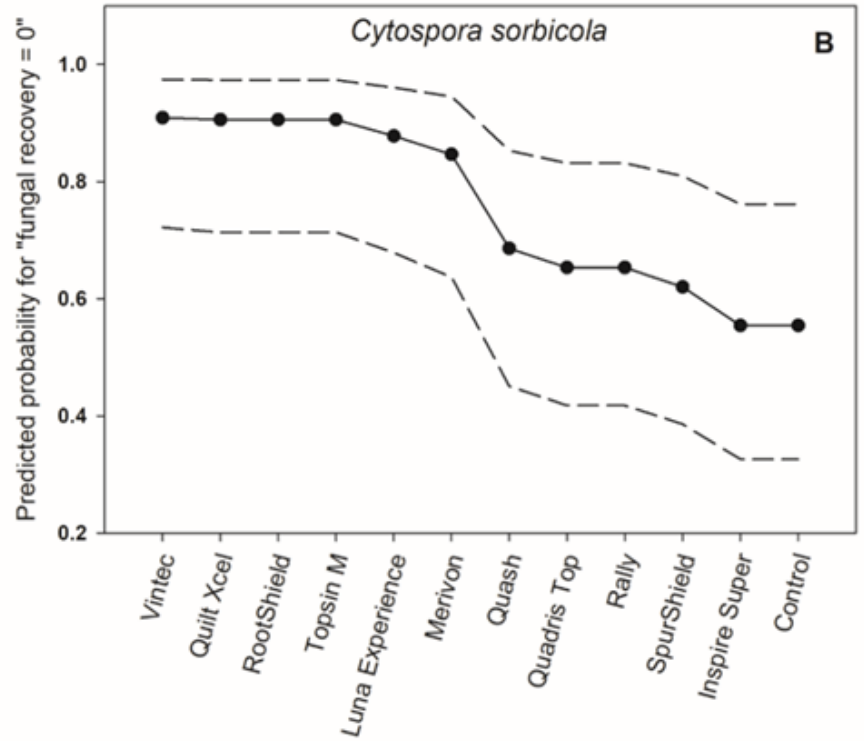
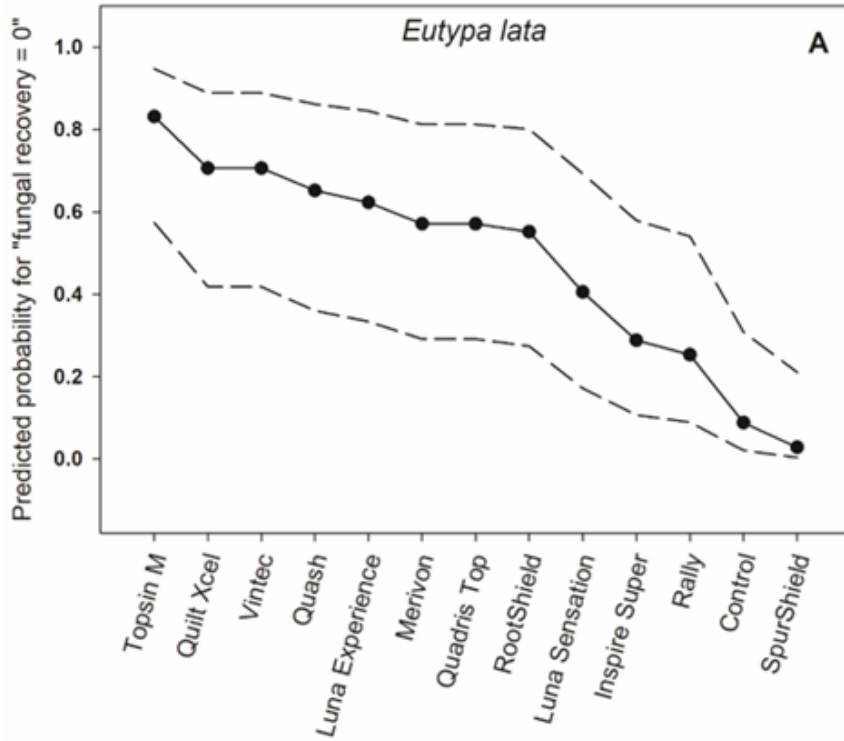
Products	Formulation	Active ingredient	Label rate
Vintec	Pellet	Trichoderma atroviride SC1	200g / Ha 2 grams per liter
Rally	Wettable powder	myclobutanil	5 to 8 dry oz / Acre
Topsin M	Wettable powder	thiophanate-methyl	1 to 1.5 pound / Acre
Quash	Pellet	metconazole	4 dry oz / Acre
Quadris Top	Liquid	azoxystrobin + difenoconazole	12 to 14 fl oz / Acre
Inspire Super	Liquid	difenoconazole + cyprodinil	16 to 20 fl oz / Acre
Quilt Xcel	Liquid	azoxystrobin + propiconazole	14 fl oz / Acre (cherry)
Luna Experience	Liquid	fluopyram + tebuconazole	6 to 10 fl oz / Acre (cherry)
Merivon	Liquid	fluxapyroxad + pyraclostrobin	6.7 fl oz / Acre (stone fruit)
Luna Sensation	Liquid	fluopyram + trifloxystrobin	5 to 7.6 fl oz per acre
Polymer 1	Liquid	polymer of cyclohexane	1 quart / 10 Gal = 94.6353 mL per Gal
RootShield Plus WP	Wettable powder	T. harzianum strain T-22 + T. virens strain G-41	3 to 8 fl oz / 100 Gal
Control (water)	Sterilized water	-	-



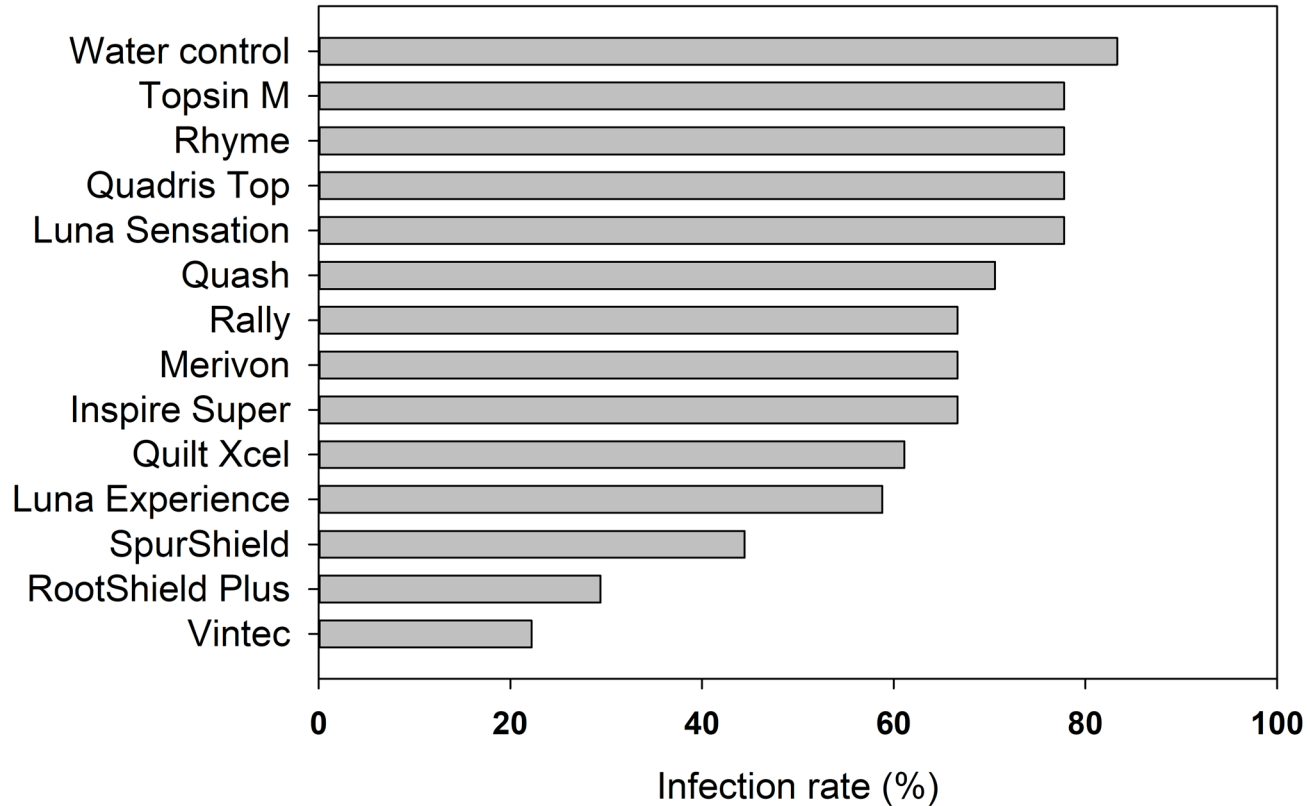
# Pruning wound protection trials: winter, dormant season



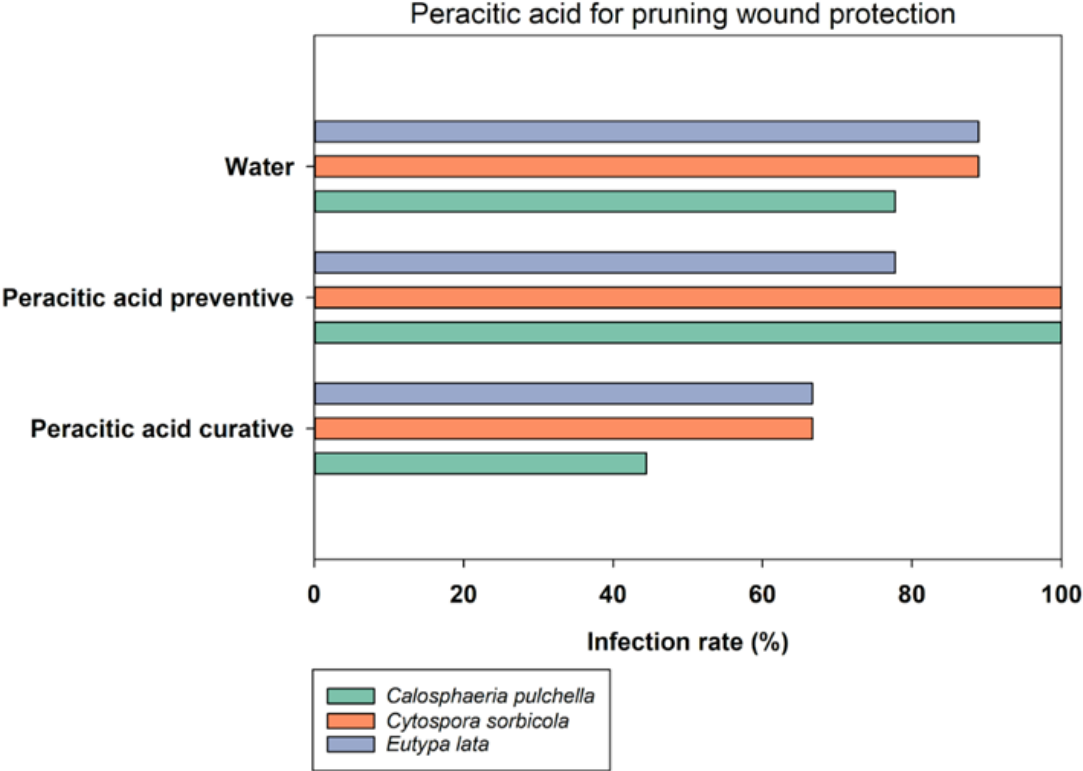
# Combined data for multiple years trials:



Cherry pruning wound protection  
*Calosphaeria* - June 2021



# Effect of peracetic acid/Hydrogen peroxide:



# Conclusion

- ❑ Three canker diseases are impacting California cherry industry
- ❑ Pruning wounds serve as main infection sites
- ❑ Wounds following harvest also can be infected
- ❑ To a lesser extent, leaf scars following leaf fall can get infected with *Cytospora*
- ❑ A treatment following harvest may be required if rain is in the forecast
- ❑ *Calosphaeria pulchella* is a pathogen that favor warm temperature (30°C) to germinate and grow
- ❑ Infection by *Calosphaeria* most likely occur following summer pruning
- ❑ Its emergence in California most likely is the result of a shift from winter to summer/early fall pruning
- ❑ Winter pruning can avoid *Calosphaeria* canker, but won't prevent *Cytospora* or *Eutypa* infection
- ❑ However, Topsin M, Quilt Xcel offer great protection of pruning wounds against *Cytospora* and *Eutypa*
- ❑ Vintec (*Trichoderma*) offers good protection against *Calosphaeria*
- ❑ Peracetic acid/Hydrogen peroxide do not prevent nor cure infection by fungal canker pathogens