

Canker Diseases of Prune

Themis J. Michailides

David Morgan, Ryan Puckett, and Daniel Felts

University of California, Davis

Kearney Agricultural Research & Extension Center

**R. Buchner, E. Fichtner, and F. Niederholzer, UCCE Tehama,
UCCE Tulare, and UCCE Sutter/Yuba/Colusa, respectively.**

Prune Day Tehama County, Feb 20, 2015

Cankers of Trunks and Branches of Prune

- 1. Bacterial Canker – *Pseudomonas syringae***
- 2. Ceratocystis Canker – *Ceratocystis fimbriata***
- 3. Cytospora Canker – *Cytospora leucostoma***
- 4. Botryosphaeria/Phomopsis cankers – *Botryosphaeria* spp. & *Phomopsis* spp.**

1. Bacterial Canker

Bacterial canker is a devastating disease of *Prunus* spp.

- ✓ *Pseudomonas syringae* pv. *syringae* (Pss).
- ✓ Islands of necrotic tissue, which coalesce into large cankers.

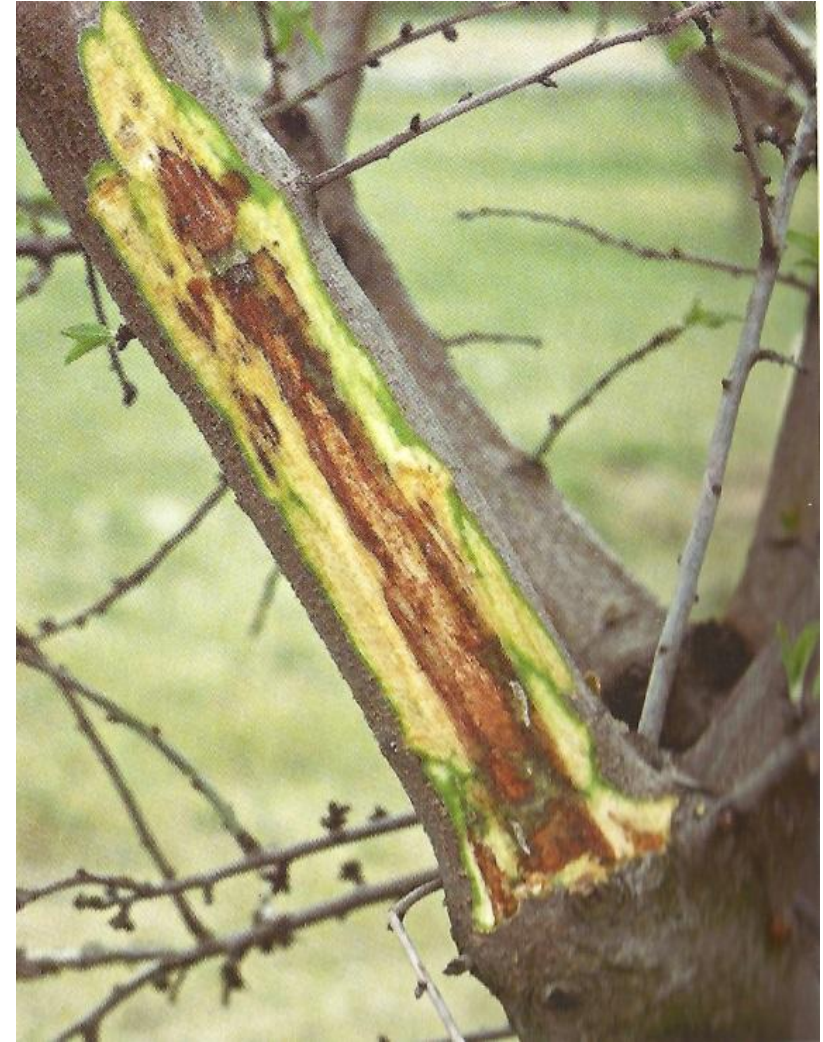


Bacterial Canker

- **Complex disease that is poorly understood.**
- **All *Prunus* species are susceptible.**
- **Symptoms usually found late winter into spring.**
- **Can be very destructive to trees 2-6 years old.**
- **Pathogen is present on plant surfaces (epiphytes) and invades through openings (lenticels, stomates, leaf scars, etc.).**
- **More associated with tree stress – heat, cold, moisture, nematodes.**



Bacterial Canker





Management of bacterial canker

Cultural control (non-chemical)

- 1) Where possible, carry out all pruning in July or August when tissues are more resistant.
- 2) Cut all cankered areas down to healthy tissues and paint wounds (wound paint) to protect from re-infection.
- 3) Burn or compost the prunings.
- 4) Graft trees higher than normal (somehow, it helps reduce bacterial canker)

Chemical control

- 1) Copper-based fungicides are effective against bacterial diseases
- 2) Three applications from late summer to mid-autumn.

2. **Ceratocystis Canker**

- **Caused by the fungus *Ceratocystis fimbriata***
- **Almost all infections occur in bruise type injuries to trunk and scaffold branches (tree shakers, etc.)**
- **Cankers are most active during the growing season.**
- **Brownish to red canker with amber gum at the canker margin.**
- **Usually associates with mechanical-harvest injury.**
- **Disease spread by sap-feeding insects and fruit flies.**

Ceratocystis Canker

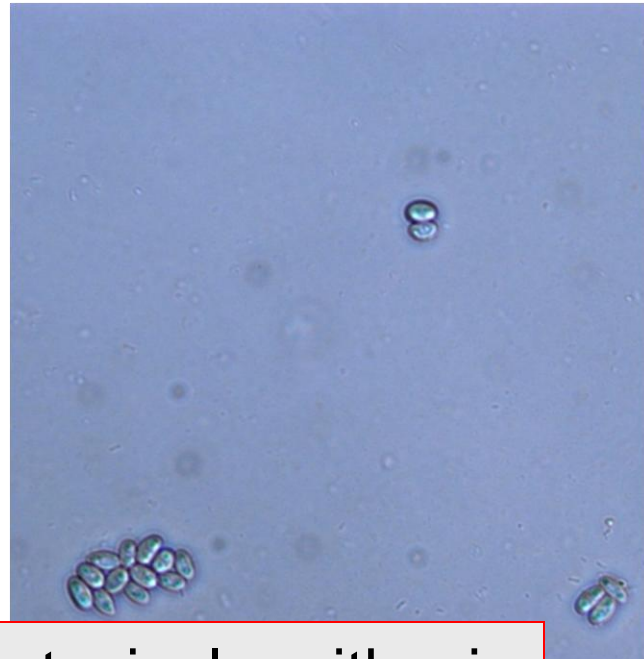
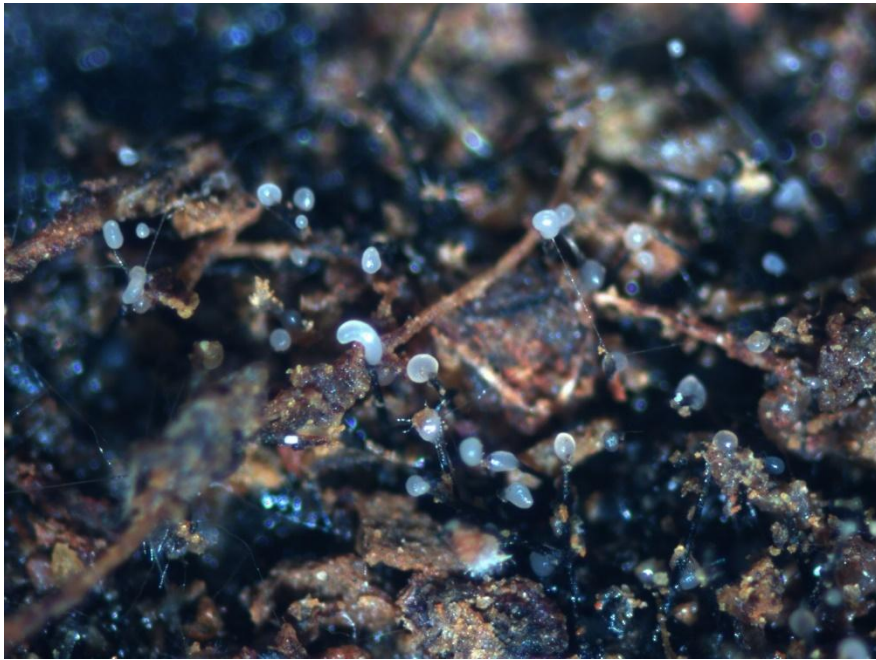


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Ceratocystis isolations difficult



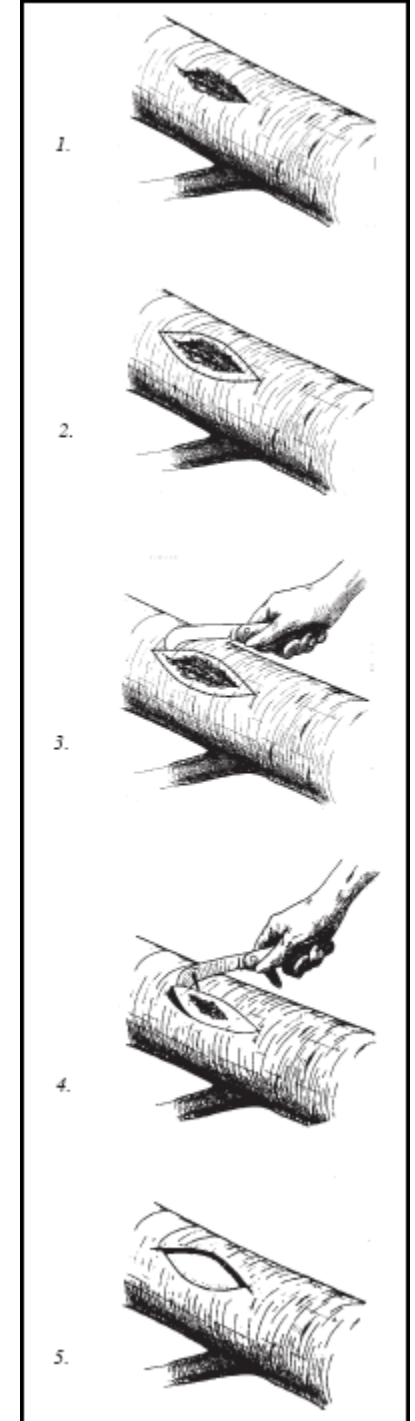


Ceratocystis fimbriata with typical perithecia

Management of Ceratocystis canker

Non-chemical control

- 1) Avoid shaker injuries to trunks and scaffolds.
- 2) Avoid wounds on small twigs and branches which can also be infected.
- 3) Bark injuries are susceptible for 8 to 14 days.
- 4) You can perform surgery (and this can be repeated in the following year).
- 5) Surgery in the winter when insects are not active (1" from canker margins).
- 6) The value of wound dressings is not clear (they may delay wound healing).



3. Cytospora Canker

- Caused by the fungus *Cytospora leucostoma*
- Usually visible as dark sunken areas in the bark.
- Factors that favor Cytospora are water stress, potassium deficiency, heavy clay soils, ring nematode and sunburn.
- Most infection occurs in sunburn injuries from rain-splashed spores.

Isolations from wood cankers and problematic *Prunus* tissues

| Year | Prune | Peach | Plum | Cherry |
|------|--|--|---|--|
| 2010 | <i>Lasiodiplodia theobromae</i> <i>Nattrassia mangiferae</i> <i>Paecilomyces variotii</i> <i>Phoma</i> species | | | <i>Cytospora leucostoma</i> |
| 2011 | | | | <i>Cytospora leucostoma</i> |
| 2012 | <i>Fusarium</i> species <i>Cytospora leucostoma</i> | Bacterial canker | | Bacterial canker <i>Botryosphaeria</i> sp. <i>Cytospora leucostoma</i> , <i>Fusarium</i> , <i>P. variotii</i> |
| 2013 | <i>Cytospora leucostoma</i> , <i>Paecilomyces variotii</i> , <i>Chondrostereum purpureum</i> , <i>Botryosphaeria</i> spp. Foamy canker ? | <i>Cytospora leucostoma</i> <i>Lasiodiplodia citricola</i> | | Blast (<i>Pseudomonas syringae</i>) <i>Cytospora leucostoma</i> |
| 2014 | <i>Cytospora leucostoma</i> 28% <i>Schizophyllum</i> 28% <i>Botryosphaeria</i> + <i>Phomopsis</i> 22% <i>Fusarium</i> 11%; <i>Paecilomyces variotii</i> 11%; <i>Eutypa lata</i> 5%; | <i>Cytospora leucostoma</i> <i>Lasiodiplodia citricola</i> <i>Botryosphaeria</i> sp. <i>Phomopsis</i> sp. | <i>Ganoderma</i> sp. <i>Phytophthora</i> sp. | <i>Paecilomyces variotii</i> and Flathead borer.____ Apricot: <i>Cytospora leucostoma</i> |

Counties: Tehama, Glenn, Butte, Sutter, Yuba

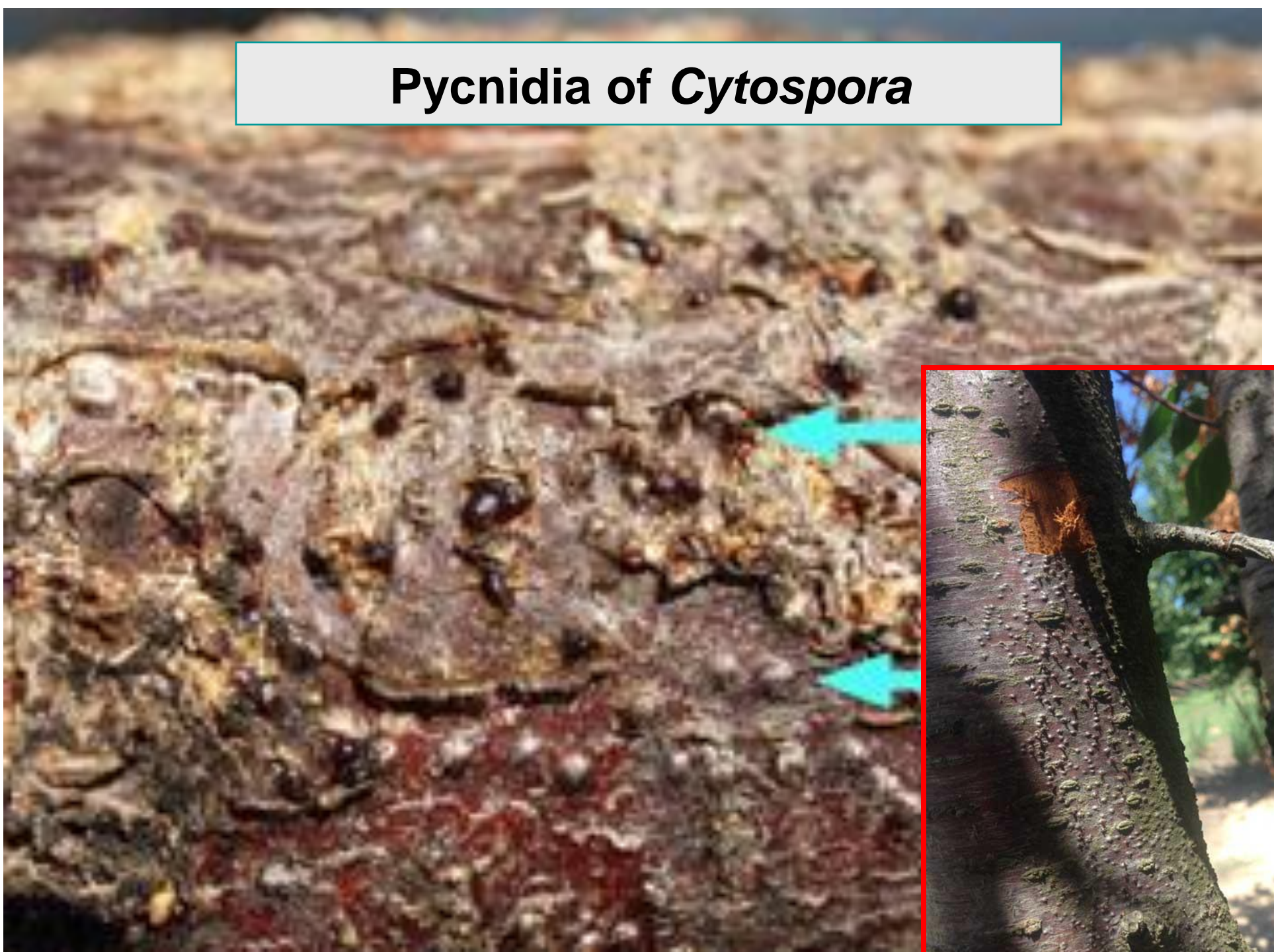
Cytospora Canker





| | |
|----|--|
| 1. | Topsin (thiophenate-methyl) |
| 2. | Quilt Xcel (azoxystrobin + propiconazole) |
| 3. | VitiSeal |
| 4. | Pristine + Pentre Bark |
| 5. | Tebuconazole |
| 6. | Pristine + VitiSeal & 7. Untreated |

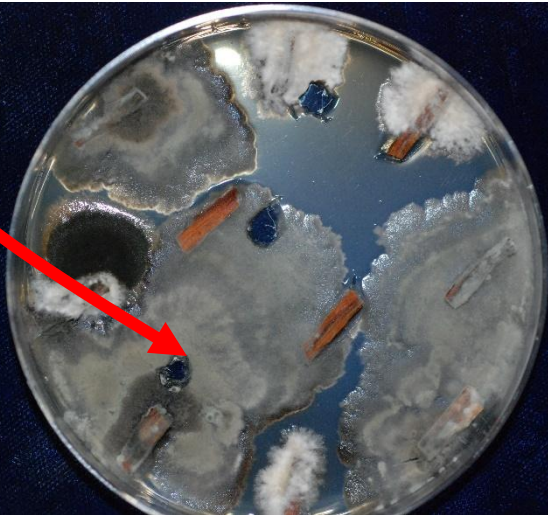
Pycnidia of *Cytospora*



Cytospora Canker



Cytospora leucostoma

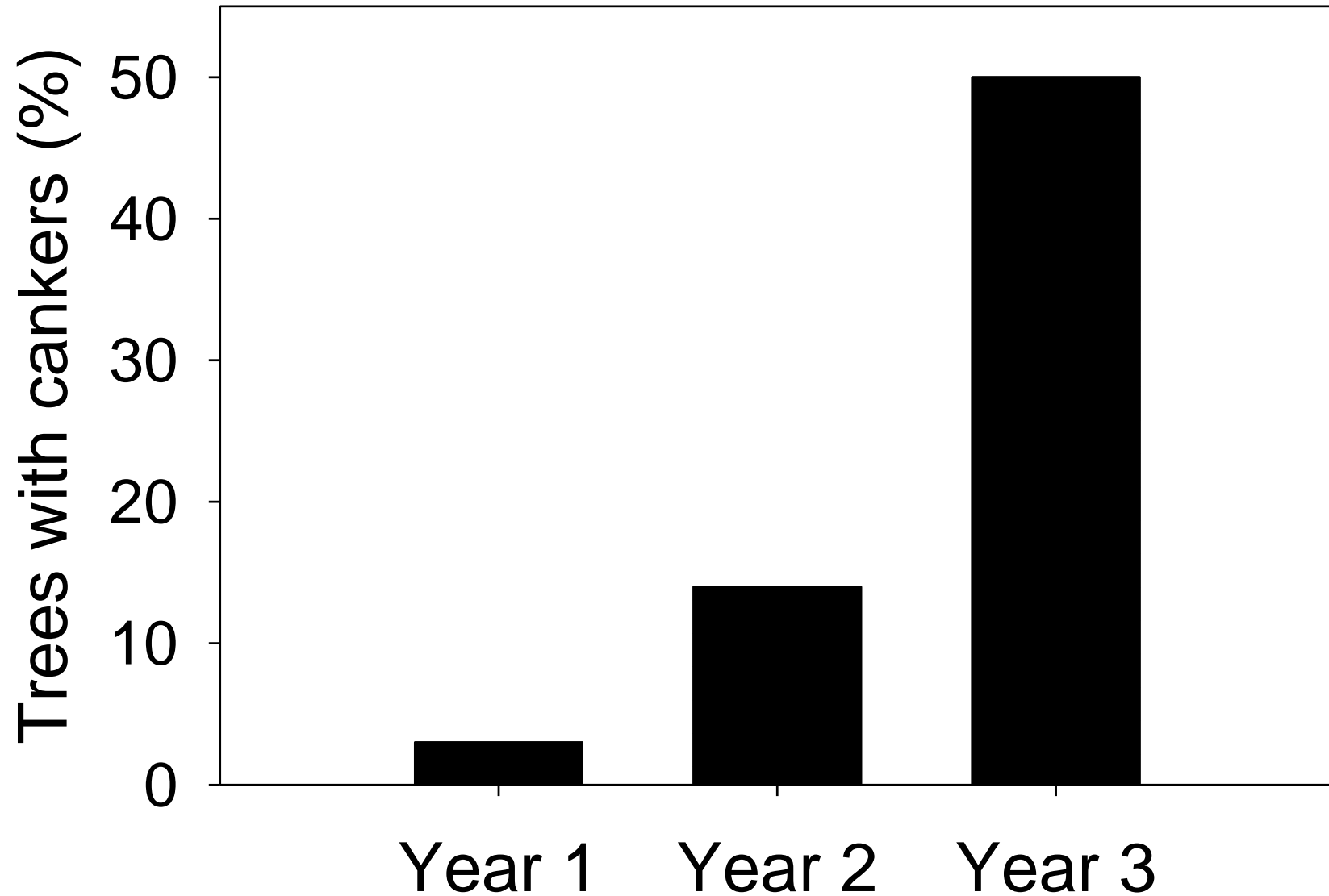






Oozing pycnidia of *Cytospora*

Progress of *Cytospora* canker disease in a peach orchard



Management of Cytospora canker

Non-chemical control

- 1) Avoid stress of the trees.
- 2) Drought stress---→ sunburn.
- 3) Flooding stress predisposes trees to infection.
- 4) Prune and remove infected limbs.
- 5) Make clean cuts and not jagged or rough cut surfaces (these last ones promote infection).
- 6) Prune when the weather is dry.

Wrong pruning:

pruning cut



4. Botryosphaeria and Phomopsis

- ✓ Are fungal pathogens.
- ✓ Cause cankers and limb dieback – dead sunken areas on branches and brown dead tissue underneath.
- ✓ Can be a serious disease of pistachio and walnut and a potentially increasing issue on prune.

Fungi isolated from Wood Cankers of Prunes

2012

- *Cytospora leucostoma****
- *Lasiodiplodia theobromae***
- *Nattrassia mangiferae****
- *Diplodia seriata***
- *Phomopsis species**
- *Paecilomyces variotii*
- *Fusarium species*

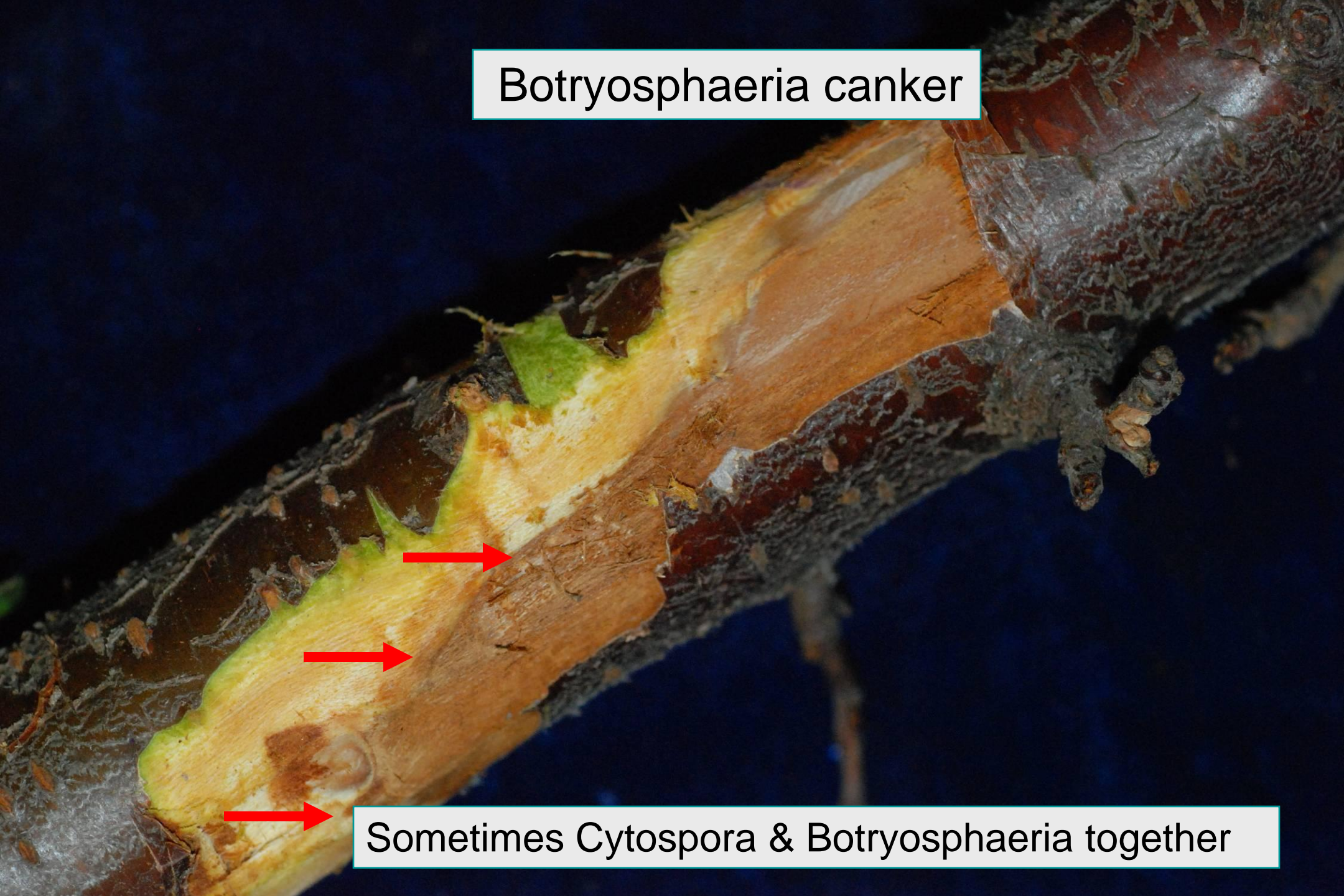
2013

- *Cytospora leucostoma****
- *Lasiodiplodia theobromae***
- *Diplodia seriata***
- *Paecilomyces variotii*
- *Fusarium species*
- *Chondrostereum purpurescens*

2014

- *Botryosphaeria & Phomopsis* spp.

Botryosphaeria canker



Sometimes Cytospora & Botryosphaeria together

Branch Canker symptom in the Orchard



A petri dish containing a fungal culture. The culture is divided into two main regions. The upper region is dark grey to black, with a red arrow pointing to it from a label. The lower region is lighter, appearing white to light grey, with numerous small, dark, circular spots scattered throughout. A red arrow points from a label to these spots. The petri dish is set against a dark background.

Botryosphaeria species

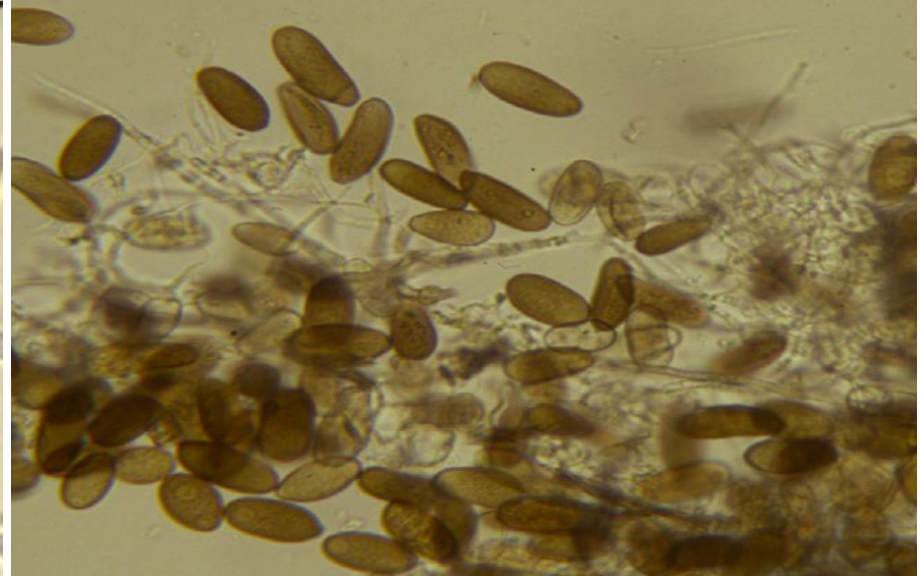
Phomopsis species

Pycnidia of *Botryosphaeria*





***Botryosphaeria dothidea* and other
Botryosphaeria spp.**



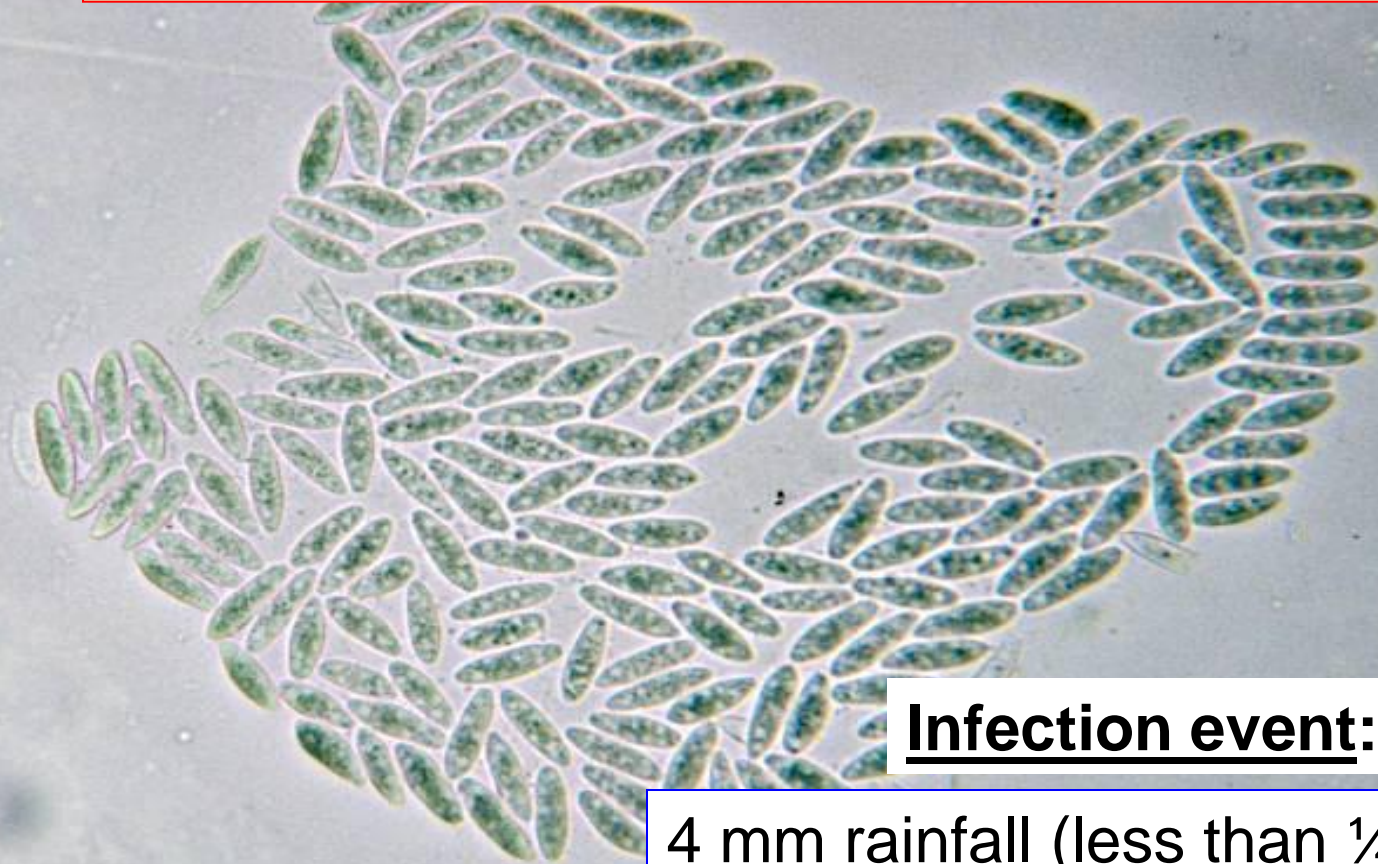
Diplodia seriata



Lasiodiplodia citricola* & *L. theobroame



Spores of *Botryosphaeria*



Infection event:

4 mm rainfall (less than ¼ th inch)
≥50 F temperature

Spores start germinating within 1.5 hours wetness!

Summary of Botryosphaeriaceae in nut crops – California

| Fungal species (red in Prunes) | Walnut | Pistachio | Almond |
|--|--------|-----------|--------|
| <i>Botryosphaeria dothidea</i> & | + | + | + |
| <i>Neofusicoccum parvum</i> | + | +? | + |
| <i>Neofusicoccum mediterraneum</i> | + | + | + |
| <i>Diplodia mutila</i> | + | --- | --- |
| <i>Neofusicoccum nonquaesitum</i> | + | --- | + |
| <i>Neofusicoccum vitifusiforme</i> | + | + | --- |
| <i>Diplodia seriata</i> | + | + | + |
| <i>Dothiorella iberica</i> | + | + | + |
| <i>Lasiodiplodia citricola</i> & | + | + | --- |
| <i>Neoscytalidium dimitiatum</i> (<i>Hendersonula toruloidea</i>) | + | --- | + |
| <i>Diaporthe rhusicola</i> (<i>Phomopsis</i>) | + | + | + |
| <i>Diaporthe neitheicola</i> (<i>Phomopsis</i>) | + | --- | --- |

cv. Muir Beauty

Inoculations

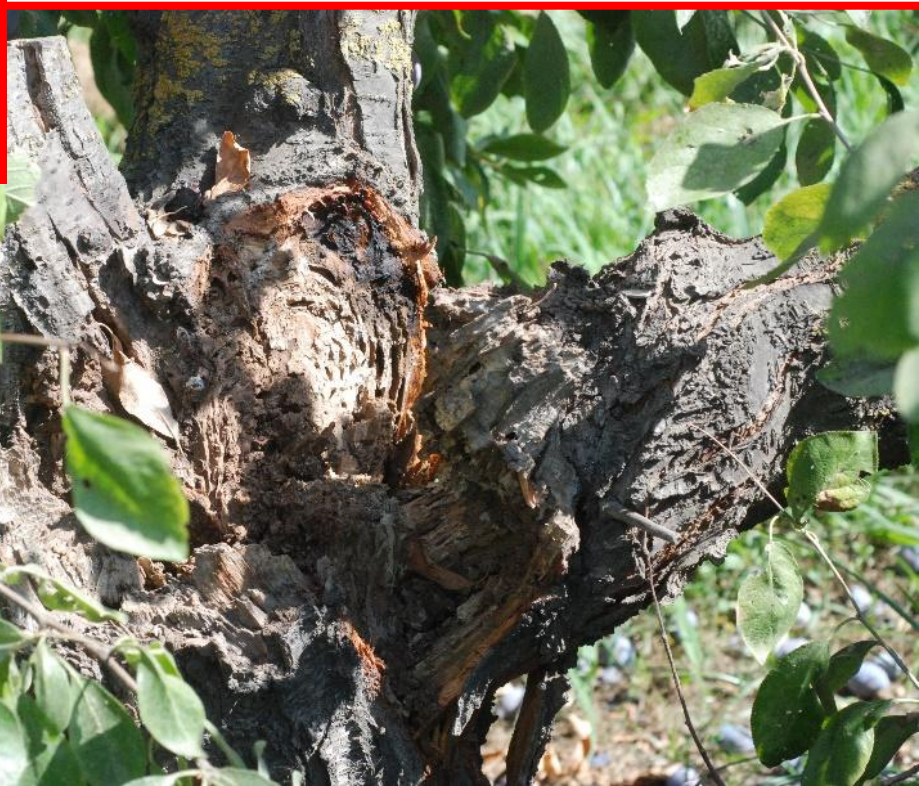


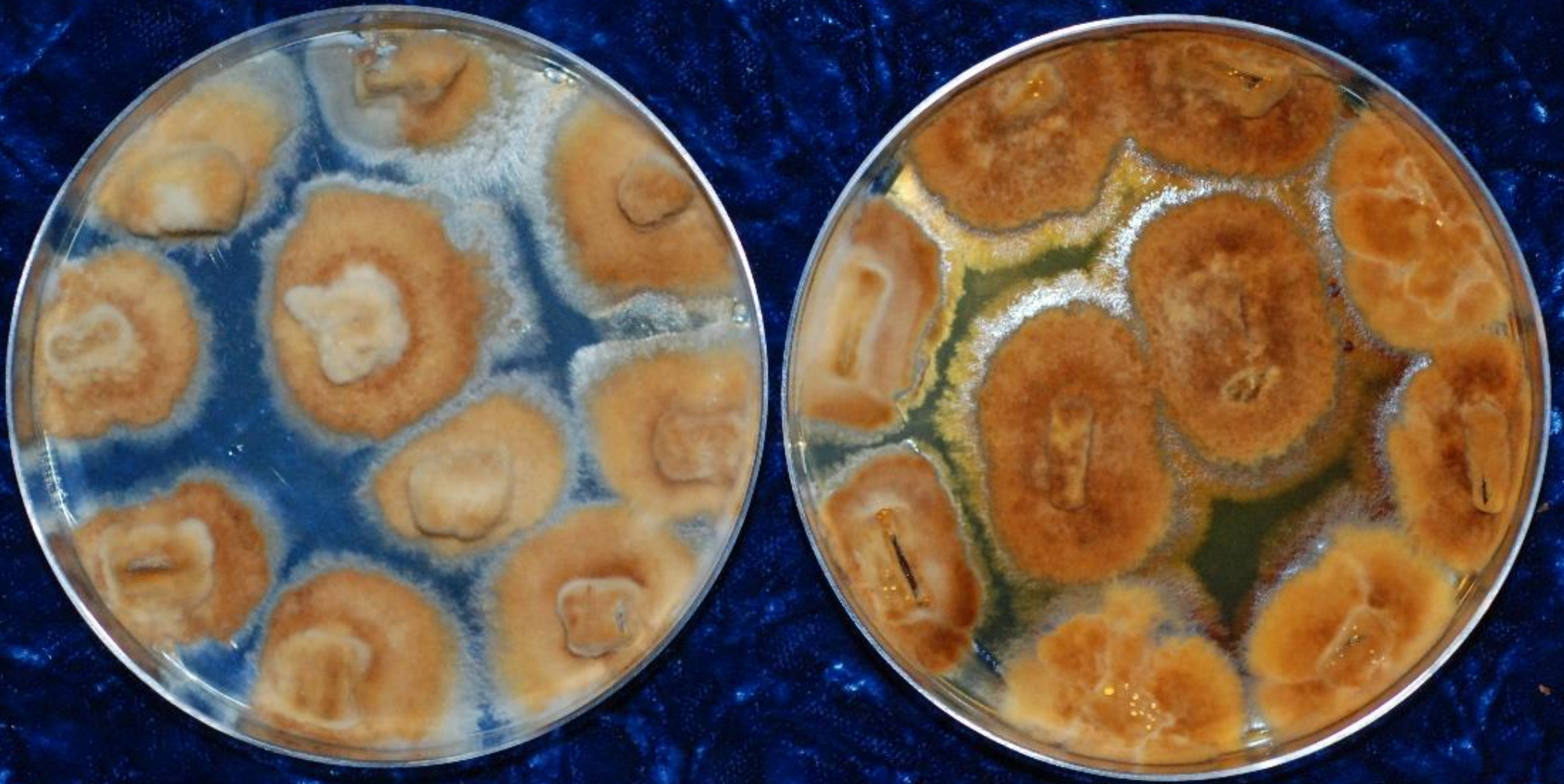
Botryosphaeria lutea



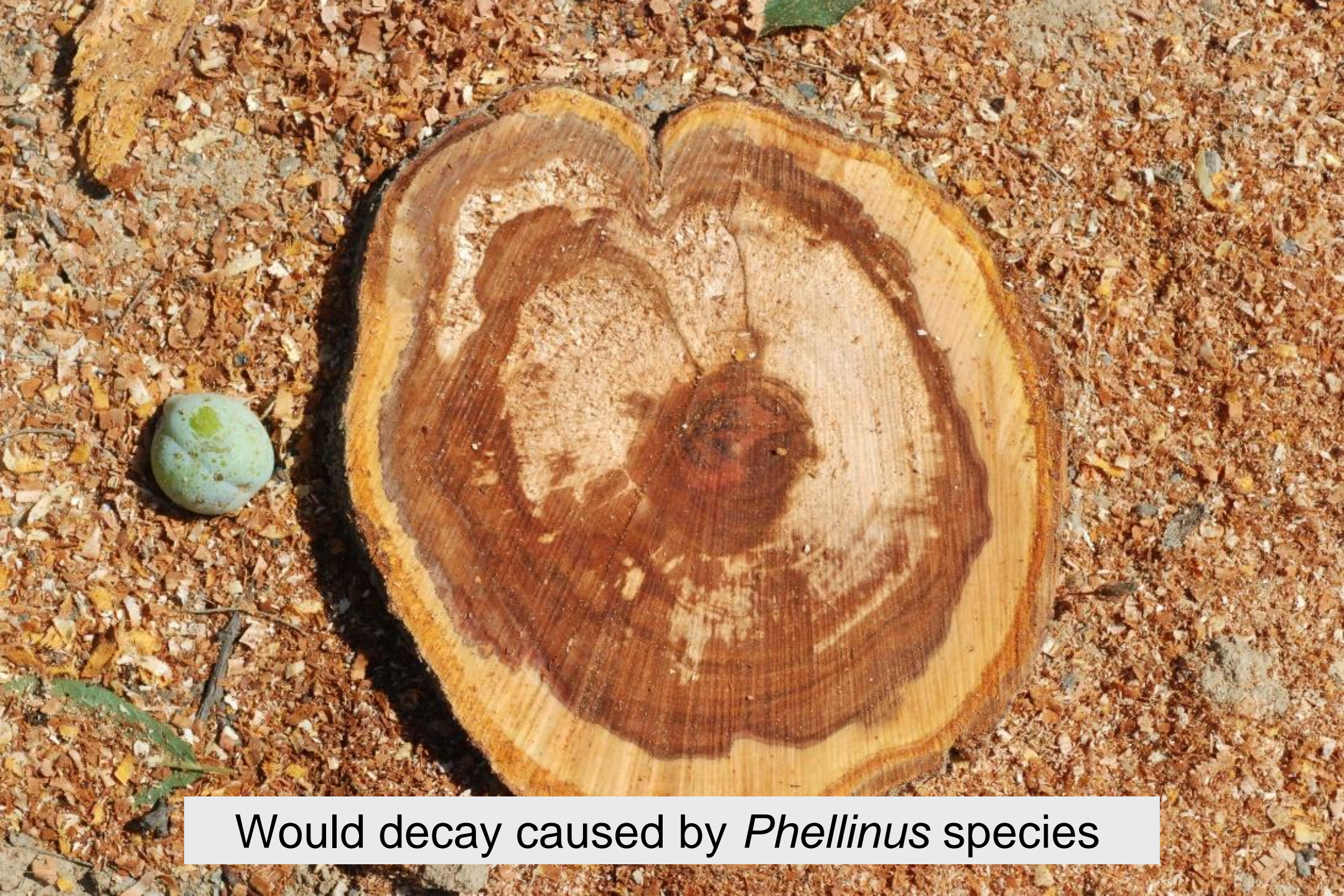
Control







Phellinus sp. (a basidiomycete mushroom)



Would decay caused by *Phellinus* species

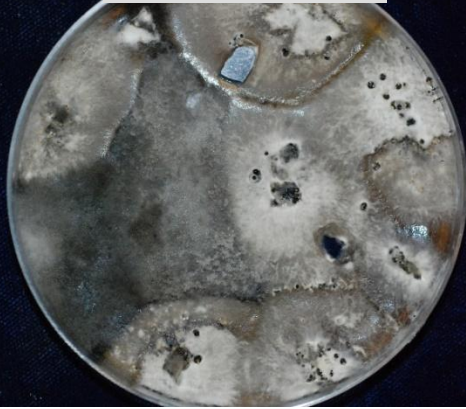
Isolations from a declining orchard in Tehama County

| Samples | Tree part | Fungal pathogens isolated |
|---------|----------------------|---|
| Tree #1 | Branch #1, canker | Cytospora + Botryosphaeria sp. |
| | Branch #2, canker | Cytospora |
| | Branch #3, canker | Cytospora |
| | Branch #4, canker | Paecilomyces variotii |
| Tree #2 | Branch #1; heart rot | Schizophyllum (80%) |
| | Branch #1; canker | Cytospora (10%) + P. variotii (10%) |
| | Branch #2; heart rot | Schizophyllum (70%) |
| | Branch #2; canker | Cytospora (10%) + P. variotii (10%) |
| Tree #3 | Branch #1; heart rot | Schizophyllum (85%) + <i>Phellinus</i> spp. |
| | Branch #1; canker | <i>Phellinus</i> spp. (60%) |
| | Branch #2; heart rot | Schizophyllum (55%)+ P. variotii (50%) |
| | Branch #2; canker | Cytospora (80%) |

Trunks: Heart rot caused by *Schizophyllum* & *Phellinus* spp.

Canker pathogens isolated from prunes

Phomopsis sp.



Eutypa lata



Lasiodiplodia citricola



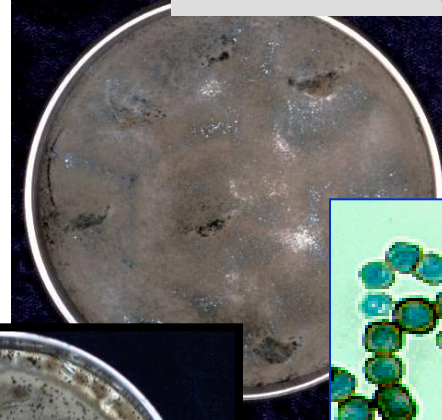
Diplodia seriata



Fusarium sp.



Nattrassia mangiferae



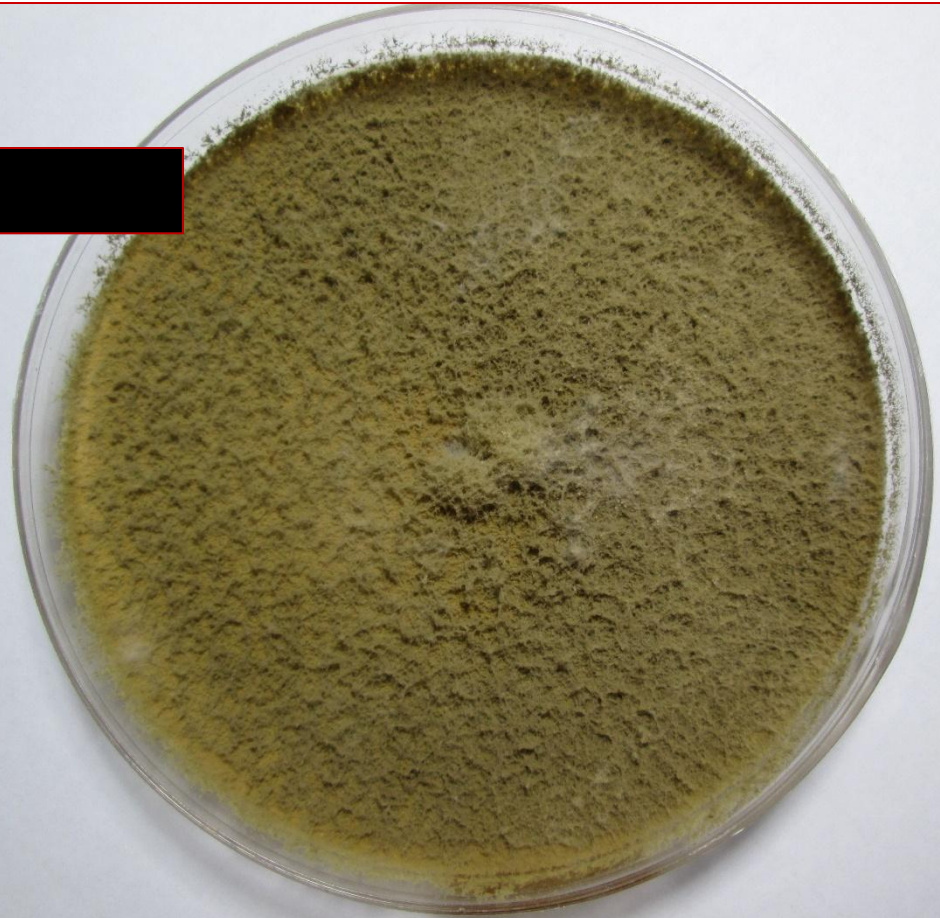
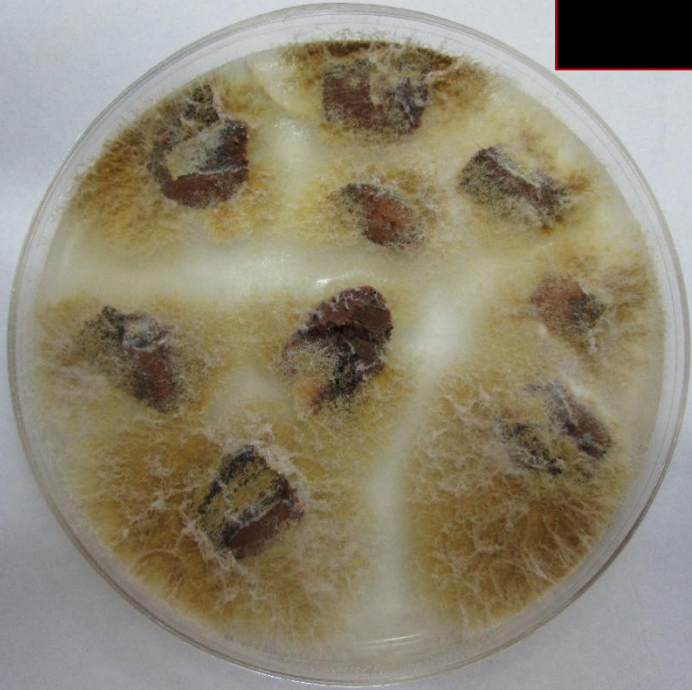
Botryosphaeria dothidea



Phoma species



Paecilomyces variotii



Example:: Inoculation of pistachio with
Paecilomyces variotii



Some isolates pathogenic

Objectives for 2015:

1. To determine the critical time of infection.
2. To understand effects of environmental and orchard factors on disease development.
3. To determine whether sunburn and freeze could predispose tissues to infection by all these fungi.
4. To evaluate efficacy of potential fungicides to manage these diseases.

Cytospora, Lasiodiplodia, Paecilomyces, & Schizophyllum/Phellinus.



Thank you