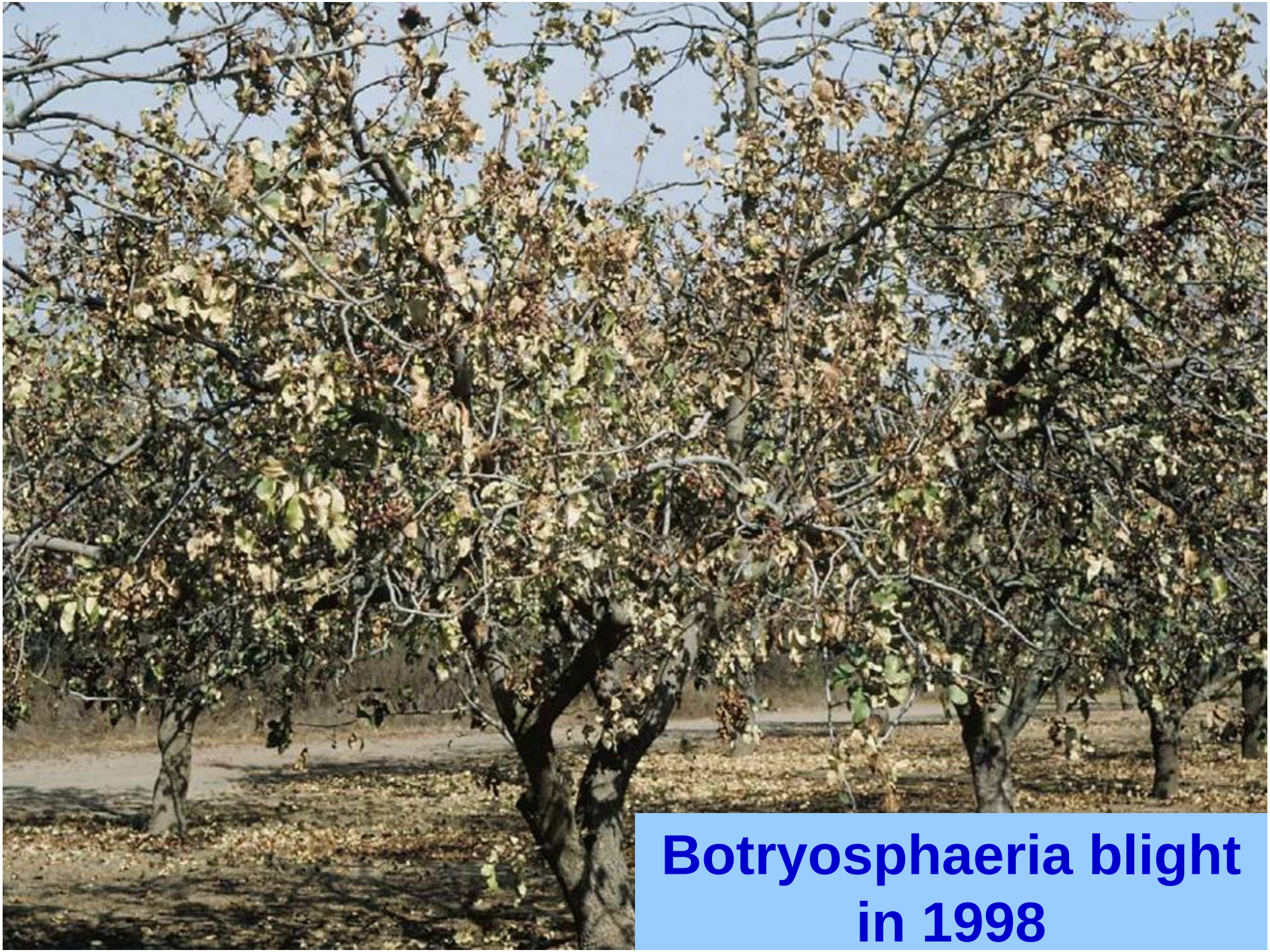
Understanding the 2009 BOT Blowup: Management Guidelines for 2010

Themis J. Michailides
Kearney Agricultural Center/UC Davis

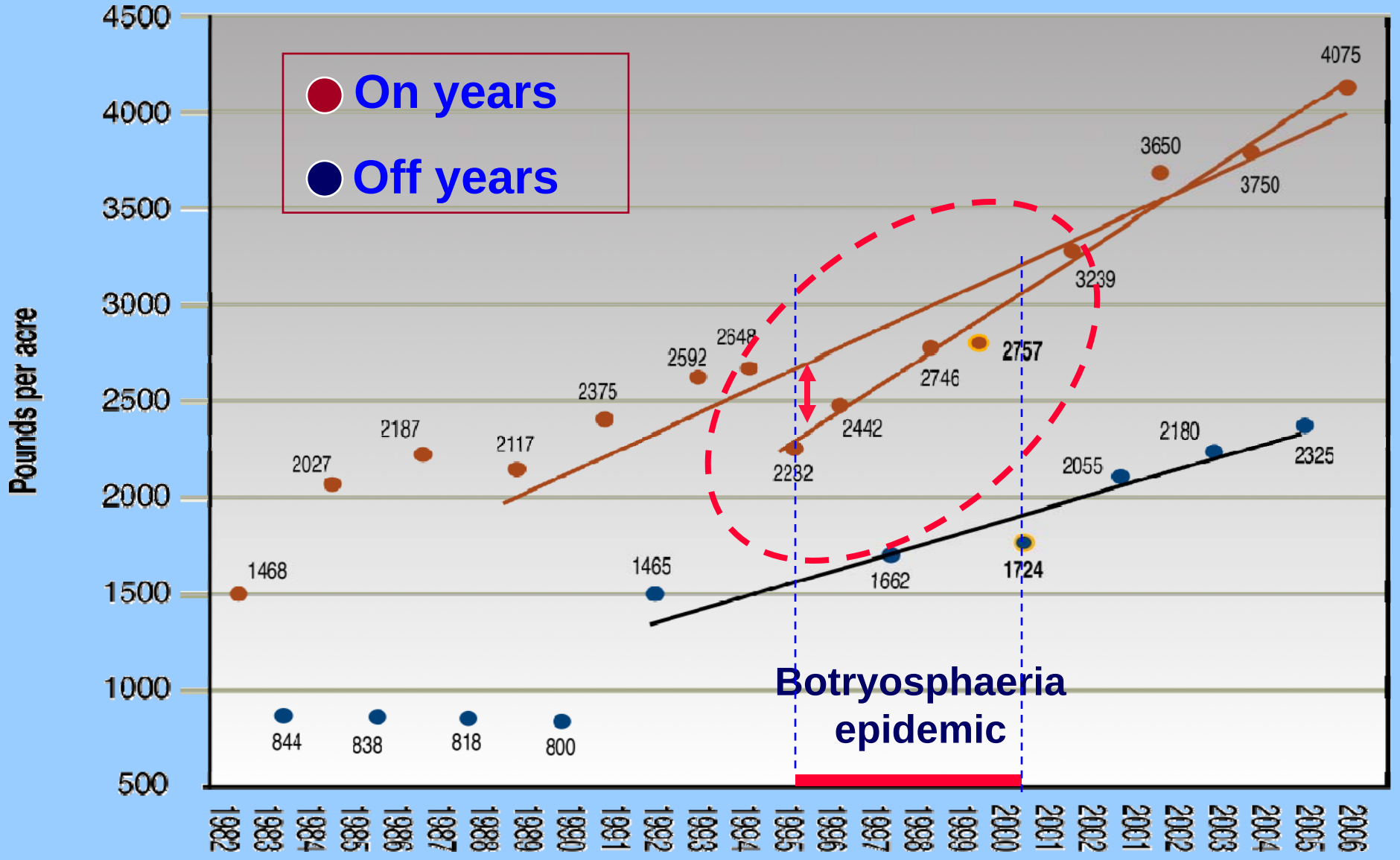

Severe Botryosphaeria blight (1998)



Botryosphaeria blight in 1998

Major damage

Yields and Botryosphaeria blight



Botryosphaeriaceae from pistachio

Botryosphaeriaceae on pistachio:

Botryosphaeria dothidea
Neofusicoccum mediterraneum
Lasiodiplodia theobromae
Diplodia seriata
Botryosphaeria obtusa

} **California**

Botryosphaeria obtusa

} **South Africa**

Botryosphaeria dothidea
Neofusicoccum parvum

} **Greece**

Botryosphaeriaceae on other hosts in California:

Botryosphaeria dothidea *
Neofusicoccum parvum *
Neofusicoccum mediterraneum *
Neofusicoccum nonquaesitum
Diplodia seriata *
Macrophomina phaseolina *
Dothiorella sarmentorum

} Almond

* also on pistachio

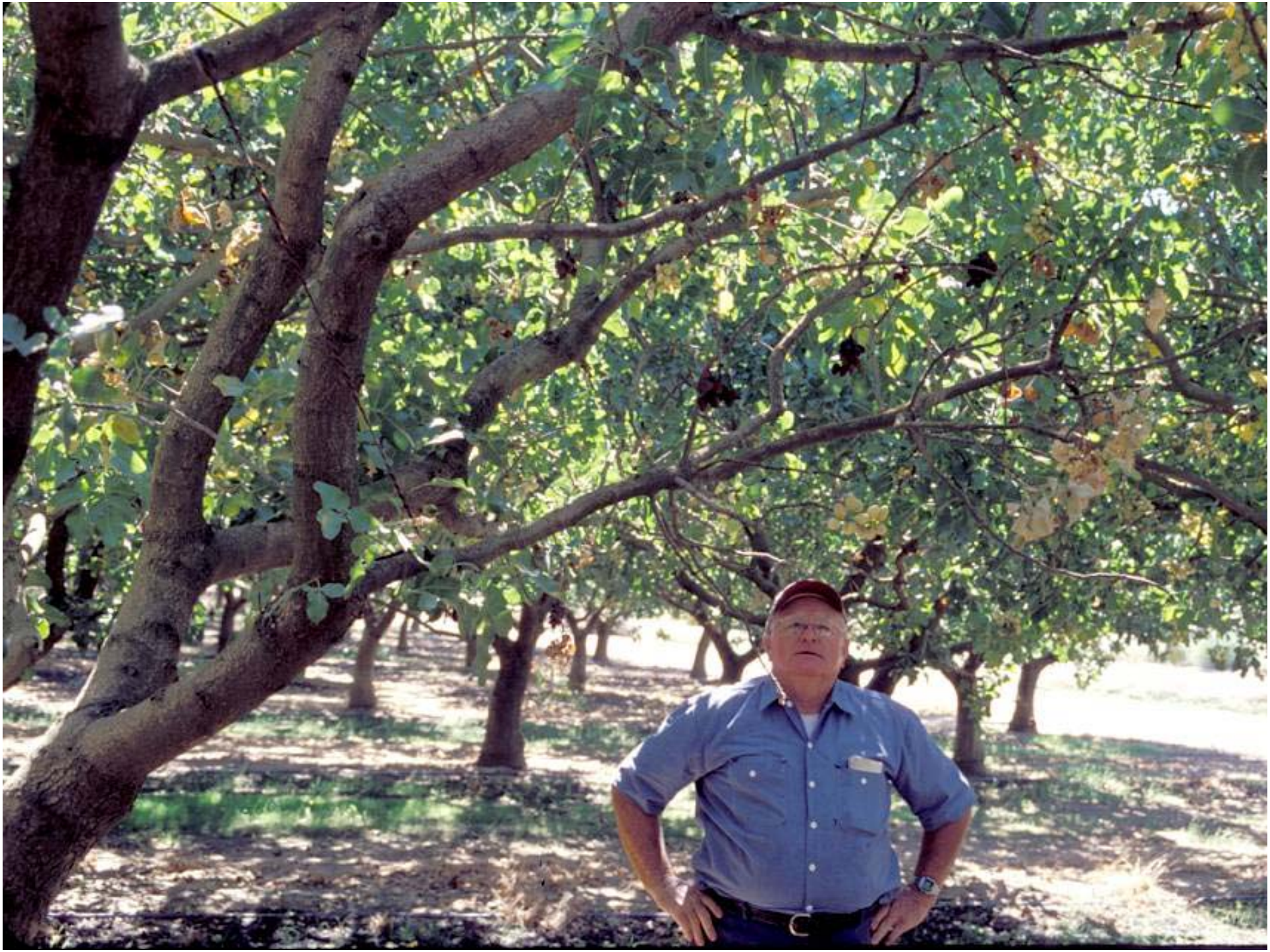
Botryosphaeriaceae on other hosts in California

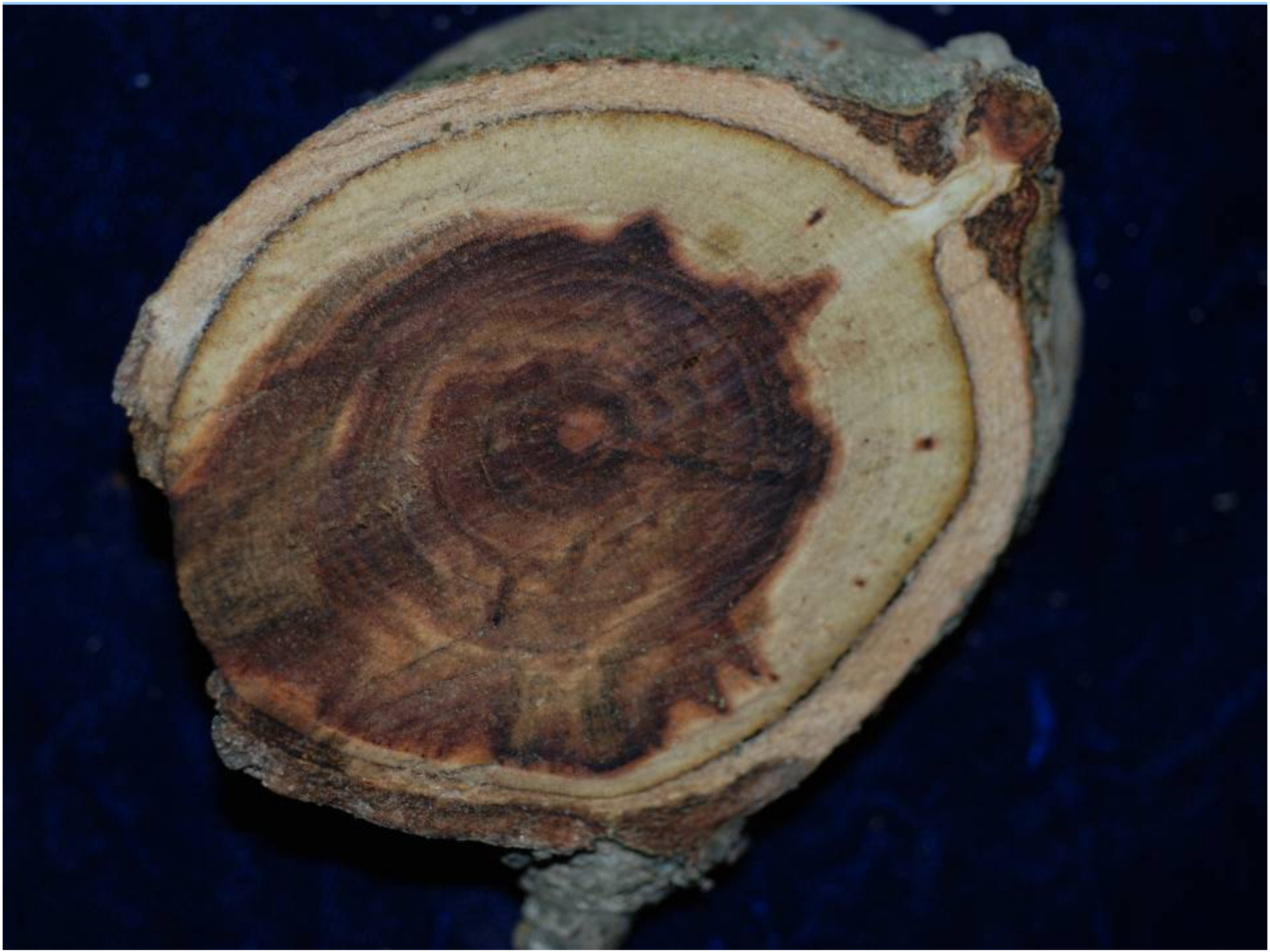
Botryosphaeria dothidea
Neofusicoccum parvum
Neofusicoccum mediterraneum
Diplodia seriata

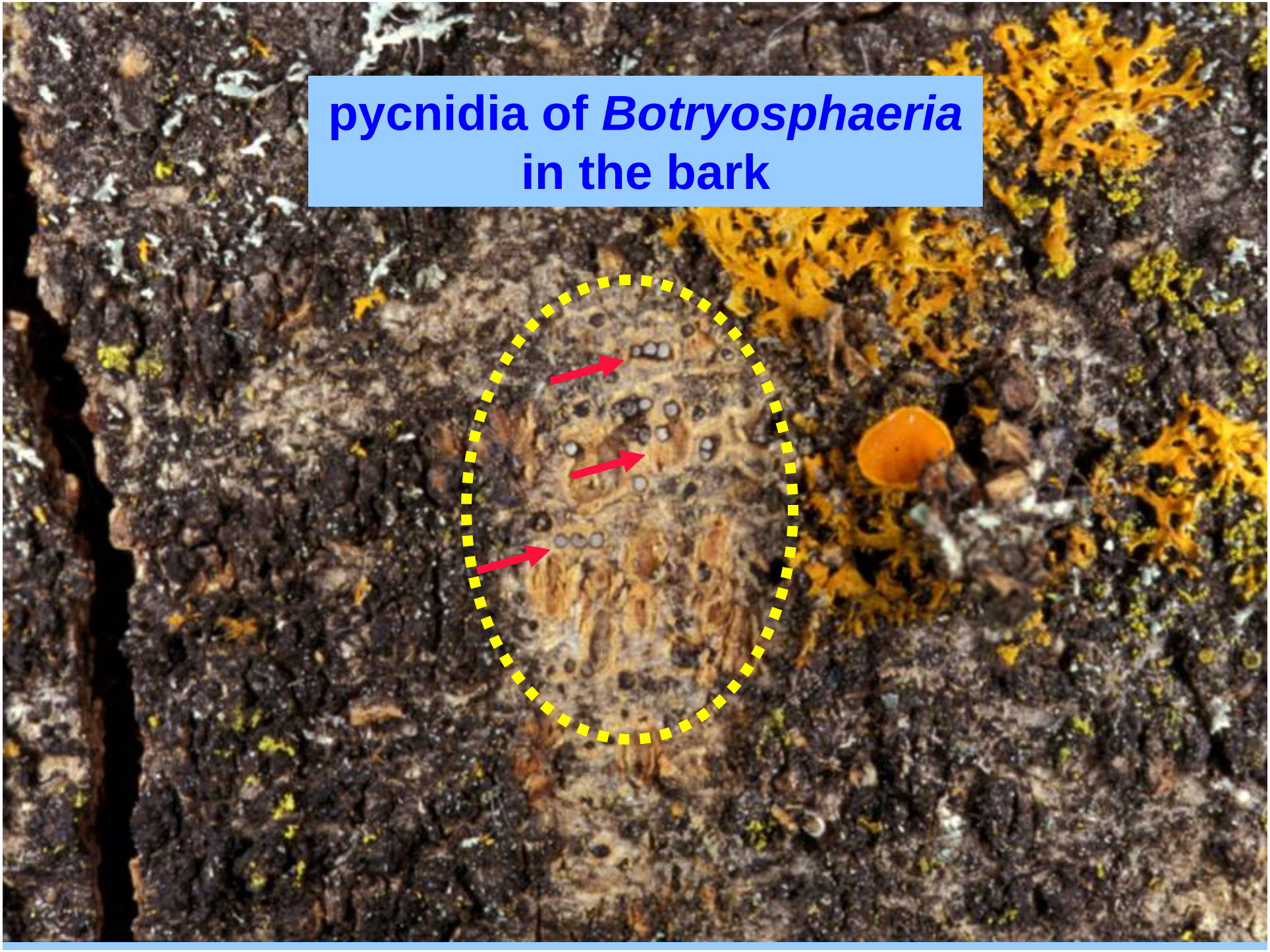
} **Walnut**

7 Botryosphaeriaceae species

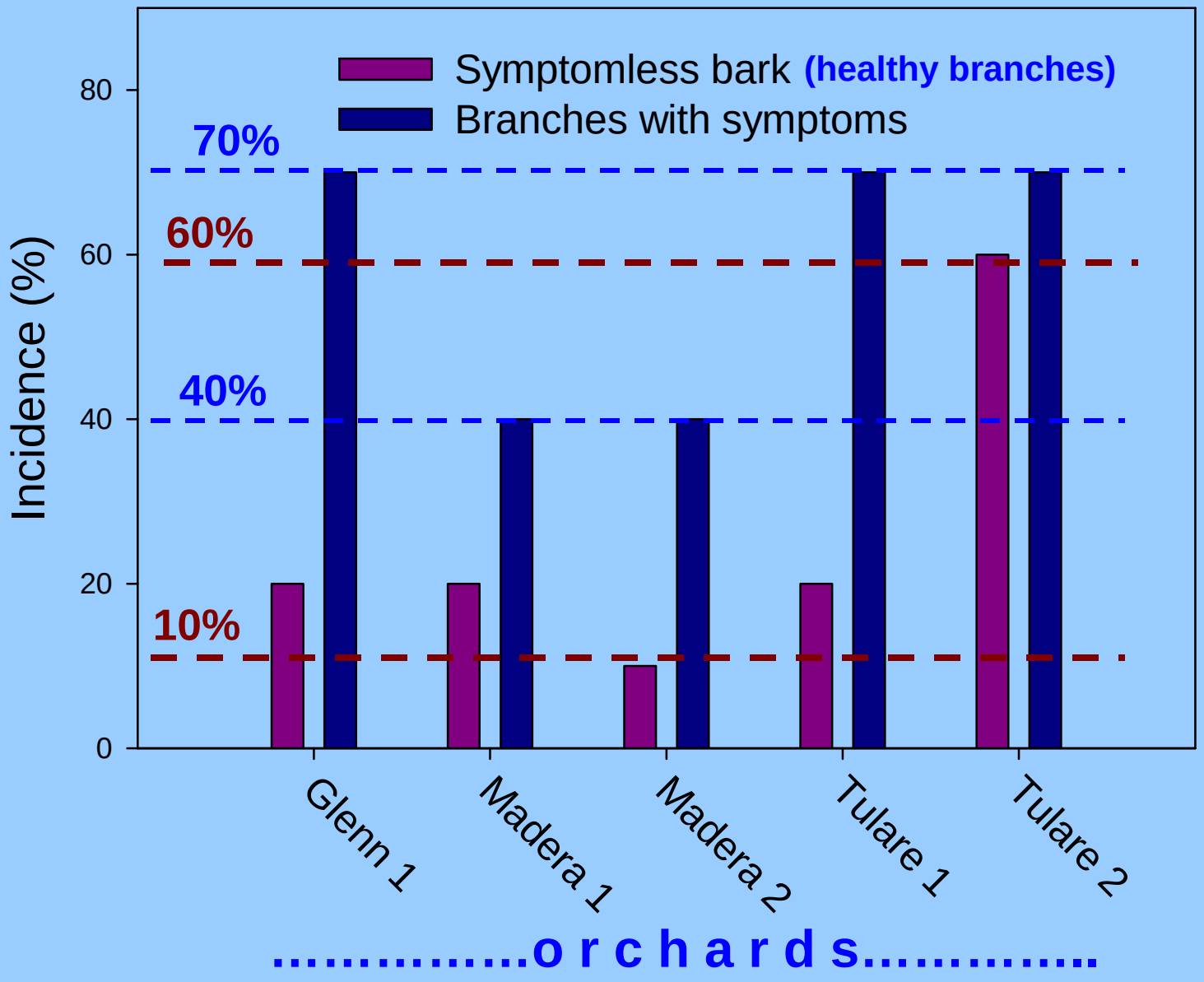
} **Grapes**



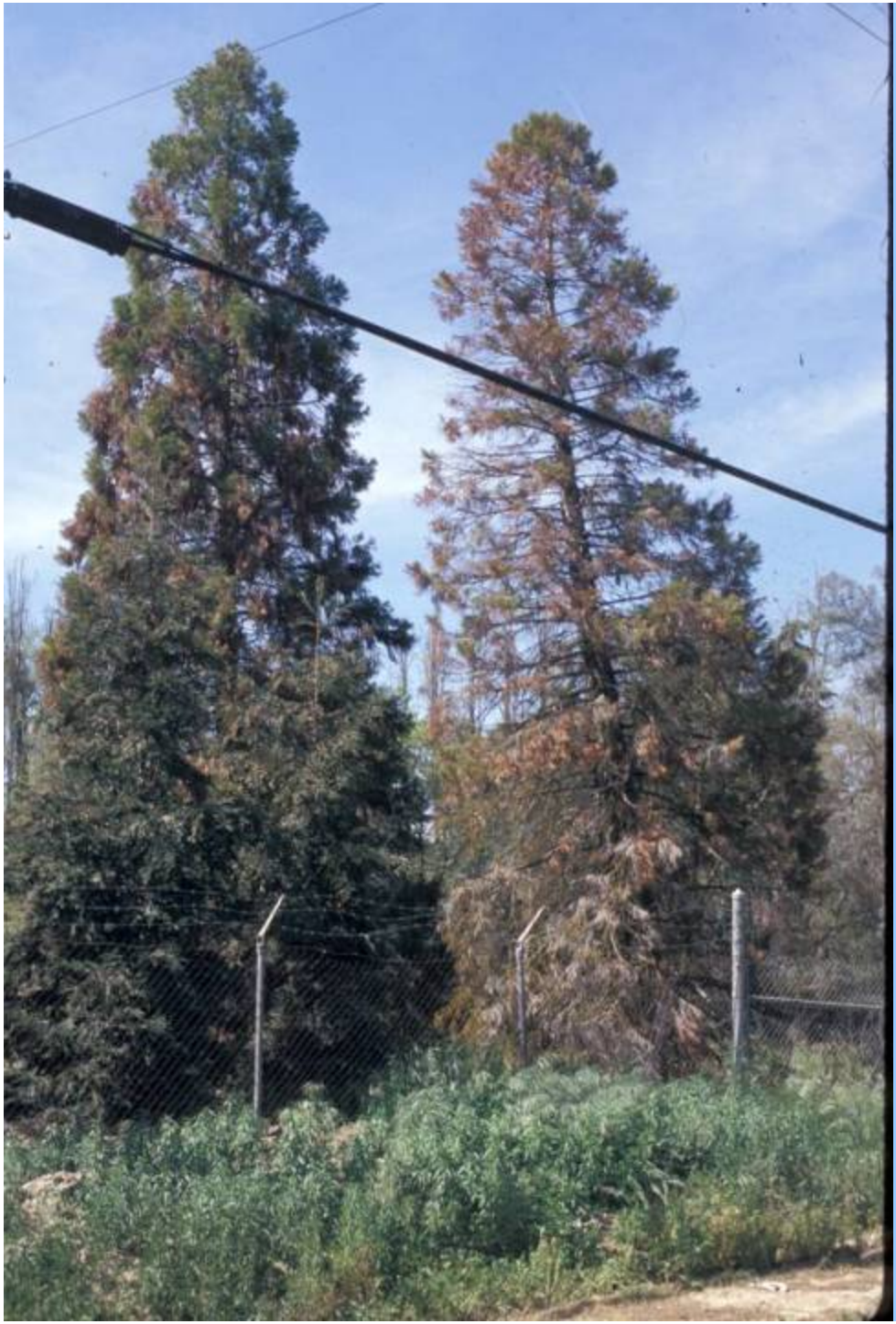



pycnidia of *Botryosphaeria*
in the bark

Incidence of *Botryosphaeria* from isolations of bark of pistachio branches



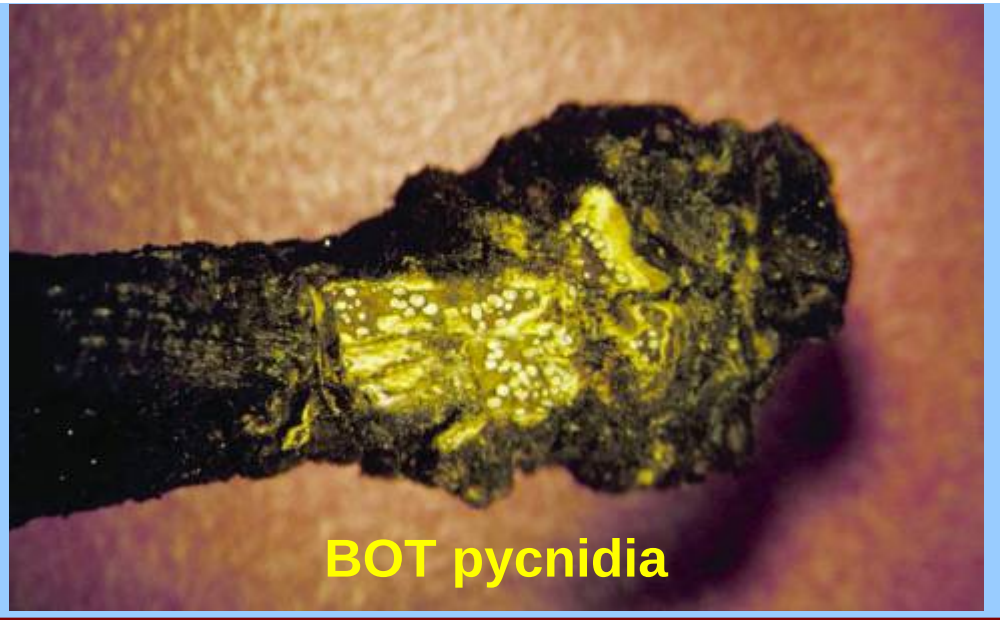
Riparian areas next to pistachios

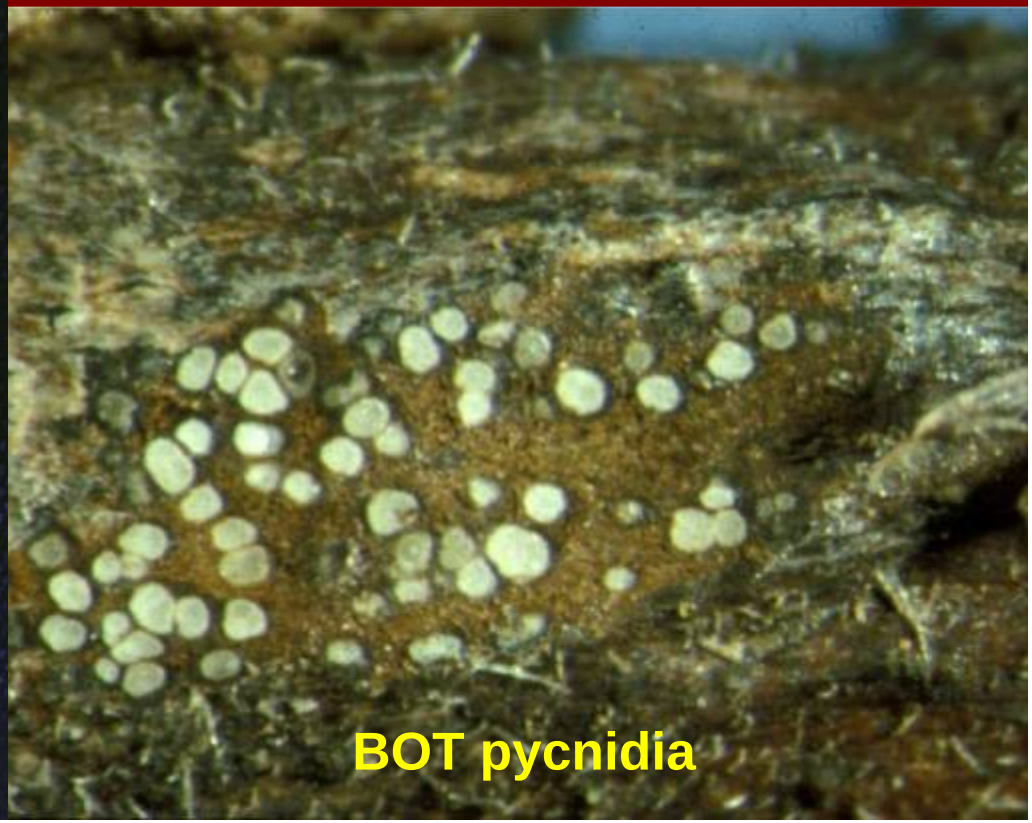


In summary:

- ✓More species of Botryosphaeriaceae fungi are involved in BOT blight of pistachio.
- ✓These species are abundant among nut crops and other hosts in California.
- ✓Spore inoculum builds up with time in older orchards.


BOT cankers


BOT pycnidia


BOT pycnidia

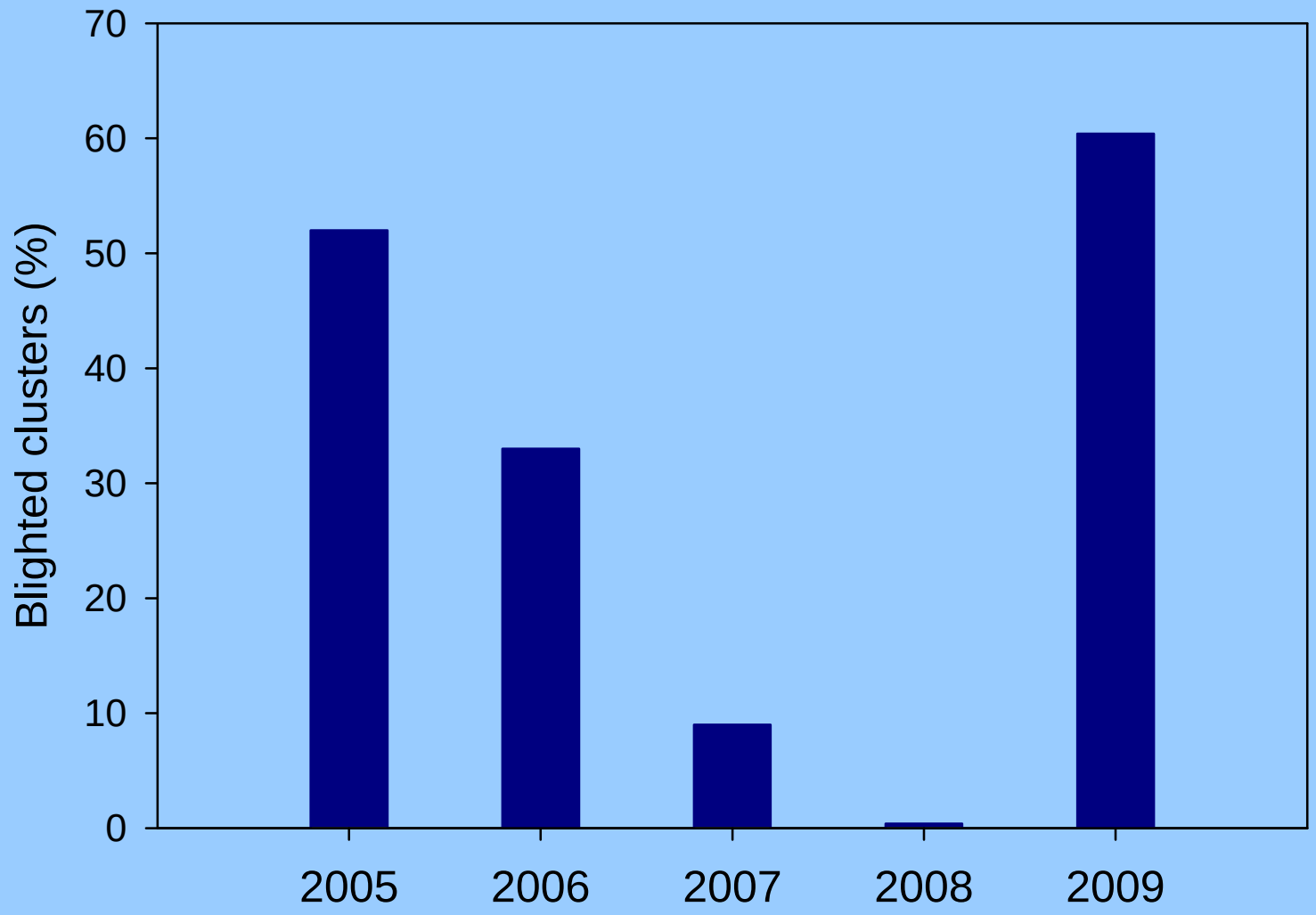
Spore inoculum in pistachio orchards:

- ✓Viable spores in pycnidia in old cankers and also in killed branches.
- ✓Spores accumulate also in the bark of healthy branches.
- ✓Inoculum does not seem to be a limiting factor for BOT disease.

BOT is back!

The Sleeping Dragon Syndrome…

Botryosphaeria blighted clusters in untreated trees of an orchard in Glenn Co.

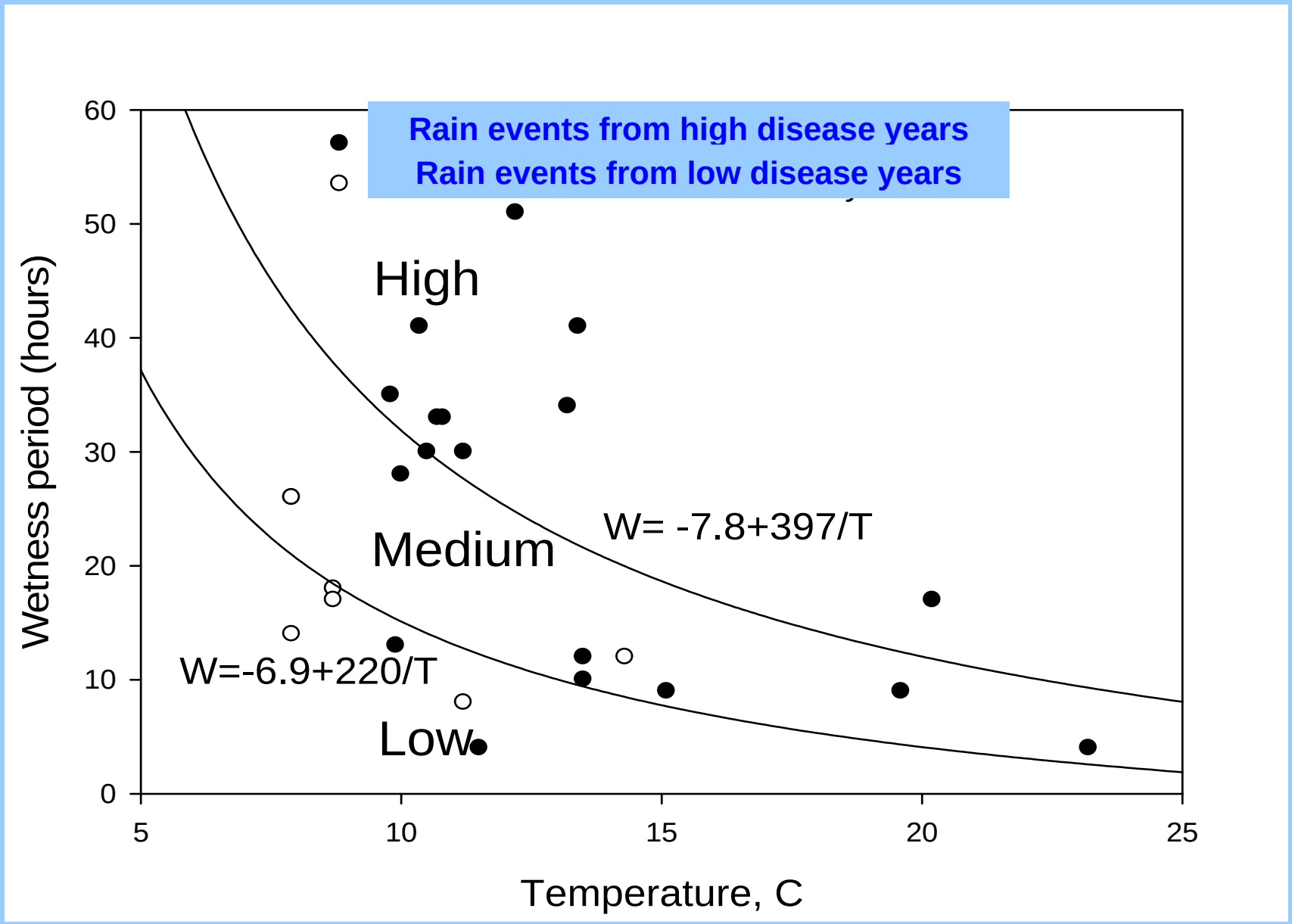


Total rain → 19” 19” 10” 14” 16”

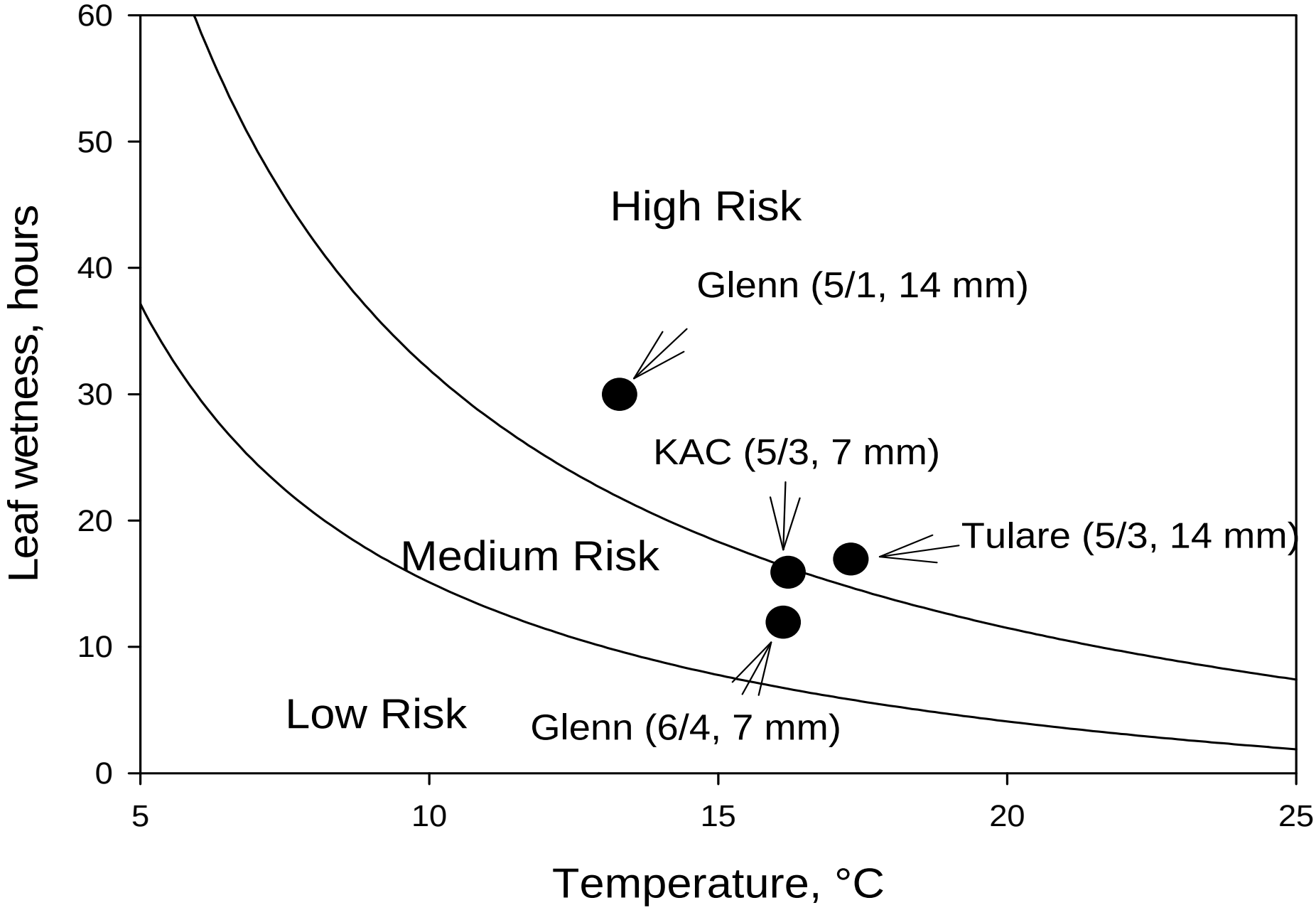
Monthly rain (mm) in a pistachio orchard in Glenn Co.

Year	April (mm)	May (mm)	June (mm)	Blighted clusters
2005	37	66	58	52 %
2006	100	17	2	30 %
2007	24	7	9	8 %
2008	2	4	0	1 %
2009	9	13	12	60 %

Relative risk of infection of pistachio fruit by *B. dothidea* by wetness period (W) events and Temperature (T)



In 2009, medium and high risk infection events



Botryosphaeria spread

- ✓ **moving water in the orchard ++++++***
- ✓ **insect transmission (hemiptera) ++**
- ✓ **pollen +**
- ✓ **pruning equipment ++**

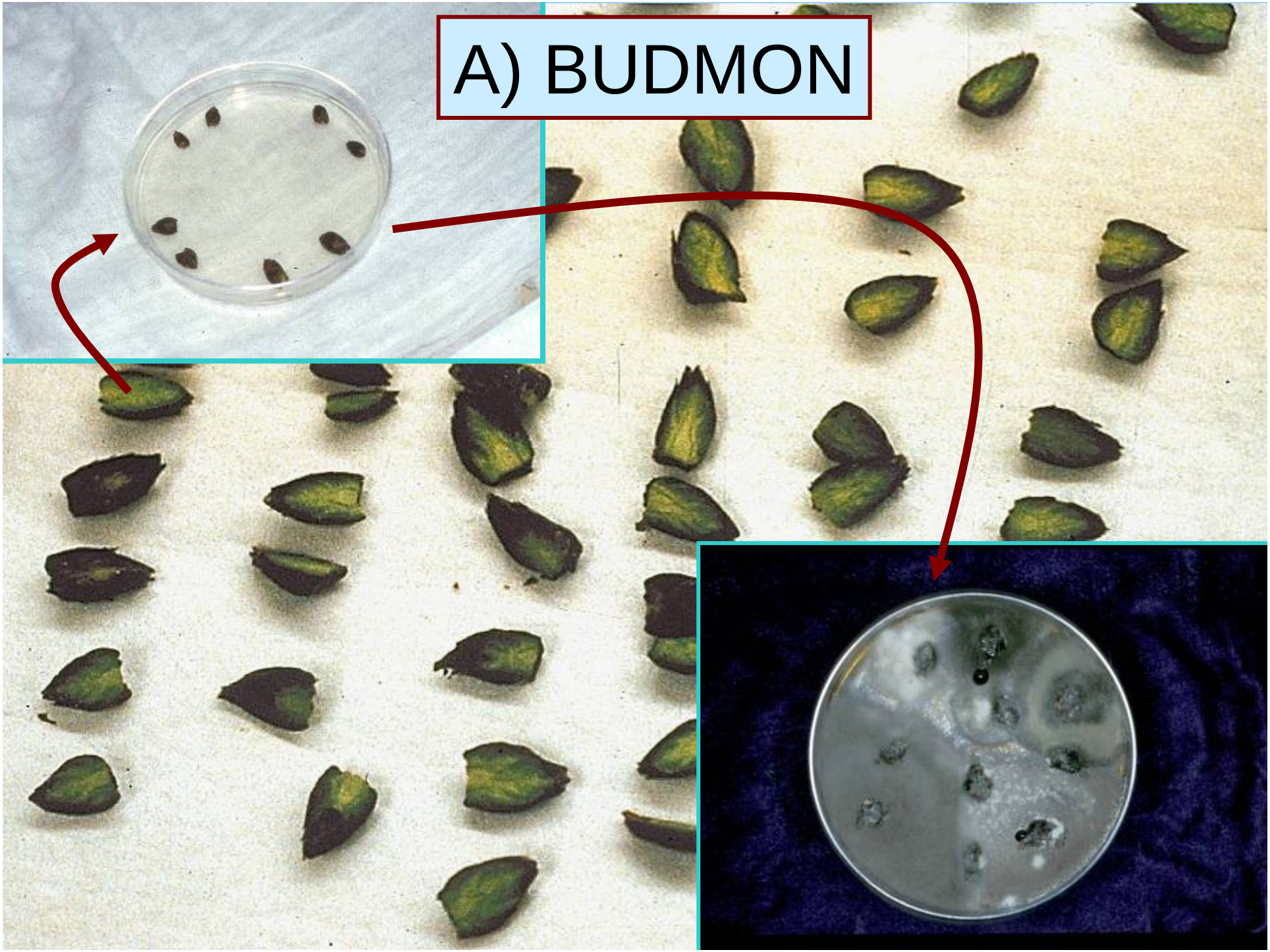
***late rain(s)**

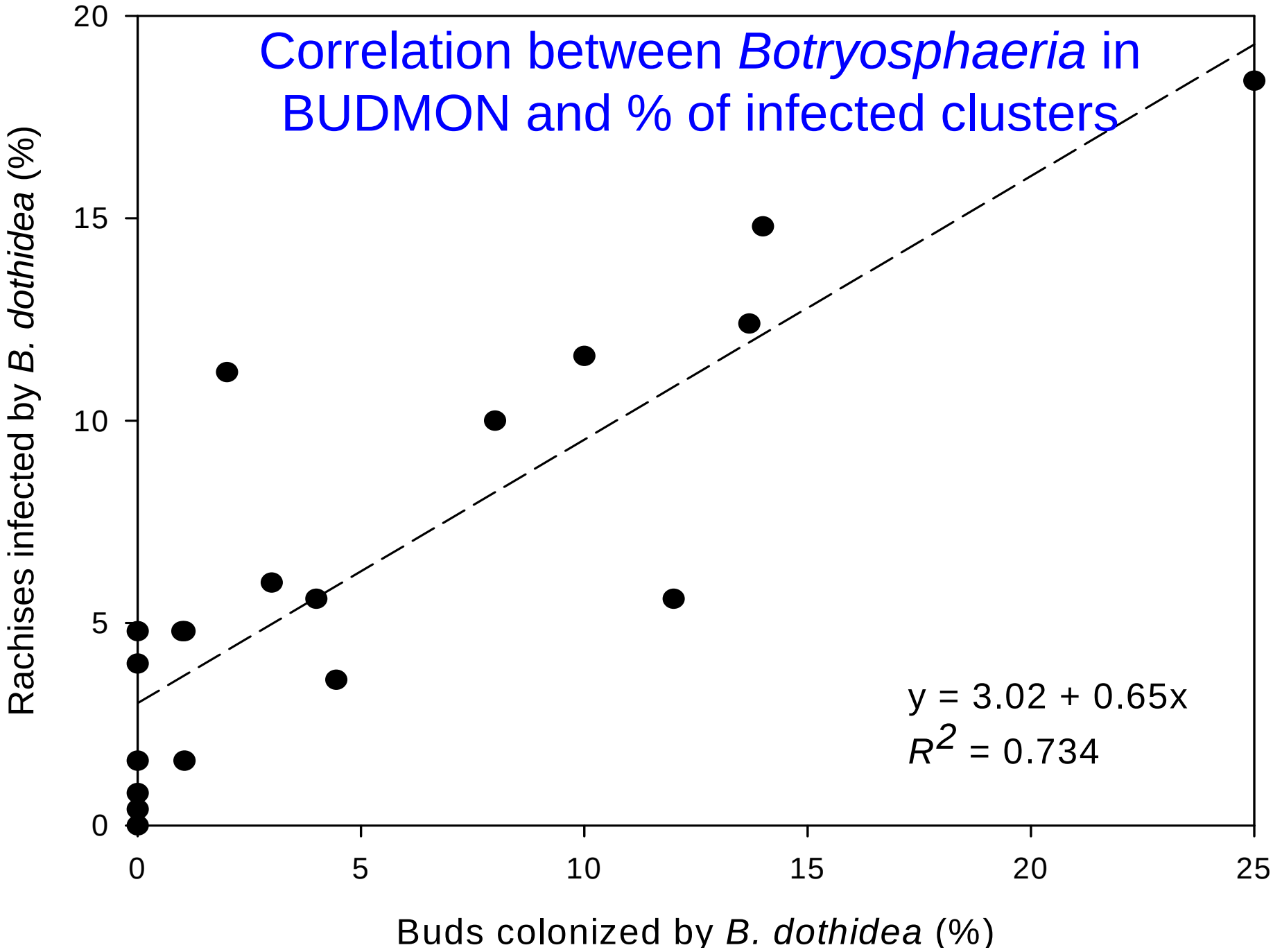
Techniques for monitoring the pathogen in latent infections:

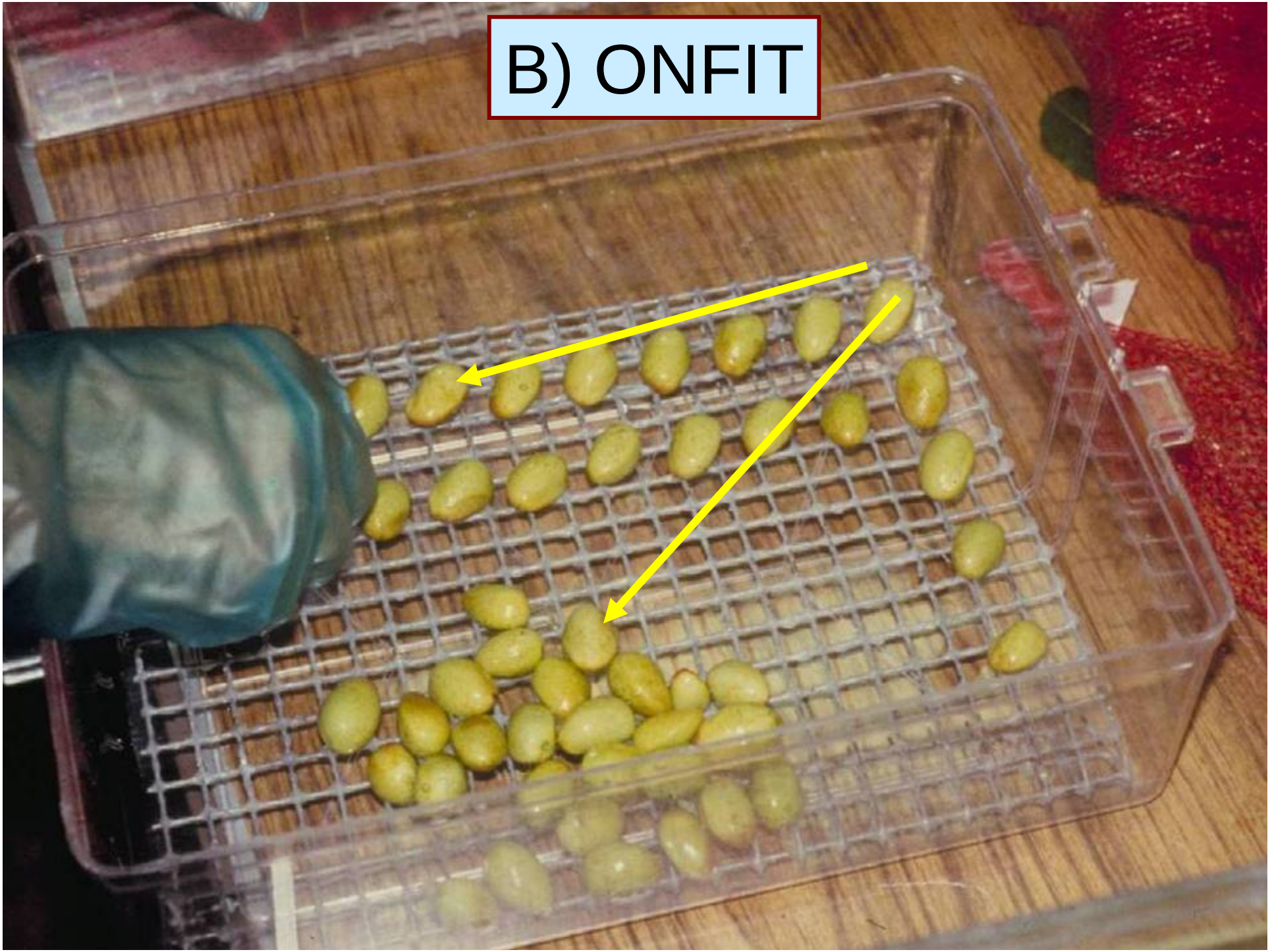
- ✓ A) Bud Monitoring for *Botryosphaeria* (BUDMON) **…preseason (Feb-March)**
- ✓ B) Overnight Freezing Incubation Technique (ONFIT) **--- during the season (June)**

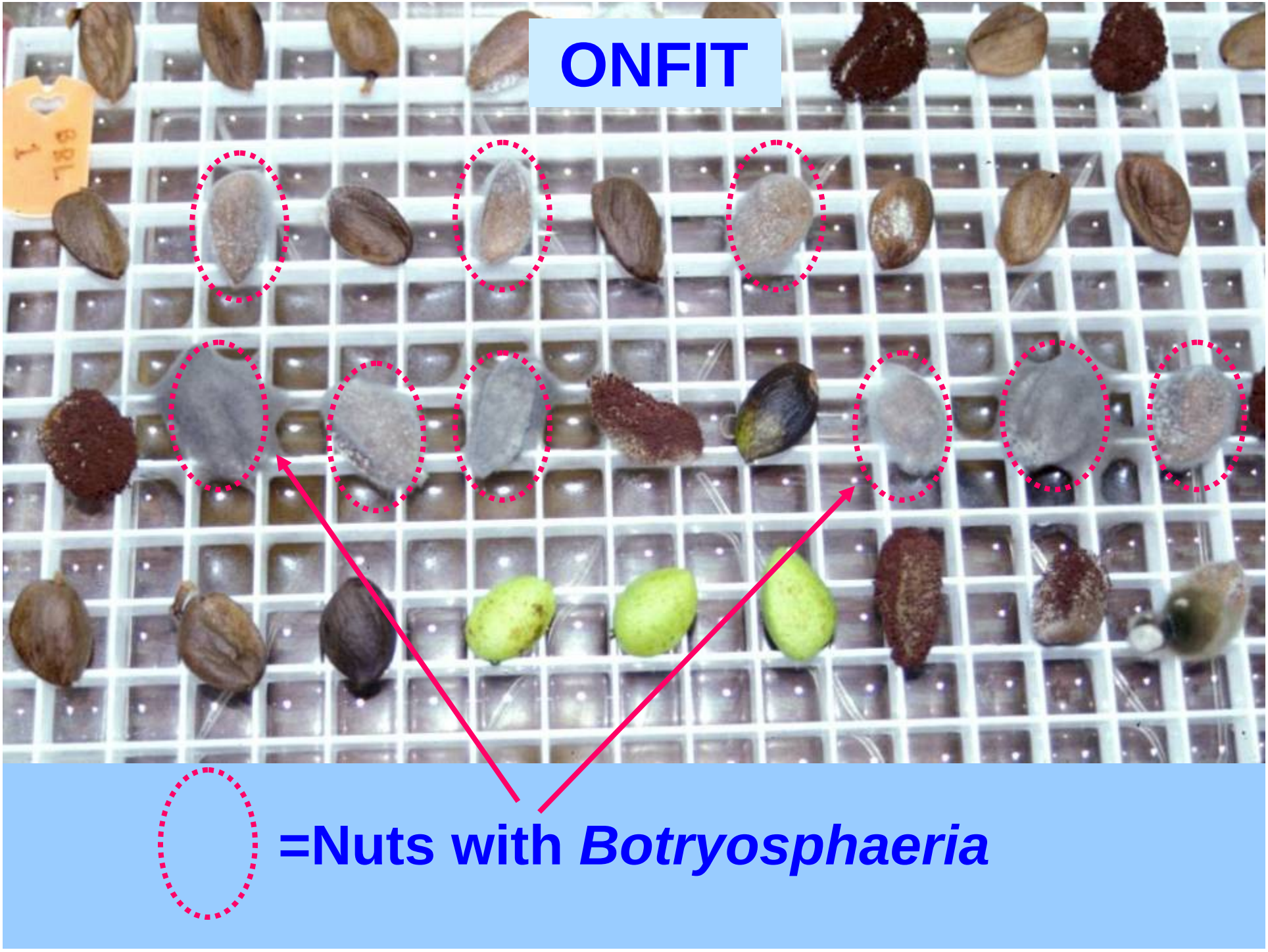
Risk:

- ✓ **how much BOT in the orchard**
- ✓ **how much disease you expect**

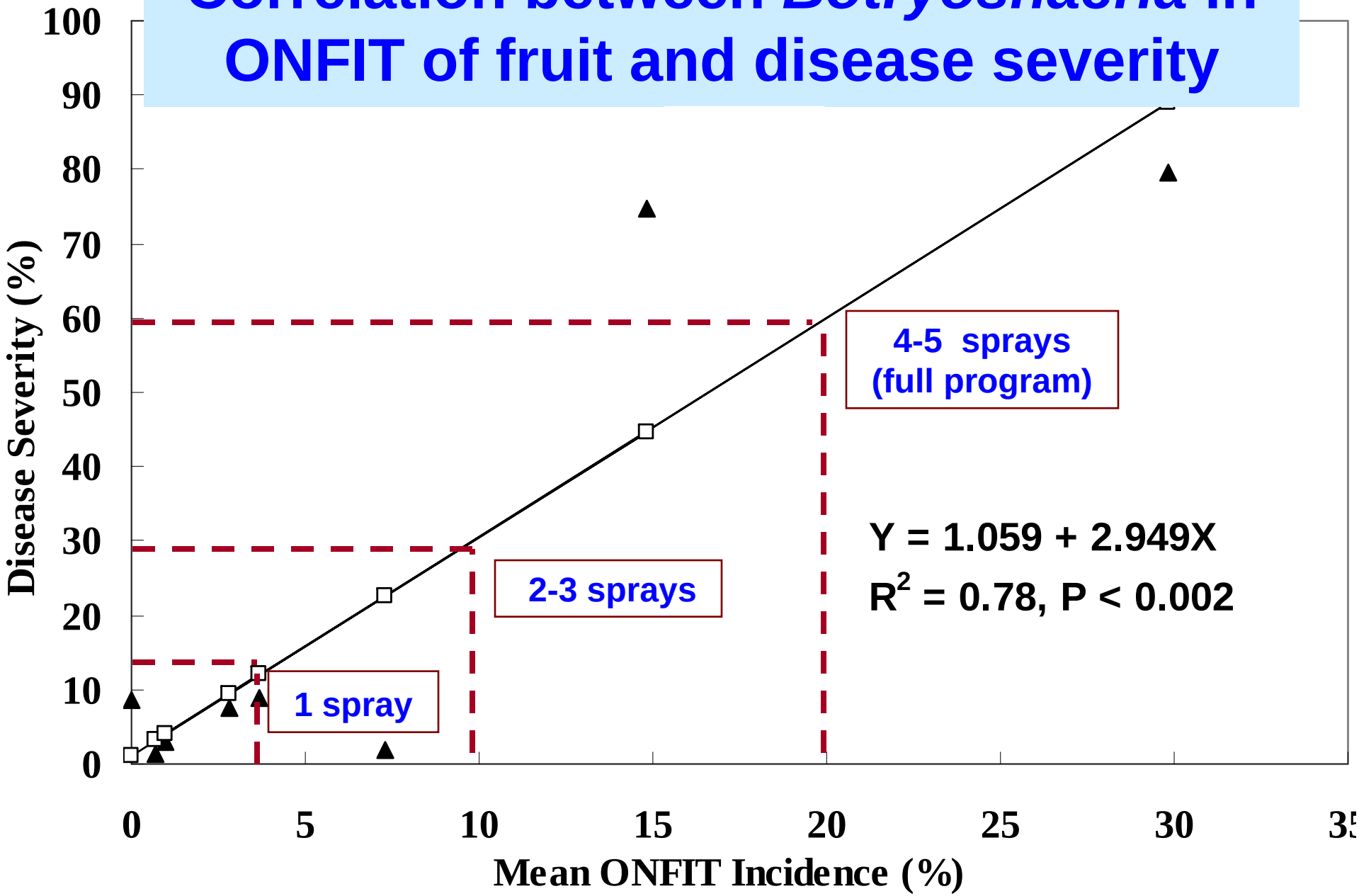

A) BUDMON


Correlation between *Botryosphaeria* in BUDMON and % of infected clusters
Rachises infected by *B. dothidea* (%)
Buds colonized by *B. dothidea* (%)
y = 3.02 + 0.65x
R^2 = 0.734
0
5
10
15
20
25


B) ONFIT

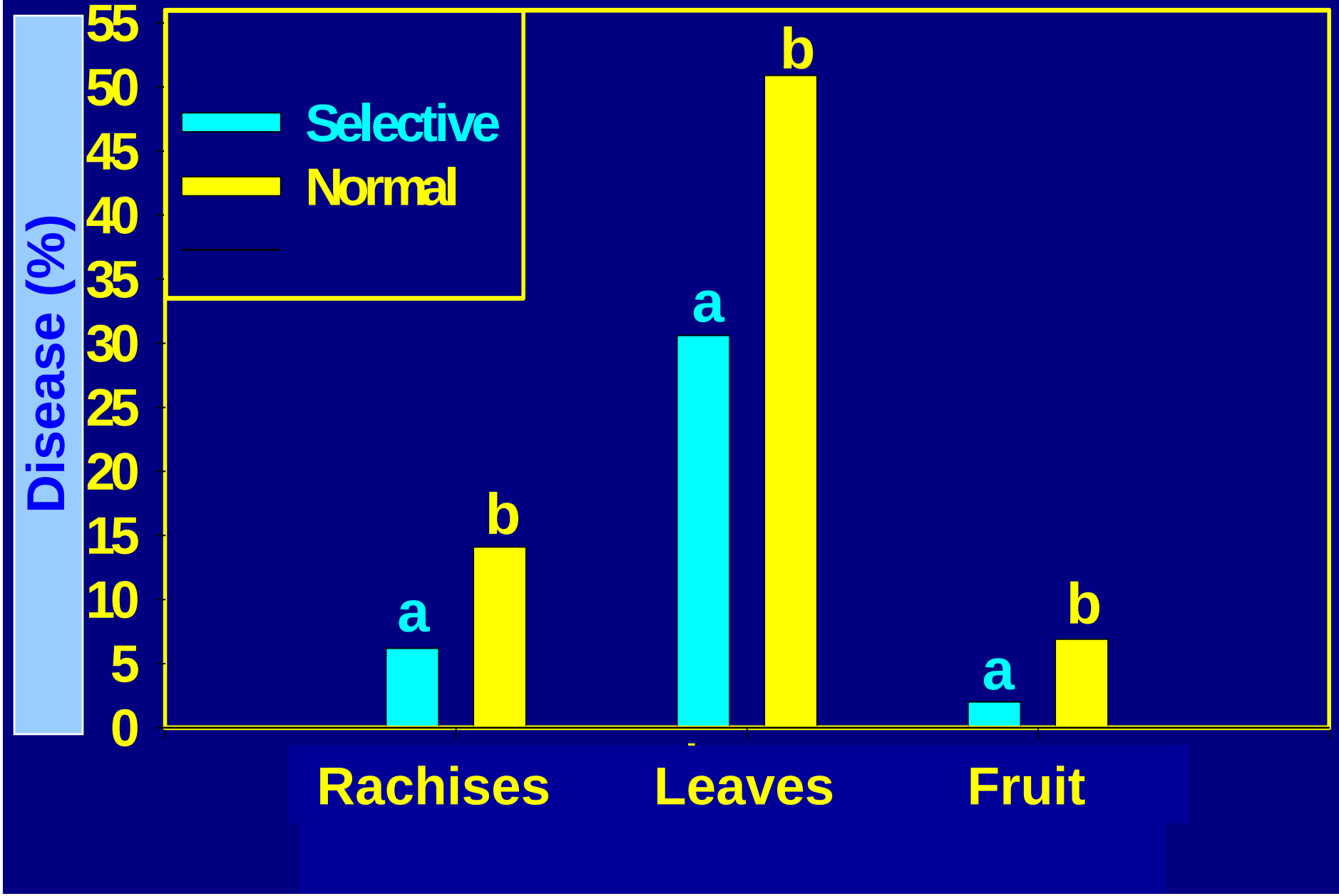

ONFIT
=Nuts with *Botryosphaeria*

Correlation between *Botryoshaeria* in ONFIT of fruit and disease severity



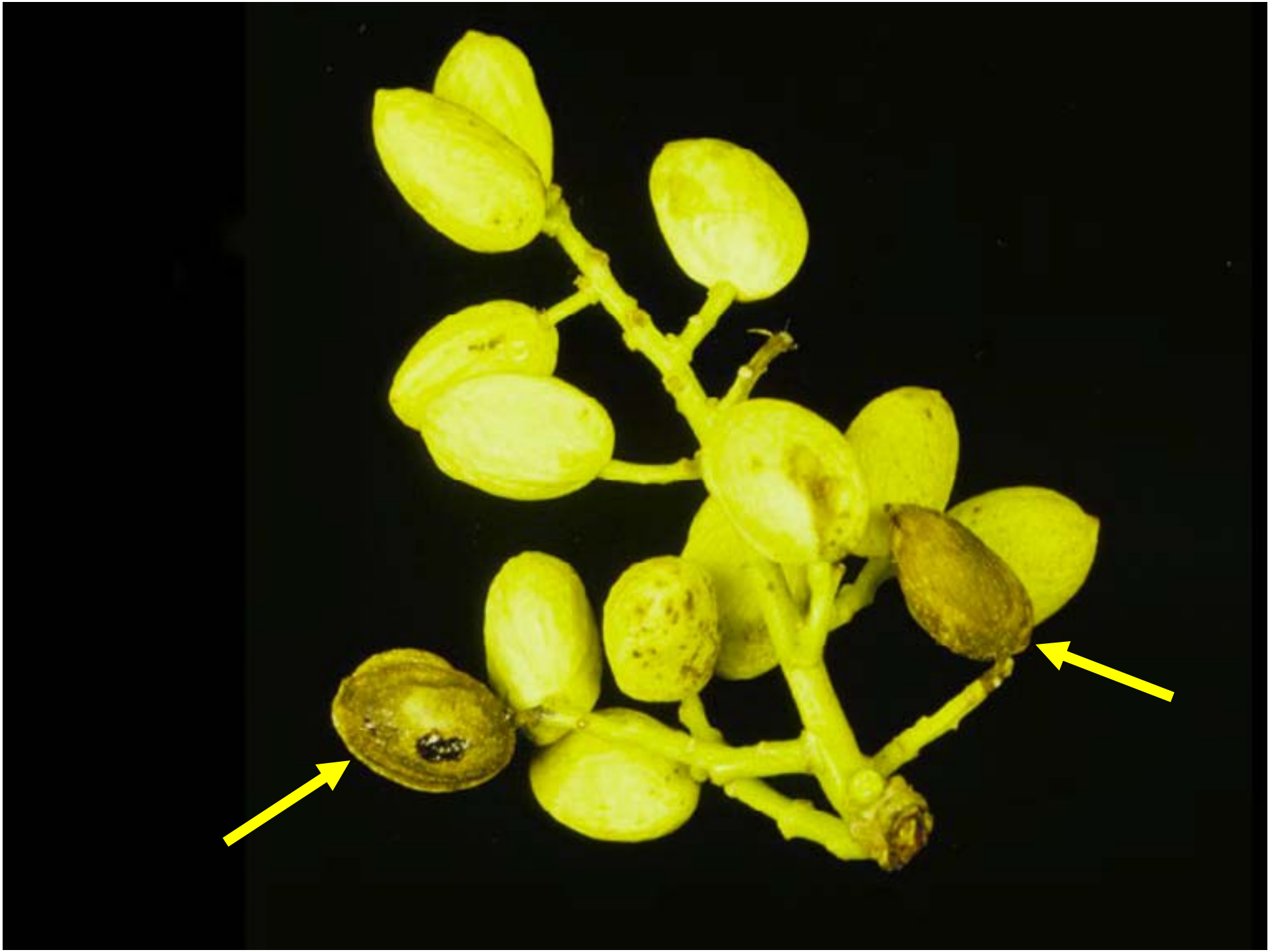

1. Sanitation: winter pruning

Selective=pruning of shoots / clusters with cankers



Summer pruning - removal of prunings

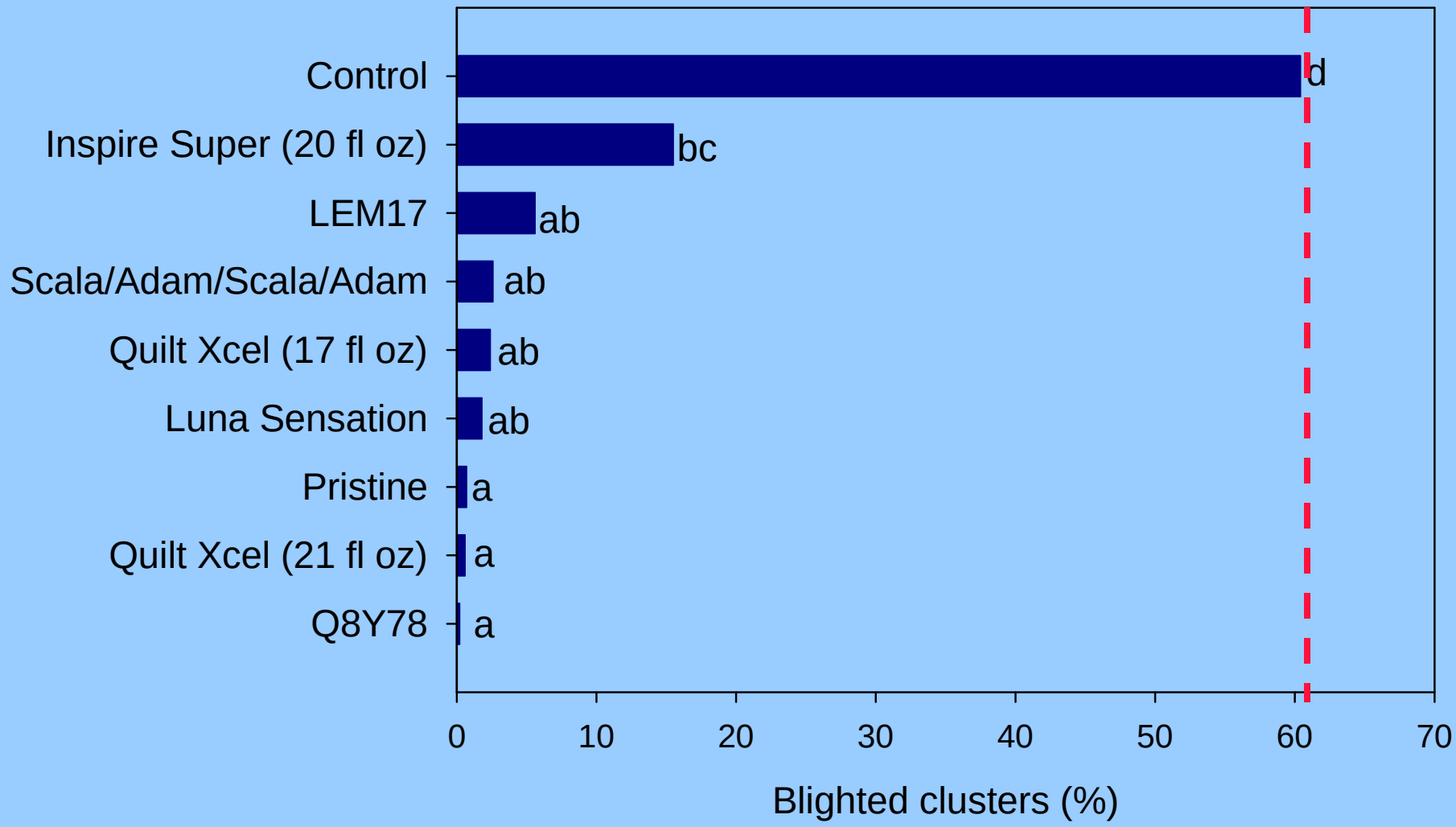
2. Control hemiptera bugs



3. Chemical Control: Fungicide efficacy

Fungicide	Resistance risk (FRAC#)	Alternaria	Botrytis	BOT
Abound	high (11)			+++
Bravo	low (M5)			++
Cabrio	high (11)			+++
Echo	low (M5)			NR
Elevate	high (17)			ND
Tilt	High (3)			++
Flint/Gem	high (11)			+++
Pristine	high (7/11)			++++
Scala	high (9)			+++[7]
Switch	high (9/12)			++
Topsin-M	high (1)			++
Quash	high (3)			++
Liquid Sulfur	low (M2)			+/-

Most effective fungicides – Glenn Co. (2009)

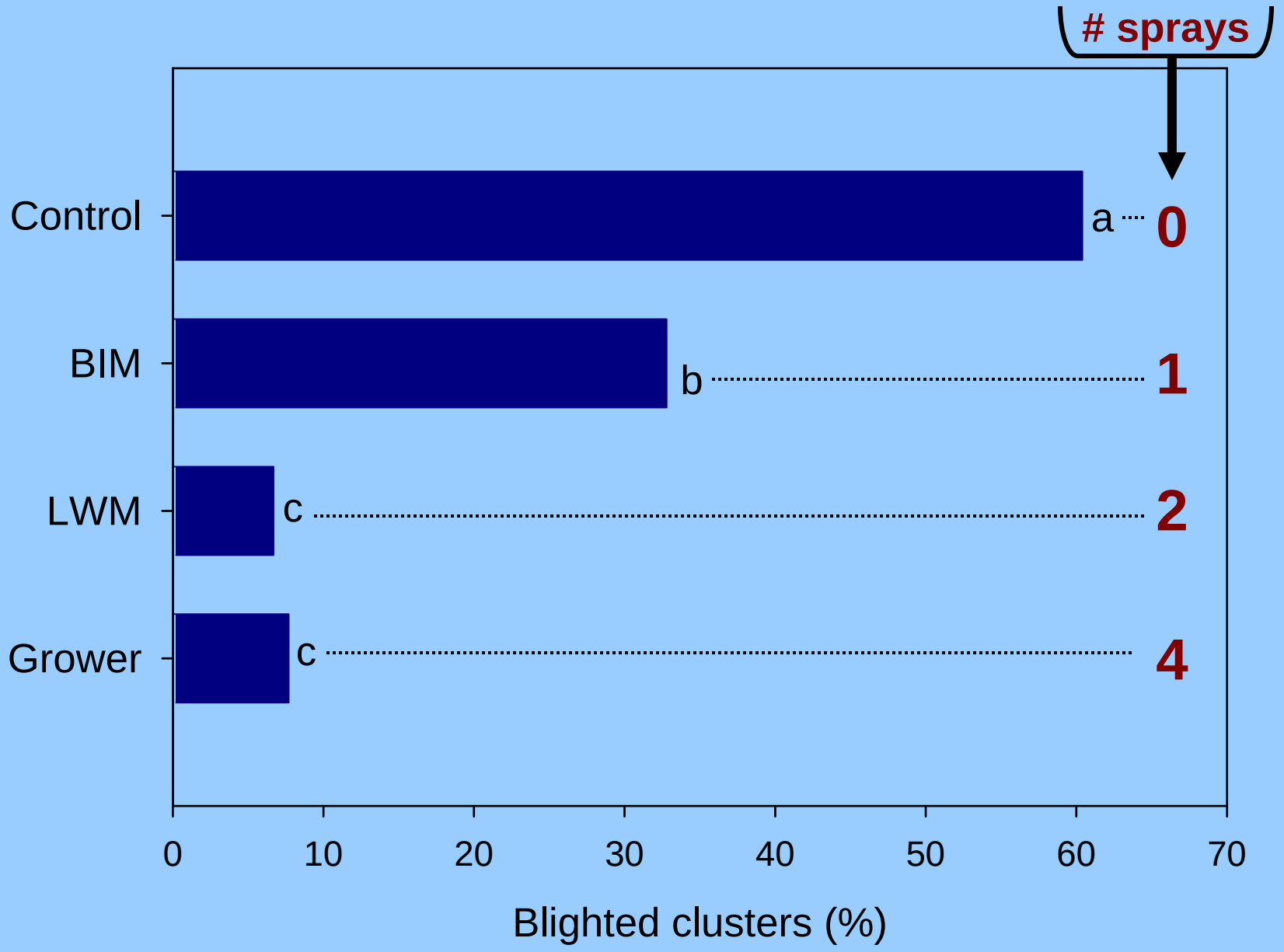


PISTACHIO—Fungicide treatment timing

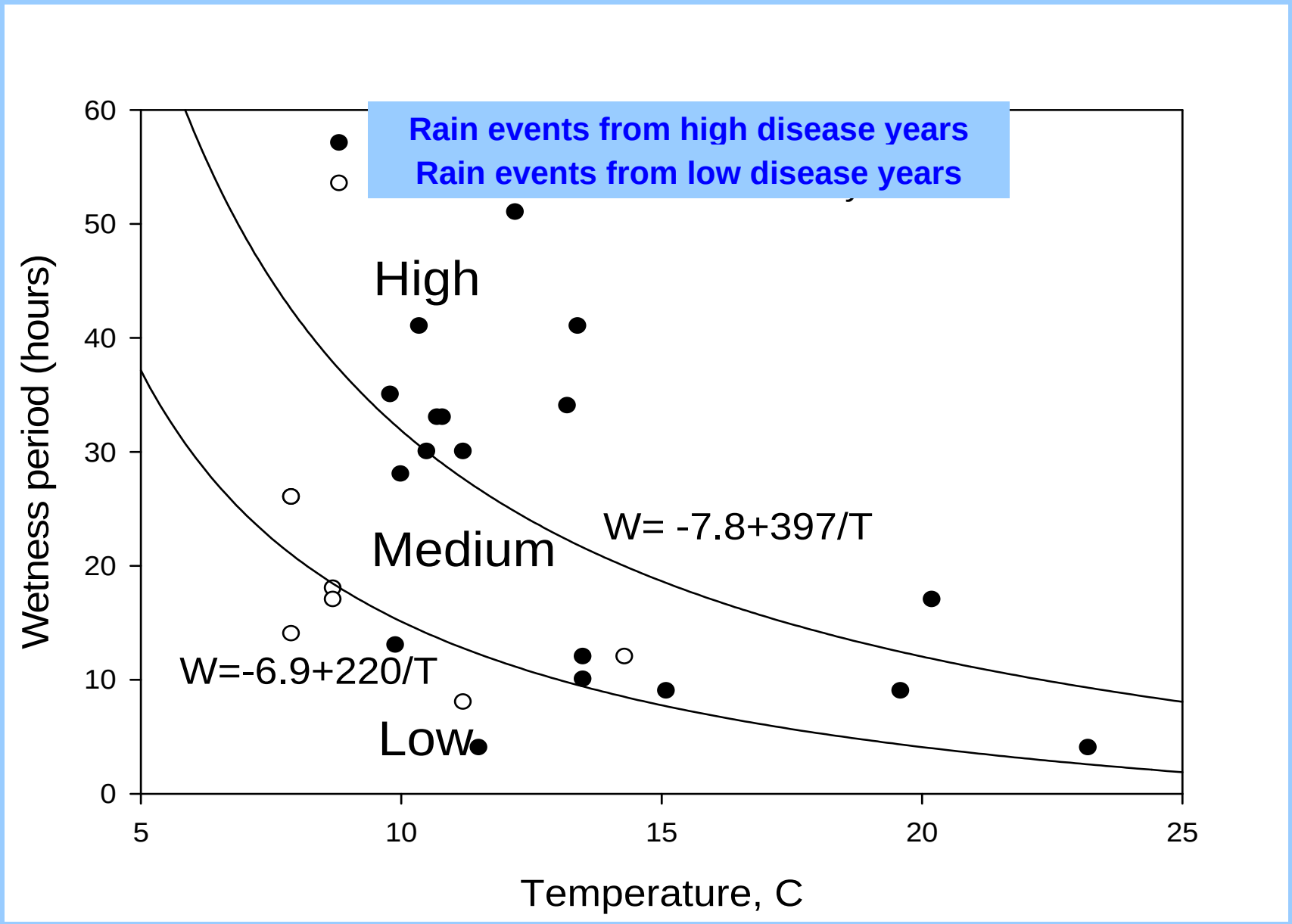
Disease	Dormant	April May	June	July	August
Alternaria	----	----	+++	+++	++
BOT	+	++	+++	+++	++
Botrytis	----	+++	----	----	----

Source: **http://www.uckac.edu/plantpath/**

Fungicide sprays based on disease models



Relative risk of infection of pistachio fruit by *B. dothidea* by wetness period (W) events and Temperature (T)



Take-home message

- Fungi of Botryosphaeriaceae accumulate in the bark of older trees (The Sleeping Dragon).

- If you do not have Botryosphaeria inoculum in your orchard, then you will have no disease.

- Rains in May & June with warm temperatures trigger infection events that cause BOT blight.

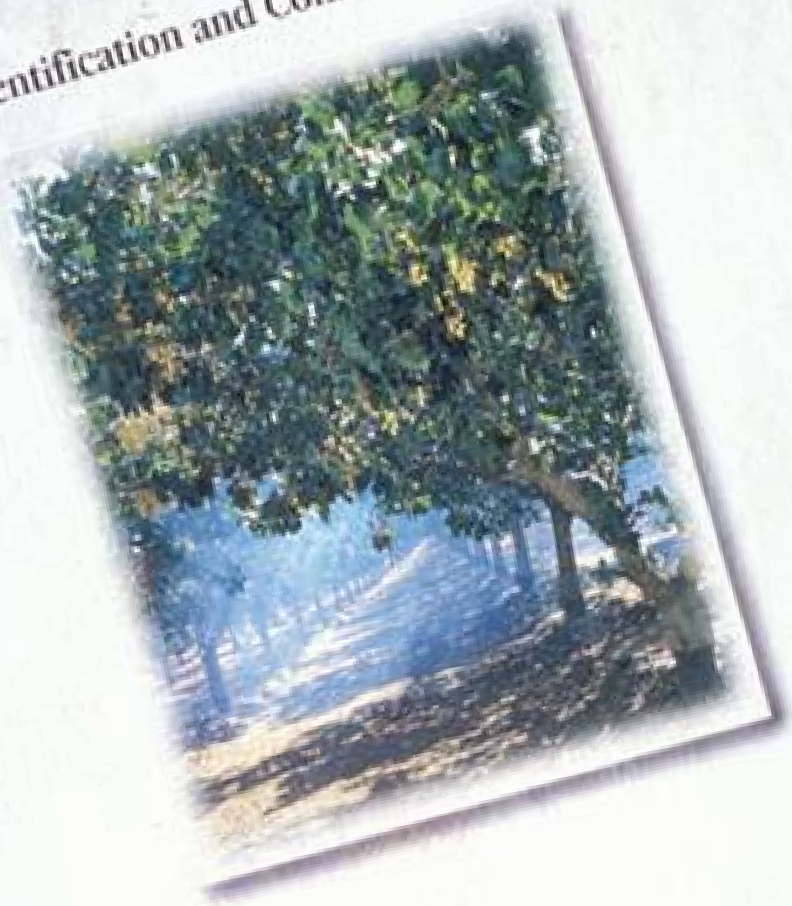
- Monitoring leaf wetness and Temperature (LWM) is a great way to decide when and how many times to spray to manage BOT blight.

BOT Management Guidelines

- ✓ Learn what “BOT” looks like
- ✓ Watch your orchard carefully
- ✓ Consider bud monitoring in Feb/March***
- ✓ Consider ONFIT at end of rainy season***
- ✓ If “BOT” appears act immediately
- ✓ Prune out infections (summer pruning)
- ✓ Evaluate your irrigation system
- ✓ Apply fungicides***
- ✓ Practice selective pruning (fall/winter pruning)

BOTRYOSPHAERIA BLIGHT OF PISTACHIO

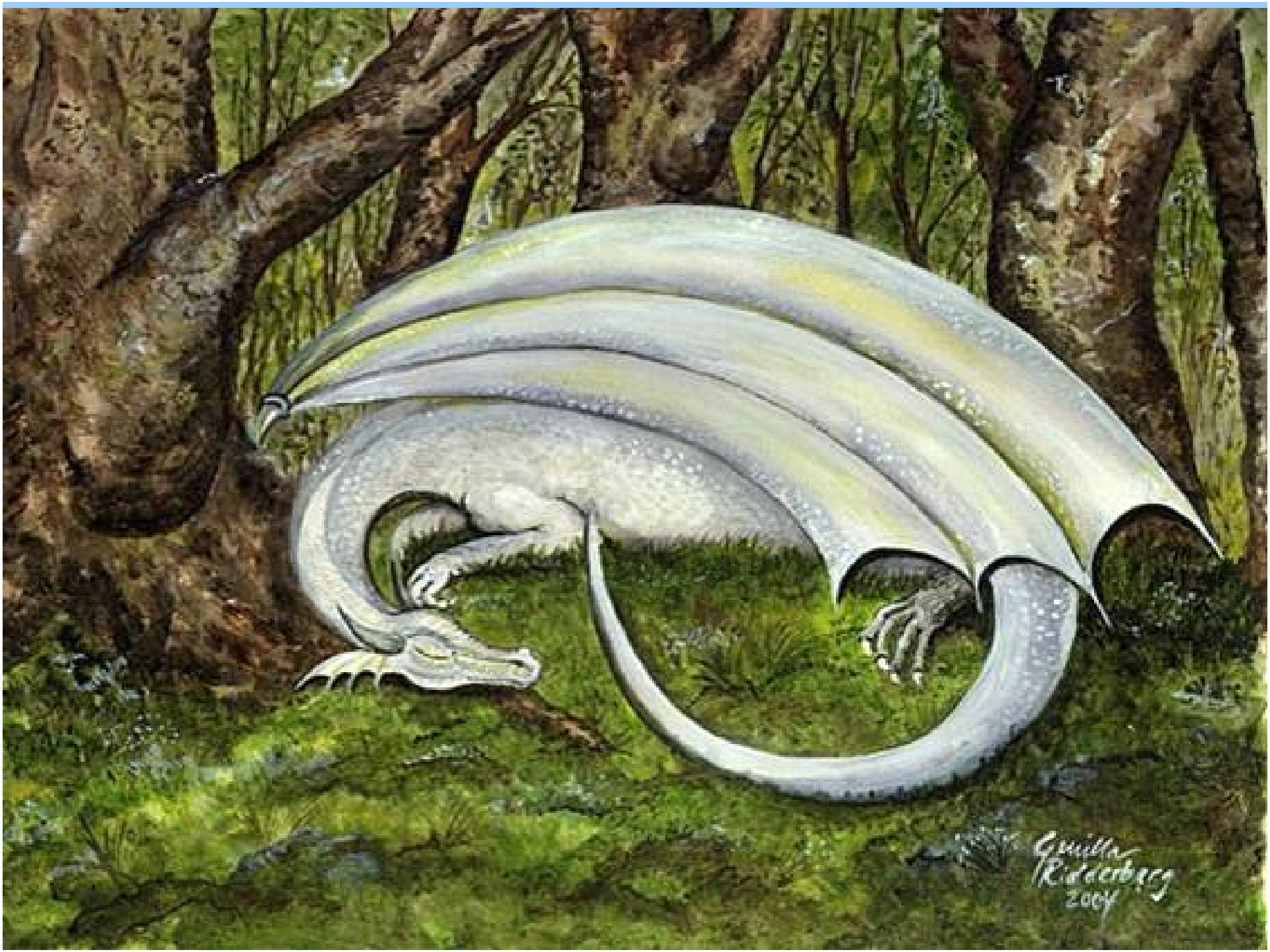
Identification and Control Manual



Fall (October-November)

Late Summer (August-September)

Early Summer (June-July)

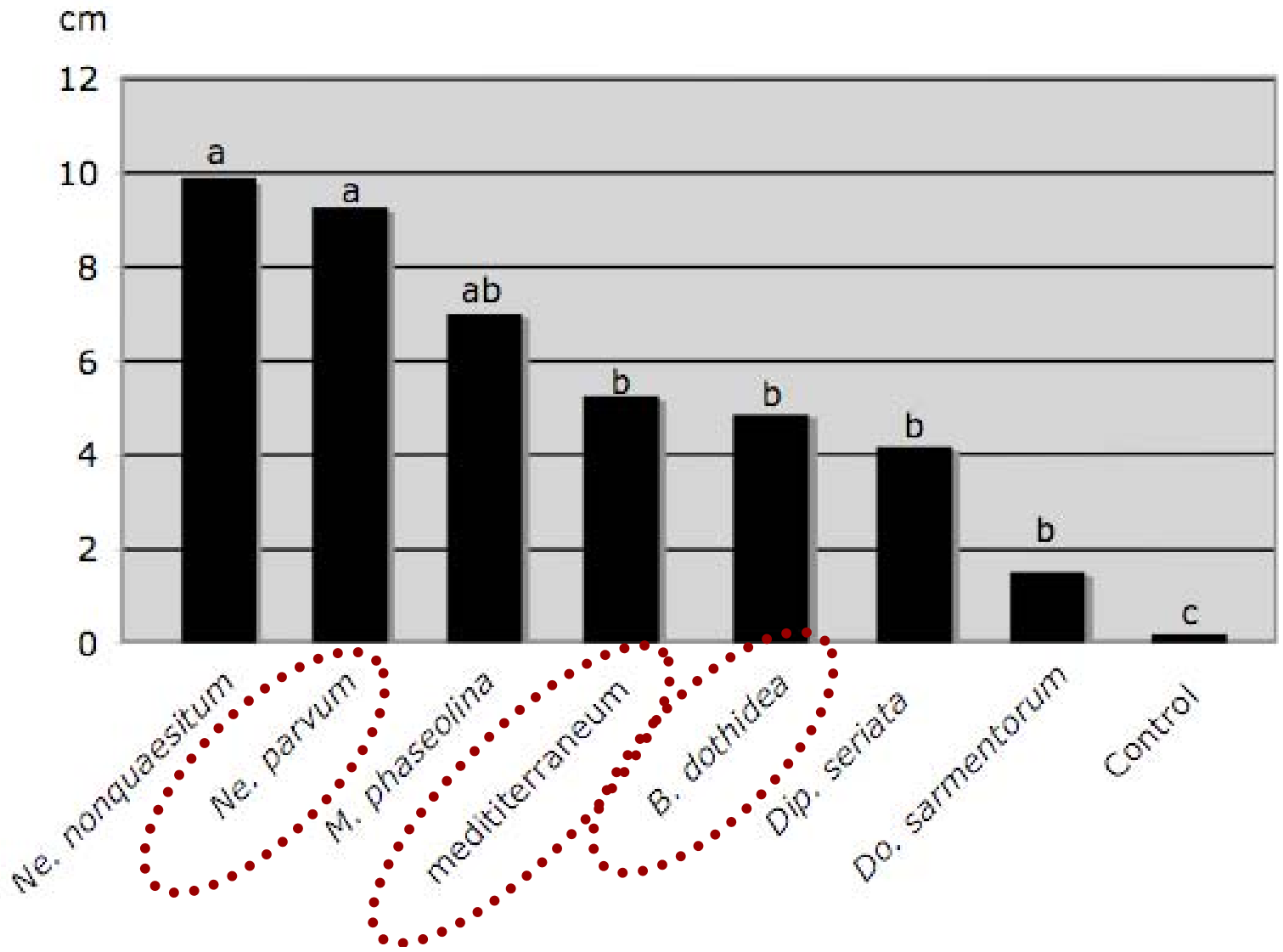

Guillermo Riddenberg
2004

Acknowledgments:

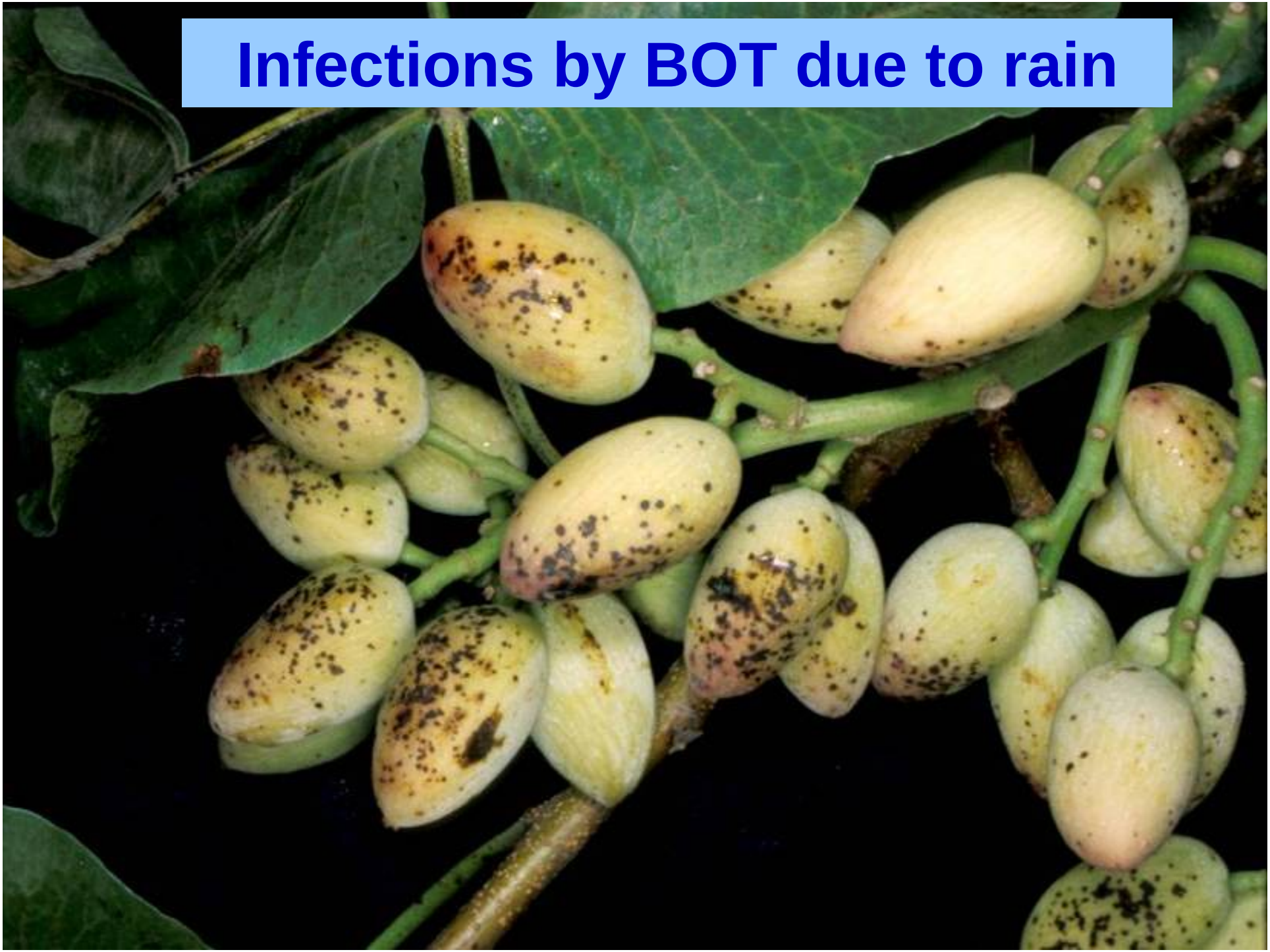
- **Patrik Interbitzin, Ph.D.**
- **David Morgan, M.Sc.**
- **Ryan Puckett**
- **Heraclio Reyes**
- **Jessica Windt**

Blighted clusters remain on trees (…1999)

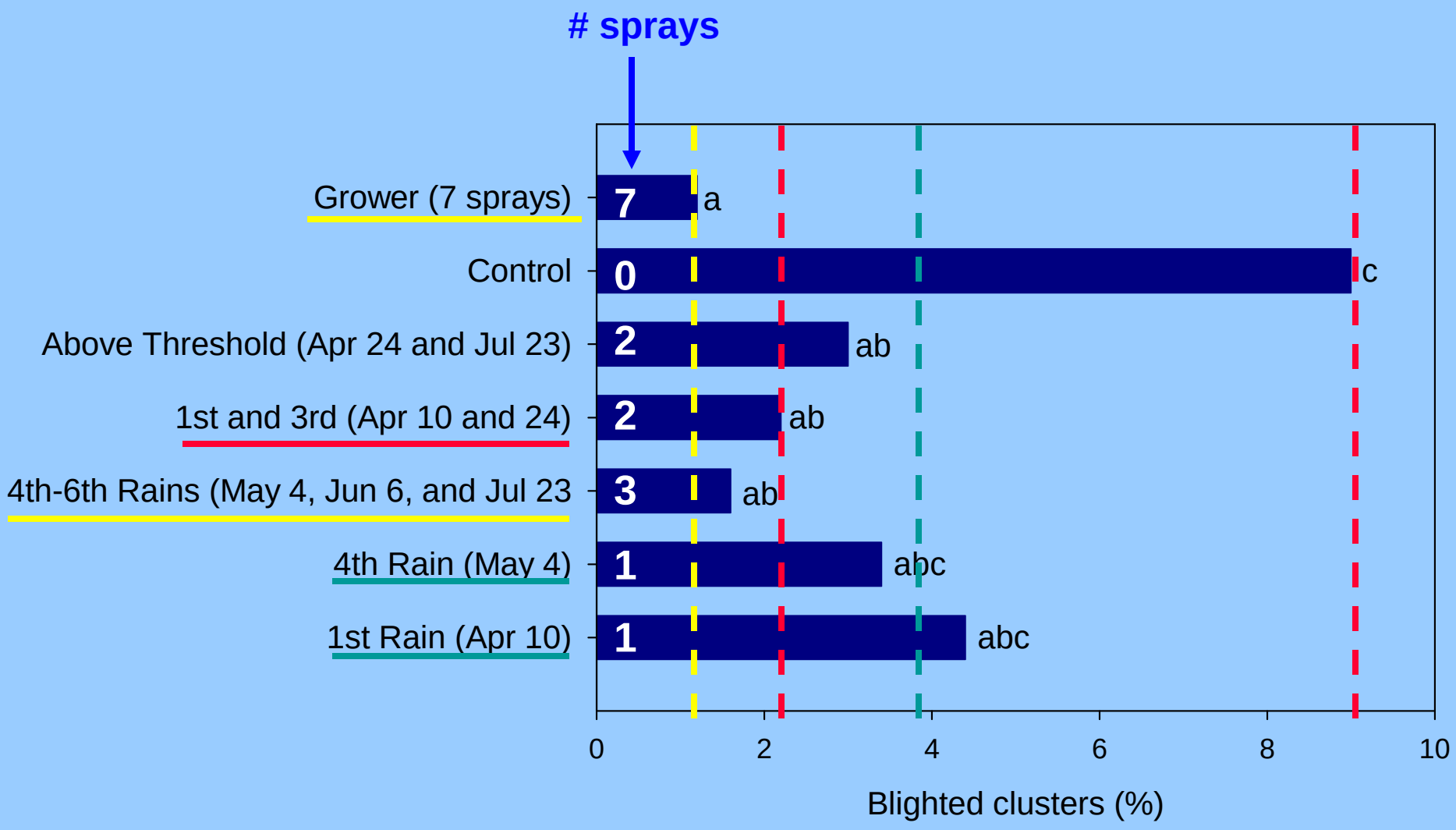
Pathogenicity of various Botryosphaeriaceae on almond



Infections by BOT due to rain



Sprays timed **near rain events** controlling Botryosphaeria blight (2007)



In 2009, medium and high risk infection events