



Botrytis and Other Pathogens in Alaska Peony Fields

Dr. Gary Chastagner
Professor of Plant Pathology
chastag@wsu.edu

WASHINGTON STATE
 UNIVERSITY
World Class. Face to Face.

Topics

- Overview of WSU Puyallup disease management research program.
- Disease surveys on peony farms in AK and WA.
- Preliminary results on the diversity of *Botrytis* species on peonies in AK and WA.
- General *Botrytis* disease management strategies.

Note: Always check the label prior to application of any pesticide to make sure you are using properly registered products in your disease management program.

Washington State University



Plant Pathology Program

Dr. Gary Chastagner



A Long History of Bulb and Cut Flower Production and Research





Plant Pathology Program Staff

Program Staff:

Dr. Marianne Elliott, Scientific Associate
Katie Coats, Scientific Associate
Annie DeBauw, Ag. Res. Technologist III
Kathy Riley, Professional Worker
Andy McReynolds, Plant Tech. II
Don Sherry, Professional Worker
Carly Thompson, Professional Worker

Grad Students:

Andrea Garfinkel (PhD)
Anna Leon (PhD)
Katie McKeever (PhD)
Lucy Rollins (MS)



Management of Diseases on Ornamental Bulb and Cut Flower Crops



Andrea Garfinkel - PhD

- Molecular-based assays to detect and quantify soilborne fungal pathogens.
- Identification and management of *Botrytis* species on peonies.
- Relationship of inoculum level to development of *Rhizoctonia* gray bulb rot.
- Prevalence of viral diseases on lilies and dahlias at cut flower farms in Western Washington.
- Efficacy of reduced-risk and biocontrol fungicides in controlling diseases.

Sources of Funding and In-kind Support for Bulb and Cut Flower Program

- USDA Floral and Nursery Crop Research Initiative
- WSDA Specialty Crop Block Grant
- Northwest Agricultural Research Foundation (NARF)
- Wally Staatz Endowment
- IR-4 program
- Alaska Peony Growers Association
- Knutson Farms
- Van der Salm Farms, Inc.
- Oregon Perennial Company
- Industry
- Regional growers



Topics

- Overview of WSU Puyallup disease management research program.
- Disease surveys on peony farms in AK and WA.
- Preliminary results on the diversity of *Botrytis* species on peonies in AK and WA.
- General *Botrytis* disease management strategies.

Note: Always check the label prior to application of any pesticide to make sure you are using properly registered products in your disease management program.



Peonies

from America's Last Frontier

This old-fashioned flower is all the more alluring once you discover it's Alaska's newest export

Story and photos by Debra Prinzing

ALASKA AIRLINES MAGAZINE AUGUST 2013

I flew to Alaska in pursuit of flowers. America's 49th state is known for producing exports such as oil and seafood. But sweet-smelling flowers? Blooming in July and August as far north as Fairbanks?

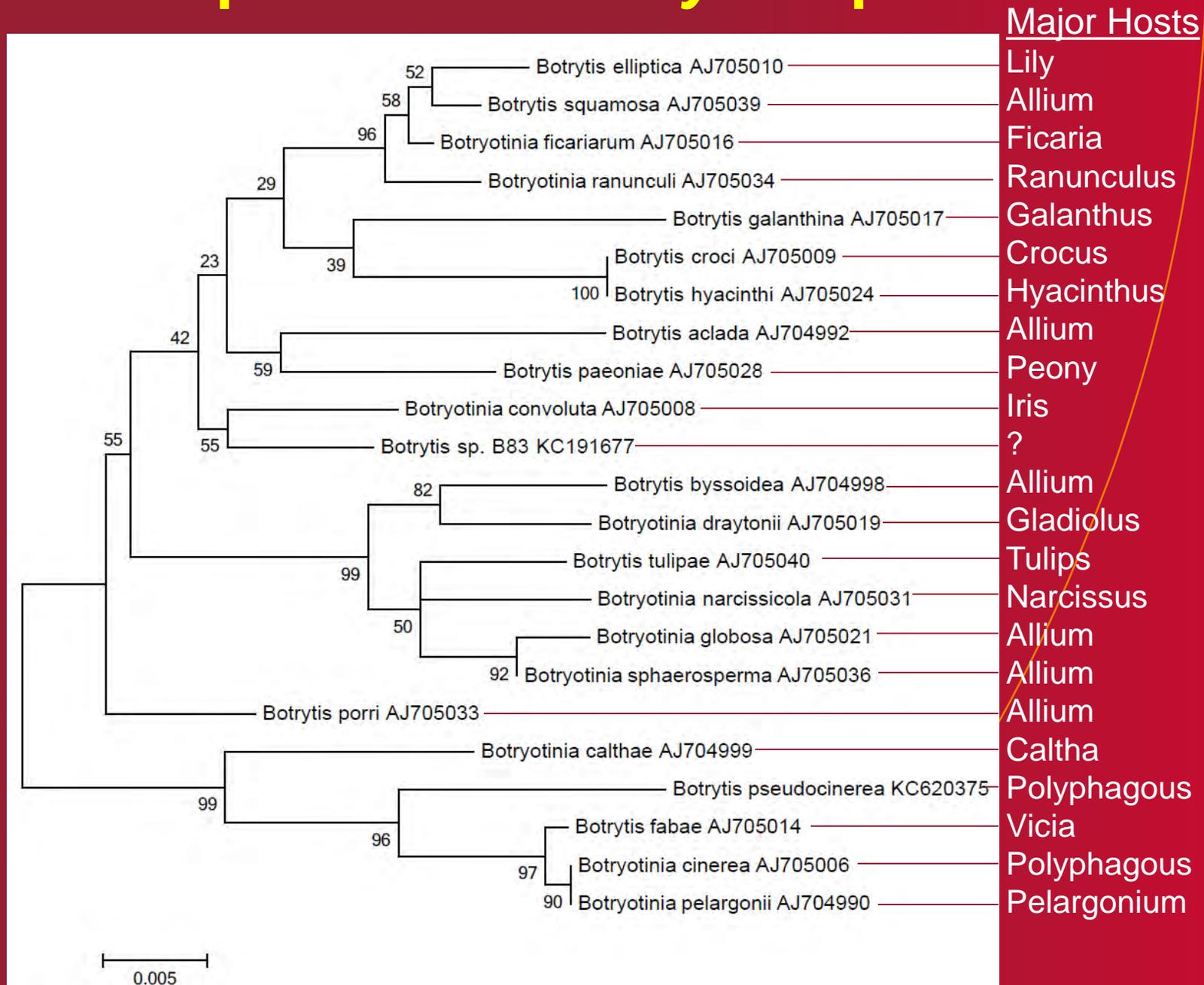
“That my plants are going to get mugged occasionally by diseases is not in question. The real questions are – do I know how to identify, prevent, or reduce the damage?”

Dr. Allan Armitage, University of Georgia

Some Common Diseases of Peonies

- Foliage blights and leaf spots – *Botrytis* spp. and *Cladosporium* spp.
- Powdery mildew – *Erysiphae* spp.
- Root and crown rots – *Phytophthora* spp. and *Sclerotium* spp.
- Stem rots - *Sclerotinia*
- Wilts – *Verticillium* spp.
- Viruses - Tobacco rattle virus (Peony ringspot or mosaic virus),
- Nematodes – *Meloidogyne* spp.
- Physiological – bud blast, oedema

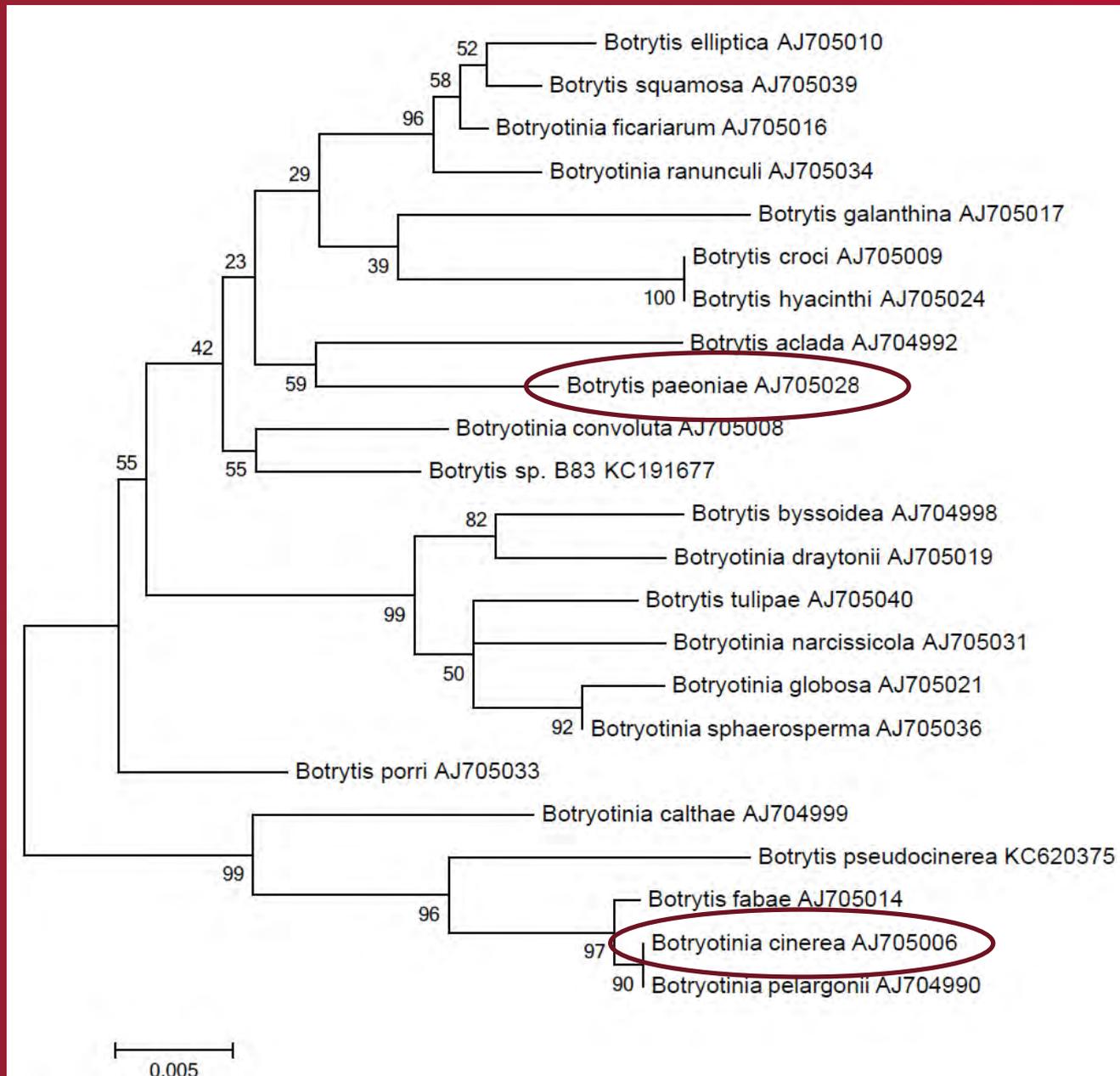
Relationship of Some *Botrytis* Species



Botrytis spp on bulbs crops are highly pathogenic and are commonly the most important disease on these crops.



Botrytis species reported from peonies



Managing Botrytis (Gray Mold) on Peonies



boards.weddingbee.com

Collaborative project with:

Dr. Patricia S. Holloway
University of Alaska Fairbanks
Georgeson Botanical Garden



viette.com



midatlanticgardening.com



Topics

- Overview of WSU Puyallup disease management research program.
- Disease surveys on peony farms in AK and WA.
- Preliminary results on the diversity of *Botrytis* species on peonies in AK and WA.
- General *Botrytis* disease management strategies.

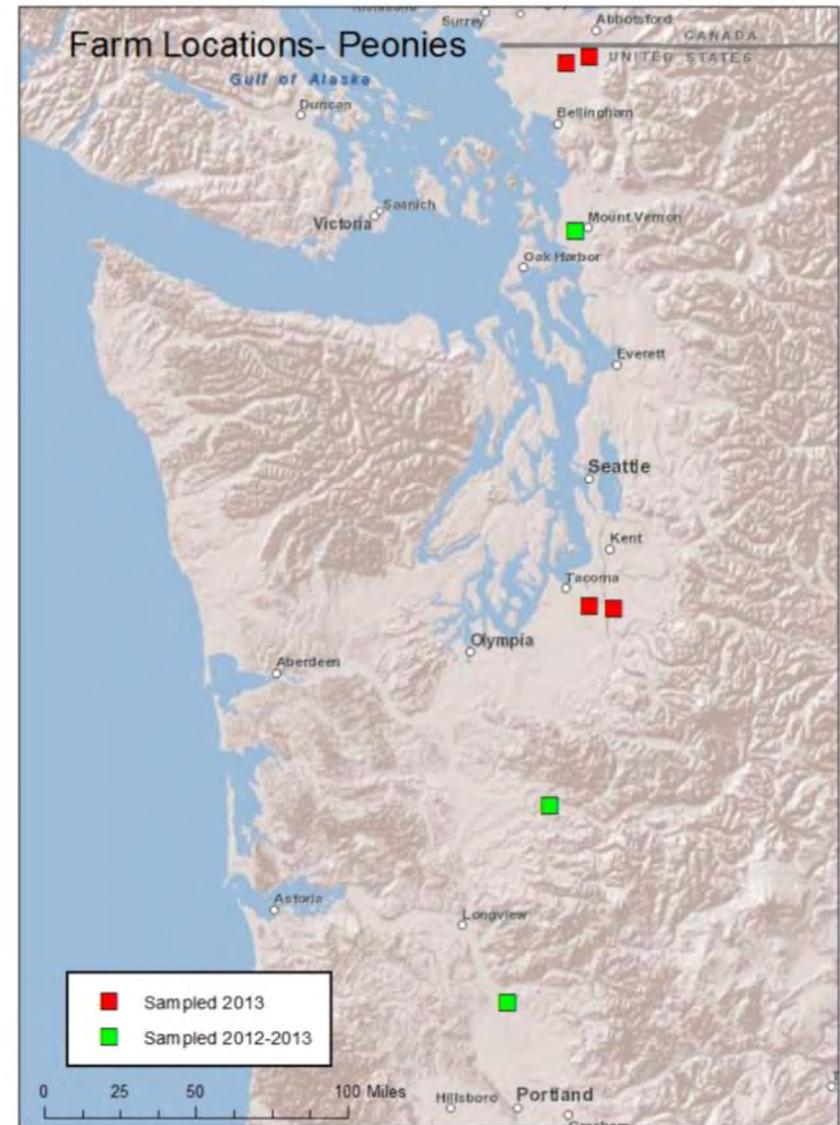
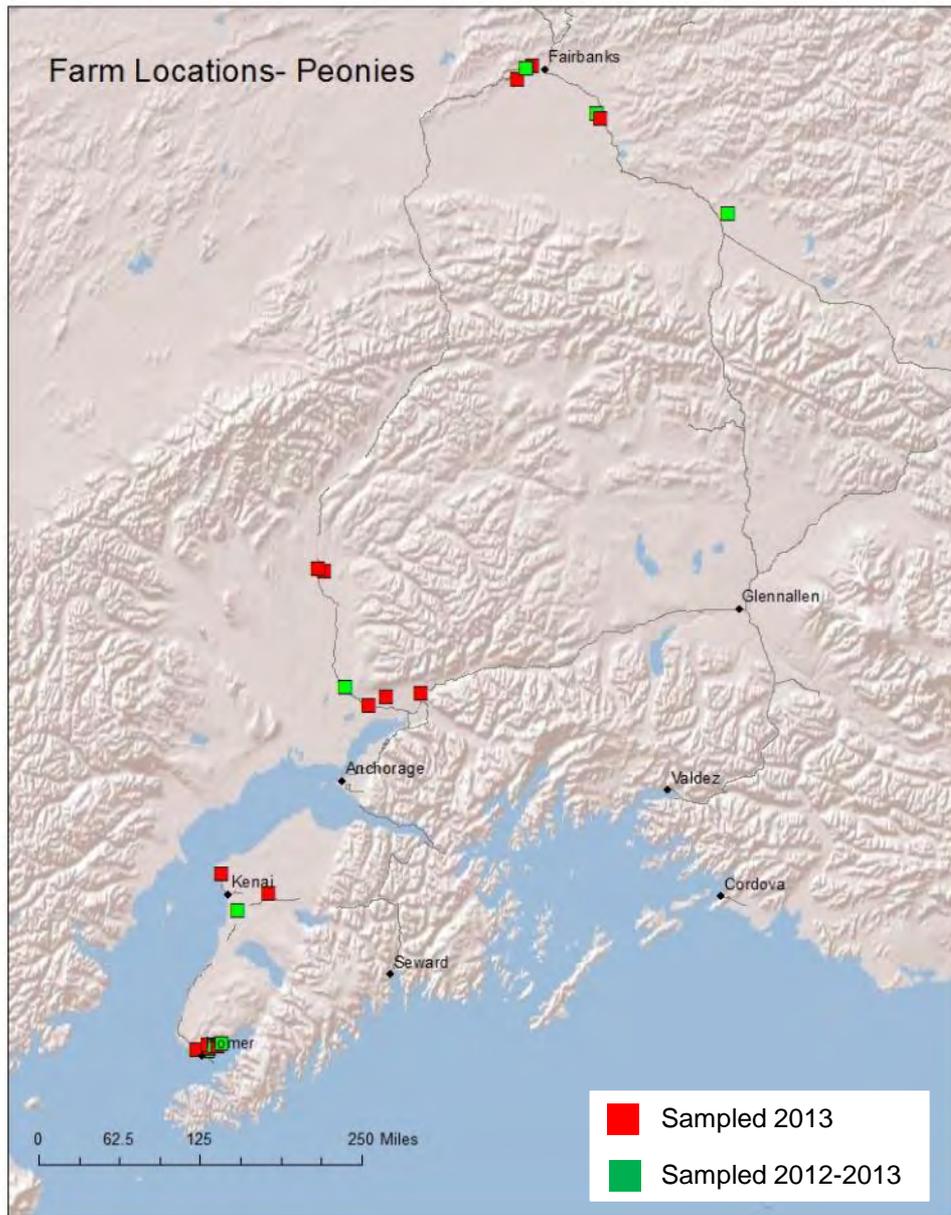
Note: Always check the label prior to application of any pesticide to make sure you are using properly registered products in your disease management program.

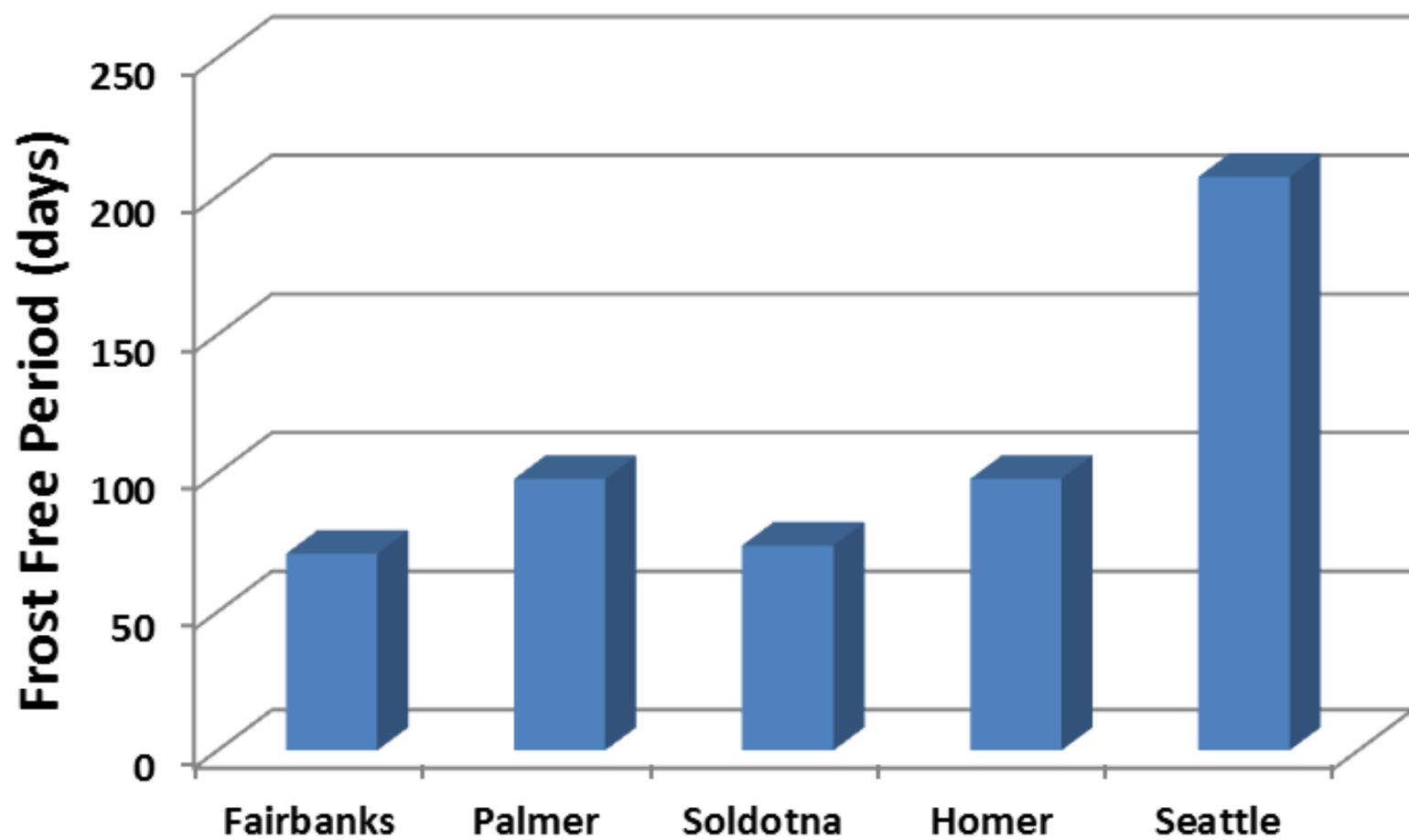
Sampled fields in three major production regions

- Fairbanks/Interior
- Matanuska-Susitna Valley
- Kenai Peninsula
 - Soldotna
 - Homer

Visited 25 farms between July 15 – 22, 2013

Peony Farm Disease Surveys









Plants with virus-like or abiotic symptoms were observed at most farms











Samples from these plants were tested for the presence of 16 viruses

Peony samples were tested for the following viruses

Alfalfa mosaic virus	AMV
Alternanthera mosaic virus/Papaya mosaic virus	AtMV/PapMV
Arabis mosaic virus	ArMV
Broad bean wilt virus	BBWV-1,2
Cucumber mosaic virus	CMV
Impatiens necrotic spot virus	INSV
Prunus necrotic ringspot virus	PNRSV
Ribgrass mosaic virus	RMV
Tobacco mosaic virus	TMV
Tobacco ringspot virus (Peony mosaic virus)	TRSV
Tobacco streak virus	TSV
Tomato aspermy virus	TAV
Tomato mosaic virus	ToMV
Tomato ringspot virus	ToRSV
Tomato spotted wilt virus	TSWV
Potyvirus Group Test	POTY
Tobacco rattle virus Specific PCR Test	TRV sp (PCR)

Tobacco Rattle Virus (TRV) was the only virus detected on plants





Residual Herbicide?





Fertilizer Damage?



Sensitivity to regional and yearly environmental extremes is often a problem associated with new crops



Symptoms association with Botrytis-positive samples

Foliage leaf spots/blights and shoot dieback

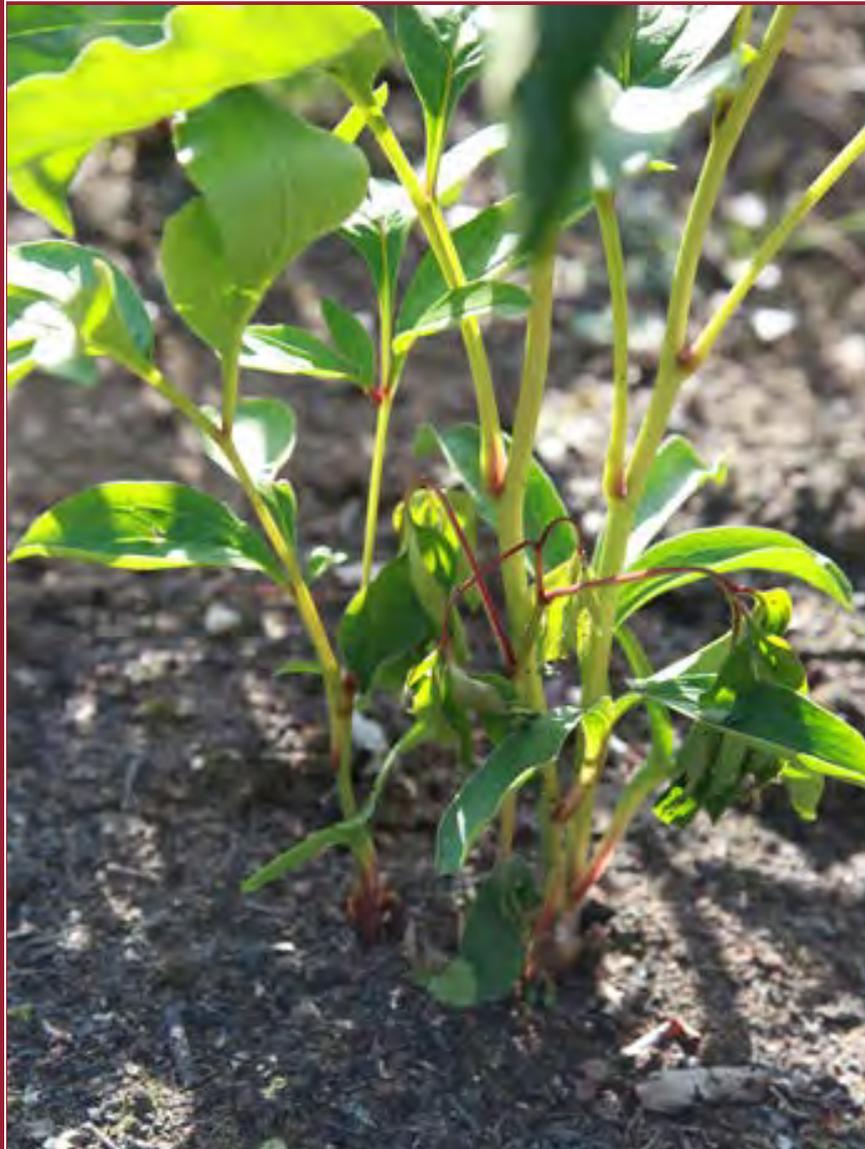


Foliage leaf spots/blights and shoot diebacks





Shoot discoloration and wilting associated with basal stem decay







Aborted buds and blighted flower petals



Aborted buds can also be caused by abiotic factors



Photo Missouri Botanical Garden

Botrytis can also cause postharvest damage to flowers in storage and shipment

Good temperature control is critical to reduce postharvest losses

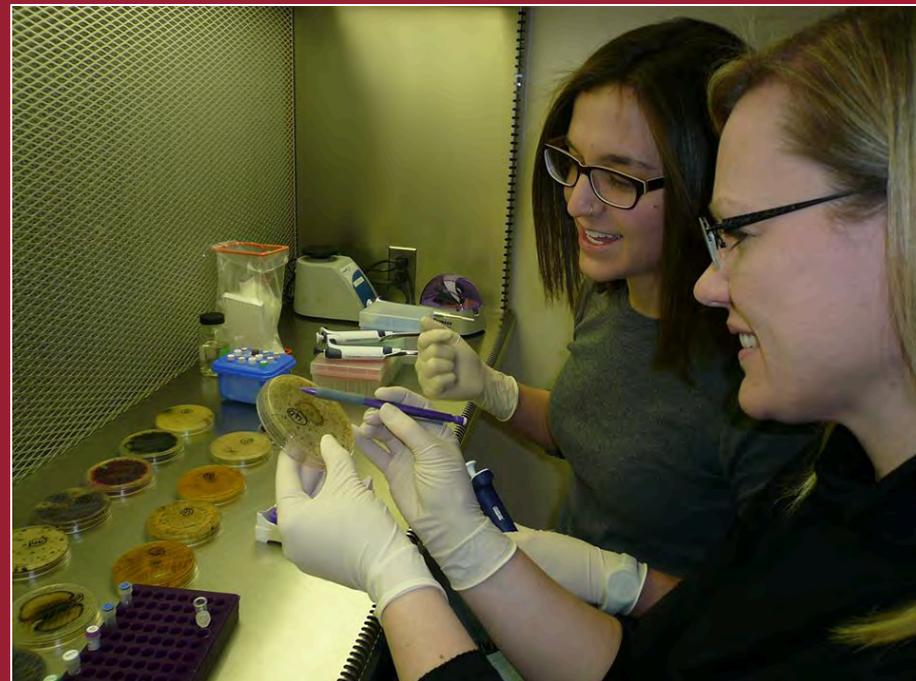
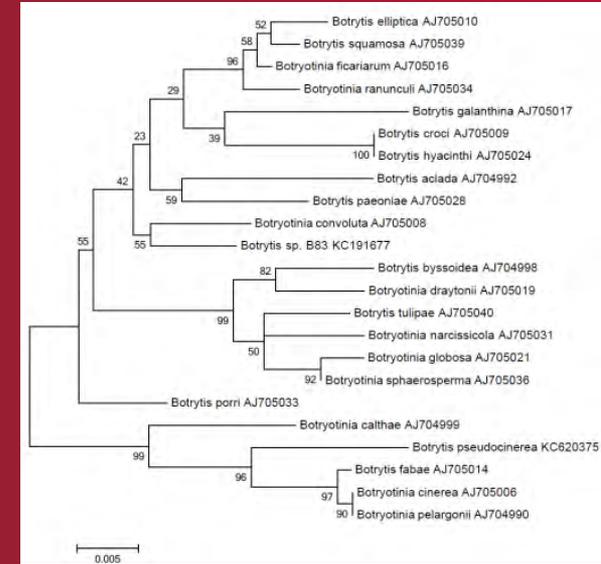


Topics

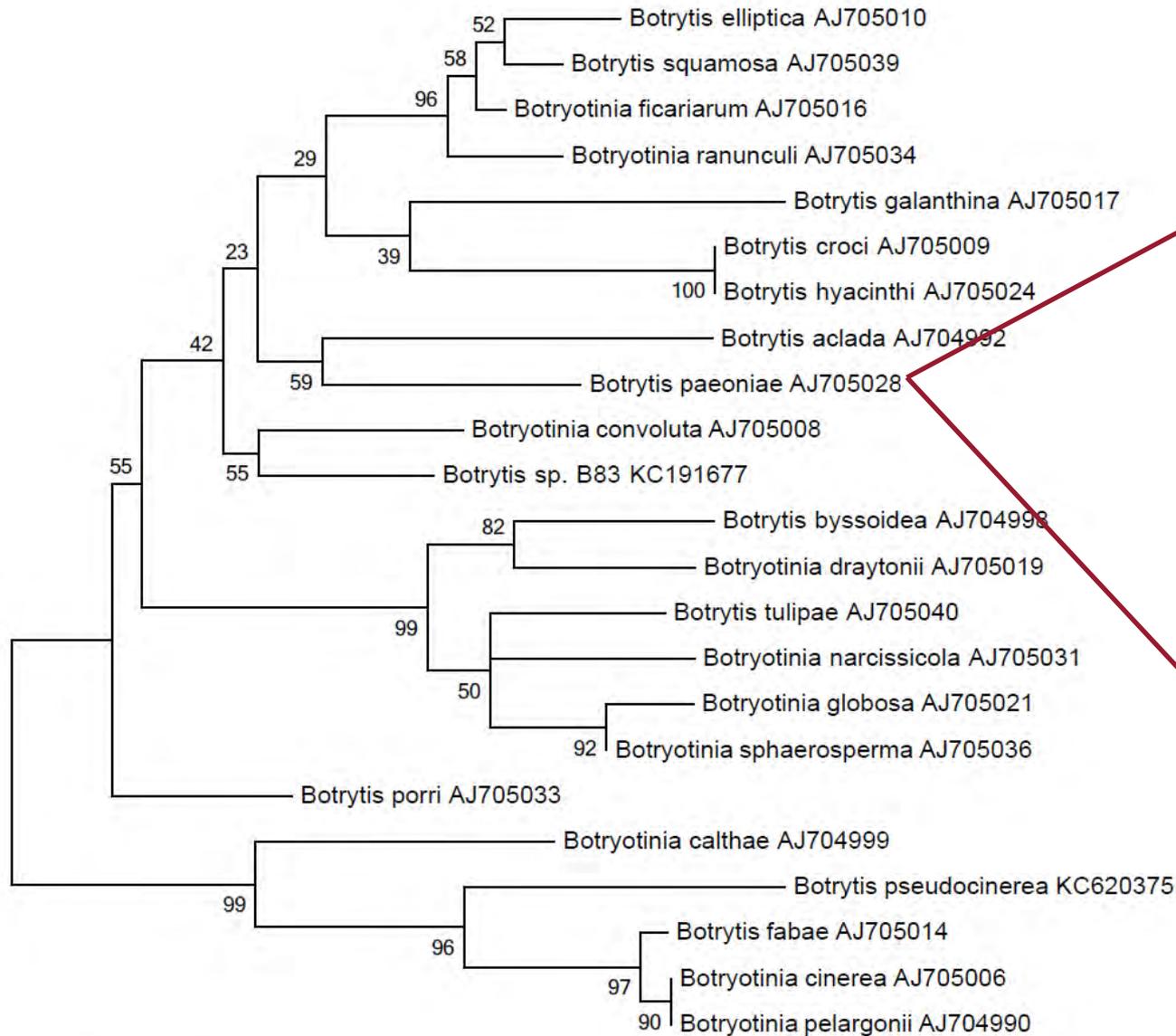
- Overview of WSU Puyallup disease management research program.
- Disease surveys on peony farms in AK and WA.
- Preliminary results on the diversity of *Botrytis* species on peonies in AK and WA.
- General *Botrytis* disease management strategies.

Note: Always check the label prior to application of any pesticide to make sure you are using properly registered products in your disease management program.

What *Botrytis* species were detected?



Botrytis species from AK and WA peony farms



Botrytis paeoniae

Washington Farm #1 - 2012 - 177

Washington Farm #2 - 2013 - 074 & 076

Washington Farm #4 - 2013 - 094

Alaska Farm #7 - 2012 - 190

Alaska Farm #12 - 2013 - 040

Alaska Farm #12 - 2013 - 043

Alaska Farm #15 - 2013 - 059

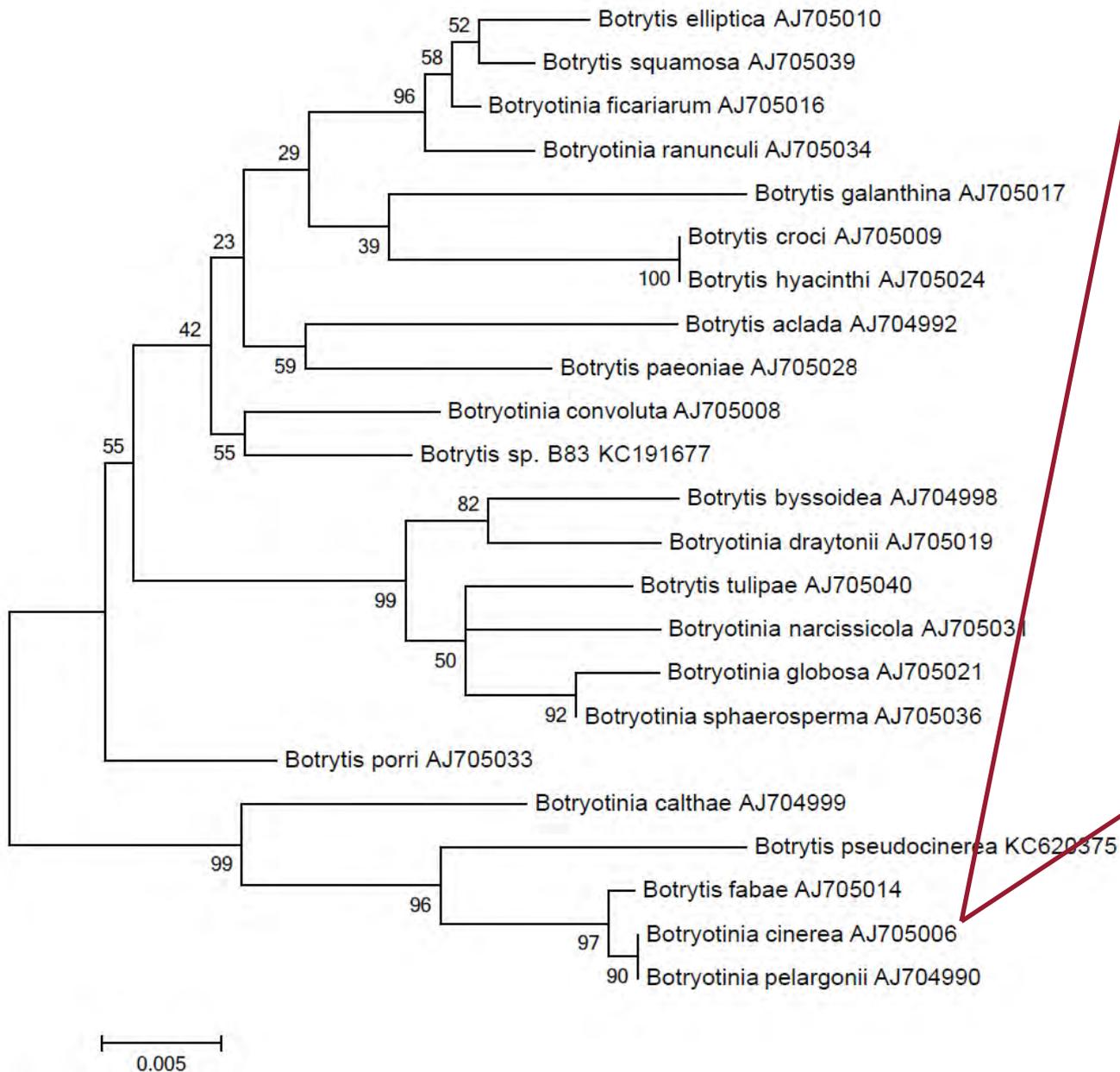
Alaska Farm #15 - 2013 - 065

Alaska Farm #19 - 2013 - 094

Alaska Farm #21 - 2013 - 104

Alaska Farm #23GH - 2013 - 116

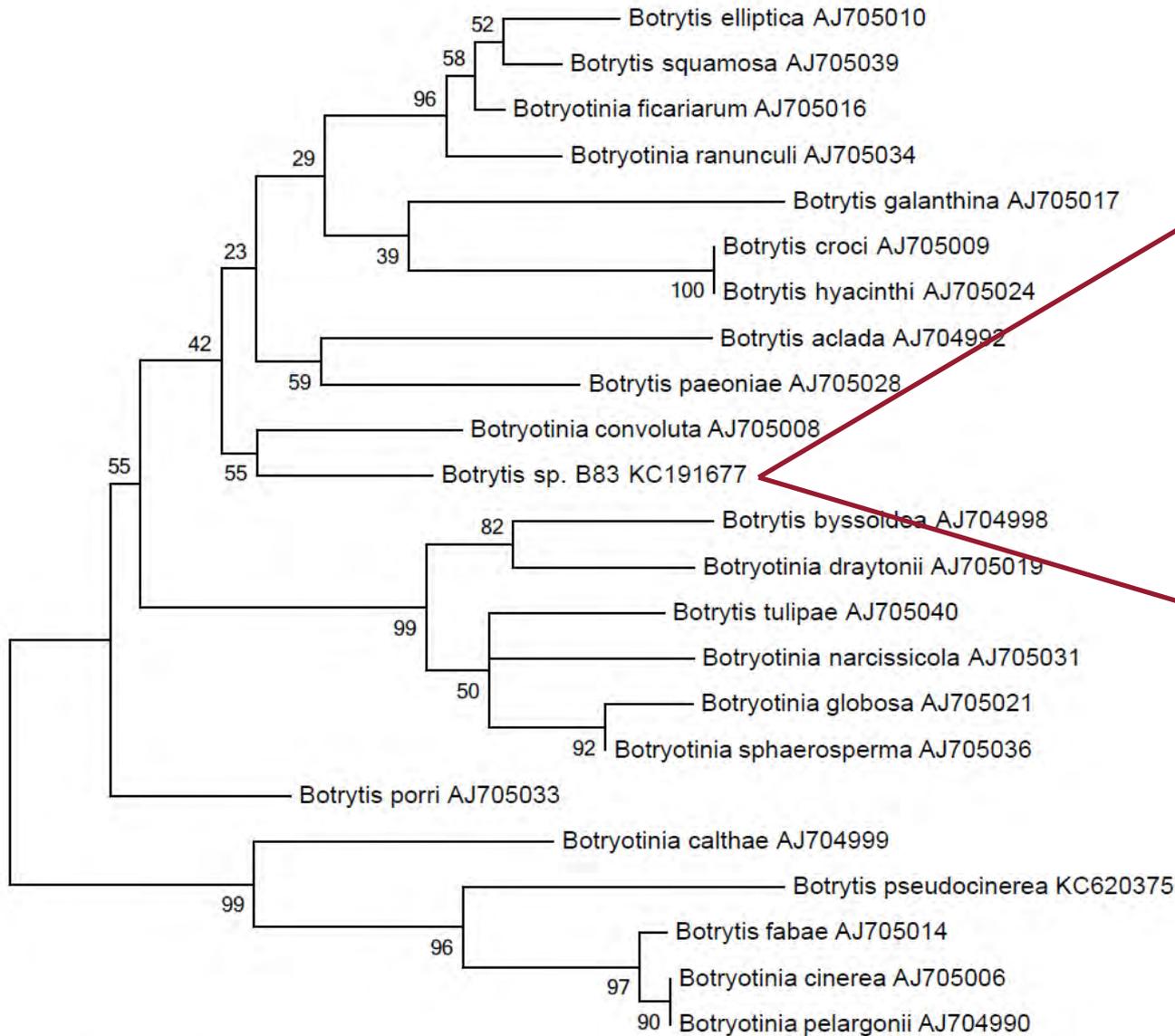
Botrytis species from AK and WA peony farms



Botrytis cinerea

- Washington Farm #2 2012 193 & 194
- Washington Farm #2 2013 075
- Washington Farm #3 2012 195 & 196
- Washington Farm #3 2013 085
- Washington Farm #4 2013 093 & 102
- Washington Farm #5 2013 079
- Washington Farm #7 2013 096
- Alaska Farm #7 2012 179 & 191
- Alaska Farm #9 2013 028
- Alaska Farm #10 2013 034 & 036
- Alaska Farm #11 2013 037 & 038
- Alaska Farm #13 2012 228, 229, 230, & 231
- Alaska Farm #13 2013 046
- Alaska Farm #15 2012 199 & 200
- Alaska Farm #17 2013 088
- Alaska Farm #19 2013 095 & 097
- Alaska Farm #22 2012 198
- Alaska Farm #22 2013 107
- Alaska Farm #23 2013 110
- Alaska Farm #24 2013 123, 124, & 127
- Alaska Farm #25 2012 182

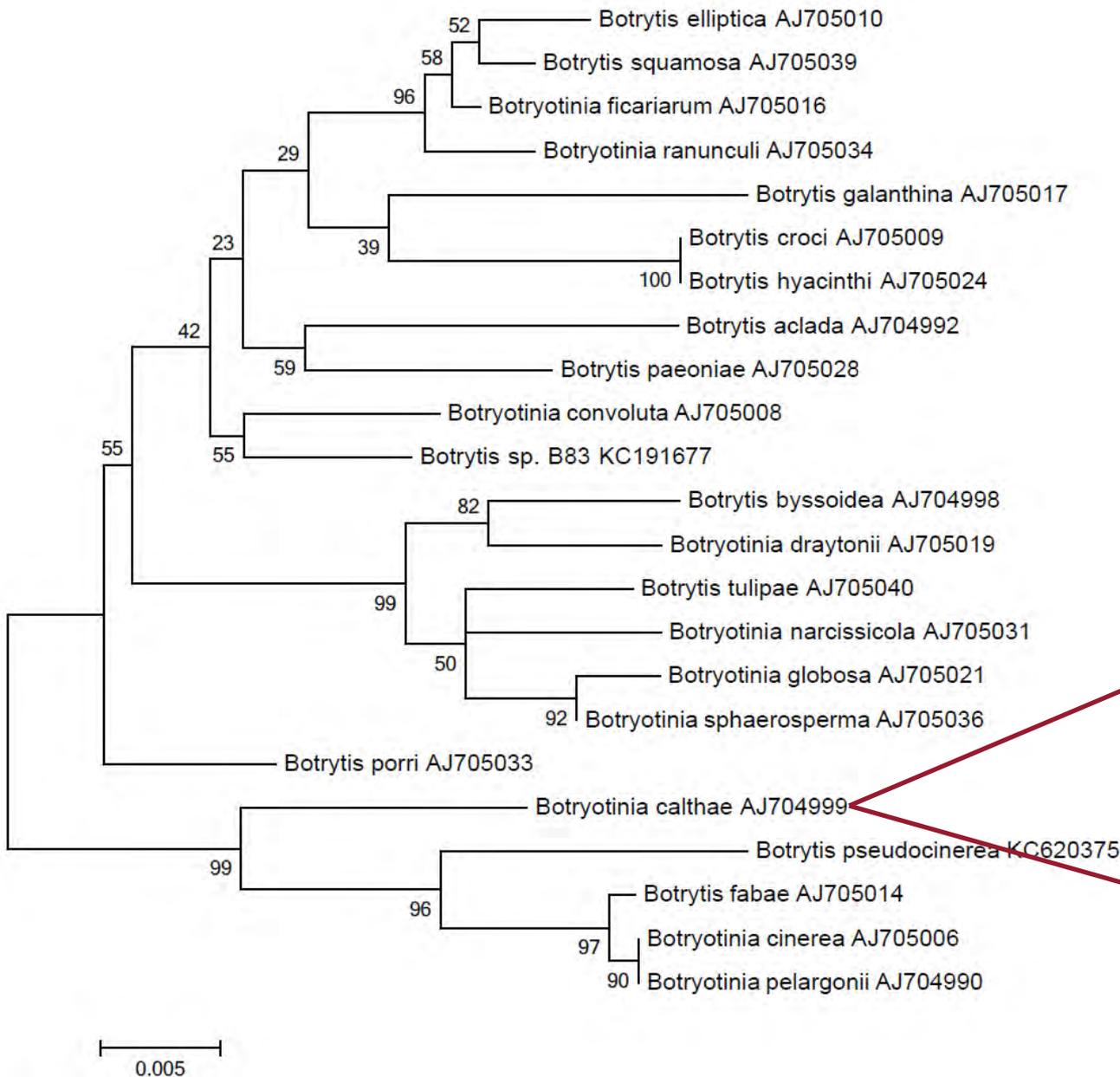
Botrytis species from AK and WA peony farms



“new” Botrytis species B83

- Alaska Farm #3 – 2013 – 005
- Alaska Farm #3 – 2013 – 010
- Alaska Farm #5 – 2013 – 015
- Alaska Farm #6 – 2013 – 018
- Alaska Farm #7 – 2013 – 021
- Alaska Farm #7 – 2013 – 024
- Alaska Farm #7 – 2012 – 178
- Alaska Farm #7 – 2012 – 180
- Alaska Farm #7 – 2012 – 192
- Alaska Farm #9 – 2012 – 202

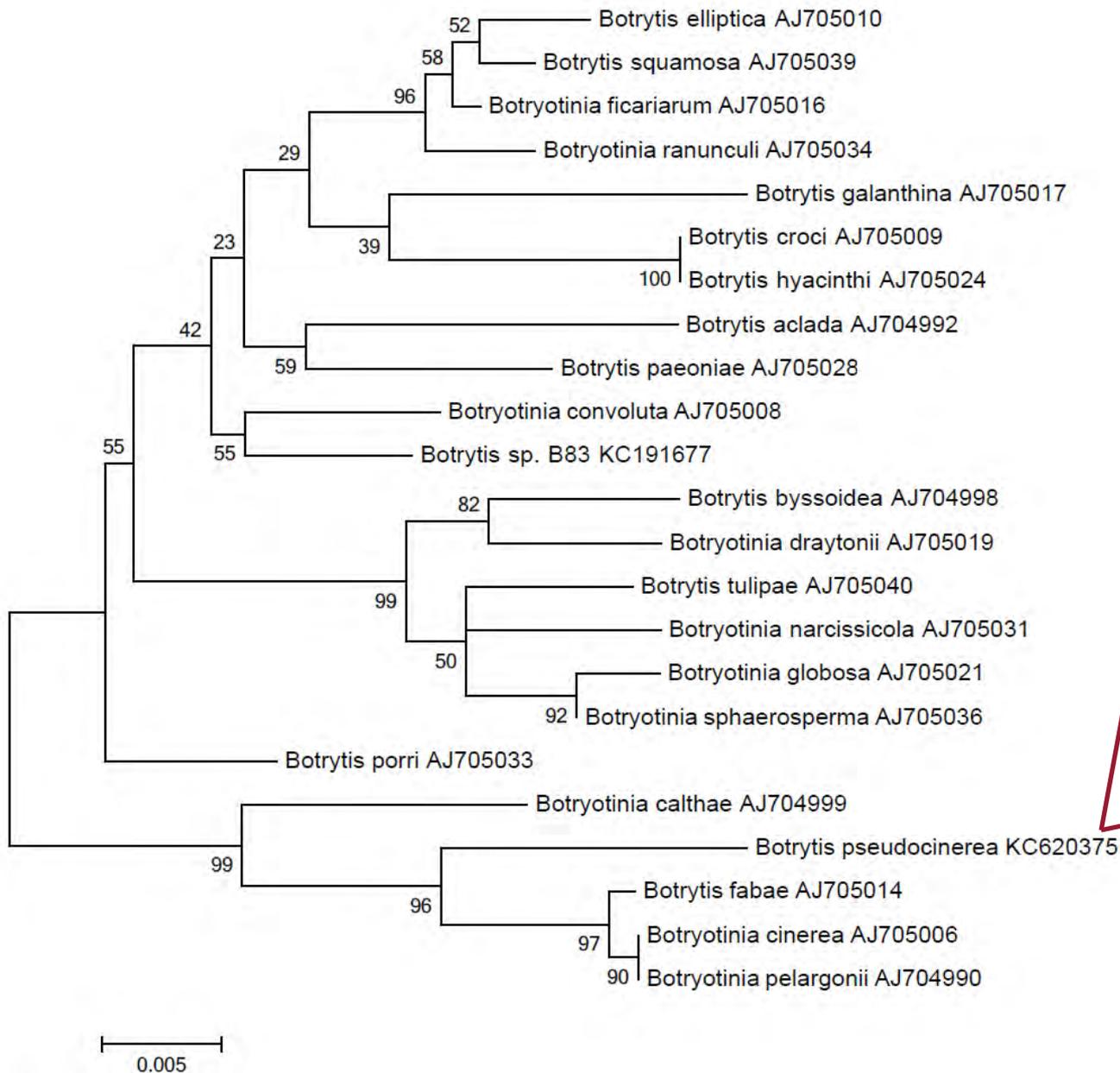
Botrytis species from AK and WA peony farms



Botrytis species similar to B. calthae

- Alaska Farm #25 - 2012 - 181
- Alaska Farm #17 - 2012 - 183
- Alaska Farm #20 - 2013 - 098
- Washington Farm #4 - 2013 - 101

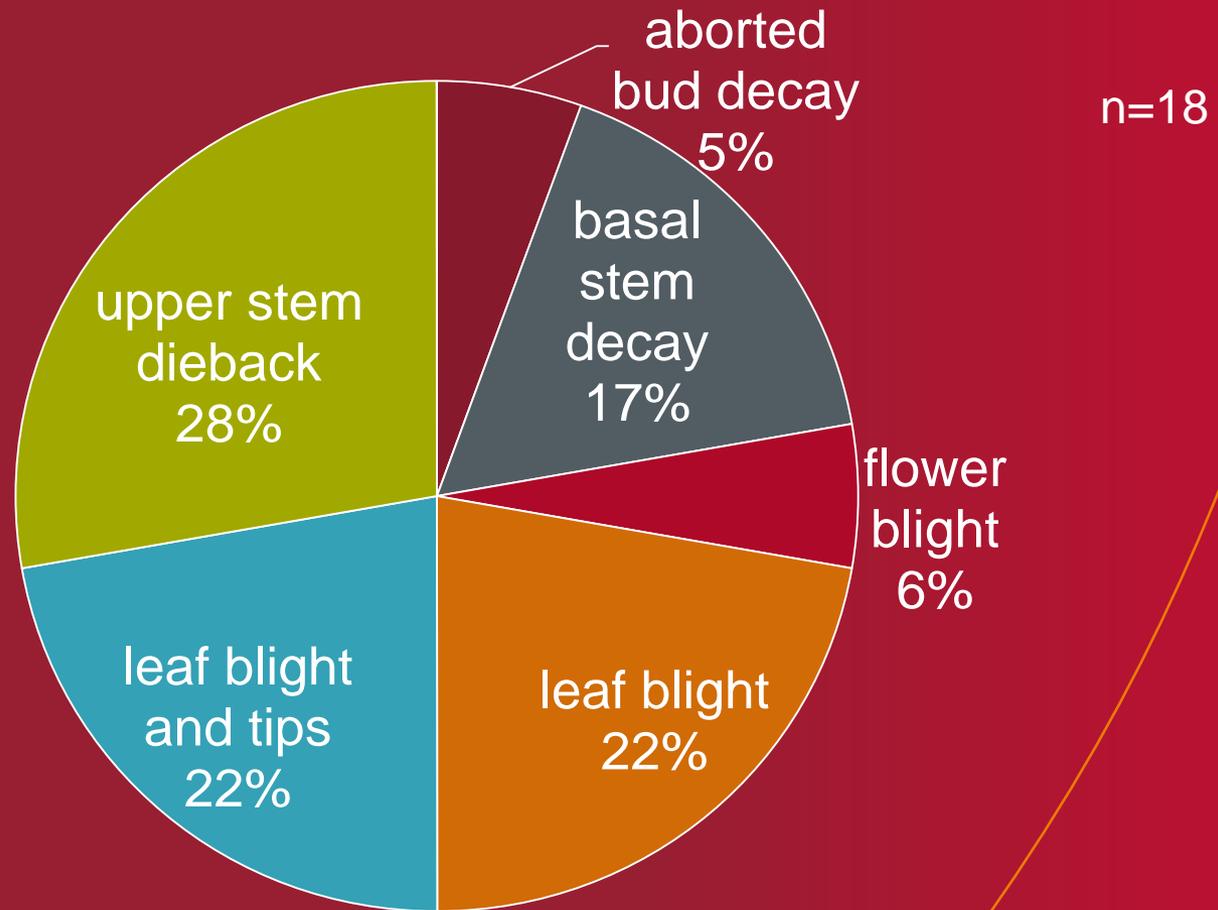
Botrytis species from AK and WA peony farms



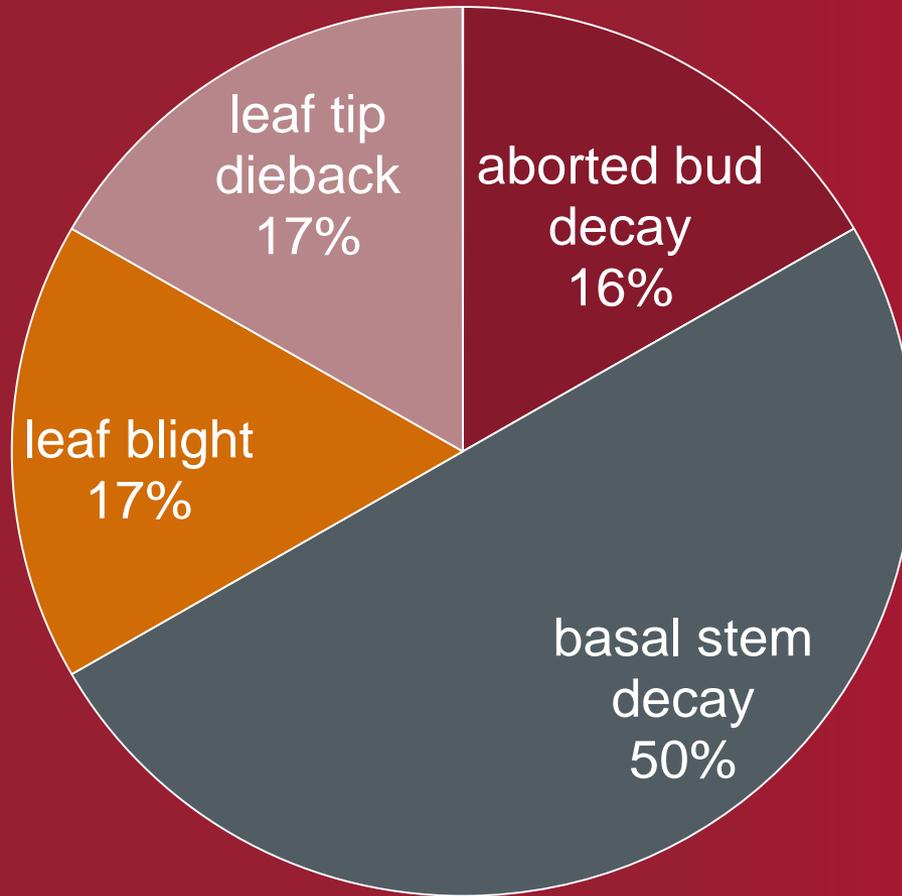
Botrytis pseudocinerea

Washington Farm #7 2013 097 & 098

Symptoms associated with *Botrytis cinerea*

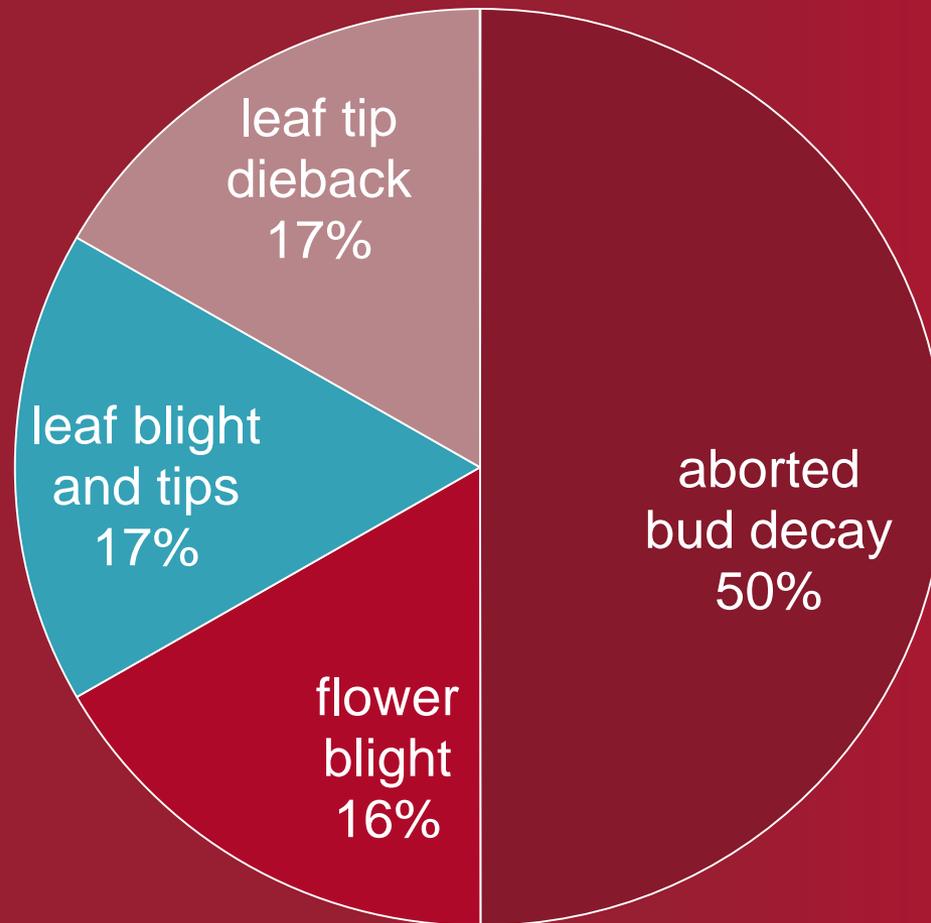


Symptoms associated with *Botrytis paeoniae*



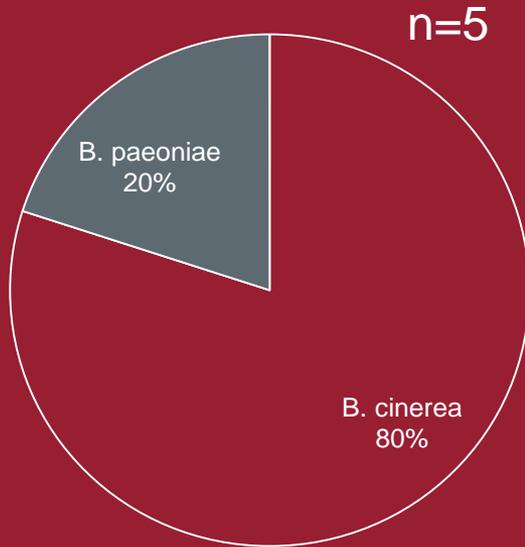
n=6

Symptoms associated with “new” *Botrytis* sp. B83

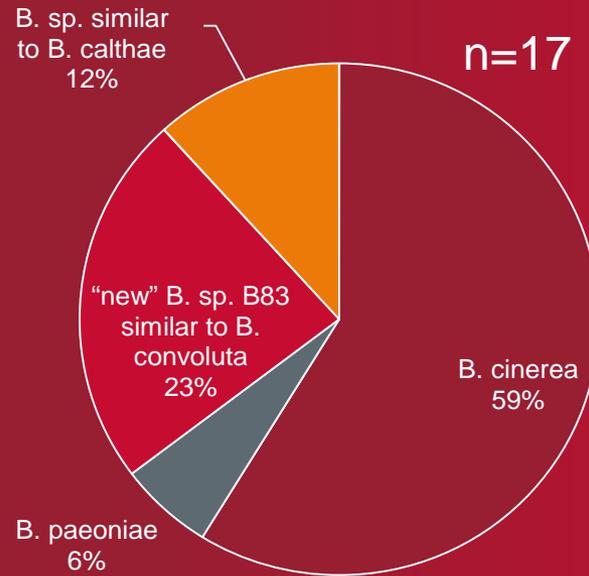


n=6

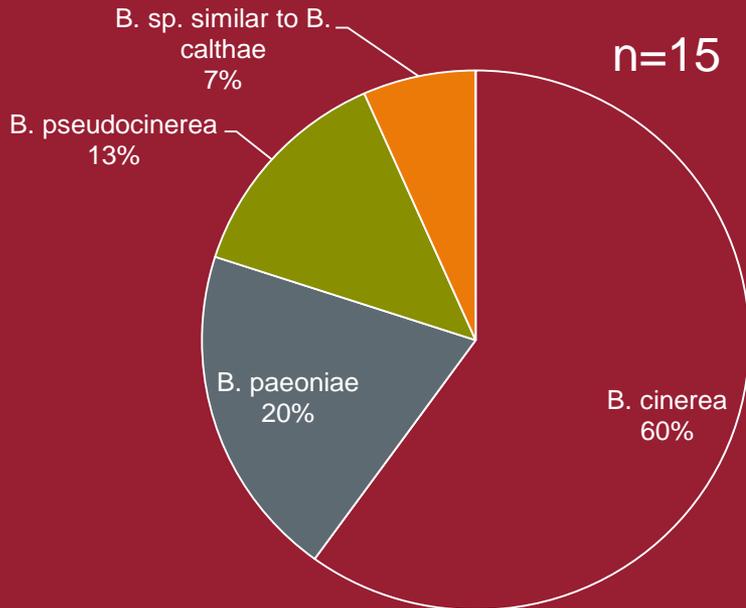
Washington 2012



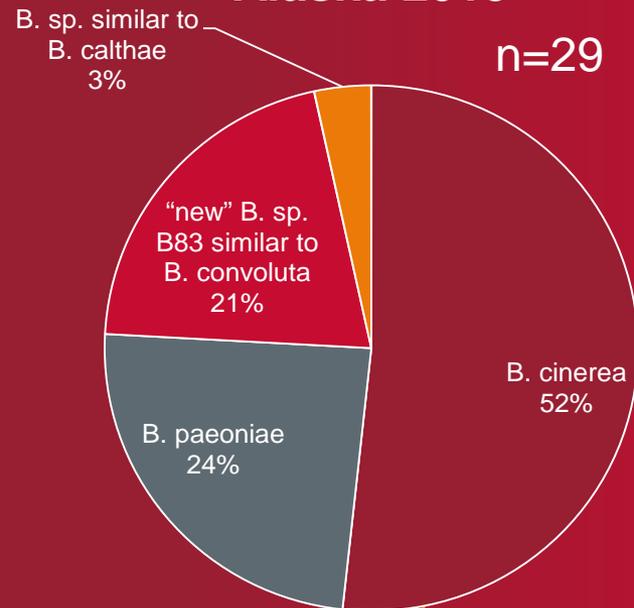
Alaska 2012



Washington 2013



Alaska 2013



What *Botrytis* species were detected?



There appears to be a greater diversity of *Botrytis* species on peonies than has been reported in the literature.

Understanding differences in the host:pathogen relationship between these species is important in the development of effective disease management programs.

Topics

- Overview of WSU Puyallup disease management research program.
- Disease surveys on peony farms in AK and WA.
- Preliminary results on the diversity of *Botrytis* species on peonies in AK and WA.
- General *Botrytis* disease management strategies.

Note: Always check the label prior to application of any pesticide to make sure you are using properly registered products in your disease management program.

General *Botrytis* disease management strategies

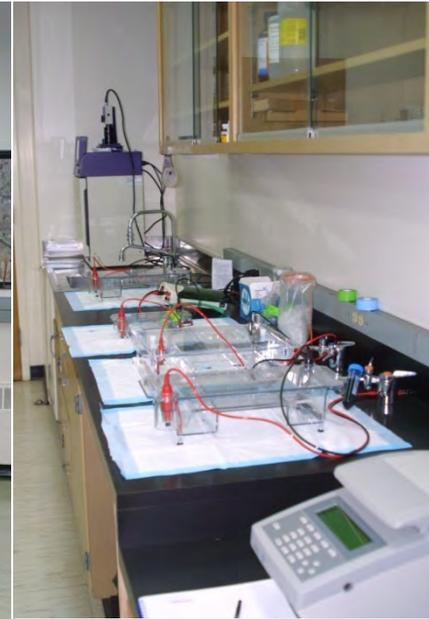
Disease management is dependent on:

- Accurate disease diagnosis.
- Understanding the disease cycle of the pathogen.
- Understanding factors that affect disease development.

Disease Diagnosis



- Send samples to diagnostic lab.
- May need to use molecular approaches to identify pathogen.
- Experience.



General Disease Cycle for *Botrytis*

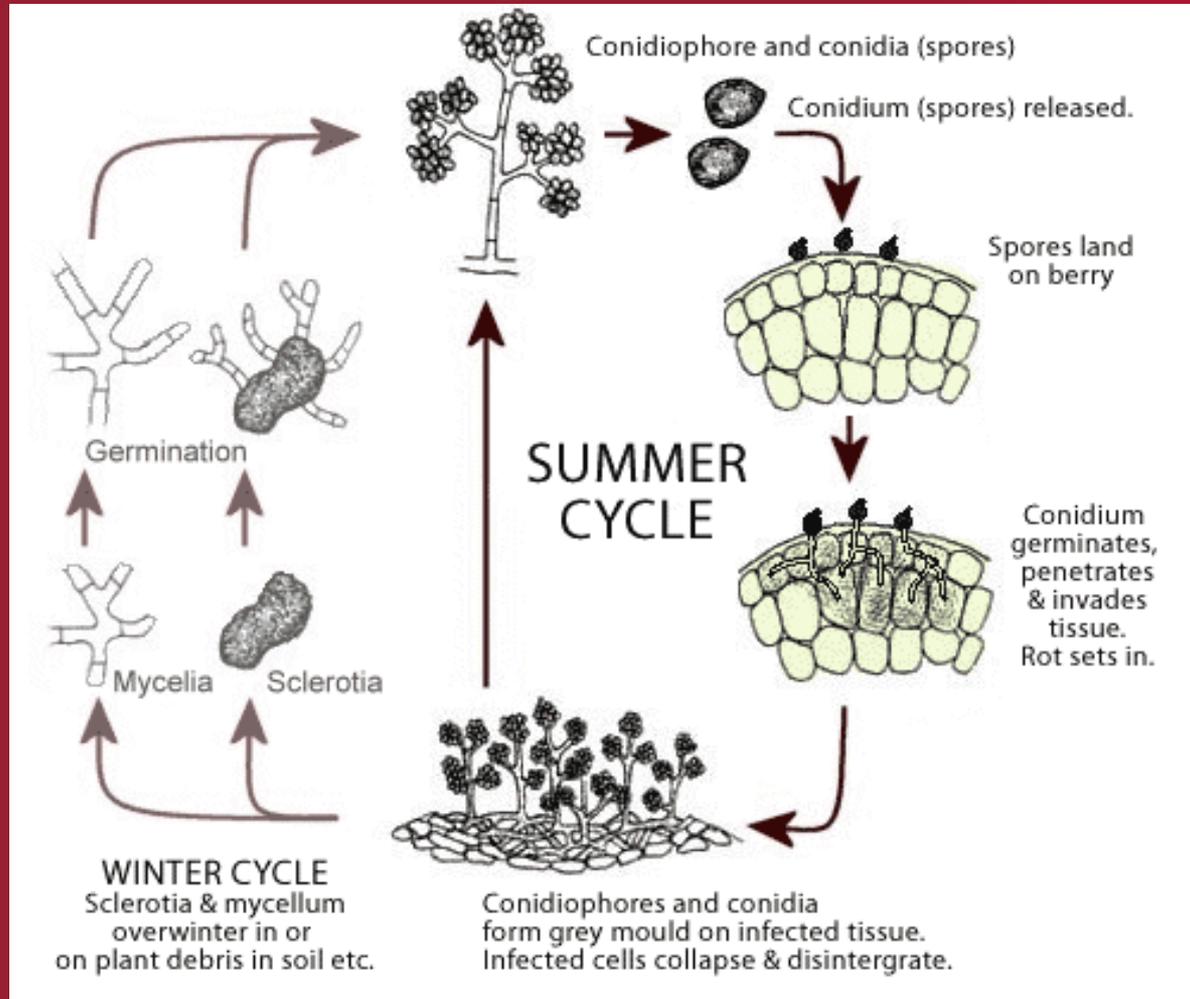


Figure from: <http://www.nicks.com.au/vintage-school-2-12-76.1417>

Tulip – Fire or Botrytis Blight

Botrytis tulipae



***Botrytis tulipae* produces sclerotia on
diseases foliage and bulbs**



Sclerotia can infect emerging shoots or germinate to produce conidia, which infect foliage or flowers



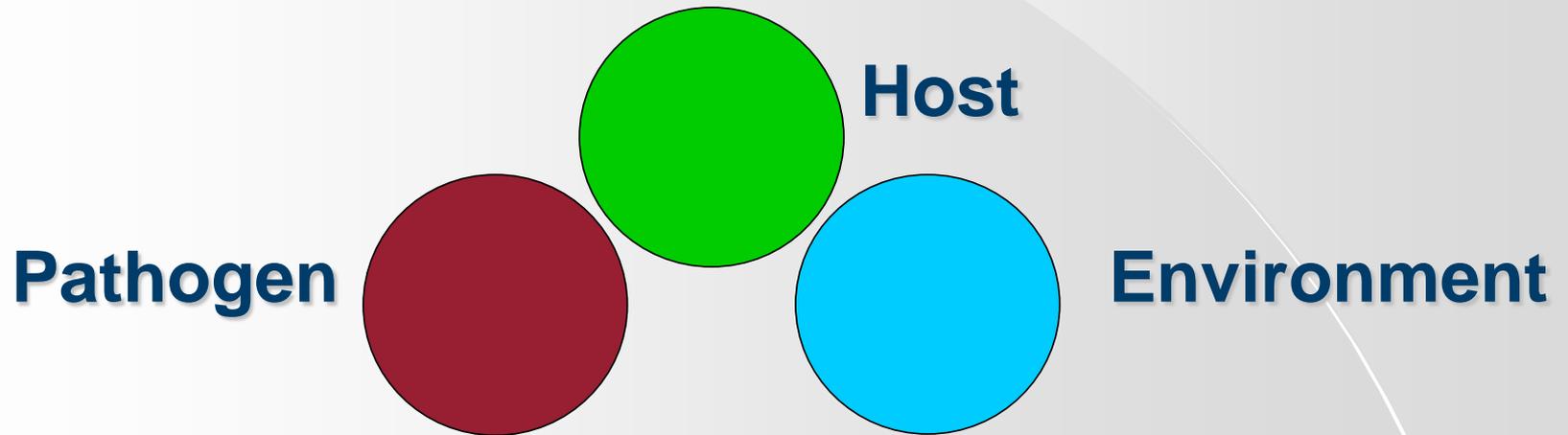
Fireheads



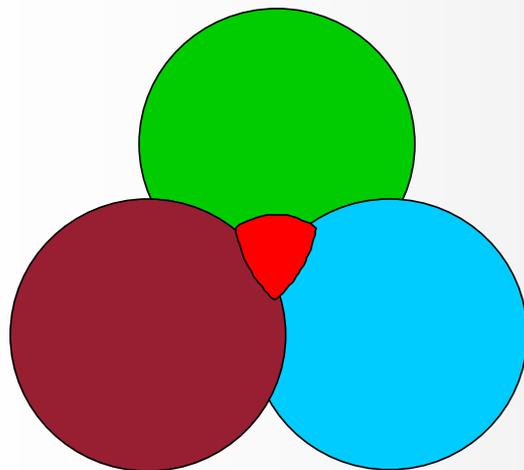
Removal of Fireheads



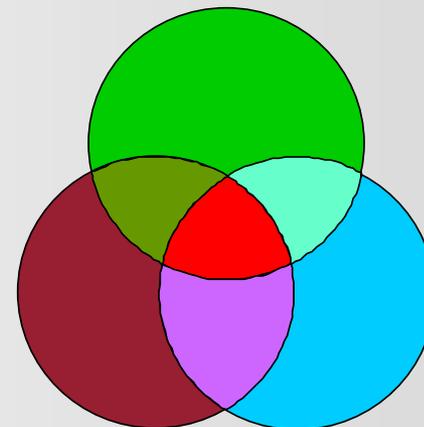
Disease Development



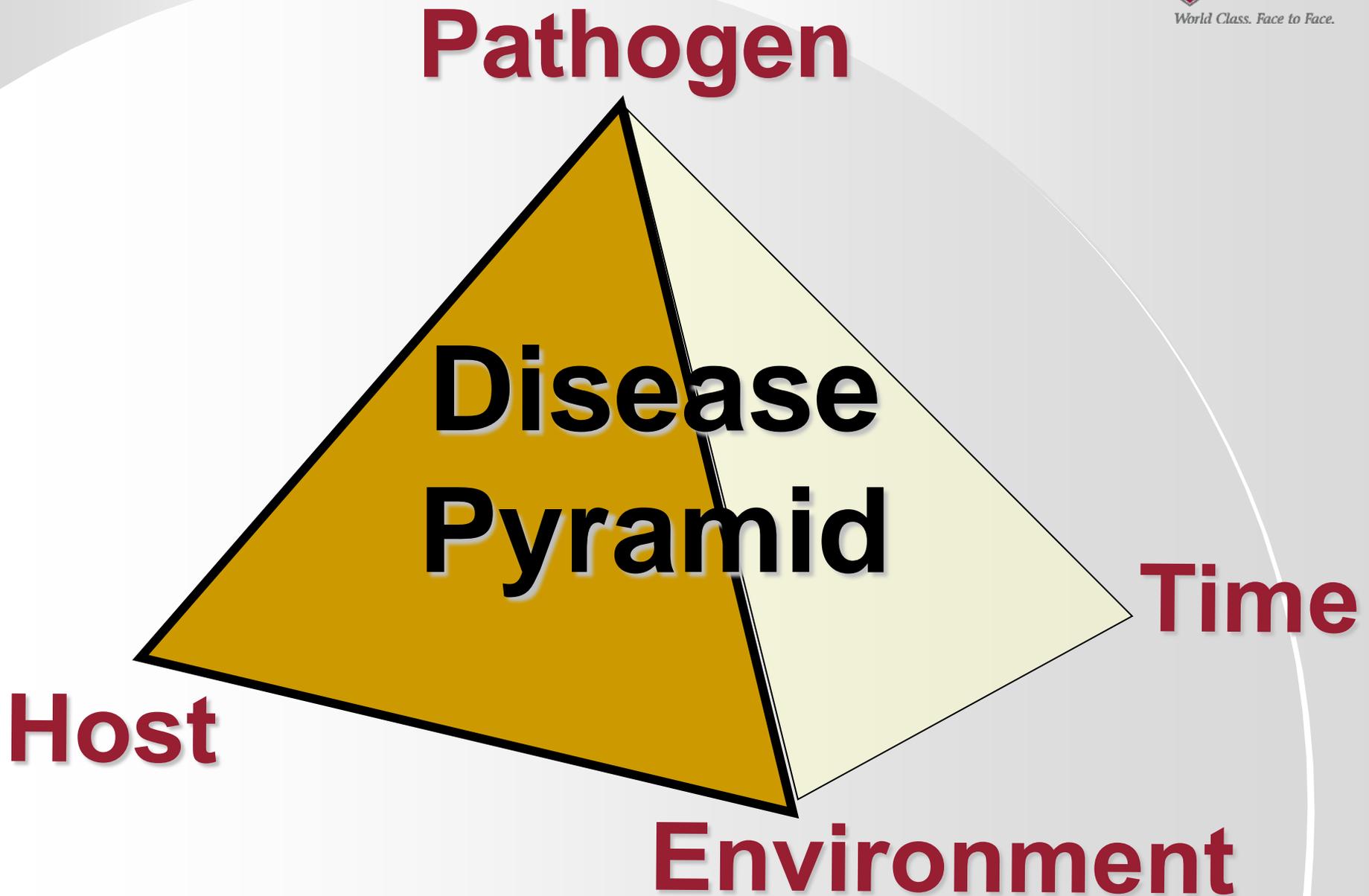
No Disease



Low Level Disease



Severe Disease



General *Botrytis* disease management strategies

Using an integrated approach is the best way to control *Botrytis* diseases.

- Site selection
- Disease-free planting stock
- Host susceptibility
- Modification of environmental conditions
- Monitoring for disease development
- Sanitation – destruction of foliage residues and removal of flowers and flower buds
- Spraying to protect the plants from infection

General *Botrytis* disease management strategies

Things to consider when spraying to protect plants from infection.

- Disease pressure
- The effectiveness of the product
- Fungicide resistance
- Timing
- Application method

Note: Always check the label prior to application of any pesticide to make sure you are using properly registered products in your disease management program.

Recent reduced-risk and biocontrol fungicide foliar disease control trials

Tulip

Fire – *Botrytis tulipae*

Daffodil

Fire – *Botryotinia (Botrytis) polyblastis*

Lily

Fire - *Botrytis elliptica* and *B. cinerea*

Iris

Leaf Spot or Fire - *Mycosphaerella macrospora*

Peony

Leaf Spot - *Cladosporium paeoniae*

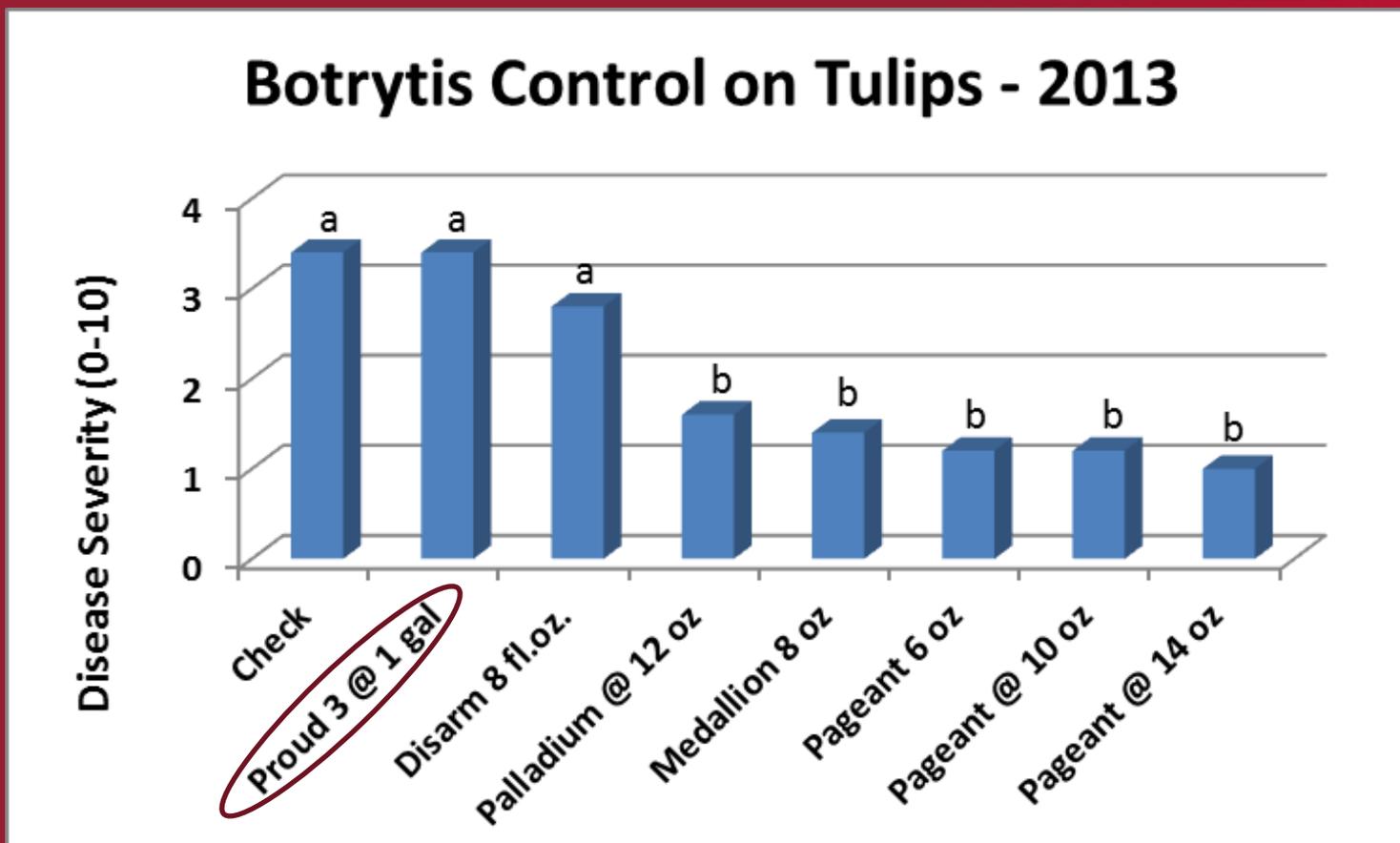
Products included in one or more trials.

Product	% active ingredient and common name	FRAC Code ¹
26GT	23.3% iprodione	2
Chipco 26019 N/G	50% iprodione	2
Daconil Weather Stik SC	54% chlorothalonil	M5
Decree 50 WDG	50% fenhexamid	17
Disarm 480 SC	40.3% fluoxastrobin	11
F9110-1	20% extract of <i>Lupinus</i>	NC
Fore	80% mancozeb	M3
Kocide DF	61.4 % copper hydroxide	M1
Insignia	20% pyraclostrobin	11
Medallion 50WP	50% fludioxonil	12
Pageant 38 WG	12.8% pyraclostrobin + 25.2% boscalid	11 + 7
Palladium 62.5WG	37.5% cyprodinil + 25% fludioxonil	9 + 12
Prestop WP	<i>Gliocladium catenulatum</i> J1446 2 x 10 ⁸ (cfu)/g	NC
Proud 3	5.6% thyme oil	NC
Regalia	5% extract of <i>Reynoutria sachalinensis</i>	P
SP 2770 10WP	proprietary	-
SP 2773	proprietary	-
Torque 3.6SC	38.7% tebuconazole	3
Tourney 50WDG	50% metconazole	3
Trinity SC	19.2% triticonazole	3
V10135 4SC (Protexio)	43.6% fenpyrazamine	17
ZeroTol 2.0	27.1% hydrogen dioxide + 2% peroxyacetic acid	NC

¹FRAC Code List 2013. <http://www.frac.inf> accessed 20 Nov. 2013

Tulip Botrytis Control Trial – 2013

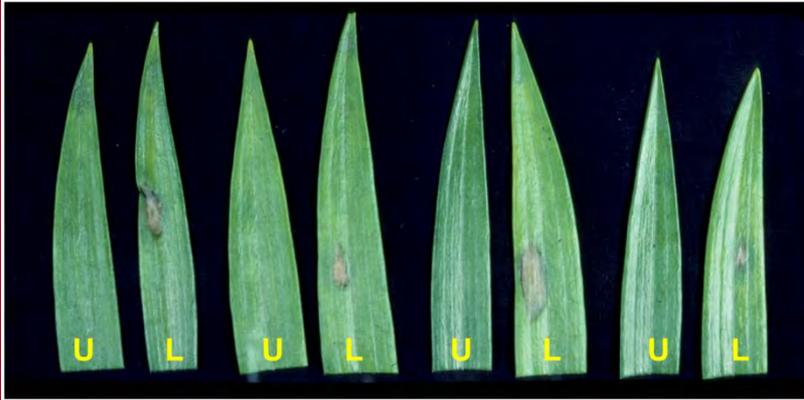
- Treatments applied between Feb. 26 – April 26, 2013.
- Data collected on April 13, 2013.
- All of the fungicides, except Proud 3 and Disarm reduced disease severity.



Columns with the same letter are not significantly different, $P < 0.05$, Tukey's Studentized Range (HSD) Test.

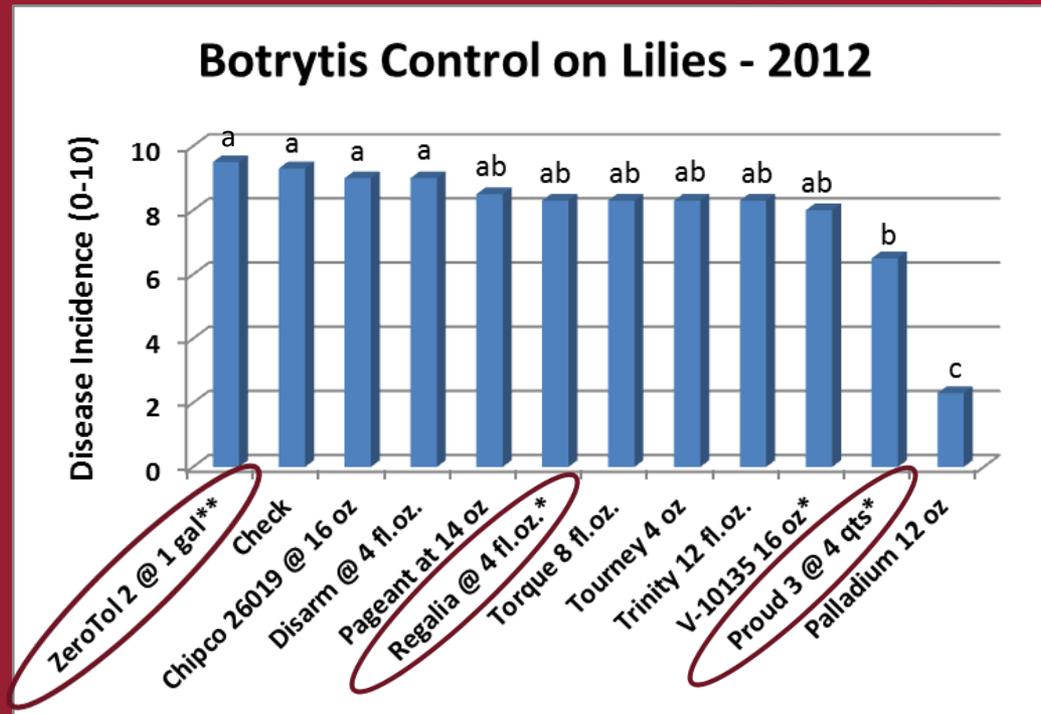
Botrytis blight, fire, or leopard fire on lily

Botrytis elliptica and *B. cinerea*



Lily Botrytis Control Trial – 2012

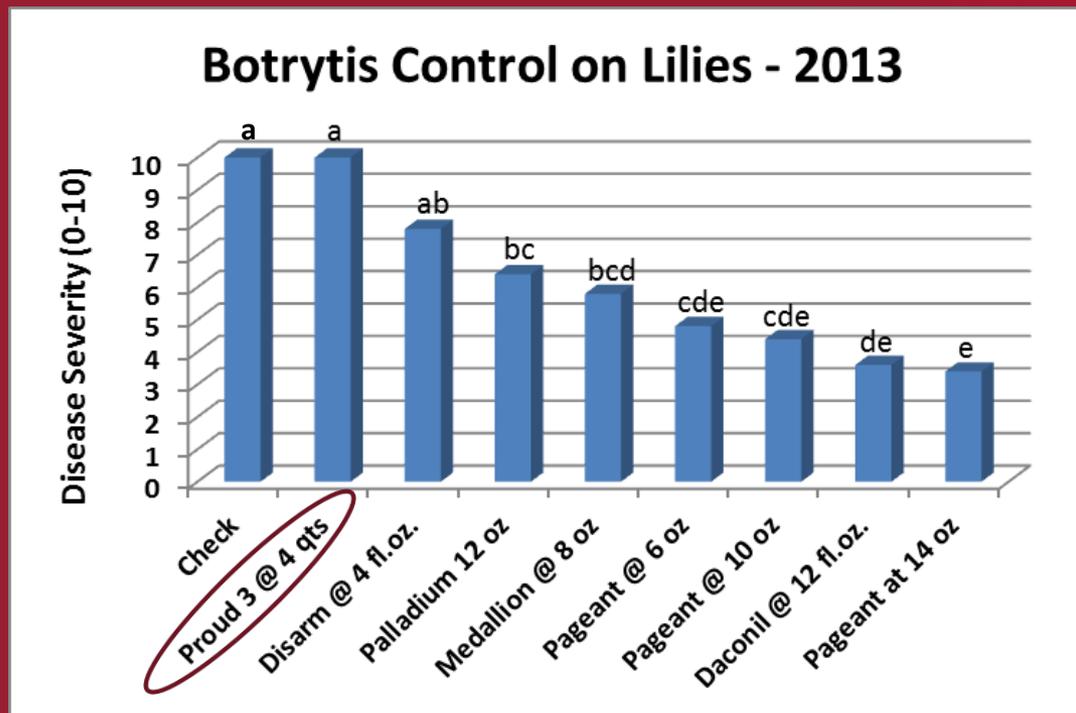
- ‘London’ Asiatic lilies with low disease pressure.
- Treatments applied between June 11 – Sept. 7, 2012.
- Data collected on Sept. 19, 2012.
- Disease development was limited to a few leaves on plants
Palladium and Proud 3 were the only treatments that had significantly lower disease incidence ratings than the checks.



Columns with the same letter are not significantly different, $P < 0.05$, Tukey's Studentized Range (HSD) Test.

Lily Botrytis Control Trial – 2013

- ‘London’ Asiatic lilies with high disease pressure.
- Treatments applied between April 11 – June 7, 2013.
- Data collected on June 23, 2013.
- All of the fungicides, except Proud 3 and Disarm reduced disease severity. The highest rate of Pageant was clearly the most effective treatment.



Columns with the same letter are not significantly different, $P < 0.05$, Tukey's Studentized Range (HSD) Test.

Control of Botrytis on Lilies

- Pageant, Medallion, and Palladium consistently reduced disease development in our trials. Of these, Pageant was the most effective.
- Other products were ineffective or inconsistent in controlling *Botrytis* on lilies.



Check



Pageant

Leaf Spot on Peonies

Cladosporium paeoniae



- Commercial 4-year-old mixed peony planting.
- Applications dates: March 22 – June 17, 2013 with applications at 7(*), 14 or 21(**) day intervals.
- Products were mixed in 100 gallons of water and applied in about 60 gallons per acre.

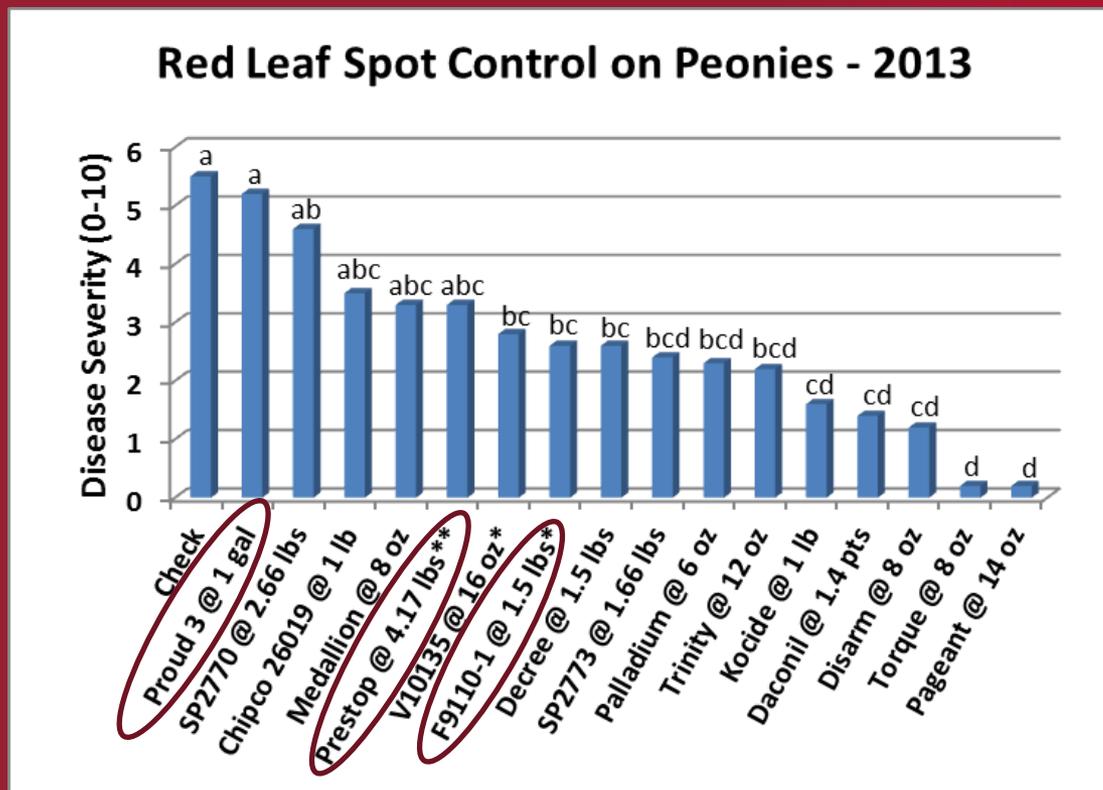
Leaf Spot on Peonies



July 2, 2013: Leaf spot severity was rated on a scale of 0-10 where : 0 = none, 1 = 1-10%, 2 = 11-20%,...10 = 91-100% of the foliage was covered with reddish/purple spots and lesions.

Leaf Spot on Peonies

All of the treatments, except Medallion, Prestop, Chipco 26019, SP2770 and Proud 3 reduced the severity of diseases compared to the check. Pageant, Torque, Disarm, Daconil WeatherStik, Kocide, Trinity, Palladium, and SP2773 were the most effective materials tested.



Columns with the same letter are not significantly different, $P < 0.05$, Tukey's Studentized Range (HSD) Test.

Collaborative Botrytis Project on Peonies

Potential research questions include:

- Population structure of *Botrytis* species on peonies
- Identification of sources of primary inoculum for different *Botrytis* spp.
- Are there differences between species in relation to:
 - Environmental conditions that favor infection and disease development.
 - Host susceptibility.
 - Sensitivity to fungicides and biocontrol agents.



Andrea Garfinkel - PhD

A Special Thanks To:

- Pat, Harry, Sue, Clay, and Beth for their hospitality.
- Lydia Clayton, UAF Coop. Ext. Soldotna and all the growers who allowed me to visit their farms.
- Beth for arranging a halibut fishing trip.



Thank You

Questions?

Key support staff who have contributed to this project:

Katie Coats, Scientific Associate

Annie DeBauw, Ag. Res. Technologist III

Andrea Garfinkel, WSU Ph.D. graduate student

