

Rhododendron Improvement at the David G. Leach Research Station

Steve Krebs

Atlantic Rhododendron & Horticulture Society
Halifax
October 2014



The Evening Menu

Rhododendrons at Holden Arboretum

Why hybridize?

A Leach retrospective

Next gen rhododendrons

Q & A

Lake Erie



David G. Leach Research Station



Holden Science Center



David G. Leach

cold hardy hybrids

USDA zone 5b -26 C/-15 F



**RHODODENDRONS
OF THE WORLD
by DAVID G. LEACH**



Displays

2000 Leach

Rhododendron
selections

500 companion plants

Mountain Laurel

Magnolia

Hollies

Viburnum

Conifers

Redbud



R. kaempferi



public engagement



Helen S. Layer Rhododendron Garden



Shammarello Hybrids



Flame Azaleas

Eliot and Linda Paine Rhododendron Discovery Garden

NEW



Creating a Hybrid Cultivar: Step by Step

Developing a new rhododendron cultivar requires an understanding of species diversity and how to combine traits into new and exciting plants. From start to finish, the process can take more than 15 years!

1 Seed to Flower (4 years)

Choose suitable two parent plants with traits of interest. Nurture their seeds and hybrids of offspring. Choose the most vigorous ones for testing.

2 Field Evaluation & Selection (4 years)

Expose new plants to the elements, including full sun and a range of winter weather. Which progeny exhibit the desired traits? (In a few cases a rhododendron will be worth a whole year's selection and will be used.)



3 Extended Assessment (4 years)

Reproduce plants in a greenhouse through 3 winters. Test a plant by reseedling in a greenhouse during winter and by reseedling in a field during summer.



4 Commercial Propagation (3 years)

It takes approximately 1 year to grow cuttings. After commercial propagation, commercial distribution begins. The marketing department of the nursery makes a final selection of plants to be sold.



Species - Hybrids - Culture



The David G Leach Research Station

Namesake Plants

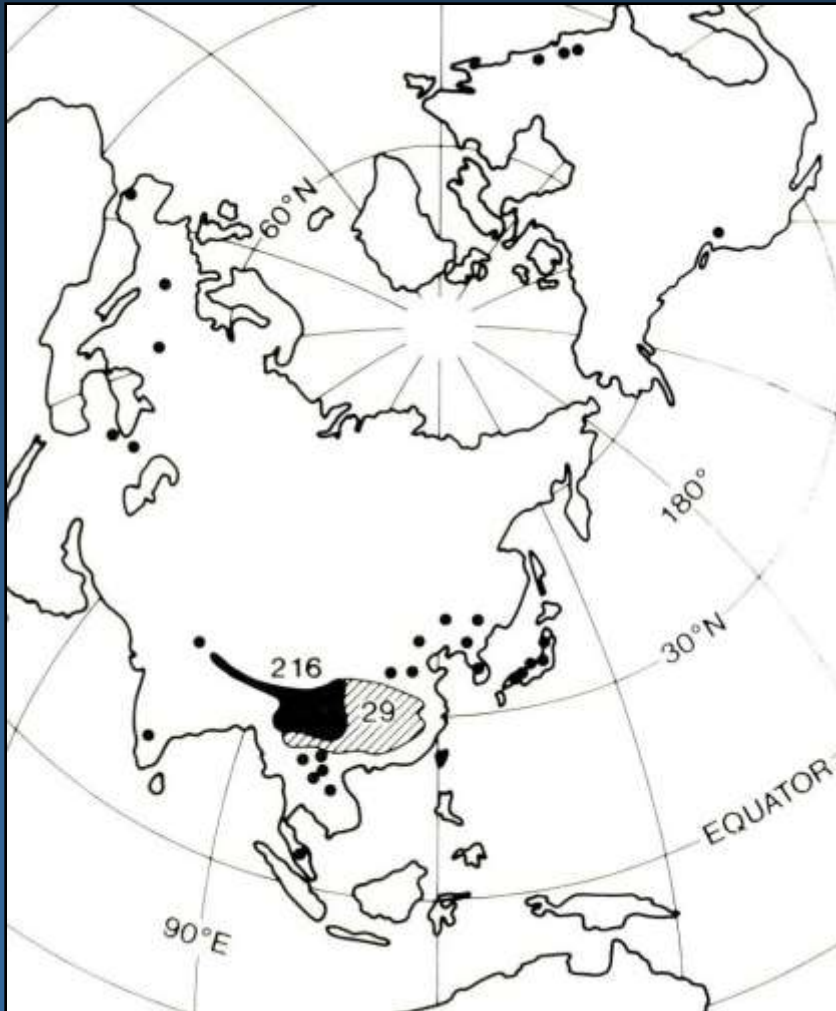


R. 'Holden'



R. 'Maud Corning'

Species: the building blocks of hybrids



Subgenus *Hymenanthus*
~140 species

broad diversity

color

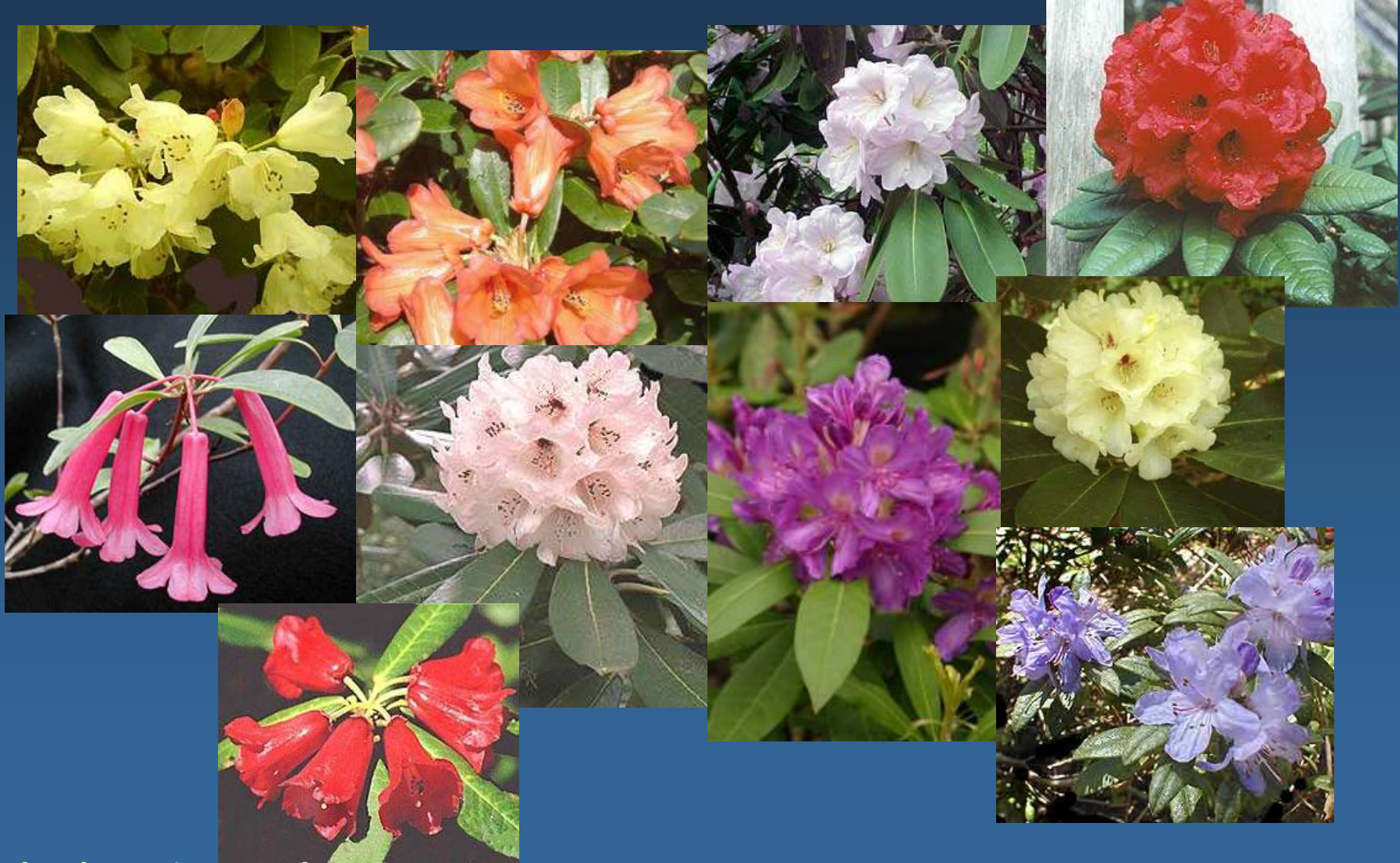
foliage

bloom date

stature

outlier ssp. adaptations

Flower Diversity Asian Rhododendrons



thank you internet!

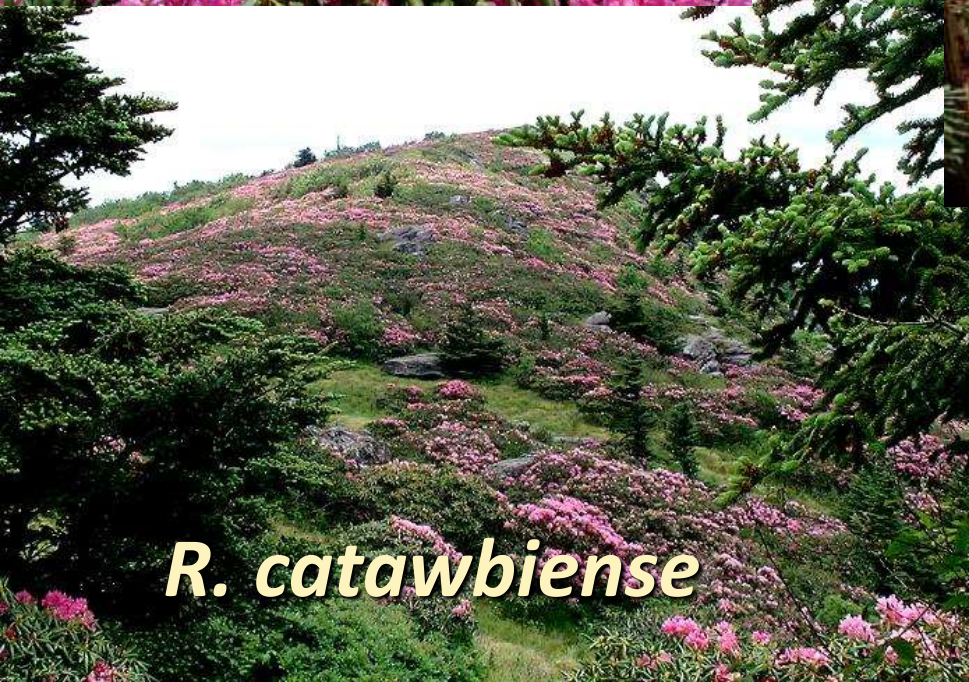
Rhododendron Leaf Diversity



Native Cold Hardy Rhododendrons



R. maximum



R. catawbiense



Leach Breeding: Foundation Plants

30% of collection



50% of collection



R. 'Russel Harmon'



B. Clyburn

Best of Leach: White



R. 'Mist Maiden'



R. 'Summer Snow'

Best of Leach: Pinks



Best of Leach: **Reds**



R. 'Red Sea'



R. 'Singapore'

Best of Leach: Yellows



R. 'Capistrano'



R. 'Holden's Solar Flair'

Best of Leach: Big Leafed



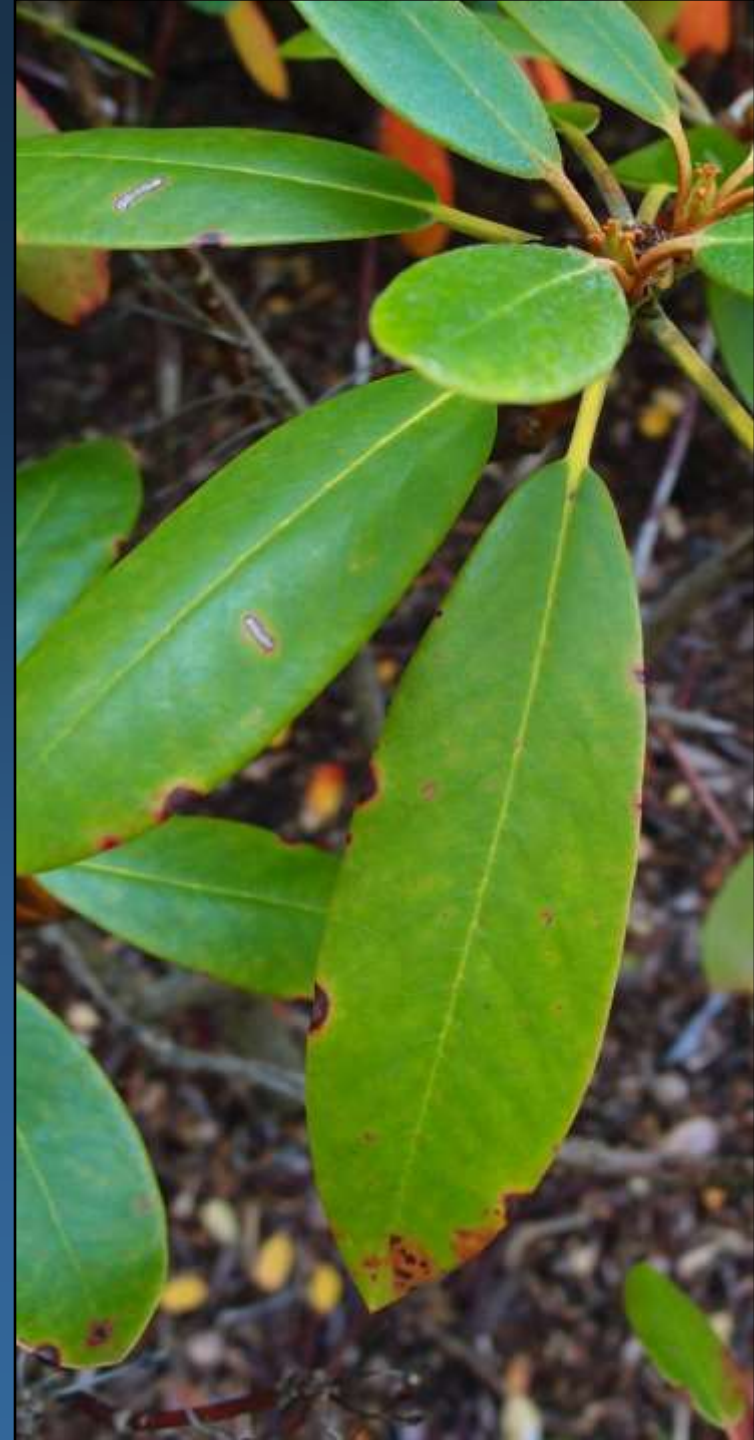
R. 'Spellbinder'



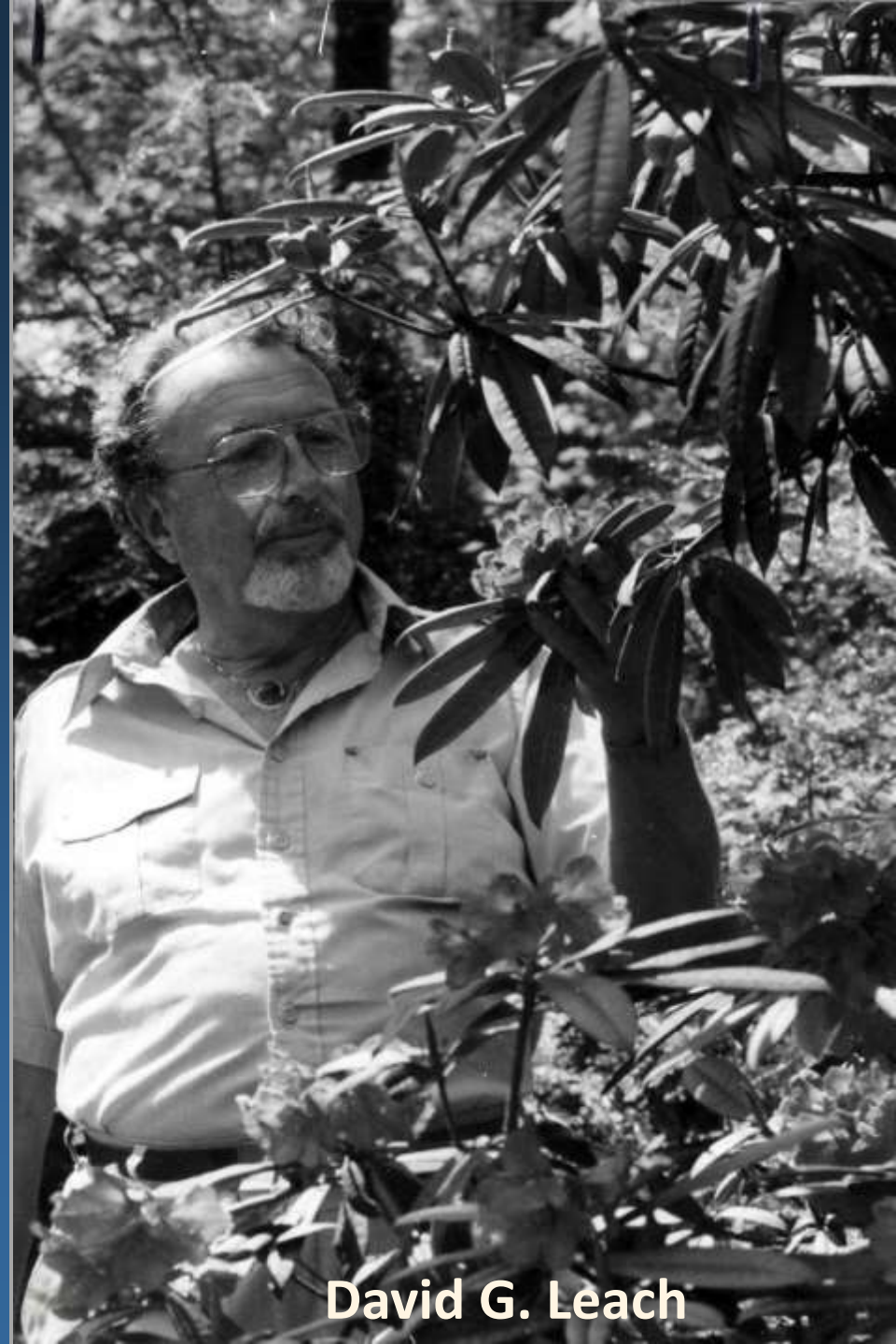
R. 'Holden's Spring Herald'

Assessment of Leach Hybrids

- **Positives**
 - USDA zone 5 hardy
 - Saturated flower colors
- **Negatives**
 - Poor leaf retention/quality
 - Limited adaptability



**Breeding
Rhododendrons
for the
21st Century A.D.**

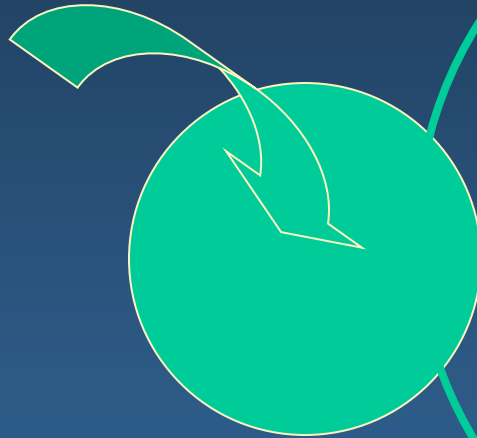


David G. Leach

Market Share of Rhododendrons

Niche market
e.g. ARS

diversity
novelty
regional



National Sales
Presence

the 'ironclads'
reliable
adaptable

The Importance of Off-Site Trialing

“If you are not killing plants, you are not really stretching yourself as a gardener”

J C Raulston





Lower Baldwin Test Site:

zone 5
full exposure
pH 6.5
heavier soils



Many of the selections that do well in Madison, OH fail at Baldwin

Good Performers at Baldwin



77-24 #97-1 = [N. Belle x (atros. x wardii)] x Sahara

Good Performers at Baldwin



00-43 #07-3 = Ingrid Mehlquist x Rio

Good Performers at Baldwin



R. 'Ingrid Mehlquist' x *R.* 'Pride's Early Red'

Adding Landscape Value to Leach Hybrids

✓ Ornamental

✓ Cold Hardy (zone 5)

+ Root Rot Disease Resistance

+ Heat Tolerance (zone 8)

} functionally
related?

= Better consumer experience

= Broader market

Root Rot Disease Caused by *Phytophthora cinnamomi*



leaf chlorosis/wilting

root and crown necrosis



Methods For Controlling *Phytophthora* Root Rot

Existing controls

- cultural
- chemical
- biological

Additional controls

- host resistance
- rootstock



Breeding with Resistant Species *R. hyperythrum*

Bud hardy zone 6

Heat tolerant zone 8

Dense, glossy foliage

Floriferous



R. hyperythrum heat tolerance

Dr. John Thornton
Franklinton, LA



R. 'Peppermint Twist'



R. 'Radiance'™
Southgate™



High Breeding Value of *R. hyperythrum*



0% (S)

X



100% (R)



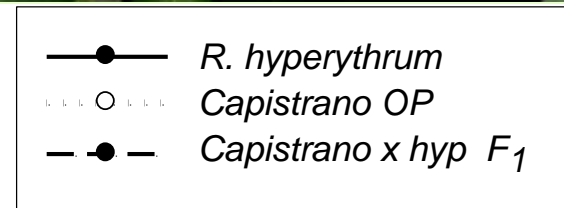
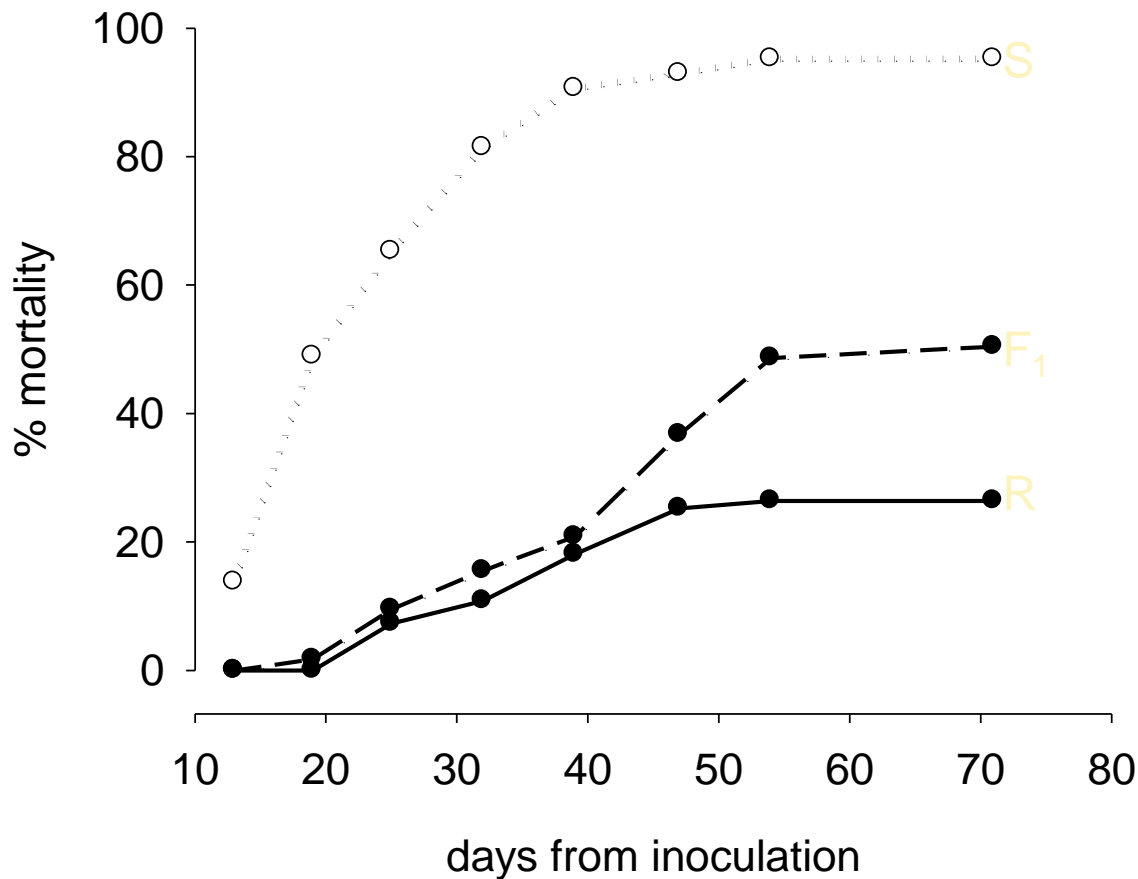
50% (F₁)

percentage of *R. hyperythrum* in seedlings

41 DAI

F₁ Gains in Resistance (AUCs)

R. 'Capistrano' x *R. hyperythrum*



$$\text{Gain} = (S - F_1) / (S - R) * 100$$
$$= 83\%$$

Field Evaluation: First Generation Hybrids (2500+ seedlings in 2005)



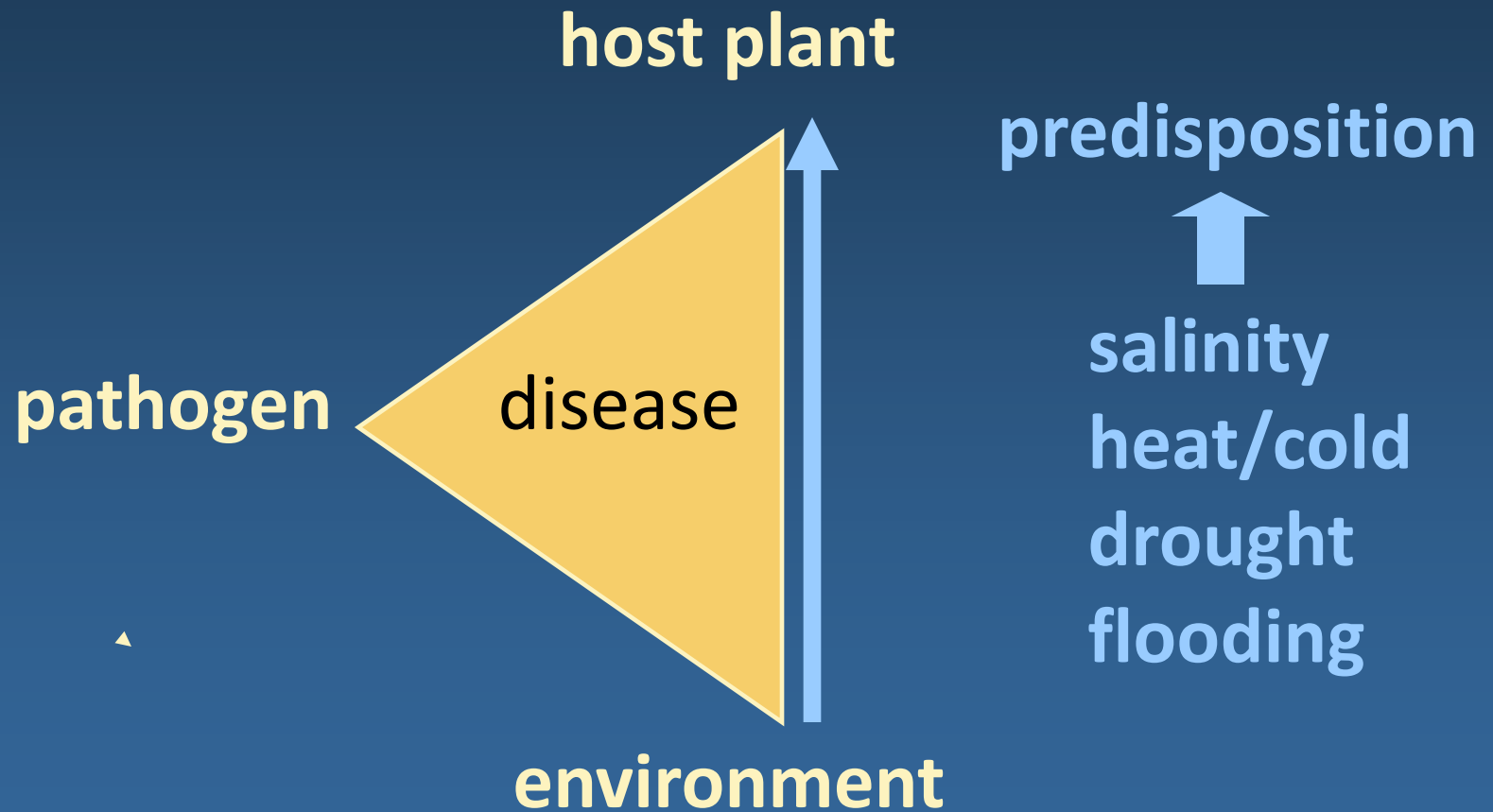
F₁ Selections - Flowers



F₁ Selections – Dense, Mounded Habit



Environmental Stress Reduces Resistance



Flooding Stress Test

2011 Field Trial: 21 Genotypes



R. hyperythrum and its hybrids were less predisposed to root rot under flooding conditions

Results of Flooding Trial

Test Group	N	Mean Root Rot Score		t-test ($P < 0.05$)
		non-flooded ^a	flooded	
Susceptible	8	4.9	4.8	}
Resistant (benchmarks)	3	2.2	4.1	
<i>R. hyperythrum</i> F ₁ hybrids	9	na	3.3	}
<i>R. hyperythrum</i>	1	2.0	2.7	

^a Hoitink and Shmittenner (1974) Pl. Dis. Rep. 58:650-
Krebs and Wilson (2002) HortSci. 37:790-

Heat Stress Test Using Water Bath



Target Soil T' s

25 C / 77 F

30 C / 86 F

35 C / 95 F

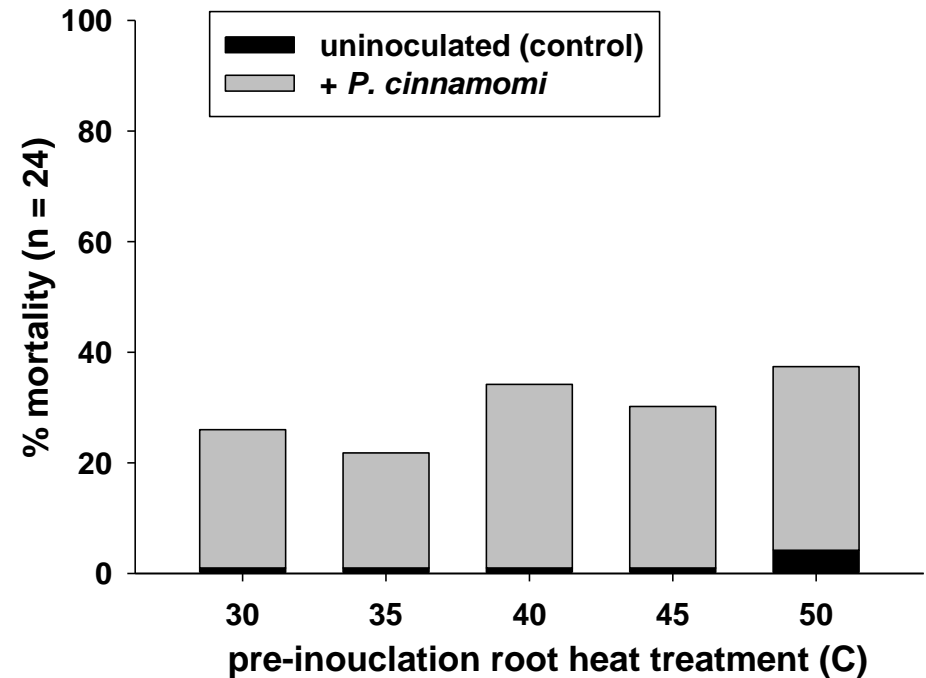
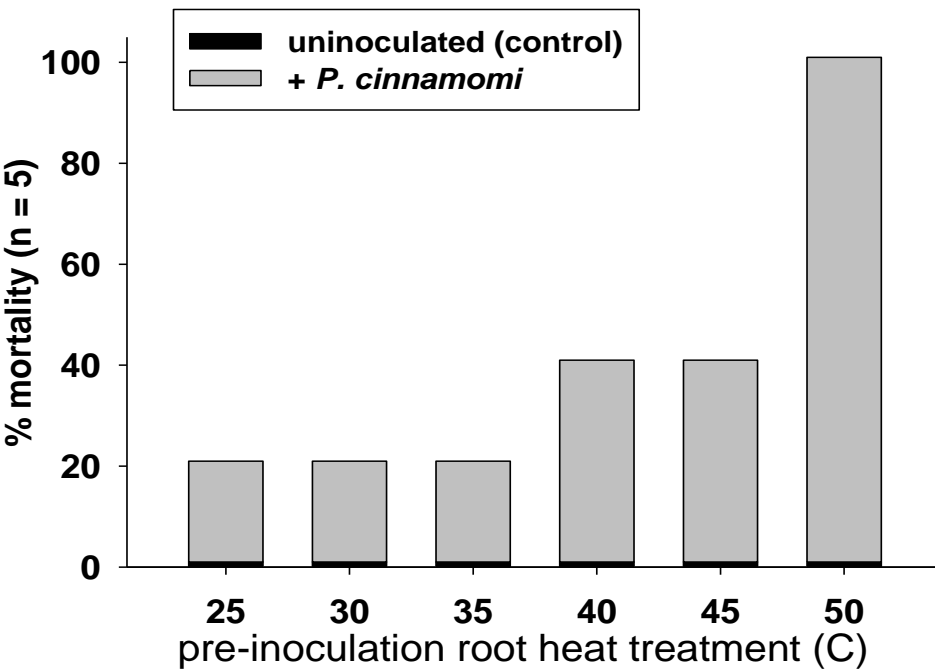
40 C / 104 F

45 C / 113 F

50 C / 122 F

~ 1 hr to target,
hold for 30 min

Results of Water Bath Heat Stress Test



R. 'Ingrid Mehlquist'
loses resistance with ↑ T

R. hyperythrum maintains
resistance with ↑ T

Buddy Lee



**Plant Development Services Inc.
Southern Living Plant Collection™**

**Southern Trials
165 F₁ selections**



Louisiana Trial Dec 2013



05-71 #8



05-181 #4

Southern Trial (2 years)

Good Doers: ~30/165





Summary

- Hybrid rhododendrons with resistant roots
- Adaptable to hardiness zones 5 – 8
- Reduced pesticide use
- Potential to cope with climate change

Acknowledgements



**Jing Wang
Hilary Wright
Susan Hanna**

American Rhododendron Society
Stanley Smith Horticultural Trust
Norweb Fellowship



Southern Trials

- **Plant Introduction:**

Identify which F_1 Ohio-selections grow well in southern climate

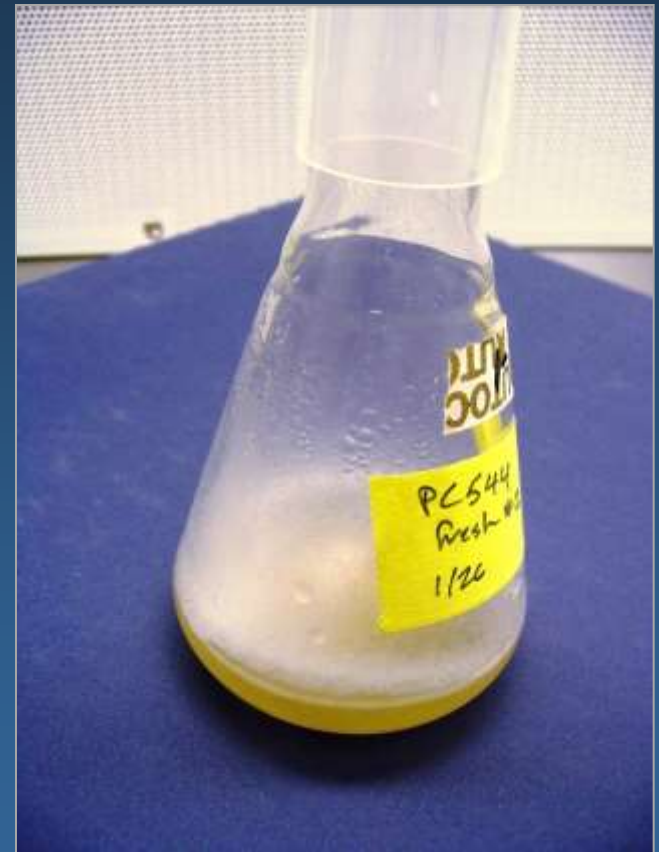
- **Hypothesis testing:**

F_1 selections vary in level of resistance. Are the best southern performers also the most root rot resistance?

Controlled Inoculations and Screening



initiation on solid media



bulking up in liquid media

Field Evaluation: First Generation Hybrids (2500+ 4 year old seedlings)



**Ornamental
Results:
R. hyperythrum
F₁s**



R. 83-57 #90-2 x
R. hyperythrum



R. 'Henry's Red' x
R. hyperythrum

Ornamental Results

R. hyperythrum F₁s



R. 'Samoa' x R. hyperythrum



R. 'Singapore' x R. hyperythrum

Ornamental Results

R. hyperythrum F₁s



Ornamental Results: *R. hyperythrum* F₁s



R. 'Besse Howells' x *R. hyperythrum*

Proven Performers: purple



R. 'Catawbiense Boursault'



R. 'English Roseum'

Proven Performers: white



R. 'Chionoides'



R. 'Mist Maiden'

Proven Performers: white



R. 'Ingrid Mehlquist'



R. 'Calsap'

Proven Performers: pink



R. 'Scintillation'



R. 'Brown Eyes'

Proven Performers: pink



R. 'Summer Glow'



R. 'Janet Blair'

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Southern Trials

- **Plant Introduction:**

Identify which F_1 Ohio-selections grow well in southern climate

- **Hypothesis testing:**

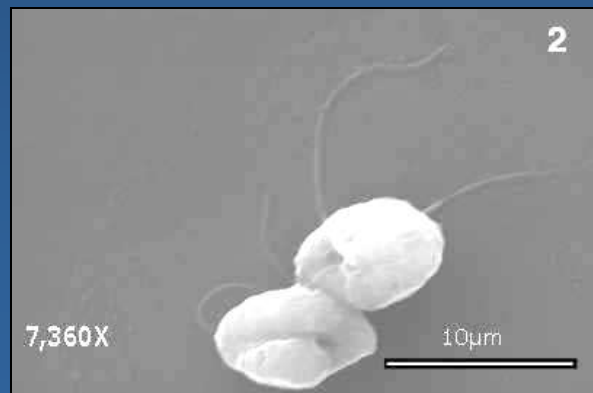
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Model for Predisposition (salinity)



P. cinnamommi Causal Organism

- broad host range – global impact
- primitive ‘fungus’
- motile zoospores
- spores persistent in field



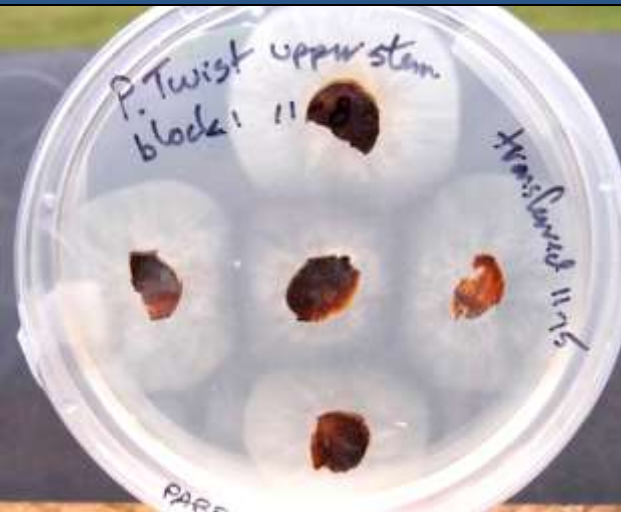
zoospores



chlamydospores

Confirmation of *P. cinnamomi*

- growth on selective media
- consistent colony morphology
- 96-100% sequence match to LPV3 storage protein in *P. cinnamomi* *



* primers per Kong et al. (2003)
Pl. Path. 52:681-