

LONGWOOD
GARDENS

The Research and Conservation Program at Longwood Gardens

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November 15, 2021







The Research and Conservation Program at Longwood Gardens

- Living Plant Collections Curation
- Plant Breeding
- Plant Exploration
- Plant Conservation

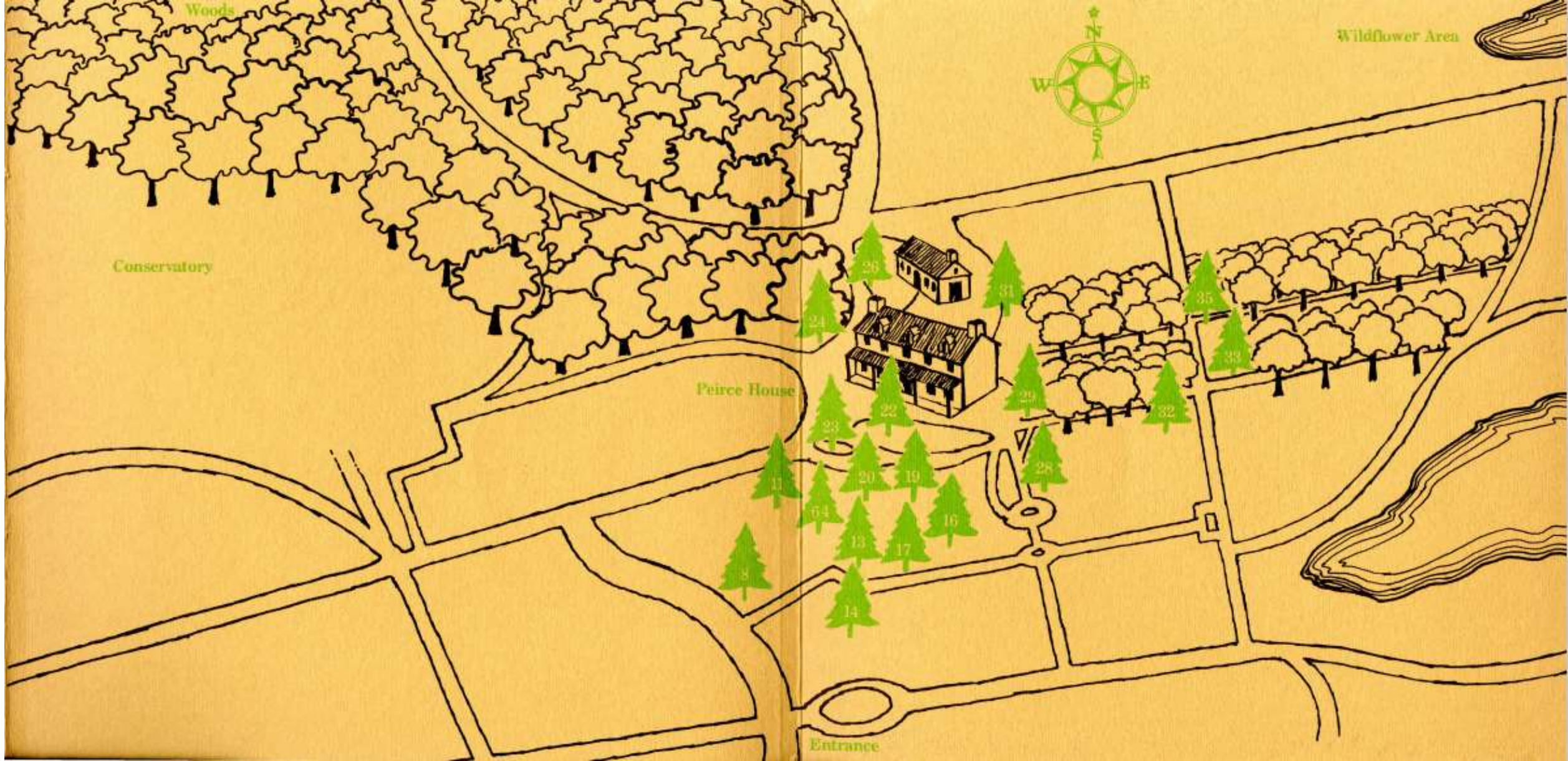




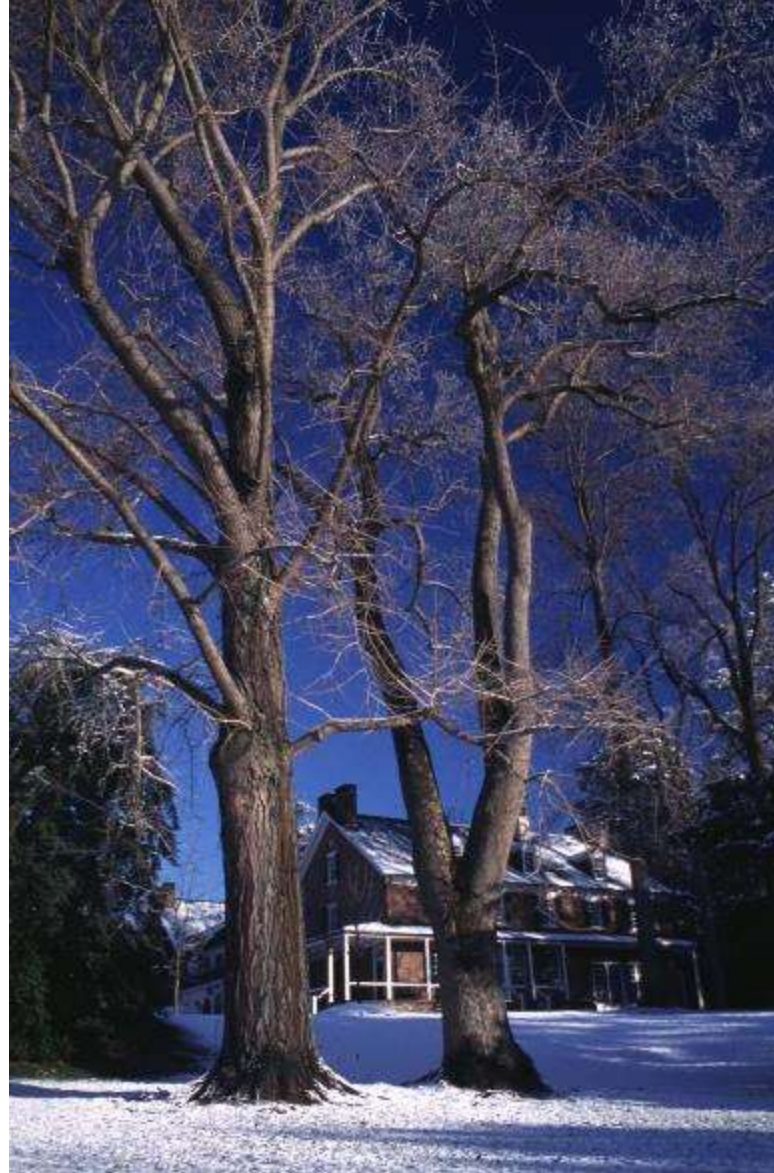
Park at Longwood Taken about 1884

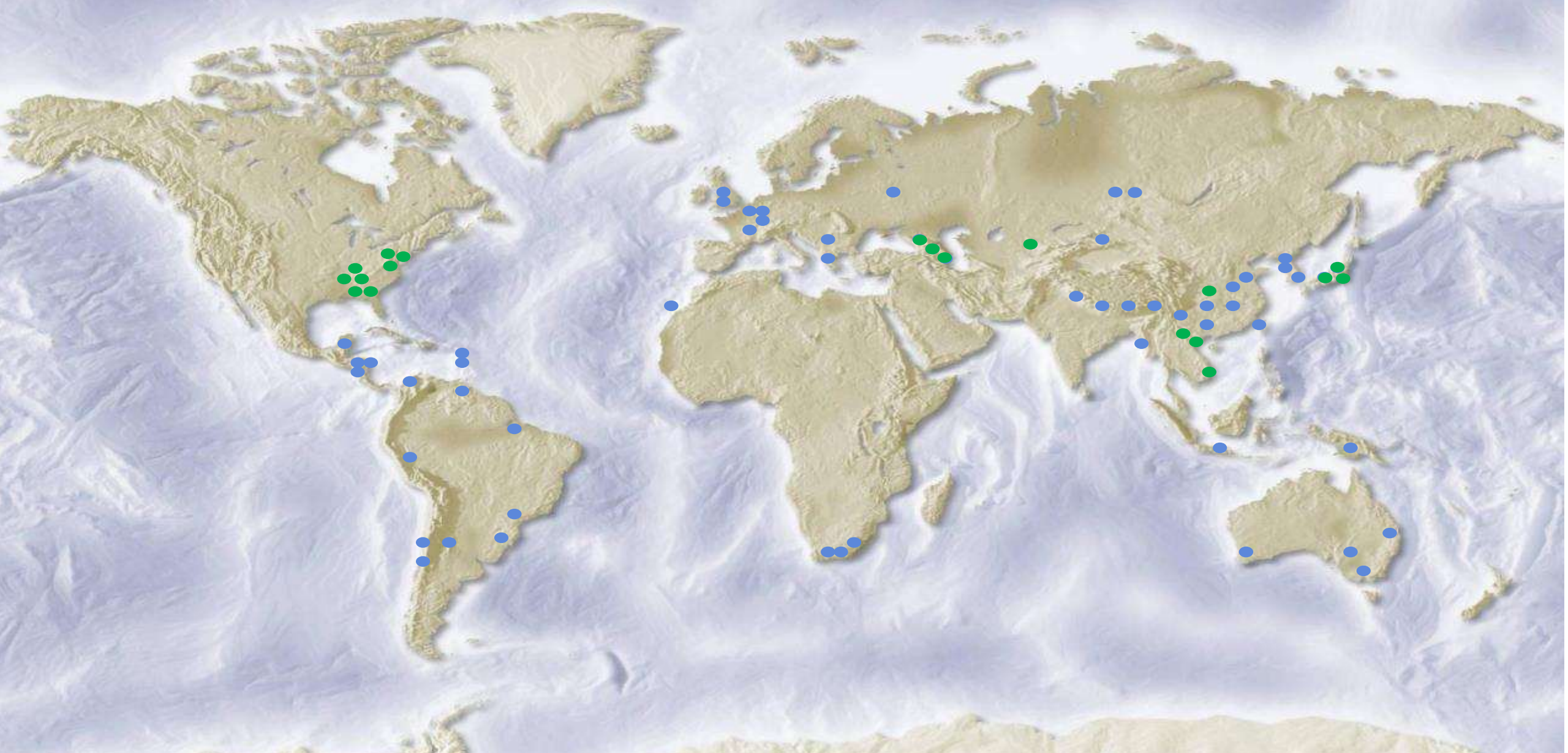
Original Owned by George B. Stebbins.





Magnolia acuminata var. *subcordata* 'Peirce's Park'





52 countries 72 expeditions 15,000+ collections

Plant Exploration for Longwood Gardens – 2014-2021

- Azerbaijan - 2017
- China- 2018
- Japan- 2016, 2018, 2019
- The Republic of Georgia – 2016, 2018
- Vietnam – 2013, 2018, 2019
- Mid-Atlantic and Southeastern United States – 2014-2021



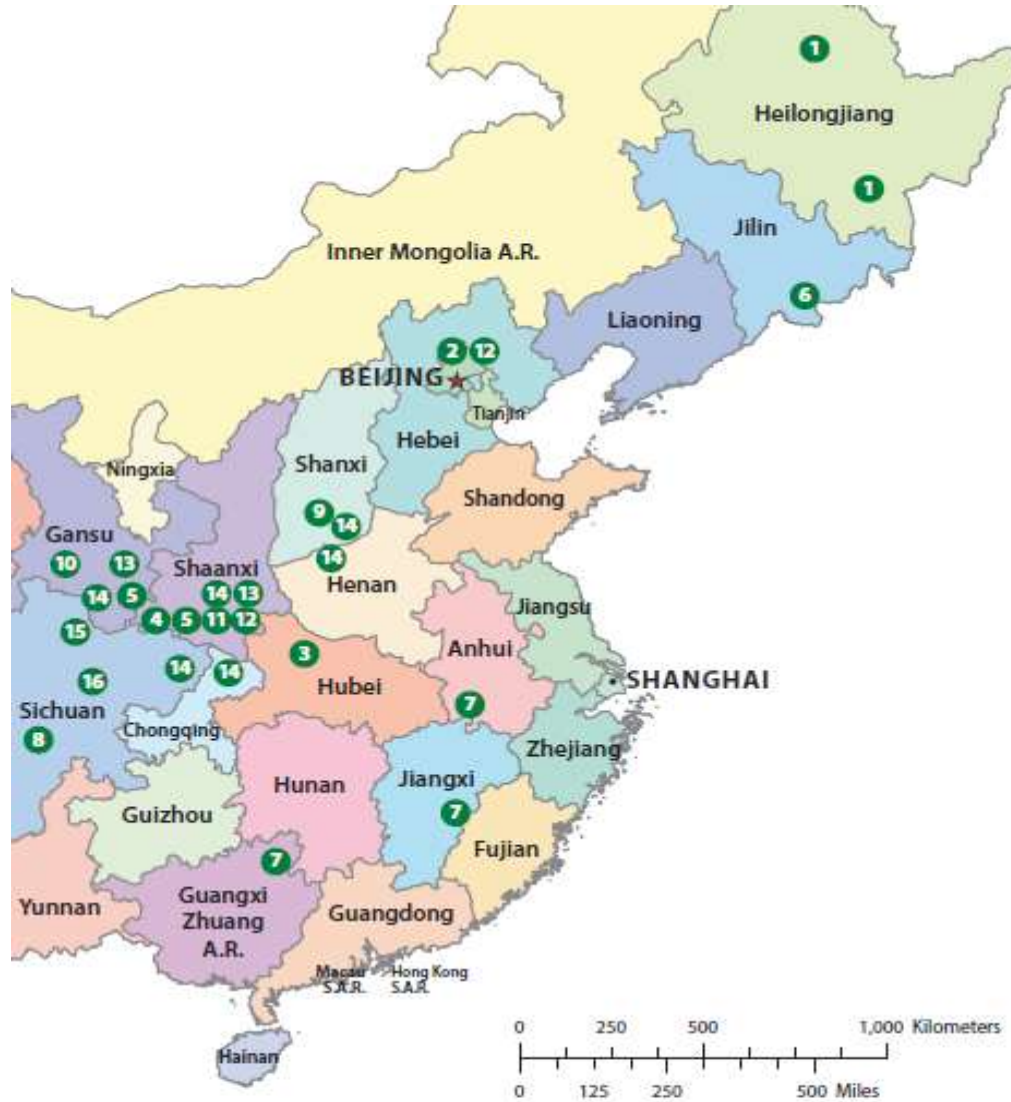
Apios priceana



Shennongjia Forestry District, Western Hubei, 2018



North American China Plant Exploration Consortium



Arnold Arboretum
 Beijing Botanical Garden
 Chicago Botanic Garden
 Dawes Arboretum
 Holden Arboretum
 Longwood Gardens
 Morris Arboretum
 Morton Arboretum
 National Arboretum
 UBC Botanical Garden

NACPEC EXPEDITION LOCATIONS

- | | | |
|--|------------------------------------|---|
| 1 1993 Heilongjiang | 6 1997 Jilin (Changbai Shan) | 11 2008 Shaanxi |
| 2 1994 Beijing | 7 1998 Anhui, Guangxi, and Jiangxi | 12 2010 Shaanxi, Hebei, and Beijing |
| 3 1994 Hubei | 8 1999 Sichuan | 13 2011 Shaanxi and Gansu |
| 4 1995 Shaanxi | 9 2002 Shanxi | 14 2015 Shaanxi, Gansu, Sichuan, Chongqing, Henan, and Shanxi |
| 5 1996 Shaanxi and Gansu (Qinling Mountains) | 10 2005 Gansu | 15 2016 Sichuan |
| | | 16 2017 Sichuan |





ng Cun

Emmenopterys henryi (926m)



*Emmenopterys
henryi*



WANG Kang





Fagus longipetiolata (1294m)

Magnolia biondii (1294m)







Paris polyphylla (926)



Helwingia chinensis (982)



Corylus fargesii (1110)

Acer sutchuenense



Rhododendron oreodoxa var. *fargesii* (2581m)



Collectors: Andrew Gajowski, Matt Lobbell,
Kang Wang, Peter Zale
Country of Origin: China
Taxon: *Acer maximowiczii*

Collector:
Kang Wang
Country of Origin:
Taxon: *Styrax*

Collector:
Kang Wang
Country:
Taxon: *M...*

Collectors: Andrew Gajowski, Matt Lobbell,
Kang Wang, Peter Zale
Country of Origin: China
Taxon: *Magnolia biondii*
Collection No: 018

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Collector:
Kang Wang
Country of Origin:
Taxon: *Styrax*

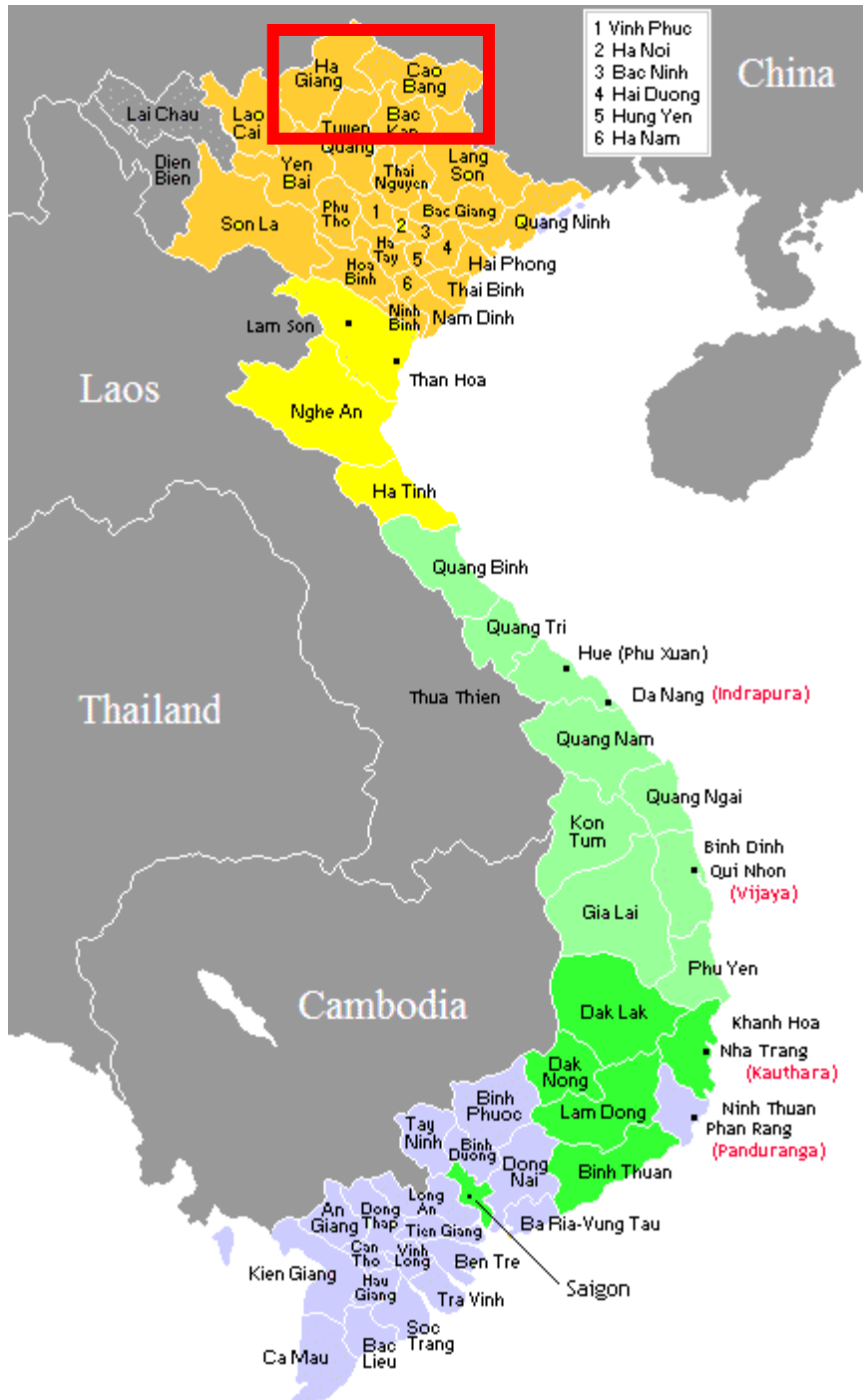
Plant Exploration in Vietnam

- In partnership with Atlanta BG, Vietnam Academy of Science and Technology IEBR
- Focal genera:
 - Conifers
 - Gesneriaceae
 - *Magnolia*
 - Orchidaceae
- Updating occurrences of critically rare species
- “Near situ” collections development at IEBR Biodiversity field station



Paphiopedilum helenae and *Oberonia* sp.





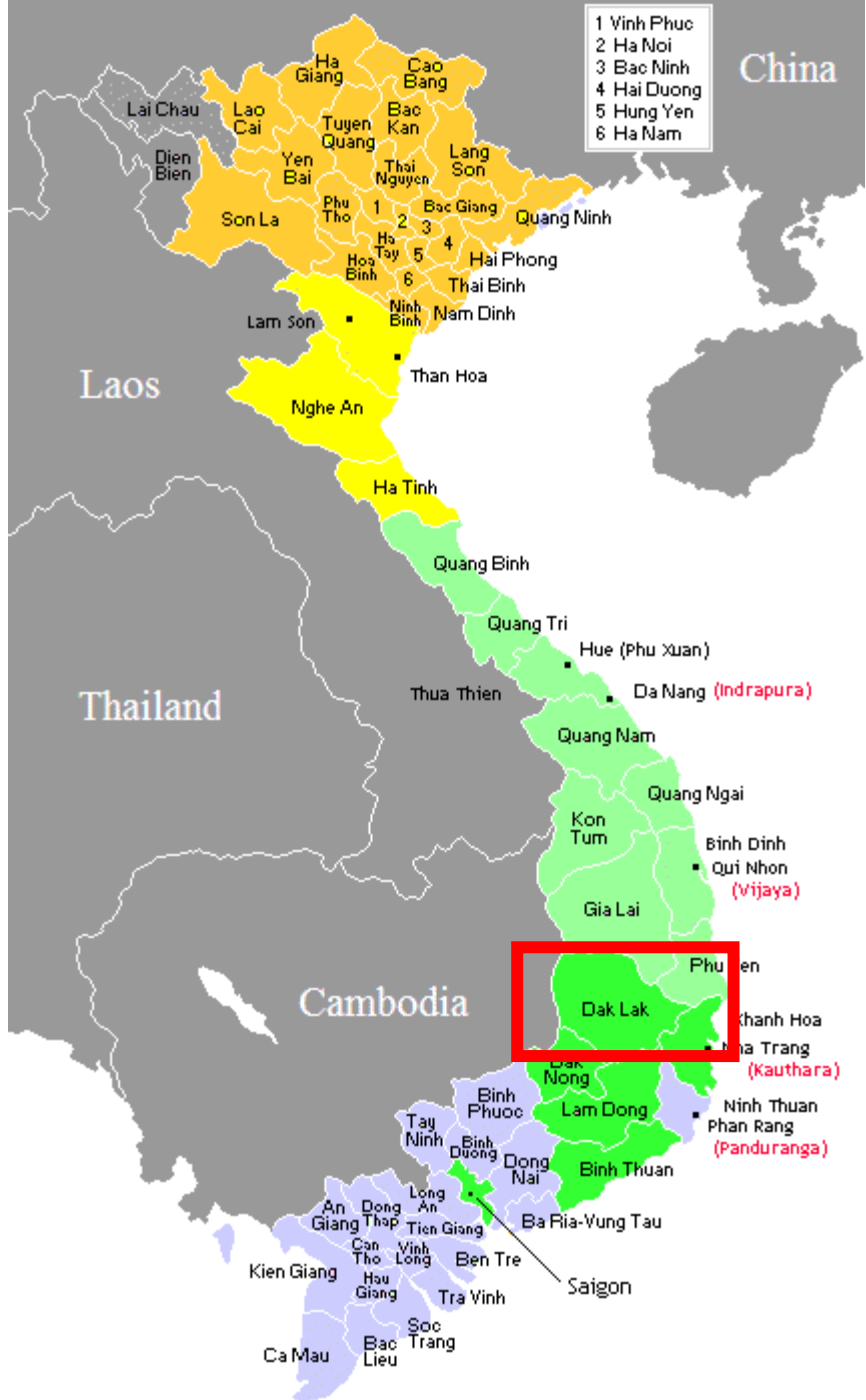
Focus on Cao Bang, Da Lat, and Ha Giang Provinces

Karst Landscape at Thang Hen, Cao Bang, Vietnam



Orchids in Vietnam





Focus on Cao Bang, Da Lat, and Ha Giang Provinces

*Pinus
krempfii*





Magnolia lamdongensis in
Bidoup Nui Ba National
Park, Vietnam



Plant Exploration in Japan

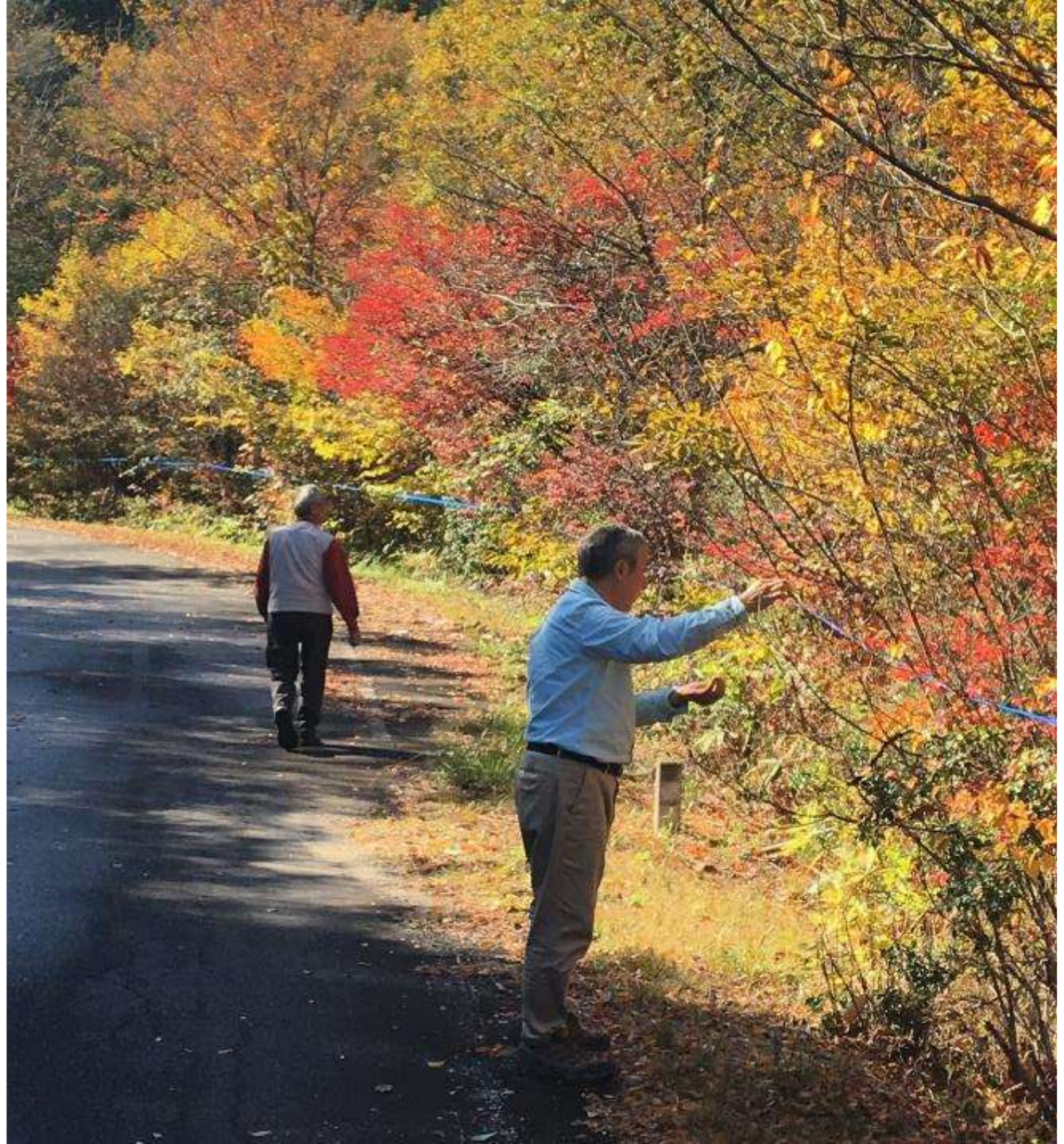
- Specialist Nurseries
- Wild collecting
- Specialty horticultural



Ilex macropoda in the Adera Valley
Gifu/Nagano border, Japan



Roadside collecting in Gifu prefecture



Japanese Arisaema – Cobra lilies



Arisaema urashima
“Kagamusha”
(Shadow Warrior)



Quercus dentata 'Kogane Fuji'





Orchids and Longwood Gardens

- Founding members of the American Orchid Society ca. 1921
- Interest in orchids beginning in 1922...
- *Galearis spectabilis*



Mr. and Mrs. du Pont, 1925



Native Orchid Conservation Program at Longwood Gardens

- **Goals**
 - Help prevent the loss of orchid diversity
 - To understand and advocate for the role of horticulture in plant conservation
 - Build ex situ orchid collections with conservation value
 - Dispel horticultural myths
- **Conservation Horticulture**
 - Seed Propagation and Seedling Development
 - Greenhouse acclimatization
 - Collections
 - Restoration/Repatriation
 - Disseminate research and germplasm
- **Long-term partnerships for conservation activities**
- **Taxon-based projects**
- **New Plant Exploration Program**



Triphora trianthophora seedlings at 32x

Native Orchids of Pennsylvania and the Mid-Atlantic



The Orchids of Pennsylvania

- Ca. 61 taxa
- All terrestrial
- At least 23 threatened,
 - 9 state endangered
 - At least 4 extirpated
- Poorly represented at public gardens
- How can public gardens play a role in native orchid conservation?



Taxa	PA Heritage rank ^z	Historical populations (No.) ^y	Number of public gardens where present ^x	Part of Longwood Conservation Program
<i>Arethusa bulbosa</i>	E	21	0	X
<i>Cypripedium parviflorum</i> var. <i>makasin</i>	E	20	9	
<i>Isotria medeoloides</i>	E	8	1	
<i>Platanthera dilatata</i>	E	8	6	
<i>P. hyperborea</i>	E	---	4	
<i>Spiranthes casei</i>	E	3*	1	X
<i>S. ovalis</i> var. <i>erostellata</i>	E	1	4	
<i>S. romanzoffiana</i>	E	6	9	
<i>S. vernalis</i>	E	13	7	X
<i>Cypripedium reginae</i>	PT	27	54	
<i>Aplectrum hyemale</i>	R	48	12	
<i>Malaxis bayardii</i>	R	23	0	
<i>Coeloglossum viride</i>	PE	20	9	
<i>Corallorhiza wisteriana</i>	PE	24	0	
<i>Platanthera aquilonis</i>	PE	---	4	
<i>Platanthera blephariglottis</i>	PE	27	6	
<i>Platanthera hookeri</i>	PE	26	1	
<i>Platanthera huronensis</i>	PE	18	3	
<i>Platanthera macrophylla</i>	PE	8	0	
<i>Goodyera tessellata</i>	PT	10	2	X
<i>Platanthera ciliaris</i>	PT	>70	8	X
<i>Platanthera peramoena</i>	PT	31	2	X
<i>Spiranthes lucida</i>	PT	44	1	
<i>Cypripedium parviflorum</i> var. <i>pubescens</i>	NL	>50	12	X
<i>Platanthera xibicolor</i>	NL	1	0	X

^zE = Endangered; PT = Potentially threatened; R = Rare; PE = Potentially endangered; PT = Potentially threatened.

^yData derived from Rhoads and Block, 2007.

^xData from Botanic Garden Conservation international (BGCI) PlantSearch! website. It is not currently known whether these represent intentional cultivation or naturally occurring populations on land holdings.

Embryo culture of Cypripedium parviflorum var. pubescens



May 5, 2016



June 22, 2016



July 22, 2016



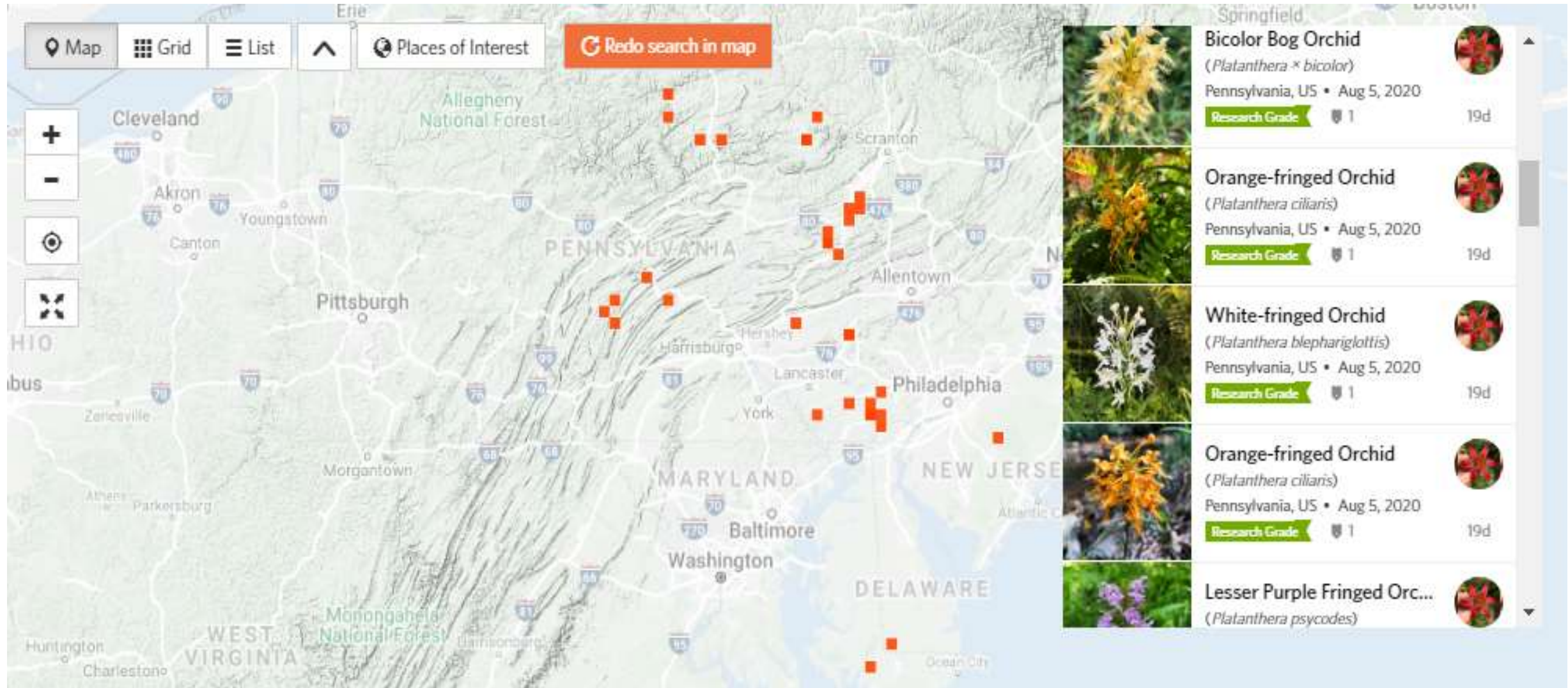
October 18, 2016



The Genus Platanthera



Orchid Conservation Field Work



The Genus Platanthera

- ~200 species worldwide
- ~32 species in the Flora of North America
- Habitats threatened by invasive species, fire suppression, deer browse
- Very difficult to propagate from mature seeds
- Is embryo culture possible? Timing?

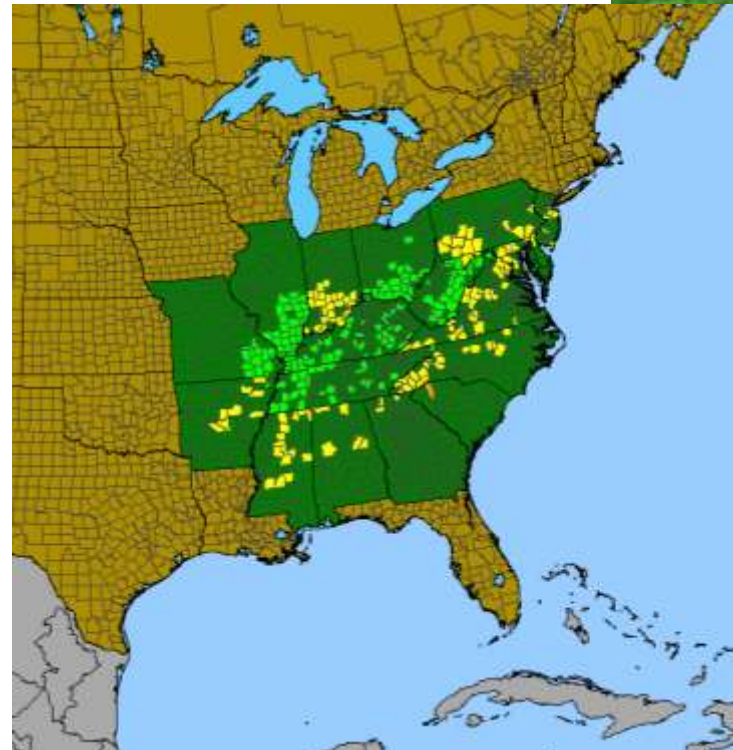


Platanthera psycodes



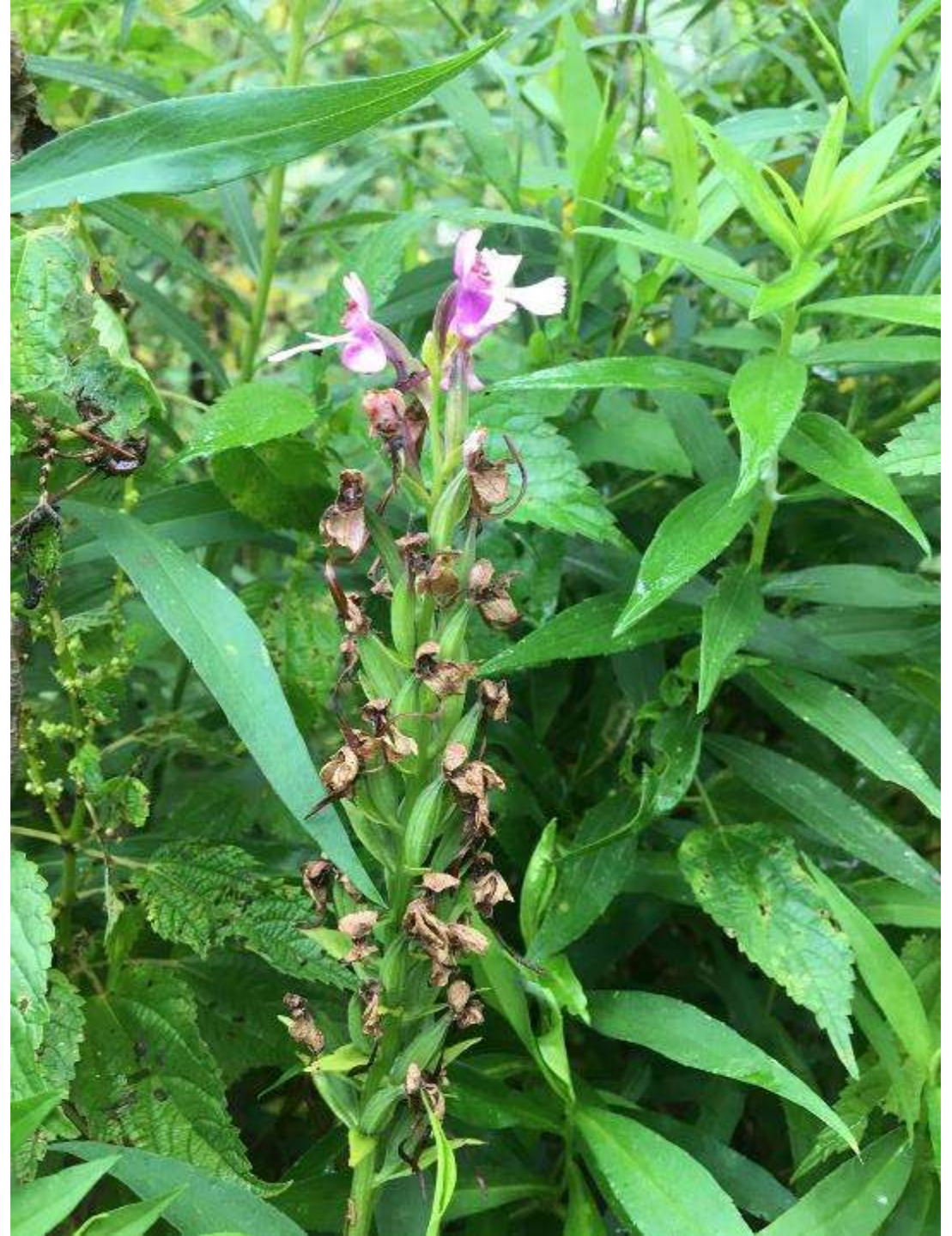
Platanthera peramoena – the purple fringeless orchid

- PA Threatened (PT)
- Listed in 10 states: AL, AR, DE, GA, MD, MS, NC, NJ, PA, VA
- Can it be used as a model for seed propagation and ex situ collections development *Platanthera* species?
- Closely related to Federally Listed and Globally Rare Species:
 - *P. leucophaea*
 - *P. praeclara*
 - *P. shriveri*



2019 Embryo culture experiment- *Experimental design*

- Sequential capsule harvest every two weeks at 2 weeks after flowering
- Hand Pollination of *P. peramoena*
 - August – 9, 14, 16, 21, 28, 30
 - September – 4, 6, 11, 14
 - 166 petri dishes



Immature seed sowing of Platanthera peramoena

- Eight replicates per sow date on two different media
- Incubated in the dark at room temperature (20 to 22 °C)
- Germination recorded every two weeks for 30 weeks



2019 Study – Results

- Germination occurred in all harvest dates but was highest at 22 and 26 days after pollination
- Germination ranged from 5 to 91%
- Mean germination of 53% across all 6 individuals



*Experimental outplanting of *P. permoena* - October 2021*



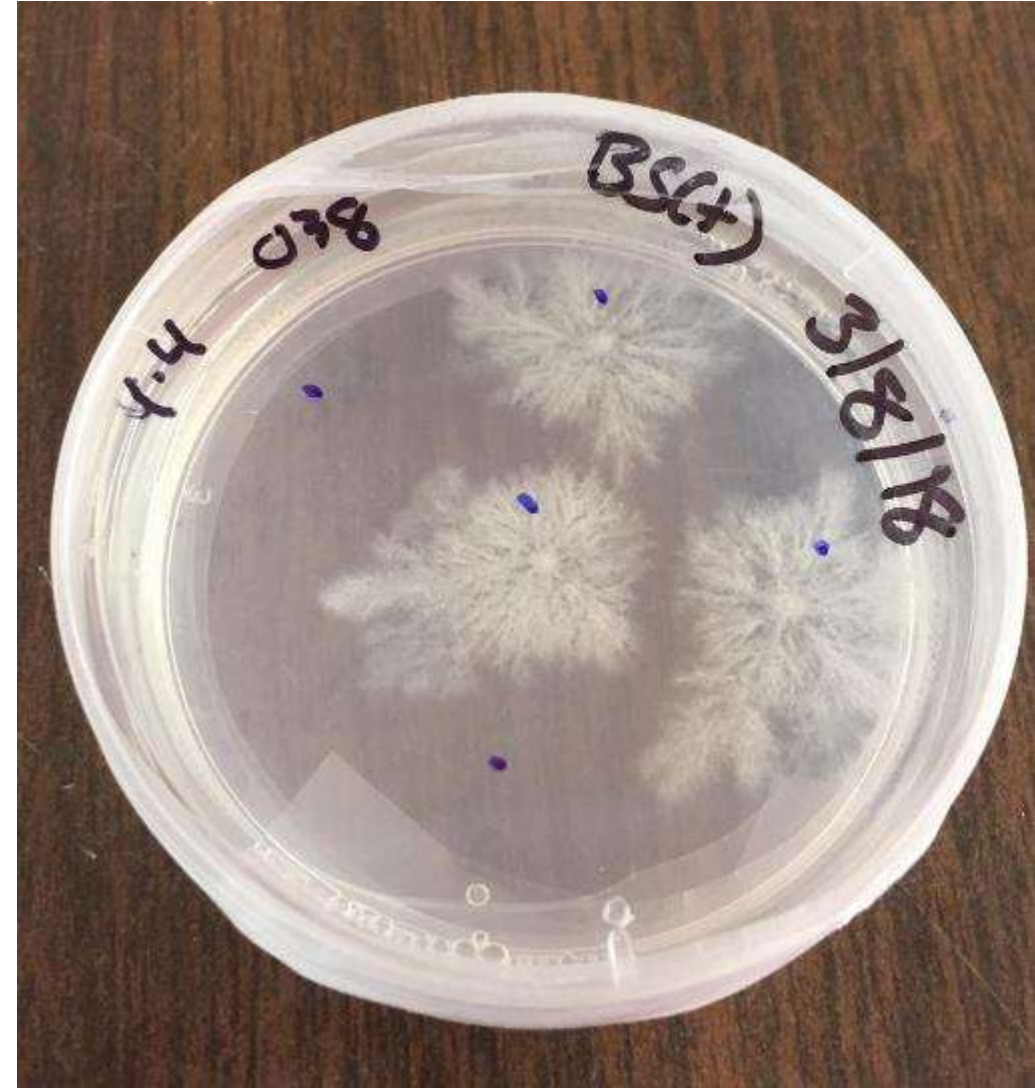
Next Steps

- Continue to optimize conditions for in vitro seedling development and ex vitro cultivation
- Fungus bathing packet bathing for symbiotic germination trials
 - Does seedling stage fungus differ from fungus associating with mature plants?



Native orchid fungal bank

- Ex situ conservation collection of orchid fungi
- Aids symbiotic germination of orchids seeds
- Experimental opportunity: Does seedling stage fungus differ from fungus associating with mature plants?



Do orchids grow better if you inoculate them with mycorrhizae?

- Collaboration with Smithsonian Ecological Research Center
- Fungus harvested from roots of parent plants for isolation and cultivation
- Fungus cultivated at SERC on Sorba Rods
- Inoculate asymbiotically produced seedlings with fungus

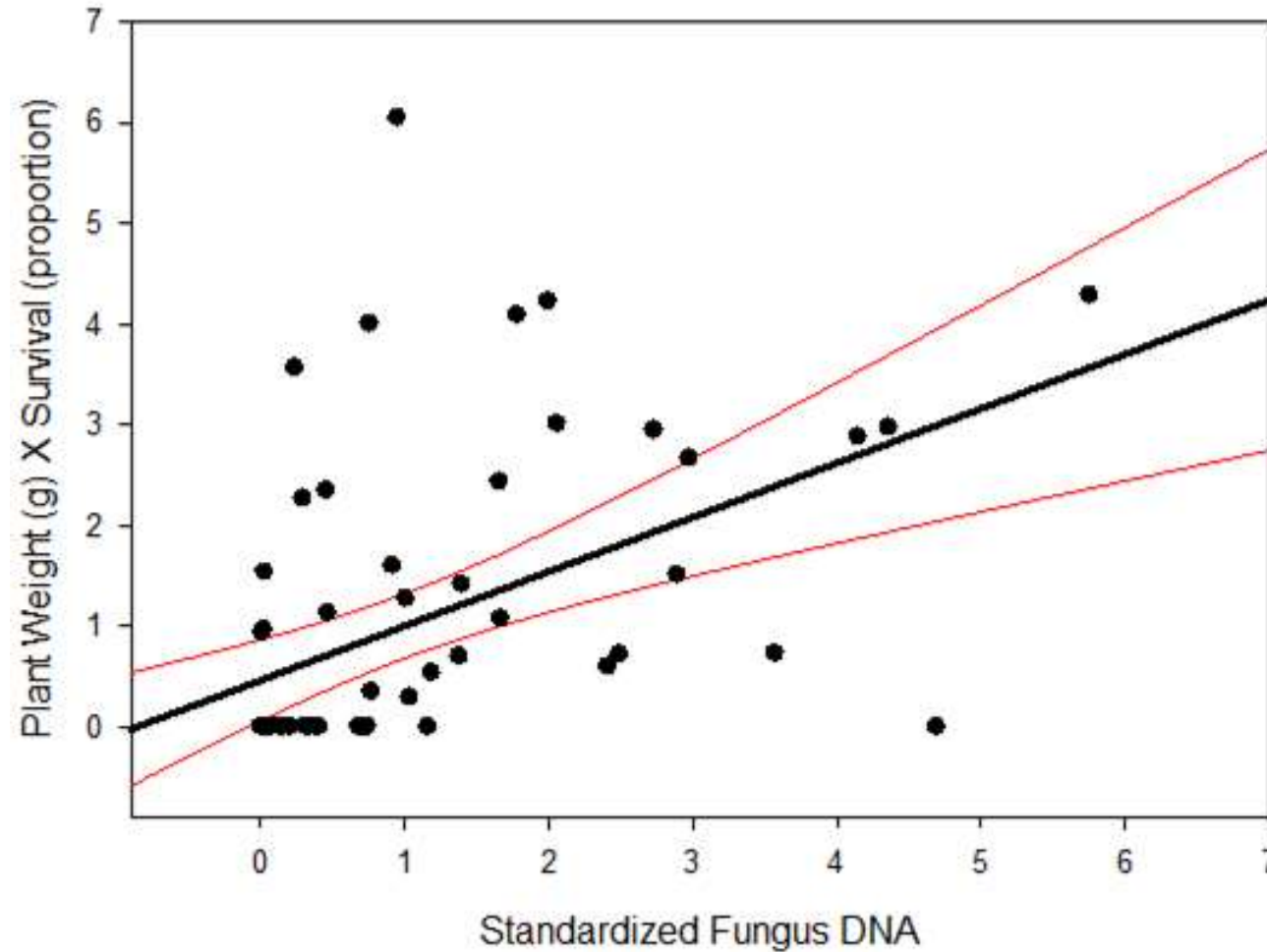


*“Container production of the U.S. native orchids *Goodyera tessellata* and *Platanthera blephariglottis* in four different substrates with and without orchid mycorrhizal fungus inoculation”*

- Seedlings grown on 4 container substrates
- All plants given a sorba rod +/- fungus
- Morphological and molecular data collected



Adding fungus to orchids increases survival in ex vitro conditions



Platanthera x bicolor



Germination database of all North American native terrestrial orchids



Top: *Arethusa bulbosa*

Right: *Dichromanthus cinnabarinus*



Phlox Collection at the Ornamental Plant Germplasm Center, Columbus, OH



Plant Breeding at Longwood Gardens

- Old efforts
 - New Guinea impatiens
 - *Canna*
 - *Camellia*
- New efforts
 - 12 *Phlox* – Direct result of Plant Exploration
 - 8 *Bletilla* – Hardy Orchids
 - *Camellia*



Phlox amplifolia selection

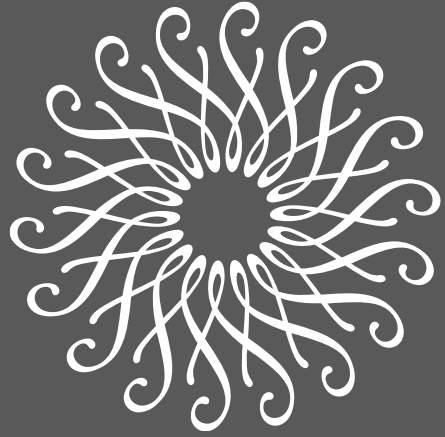




Orchid Breeding – Bletilla ‘Candles in the Wind’

- 4' tall x 6' wide hardy orchid that flower for 6-8 weeks.
- Will be introduced in the 2022 Plant Delights Nursery Catalog





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Thank You!
