Camellia Breeding at Longwood Gardens

Matt Taylor
The Land as Inhabited by the Pierce Family, Quaker Explorers, 1700s to 1906
The Creation of a Country Estate and Garden by Pierre S. du Pont
1906 to 1954
World-Class Conservatory and Gardens - 1955 to Today
Longwood Gardens Camellia History

• Camellias from France were some of the first species planted upon completion of the Conservatory in 1921.

• Du Pont also desired large specimen camellias
  – He had a contact rural Georgia who would locate well-shaped plants with good flowers and make an offer.
  – He collected thirteen camellias this way.
December, 1929 - Handwritten note by Pierre
"Order this Camellia. As you can see this is a very fine bush - from Louise Barrett, 2236 Walton Way, Augusta, GA."
Longwood Gardens Camellia History

• Camellia Inventory of 1937
  – 372 plants representing 167 cultivars
    • All were Japanese cultivars except for on *C. reticulata*

• 2011
  – 229 Living accessions
    • 12% - indoor display
    • 29% - indoor – research greenhouses
    • 59% - outdoor research plots
Camellia house 1957
Camellia house 2011
Dr. Russell J. Seibert was the first director of Longwood Gardens.

He initiated LWG’s research program, which included camellia trials and breeding.
First outdoor camellia trial - 1957
First outdoor camellia trial - 1957
First outdoor camellia trial - 1957
First outdoor camellia trial - 1957
First outdoor camellia trial - 1959
Cold Hardiness Breeding

• 1957 to the late 70’s

• Longwood collaborated with the U.S. National Arboretum and Dr. Clifford Parks at Descanso Gardens near LA.

• Parks did most of the hybridizing and hybrids were evaluated at Longwood and USNA. Two extremely cold winters (temps < -14 °F) in the late 70’s, killed most of the trial plants (Thomas, 1999).
C × williamsii ‘Aida’ selected in 1974
C × williamsii ‘Aida’ – Released 1995

C. japonica 'Ville de Nantes'

C. saluenensis 'Dogrose'

http://www.rarefindnursery.com/
Cold Hardiness Trials

- Reinvigorated by plant exploration to Sochong Island, off the North West coast of South Korea (zone 6)
Plant Exploration Trip

  - 28 collections of *C. japonica* seeds
  - Cuttings from 20 well established trees
Cold Hardiness Trials - Mid 80’s to Present

Two 1-acre fenced in plots
Releases from Korea trip

*C. japonica*

‘Longwood Valentine’
Releases from Korea trip

*C. japonica*

‘Longwood Centennial’

Both released in 2006 to celebrate the 100th anniversary of Du Pont’s purchase of the property that is Longwood Gardens
Releases from Korea trip

C. japonica ‘Korean Fire’

Released by Barry Yinger

Awarded the Gold Metal by the Pa Hort Society in 2003

Morris Arboretum is planning on releasing 4 more cultivars

All 3 named cultivars from Korea are available at http://www.rarefindnursery.com/
Current Hardiness Breeding Collaborative program with NovaFlora

• Longwood provides genetic material

• NovaFlora provides facilities and cultivar development

• Currently, 99% of seed is open pollinated
22,000 seeds
≈ 65% germination
Camellia azalea breeding
Ever-Blooming *Camellia azalea Wei*.

- Rare and endangered *Camellia* species
- Very difficult to propagate
  - Seed, cuttings, grafts, tissue culture
- Native to China in zone 9/10
- Blooms every month of the year in the greenhouse!!!!!!!
Ever-Blooming *Camellia azalea* Wei.

- Obtained by Longwood Gardens in 2000
- Breeding began soon after but was a low priority
- 2008 breeding for an ever-blooming, hardy and easy to propagate camellia became a high priority
Emasculation
Emasculation

• To remove the male parts of the flower to prevent self pollination during cross pollination.
JAPANESE CAMELIA
Camellia japonica
‘Marie Mackall’
Camellia Breeding - Tag Your Flower

Maternal or Seed Parent

\times

Paternal or Pollen Parent

+ 

Date

MMACKAEL
\times
CATH
0837
Breeding with *C. azalea*

- Nearly 3000 crosses with a 6% success rate
- 145 hybrid seedlings
- Over 400 underdeveloped seeds into tissue culture/embryo rescue
  - Only 25% of hybrid seed considered viable
Seed Viability Test

C. Azalea hybrid seed
Seed Viability Test
Seed Viability Test

Embryo Rescue
Embryo Rescue

• Takes place in sterile tissue culture
• Provides optimal environment
  – Light
  – Water
  – Fertilizer
  – Sugar
  – Insect free
  – Disease free
Floating Seed
Somatic Embryogenesis

- Induced embryo formation from vegetative tissue
C. azalea × C. japonica ‘Maiden of Great Promise’
### Experimentation

#### Somatic Embryos per Tube

<table>
<thead>
<tr>
<th>Week</th>
<th>0</th>
<th>2</th>
<th>4</th>
<th>6</th>
<th>8</th>
<th>10</th>
<th>12</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 ppm BAP</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 ppm BAP and 1 ppm GA</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 ppm GA</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Control</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### Germinated Somatic Embryos per Tube

<table>
<thead>
<tr>
<th>Week</th>
<th>0</th>
<th>2</th>
<th>4</th>
<th>6</th>
<th>8</th>
<th>10</th>
<th>12</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 ppm BAP and 1 ppm GA</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 ppm BAP</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 ppm GA</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Control</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### Auxin (IBA) Soak

<table>
<thead>
<tr>
<th>Auxin (IBA) Soak</th>
<th>20 Days Darkness</th>
<th>Rooting %</th>
</tr>
</thead>
<tbody>
<tr>
<td>1000 ppm</td>
<td>Yes</td>
<td>7 %</td>
</tr>
<tr>
<td>2000 ppm</td>
<td>Yes</td>
<td>70.6 %</td>
</tr>
<tr>
<td>3000 ppm</td>
<td>Yes</td>
<td>0 %</td>
</tr>
<tr>
<td>1000 ppm</td>
<td>No</td>
<td>0 %</td>
</tr>
<tr>
<td>2000 ppm</td>
<td>No</td>
<td>0 %</td>
</tr>
<tr>
<td>3000 ppm</td>
<td>No</td>
<td>0 %</td>
</tr>
</tbody>
</table>
Current and Future Work

• Continue to refine somatic embryogenesis process

• Determine effects of genetic variation

• Develop broader range of available camellias for zone 6 or lower.
C. japonica ‘Longwood Valentine’ × C. azalea
C. japonica ‘Longwood Centennial’ × C. azalea
C. japonica ‘Wildwood’
×
(C. azalea × C. japonica)
C. japonica ‘Marie MacKall’
\times
(C. azalea × C. japonica)
Camellia ‘Alice B du Pont’ (2008)

Available from:
• Dr. Edwin Leinbach

• Louis Kasprzyk

• And many others
Thank You!

Questions or Comments
The Bonsai Shortcut

Kurume, Japan