Alaska Native Plant Research

- **Tissue culture propagation**
- **Wildflower meadows, wildflower propagation**
- **Aleutian shield fern, Polystichum aleuticum**
- **Endangered species recovery plans**
- **K-6 educational programs**
  - Science and Alaska native plants
- **Cultivation and wild stand management of Alaska wild berries**

**Alaskan Ethnobotany**
Fruit research - mid 1970s

- Bog blueberry, *Vaccinium uliginosum*
- Coastal Blueberries, *V. ovalifolium*, *caespitosum*, *alaskense*
- Lingonberry, *Vaccinium vitis-idaea*

Scammon Bay, SW AK

UAF Archives, 1950s

Fairbanks, AK

Berry Pickers, Barbara Lavallee
Lingonberries

• *Vaccinium vitis-idaea* L. ssp. *minus* (Lodd.) Hult.
Greatest biomass in peat

All other substrates = leaf chlorosis (mostly N deficiency)

Optimum Substrate?

Lemeta peat (pH 4.8)
Silt loam soil (pH 6.5)
Chena very fine sandy loam (pH 6.4)
Soil/peat (50/50) [pH 5.4]
<table>
<thead>
<tr>
<th>Location</th>
<th>Fruit set (%)</th>
<th>Fruit weight (g)</th>
<th>Seeds per berry</th>
</tr>
</thead>
<tbody>
<tr>
<td>Floodplain</td>
<td>4.7** 38.9</td>
<td>0.16** 0.27</td>
<td>5.2** 12.7</td>
</tr>
<tr>
<td>Screened</td>
<td>Open</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Upland</td>
<td>0 9.4**</td>
<td>0.13</td>
<td>8.9</td>
</tr>
</tbody>
</table>

** Means differ significantly, P<.01
• Fourteen Potential Pollinators of Lingonberry

- **Andrena sp.** (Andrenid bee)
- **Apis mellifera**
- **Bombus flavifrons flavifrons**
- **Bombus terrestris**
- **Bombus sylvicola**
- **Syrphus sp.** (Syrphid fly)

Ms. Nikki Demers. MS Natural Resources Management
<table>
<thead>
<tr>
<th>Time</th>
<th>Visitors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Midnight- 2 a.m.</td>
<td>0</td>
</tr>
<tr>
<td>2 – 4 a.m.</td>
<td>0</td>
</tr>
<tr>
<td>4 – 6 a.m.</td>
<td>0</td>
</tr>
<tr>
<td>6 – 8 a.m.</td>
<td><em>Dolichovespula</em> (wasps)</td>
</tr>
<tr>
<td>8 – 10 a.m.</td>
<td><em>Apis</em></td>
</tr>
<tr>
<td></td>
<td><em>Dolichovespula</em></td>
</tr>
<tr>
<td></td>
<td><em>Andrena</em></td>
</tr>
<tr>
<td></td>
<td><em>Syrphus</em></td>
</tr>
<tr>
<td></td>
<td><em>Melangyna</em> (hover fly)</td>
</tr>
<tr>
<td></td>
<td><em>Bombus</em></td>
</tr>
<tr>
<td>10 – 12 p.m.</td>
<td>All of above +</td>
</tr>
<tr>
<td></td>
<td><em>Dialectus</em></td>
</tr>
<tr>
<td></td>
<td><em>Rheumaptera</em> (moth)</td>
</tr>
<tr>
<td>12 -2 p.m.</td>
<td><em>Diasceptus</em></td>
</tr>
<tr>
<td></td>
<td><em>Ochlerotatus</em></td>
</tr>
<tr>
<td></td>
<td>(mosquito)</td>
</tr>
<tr>
<td></td>
<td><em>Syrphus</em></td>
</tr>
<tr>
<td></td>
<td><em>Psithyrus</em> (cuckoo bee)</td>
</tr>
<tr>
<td></td>
<td><em>Bombus</em></td>
</tr>
<tr>
<td></td>
<td><em>Andrena</em></td>
</tr>
<tr>
<td>2 -4 p.m.</td>
<td><em>Apis</em></td>
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Insect visitors to lingonberry, *Vaccinium vitis-idaea* at different times of day in interior Alaska

Number of insect visitors (all types)
Antioxidant capacity of Alaska berries (ORAC score)

- Lingonberry: 203
- Highbush Cranberry: 174
- Blue huckleberry: 111
- Pomegranate (Lower 48): 105
- Crowberry: 94
- Dwarf Blueberry: 85
- Red Bearberry: 79
- Bog Blueberry: 77
- Alaska Blueberry: 76
- Wild blueberry (Lower 48): 61
- Northern Black Currant: 66
- Nagoonberry: 51
- Kinnikinnick: 49
- Red Raspberry: 47
- Bog cranberry: 45
- Cloudberry: 29
- Cult. blueberry (Lower 48): 24
- Red currant: 23
- Watermelon berry: 19

ORAC score (uMTE/g)
ORAC score for frozen and processed bog blueberries

- Frozen Fruit: 71
- Freezer Jam: 30
- Frozen Juice: 48
- Fruit Leather: 270
- Dried Fruit: 420
- Sauce: 34
- Jam: 36
- Canned Juice: 44
- Syrup: 32
- Canned Fruit: 43
Natural products in bog blueberry-
Colin McGill

1. $\beta$-sitosterol,
2. ursolic acid,
3. 3-O-(4-hydroxyphenylcarboxylic acid) 4-O-(\(\beta\)-D-glucopyranosyl) gallic acid*,
4. malic acid, and
5. 2,3-dihydroxybutane-1,2,3,4-tetracarboxylic acid*
= bluberric acid

* Not previously known
Natural products in bog blueberry - Sally Gustafson

Dietary intake of bog blueberries:

Anti-inflammatory

Reduce oxidative stress

Protect against neuroinflammation

Protect against age related memory loss

NOT via antioxidant activity, chemicals directly prevent the accumulation of NOX enzymes that destroy brain neurons and lead to losses of brain function.
Two ways to manage wild berries

• Improve wild stands
  – (Maine Blueberry Industry)

• Field Cultivation
  – Domesticate a wild crop

Lingonberry, Lowbush cranberry
Vaccinium vitis-idaea

Bog blueberry
Vaccinium uliginosum
Maine wild blueberries

- Fertilizers
- Field leveling
- Stump removal
- Pesticides
- Irrigation
- Honeybees
- Burning

www.umaine.edu
Alaska blueberries are not Maine blueberries

Lowbush blueberry, *Vaccinium angustifolium*

Velvetleaf blueberry, *Vaccinium myrtilloides*
Three main species of Alaska blueberries

- Oval leaf blueberry
- Coastal blueberry
- Early Blueberry
- Oval leaf huckleberry
  *Vaccinium ovalifolium*

- Dwarf bilberry
- Dwarf blueberry
  *Vaccinium caespitosum*

- Bog blueberry
- Bog bilberry
- Alpine blueberry
  *Vaccinium uliginosum*

Alaska Blues, LLC
Tongass NF, southeast, AK

Central Siberian BG
UAF
Improving wild berry yields

Management requires knowledge

- How does it grow?
- Sun vs. shade
- Bog? Dry roadside?
- Mineral vs organic soils
- Bloom times
- Pollinators

Crowberry
Lingonberry
Blueberries
Highbush cranberry
Nagoonberry
Salmonberry
Currants
Raspberries
Watermelon berries
Wild stands- find the best berry spots

- Back yard? fish camp?
- Legal
- Accessible
- Less prone to spring frost
- Lots of berry plants
- No bears (yeah right!)

Alaska-in-pictures.com
Remove Competition

- Grasses
- Trees
- Shrubs

- More nutrients, water, light available to crop
Where are the roots, rhizomes?

- Plants rooted in logs or moss dry out if trees (shade) are removed
Disturbance = grass invasion

- Dr. Arvo Kallio - bog blueberry research
  - Hand removal
  - Mowing
  - Herbicides
Add fertilizers

- Commercial fertilizers (especially N, P)
- Fish scraps, composts, liquid fish slop, manures
- Placement important
Garden Culture

- Transplantable
  - Lingonberry
  - Cloudberry
  - Wild red currant
  - Black currant
  - Nagoonberry
  - Watermelon berry

- Not as easily transplantable
  - Bog blueberries
  - Highbush cranberry
  - Crowberry

Not recommended
- Wild strawberry
- Wild raspberry
- Coastal blueberry
Pay attention to:

- Soil pH
- Organic matter
- Mulches (peat, sawdust)
- Moisture
- Row spacing
- Fertilizers
Pests and diseases

Leaf spot disease

Pesky, sneaky birds

Rose bloom fungus
Cultivation = propagation

- Seeds?
- Clones (stem cuttings, root cuttings, layering)

Bog blueberry 6 mo. seedlings
Lingonberries

- Seeds
- Rhizome cuttings
- Division
Seed germination bog blueberry

Germination of bog blueberry seeds air dried (21°C) for up to 66 days

$y = -0.2x + 30, \quad r^2 = .6$
Frozen seeds

Germination of bog blueberry seeds from fruit frozen up to 63 days
Cold stratify

Moistened filter paper sandwich

Petri dish

40F
Cutting propagation of bog blueberry

- Stem cuttings collected in late June - Aug
- Root in peat under intermittent mist

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**Fig 1. Percent rooting of softwood and semi-hardwood stem cuttings of *Vaccinium uliginosum***

<table>
<thead>
<tr>
<th>Month</th>
<th>Germination %</th>
</tr>
</thead>
<tbody>
<tr>
<td>June</td>
<td>1.4*</td>
</tr>
<tr>
<td>July</td>
<td>1.6</td>
</tr>
<tr>
<td>August</td>
<td>2.0 1.3</td>
</tr>
</tbody>
</table>

*Root quantity rating: 1= least roots, 3=most roots
Cutting Collection areas

Best sites not necessarily best rooting

Genetic diversity
Other Cultivation Protocols

- Crowberry- *Empetrum nigrum*
- Highbush Cranberry *Viburnum edule*
- Red, black Currants *Ribes spp.*
Flower Biology Essentials

- Flower timing
- Sex of flowers
- Pollinators
- Barriers to pollination
- Pollination intensity
- Disease and insect pests
Cloudberry, Salmonberry

• Spread by rhizomes

• Acidic, high moisture

• Male and female plants

• Insects + male + female + good weather
• Male, female, or both in one flower

• Pollination
  – Selfing
  – Insects

  – Staggered bloom time
Poor pollination or genetics
Black, red currants

- Very early flowering – frost damage
- Insect pollination - beeflies, wasps
- Self incompatibility
Strawberries

www.botany.hawaii.edu
Nagoonberries

- Clonal by rhizomes
- Male + female
- Self incompatible
Incompatibility

- Inability of pollen to fertilize ovules on plants with the same genetic signature
Fruits with incompatibility

- Apples
- Crabapples
- Cherries
- Plums
- Apricots
- Nagoonberries
- Currants
- Gooseberries
- Saskatoon serviceberry
- Mountain ash
- Raspberries (some)
Fruits- cultivated and wild - need insect pollinators

- What are environmental conditions of insects?
- Nesting sites
- Food sources
Honey bees

- Expensive, annual costs
- Imported bees
- Limited life

Honey bees visit lingonberry, blueberry flowers but no increase in yield
Problems with honey bees

- *Varroa destructor*, *tracheal mites*
- *Nosema* disease (protozoa)
- Colony collapse disorder
Bumblebees

• Nest in
  – Warm, south-facing slopes
  – Vegetation cover
  – Nearby bee plants
28 bumble bee species in Alaska

borealis  frigidus  balteatus  centralis  mixtus  melanopygus

sylvicola  bifarius  occidentalis  moderatus  rufocinctus  perplexus

jonellus  flavifrons  insularis  ashtoni  fernaldae
Bumble bee nests

• Old vole holes
• nests in the ground
• Insulation, wood shavings, dark boxes, flower pots
Other pollinators

- Sweat bees
- Yellow jackets
- Andrenid bees
- Mosquito
Why mosquitoes don’t work on blueberries, lingonberries

- Anthers have tubes
- Buzz pollination
- 10 mph winds do not dislodge pollen
Lakkakermakakku cake
Cream cake with cloudberrries
www.axis-of-aevil.net/archives/food