

# Botanic Gardens from A to Z

(526089; 2 – 4 credit points)

March 10 - May 14 2009,  
Tue + Thu 8 – 10, Kaisaniemi

[www.fmnh.helsinki.fi/opetus](http://www.fmnh.helsinki.fi/opetus)



Leif Schulman, PhD, Director  
FINNISH MUSEUM OF NATURAL HISTORY, BOTANIC GARDEN



## Today's lecture

7. & 8. Public outreach and education in BGs  
(Julia Willison)

9. Teaching in BGs

10. Research in BGs

- what kind of research is done in or is based on the collections of BGs?
- a wide range of examples of studies that make use of BG collections, services, and facilities
- which are the particular benefits of BGs in research?



Leif Schulman, PhD, Director  
FINNISH MUSEUM OF NATURAL HISTORY, BOTANIC GARDEN



remember: aims of the course were...

- After completion of the course, students should be able to answer the following questions:
  - What is a botanic garden?
  - Which are the core fields of activity of BGs?
  - What constitutes an accession, i.e., the basic unit of a BG collection?
  - **For which fields of research are BG collections particularly valuable?**
  - Which are the specific benefits of BG collections in teaching and education of various target groups?
  - In which ways can and do BGs play a particular role in conservation?



Leif Schulman, PhD, Director  
FINNISH MUSEUM OF NATURAL HISTORY, BOTANIC GARDEN



## How do BGs support research?

1. by acting as research institutions
  - curators usually also are researchers
  - research posts, particularly in projects
  - joint projects with other institutions
2. by providing material
  - the living collections are used as research material
3. by acquiring material
  - seed exchange



Leif Schulman, PhD, Director  
FINNISH MUSEUM OF NATURAL HISTORY, BOTANIC GARDEN



...how BGs support research

4. by providing facilities
  - research glasshouses
  - outdoor lots
  - labs
  - etc.



Leif Schulman, PhD, Director  
FINNISH MUSEUM OF NATURAL HISTORY, BOTANIC GARDEN



## Examples from Helsinki Univ. BG

1. Acting as research institution

- research work of academic staff
  - often continue with what they have done before (“academic freedom”)
  - HUBG: e.g., Neotropical botany (systematics, biogeography, ecology, conservation)
- in-house research activities collection-oriented
  - ex situ conservation of *Saintpaulia*
  - Kumpula case: evaluation of collection policy



Leif Schulman, PhD, Director  
FINNISH MUSEUM OF NATURAL HISTORY, BOTANIC GARDEN



### ...examples

#### 2. Providing material

- systematics, esp. phylogenetics, usually DNA
  - *Corydalis* (Sapienza University of Rome, 2009)
  - *Lonchitis* (Univ. of Turku, 2009)
  - *Salix* (Univ. Ekaterinburg, 2006)
  - *Arnica* (Univ. Uppsala, 2005)
  - *Annona*, *Cycas*, *Angiopteris*, *Athyrium*, *Cystopteris* (UH, 2004)
  - *Celtis* (Univ. Wageningen, 2004)
  - *Rumex* spp. (Imperial College, 2003)
  - *Ziziphus* and *Paliurus* (Univ. Colorado, Boulder, 2003)
  - *Physocarpus* (Univ. California, Davis, 2001)
  - also other organisms than plants, e.g. microfungi, bracket fungi



Leif Schulman, PhD, Director  
FINNISH MUSEUM OF NATURAL HISTORY, BOTANIC GARDEN



### ...examples

#### 2. Providing material

- ecological studies
  - *Molinia caerulea* (from seed list) - competition trials (Univ. Tartu, 2001)
  - *Vaccinium myrtillus*, *V. oxycoccos*, *V. uliginosum*, *V. vitis-idaea* (from seed list) – N nutrition with diff. strains of mycorrhiza (Univ. Aberdeen, 2001)
  - *Centaurea jacea*, *C. scabiosa* (from seed list) – phenotypic plasticity (Univ. Tennessee, 2001)
  - *Fagus sylvatica*, *Viburnum lantana* - 'Interaction between foliar surfaces and elevated ozone concentrations' (UH, 2002)



Leif Schulman, PhD, Director  
FINNISH MUSEUM OF NATURAL HISTORY, BOTANIC GARDEN



### ...examples

#### 2. Providing material

- plant pathological studies
  - *Vincetoxicum* sp., *Paeonia* sp., *Myrica gale* – possible intermediate hosts of fungal disease on pine (METLA 2000-01)
  - *Citrus limon* - leaves as substrate for *Pyrenophora teres*, pathogen of barley (MTT 2001)
  - *Kalanchoe daigremontiana* – virulence of different strains of *Agrobacterium tumefaciens* (UH, 2003)
- developmental studies
  - various Asteraceae – development of florets in the flowerhead (UH, 2002)



Leif Schulman, PhD, Director  
FINNISH MUSEUM OF NATURAL HISTORY, BOTANIC GARDEN



### ...examples

#### 2. Providing material

- breeding, other horticultural sciences
  - *Pyrus ussuriensis* pollen – breeding of hardy fruit trees (hybridisation with *Chaenomeles*; UH, 2001)
  - *Acer platanoides* 'Dissectum' – tests of propagation methods of this rare cultivar (UH, 2004)
  - numerous perennials – field-scale trials for hardiness of horticulturally potential accessions (MTT, 2005-)
  - various *Malus* taxa – DNA fingerprints of apple cultivars plus computerised fruit shape identification (UH, 2007)
  - *Jatropha curcas* – retrotransposon-based molecular markers for breeding programme (UH, 2008)
  - *Tilia* spp. – development of microsatellite markers (UH, 2008)



Leif Schulman, PhD, Director  
FINNISH MUSEUM OF NATURAL HISTORY, BOTANIC GARDEN



### ...examples

#### 2. Providing material

- biochemical studies
  - *Forsythia* spp. – polyphenols in different spp. (Yomeishu Seizo Co. Ltd., 2004)
  - *Cacalia hastata* - stereochemistry of pyrrolizidine alkaloids (Univ. Braunschweig, 2005)
  - *Vaccinium*, *Osmunda*, various Maloidae – search for the glucoside parasorbicide (UH, 2006)



Leif Schulman, PhD, Director  
FINNISH MUSEUM OF NATURAL HISTORY, BOTANIC GARDEN



### ...examples

#### 2. Providing material

- miscellaneous
  - *Pinus banksiana*, *P. resinosa* – reflectance and other optical properties of pine forests (UH, 2003)
  - *Barbarea vulgaris* (from seed list) - natural history, development, and food properties (Inst. for the Study of Edible Wild Plants, USA, 2006)
  - *Humulus lupulus* – origin in Sweden (Nordiska Genbanken, 2007)
  - *Briza media* (from seed list) – population genetics in Europe (Univ. Zürich, 2008)
  - *Betula* spp. – DNA barcoding (UH, 2009)



Leif Schulman, PhD, Director  
FINNISH MUSEUM OF NATURAL HISTORY, BOTANIC GARDEN



## ...examples

### 3. Acquiring material

- ecological studies
  - *Epilobium angustifolium*, *Fragaria vesca*, *Leontodon autumnalis*, *Festuca ovina*, *Deschampsia flexuosa*, *Trifolium pratense*, *Vicia cracca* – ozone trials (UH, 2001)
- plant pathological studies
  - *Melampyrum* spp. – possible intermediate hosts of fungal disease on pine (METLA 2000-01)
  - *Nicotiana glauca* – virulence of different strains of *Agrobacterium tumefaciens* (UH, 2003)



Leif Schulman, PhD, Director  
FINNISH MUSEUM OF NATURAL HISTORY, BOTANIC GARDEN



## ...examples

### 3. Acquiring material

- biochemical studies
  - *Ricinus communis* – development of analytical methods for ricine protein (UH, VERIFIN, 2008)
  - *Aloe* spp. - development of konine (?) (VTT, 2009)
- miscellaneous
  - numerous weedy spp. of Finnish fields – identification of seeds and seedlings of weeds (UH, 2000)



Leif Schulman, PhD, Director  
FINNISH MUSEUM OF NATURAL HISTORY, BOTANIC GARDEN



## ...examples

### 4. Providing facilities

- Long-term phenological research on *Sorbus* (METLA *etc.*, 199?-2006)
  - experimental plot, maintenance of trees
- Studies on Finnish spp. of *Lemna* (UH, 2001)
  - placement and maintenance of growing tanks
- Taxonomy of *Musa* (M. Häkkinen, 2001-)
  - care for and curation of study plants
- Winter-time photosynthesis of *Allium oleraceum* (UH, 2002-)
  - delimitation of naturalised population in Kaisaniemi



Leif Schulman, PhD, Director  
FINNISH MUSEUM OF NATURAL HISTORY, BOTANIC GARDEN



## ...examples

### 4. Providing facilities

- Beetles living in rare bracket fungi (UH, 2002-04)
  - incubation of collected fungi to hatch beetles (cellars)
- Pollutants in urban rainwater (UH, 2003-)
  - placement of rainwater collectors
- Using soil magnetism in urban pollution studies (UH, 2007-)
  - sites for calibration of meters



Leif Schulman, PhD, Director  
FINNISH MUSEUM OF NATURAL HISTORY, BOTANIC GARDEN



## In summary: benefits of BGs for research

- documented collections
  - reliable identifications (relatively at least)
  - information on origin, wild-collected material
- living plants
  - DNA extraction easier
  - biochemical analyses possible
  - many studies require living plants
- global exchange network
- unique facilities (in city centres)



Leif Schulman, PhD, Director  
FINNISH MUSEUM OF NATURAL HISTORY, BOTANIC GARDEN



## Course Programme

11. Tue April 14: *Research in BGs*

12. Thu April 16: *Cons. work in BGs - CANCELLED!*

– instead read:

- International Agenda for BGs in Conservation: 0-14; 24-31; and Annexes 4, 5, and 6 (pp. 45-47)
- GSPC: 0-13
- (Action Plan for BGs in the EU: pp. 31-40)

– + assignment:

- which targets of the GSPC are the most relevant for BGs? List, motivate, write a 1-page 'report'

13. Tue April 21: *Conservation work in BGs (seed-banking) – Mari Miranto*



Leif Schulman, PhD, Director  
FINNISH MUSEUM OF NATURAL HISTORY, BOTANIC GARDEN

