APPLE GENETIC RESOURCES IN LATVIA
- HISTORY, CURRENT SITUATION AND PERSPECTIVES

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Native apples

• The native species *Malus sylvestris* is found sporadically in whole Latvia and is thought to be endangered by cross-hybridization with *Malus × domestica*.
• Species is marginalized to forest meadows and edges of arable lands.
• Actual scope of hybridization with *M. domestica* (and *M. × prunifolia*?) is unknown. It yet waits for genetic study in Latvia.
• Morphology alone cannot be used to differ species. E.g. ‘Golden Delicious’ has weak leaf pubescence; cider apples are bitter; thorns are not always present. Pistil morphology may be more certain?

*Malus sylvestris* (Slītere) >

< 'Turlavas mežābele’ – hybrid?
General history

• Apple genetic resources in Latvia historically originate in the crossroads of Germany; Poland, Lithuania and Belarus (Rzeczpospolita); Sweden; Russia.
• Some introduced cultivars have survived; others gave seeds for origin of landraces.
• Winter-hardiness and disease tolerance are important demands in Latvian climate.

‘Kitaikas hibrīds’- disease tolerant seedling of Malus x prunifolia
History of cultivars (before 1800)

• The first *Malus × domestica* cultivars supposedly were introduced in 14th century from Germany and planted at castles and manors.

• Later - also cultivars from Sweden, Rzeczpospolita and Russia:

• Yet few of old plantings could have survived the constant wars in 1600ties - early 1700ties.

• German cultivars in Latvia generally lack winter-hardiness. More hardy seedlings could originate at farms.

‘Edelborsdorfer’ (before 1544) is still found in Latvian orchards
History of cultivars (1800-1900)

- **First local cultivars** described in 19th century by German and Russian pomologists. Descriptions lacked local Latvian names.

- Many local cvs. have no definite true names and country of origin, as the borders were different:
  - e.g. ‘Serinka’ (Mālābols’, ‘Lehmapfel’), ‘Rudens Svītrainais’ (‘Streifling Herbst’, ‘Osenneye Polosatoe’)

- Many new introduced cultivars.
- Propagation by seed at farms continues till 20th century.
History of cultivars (1900-1950ties)

• Development of commercial growing.
• A wide range of cultivars introduced from the whole world.
• No scientific breeding.
• Grave damages to orchards in severe winters of 1939-1941.

• In 1950ties Institute of Biology expedition collected and described hardy landraces, some were named and planted in orchards. Others not preserved in collection.

‘Coulon Reinette’ – disease tolerant

‘King David’ (USA) – survives at farm «Pikšas» since 1930ties
Some local cultivars from 1950ties-1970ties

‘Jelgavas Vasaras’ (Planta Nurseries before 1940) – delicious summer apple

‘Krapes Cukuriņš ‘- summer, sweet; recently mildew susceptible
History of cultivars (1950ties - today)

- **Start of controlled breeding** at «Iedzeni» farm, continued at Institute of Horticulture. Registered cultivars.
- Amateur breeding continues.
- Building of GR collections, evaluation and description of cultivars (IPGRI descriptors).
- **State program for maintenance of GR collections since 1990ties** (limited number of accessions).
- **The GR collection consists of two groups:**
  - (1) base collection: cultivars of Latvian origin and long-grown in Latvia,
  - (2) cultivars and hybrids of breeding value.
  - The base collection (109) duplicated at two locations – Institute of Horticulture (Dobele) and Pūre.
GR in 21st century

• Expeditions in 21st century aimed to **collect the dwindling diversity** in a situation of rapid social changes and loss of memory:
  • ~200 samples collected, identified, evaluated and characterized.
• **Marker-assisted evaluation** of genetic relationships (Lacis G., Kota I., Ikase L., Rungis D., 2011).
• **Scab research project (2013-2016)** identifies new resistance sources:
  • Collection of **field data** in unsprayed GR collection for 3 years;
  • **Genotyping** of 161 samples, analysis of genetic and field data started;
  • **mRNS and miRNS** extraction for 32 apple cvs.;
  • For 20 genotypes resistance **evaluation in laboratory** started;
  • **Primers for determining resistance genes:** CH02b07, CH02b10, CH02c02a, CH02f06, CH05e03, CH-Vf1, Hi07f01 and Hi07h02 - respectively for 8 genes **Rvi13 (Vd), Rvi2 (Vh2), Rvi4 (Vh4), Rvi15 (Vr2), Rvi11 (Vbj), Rvi6 (Vf), Rvi5 (Vm)** un **Rvi12 (Vb)**.

• Obtained results will be valuable in breeding.
Expeditions in 21st century

SW region is especially rich in old apple trees

Samples propagated on B9 or M9
Scab research project: field results

• In field, evaluated 3 years in unsprayed collection by methodics of VINQUEST (A.Patocchi) by scale:
  – 1 - no visible damage; to ...9 - all tree heavily infected.
• Fruits and leaves evaluated separately – scab damages differ.
• **Genotypes with high scab tolerance (damages 1.5...3):**
  – ‘Court Pendu Plat’,
  – ‘Neīstā Orleānas Renete’ – no fruit damage!,
  – *Malus x prunifolia* Nr.9 - *Rvi13 (Vd)*,
  – ‘Sulīgais krebs’ (*Malus x floribunda?)
  – Crabapple ‘Vīna krebs’ - *Rvi5 (Vm), Rvi12 (Vb), Rvi13 (Vd).*

‘Neīstā Orleānas Renete’ – productive, small tree; midseason
Examples of scab resistance genes found in GR collection
(old local cultivars; coloured – 3 or 4 genes)

<table>
<thead>
<tr>
<th>Rvi2 (Vh2)</th>
<th>Rvi4 (Vh4)</th>
<th>Rvi12 (Vb)</th>
<th>Rvi 13 (Vd)</th>
<th>Rvi14</th>
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<td>‘Rīgas Antonovka’</td>
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<th>Rvi5 (Vm)</th>
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<td>Vīna Krebs</td>
<td>Kanāls</td>
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Clone selection

• Clones of ‘Baltais Dzidrais’ (‘White Transparent’) collected and tested with 7 SSR markers:
  – 6 different clones/clone groups identified.

• Colour mutations of several cultivars evaluated:
  – stable clones: ‘Sarkanais Cukuriņš’, 2 clones of ‘Ādamābele’;
EXAMPLES:

‘Ādamābele’ - old.cv. of unknown origin (Prussia?), excellent tree and good fruit quality; 2 clones with different ripening time
Clones of ‘Korobovka’ (LV syn. ‘Cukuriņš’)

‘Korobovka’ - ancient Russian cv. valued for excellent sweet flavour; early ripening; disease tolerant; *drawbacks* – *small unattractive fruits, difficult tree*

Red clone ‘Sarkanais Cukuriņš’ – much better fruit look
‘Pienābele’ (early cooking «milk apple»)

‘Baltā Pienābele’ - productive, but disease susceptible

‘Lielā Pienābele’ – disease tolerant

‘Rīgas Pienābele’ (‘Smetankowe’)- much better known; excellent drying
Accessions from Liepāja region (breeders: Šterns family)

‘Dainis’ – attractive sweet apple; productive, disease tolerant; midseason

‘Dzintariņš’ (cross ‘Sīpoliņš’ x ‘Coulon Reinette’) – productive, tasty winter apple; disease tolerant
Some original accessions

‘Ugunda’ - highly coloured

‘Valtera Sarkanā’ - red leaved, sweet, early
Amateur breeding

‘Vera’ – extremely juicy; productive, compact tree

‘Vigo’ – the flat apple; long storage; very hardy
Crab apples

‘Raganas Sarkanais’ – redleaf foundling; valuable for juice and cider

‘Duftzauber’ - late flowering ornamental (breeder A.Plaudis)
Thank you!