Apple breeding at Institute of Horticulture, LUA

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Apple breeding in Latvia

- Controlled breeding started after 1945 at «Iedzēni» farm (A.Maizītis, R.Āboliņš, R.Dumbravš)
- Hybrid material from «Iedzēni» in 1990ties was transferred to Dobele (now IH LUA) and Pūre HRC
- New cvs. were selected and registered from these hybrids
- At present breeding is done at Institute of Horticulture LUA
- Active amateur breeders also have obtained a number of cvs.

R. Dumbravš (1931-2016)
Some best cultivars from other breeding programs

- ‘Iedžēnu’ – late, large firm fruits; susceptible to bitter pit (*much used in breeding*)
- ‘Velte’ (P.Upītis, Dobele) – midseason, very good quality, disease tolerant, medium hardy
- ‘Agra’ (Iedzeni/Dobele) – very early, disease tolerant, good market quality
- ‘Laila’ (R.Dumbravs/Pure HRS) – late, very good quality, regular yields
- ‘Pure Ametist’ (R.Dumbravs/Pure HRS) – late, productive, good quality
- ‘Inese’ (R.Dumbravs/Pure HRS) – columnar, scab resistant, very good quality, regular yields
Aims of the breeding program at Institute of Horticulture

To obtain and select apple cultivars suitable for the Baltic region:

• **improved fruit quality** (includes fruit market quality, flavour, biochemical content and storage),
• **winter-hardy, productive tree, easy in management** (compact, needs minimum training, little need of fruit thinning, no premature drop),
• **complex resistance** to main apple diseases in the region (scab, cankers, fruit rots, mildew)
• **different ripening time**.
Specific targets: fruits

Priority - high consumption quality:
• Taste panel evaluation 7.6-8 points;
• Soluble solids >12° Brix (better >14°);
• Total polyphenols >100 mg/100 g;
• Firmness >5 kg cm$^{-2}$ (at harvest 7...8);
• High juiciness and aroma;
• Crisp, fine-grained;
• Size about 150 g (65-75 mm), self-thinning;
• Bright colour, good smooth shape, uniform;
• Tolerant to physiological diseases.

Cider apples (increasing interest !)
Specific targets: tree

- Complex resistance /tolerance to diseases:
  - Scab – combining genes Rvi6(Vf), Rvi5(Vm) and other:
    - Genetic research in GR collection: complex of scab resistance genes
  - Tolerance to mildew, different fruit rots and cankers,
  - in perspective - *Erwinia*;
- Easy in training;
- Productive, annual yields;
- Fruits hold well on tree;
- Winter-hardy and tolerant to climate fluctuations;
- Additional: columnar and ornamental apples

![Mildew on formerly tolerant cv. ‘Krapes Cukuriņš’ (2015)](image-url)
Principles of parent choice and crosses (1)

1. Choose only outstanding cultivars

2. Combine the maximum number of positive traits

3. Cultivars with good growing history in Latvia: Best results in crosses - Alesya, Antei (Belarus), Bogatir, Doch Melbi, Konfetnoe, Korichnoe Novoe (Russia), Rubin, Saltanat, Zailiyskoe (Kazakhstan), Merrigold

4. Cultivars from GR collection – after investigating of breeding potential: Analdal, Celmiņu Dzeltenais, Iedzēnu, Martsipan, Rīgas Rožābele, Sarma, Stars, Signe Tillisch, BM 55734 etc.

BM 55734 (Rosen crab x Mantet) – Swedish hybrid with high content of polyphenols incl. anthocyanins; early ripening; not tolerant to diseases - crossed with ‘Konfetnoe’ (Korobovka x White Transparent)
Principles of parent choice and crosses (2)

4. **Donors of quality and storage** – most successful cvs. from **Europe and USA**: Alkmene, Bohemia, Discovery, Golden Delicious spurs, Greensleeves, Honeycrisp, Julia, Kanzi, Ligol, Lobo, Lodel, Redchief etc.

5. **Donors of disease tolerance** – cvs. from **Russia** (Kandil Orlovsky, Kurnakovskoe, Pervinka etc.), **Western Europe and USA** (Dayton, Enterprise, Florina, Priscilla, Reanda, Remo, Rewena, Scarlett O’Hara, William’s Pride, Co-op 16) etc.


Materials and methods

1. Seedlings scab-infected in greenhouse: 1st selection
2. Evaluation in seedling field for >3000 seedlings: 2nd selection
3. Selected hybrids – on clonal rootstocks B.9 or B.396, 5-10 trees
4. Trials of growing technologies
5. Testing at farms
   • Molecular markers for certain scab resistance genes – especially important for gene pyramiding e.g. Rvi6 + Rvi5
   • For elite hybrids – fruit quality evaluation:
     – biochemical analyses of fruits and juice,
     – flesh firmness,
     – taste panels (untrained)
   • Storage trials (hybrids only common storage)
   • Since 2016 no more crosses (will continue)

Nr.16-97-86 (Priscilla o.p.) – biochemically rich
Newest registered cultivars


‘Baiba’ (columnar) – 2009

‘Zane’, ‘Uldis’ (columnar) - 2011

‘Monta’ (resistant, late storage) – DUS 2012
Most promising in trials: ‘Dace’

- Cross: BM 41497 (Vf/Rvi6) x Eksotika (Iedzēnu x Slava Peremozhtsam)
- Midseason, good storage
- **Fruits** large, partly self-thinning, light red with strong bloom
- Very good flavour
- **Tree** easy in training, very early yields
- **Scab resistance gene Vf/Rvi6**
- Rather susceptible to mildew
- **Winter hardiness good**, but may suffer from temperature fluctuations
- Tested in Estonia and Nordic countries – good results
Cultivar application in 2016 (1)

‘Felicita’

- **Cross**: BM 41497 (Vf/Rvi6) x Forele
- Late ripening.
- **Fruits** smooth, uniform, bright red. Flesh firm, subacid, aromatic, very good.
- **Tree** vigorous, easy branching, on B.9 tendency to some bare wood.
- **Highly productive**, medium biennial. Winterhardiness good.
- **Scab resistant** (Vf/Rvi6), but **late harvested fruits may develop bitter rot.** In 2016 included in a trial for optimal picking time.
Cultivar application in 2016 (2)

‘Inta’

• *Yellowspur o.p.*
• Midseason, good storage.
• **Fruits** large, bright red, rather uniform. Flesh crisp, juicy, subacid with dominance or swetness.
• **Flavour very good.**
• **Tree** medium vigour, easy in training.
• **High productivity**, tendency to bienniality.
• **Medium tolerance to scab**, no other disease injury.
Cultivars for home gardens (1)

‘Lienīte’ *(Remo o.p.)*
- Early midseason.
- Fruits **extremely tasty**, but smallish, short storage.
- Tree small, medium productive.
- **Scab resistance gene Vf/Rvi6.**

‘Paulis’ *(Arona x Liberty)*
- Midseason, stores till January.
- Fruits medium or smaller, flavour very good.
- Tree compact, good regular yields.
- **Resistant to scab (Vf/Rvi6), mildew, fruit rots, canker.**
- Very good winter-hardiness.
‘Zelta Rudens’ (*Redchief* o.p.)

- Early midseason, stores till November-December.
- Fruits very large and tasty, but soft and irregular in shape.
- Tree vigorous, spreading, easy in training.
- **Very high yields.**
- Tolerance to scab medium.
- Fruits hold well on tree, may develop watercore.
- Recommended for pick-your-own orchards.
## Selected elites (advanced trials)

<table>
<thead>
<tr>
<th>Hybrid</th>
<th>Cross</th>
<th>Fruits</th>
<th>Tree</th>
<th>Resistances</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nr.16-97-30</td>
<td>Priscilla o.p.</td>
<td><strong>Late.</strong> Uniform, very good balanced flavour, <strong>long shelf life</strong></td>
<td>Compact, regular good yields</td>
<td>Medium tolerant to scab</td>
</tr>
<tr>
<td>DI-3-90-45</td>
<td>BM 41497 x AMD-27-10-1</td>
<td><strong>Late.</strong> Uniform and smooth, bright dark red, subacid with more acidity, aromatic</td>
<td>Compact, high yields</td>
<td>Resistant to scab Rvi6 (Vf)</td>
</tr>
<tr>
<td>D-5-92-3</td>
<td>Iedzēnu x Liberty</td>
<td><strong>Very late.</strong> Very uniform and smooth, dark red, subacid with more sweetness</td>
<td>Rather small, <strong>very productive</strong></td>
<td>Resistant to scab Rvi6 (Vf) &amp; fruit rot</td>
</tr>
<tr>
<td>Nr.19-97-98</td>
<td>Remo o.p.</td>
<td><strong>Cider apple.</strong> Fruits large, biochemically rich</td>
<td>Easy training, high <strong>regular yields</strong></td>
<td>Good to all diseases</td>
</tr>
</tbody>
</table>
# Selected elites (1st trial)

<table>
<thead>
<tr>
<th>Hybrid</th>
<th>Cross</th>
<th>Fruits</th>
<th>Tree</th>
<th>Resistances</th>
</tr>
</thead>
<tbody>
<tr>
<td>H-3-03-15</td>
<td>Golden Del. x Korichnoe Novoe</td>
<td>Medium late. ‘Golden’ type, excellent flavour, banana aroma</td>
<td>Easy training, productive</td>
<td>Medium tolerant to scab</td>
</tr>
<tr>
<td>H-1-07-36</td>
<td>Alesya x Honeycrisp</td>
<td>Late. Just a bit softer than ‘Honeycrisp’, very good</td>
<td>Easy training, early yields, productive</td>
<td>Good</td>
</tr>
<tr>
<td>H-4-03-29</td>
<td>Lodel x Rubin Kaz.</td>
<td>Late. Bicolor, firm, excellent aroma</td>
<td>Spreading, productive</td>
<td>Medium to good</td>
</tr>
<tr>
<td>H-4-03-1</td>
<td>Lodel x Rubin Kaz.</td>
<td>Very late. Red, firm, tasty, need thinning</td>
<td>Small, early yields, very productive</td>
<td>Very good</td>
</tr>
<tr>
<td>VM-2-93</td>
<td>Scarlett O’Hara x D-1-92-32</td>
<td>Very late. Large, firm, bicolor excellent quality</td>
<td>Easy training, productive</td>
<td>Resistant to scab Rvi6 (Vf)</td>
</tr>
<tr>
<td>VF-6B-81</td>
<td>Enterprise x Dace</td>
<td>Very late. Large, firm, dark red, excellent quality</td>
<td>Easy training, productive</td>
<td>Resistant to scab Rvi6 (Vf), medium to leaf spot</td>
</tr>
</tbody>
</table>
Early apple elite hybrids

**H-1-05-81 (BM 55734 x Konfetnoe)**
- Fruits large, uniform, very attractive, like BM55734, but never have bitterness
- Tree compact, productive, tends to be biennial.
- Very good tolerance to scab.

**H-1-05-85 (BM 55734 x Konfetnoe)**
- Fruits very attractive, excellent flavour.
- Tree rather small, production good.
- Medium tolerant to scab.
Breeding of columnar redleaf apples

Parents:
• redleaf crabs – ‘Dimzu Sarkanā’, ‘Top Millionaire’, ‘Top Secret’ (Latvia, amateur breeding)

Both columnar and compact elites selected:

Ornamental columnar apple hybrids:
H-17-05-19 (Antonija)
H-17-05-16 (Dudars)
• Better winter-hardiness than ‘Maypole’.
• Tolerant to diseases.
• Abundant flowering, attractive trees.
• Fruits – very bitter, not for consumption
Cultivar application in 2016 (3)

Ornamental apple ‘Karlens’

- Cross ‘Top Millionaire’ x D-1-94-2 (Arbat x Forele).
- **Columnar**, stout, unbranched tree.
- Leaves large, dark red, glossy, in autumn bright bronze.
- **Flowering** late, flowers large, purple red, do not lose colour.
- **Fruits** small (30g), dark red, with intense red flesh, bitter. Mature late, do not drop.
- Tolerant to diseases.
- Fruit can be used for preserves.
Crabs promising for juice production

- Fruits small (30 mm), light red.
- Biochemically rich, high polyphenol content (460 mg 100g), but no tannins.
- Excellent juice evaluation.

- Fruits small (30-36 mm, 40,5 g), dark red with intense red fresh.
- Good biochemical content, high Brix (16.5), relatively little tannins.

Both – compact trees, tolerant to diseases. Good ornamental value, but flowers lose colour very soon.
Thank you!