Dārzkopības institūts

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. x prunifolia?)* is unknown. It yet waits for genetic study in Latvia.
- Morphology alone can not be used to differ species. E.g. 'Golden Delicious' has weak leaf pubescence; cider apples are bitter; thorns are not allways present. Pistil morphology may be more certain?

< 'Turlavas mežābele'
– hybrid?

Malus sylvestris
(Slītere) >

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:
  - F.B.Blaufuss. **Vidzemes stāsti,** 1753: *Johan Fisher, Livland's superintendant under Sweden, urged fruit planting at farms near Liepa manor since 1687. Such trees still existed in 1753.*
- 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)

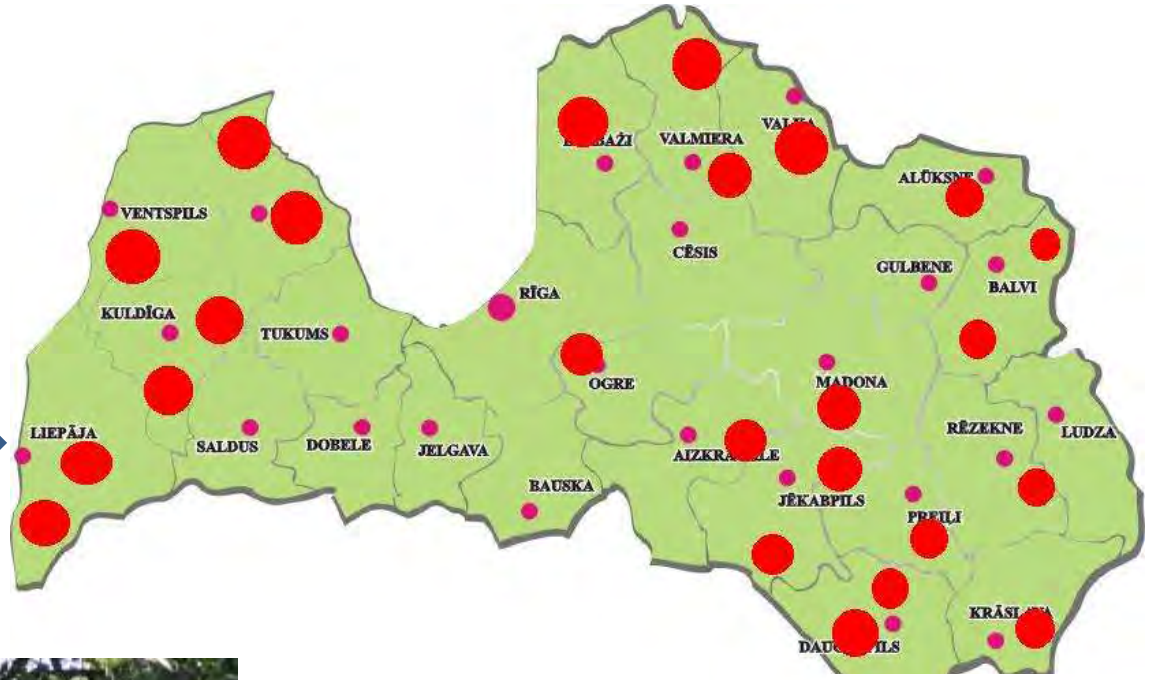
- **Start of controlled breeding** at «Iedzeni» farm, continued at Institute of Horticulture. Registered cultivars.
- Amateur breeding continues.
- Building of GR collections, evaluation and description of cultivars (IPGRI descriptors).
- **State program for maintenance of GR collections since 1990ties** (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 resitance 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)

Rvi2 (Vh2)	Rvi4 (Vh4)	Rvi12 (Vb)	Rvi 13 (Vd)	Rvi14
Dārznieku Ābele Gaiziņš PU-1-15-2 Rudens Svītrainais **Steiga** Taranovas 5/13	Danču Skaistais Glūdas Vasaras Mažoņa Sēklaudzis Mežābele no Turlavas Plauža Sarkanā PU-11-18-22 PU-15327 PU-16614 (Austra) PU-17508 **Rīgas Antonovka** Serinka U-10054 U-4641 (Gundega) U-4765	Ādamābele Cesvainiete Danču Skaistais Dzeltenais Dzidrais Grīnvalda 24-11 Magone Matīsu sarkanais Miks Raganas Sarkanais **Rīgas Antonovka** Sērsna **Steiga** Vasaras Citronu **Vīna Krebs**	Aivariņš Apguldes plūmjlapu Ādamābele Balva Dārznieku Ābele Gaiziņš Malus prunifolia Nr.9 Matīšu sarkanais Mažoņa Sēklaudzis Mežābele no Turlavas Mirga Ničnera Zemeņu Rāmaviete **Rīgas Antonovka** Sakstagala Saldais Saldais Sīpoliņš Sarkanais vēlais krebs Sarkanā Otaņķniece Serinka Vilka Rožābele **Vīna Krebs** Zamberga Citronābele Ziemas Rožābele Etc.	Antre Apguldes plūmjlapu Baltais Dzidrais (Daugmales) Baltais Dzidrais (Nr.4) Balva Dobeliete Dzeltenais Dzidrais Glūdas Vasaras Grīnvalda 24-11 Kanāls Krebs Kitaikas hibrīds (Brūna 01-21) Mirga Pomeranču Ābols Priekuļniece **Rīgas Antonovka** Saldais Dzidrais Saldais Sīpoliņš **Steiga** Torņakalns Vasaras Firziķu Vilma Zamberga Citronābele Ziemas Rožābele Etc.
Rvi5 (Vm)	Rvi11 (Vbj)			
Vīna Krebs	Kanāls			

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’;
  - unstable clones: ‘Sarkanā Korta’, ‘Jelgavas Vasaras Sarkanais’.

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!