



Agricultural Institute of Slovenia

Collection of Slovenian vegetable landraces and their re-introduction into cultivation

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Outline

- Introduction
- Slovene Plant Gene Bank and Gene Bank at the Agricultural Institute of Slovenia
- Re-introduction of lettuce landraces
- Re-introduction of common bean landraces



Natural conditions for agriculture:

- **72 % of utilized agricultural land lies in less favoured areas** (hilly areas, karst areas, ...)
- **Utilised agricultural land owned by agricultural holdings: 476.862 ha**
 - grassland - 278.678 ha, arable land - 171.167 ha, vineyards, orchards, ... 26.673 ha
 - **vegetables: 4.115 ha** (cabbage, young potato, lettuce, onion,..)
 - **dried pulses: 847 ha** (common bean, peas...)

Farm structure:

- **>75 000 agricultural holdings**
- **95 % of agricultural land is cultivated by family farms, 5 % by agricultural enterprises**
- **Average agricultural holding: 6,6 ha**
- **Main sector: Cattle production**

Source: SORS, 2016

PGRFA in Slovenia

Lettuce and common bean have been cultivated in Slovenia for centuries



Slovene Plant Gene Bank

**Agricultural Institute
of Slovenia, Ljubljana**

**Slovenian Institute for
Hop Research and
and Brewing, Žalec**

**Biotechnical Faculty
University of Ljubljana**

DB MEDPLANT

**SLOVENE PLANT
GENE BANK**
Central Seed Bank
ECPGR NC
(AIS LJ)

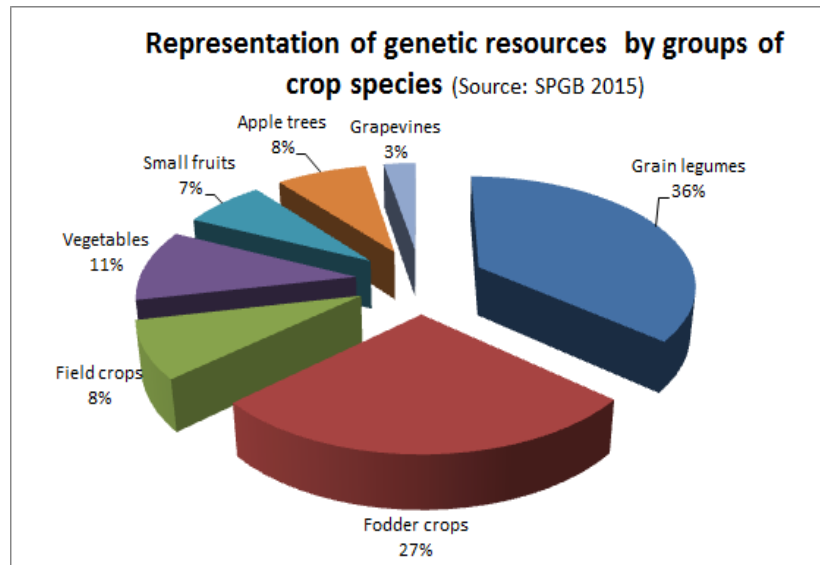
Central Database,
MAFF

NGO

Urban Furrows,
botanical gardens, schools, ...

**Faculty of Agriculture
and Life Sciences
University of Maribor**

Gene Bank at the Agricultural Institute of Slovenia



| Group of species | Species | Number of accessions |
|----------------------|---|-----------------------------|
| Grain legumes | <i>Phaseolus</i> spp. | 1125 |
| | <i>Vicia faba</i> | 37 |
| | Skupaj | 1162 |
| Fodder crops | <i>Trifolium</i> sp. | 199 |
| | <i>Medicago</i> sp. | 39 |
| | <i>Vicia</i> sp. | 69 |
| | <i>Lotus</i> sp. | 33 |
| | <i>Lolium</i> sp. | 30 |
| | <i>Festuca</i> sp. | 83 |
| | <i>Dactylis</i> | 110 |
| | <i>Phleum</i> | 39 |
| | Travniske zeli | 65 |
| others | 202 | |
| | Skupaj | 869 |
| Field crops | <i>Zea mays</i> | 11 |
| | <i>Triticum</i> | 76 |
| | <i>Secale</i> | 12 |
| | <i>Papaver</i> | 26 |
| | <i>Panicum</i> | 15 |
| | ostale | 60 |
| | | Skupaj |
| Vegetables | <i>Lactuca</i> sp. | 227 |
| | <i>Allium cepa</i> | 56 |
| | <i>Brassica oleracea</i> | 11 |
| | <i>Diplofaxis</i> spp. | 18 |
| | ostale (Cichorium, Valerianella, Solanum Lyc.) | 14 |
| | <i>Allium sativum</i> | 8 |
| | | Skupaj |
| Small fruits | <i>Vaccinium corymbosum</i> , <i>Rubus</i> , <i>Ribes</i> , <i>Fragaria</i> | 230 |
| Apple trees | <i>M. domestica</i> , <i>M. floribunda</i> | 256 |
| Grapewine | <i>Vitis</i> | 90 |
| Potato | <i>Solanum tuberosum</i> L. | 34 |
| Other potato species | <i>Solanum</i> sp. | 18 + 14 diploid populations |
| | Total | 642 |
| Total | | 3207 |

Gene Bank at the Agricultural Institute of Slovenia

- Collecting
- Documentation and Regeneration
- Characterization and evaluation
- Conservation (storage at + 4°C, -20 °C)
- Exchange, research, breeding



EURISCO multicrop passport data

1. Koda inštituta:.....**SVN019/AISLJ**
2. Številka akcesije:.....**SRGB5**
3. Ime akcesije:.....**Ribničan**
4. Genus:.....***Phaseolus***
5. Species:.....***vulgaris* L.**
6. Subspecies:....**ssp. *vulgaris* var. *nanus***
7. Država izvora:.....**SVN**
8. Zbirateljova številka:..**MČ-95:RIBN**
9. Vir zbiranja:.....**2 (Kmetija)**
10. Lokacija zbiranja:.....**Ribnica**
11. Datum zbiranja:..... **25.05.1995**
12. Zemljepisna širina lok.:.....**45°44'**
13. Zemljepisna dolžina lok.:.....**14°44'**
14. Nadmorska višina lok:.....**530 m**
15. Status vzorca.....**3 (avtohtoni kultivar)**
16. Koda darovalca:.....**Presečnik M.**
17. Številka darovalca:.....**MČ-95:RIBN**
18. Druge številke:.....**PHA-50**
19. Komentar:**0**
20. Lokacija duplikatnega vzorca:.....**0**
21. Dodatni pasport podatki:.....**0**
22. Podatki o karakterizaciji:.....**1**
23. Podatki o evalvaciji:.....**1**
24. Tip pridobljenega vzorca:.....**1**
25. Datum pridobitve:.....**25.05.1995**
26. Hranjenje vzorca:.....**2 (srednjeročno)**
27. Žlahtnitelj:.....**0**

Characterization



MINIMALNI DESKRIPTORJI ZA FIŽOL (Phaseolus: http://phaseolus.cesga.es/handbook_germplasm.html)

Datum setve:

Rastlina:

- 1 **Število dni do cvetenja:**
število dni od vznika do takrat, ko se na 50 % rastlin pojavijo prvi cvetovi.
- 2 **Trajanje cvetenja:**
Število dni od takrat, ko ima 50 % rastlin prve cvetove do takrat, ko je 50 % rastlin prenehalo cveteti.
- 3 **Tip rasti:**
 - 1 - determinantni grm,
 - 2 - indeterminantni grm s pokončnimi vejami,
 - 3 - indeterminantni grm s številnimi horizontalnimi vejami,
 - 4 - indeterminantni plezalec.

Cvet:

- 4 **Barva jadra:**
Barvo je potrebno določiti na sveže odprtem cvetu; barve sveže odprtih cvetov so zelo spremenljive po odprtju.
 - 1 - bela,
 - 2 - zelenkasta,
 - 3 - lila,
 - 4 - bela z lila robovi,
 - 5 - bela z lila progami,
 - 6 - temno lila škrlatnim zunanjim robom,
 - 7 - temno lila škrlatnimi pikami,
 - 8 - karmin rdeča,
 - 9 - škrlatna,
 - 10 - druga.

- 5 **Barva kril:**
Barvo je potrebno določiti na sveže odprtem cvetu; barve sveže odprtih cvetov so zelo spremenljive po odprtju.
 - 1 - bela,
 - 2 - zelenkasta,
 - 3 - lila,
 - 4 - bela s karmin progami,
 - 5 - zelo ožijena rdeča do temno lila,
 - 6 - blede rdeča do temno lila,
 - 7 - lila s temno lila žilami,
 - 8 - škrlatna,
 - 9 - druga.

- 6 **Žile na jadrju:**
+ - prisotne, 0 - odsotne

List:

Oblika lista:

Terminalni list tretjega trokrepnega lista.

1 - trikoten,



2 - kvadrast,

3 - okrogel,

4 - jajčast,

5 - jajčast / suličast,

6 - suličast (lanceolate),

7 - suličast (hastate).



Barva lista - klorofil (intenzivnost zelene)

3 - svetlo zelena

5 - srednje zelena

7 - temno zelena

Barva lista - antocijan (prisotnost antocijan)

0 - prisoten

9 - odsoten

Strok:

- 10 **Položaj na rastlini:**
 - 1 - Pri osnovi
 - 2 - Na sredini
 - 3 - na vrhu
 - 4 - Kombinacija 1, 2, 3 (po celi rastlini)
 - 5 - Drugo
- 11 **Vlaknatost:**
 - 1 - Odsotna
 - 5 - Močno prisotna
- 13 **Barva svežega stroka**
 - 1 - zelena
 - 2 - rumena
 - 3 - zelena s škrlatnimi progami

14 Barva zrelega stroka

| Barva | Okrajšava | Slika |
|---------------------------|-----------|-------|
| Bela | WH | |
| Belo rumena ali rjavkasta | WY | |
| Rumeno rjavkasta | YB | |
| Zelena | GR | |
| Vijolična | VI | |
| Rozn lisasta | PM | |
| Rdeče lisasta | RM | |
| Rdeče črtasta | RS | |
| Vijolično lisasta | VM | |
| Lila lisasta | LM | |
| Vijolično črtasta | VS | |

Leafy vegetables collection in SPGB

| Genus / Species | No. of accessions |
|---------------------------|-------------------|
| <i>Lactuca sp.</i> | 227 |
| <i>Diplotaxis sp.</i> | 19 |
| <i>Cichorium intybus</i> | 9 |
| <i>Valerianella sp.</i> | 6 |
| Total | 241 |



SPGB Lettuce collection

177 accessions of *Lactuca sativa* collected in Slovenia in the period from 1988 to 1992:

- *L. sativa* var. *capitata*: 70 % crisp, 20 % butterhead,
- *L. sativa* var. *longifolia*, *L. sativa* var. *crispa*: 10 %.

The most common name is 'Ljubljanska ledenka' (16 accessions).





'Ljubljanska ledenka'



Old Slovene autochthonous variety that originates from Ljubljana (Trnovo, Krakovo) and its surroundings. In 19th century it was spread to Austria (Vienna, Graz) and to Czech Republic (Prague). It was characterized by red leaf edge.

'Ljubljanska ledenka' is considered as an 'umbrella variety' and some of the varieties derived from it are included also in the Common Catalogue of Varieties (CCV) of the EU under synonyms 'Laibacher Eis' 2, 3 and 4, with characteristic red leaf edge.

'Laibacher Eis 2' (Batavia rubia de borde rojo 2,..)



'Laibacher Eis 3' (Blonde a borde rouge 3,...)



'Laibacher Eis 4' (Grazer Krauthauptel 4, Laibacher Eis 4).



'Ljubljanska ledenka'

- With the selection in Slovenia during the past decades the red leaf edge was lost. Comparative trials have shown that 'Ljubljanska ledenka' such as it is grown and marketed today is morphologically very similar to the Slovene varieties 'Braziljanka' and 'Leda' which were selected from it.
- 'Leda' is the only variety of the two that has successfully passed DUS test which is necessary for the inscription in the National List of Varieties or in the Common Catalogue of Varieties of the EU and, consequently, for the marketing of a variety.

'Ljubljanska ledenka'



'Braziljanka'



'Leda'

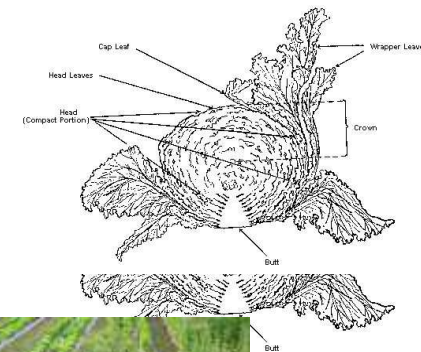
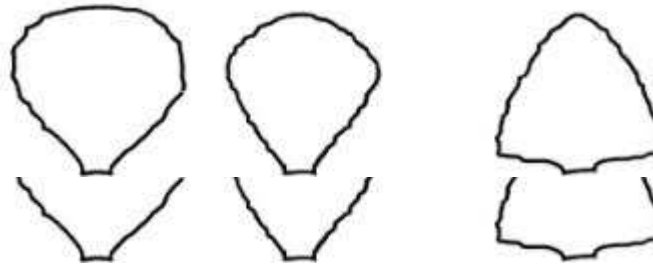


'Ljubljanska ledenka'

- **SPGB – accessions were selected on the basis of passport data (138 crisp accessions)**
- **Gene banks in Europe and USA: accessions with the name 'Ljubljanska ledenka' and its synonyms:**
 - **IPK Gatersleben (Germany): 2 accessions**
 - **RICP Prague (Czech Republic): 5 accessions**
 - **CGN (The Netherlands): 7 accessions**
 - **USDA-ARS, National Genetic Resources Program, GRIN (USA): 3 accessions**
- **Cultivars: 'Leda', 'Braziljanka' and 'Ljubljanska ledenka' (Semenarna Ljubljana, SI), 'Laibacher Eis 3' and 'Laibacher Eis 4' (Naktouinbouw, NL).**

'Ljubljanska ledenka'

34 morphological and phenological parameters were evaluated according to the UPOV descriptors for lettuce (TG13/8) (Guidelines for the conduct of tests for distinctness, uniformity and stability) in three successive years.



'Ljubljanska ledenka'

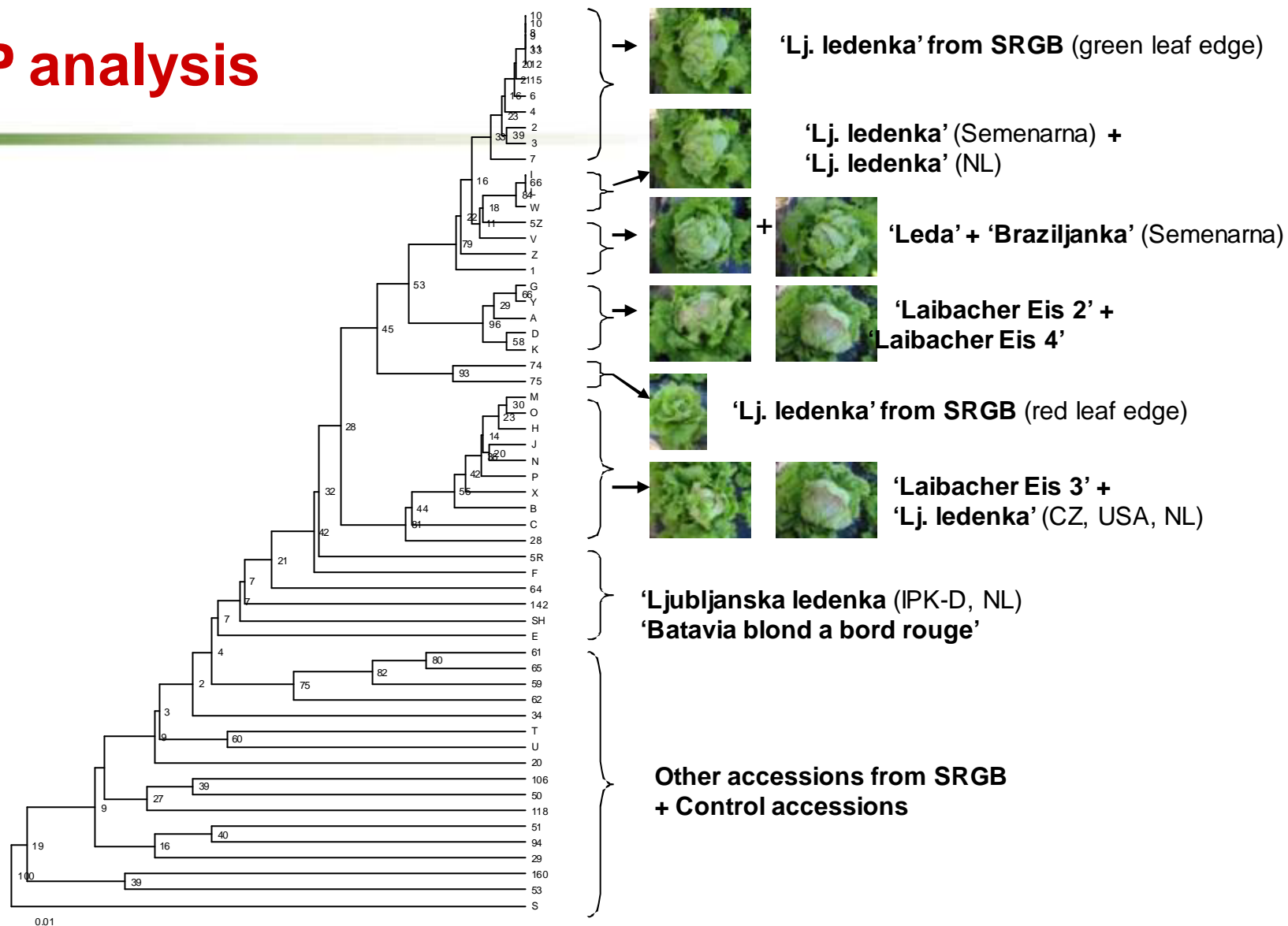
- SRGB: 27 accessions correspond to 'Ljubljanska ledenka' based on morphological data.
- Other gene banks: 14 accessions correspond to 'Ljubljanska ledenka'.

Red leaf edge:

- 2 accessions of 'Ljubljanska ledenka' (7%) from SRGB (collected after 1989),
- 11 accessions from other gene banks (80%) (collected before 1970).



AFLP analysis



Beans in Slovenia

Collection of *Phaseolus* accessions in the Slovene Plant Gene Bank:

- >1030 accessions collected in Slovenia:
 - >800 *Phaseolus vulgaris* L. ssp. *vulgaris* var. *vulgaris*,
 - >180 *Phaseolus vulgaris* L. ssp. *vulgaris* var. *nanus*,
 - 53 *Phaseolus coccineus* L.
- 61 accessions from international expeditions
- 39 accessions from other gene banks worldwide



Foto: J. Verbič

Evaluation of common bean

Diversity studies:

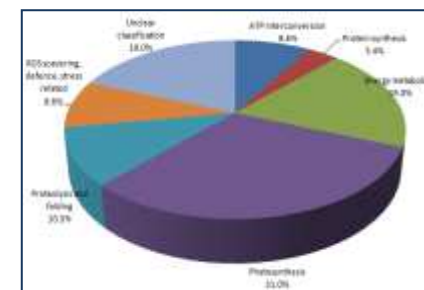
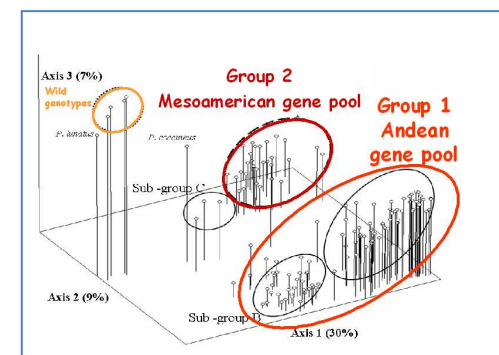
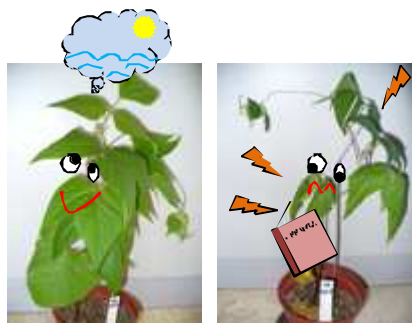
- Morphological markers
- Biochemical markers
- Molecular markers

Genetic erosion

Disease resistance

- *Colletotrichum lindemuthianum*

Drought tolerance



Re-introduction of traditional Slovenian common bean landraces

- 16 Češnjevec accessions and 23 accessions of landrace Lišček (another traditionally grown common bean type) were selected from the gene bank at AIS. Three cultivars were included as outgroups.
- Field studies were conducted in three successive years; plant growth, resistance to diseases and pests were evaluated and the yield was determined.
- The chemical composition of raw seeds was analysed, which included determination of macro and microelements, dry matter and starch content,
- crude proteins, crude fiber and polyphenols. Sensory analysis was performed as well as.

| Češnjevec rdeči | teža (g) | št.rastlin | g/rastlino |
|--|----------|------------|------------|
| GB153 | 1607 | 47 | 34,2 |
| GB729 | 1039 | 46 | 22,6 |
| GB733 | 541 | 49 | 11 |
| GB280 | 597 | 45 | 13,2 |
| Češnjevec pisani debeli | | | |
| GB152 | 1119 | 48 | 23,3 |
| GB283 | 1375 | 50 | 27,5 |
| GB740 | 884 | 46 | 19,2 |
| GB751 | 754 | 41 | 18,3 |
| GB1026 | 536 | 47 | 11,4 |
| Lišček marmorirani in temnordeč | | | |
| GB23 | 1441 | 41 | 35,1 |
| GB29 | 669 | 34 | 19,6 |
| GB133 | 1317 | 37 | 35,6 |
| GB279 | 968 | 43 | 22,5 |
| GB289 | 1519 | 48 | 31,6 |
| GB627 | 1291 | 50 | 25,8 |
| Lišček koksasti | | | |
| GB631 | 773 | 35 | 22,1 |
| | | | |
| KLEMEN | 1483 | 83 | 17,8 |
| JABELJSKI PISANEC | 1396 | 85 | 16,4 |
| SEM22 | 1867 | 85 | 21,9 |



| Višji slovar vrst | Popisni št. | Marko: a vrsta |
|---------------------------------|-------------|----------------|
| Češnjevec rdeči | 153 | 153 |
| Češnjevec pisani debeli | 152 | 152 |
| Lišček marmorirani in temnordeč | 23 | 23 |
| Lišček koksasti | 631 | 631 |
| KLEMEN | 1483 | 1483 |
| JABELJSKI PISANEC | 1396 | 1396 |
| SEM22 | 1867 | 1867 |

Češnjevec:

- 16 genskih virov (rdeči, pisani)

Lišček:

- 23 genskih virov (5 različnih tipov)

Dan in noč:

- 2 genska vira



New varieties inscribed in the List of varieties as conservation varieties

Češnjevec pisani visoki



Lišček rdeči marmorirani





Foto: J. Verbič

Thank you for your attention!