

Diversification in the Slovenian Vegetable Production

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Abstract

Slovenia could be considered as one of the centres of diversification for a number of vegetable crops. Several landraces and cultivars were named according to the place where they have been grown for centuries. Cultivars of lettuce, corn lettuce, carrot and cabbage were named after the town of Ljubljana; after the town of Ptuj cultivars of onion and garlic and after the town of Gorica cultivars of chicory. Autochthonous cultivars, landraces of beans and cabbage, were collected and studied even before World War II and soon after breeding programmes started for different vegetables. At present the following number of varieties can be found in Slovenia's 2001 National List of Varieties: 12 beans, 6 chicory, 4 lettuce, 4 corn lettuce, 3 cabbage, 3 onion, 2 shallot, 2 carrot, 2 turnip, 2 garlic, 1 pepper and 1 tomato. The Agricultural Institute of Slovenia holds 995 bean accessions, 170 lettuce accessions, 100 onion accessions and 12 cabbage accessions, all conserved at the national gene bank collection of agricultural crops.

INTRODUCTION

Slovenia with the surface of 20,251 km² has three main climatic areas: Mediterranean, Alpine and Pannonian, with eight pedoclimatic regions: Sub-mediterranean, Sub-pannonian, Pannonian, Sub-alpine lowland, Sub-alpine highland, Alpine, Alpine highland and Karst highland. Due to the diversity of pedoclimatic characteristics there are four different types of flora: Central European-Alpine (30 % of the territory) in the north, Mediterranean (10 %) in the south-west, Pannonian (30 %) in the east and Illiric Dinaric (30 %) in the south. Richness of Slovenian flora was presented in different written documents and books from 1500 to 1995 (Černe, 1996). Because of such a variety of pedoclimatic conditions and as well selection by farmers that maintained landraces, there is a great diversification in Slovenian vegetable production.

MATERIALS AND METHODS

Janez Zaplotnik of the Agricultural Institute of Slovenia, first started to collect autochthonous bean accessions in 1937. In his book (Zaplotnik, 1952) morphological and phenological characteristics for 287 bean accessions were presented as the result of studies carried out from 1938 to 1941. Silva Avšič made a second collection in 1965 and altogether 1,507 accessions were sampled with the participation of elementary schools from across Slovenia. Following this investigation 3 pole bean and one dwarf bean cultivar were included in the National List of Varieties (MKGP, 2001). A third collection was done by Mihaela Černe from 1995 to 1998 surveying all Slovenian regions (these are the only seeds out of these three expeditions currently preserved in the Slovenian gene bank).

Cabbage autochthonous accessions were studied from 1940 to 1941 by Gvido Fajdiga. In the year 1962 Anton Petriček started collecting landraces of cabbage in the vicinity of the town of Ljubljana. From 1963 to 1965 Mihaela Černe collected cabbage landraces also in the areas of Bloška planota and Škofjeloško pogorje. From this collection two cabbage cultivars were eventually bred (Černe, 1998) and included in the National List of Varieties. Thirty years after the first germplasm collection a further expedition was performed in the vicinity of Ljubljana and in other regions of Slovenia

with the goal of sampling and safeguard local germplasm in the national gene bank.

Elza Leskovec, from the Biotechnical Faculty, University of Ljubljana, collected landraces of onions in the village Griblje in the region of Bela Krajina. One cultivar was subsequently bred and released using that material. Additional onion landraces were also collected from 1989 to 1998 by Mihaela Černe in the vicinity of the town of Ptuj, in Bela Krajina and in Dolenjska area. At the same time several lettuce accessions were collected across Slovenia (Černe, 1999).

The majority of Slovenian vegetable cultivars were bred by the Seed Company Semenarna of Ljubljana, which maintains as well those cultivars bred at the Agricultural Institute of Slovenia and at the Biotechnical Faculty.

Chicory, lettuce and bean cultivars were bred by Jože and Marinka Osvald. Their cultivars are based on collected autochthonous material in the southwest part of Slovenia, mainly in Goriška region (Osvald, 1996).

RESULTS AND DISCUSSION

Cultivars

Cultivars bred from autochthonous accessions represent not only our national and cultural heritage but are also important for organic farmers and small gardeners. For this type of production biological diversity, diversity in crop quality and the conservation of traditional food is emphasised. According to the National Statistical Inventory for the year 2000, only 2 % of the marketable vegetable producers are organic farmers, growing also Slovenian cultivars (Černe et al., 2000) and there is a tendency of increasing such production.

Cultivars entered into the National List of Varieties in 1989 are on the list from the early beginning and were revised by the late Yugoslavian Commission for Testing Cultivars. This Commission approved also those cultivars that entered the National List of Varieties from 1975 to 1988. Some of these cultivars are still used as standards in testing new cultivars. Cultivars bred from Slovenian landraces and included on the National List of Varieties in recent years (from 1995 to 2000) have been tested according to UPOV standards along with DUS testing performed in approved foreign institutions. Before being entered into the National List of Varieties (Table 1) new cultivars are evaluated not only for yield but also for other morphological and organoleptical characteristics. Slovenian lettuce cultivar 'Ljubljanska ledenka' or 'Laibacher Eis' is also included in European List of Varieties.

Slovenian cultivars of lettuce 'Leda', of chicory 'Vervit', of turnip 'Kranjska podolgovata', of pepper 'Ferdí' and of tomato 'Val' are on the List of Protected Varieties (Table 2) (MKGP, 2001). Tomato cultivar 'Val' was bred using material collected from Slovenian gardeners that grew it for longer periods. "Ferdí" pepper cultivar is the result of a long term breeding program carried out by the Seed Company Semenarna in Ljubljana.

Genetic Resources

From the early collections, no seeds have been preserved. Therefore for the establishment of the national Slovenian gene bank several germplasm collecting missions were carried out using data from previous collections over the period 1989-1998. Accessions were obtained from local markets, on farms with the help of the advisory service, elementary schools or through personal contact with farmers, by advertisements in newspapers and collecting trips. The accessions for each crop maintained by the Slovenian vegetable gene bank are listed in Table 3.

When comparing results from different collecting efforts mounted so far, we came to the conclusion that in the vicinity of Ljubljana, 90 % of cabbage landraces have been replaced by hybrids, this resulting in high genetic loss.

For instance, a great diversity in shape, colour, weight and storage ability has been observed among accessions from various parts of Slovenia. For example, the weight of heads varies between 1.0 to 3.5 kg and the weight of plants between 1.7 to 5.5 kg. The

length of inner stem differs from 1/3 to 2/3 of the head height. Dry matter content is from 4.88 to 8.15 %, raw fibre content from 0.57 to 0.89 %, sugar content from 0.15 to 2.84 %, vitamin C from 15.3 to 24.9 mg/100 g of fresh weight and nitrates from 8.0 to 29.4 mg/kg (Černe and Koron, 1994).

Lettuce accessions are mainly crisp-leaved (74 %), followed by soft-leaved (15 %), cos lettuce (10 %) and oak-leaved lettuce (1 %). Many crisp-leaved accessions are suitable for all year round production, whereas soft-leaved accessions are mainly for early spring and autumn production. Crisp-leaved accessions with yellow green colour of outer leaves are very resistant against bolting, whereas less resistant are those accessions having green or dark green colour of their outer leaves. These are sensitive also to *Bremia lactucae*. Some accessions with red spotted and dark green leaves are resistant against cold. The results of two years testing showed that 10 to 13 % of samples were infected with lettuce mosaic virus (LMV) and 2 % with cucumber mosaic virus (CMV) (Černe, 1999).

Onion accessions have a great diversity in shape and color. Accessions from the region of Dolenjska are round to flat, with red colour. They start rotting and bolting earlier than accessions from Ptuj and Bela Krajina. Accessions from Bela Krajina are elongated whereas the accessions from Ptuj are round to flat, both have good storability. About 25 % of onion accessions were found to be infected with onion yellow dwarf virus (OYDV) and leek yellow stripe virus (LYSV) (Černe, 1999).

Bean accessions are mainly of the pole type (72 %), followed by dwarf (20 %), intermediate (3 %) and scarlet runner (5 %). Twenty six *P. vulgaris* accessions from the collection were chosen according to multicrop passport data and morphological characteristics for analysis with molecular markers. Accessions were first compared to a set of 21 previously described check accessions of Mesoamerican and Andean type using the RAPD assay. Slovenian accessions were divided into two distinct groups where the majority of accessions clustered near the Andean group and two accessions clustered with the Mesoamerican one. The Andean group was then compared to a database containing RAPD data for 240 *P. vulgaris* genotypes from the Andean gene pool. Analysis revealed a tight group of 14 accessions that didn't contain any Andean gene pool check lines. This suggests that these Slovenian genotypes are significantly different from any *P. vulgaris* genotypes previously characterised with RAPD, representing a unique set of germplasm that should be included in *Phaseolus* germplasm collections and used for further analysis (Meglič et al., 1999; Šuštar –Vozlič and Meglič, 2000).

Cabbage, lettuce and bean accessions are, along with other species of agricultural crops, documented and available at the Slovenian Gene Bank internet homepage accompanied by multicrop passport descriptors data. At present seeds are stored at + 4 °C (Meglič et al, 1998).

CONCLUSION

In the Slovenian vegetable production, the majority of cultivars -bred from autochthonous material- are still in production because of their peculiar morphological traits still sought by consumers. New breeding programmes should consider incorporating resistance for diseases and pests along with maintenance of desired characteristics into these local materials. Slovenian cultivars are also interesting for organic production since both consumers and growers alike prefer them.

The National Programme (Černe, 1997), has been devoting special attention to local vegetable genetic resources since the date of its inception in 1996. This work is indeed very valuable for the National programme since it deals specifically with Slovenian landraces and cultivars only. In view of the high genetic erosion noticed across the country, the authors recommend that researchers should decisively pursue data on this aspect from previous collections in the immediate future.

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Tables

Table 1. List of Slovenian cultivars of vegetable crops included in the National List of Varieties.

Species	Cultivar	Date of entry	Breeders, maintainers ¹
Shallot (<i>Allium escalonicum</i> L.)	'Kozjanka'	2000	3, 3
	'Pohorka'	1996	3, 3
Onion (<i>Allium cepa</i> L. var. <i>cepa</i>)	'Belokranjka'	1984	1, 3
	'Ptujška rdeča'	1989	3, 3
	'Tera'	1996	3, 3
Garlic (<i>Allium sativum</i> L. var. <i>sativum</i>)	'Ptujski jesenski'	1989	3, 3
	'Ptujski spomladanski'	1989	3, 3
White cabbage (<i>Brassica oleracea</i> L. ssp. <i>oleracea</i> convar. <i>capitata</i> (L.) Alef. var. f. <i>alba</i> DC.)	'Emona'	1979	2, 3
	'Kranjsko okroglo'	1979	2, 3
Chicory (<i>Cichorium intybus</i> L. var. <i>foliosum</i> Hegi)	'Ljubljansko'	1989	3, 3
	'Anivip'	1985	4, 4
	'Goriški'	1989	4, 4
	'Monivip'	1985	4, 4
	'Solkanski'	1996	4, 4
	'Tržaški solatnik', 'Zuccherino di Trieste'	1989	3, 3
Lettuce (<i>Lactuca sativa</i> L. convar. <i>sativa</i> var. <i>capitata</i> L.)	'Vervit'	1996	3, 3
	'Leda'	1996	3, 3
	'Ljubljanska ledenka', 'Laibacher Eis'	1989	3, 3
	'Marija'	1998	4, 4
Dwarf bean (<i>Phaseolus vulgaris</i> L. ssp. <i>vulgaris</i> var. <i>nanus</i> Ashers.)	'Bistra'	2000	3, 3
	'Filip'	1998	4, 4
	'Češnjevec'	1989	3, 3
	'Ribničan'	1989	3, 3
	'Stanko'	1998	4, 4
Pole bean (<i>Phaseolus vulgaris</i> L. ssp. <i>vulgaris</i> var. <i>vulgaris</i>)	'Zorin'	1986	2, 3
	'Cipro', 'Cipro di Trieste'	1989	3, 3
	'Jabelski pisanec'	1975	2, 3
	'Jabelski stročnik'	1975	2, 3
	'Jeruzalemski'	1989	3, 3
	'Klemen'	1983	2, 3
	'Ptujski maslenec'	1988	3, 3
	'Semenarna 22'	1975	3, 3
	Corn lettuce (<i>Valerianella locusta</i> (L.) Laterr.)	'Ljubljanski motovilec'	1989
'Pomladin'		1996	3, 3
'Zimko'		1996	3, 3
'Žličar'		1996	3, 3

Table 1. Continued.

Species	Cultivar	Date of entry	Breeders, maintainers ¹
Carrot (<i>Daucus carota</i> L. ssp. <i>sativus</i> (Hoffm.) Hayek)	'Ljubljansko rumeno'	1989	3, 3
	'Semor'	1995	3, 3
Turnip (<i>Brassica rapa</i> L. var. <i>rapa</i>)	'Kranjska okrogla'	1989	3, 3
	'Kranjska podolgovata'	1995	3, 3
Pepper (<i>Capsicum annuum</i> L. ssp. <i>microcarpum</i> var. <i>acuminacum</i>)	'Ferdì'	1996	3, 3
Tomato (<i>Lycopersicon lycopersicum</i> (L.) Karsten ex Farwell)	'Val'	1999	3, 3

¹1 = Biotechnical Faculty, Agronomy Department, Jamnikarjeva 101, 1000 Ljubljana, Slovenia

2 = Agricultural Institute of Slovenia, Hacquetova 17, 1001 Ljubljana, Slovenia

3 = Seed Company Semenarna Ljubljana, Dolenjska c. 242, 1000 Ljubljana

4 = Oswald d.o.o., Goriška 17, 5290 Šempeter pri Novi Gorici, Slovenia

Table 2. List of Protected Varieties.

Species	Cultivar ¹	Grant year / expiration year
Turnip (<i>Brassica rapa</i> L. var. <i>rapa</i>)	'Kranjska podolgovata'	1997 / 2012
Pepper (<i>Capsicum annuum</i> L. ssp. <i>microcarpum</i> var. <i>acuminacum</i>)	'Ferdì'	1998 / 2013
Lettuce (<i>Lactuca sativa</i> L. convar. <i>sativa</i> var. <i>capitata</i> L.)	'Leda'	1998 / 2013
Tomato (<i>Lycopersicon lycopersicum</i> (L.) Karsten ex Farwell)	'Val'	2000 / 2020
Chicory (<i>Cichorium intybus</i> L. var. <i>foliosum</i> Hegi)	'Vervit'	1997 / 2012

¹Title holder: Seed Company Semenarna Ljubljana, Dolenjska c. 242, 1000 Ljubljana, Slovenia

Table 3. Number of accessions included in the Slovenian vegetable gene bank at the Agricultural Institute of Slovenia.

Species	Number of accessions
<i>Brassica oleracea</i> L. ssp. <i>oleracea</i> convar. <i>capitata</i> (L.) Alef.	12
<i>Lactuca sativa</i> L. convar. <i>sativa</i> var. <i>capitata</i> L.	170
<i>Phaseolus vulgaris</i> L. ssp. <i>vulgaris</i> var. <i>vulgaris</i>	713
<i>Phaseolus vulgaris</i> L. ssp. <i>vulgaris</i> var. <i>nanus</i> Ashers.	203
<i>Phaseolus vulgaris</i> L. ssp. <i>vulgaris</i> var. <i>intermedius</i>	27
<i>Phaseolus coccineus</i> L.	52
<i>Allium cepa</i> L. var. <i>cepa</i>	100