Establishing the European Network for
In Situ Conservation and Sustainable Use
of Plant Genetic Resources

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Landraces

Issue 6, August 2020

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Conserving plant diversity

for future generations

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Knowledge passing from a generation to another; two gardeners (Panicale, Italy).
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Welcome to Issue 6 of *Landraces*.

Thanks to the funding awarded by the European Commission to the project '*Networking, partnerships and tools to enhance in situ conservation of European plant genetic resources*' (short name 'Farmer's Pride') within the Horizon 2020 Framework Programme, we are able to provide a further issue of this newsletter.
As in the previous issues, '*Landraces'* provides a medium to draw attention to information about the conservation, promotion and use of landraces in different contexts.
This issue initially provides information concerning the progresses of the 'Farmer's Pride' project as regard landraces. The main achievements, thus far after nearly three years work, are the publication of Propagation Management Guidelines, a self-help guide for landrace maintenance on-farm, and of a Best Practice Evidence-Based Database tool that through practical examples illustrates the diverse means of landrace conservation and adding value to landrace products. However, like many projects currently progress has been partially stifled by the Covid 19 outbreak and the accompanying European lock down. By this stage we should have the planned "European network for *in situ* conservation and sustainable use of plant genetic resources" at least partially implemented with a few initial case study sites actively conserving unique landrace populations held on-farm. The Covid 19 and lock down have slowed progress, but we are actively encouraging farmers and landrace maintainer that manage diversity landrace populations to nominate their sites to join the Network. Anyone managing a landrace population can nominate a site and do so you simply complete the following survey:

https://bham.onlinesurveys.ac.uk/farmers-pride-network-expressions-of-interest

Within the EU our current thinking is the Network will be supported financially via the EU Green Deal and the revised CAP. Although the Network will not be restricted to the EU countries, sites of European and national significance outside of the EU are also likely to be supported under national Agriculture Bills that mirror the Green Deal and turn partially from supporting agricultural production to farmers providing ecosystem service public goods. Therefore, can we have your support to complete expression of interest for sites and included landrace (or CWR) populations to join the fledgling network that aims to underpin future food and nutritional security for Europe..
Finally, this issue of Landrace presents a collection of case study landraces, reviewing where and how they are cultivated, how they are promoted and marketed, among other issues. They concern tomato (Armenia), swede (Sweden), vine (Serbia) and plum (Italy) on-farm maintained landraces. These case studies, with those already published in other '*Landraces'* issues, show that landraces of different crops have indeed been maintained in the entire Europe across time, in spite of the fact they have been considered extinct for long time, and offer examples of how they can be rescued and used nowadays.

We hope you will enjoy reading this issue.

Valeria Negri, Lorenzo Raggi and Nigel Maxted

Above: the plum (Prunus domestica *domestica* L. subsp. *insititia* L.) landrace 'Mascina di Montepulciano' (Italy).
Photo: Niccolò Terzaroli

In situ landrace propagation management guidelines

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Farmer's Pride project provided the landrace stakeholder community with guidelines and recommendations that can significantly help maximising the level of *in situ* maintained diversity (Caproni et al. 2020). The used approach is based on collection and analysis of diverse case studies of European *in situ* maintained landraces together with a review of the existing literature this topic.

During 2019, Farmer's Pride Partners and Ambassadors (the latter helping in achieving Farmer's Pride aims), members of the ECPGR (European Cooperative Program on Plant Genetic Resources) On-farm working group, Universities, Non-Governmental Organisations, national and local authorities, and private citizens across Europe were invited to provide a number of relevant case studies of on-farm/in-garden maintained landraces representing successful (or potentially successful) examples of valorisation and/or use. The strategy used to collect case studies aimed at including *in situ* maintained resources of open-field, garden and tree crops, encompassing diverse countries, environmental conditions, management systems, multiplication procedures and diverse levels of relevance on the market (Raggi et al. 2020). Basic characteristics of the species cultivated as landrace and several other information about how, where, why such landraces are still kept, used, marketed and propagated were asked. In addition, some of the information used to compile the case studies were retrieved from the available literature, the main goal being to collect as much case studies as possible. In order to standardise the collection of information a template was developed and shared among potential contributors.

By January 2020, a set of 105 case studies of in situ maintained landraces was successfully collected; the collection encompasses case of 54 different species from 14 European countries. The dataset included open-field, garden and tree crops of which about half are cultivated in marginal areas.

Different practices are applied for maintenance and propagation of landraces, according on their use, type, mating systems and applied propagation strategies, although common elements were indeed identified: selection, isolation, number of plants, (eventual) exchange of propagation material among farmers and number of farmers cultivating the landrace. Table 1 reports the importance (by score) attributed to each of the identified common elements per crop type (Garden-autogamous, Garden-allogamous, Open-field-autogamous, Open-field-allogamous and Clonally Propagated crops).

Table 1. Importance of 'key propagation management elements' according to crop categories. 1=not relevant; 2=can be relevant; 3=relevant; 4=recommended and 5=mandatory .

Key propagation management elements	Garden-autogamous	Garden-allogamous	Open-field-autogamous	Open-field-allogamous	Garden- and open-field clonal	Tree-clonal
Selection						
Of mother plants	3	**5**	2	**5**	**5**	**5**
Of fruits	4	2	4	3	1	1
Of seeds	**5**	2	4	3	1	1
Isolation						
Spatial	3	**5**	3	**5**	1	1
Mechanical	1	4	1	2	1	1
Temporal	2	3	2	3	1	1
Plants						
Number of cultivated plants	4	3	**5**	**5**	4	2
Cultivated area	2	2	4	4	2	2
Farmers						
Material exchange	3	2	2	2	4	3
Number cultivating the resource	4	2	2	2	2	3

Based on this evidence, but also relying on an accurate literature review, clear guidelines to improve landrace propagation management were developed that provide the user community with prescriptions to carry out (or develop) proper multiplication strategies for the main crops with the aim of maximising within landrace diversity while keeping its identity.

In the guidelines, for each group of sexually propagated landraces (i.e. Garden-autogamous, Garden-allogamous, Open-field-autogamous, Open-field-allogamous), outcrossing rates, recommended minimum distances (from other sexually compatible plants present nearby) and minimum number of mother plants/minimum number of mother plants expressed as 'minimum cultivated area' (for open field crops) to be used for seed multiplication are reported. For clonally propagated landraces, where the most relevant management practice is a wise selection of mother plants from which propagation materials are collected, minimum recommended number of plants is reported.

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We wish to acknowledge all those who, beside us, provided the case studies: A. Barata and J. Magos Brehm (Instituto Nacional de Investigação Agrária e Veterinária, Portugal); H. Meierhofer (Arche Noah, Austria); B. Bartha (ProSpecieRara, Switzerland); J. Fehér (The Hungarian Research Institute of Organic Agriculture, Hungary); O. Shoemark, S. Kell and N. Maxted (University of Birmingham, United Kingdom); A. Tabaković (Ministry of agriculture, forestry and water management, Serbia); V. Holubec (ECPGR national coordinator, Czech Republic); J. M. Iriondo Alegría (Universidad Rey Juan Carlos, Spain), J. Prohens, J.T. De Jesus Diez Nicols and S. Soler Aleixandre (Universitat Politècnica de València, Spain), M. Heinonen (Natural Resource Institute (LUKE), Finland), P. Ralli and K. Koutis (Hellenic Agricultural Organization-DEMETER, Greece); J. Weibull (Swedish Board of Agriculture, Sweden); G. Poulsen (Danish Seed Savers, Denmark), C. Buscaroli (Centro Ricerche Produzioni Vegetali, Italy). We also thanks N maxted for his useful inputs.

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The Best Practice Evidence-Based Database: a tool for promoting landrace conservation

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Based on the 105 case studies set of *in situ* maintained landraces (see the previous paper for description) a Best Practice Evidence-Based Database was developed which provides access to information on the benefits, opportunities and practices of landrace cultivation to help in decision-making and to promote their *in situ* maintenance as a means of conserving and diversifying plant genetic resources for food, nutrition and livelihood security

This tool is for landrace maintainers or those considering the cultivation of landraces to diversify their crop production system.

The tool includes examples of *in situ* management practices and of adding value to landraces—for example, marketing options—for different crops and socio-cultural, environmental and economic contexts.

This information can help to enhance landrace cultivation and make it sustainable and profitable at the same time, while conserving biodiversity for future generations.

The landrace Best Practice Evidence-Based Database is searchable with single or multiple keys (*i.e.* scientific or common name of the crop, crop type, country, propagation system and added value) or from the grid, list or map view (Figure 1).

The data base is hosted by the European Cooperative Program on Genetic Resources and is available at: https://www.ecpgr.cgiar.org/in-situ-landraces-best-practice-evidence-based-database

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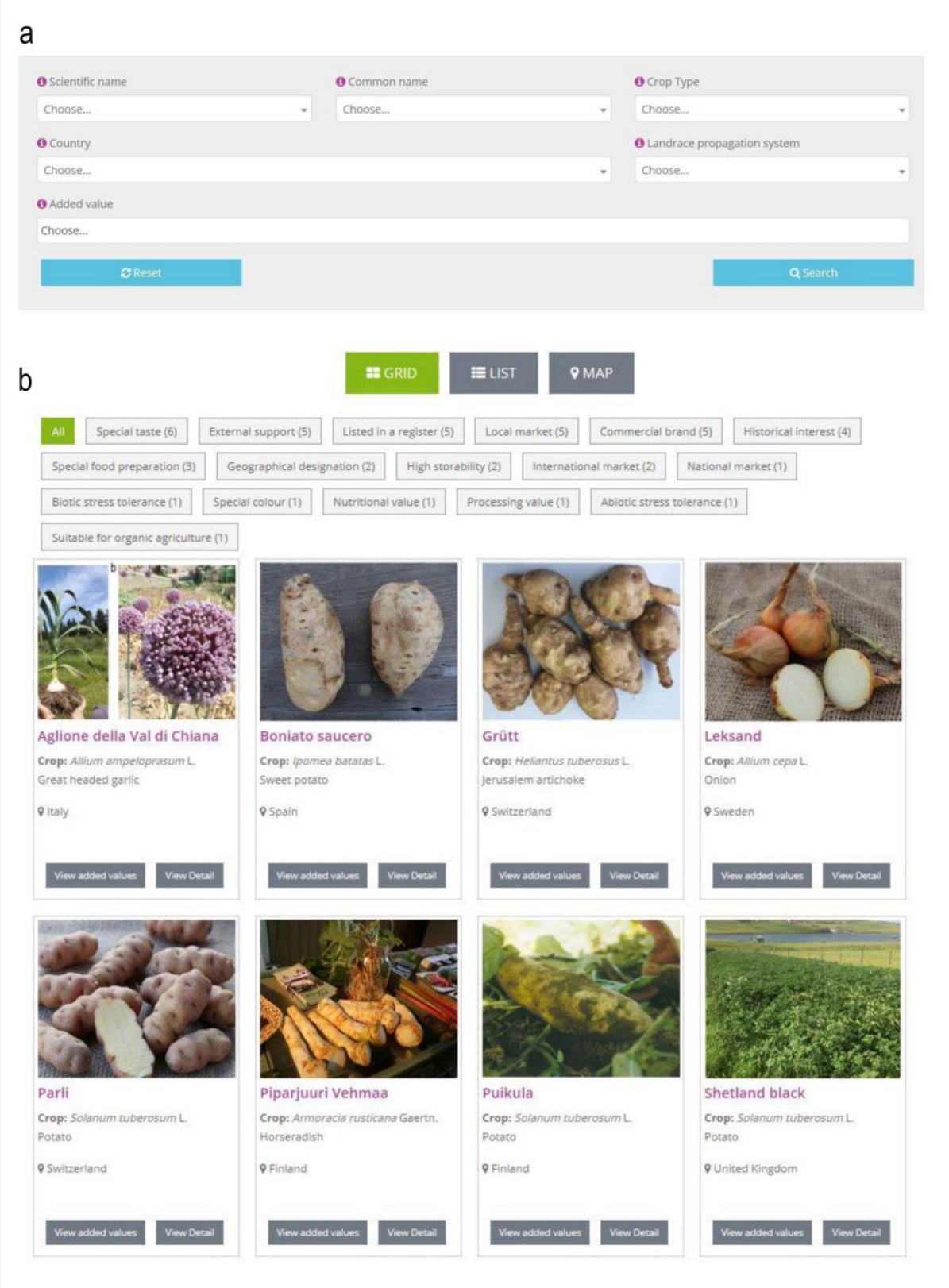

Figure 1. a) search mask**; b)** search results: example of visualisation.

The Armenian tomato landrace 'Tavushy'

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Historical aspects

It is more than 100 years that tomato which (Solanum *lycopericum* L.) is world-famous crop and widely used by vegetable producing large companies, small farmers, processors, breeders and researchers. Having been native to Andes, tomato have been cultivated in Mexico and less accepted by population until the end of the 19th century. Robert Gibon Johnson opened a new page in the history of vegetable growing daring to eat tomatoes standing on the steps of the courthouse in New Jersey (USA) in 1820 (Khrapalova, 2001).

Currently the popularity of tomato and its prevalence everywhere goes hand in hand with large businesses, breeding and now with gene engineering. The wide spread of tomato in many countries of the world and its large share in world gross vegetable production is conditioned by possibilities of its growth and fruit-bearing under different agro-climatic conditions, high yield and diverse use (fresh, canning, drying, etc.), as well as by its biologically traits, high gustatory and qualitative value (sugar content, vitamins, microelements, mineral salts). According to Grincharov's (1970) tomato fruits contain 5-6% of dry substances, 50% of which is soluble sugar (mannose), 0.5% of organic acid, 0.84% of cellulose, 0.19% pectic substances, 0.95% wet protein, 0.2% fats and essential oils, and 0.6% mineral salts (Zhuchenko 1973). Such healthsome chemical composition classifies tomato also as a source of dietary food. Breeding works also impacted a leading role of tomato, thanks to which various varieties and hybrids have been created in the world providing opportunity to meet the demand of agricultural production in different countries at significant rates.

Landrace and old breeding varieties

There are no exact dates of introduction of tomatoes in Armenia. Tomato is cited among the vegetable crops cultivated for "home needs" in the Agricultural Statistical Information of Yerevan province in 1870. Tomato is also mentioned in Ghevond Alishan's "Armenian vegetables" (1985) book. According to Professor G.P. Grdzelyan tomato was cultivated in Transcaucasia (Georgia) starting from the 70s of the 19th century and was known among the population as Rusuli badrejan (rusul's eggplant) (Ananyan, Egiazaryan, Grigoryan 1965). Tomato breeding is conducted in Armenia starting from 1932. At that time a number of initial breeding material have been formed from the local population of tomato which according to A. Ananyan (Ananyan, Egiazaryan, Grigoryan 1965) was formed as a result of introducing and mixed cultivation of some old breeding varieties ('Yuvel', 'John Ber', 'Chudo Rinka', 'Fikarazzi', 'Ponderosa', 'Humberg' and others). In the mountain areas of Tavush marz of Armenia farmers cultivated local population of tomato (landrace 'Tavushy'). Landrace 'Tavushy' (Figure 1) created in the past century has been cultivated in the Republic for a long time meeting demand of population in fresh tomato and of a cannery production. The accessions of landrace 'Tavushy' are maintained at the Department of Solanaceae Crops of the Scientific Centre of Vegetable and Industrial Crops (Sarikyan 2003; Sarikyan 2006; Sarikyan et al. 2009).

Figure 1. Tomato landrace 'Tavushy'. Photo: Emma Hakobyan

Use in breeding

The Armenian landrace is characterized by high gustatory and a number of biological properties and can serve as a donor of valuable traits. In order to use the landrace as an initial material in inter-variety crossbreeding, the seeds collected from farms located in Aygedzor village of the Tavush marz were multiplicated and planted, preliminary studies of biologically and economically valuable features were conducted, elite plants of tomato landrace 'Tavushy' were selected. As a result of breeding process with use of landrace as an initial material the new tomato variety 'Aspram' posing a number of biological, morphological, agronomic and economically important traits is bred (Figure 2).

Promoting cultivation of landrace and old varieties

Armenian old varieties and landraces are not very productive and fruits are not transportable, but their palatability traits are very high. Today local population expresses dissatisfaction with modern high productive tomato varieties with high transportation ability and prefers to have old ones in their everyday food. However, the traditional cultivation technologies and methods are not enough to ensure quality and high yield of old varieties. To help farmers to get higher yield from old breeding varieties and landrace, modern cultivation technologies developed by the Asian Vegetable Research and Development Center (AVRDC) such as mulching plant beds with polyethylene foil, plant forming, cultivation with sticks (Figure 3), drip irrigation, were studied and proposed to farmers.

Figure 2. Tomato landrace cultivation through application of **modern** cultivation technologies. Photo: Emma Hakobyan.

Figure 2. New tomato variety 'Aspram'. Photo: Emma Hakobyan

Taking into consideration the fact that farmers use mainly organic fertilizers while cultivating the tomato landrace and old breeding varieties a new bio-preparation "ECOBIFID PLUS" produced in "ArmBioTechnology" Scientific and Production Center of the National Academy of Sciences of Armenia was tested and offered to farmers to increase yield and preserve palatability traits of tomato old breeding varieties and landrace.

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Swedes in Sweden – the renaissance of a low-status crop

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Swede, or rutabaga (*Brassica napus* Napobrassica-Group), is a traditional vegetable in Swedish cuisine. It has however long been considered as dull and a last-choice among vegetables (Figure 1). The swede is also associated with war-time food in Sweden and many other countries in Northern Europe, contributing to its bad reputation. Nevertheless, when a national seed call was performed in the early 2000's, many heirloom swede landraces were gathered. In many cases, they had been preserved for their sensory qualities.
In 2015 we began to evaluate landraces and obsolete cultivars of swedes in Sweden for agronomic and sensory characteristics. In parallel, work was initiated of small-scale-seed production and marketing of traditional cultivars. Here, we report on this work and how swedes are now a sought-after crop and served with pride on the best Swedish restaurants.

Figure 1. "Rotmos", mashed swedes, is the most traditional dish made from swedes, but has an unearned bad reputation. Photo: Patrik Arneke.

A brief account on origin and history

Already the English name "swede" points at a Swedish origin of the crop. Similarly, a swedish origin is indicated by the German "Schwedische Rübe" and French "chou suédois". The American name "rutabaga" has its roots in "rotabagge", a dialectal word for Swede in the province Västergötland in Sweden. So, if Swedish, when did swedes first occur?

First, we can conclude that the swede is a hybrid between two cultivated species. No wild ancestor has ever been found. Earlier conclusions that Linnaeus´ notes on "Brassica napus" on the island Gotland should refer to swedes have proved false (Ahokas, 2004).
Instead, the hybridisation must have occurred at a place where both turnips (the mother) and kale (the father) were cultivated. In Northern Europe this was the case for most vegetable patches in the Medieval and Early Modern Period. Illustrations and written records from this time are however surprisingly void of swedes although both parental species occur frequently. The first certain record of swedes was made by Elias Tillandz (1683). Tillandz was a professor in botany, active in Åbo, Finland (then a part of Sweden) and described the local flora and crops.
In the 18th century, swede cultivation expanded rapidly and swedes became a base food in Sweden (Hallgren, 2016). The crop was eventually exported to Great Britain and became an essential part of the agricultural revolution and early crop rotation systems (Harvey, 1949). Also in France, Germany and the Americas were swedes taken up as an important crop at the turn of the 18th century. In Sweden, on the other hand, swedes were to some extent outcompeted by potatoes in the 19th century and partly reduced to a horticultural crop (Figure 2). In the early 20th century swede cultivation again expanded, but then as a fodder crop. After WW2 the demand and cultivation of swedes have constantly decreased.
Plant breeding of swedes occurred in Sweden from the 1880s until the end of the 20th century. Both fodder and vegetable types were bred and both Scottish and German fodder types as well as Swedish landraces were used as parental lines (Osvald, 1959). Although many varieties were released in the first half of the century the number of registered varieties had been reduced to three in the 2000s (Lyhagen, 2016).

In situ conservation of swede landraces

In the 1950s, many farms and gardeners still maintained their own breeds of swedes (Osvald, 1959). It was generally believed that this tradition ceased completely the decades to come, but when a "seed call" was performed within the Swedish programme for diversity of cultivated plants in 2002-2004 surprisingly many locally maintained swede landraces were still found in active cultivation (Nygårds and Leino 2013).
The central area for the extant growing of swede landraces, including their seed multiplication, appears to be between the 60th and 65th parallel since all recent collections have been made here. This region includes the administrative regions of Västerbotten, Ångermanland, Jämtland, Medelpad, Hälsingland and Dalarna, the latter of which proved particularly rich in landraces and/or local cultivars.

Here, maintenance of local cultivars by seed production of farmers and gardeners themselves is still an active tradition (Magnusson, 2019). Nygårds and Leino (2013) speculate that one possible reason for the lack of cultivation further south in Sweden is due to the pest and disease pressure being high as a result of oilseed rape being grown extensively. Another reason could, of course, be that local culinary traditions had developed that safe-guarded continuous cultivation of swedes, with desired properties, in this region. Finally, the capacity of the swede to withstand modest, or even poor, growing conditions may have played a role as a trait for survival when more demanding vegetable crops made their entry in the southern parts of the country.

Collecting, collecting and… collecting

The Nordic Gene Bank - nowadays better known as the Nordic Genetic Resource Centre or NordGen - was established in 1979 as a regional collaborative initiative between the five Nordic countries. NordGen today holds c. 26 400 accessions that are accepted for long-term storage. Of the 117 swede accessions in total, 51 are of Swedish origin and 23 of these are classified as landraces or locally developed cultivars. Altogether 42 accessions are accepted for long-term conservation, while the remaining nine are stored temporarily.

While the majority of the accessions held by the genebank originate from breeders' collections, repeated collecting missions by the genebank curators throughout the years have managed to enrich the Nordic genetic material. The nation-wide "Seed Call" that went on during three years and searched Sweden from north to south yielded at least 15 hitherto unknown landraces of swede (Weibull et al. 2009). This means that the inventory expanded NordGen's collection by almost one third. Prior to that, the Swedish Seed Savers organization Sesam had for many years been conducting pioneering 'detective work' to track and identify heirloom cultivars of a broad range of vegetable crops, including swedes. Sesam has taken on as their main responsibility to produce seed of all maintained cultivars, to be shared among members of the association, and therefore collaborates closely with NordGen.

The observation that such a large number of unknown landraces or local cultivars of swedes were still grown and maintained in Sweden in the early 2000's came, as mentioned, as a surprise to many of us. Being a biennial crop, that flowers and sets seed only the second year following winter storage of the roots, means that maintaining the landrace is labour intensive. Still, the range of anecdotes to accompany the donated accessions revealed very close relationships between the crop and its caretakers, very often over several generations (Nygårds and Leino 2013). While the Seed Call aimed at finding most of what was still grown "out there" in terms of unknown cultivated diversity, we cannot rule out that

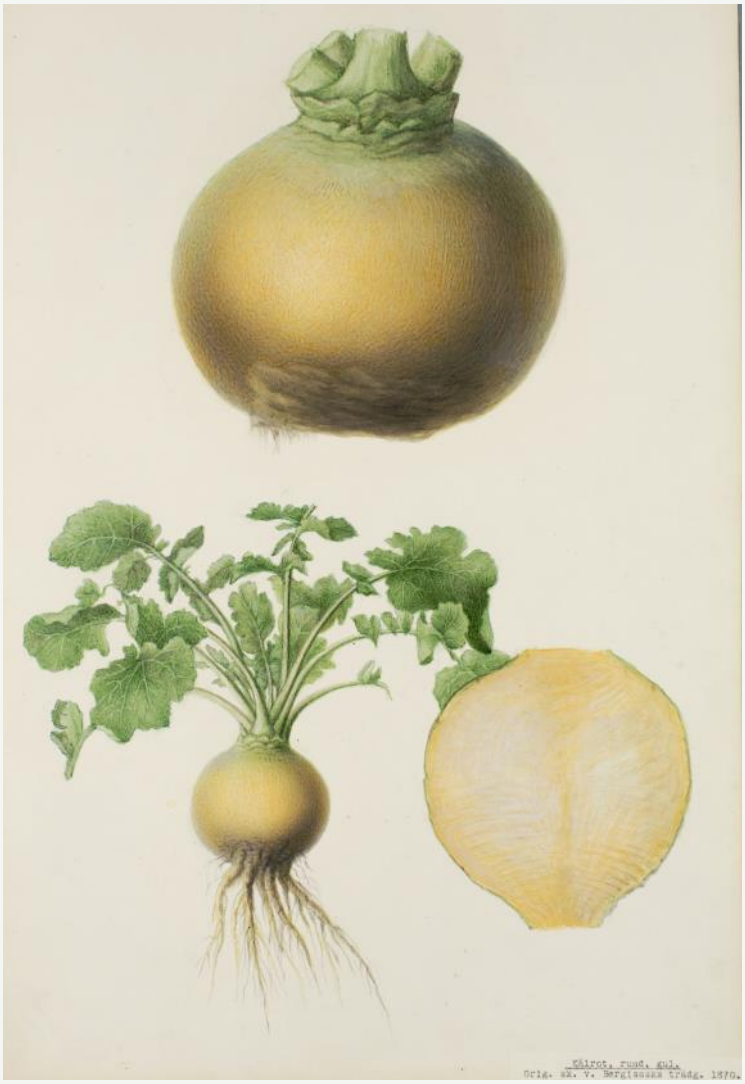

Figure 2. 'Swedish Yellow Swede', is considered as the cultivar being closest to the original swede. Illustration by Henrietta Sjöberg 1870. Photo: Kentaroo Tryman.

there might still exist landraces or local cultivars deserving to be collected. The time left for us to find them is running short, however, since many of the caretakers were elderly people already 15 years ago. Nonetheless, as late as 2018, another previously unknown swede landrace was identified (Magnusson, 2019).

Cultivation trials and tastings

The ambition of Kålrotsakademien - the swedish Academy (founded in 2015) is to show the diversity of the swede concerning shape, colour and eating experience. The efforts have given effect - the best chefs in Sweden ask for cultivar names, and they specify taste and texture properties of swedes. The country's largest producer of swedes has now chosen to grow the conservation variety 'Vintjärn', as a result of market demand. At the Nobel Prize Dinner of 2018, swede was on the plate. The swede's class trip is exceptional! How has this been possible?

"- What nobody knows about, cannot be asked for!" Kålrotsakademien - the swedish Academy took firmly on hold of this statement, and in 2018 all 50 accessions of Swedish origin that were available at NordGen were grown. The cultivation took place in Södermanland (about 150 km south of Stockholm) in light soil in a slight southerly slope. This particular year was characterized by severe drought, and thus frequently watered. The cultivation was covered with insect nets throughout the season (Figure 3). On two occasions characters were registered according to UPOV standards.

Figure 3. Test cultivation of 50 different accessions. Photo: Patrik Arneke.

The different accessions demonstrated a great variation for many characters. An obvious difference was that swedes of fodder type had a much later root development and generally produced larger roots. The susceptibility to mildew also differed markedly between the varieties.

The harvest from the test cultivation formed the basis for the "world's largest" palatability test of swedes at the Rutabaga restaurant, Grand Hôtel, in Stockholm in October the same year (Figure 4). Fifty volunteers tested all accessions and filled in forms for sensory mapping, prepared by researchers at Örebro University. A brief account of the event can be seen on YouTube (https://www.youtube.com/watch?v=ZDZ0AB-bZyA).

The test panel reported a very large, and pronounced, variation in taste, scent and texture. As a result of the sensory mapping, the tested swede accessions could be divided into the following three sensory groups:

a) More woody, bitter and peppery, with a tinge of earth and stable. Less fruity, fresh, sweet, crispy and/or watery;
b) Sweeter, firm, woody and fruity. Less tart, crunchy, peppery and/or bitter;
c) More crisp, watery, fresh and tart. Less spicy, bitter, earthy and/or woody

The most highly rated swede of all was 'Nusnäs', a local cultivar from Dalarna in Central Sweden (Figure 5). To our surprise, many of the fodder swede roots received good sensory grades. We also noted that the variety lowest in rank in terms of palatability was the variety that completely dominates commercial production of swede in Sweden. We can now firmly argue that there are very many good alternatives.

Conservation, seed production and remarketing

Re-establishment of the swede on the market requires both that its value as food is restored and that seed is available. Seed production is perhaps the greatest obstacle. As mentioned earlier, the Swedish swede accessions are long-term preserved at NordGen. Here the accessions are preserved for future food supply and are mainly used for research and plant breeding. But it is also possible to order smaller seed quantities for further propagation. This propagation requires knowledge, space and time. Today, 4-5 000 tonnes of swede is produced commercially in Sweden (Statistiska centralbyrån, 2019). The production for own use is probably negligible. The number of varieties is low. Thus, there is potential for growing more varieties of different qualities since, with greater diversity, demand would be expected to increase, as would GDP (Gross Domestic Product).

Figure 4. Palatability test of 50 different swedes at the Rutabaga restaurant. Photo: Patrik Arneke

Figure 5. 'Nusnäs', a landrace from the province Dalarna, received most top scores at the palatability test. Photo: Patrik Arneke.

While we do not expect that production of these unique varieties would be comparable to the current commercial production of swede, we are certain that a larger assortment of varieties on the seed market could increase interest in home garden cultivation.

Whereas commercial production of swede for sale as a food crop is reasonably straightforward, seed production is more demanding. We know there is an interest, but even if these 'quality' varieties would generate a higher price than bulk seed, seed production is the one major challenge. To satisfy seed demand, a target for seed production could be 500 g-2 000 g seed per variety of between 10-20 varieties. While seed amounts available from the genebank produces 75-150 plants, there is a need to select among these plants to get healthy and good seeds. Each plant is expected to yield 20 g of seeds on average (George, 2009).

This way it should be possible to produce decent amounts of seed already in one generation (i.e. the second year after sowing) (Figure 6).

The difficulties with seed production are, however, several. The first, and most problematic, cumber is to engage growers who are willing to carry out this small-scale craft, yielding only limited amounts of seed. Another problem is that the swede is cross-fertilized and insect-pollinated. Being botanically speaking the same species as rapeseed, seed production in rapeseed districts is excluded. Risk of cross-fertilization also prevents the same grower from growing several varieties at the same time, unless each cultivar can be safely protected from pollinated insects.

Figure 6. Transplanting swedes from last year for seed production. Also rather small seed production plots can produce enough seeds for large scale cultivation. Photo: Linda Wiking.

Finally, due to current seed legislation, marketing requires that varieties are included on an official variety list. For these historical and unique varieties an option is to make use of the exception for so-called conservation varieties. The cost for listing is lower and registration is easier. Nonetheless, a seed grower can always expect some bureaucracy and it also involves restrictions on the amount of seed that can be sold. The new regulation 2016/2031 (EU) on protective measures against pests of plants may also affect the possibilities for small seed producers to make their seed cultivation profitable.

Today, six local Swedish swede cultivars are listed as conservation varieties and another two in preparation for application. Micro-volumes of seed from these have also been marketed. Although the seed prize is several magnitudes higher than for standard commercial varieties, the demand is much higher than availability.

Conclusions

The status of swedes has without doubt risen significantly in recent years and the demand for traditional cultivars, with a cultural and local background, as well as specific sensory characteristics, is now large. We see this renaissance of a diminishing crop as the result of several parallel activities: the documentation and gathering of history and local cultivars, test cultivations, sensory profiling and the development of new cuisine using swedes. We further identify seed production as a critical factor. When the demand rises for local swede cultivars it is essential that seed production keeps pace and can provide seed before the momentum is lost.

Acknowledgements

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‘Seduša’, a rescued grapevine landrace from Fruška gora, Serbia

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The grapevine

Vitis vinifera is the most cultivated fruit tree of the *Vitis* genus, which encompasses about 60 inter-fertile wild species (This et al. 2006; Emanuelli et al. 2013). Although its cultivation focuses predominantly on the production of wine, the production and consumption of table grape (fresh berries) and raisins (dried grape) is common. Its area of production is over 7,464 M ha across the world and the global wine production is around 269 M hL. *Vitis vinifera* has a great diversity in grapevine varieties (8,400 in the world, http://www.oiv.int/en/statistiques/) which consequently show great variability in terms of plant architecture, bunch characteristics (size, shape and colour), relative duration of the reproductive cycle and many other qualitative and quantitative traits. Grapevine is known to adapt well to a wide range of cropping systems and environments such as dry and semi-dry regions; but despite the drought tolerance, grapevine grown under low water conditions presents limitations in development, normal ripening and reduced berry quality. Varieties solely or partially derived from other *Vitis* spp. are grown in other wine regions of the world, namely France, Italy, Spain, United States, Argentina, Australia, South Africa, China, Chile, Germany, Russia, Portugal, Romania, Greece, New Zealand, Hungary, Brazil, among others.

The great majority of grapevine varieties are predominantly self-pollinating, with occasional occurrence of wind-mediated cross-pollination.

The landrace

Seduša is cultivated in northern Serbia, on northern slopes of Fruška gora, a mountain area in the Pannonian Plain, on the steep hillsides of the village Banoštor (within the Srem wine region). Prokopije Bolić in his book ‘Soveršen vinodelac’ (‘Perfect winemaker’, 1816) mentions and describes for the first time the landrace Seduša.

Seduša is a sensitive grape landrace characterized by medium -sized, thin skinned berries (Figure 1). It can accumulate high levels of sugar and usually matures between the third and fourth epoch of maturation. Seduša is generally characterised by high yield, so the key factor that usually affect the quality of wine making, is to severely limit the yield; thus, the yield is limited by removing circa 50-60% of the clusters at the green pruning stage.

The resulting wine is characterised by a light ruby colour, with a lot of earthy and mineral tones, while, at the same time, fruity with clear aromas of currants and cherry plum. The resulting wine is quite high in alcohol content that does not interfere with the balanced aromas.

Figure 1: ‘Seduša’ grapevine landrace. **a:** grape at harvest;; photo: Ivana Sijacki Majorosi **b:** grape, detail; photo: Aleksandar Tabaković, Ministry of agriculture, forestry and water management Belgrade, Serbia.

Seduša is traditionally cultivated in the village of Banoštor (in the municipality of Beocin, South Backa District). Currently, this landrace is cultivated in small vineyards, for a total of a less than 1 hectare. Vineyards are located in the highest part of the municipality, at 125 m a.s.l. However, there is also evidence of its presence in the past in Divoš, a village located circa 20 km south west from Banoštor, within the same region (*i.e.* Srem).

After the phylloxera plague, many old varieties were neglected or abandoned due to the introduction of other internationally recognised varieties, as well as due to the changing of the cultivation system. Seduša was rediscovered in 2009 and a process of characterisation helped its rescue. In fact, a collaboration with Consiglio Nazionale delle Ricerche, Istituto per la Protezione Sostenibile delle Piante (Unit of Grugliasco, Torino, Italy 2009), ended up with a molecular characterisation of the landrace.

Currently, Seduša is only used by a single small winery, cultivated on an area of circa 1 ha. The Province of Vojvodina, through its subsidies, recognised the importance of landraces, so that it provides funds for co-financing the costs of introducing and certifying the system of safety and quality of food and products with geographical designations. In 2019, new potential producers were encouraged through the above-mentioned system of subsidies to start plating Seduša in their vineyards.

Valorisation

Currently, for Seduša wine there is a much higher demand than production. As it is a limited production, about 3000 litres per year, Seduša wine is mainly marketed in the Province of Vojvodina, within the Srem region.

The Serbian 'Ministry of Agriculture, Forestry and Water Management' within the measures of rural development, made two strategic regulations to foster the use of Seduša as well as other landraces:

Rulebook on incentives for production of planting material and certification and clonal selection of fruit trees, vines and hops. This impetus measure is a made for science research institutes, to favour their work in rural areas, abandoned vineyards and fruit yards; this will help rescuing traditional landraces and historical varieties. Their work also covers processing of plant virus sanitations, certification, and promotions. The measures can support actions up to 85 K €.

Rulebook of support for the raising of new plantations of fruit, vines and hops. Even if this measure is made for all varieties it gives extra support to traditional varieties, landraces and historical varieties, especially in rural area. Currently, the measure can provide up to 25 K € per ha.

This landrace and its product have a good value as an authentic product linked with the cultural heritage of the area in which it is cultivated. In 2019, 5 clones of Seduša were registered in National catalogue of agricultural varieties (http://www.sorte.minpolj.gov.rs/sites/default/files/rsprilogom_3.pdf). The standard samples are maintained in Institute for winegrowing, which is held at the Agriculture college in Novi Sad.

Thanks to the above-mentioned measures, there is a great potential to increase the cultivated area and interest of winemakers to meet the increasing market demand. All the activities and the measures put in place to rescue Seduša started a virtuous process that will help the *in situ* maintenance of this landrace.

Acknowledgments

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‘Mascina di Montepulciano’, a purple gem plum typical of the Chiana Valley

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The species

Prunus domestica L. belongs to the *Rosaceae* family and is commonly referred to as ‘European plum’; it is an allopolyploid species (2n=6x=48); it is grown and commercialised worldwide as fresh fruit, prunes, jams, distilling and as processed ingredient. It is thought to have originated from the Caucasus region in West Asia, specifically between the Black Sea and the Caspian Sea (Vavilov, 1930); however, recent discovery of wild *P. domestica* in the Xinjiang province, in northwest China, prompted the hypothesis that European plum may have originated in China (Lin and Shi, 1990). Currently, the origin of the various pomological plum groups remains under debate (Zhebentyayeva et al. 2019).

Plums (intended in a broad sense) constitute the most numerous and diverse group of tree species (Pijipers et al., 1986). Over 6000 varieties of plums, referable to more than 20 species differing in their geographical origin, chromosome number and pedo-climatic demand are currently cultivated or are part of germplasm collections (Blažek, 2007). Among these varieties, most of which are landraces, a wide range of fruit trait variation can be found (*e.g.* fruit size, colour, firmness, texture). The plant morphology is also very variable; in fact, some plants are shrub-like while others tree-like (Blažek, 2007). However, only few *Prunus* species are commercially relevant: *Prunus domestica* L., P. *cerasifera* Ehrh., *P. salicina* Lindl. and hybrids derived from their crosses. Among them *P. domestica* L., is the most important plum species in Europe. This species has been divided into three subspecies: *insititia* (L.) Pir, *italica* Borkh. and *oeconomica* Borkh. Some botanists even consider the subspecies *insititia* as another species (*i.e. P. insititia*). The world annual production of plumes and sloes is about 12 million tonnes (FAOSTAT, 2019). Plums, like most other fruit tree crops, are commonly propagated by grafting onto rootstocks.

The landrace ‘Mascina di Montepulciano’ or ‘Susina scosciamonaca’

Plants of ‘Mascina di Montepulciano’ (*P. domestica* L. subsp. *insititia*) are characterised by weak vigour and compact tree habit. Fruits are typically purple, covered by a thick layer of bloom and are characterised by a yellow flesh (Figure 1); at maturity seeds are well attached to the pulp; fruit shape is typically oblong. Fruits of ‘Mascina di Montepulciano’ are very appreciated for their high content in sugars (sweet) but at the same time by high content of compounds that provide a strong sour taste. Plants appear to be extremely resilient and within the cultivation area are traditionally used to produce ‘wild’ rootstocks for other *P. domestica* varieties.

Figure 1: ‘Mascina di Montepulciano’ fruit (credits: http://www.qualitaesvilupporurale.it/in-evidenza/art000131/la-susina-mascina-nell-elenco-dei-pat-nazionali)).

The harvest is carried out between the end of June and mid-July. Some farmers use mechanical harvester (shakers) while others directly collect fruits from the ground. Collecting fruits directly from the ground (occurrence of fruit over-ripening) allows farmer to produce plum jams without using additional sugars; this way some farmers brought this traditional processing of ‘Mascina di Montepulciano’ to date.

This landrace was cultivated within the Chiana valley (central Italy), especially under the municipalities of Montepulciano, Chiusi and Chianciano Terme (Province of Siena, Italy). Currently, its cultivation is mainly carried out under the municipality of Montepulciano while only few plants can still be found in the areas around, mainly in private gardens or backyards.

Generally, few plants are conserved on-farm. Typically, trees of ‘Mascina di Montepulciano’ can be found within different farms and small private orchards only for family consumption. Within the traditional cultivation area two farmers planted circa 2 ha each using ‘Mascina di Montepulciano’ (Figure 2).

The first orchard was planted circa 35 years ago while the second one in recent years, testifying the interest and the market potential on this landrace has been growing until now.
The traditional multiplication procedure of 'Mascina di Montepulciano' relies on the use of root sprouts (adventitious sprouts) that are separated from the mother plant by cutting a portion of root (sucker division); the root sprouts are used as vegetative propagation material.

Valorisation and Market

In recent years, market of 'Mascina di Montepulciano' grown quickly both locally and nationally. The fresh fruits are characterised by relatively short shelf-life that does not favour their distribution and commercialisation. Thus, fruit of this landrace are mainly processed to produce jams still nowadays.
Currently, 'Mascina di Montepulciano' is recognized as 'Prodotto Agroalimentare Tipico' (PAT, litteraly Typical Food Product) by the Italian Ministry of Agriculture and Forestry, through the technical support of 'Regione Toscana'.

In Italy, the attribution of a PAT is an important step in the recognition of a landrace; in fact it is based on evidence that demonstrate the use of a certain landrace (or a processed foodstuff in other cases) in a certain area for at least 25 years (this must be documented case by case).Currently, the Department of Agricultural Food and Environmental Science of the University of Perugia is carrying out phenotypic and genetic characterisation of the landrace in order to promote its registration to the regional register of landraces and to also to favour additional valorisation and conservation intiatives. However, the provisions set by the Italian Ministry of Agriculture and Forestry and 'Regione Toscana' through the PAT recognition and the interest of various local associations grouping farmers potentially interested in cultivating 'Mascina di Montepulciano' helped increasing the perception of the landrace value and generated a renewed interest; all these activities give hope for the on-farm conservation of this landrace in the next future.

Figure 2: 'Mascina di Montepulciano' orchard in Montepulciano (Siena, Italiy) (courtesy of Mr. Niccolò Terzaroli).

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Landraces Resources

Farmer's Pride network (http://www.farmerspride.eu/)

https://www.birmingham.ac.uk/index.aspx
https://www.froesamlerne.dk/
https://www.nordgen.org/en/
https://www.ipk-gatersleben.de/
https://www.wur.nl/en/wageningen-university.htm
https://www.plantlife.org.uk/uk
https://www.urjc.es/
http://map.seedmap.org/solutions/conservation/on-farm/prospecierara/
http://www.upv.es/index-en.html
https://www.arche-noah.at/
https://www.bioversityinternational.org/
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https://www.gfar.net/organizations/ministry-food-agriculture-and-livestock-general-directorate-agricultural-research-and
https://www.euroseeds.eu/
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https://www.unipg.it/en/
http://www.elgo.gr/index.php/el/
http://www.iniav.pt/

***In situ* conservation networks**

http://www.ecpgr.cgiar.org/working-groups/on-farm-conservation/
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