‘Swedes revisited’: a landrace inventory in Sweden

A brief historic background

Sweden has a long history of research on plant genetics and plant breeding. When crop improvement began at the turn of the last century, the breeders’ raw material consisted of landraces or locally adapted cultivars that were often collected from the nearby farmer’s field. We should envisage the Swedish early 20th century agricultural landscape as a mosaic of crops and cultivars, most of them locally improved and genetically variable, very much like today’s crops in marginal areas were agriculture has not undergone modernisation. Some plant varieties had been introduced from abroad such as Chevalier and Hanna barley, the Squarehead wheat, Golden Tankard and Red Mammoth fodder beets, but most of the crops grown were local selections.

This was before the rediscovery of Mendel’s laws of heritability. The possibilities inherent in recombination, or crossing of genotypes, had not yet been exploited. Breeding meant selecting superior individuals from the mixture present in the landrace, further multiplying it to the stage where the amount of seed was large enough to be sold as a new variety. Now and then a new selection would be made from the released variety and marketed under a new name as a improvement, simply because the rules for uniformity were not as strict as under modern variety legislation.

With the arrival of varieties bred through recombination the traditional landraces gradually lost their importance in Swedish agriculture and by the 1950s they were basically no longer extant in cultivation. Thanks to the visionary work of some breeders, however, many of the original landraces were maintained and saved as both as testimony of the traditional agriculture and as a source of possibly new genetic variation that might be tapped anew. While this was especially true for the larger cereal crops, many other crops such as e.g. the vegetables, were not conserved to the same extent.

When the former Nordic Gene Bank was established in 1979 (NordGen as from 1 Jan 2008) much of the genetic stocks, including traditional landraces, was provided by the breeding community itself. This included, among others, einkorn, emmer, spelt wheat and lentils from the island of Gotland in the Baltic Sea, and oat, rye and barley from many parts of mainland Sweden. A few swede (rutabaga) and turnip cultivars were also provided. Over the years the NGB have made several surveys to find and collect additional landraces, and by the end of the 1990s the collection contained some 300 accessions, including those of potato, *Pisum*, *Phaseolus* and local fruit and berry cultivars.

POM a new step in Swedish PGR work

The programme for the diversity of cultivated plants POM was established as a national commitment in 2000. Through this programme, work on cultivated plants is to be better coordinated and developed. Sweden, together with 187 other countries, has pledged itself to conserve biodiversity by signing the UN’s Convention on Biological Diversity. The country has also signed the FAO Global Plan of Action for the conservation and utilisation of plant genetic resources. POM is seen as a vital instrument for the conservation and utilisation of Sweden’s plant resources in a sensible and sustainable manner.

A priority issue for POM includes a national inventory to be made of our cultivated plants and their relatives. A 10-year strategy has therefore been developed that lays down the priorities and technical details of how the inventory will be carried out. In 2000, small-scale inventories were made on a trial basis of three groups of very popular and well known cultivated plants with the aim of evaluating inventory techniques including introduced early of daffodils and white narcissi (*Narcissus*), roses (*Rosa*) and turnips (*Brassica rapa* ssp. *rapa*). Since then, more comprehensive inventories of other cultivated plants or plant groups have been initiated throughout Sweden. These include fruit and berry crops, perennial ornamentals, ornamental bulb and tuber plants, forage crops, ornamental trees and bushes, vegetatively propagated crops, and cultivated roses. Plant material is currently being collected for evaluation and comparison before final selection for long-term conservation in national collection is made.

The first inventory, however, targeted a very critical group of crops, namely the vegetables. We know from historic documents such as garden literature and seed catalogues that the variety of vegetable cultivars was much larger in the late 1800s and first half of the 20th century. A sudden change seem to have taken place after the 2nd World War, however, when many of the older cultivars disappeared during a few number of years only. Focus of the 'Seed Call' was therefore placed primarily on vegetables, annual ornamentals and fibre plants, and was made as a concluding search for any redundant seed that could possibly be still around in the country. Other seed of interest was of course also welcomed. The call was carried out in collaboration with the NGB and the Swedish seed NGO Sesam.

Methods

We used a wide spectrum of channels to reach the largest possible number of potential growers: media (TV, radio broadcasting, newspapers – both local and national, and garden magazines), exhibitions, relevant organisations (for seed growers, farmers, retirees), the regional organisations for agricultural outreach, the so called 'book buses' (i.e. touring libraries) and many others. The appeal was also advertised at crop demonstration trials set up by various organisations.

Potential seed donors were asked to contact POM, inform about their plant material and provide as much documentation as possible. This could include some of the following:

- were, by whom and how long had it been grown
- was something known of its origin
- was it still being grown
- the name of the cultivar, if available
- the age of the seed
- any information on the seed bag
- some particular traits or characteristics of the cultivar

All seed that was obtained was carefully documented and sent to the NGB for germination tests or seed multiplication, if necessary. Seed samples were also multiplied by Sesam. Although the call was planned to go on during 2003 and 2003 seeds kept coming in also during 2004.

Today all seed are kept under long-storage conditions at NordGen in Alnarp, S Sweden. Material has also been safety duplicated at Svalbard. Some accessions are already freely available from the genebank but some still have to go through additional regeneration cycles before being available for distribution.

The findings

a. Seeds

In total 227 different seed samples came in from all over the country except the northernmost part, Lapland. Apart from these, a large number of unspecified seed collections were sent in, the identity and origin of which was difficult or impossible to conclude. Many of them were of the kind that early 20th school pupils had to prepare as a compulsory topic in botany. Because of the lack of documentation this seed is of little scientific value and in general non-viable. Finally, a number of original seed bags (figure 1) of named cultivars were sent also in. These seed were also generally non-viable but nevertheless represent an interesting reference material for future use.

Viable seeds – or bulbs in the case of *Allium* – came in from 175 accessions representing almost 30 taxa, some of which had not previously been collected by the genebank. These included common marigold (*Calendula officinalis*), sweet william (*Dianthus barbatus*) and rose campion (*Lychnis coronaria*). By far the largest number of seed samples that were sent in were of pea (*Pisum sativum* ssp. *sativum* and ssp. *arvense*), common bean (*Phaseolus vulgaris*) and broad bean (*Vicia faba)*. Altogether 59 new accessions of garden or field pea, 25 common beans and 12 broad beans were obtained. This is not unexpected since these are self-pollinated crops that are easily regenerated. Furthermore, legumes generally have hard seeds that maintain their viability well even under less favourable conditions of storage. Somewhat more unusual crops included melon (*Cucumis melo*), tobacco (*Nicotiana tabacum*), garden orach (*Atriplex hortensis*) and thorn-apple (*Datura stramonium*).

Figure 1. Beautiful old seed bags sent in to the ‘Seed Call’

Interestingly, 22 accessions were biennial root crops that require the laborious storage of roots and replanting the following year in order to give seed. Fifteen swedes (*Brassica napus* var. *napobrassica*), six turnips (*B. rapa* var. *rapa*) and two fodder beets (*Beta vulgaris* var. *alba* and var. *conditiva*) were obtained, proving that still today there are growers that are enough well-informed to be able to manage seed production of such crops. All swede accessions were obtained from the northern half of the country (north of 60°N), indicating that the tradition to grow swedes is strongest in this part of Sweden. While only one turnip was received from central S Sweden the remaining five were also sent in from the north-western part. This may coincide with the fact that turnip growing has always been popular in neighbouring Norway, and that seed exchange historically may have taken place across the border. The growing of swedes and turnips for centuries preceded that of potatoes, which was introduced only in the latter part of the 18th century, which may also explain why these crops crops have maintained their popularity in the mentioned areas.

Altogether 148, or 85%, of the accessions that came to POM through the ‘Seed Call’ can be classified as either landraces, locally adapted cultivars or local populations. This is a surprisingly high figure considering the general belief that Sweden, from a genetic resources perspective, has been considered a ‘poor’ country and possibly devoid of historical plant material. The basis for classify-

ing rests primarily on the source of documentation and to what extent this can be fully substantiated. Many donors provided photographs, receipts, seed orders, diaries and other verifiable documents that helped in this respect. Together with the 'Seed Call' material the NordGen collection of Swedish landraces now counts 568 accessions of 38 taxa.

b. Stories

The conservation of landraces and other redundant plant material is not only a matter of saving seeds or plants, but it is also about saving knowledge and memories. During the 'Seed Call' POM received a wealth of information explaining why this particular pea or swede cultivar had been maintained, perhaps for more than a generation or two. The guiding questions given in the information sent out led many donors to write down their personal reflections and experiences. This information, seldom valued or recognised, represents a central component in the conservation of our green cultural heritage.

Many of those responding to the 'Seed Call' were elderly people and very often retirees. A clear majority of the donors were women (69%) which probably reflects the fact that women often have been responsible for the vegetable garden and, therefore, also for maintaining seed stocks. These bearers of traditions also maintain in silence a rich cultural history, expressed and passed on by their hands. It is an ageing group of people, the knowledge of whose could very well be defined as 'Near threatened' to use a modern terminology. Their work and efforts to sustain our 'green' heritage deserve to be documented and acknowledged.

Genetic analyses of pea

Because of the high number of collected pea cultivars, some of which had been grown for several human generations, we found it interesting to compare their variability with that already occurring in the genebank *Pisum* collection. Over the years cultivar names are obviously lost, and the only reliable method remaining at hand is that of using molecular markers. We decided to look at variation in microsatellite markers and therefore compared 34 genotypes from the 'Seed Call' with 46 others already stored at NordGen. We used 8 primer pairs based on the work by Loridon et al. (2005) and analysed the data using cluster analysis and Nei's diversity index (Nei 1973). Publication of this work is in progress.

A general, and surprising, finding from the analysis was that many of the genotypes obtained through the 'Seed Call' represented new and previously unknown diversity. On the basis of only five primer pairs we could conclude that 21 of the 34 genotypes were new and unique. The remaining 13 genotypes shared markers with either other 'Seed Call' genotypes or accessions already stored at the genebank. The analysis is currently being expanded using more primer pairs.

We find it interesting to conclude that Swedish pea diversity was suddenly greatly enriched through the activities of the 'Seed Call'. We may perhaps never find out the true identity of each of the collected pea cultivars because descriptive documentation about the varieties that were introduced around the turn of last century is scarce or even non-existent. A 'variety' over 100 years ago was most probably not a pure line in the strict sense, thereby allowing for additional (local) selection and improvement. What we see today are possibly the descendants of those cultivars planted in gardens and fields at the end of the 19th century.

Publications

The stories and experiences of generations of growers has nicely been compiled and described by Nygårds (2005) through interviews and much of the available documentation. It is a long-needed and much welcomed recognition of those that, idealistically, have contributed to the conservation of our genetic heritage.

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