

ADAPTATION OF FOREIGN APPLE AND PEAR VARIETIES IN SWEDEN

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Fruit growing has a long tradition in Sweden with indigenous Nordic as well as foreign varieties frequently being grown in private gardens and commercial orchards. In this article we analyse the geographical origins of these varieties. The assortment of apples and pears in the most influential Swedish pomologies was investigated along with that of the national fruit gene bank mandate variety list. Furthermore, we discuss how fruit genetic resources from other countries with different climates have influenced the Swedish pomological heritage. In total we found 358 apple varieties, whereof 45% were Swedish, 44% foreign and 11% of uncertain origin. Of the foreign cultivars 15% were from outside Europe (mainly North America). As for pears, a total of 138 varieties were identified. Among these 17% originated from Sweden, 70% from abroad and 13% were of uncertain origin. Ten percent of the foreign pear varieties were found to be non-European. The main donor countries for apples were England, followed by Germany, Denmark and France. The corresponding countries for pears were France, Belgium, Germany and England. Interestingly, all of these countries are characterized by a warmer climate than Sweden and thus it can be concluded that certain apple and pear genetic resources from more southern latitudes do adapt well to the colder Swedish climate.

Key words: climate adaptation, cultivar, *Malus domestica* Borkh., *Pyrus communis* L., pomology.

Introduction. The progenitors of the cultivated apple (*Malus domestica* Borkh.) and pear (*Pyrus communis* L.) were probably first gathered in Central Asia, where many fruit species have their centres of diversity. According to Fischer (2004), apples have been used as human foodstuff for more than 10 000 years. European cultivation of apples and pears is described in the work of Homer about 800-600 B. C. Both Greeks and Romans knew about vegetative propagation and distinguished between cultivars. An early interest for apples can also be noted on northern latitudes. At Alvastra (central Sweden) remnants of dried apples have been reported from settlements dating back to the Scandinavian middle Neolithic (approx. 3000–2000 B.C.) (Anon., 2007). Most probably these apples originated from wild growing trees of the indigenous species *Malus sylvestris* Mill., which is one of the progenitors of *M. domestica*. Furthermore, apple seeds were found in the excavations of the Norwegian Oseberg ship from the Viking Age (Holmbo, 1921).

Fruit cultivation began in Sweden during the Middle Ages at monasteries, where foreign plant material was introduced by monks (Nilsson, 1986). During the 17th and 18th century fruit growing became popular among the Swedish nobility (Påhlman, 1950), which imported large quantities of apple and pear trees from nurseries in southern Europe. Both named cultivars and seedlings were thus brought to the country. Some of the imports survived and became well known varieties with either their original names or with given local names. Other varieties and tree individuals could not withstand the Scandinavian climate and were sorted out. The majority of the cultivated fruit trees died in the winter of 1709 and those, who survived like 'Snilsäpplet' in Dalarna (central Sweden) were considered extremely hardy.

The first attempt to systematically describe and classify the fruit varieties grown in Sweden was made by Eneroth, who published his pomology in 1866. This was followed by a revised edition in the 1890s (Eneroth and Smirnoff, 1896–1899). The next Swedish pomology to be written was by Dahl, who published his first edition in 1929 and an extended second in 1943. In addition to their writings, both Eneroth and Dahl were engaged in testing and evaluating new foreign varieties under Swedish climatic conditions, a work which was reflected in their books.

In the 1980s a new Swedish pomology was published in two volumes by Nilsson (1986, 1989). By this time the main focus was on genuine Swedish varieties, rather than on imported ones. Since 2003 the interest for old plant material is manifested through the national program for cultivated plants (Programmet för Odlat Mångfald – POM). Today's conservation efforts include Swedish mandate varieties, i.e. varieties of Swedish origin, which either has been named and spread locally or bred and marketed by Swedish plant breeders (Hjalmarsson, 2003). Foreign varieties for which longstanding growing traditions in Sweden can be documented are also included.

The aim of this paper was to carry out analyses of the assortment of apples and pears in Swedish pomology literature and in the Swedish mandate variety list. It documents and highlights the substantial influence of foreign apple and pear genetic resources in Swedish horticulture.

Materials and methods. For our study the following editions of Swedish pomologies were selected: Eneroth 1866 (apples and pears), Dahl 1943 (apples and pears), Nilsson 1986 (apples) and Nilsson 1989 (pears). Eneroth's first edition was chosen because it is the earliest Swedish pomology, while Dahl's second edition was chosen because it is more complete than the first. Nilsson pomology is the most recent and has not been subjected to revision.

With the exceptions mentioned below, all varieties in the studied material were arranged in two tables, one for apples, and one for pears. Furthermore, each variety was checked for synonyms and its country of origin was noted. The complete material includes 358, to our knowledge, unique apple varieties and 138 pear varieties.

In Eneroth's pomology some foreign pear varieties that were recently imported for assessment are mentioned. When it was apparent to us that a variety never came into cultivation it was omitted. Additionally, we decided to omit colour mutants unless they were well known and described separately from the original variety. 'P. J. Bergius', the dark red mutant of the Swedish 19th century apple variety 'Sävstaholm', which was described in detail by Florin and Florin in 1918, is an

example of a mutant fulfilling the criteria for inclusion.

Results. Apples. In total 358 apple varieties were identified (Table 1). On average each variety appeared in the study twice. Of the 358 registered varieties, 45% were indigenous, 44% originated from other countries and 11% had uncertain origin. Fifteen percent of the foreign varieties were from outside Europe (mainly North America). Among European donor countries England, Germany and Denmark were the most important contributing with 43, 36 and 19 varieties respectively, i.e. 63% of the total foreign material.

Table 1. Apples. Origin of Swedish mandate varieties and varieties appearing in the pomology books of Eneroth (1866), Dahl (1943) and Nilsson (1986).

1 lentelė. Obuoliai. Švediškų veislių ir veislių, paminėtų Enerotho (1866 m.), Dahlo (1943 m.) ir Nilssono (1986 m.) pomologijos knygose, kilmė.

| Country of origin Kilmės šalis | No of varieties in Paminėtų veislių skaičius | | | No of Mandate varieties (2003) Švediškų veislių skaičius, 2003 m. | Total no of Iš viso | |
|---|---|--------------------------------------|--|--|------------------------|---------------------------|
| | Eneroth (1866) Enerotho (1866 m.) | Dahl (1943) Dahlo (1943 m.) | Nilsson (1986) Nilssono (1986 m.) | | varieties veislių | observations stebėjimų |
| Sweden Švedija | 28 | 25 | 126 | 144 | 162 | 323 |
| Belgium Belgija | 1 | 1 | 1 | | 1 | 3 |
| Denmark Danija | 5 | 15 | 11 | 5 | 19 | 36 |
| England Anglija | 13 | 36 | 26 | 5 | 43 | 80 |
| France Prancūzija | 10 | 5 | 5 | 3 | 14 | 23 |
| Germany Vokietija | 22 | 17 | 18 | 11 | 36 | 68 |
| North America Šiaurės Amerika | 1 | 11 | 15 | 1 | 20 | 28 |
| Russia Rusija | 4 | 6 | 9 | 8 | 9 | 27 |
| Other foreign countries Kitos užsienio šalys | 5 | 7 | 11 | 5 | 14 | 28 |
| Uncertain Nežinoma | 30 | 14 | 26 | 27 | 40 | 97 |
| Summary Suvestinė | 119 | 137 | 248 | 209 | 358 | 713 |
| % of total Iš viso | 33% | 38% | 69% | 58% | 100% | 199% |
| % Swedish Švediškų | 24 | 18 | 51 | 69 | 45 | |
| % foreign Užsieniškų | 51 | 72 | 39 | 18 | 44 | |
| % uncertain Nežinoma | 25 | 10 | 10 | 13 | 11 | |

Following the time axis represented by the pomologies it can be seen that the total number of listed varieties more than doubled between 1866 and 1986. The

percentage of varieties with uncertain origins declined from 25% in 1866 to 10% thereafter. On the other hand, the percentage of varieties of Swedish origin increased from 24% in 1866 to 51% in 1986. However, a decline was noted in 1943 when indigenous varieties only amounted to 20%. Varieties from North America were almost unknown in 1866, but during the 20th century their influence became comparable to that of Danish varieties. Compared to the pomologies the assortment in the mandate list is somewhat biased towards Swedish varieties.

Pears. The study comprised 138 pear varieties. As can be seen from Table 2, each variety, as for apples, appeared approximately twice in the studied material. Of the 138 varieties 13% had uncertain origin. Seventeen percent originated from Sweden and 70% where from other countries, whereof 10% had non-European background.

Table 2. Pears. Origin of Swedish mandate varieties and varieties appearing in the pomology books of Eneroth (1866), Dahl (1943) and Nilsson (1989).

2 lentelė. Kriaušės. Švediškų veislių ir veislių, paminėtų Enerotho (1866 m.), Dahlo (1943 m.) ir Nilssono (1986 m.) pomologijos knygoje, kilmė.

| Country of origin Kilmės šalis | No of varieties in Paminėtų veislių skaičius | | | No of Mandate varieties (2003) Švediškų veislių skaičius, 2003 m. | Total no of Iš viso | |
|---|---|--------------------------------------|--|--|------------------------|---------------------------|
| | Eneroth (1866) Enerotho (1866 m.) | Dahl (1943) Dahlo (1943 m.) | Nilsson (1986) Nilssono (1986 m.) | | varieties veislių | observations stebėjimų |
| Sweden Švedija | 6 | 4 | 18 | 23 | 23 | 51 |
| Belgium Belgija | 16 | 19 | 15 | 4 | 26 | 54 |
| Denmark Danija | | 2 | 2 | 2 | 2 | 6 |
| England Anglija | 5 | 8 | 5 | 3 | 9 | 21 |
| France Prancūzija | 14 | 29 | 21 | 7 | 37 | 71 |
| Germany Vokietija | 12 | 2 | 9 | 6 | 18 | 29 |
| North America Šiaurės Amerika | 6 | 7 | 5 | 6 | 10 | 24 |
| Russia Rusija | 1 | 5 | 3 | 1 | 5 | 10 |
| Other foreign countries Kitos užsienio šalys | | | | | | |
| Uncertain Nežinoma | 4 | 4 | 5 | 5 | 8 | 18 |
| Summary Suvestinė | 64 | 80 | 83 | 57 | 138 | 284 |
| % of total Iš viso | 46 | 58 | 60 | 41 | 100 | 206 |
| % Swedish Švediškų | 19 | 3 | 11 | 11 | 13 | |
| % foreign Užsienietiškos | 9 | 5 | 22 | 40 | 17 | |
| % uncertain Nežinoma | 72 | 92 | 77 | 49 | 70 | |

Of the latter varieties five came from North America. In addition, three bergamotts were noted as Asian. France and Belgium were the most important donor countries contributing with 37 and 26 varieties respectively, i.e. 65% of the total foreign material.

Following the time axis represented by the pomology books the number of varieties increased from 64 in 1866 to 83 in 1989, that is by 30%. The number of varieties of uncertain origin was substantially higher in 1866 (19%) than in 1943 (3%) and 1986 (11%). Notably the number of varieties with Swedish background was below 10% in 1866 and 1943, a percentage that more than doubled to 22% in 1989. Similarly to apples, American pears were almost unknown in 1866, but in contrast there was no significant influx of varieties during the 20th century. Also for pears, the mandate list is biased towards Swedish varieties.

Discussion. In the pomological literature varieties tend to be described with their history. Our geographical classifications were based on this information. However, the study revealed some difficulties. The fact that the indigenous apple species, *M. sylvestris* Mill., only had a small impact on today's apple gene pool and that all pear genetic material was brought to Sweden from abroad sometimes makes it difficult to define whether a variety is indigenous or not. Most difficulties were noted in 1866 when the highest percentage of varieties with uncertain origins was recorded. In modern times some of these uncertain varieties were in the absence of synonyms eventually classified as Swedish.

Apples. The total number of apple cultivars in the studied material increased between 1866 and 1986. New varieties were brought into cultivation due to continued import, selection of promising seedlings and organized national breeding programs. However, some 40 varieties are found in all of the studied pomologies, among them 50% are obvious imports such as 'Alexander', 'Ananas reinette', 'Baumanns reinette', 'Blenheim Orange', 'Calville blanche d'hiver', 'Charlamovsky', 'Danziger kantapfel', 'Gelber Richard', 'Keswick codlin', 'Mecklenburger köningsapfel', 'Reinette de Damason' and 'Ribston pippin'. Another 25% are classified as genuine Swedish varieties. 'Arvidsäpple', 'Brunnsäpple', 'Kavlås', 'Ringstad', 'Rossvik', 'Stenkyrke' and 'Sävstholm' are included in this category. 'Åkerö', 'Ivö', 'Tornpipping', 'Madam Palm' and 'Salaholmsäpple' are normally classified as local varieties, but are here considered to be foreign.

According to the literature, 'Åkerö' was imported in 1759 as a seedling from the Netherlands to the Åkerö estate (central Sweden), where the mother tree still bears fruits. Until this day 'Åkerö' remains one of the most popular varieties in the Nordic countries. 'Ivö' and 'Tornpipping', widely cultivated in the county of Scania (southern Sweden), are considered synonyms to the American 'Monroe seedling' and the Belgian 'Reinette de Thorn'. Furthermore, 'Madam Palm' seems to be identical to the French 'Pomme de notre Dame' and 'Salaholmsäpple' with the Polish 'Morega polska'.

The high percentage of foreign varieties in Dahl's pomology (1943) can be explained by his extensive import and evaluation work at the Alnarp Institute of Horticulture (southern Sweden). In the early 20th century apples and pears were considered crops for the future and efforts were made to promote their development. Variety testing and national breeding programs were part of this strategy. Ten Swedish bred cultivars resulting from these efforts along with previously unknown Swedish

local varieties identified in an inventory by the Nordic Gene Bank explain the increase of Swedish varieties in Nilsson's pomology (1986).

Studying the origin of the imported material we found that countries with warmer climate than Sweden were main donors, i.e. England, Germany, Denmark and France. The introduction of varieties from Canada and northern U.S.A., where the climate is similar to that of Sweden, was important during the first half of the 20th century. In addition Russia, also situated to the north, made contributions to the Swedish apple assortment. When the national mandate variety list was established in 2003 conservation of indigenous genetic resources was in focus. Thus, the list contains more local varieties than any of the pomology books, but in all fewer varieties than Nilsson (1986). Out of 209 varieties 69% are of Swedish origin.

Pears. The total number of pear cultivars in the study was 138, substantially less than the 358 apple cultivars. This is due to pears being less hardy than apples. Consequently most pear cultivars can only be grown in the southern parts of Sweden and the local varieties are few. Between 1866 and 1989 the increase of varieties was from 60 to 83. In percentage terms this increase was similar to that of apples, and so were the reasons for it. Some 21 varieties were described in all of the pomologies, whereof two were of presumed Swedish origin ('Gränapäron' and 'Hovsta') and the remaining 90% foreign, among them 'Bonne Louise of Jersey', 'Belle lucrative', 'Gansels bergamott', 'Epargne', 'Noiveau poiteau', 'Seckel', 'Windsor', 'Williams' Bon Chrétien' and 'Yat'.

As with apples there are several examples of local names having replaced the original denominations. For instance 'Gråpäron', one of the most common varieties in Sweden, is synonym with 'Föret d'été' (eng. 'Yat'), which was first described in France in 1628. Furthermore, the presumed local variety 'Johantorp', is probably identical to the cultivar 'Jaminette'. Dahl (1943) differs from the two other pomologists by presenting very few varieties with uncertain origin (3%) and a high amount of foreign varieties (92%). These data reflect the pomological research at the time. They also emphasize the fact that the Swedish growing tradition and climate is more oriented towards apples than pears. Naturally, the influence of foreign cultivars in the past was much more pronounced for pears than apples.

Swedish pear breeding efforts have been very limited. A variety, 'Carola', was released in 1983 and two more, 'Fritjof' and 'Ingeborg', in the 1990s. The latter two were the result of a joint Swedish-Norwegian breeding program. Thus the increase of national varieties in the pomology of Nilsson (1986) is primarily due to the finding and describing of unknown and forgotten local cultivars rather than the introduction of new nationally bred varieties. Studying the origin of the imported cultivars it was found that the majority of cultivars, as for apples, came from countries with warmer climate than Sweden. The main donor was France, followed by Belgium. Additionally, Germany and England were important donors. As a percentage of the total number of varieties American (US) pears comprised 6%, half the number of that of apples.

Conclusions. Our review of the Swedish pomological literature and the Swedish mandate list revealed that 358 apple and 138 pear varieties were traditionally grown in Sweden. Even though problems may occasionally arise when trying to define the origin of individual varieties, our results clearly show that several of the historically

most successful varieties originated from geographic areas outside Sweden. In spite of a strong focus on the national heritage of varieties in Nilsson (1986, 1989) the percentage of imports is as high as 49% for apples and 77% for pears. In the Swedish mandate list, which reflects the national pomological heritage, the corresponding figures are 18% and 49%, respectively. Thus, it can be concluded that the foreign influence is strong, and more pronounced among pears than apples. The main donor countries for apples were England, Germany, Denmark and France, and for pears France, Belgium, Germany and England. All of these countries are characterized by warmer climate than Sweden, and thus we can also conclude that certain apple and pear genetic resources from southern latitudes may adapt well to the relatively harsh Swedish climate.

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UŽSIENIETIŠKŲ OBELŲ IR KRIAUŠIŲ VEISLIŲ ADAPTACIJA ŠVEDIJOJE

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Santrauka

Vaismedžių auginimas Švedijoje turi senas tradicijas. Ir vietinės, Šiaurės Europos, ir užsienietiškos veislės dažnai auginamos privačiuose bei komerciniuose soduose. Šiame straipsnyje analizuojama geografinė šių veislių kilmė. Įtakingiausiose švedų pomologijose aprašytos obelų ir kriaušių veislės buvo tirtos kartu su nacionalinio vaismedžių genų banko švediškųjų veislių sąrašu. Be to, aptarta, kaip kitų skirtingo klimato šalių vaismedžių genetiniai išteklių paveikė švedų pomologinį paveldą. Iš viso rastos 358 obelų veislės, iš kurių 45% švediškų, 44% užsienietiškų ir 11% nežinomos kilmės. Iš užsienietiškų veislių 15% – ne europinės kilmės (daugiausia iš Šiaurės Amerikos). Kriaušių veislės identifikuotos 138. Iš jų 17% kilusios iš Švedijos, 70% užsienietiškos ir 13% nežinomos kilmės. 10% užsienietiškų kriaušių veislių kilusios ne iš Europos. Pagrindinės obelų šalys donorės – Anglija, Vokietija, Danija ir Prancūzija. Kriaušių atitinkamai – Prancūzija, Belgija, Vokietija ir Anglija. Įdomu, kad visoms šioms šalims būdingas šiltesnis klimatas nei Švedijai, taigi galima daryti išvadą, kad tam tikri obelų ir kriaušių genetiniai išteklių iš labiau pietinių platumų gerai prisitaiko prie šaltesnio Švedijos klimato.

Reikšminiai žodžiai: *Malus domestica* Borkh., prisitaikymas prie klimato, *Pyrus communis* L., pomologija, veislė.