

CONTENT OF THE SWEDISH BERRY GENE BANK

Inger Hjalmarsson and Björn Wallace

Nordic Gene Bank, PO. Box 41, 230 53 Alnarp, SWEDEN

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A B S T R A C T

Indigenous species of berries, including currants, raspberries and wild strawberries have long been used and grown in Sweden. Varieties have arisen through domestication of wild-growing plants, farmers' selections and modern breeding. There are also many imported varieties which have long been cultivated in Sweden. Taken together, these varieties make up the Swedish berry gene pool. Up until now, care of these varieties has been dispersed among different institutes and private citizens, often with mixed results. In 2001, the Nordic Gene Bank, with support from the national program for plant genetic resources, started to assemble a gene bank of Swedish berry varieties.

The first step was to identify the varieties to be included in the collection, i.e. the identification of so called mandate varieties. This was done mostly by reviewing relevant pomological literature, as well as nursery catalogs, periodicals, and other publications. The largest number of traditional varieties belonged to the genus *Ribes*, followed by *Fragaria* and *Rubus*. The species with the most cultivars were gooseberries, black currants and raspberries. Altogether, 155 varieties have been identified as candidates for the gene bank. About a quarter are of foreign origin, mainly from Great Britain and other Nordic countries. Several of the gooseberry varieties are of English origin. Black currant varieties are mostly indigenous. Domestic hybrids between black currant and gooseberry, cultivated and wild strawberry, and two arctic brambles add extra interest to the Swedish berry assortment.

Key words: variety, gene pool, gene bank, breeding, hybrid

INTRODUCTION

Scandinavia has a wealth of berry genetic resources. Species of *Fragaria*, *Hippophae*, *Ribes*, *Rubus*, *Rosaceae* and *Vaccinium* are indigenous (Hultén 1971), and there is a long tradition of picking wild-growing berries.

Actual berry cultivation was presumably introduced by monks during the Middle Ages (Nilsson, 1958). The first species cultivated were wild strawberries (*Fragaria vesca* L.), red currants (*Ribes rubrum* L.), and raspberries (*Rubus idaeus* L.). The interest for gooseberry (*Ribes uva-crispa* L.) cultivation peaked in the nineteenth century, while strawberry (*Fragaria ananassa* Duch.) and blackcurrant (*Ribes nigrum* L.) cultivation took off in the twentieth century. Recently, lingonberries (*Vaccinium vitis-idaea* L.), sea buckthorn (*Hippophae rhamnoides* L.), and rose hips (*Rosa* species) have been domesticated.

Swedish berry varieties were developed from superior indigenous wild material brought into private gardens over the centuries as well as from imported varieties.

In about 1800, the first cultivar collections were established to aid in testing and further development. Later, collections were established by the governmental horticultural research organization, which was most active in the middle of the twentieth century. Plant hardiness was a primary concern, and was evaluated on experimental farms in different climatic zones. On the basis of its research, this organization recommended varieties to commercial growers and hobbyists. Recently, it has been noticed that several unique varieties are at risk of being lost both because of waning interest in pomological research as well as because berry plants are specifically vulnerable. The aim of our study was to identify varieties as candidates, so called mandate varieties, for inclusion in the proposed Swedish National Berry Gene Bank. Mandate varieties are defined as indigenous varieties which have been either named, bred, propagated or marketed in Sweden. Varieties with a long history of being cultivated in Sweden are also included.

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MATERIAL AND METHODS

Candidate varieties were identified mostly by reviewing relevant pomological literature, as well as nursery catalogues, periodicals, and other publications.

The earliest source we examined was the “Handbook of Swedish Pomology” from 1864-1866. It contains detailed description of varieties assembled by the eminent pomologist O. Eneroth, the founder of Swedish pomological research. The book was revised in 1896-1902 by Alexandra Smirnoff, who added recent data from the Experimental Field of the Royal Swedish Agricultural Academy in Stockholm. Both editions provided useful information for our study.

Horticultural activities at the Academy stagnated at the beginning of the twentieth century, and the work was taken over by the Institute of Horticulture in Alnarp in southern Sweden under the leadership of professor C.G. Dahl. Thanks to his initiative, a governmental research organization for the cultivation of fruit and vegetable crops, called ST (Statens Trädgårdsförsök), was established in Alnarp in 1938. The organization ran several experimental stations. For evaluation of promising berry varieties and crosses 'Öjebyn' in the far north was the most important. In 1963, ST was incorporated into the Royal Swedish Agricultural College, which in turn became a faculty of the Swedish University of Agricultural Sciences (SLU) in 1977. There is no equivalent of ST operating in Sweden today. The ST research reports published at Alnarp from 1938 to 1963 proved very valuable for our study.

Valuable information was also obtained from the annual reports published from 1941 to 1996 by the Balsgård Fruit Breeding Institute near Kristianstad in southern Sweden. In addition information was obtained from lists of varieties published by the Swedish Pomological Society, which operated from 1900 to 1963, and contributed greatly to the development of the fruit industry. The yearbooks of the Swedish Pomological Society also provided useful information, as did textbooks published by Swedish pomologists.

Relevant information was also gleaned from nursery catalogs, periodicals and various other publications.

RESULTS AND DISCUSSIONS

Red and white currants

According to Eneroth and Smirnoff (1902), the oldest and most common red currant variety in Sweden is 'Red Dutch'. Two other important cultivars they mentioned are 'Cherry' and 'Versailler'. The most commonly grown white currant variety is believed to be 'Vita långklasiga' (Nilsson, 1958). 'Red Dutch', 'Cherry', 'Versailler' and 'Vita långklasiga' are all European varieties, but little more can be said for certain about their provenance.

Other candidates include the large-fruited American varieties 'Red Cross' from 1885 and 'Red Lake' from 1933, which have been widely cultivated. Also included is 'Jonkher van Tets', which was developed in the Netherlands and marketed in 1941 (Fischer, 1995).

Also on the list are 'Rödluan' with red berries, and 'Gullan' with yellow berries, which were bred in Alnarp by professor F. Nilsson (Nilsson, 1980). Eight varieties from northern Sweden have also been included, two of which had been bred at 'Öjebyn'. The others are indigenous northern Swedish local varieties.

Finally, we included 'Vit Jätte' (white berries), a new variety developed by a Å. Truedsson, a private breeder.

In all, we identified fourteen red currant varieties and five white currant varieties as candidates for the collection. Eleven (58%) are indigenous to Sweden, of which six are local varieties domesticated from the wild, and five are modern varieties. Of the eight foreign varieties on the list, all are non-Nordic, and five had been introduced in the nineteenth century or earlier.

Black currants

In Sweden, the predominant varieties of black currants grown have traditionally been Dutch and English varieties and local Nordic varieties. From 1900 to 1950, one of the most popular imported varieties grown was 'Boskoop Giant', a Dutch variety from 1890. Another variety that was also widely cultivated at that time was 'Bang up', from England. During World War II, winters were particularly harsh, which prompted a shift away from non-Nordic varieties to 'Brödtorp', a hardy old local variety from Finland (Nilsson, 1958). 'Åström', another local variety from Finland, is also a candidate for the collection.

Black currant clones from northern Scandinavia are especially hardy and well adapted to northern climates. In the 1940s, the experimental station at 'Öjebyn' collected and evaluated local varieties from Norrland. The best varieties were marketed in the 1950s (Nilsson, 1958) and assigned the names of their home villages. The most famous of these was 'Öjebyn', originating from the same village as the experimental station. Other varieties introduced at the same time were 'Erkiheikki', 'Haparanda', 'Sunderbyn' and 'Östersund'. Altogether, twelve local varieties from Norrland are on our list of candidates for the collection. Two other candidates are 'Janslunda' and 'Finnskogens druva', local varieties from central Sweden which have been cultivated since the 1940s and are well appreciated for their hardiness and large berries. Two local varieties of green-fruited black currants are also on the list.

Modern black currant breeding has been carried out in Alnarp and Balsgård. The breeding work at Alnarp resulted in three varieties, 'Stella I', 'Stella II' and 'Stellina', which are all crosses between 'Boskoop Giant' and 'Erkiheikki' selected at 'Öjebyn' primarily for cultivation in northern latitudes (Nilsson, 1966). 'Stella I' and 'Stella II' were introduced in 1967, and 'Stellina' in 1979.

In his breeding program in Balsgård, professor V. Trajkovski used other local Norrland varieties which were hardy and resistant to powdery mildew. He also used the wild form of *Ribes nigrum* L. from Russia as a source of genes for hardiness and resistance to gall mite, and the Canadian variety 'Consort' as a source of genes for hardiness and resistance to rust. The varieties bred by Trajkovski represent a new generation of black currant

varieties with superior resistance, hardiness, yield, and berry size (Trajkovski, 1986; 1992). All of these, 'Storklas', 'Polar' and 'Intercontinental', are candidates for the collection. Similar parentage is also found in 'Triton' and 'Titania', which were marketed in 1980 by the private breeder P. Tamas (Tamas, 1980).

In all, twenty-eight black currant varieties and two green currant varieties were identified as candidates for the collection. Twenty-eight (93%) are Nordic varieties, of which twenty-six are from Sweden, and two are from Finland. Of the Swedish varieties, ten were introduced by professional breeders. The other sixteen are local varieties domesticated from the wild. Both of the Finnish varieties are local varieties. One of the non-Nordic varieties is from the Netherlands, and the other is from England. Both were introduced at the end of the nineteenth century.

Gooseberries

Eneroth and Smirnoff (1902) mention more than one hundred varieties of gooseberry. Nilsson (1958) reports that about two hundred varieties were evaluated in Alnarp in the first half of the twentieth century. The majority of the varieties tested were from England.

At the Experimental Field of the Academy in Stockholm, seedling selection resulted in four varieties, which were introduced at the end of the nineteenth century.

In about 1905, Sweden was hit by the American mildew, prompting professor C.G. Dahl to use mildew resistance as the primary criterion in his breeding program in Alnarp. He used American species as sources of resistance genes to develop two mildew-resistant varieties, 'Scania' and 'Centum' (Nilsson, 1979). Dahl's successor, professor F. Nilsson, also used American species in his breeding program to develop 'Jacob', a mildew-resistant variety that he introduced in 1979 (Nilsson, 1979). Unlike the earlier varieties from Alnarp, 'Jacob' has large berries.

There have also been some important varieties from Finland which are hardy and mildew resistant. One of them, 'Hinnonmäen keltainen', is a candidate for the collection.

The importance of local gooseberry varieties such as 'Svenska tidiga gula' and 'Landströms gröna' peaked about fifty to one hundred years ago, or even earlier. The oldest known local variety is 'Röda syltbär', which has been grown for more than two hundred years. However, some pomologists consider 'Röda syltbär' to be a synonym of the old English variety 'Red Warrington' (Billbäck, 1941).

In all, thirty-one gooseberry varieties were identified as candidates for the gene bank. Twenty (65%) are Nordic, of which nineteen are from Sweden and one is from Finland. Of the Swedish varieties, nine are the result of selection and breeding in Sweden during the past one hundred and twenty five years.

The other ten are local varieties domesticated from the wild. The variety from Finland was developed through breeding.

Of the eleven non-Nordic varieties, nine are from England, one is from Germany, and one is from the United States. All had been introduced in the nineteenth century or earlier.

Raspberries

Among the first raspberry cultivars grown in Sweden were the English variety 'Red Antwerp' from 1817 and the French variety 'Hornet' from 1858 (Eneroth and Smirnoff, 1902). Varieties introduced later include 'Superlative' and 'Lloyd George' from England, 'Marlboro' and 'Golden Queen' from the United States, and 'Schönemann' and 'Preussen' from Germany (Nilsson, 1958).

Another important variety is 'Asker', which had been introduced into Norway under the name 'Falstolff'. However, Norwegian pomologists noticed that the bushes were not typical for 'Falstolff'. It was therefore renamed 'Asker' in honor of the region in Norway where it was most frequently cultivated (Reimer, 1935). 'Maria' and 'Ålandsbro Asker' are Swedish sports of 'Asker' which differ in terms of leaf color and hardiness.

At Alnarp in 1930, Dr. E. Johansson used 'Superlative', 'Marlboro', and the old English variety 'Pyne's Royal' to develop two varieties with large fruits, 'Mitra' and 'Miranda', which he marketed in 1948 (Nilsson 1958). 'Miranda' is very hardy, and was recommended for cultivation in the north along with 'Hornet', 'Marlboro' and 'Asker'. 'Mitra' and 'Miranda' are the only summer-fruiting raspberry varieties which have ever been bred in Sweden.

When raspberry breeding resumed in Balsgård in 1982, the objective was to develop early-cropping autumn varieties that would grow well in northern climates (Sjöstedt and Trajkovski, 1996). Five autumn-cropping varieties were developed in Balsgård from 1996 to 2002.

In all, twenty-three summer-fruiting raspberry varieties were identified as candidates for the collection. Fourteen (61%) are Nordic, of which thirteen are from Sweden, and one, 'Asker', is from Norway. Of the Swedish varieties on the list, two are from Alnarp, two are from the nursery "Herberts hallon" in southern Sweden, five are local improvements of previously described cultivars, and four are local varieties of unknown provenance.

The nine non-Nordic varieties were introduced from England, France, Germany and the United States. Five were introduced in the nineteenth century.

There are also five autumn-bearing varieties on the list.

Strawberries

The oldest strawberry variety which is a candidate for the collection is 'Carolina Superba', an English variety from 1854.

Another old and widely cultivated variety is 'Abundance', whose provenance is uncertain because there are several different varieties with similar names. Eneroth and Smirnoff (1902) reported that 'Abundance' had been grown in Sweden since the 1860s. 'Abundance' grew well in central and northern Sweden and gave rise to different clones such as 'Abundance Wannberg' and 'Abundance Bergsjö'.

There were some important German varieties in the first half of the twentieth century, of which 'Deutsch Evern' from 1902 and 'Königin Luise' from 1905 are on the list of candidates for the collection. Another candidate is 'J.A. Dybdahl', a Danish variety introduced in 1909. Cultivars which were more recently widely grown in Sweden are the Danish varieties 'Ydun' from 1948 and 'Zefyr' from 1965, and the German variety 'Senga Sengana' from 1954.

Swedish strawberry breeding began during the 1920s under the guidance of Dr. E. Johansson at Alnarp, where eight varieties were developed from 1933 to 1955 (Fernqvist, 1972). Parent cultivars used in the breeding program included 'Vicomtesse Héricart de Thury' and 'Späte von Leopoldsville' (Reimer, 1935). Nilsson (1958) recommended five varieties from Alnarp: 'Indra', 'Landia', 'Silva', 'Finn' and 'Julia'. However, their success was short-lived and they were soon replaced by newer varieties. In the 1960s, the breeding program was transferred to Balsgård, where the varieties 'Kristina', 'Felicia', 'Sally', 'Lina' and 'Elin', were developed between 1968 and 1991. 'Elin' is the first and only day-neutral variety developed in Sweden (Karin Trajkovski, 1990).

In all, twenty-four strawberry varieties were identified as candidates for the collection. Nineteen (79%) are Nordic, of which sixteen are from Sweden, and three are from Denmark. The Swedish varieties include the varieties developed in Alnarp and Balsgård, as well as three clones of 'Abundance'.

The five non-Nordic varieties are from Germany and Great Britain. Two of them were introduced in the nineteenth century.

Other berries

The historical Swedish berry breeding programs developed three new hybrid berries, one of which is all-fieldberry (*Rubus arcticus* L. subsp. × *stellarcticus* G. Larsson subsp.), developed between 1953 and 1978 by professor G. Larsson at Öjebyn. This berry is an artificial subgenus derived from two wild growing subgenera, the American arctic raspberry and the Swedish arctic raspberry. After field experiments in various parts of Sweden, two promising clones, 'Anna' and 'Linda', were released in 1980. Two other clones, 'Beata' and 'Sofia', were released in 1982. Finally, 'Valentina' was released in 1985. According to Larsson (1984), all-fieldberry has inherited the best traits of the parents and is far superior to either. For example, all-

fieldberry blossoms more abundantly over a shorter period and has a higher fruit yield than either parent species.

The second hybrid berry is 'Kroma', which was developed by professor F. Nilsson at Alnarp as a result of breeding work with tetraploid hybrids of blackcurrants and gooseberries (Nilsson 1979). 'Kroma' is now more of a curiosity, even though it was considered worth growing in home gardens for juice and jam production when it was released twenty-five years ago.

The third hybrid berry is the product of crosses between the cultivated strawberry and its wild relative, *Fragaria vesca* L. At Balsgård in the 1960s, an intricate breeding program was established with the aim of combining the fine aroma of the wild strawberry with the large and firm fruits of the cultivated strawberry (Karin Trajkovski, 2002). The result was three *vescana* hybrids which were suitable mostly for home gardens. Anne-Lise Koch developed the first hybrid, 'Annelie', which she released in 1975. Subsequently, Karin Trajkovski developed 'Sara', released in 1988, and 'Rebecka', released in 1998. 'Rebecka' is especially interesting because it is day-neutral.

All these hybrid berries deserve long-term preservation and are candidates for the collection, as are some varieties of wild strawberry, blackberry, sea buckthorn, lingonberry, and blueberry.

CONCLUSIONS

A review of the pomological literature from the nineteenth and twentieth centuries revealed that a large number of berry varieties have been grown in Sweden. We identified 127 varieties of traditionally grown berry species such as currants, gooseberries, raspberries, and strawberries, as well as 28 varieties of other berry species corresponding to the definition of a Swedish mandate variety. These 155 varieties are candidates for long-term preservation in the proposed berry gene bank. Of the traditionally grown berry varieties on the list, 67% are from Sweden, 6% are from the other Nordic countries, and 12% are from Great Britain. Of the imported varieties, more are from Great Britain than from any other country. Indigenous varieties are especially well represented among the varieties of *Ribes* grown in Sweden. 53% of the blackcurrant varieties which are candidates for the collection are local selections made by farmers and gardeners, as are 32% of the red currant and gooseberry candidates. Few of the raspberry and strawberry varieties on the list are local varieties. However, imported raspberry and strawberry varieties have given rise to improved varieties and sports which have been propagated and named in Sweden. Of the raspberry and strawberry varieties recommended for inclusion in the collection, 15% are local improved varieties and sports derived from previously imported varieties, and 71% are non-

Nordic varieties which had been introduced in the nineteenth century, or even earlier. It is often difficult to determine when local varieties from Sweden were developed. As for berry varieties produced by horticultural research the four gooseberry varieties released from the Experimental Field of the Royal Swedish Academy in Stockholm in the nineteenth century are the oldest known.

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ZAWARTOŚĆ SZWEDZKIEGO BANKU GENÓW ROŚLIN JAGODOWYCH

Inger Hjalmarsson i Björn Wallace

S T R E S Z C Z E N I E

Szwecja ma długą tradycję uprawy roślin jagodowych, w tym porzeczki, maliny i dzikich form truskawki. Odmiany pozyskano z udomowienia dziko rosnących roślin, w drodze selekcji i z hodowli twórczej. Ponadto wiele odmian przybyło z zagranicy. Wszystkie razem tworzą szwedzką kolekcję banku genów, która jest w różnych instytucjach państwowych i u osób prywatnych. Nie zawsze gwarantuje im to dobre bezpieczeństwo. Projekt utworzenia Nordyckiego Banku Genów, w którym przeważają rośliny jagodowe zebrane głównie w Szwecji, powstał w 2001 roku. Stał się on narodowym programem popierania idei ochrony zasobów genowych. Pierwszy krok został zrobiony. Dokonano identyfikacji odmian, które wraz z opisami włączono do kolekcji. Zrobiono to na bazie dostępnej literatury pomologicznej, publikacji naukowych i katalogów szkółkarskich. Stwierdzono, że najwięcej odmian zachowało się z gatunku *Ribes* – (porzeczka), następnie poziomka-truskawka i jeżyna. Dobrze w kolekcji reprezentowane są takie odmiany gatunków, jak agrest, czarna porzeczka, malina. W sumie 155 taksonów nadawało się do tego, aby je jako rozpoznane formy włączyć do banku genów. Jedna czwarta zbiorów umieszczonych w kolekcji pochodziła z Wielkiej Brytanii i innych krajów skandynawskich. Wiele form agrestu ma angielskie pochodzenie, podczas gdy w czarnej porzeczce przeważają odmiany krajowe. Mieszance czarnej porzeczki i agrestu, szlachetne i dzikie typy truskawek oraz dwie arktyczne jeżyny stanowią grupę cenniejszych obiektów szwedzkiej kolekcji roślin jagodowych.

Słowa kluczowe: odmiany, pula genowa, bank genów, hodowla, mieszaniec