RESULTS OF FRUIT BREEDING IN BALTIC AND NORDIC STATES

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Abstract. *The specific climate of Nordic and Baltic countries allows profitable and sustainable growing of various fruit and berry crops including rare and novel ones, but demands climate adapted cultivars. Fruit breeding in the region is targeted mostly at the local fruit market and has reached notable results in apple, pear, plum, cherry, blackcurrant and other crops. Modern pre-breeding research and breeding methods have been used with good results, first of all marker assisted selection (MAS). At the same time, the high competition from more southern regions has resulted in decrease or zero growth of fruit production in some countries and subsequent closing or temporarily stopping of breeding programs. The situation looks more promising with berry crops, especially these adapted exclusively to Northern climate, like Vaccinium and Rubus species. Novel crops include, first of all, Japanese quince (Chaenomeles japonica) and seabuckthorn (Hippophaë rhamnoides). Significant differences exist between Scandinavia with a long and uninterrupted history of fruit growing and the Baltic countries which started to develop modern fruit production only since 1990ties. Changes in consumer attitudes create increased demand for locally grown and organic fruits, as well as for more variety in cultivars, and hopefully may lead to increase in funding for breeding in future.*

Key words: *climate adaptation, pome fruits, stone fruits, small fruits, new fruit crops.*

INTRODUCTION

Nordic and Baltic countries form a specific area in European fruit growing. The northern border of growing most of fruit crops runs through the region, and the region may further be divided into several zones – southern, favourable for most fruits (Denmark, Lithuania, south of Scandinavia); central, marginal for such fruits as pear or sweet cherry (Latvia, Estonia, Central Scandinavia lowlands, Southern Finland); northern, favourable mostly for berry crops, including ones which would not grow more south, like Arctic bramble *Rubus arcticus.* While the southern part of the region can, with some limitations, use cultivars from large fruit growing countries like Poland or Germany, the rest must rely mostly on their own breeding programs. This review tries to give a brief summary of the present situation and recent results in fruit breeding.

CLIMATE AND SITUATION IN FRUIT GROWING

If compared with other European fruit growing areas, the climate in Nordic and Baltic countries can be characterized by:

- Cool, rather short growth season with active t° sum marginal for some crops e.g. pear;
- Relatively high rainfall and low evaporation (hydrothermic coefficient – HTC);
- Long days in summer (high count of sunshine hours);
- Rather frequent extreme winter temperatures (below – 25...30°C) in most of the region;
- High differences in climate zones even inside a single country;
- In the southern part of region – unstable snow cover and frequent winter thaws;
- In the northern part – high and stable snow cover.

This climate allows profitable and sustainable growing of various fruit and berry crops including rare and novel ones, but demands climate adapted cultivars and careful choice of growing zones. As all fruit crops are perennial, the negative effect of stress on plant health tends to accumulate. Winter hardiness, including resistance both to extreme temperatures and to temperature fluctuations, is the main limiting factor. Length of the growth season also is limiting and does not allow to use very late ripening cultivars. Day length is mostly important in strawberry growing as their flower bud formation directly depends on it.

Resistance to fungal diseases in conditions of relatively high moisture has allways been important in the region. Winter injury, too, increases susceptibility to infection. Climate change has negative effect on plant health, and some plant diseases and pests have moved more north, like fire blight *(Erwinia amylovora)* and sharka virus (PPV). On the other side, the local climate allows a reduced number of pesticide sprayings.

The whole region gives just a minor part of total European fruit production, e.g. 140 000 t apple as compared to 10 mill.t in EU 28 and 2.5 mill. t in Poland alone (FAOSTAT). The high competition from more southern regions has resulted in decrease or zero growth of commercial production in some countries. The situation looks more promising with berry crops, especially these adapted exclusively to Northern climate, like *Vaccinium* and *Rubus* species, and new crops e.g. Japanese quince and seabuckthorn. Areas of these crops are increasing. It may be supposed that the future focus of breeding, too, may change to these species.
At the same time, local fruits and berries are produced in amounts that do not meet consumer demand. There is also a tendecy to return to a higher diversity in cultivars, and increased consumer interest in fruits grown close to home and organic production. Improved storage technologies may mean that genetically late maturing of a cultivar is no more that important.

BREEDING PROGRAMS AND RESULTS OF BREEDING

Fruit breeding programs in most of the region almost entirely depend on state funding, although there are some succesful private breeders. Unsufficient funding may be explained both by the necessary longterm investment, as well as the relatively low scale of local fruit production in general, in which home gardens still play a significant role, and by competition from other regions. Growing local and export markets for some soft fruits and new crops, and new storage technologies can change the situation. Changes in consumer attitudes mean that breeding of disease resistant and climate adapted tree fruits also should be continued.
National fruit breeding programs at present exist in all countries, except Denmark, although the scale differs. Balsgard, Swedish Agricultural University (SLU) is closing or freezing a significant part of breeding programs at present. In Finland fruit breeding is in the competency of MTT (Agrifood Research Finland), while in Norway – Graminor AS. In Baltic countries the programs are carried out by Polli Horticultural Research Centre (Polli HRC) at Estonian University of Life Sciences, Lithuanian Institute of Horticulture (LIH) and Latvia State Institute of Fruit-Growing (LSIFG), although in Latvia breeding is done also by the private Pure Horticulture Research Centre (Pure HRC) and some other private breeders (consolidation is planned in 2015). Common breeding projects have been active among Nordic and Baltic countries.
The breeding and pre-breeding in Nordic and Baltic States has included marker assisted selection (MAS) mostly for disease resistance in apple [1],[6],[15], sweet cherry S-alleles [14],[22], fruit flesh quality [16],[17]. Marker assisted screening of genetic resources (pre-breeding) has been carried out in most countries.
Complex traits for which almost no markers exist include climate adaptation e.g. winterhardiness. In Nordic and Baltic countries this is a breeding priority, achieved by traditional longterm breeding and using the potential of well-adapted local cultivars. Molecular mechanisms and potential markers for strawberry cold hardiness are studied at Graminor in the framework of a joint project [12].

Apple *(Malus)*

Apple is the most widely grown fruit crop, including local cultivars from controlled breeding like 'Aroma' (Sweden) in Scandinavia and 'Auksis'(Lithuania) in Baltic states, both registered in 1970ties. There certainly is a field for improvement, joining fruit quality and storage potential with complex resistance (using MAS) and climate adaptation. Other targets are improved firmness, texture and biochemic content; easily manageable tree. Most breeding programmes in the region have included two valuable scab resistance donors, formerly obtained in Sweden – BM41497 (gene Vf or Rvi6) and SR0523 (gene Vm or Rvi5) [1],[6].
At SLU-Balsgard the breding program (till 2013) used significant genetic research and MAS [15]-[17], including allergenes. The latest developments are scab resistant cultivars 'Frida'® (club variety), 'Fredrik' and variety candidates 'Augusta', 'Fanny', 'Folke', 'Lovisa', 'Sofia', polygenic resistant 'Agnes', 'Trulsa'.
In Norway apple breeding program started in 1980ties, targeted for early ripening and low susceptibility to scab. The newest cultivars are 'Eir', 'Idunn', 'Nanna' and 'Siv' [20].
Finland is the northernmost country growing apples. The apple breeding program (till 2003) has given a number of cultivars, which are early ripening, have high winter-hardiness, but medium scab tolerance. The latest cultivars are 'Tobias' (suitable for storage), 'Jättimelba', 'Petteri', 'Talvikki', 'Talvikaneli'. Breeding of rootstocks resulted in obtaining a series from MTT1 (very dwarfing) to MTT5 (medium vigour).
In Estonia many new cultivars have beed created at Polli HRC. The combine good disease tolerance with good flavour, mostly sweet. The most promising seem to be 'Liivika' and 'Krista'. Some have storage potential –

'Aule', 'Katre', 'Kersti'. Scab resistant hybrids are in trial – 'Kelin', 'Kikeriki', 'Virve' etc. Of new crabapple cultivars the best is 'Kuku' [8]. Some rootstock breeding also has been done.

In Latvia the controlled breeding started at „Iedzeni" in 1940ties was continued by LSIFG and Pure HRC, taking over large hybrid material in 1990ties; 25 apple cultivars have been released since 2002 [9]. The most interesting are – early ripening 'Roberts' (Vf) and 'Agra'; midseason – 'Dace' (Vf), 'Gita' (Vf), 'Eksotika', 'Joko'; late – 'Pure Ametist', 'Laila'; very late - 'Monta' (Vf); columnar – 'Inese' (Vf), 'Baiba', 'Zane'. Scab resistant (Vf) 'Edite'and 'Ligita' have been registered also in Belgium, 'Joko' – in South Africa by „Color" Ltd., breeding partner of Pure HRC. Some breeding is done for red-leaved, columnar and cider apples.

In Lithuania breeding of disease resistant apples recently has has resulted in cultivars 'Aldas', 'Skaistis', 'Rudenis' (all Vf). Breeding continues with donors of scab resistance, using MAS [1].

Pear *(Pyrus)*

Winter hardiness is the main limiting factor for growing pear in the region, along with the ability to develop good flavour after cool summers, and better storage. The lack of suitable cultivars means that pear areas in the region are small, the biggest – in Denmark and Norway.

Norway has the best breeding results for fruit quality, although not for winter-hardiness. The breeding program in cooperation with Sweden (1983-2000) still brings forward new cultivars and variety candidates. These include 'Ingrid' (early), 'Kristina' (scab tolerant), 'Celina' (blushed), the last in most promising in commercial trials [5]. Promising hybrid is NP10130, in Latvia – NP2870 and NP61.

Pear breeding at SLU-Balsgard is not continued at present, but BP8965 and 10529 have showed good results in Latvia and hopefully will be registered as cultivars.

In Lithuania a number cultivars have been registered from the breeding material obtained earlier, including 2 since 2010 – 'Liepona' and Gaisra'. Of previously registered cultivars 'Lukna' (midseason) is considered promising for commercial plantations [13].

In Latvia targeted crosses were done since 1973 by R.Dumbravs. 'Suvenirs' is among the most widely planted pears in Latvia, but lacks storage potential [3]. Newer cultivars with better storage potential are 'Balva' and 'Selija'. At present breeding is continued at Pure HRC in a joint project with „Color" Ltd.

In Estonia pear breeding is done on a smaller scale, the main target being winter-hardiness. Newer cultivars are 'Kadi' (dark red), 'Polli Punane' (redflesh). Unluckily, none of them is large-fruited [8].

Japanese quince *(Chaenomeles japonica)*

Japanese quince, rich in aroma and vitamin C, was first grown as a fruit crop in 1970ties in Latvia. In 1990ties controlled breeding started. In cooperation between LSIFG, SLU-Balsgard and LIH, the first in the world cultivars for fruit production were released – 'Darius', 'Rondo' and 'Rasa' [9], with improved fruit quality and production characteristics.

Rowan, mountan ash *(Sorbus*)

This species has quite good market potential in Latvia, and there are about 4-5 ha of commercial plantations, mostly Russian cultivars. At Pure HRC in 1993 inter-generic hybridization was started with pear (*Pyrus domestica*) and hawthorn (*Crataegus submollis),* and 2 hybrids are pending for registration. Breeding continues in cooperation with partners in South Africa, Germany, Czechia, Canada.

Domestic plum *(Prunus domestica)*

Domestic plums have long been grown in the region, but the occurring climate change has put new stress on tree health and regular production. The plum pox virus (sharka) occurence is the region has become dangerous. Climate adaptation, disease resistance, self fertility and fruit size are the main breeding goals; breeding is done mostly for dessert fruits with different time of ripening. At present there are a few state funded breeding programs. Breding program in Norway was interrupted in 1997 because of sharka virus destroying most of the material, and renewed in 2001; it yet has no registered cultivars. In Lithuania breeding at present is done in cooperation with Graminor AS, Norway.

In Baltic countries a plum breeding program continues at Polli HRC. Many winterhardy cultivars have been released and are grown commercially. The newest selections are 'Villu', 'Reeta', 'Kaidi' [8].

In Latvia 4 cultivars with large dessert fruits have been obtained in cooperation with Swedish partners – early ripening 'Ance' (yellow), midseason 'Adelyn' (yellow with blush) and 'Sonora' (purple, self-fertile), late 'Lotte' (blue, sweet, lower winter-hardiness). All have good market quality and storage potential [9].

Sweet cherry *(Prunus avium)*

Breeding of sweet cherries in the region is targeted, first of all, at improving winter hardiness and fruit quality (size, firmness, resistance to cracking), obtaining self-fertile cultivars and compact tree. At present breeding programs are active in Baltic countries.

In Estonia, Polli, the sweet cherry breeding program continues since 1945 and has resulted in numerous winterhardy cultivars [8]. Cultivars 'Anu', 'Arthur', 'Elle', 'Karmel', 'Kaspar', 'Madissoni Roosa', 'Meelika', 'Mupi', 'Norri' and 'Polli Murel' are recommended for commercial growing [11]. Most have relatively small and soft fruits; a few are above 5 g – 'Anu', 'Irma', 'Mupi', 'Polli Murel'.

In Latvia the program was started in at "Iedzeni" and continued in 1990ties at LSIFG. The first registered cultivars of LSIFG were 'Aija', 'Indra' and 'Janis' selected from open-pollinated seedlings of the local population. New large-fruited cultivars are 'Paula' (yellow) and 'Artis' (dark red). Recently self-fertility and compact tree donors have been included in crosses [9]. Cultivar 'Ugis' was named at Pure HRC in 2013.

In Lithuania the breeding program started in 1965, and 9 cultivars were released till 1996. Of these 'Vytenu Geltonoji', 'Jurgita', 'Auste' and 'Vasare' are recommended for commercial growing in Lithuania, 'Vytenu Juodoji' is planted in Latvia. The newest releases are 'Gema', 'Irema', 'Luke' in 2012.

Sour cherry (*Prunus cerasus)*

Sour cherry breeding is done on a very small scale. The main reason is massive drop of growing areas, because widespread diseases – leaf spot (*Blumeriella jaapii*) and brown rot (*Monilinia laxa*) are dramatically reducing productivity and tree survival. In Lithuania 'Vytenu Žvaigžde' and 'Note' were released before 2001. M. Jensen at Aarhus University, Denmark at present is working on developing methods of resistance evaluation in sour cherry (http://dca.au.dk), including hybrid evaluation.

Apricot *(Prunus armeniaca)*

Apricot is a marginal crop in the region, but breeding with significant results has been performed in Latvia. Two breeders started this process in 1950ties – P.Upītis in Dobele and V.Vārna at Botanical Gardens, University of Latvia, using material from Caucasus, Central Asia mountain areas and the northern frontier of apricot cultivation in Europe. The problems to be solved are short dormancy, susceptibility to spring frosts and temperature fluctuations in winter, susceptibility to fungal diseases and self-sterility. In 1999 first apricot cultivars were registered in Latvia (LSIFG) – 'Daiga', 'Lasma' and 'Velta' [10]. In 2004 'Jausma' and 'Rasa' from the Botanical Gardens were registered. Promising hybrids have been selected also at Pure HRC.

Peach *(Prunus persica)*

Breeding of peach was done by V.Vārna at Botanical Gardens, University of Latvia. Only the 4th generation was suitable for growing in open field [10]. In 2004 two cultivars were registered – 'Maira' (most hardy) and 'Viktors'. At present peach breeding is not continued, but 2 elite seedlings have been selected at Pure HRC. Of these `Venita` shows better hardiness than 'Maira'.

Strawberry *(Fragaria x ananassa)*

Strawberry is among the most widely grown crops in the region, but the breeding programs are not impressive. The main reason is the high adaptation abilities of most strawberry cultivars; the best are grown worldwide. Yet winter-hardiness is essential, especially in regions with unstable snow cover, and is one of the main breding targets in the region. Another problem is adaptation to the long day. Breeding for disease resistance is also done, especially mildew.

Mildew resistant cultivars with good fruit quality 'Suvetar','Valotar', 'Kaunotar' and ''Luvetar' have been released by MTT, Finland, and hybrids with everbearing cultivars have been selected [4]. In Norway mildew resistant cultivars 'Gudleif', 'Iris'and 'Blink' were released in 2007 [23]. A few winterhardy, productive cultivars have been relatively recently released in Baltic countries – 'Suitene' in Latvia by Pure HRC, 'Dange' and 'Saulene' in Lithuania.

Raspberry *(Rubus idaeus)*

The aims of raspbery breeding are regular high productivity and improved fruit quality, combining of cold hardiness with tolerance to fluctuating temperatures common in the Baltic sea region, with good disease resistance. The biggest raspberry breeding programs now exist in Norway, Latvia and Estonia**.** Breeding of primocane cultivars was done previously in Sweden.

The Latvian program at LSIFG has included also large fruit gene L1 donors from Russia. Cultivars 'Ina', 'Lina', 'Liene', 'Viktorija' have been released; the first has the highest market potential. The main problem at present is resistance to bushy dwarf virus; marker assited breeding has started [9].
In Estonia, cultivars 'Aita'and 'Alvi' were released in 2008, hardy, productive and with good quality [8].
In Norway the longterm breeding program is targeted at quality, productivity and disease resistance; some promising hybrids have been selected.

Arctic bramble *(Rubus arcticus)*
The southern border of *R.arcticus* in wild reaches Estonia. It is a species adapted exceptionally to cool or subarctic climate and thus the speciality of Northern Europe. Some commercial plantations have been established. Breeding was started in 1970ties, cultivars include 'Anna', 'Beata' (Sweden), `Astra`, `Aura`, `Pima`, 'Mespi', 'Susanna' (Finland) [24].

Blackcurrant *(Ribes nigrum)*
Blackcurrant is one of economically most important berry crops in Northern Europe, a valuable source of vitamin C and anthocyanins, rich in aromatic components. There are two directions of breeding – berries for dessert and for processing (and mechanical harvest). The main problems are suceptibility to diseases, especially mildew (*Sphaerotheca mors-uvae*) and gall mite (*Cecidophyopsis sp.*), which is a carrier of blackcurrant reversion virus (BVR). Susceptibility to spring frosts because of early bud break also is included in breeding programs. Interspecies hybridization and marker assisted breeding have been used in Latvia and Lithuania. In 2007-2011 *Ribesco* project helped to analyse blackcurrant genetic resources in Europe, providing valuable data for breeding programs.
Cultivar – 'Karina' was released in 2012 from a common breeding project of Latvia, Sweden and Lithuania.
In Latvia cultivar 'Mara Eglite' was registered in 2004 by National Botanical Gardens (program closed). It is large-fruited, late ripening and highly productive, even when infected by gall mite to which it is susceptible.
In Lithuania, blackcurrant breeding has resulted in a number of cultivars suitable both for processing and dessert – 'Almiai' (highly productive), Joniniai' (early), 'Gagatai' and 'Kriviai' (high quality), 'Vakariai' (resistant to gall mite) [21]. Recently released are 'Dailiai', 'Gojai', 'Salviai', 'Senjorai', 'Svajai'.
In Estonia the newest cultivars are 'Ats' (spring frost resistant), 'Almo' (long racemes), 'Elo' (early), 'Karri' (both dessert and processing). They all are disease resitant and have large fruits [8].
In Finland, 2 blackcurrant cultivars 'Marski'and 'Mikael' have been released recently, as well as 2 green-fruited cultivars 'Venny' and 'Vilma' with high vitamin C content [7].

Red and white currant *(Ribes rubrum)*
Breeding of red and white currants is done in Finland. Intense red 'Punahilkka' [7] and white 'Lepaan Valkea' and 'Piikiön Helmi' are recent releases.

Gooseberry *(Ribes grossularia)*
There are no active breeding programs. In Latvia, a few gooseberries were selected from a closed breeding program; thornless cultivar 'Rita' (dark red, late) was released in 2011.

Blueberry *(Vaccinium spp.)*
Blueberry areas in the region expand, but in its northern part climate adaptation of American highbush cultivars is not sufficient. The Finnish cultivars 'Arto', 'Aino' and 'Alvar' were obtained in hybridization with *V.uliginosum* and/or *V.angustifolum* [7]; newer crosses are 'Jorma', 'Saani', 'Siro', 'Sine'. In Sweden 'Putte', 'Emil', in Lithuania 'Danute', 'Freda' are *V. corymbosum* × *V. angustifolium*. At National Botanical Gardens, Latvia, 2 *V.ashei* cultivars have been registered – 'Lielogu', 'Salaspils Izturīgā', as well as *V.corymbosum* cultivar 'Agrīnais Kovills' [19].

Cranberry *(Vaccinium macrocarpon, V.oxycoccos)*
Cranberry is a typically northern crop, yet the commercial growing zone of American cranberry (*V.macrocarpon*) lies more south than the area of the local bog cranberry (*V.oxycoccos*). In areas suitable for American cranberrry, cultivars from the USA are most widespread, but some breeding also has taken place. The main tasks of breeding are earlier ripening, uniform size and intensive colour, productivity, disease resistance. In Latvia *V.macrocarpon* cultivars obtained at NBG have been just registered – 'Kalnciema Agrā', 'Kalnciema Tumšā', 'Kalnciema Ražīgā', 'Septembra'.

All cultivars of bog cranberry have been selected from wild populations. In Estonia at Nigula Nature Reserve H. and J.Vilbaste have selected and in 1996 registered 6 cultivars: 'Kuresoo', 'Maima', 'Nigula', 'Soontagana', 'Tartu', 'Virussaare' [11]. In Lithuania, Kaunas Botanical Gardens, 5 clones have been selected – 'Amalva', 'Žuvinta', 'Vaiva', 'Vita' and 'Reda'.

Lingonberry *(Vaccinium vitis-idaea)*

Lingonberry is mostly harvested in wild, but commercial plantations also exist. At SLU Balsgard cultivars 'Sanna' and 'Susi' were developed some time ago. In Latvia breeding was done at NBG, resulting in cultivars `Salaspils Ražīgā`, `Jūlija` and `Rubīna Lāse`, released after 2010.

Cranberry-lingonberry hybrids

In Latvia, NBG intespecific hybrids between *Vaccinium macrocarpon* x *Vaccinium vitis-idaea* have been obtained by A.Ripa – 'Dižbrūklene', 'Salaspils Agrā' and 'Tīna'. These are first such cultivars worldwide, with fruits resembling cranberry, but plant more compact and upright [19].

Seabuckthorn *(Hippophaë rhamnoides)*

Seabuckthorn is one of the fastest expanding fruit crops in and Northern Europe, although recently a newly arrived pest *Rhagoletis batava* has put it at risk. The main breeding tasks are: fruit quality (size, firmness, stalk length, biochemic content), suitability to mechanical harvesting, reduced thorniness, productivity, disease resistance, climate adaptation (from *H.rhamnoides ssp.rhamnoides*). Study of molecular markers was started in Sweden [2]. In Latvia breeding is done privately by A.Brūvelis and K.Blūms, who have obtained cultivars 'Marija', 'Tatjana' and 'Lord' (pollinator) [9].The first registered cultivars in Finland are 'Terhi' and 'Tytti', obtained by X-ray radiation of seeds [7].

Grape *(Vitis)*

Growing of grapes in Nordic and Baltic states is gradually becoming commercial, in which breeding of winterhardy and early ripening cultivars has played a crucial role.

In Latvia the first succesful cultivars were obtained by P.Sukatnieks, using crosses between *Vitis vinifera* and winterhardy *V. labrusca*, *V.amurensis*. His cultivars 'Guna', 'Sukribe', 'Supaga', 'Zilga' have been widely planted. Yet they increasingly suffer from downy mildew (*Plasmopara viticola*) and lose popularity.

At present the most successful breeder in Latvia is G.Vēsmiņš (LSIFG) [9]. Starting with *V.vinifera*, he later included in crosses also a very early *V.amurensis* mutant and a *V.vinifera* x *V.riparia* elite hybrid. His breeding aims are: short growth season (90-110 days) and early shoot maturing; berry quality equal to dessert *V.vinifera* cultivars; cold tolerance (– 23º...– 25ºC); resistance to mildew and other diseases. His cultivars are 'Dovga', 'Liepājas Dzintars', 'Liepājas Agrā', 'Cīravas Agrā', 'Silva'.

Good results in grape breeding have been achieved in Lithuania till 1990ties, but not later.

Kolomikta kiwi (*Actinidia kolomikta*)

A.kolomikta is ar hardy kiwi species with small and soft fruits, unsuitable for long storage, but with very high vitamin C content. Breeding at Kaunas Botanical gardens, Lithuania has resulted in 4 registered cultivars 'Laiba', 'Lanke', 'Lande' and 'Paukštes Šakarva' [18].

CONCLUSIONS

Fruit breeding in Nordic and Baltic countries is targeted mostly at the local fruit growers and has reached notable results in apple, pear, plum, sweet cherry and even grape breeding. Good results have been achieved also in breeding of small fruit – mostly blackcurrant, *Vaccinium* and raspberry. Novel crops include, first of all, Japanese quince and seabuckthorn, as well as *Rubus arcticus* (Arctic bramble). At the same time, fruit breeding in the region experiences difficulties due to reduced public funding, and there is a tendency to close or freeze breeding programs. Still, present changes in consumer attitudes may result in increased demand for fruits and berries grown close at home, which in turn would create need for breeding of suitable cultivars.

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