



## NJF Seminar 426

**„Vaccinium ssp. and less known  
small fruit: challenges and risks“**  
- International Scientific Confernce

**Jelgava, Latvia, 6-8 October 2009**



**LATVIJAS LAUKSAIMNIECĪBAS UNIVERSITĀTE**  
**LAUKSAIMNIECĪBAS FAKULTĀTE**  
LATVIA UNIVERSITY OF AGRICULTURE  
FACULTY OF AGRICULTURE

**LATVIJAS LAUKSAIMNIECĪBAS UN MEŽA ZINĀTŅU AKADĒMIJA**  
LATVIAN ACADEMY OF AGRICULTURAL AND FORESTRY SCIENCES

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**VACCINIUM SSP. AND LESS KNOWN SMALL  
FRUIT: CHALLENGES AND RISKS**

**BOOK OF ABSTRACT**  
**AND**  
**PROGRAMME**

JELGAVA 2009



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## CONFERENCE PROGRAMME

### Tuesday, October 6

18:00 – 20:00 | Welcome reception

### Wednesday, October 7

**08:30 – 09:30** | **Registration of participants**  
Main building of LLU, Jelgava palace, Liela iela 2, LLU Hall

**09:30 - 09:45** | **Opening of conference** LLU Hall

Conference session 1. “**Genetic resources, domestication, breeding and cultivar evaluation**”

Conference session 2. “**Pests, diseases, herbs, and their control**”

Chairman: Kaspars Kampuss and Jim Hancock

09:45 – 10:15 | **Key Lecture. Jim Hancock** Highbush Blueberry Breeding

10:15 – 10:30 | **Frantisek Paprstein, Jarmila Ludvikova and Jiri Sedlak** Germplasm collections of cultivated *Vaccinium* genetic resources in Czech Republic

10:30 – 10:45 | **Eivind Uleberg, Gunnlaug Røthe, Inger Martinussen** Cloudberry breeding in Norway

10:45 – 11:00 | **Taimi Paal, Marge Starast and Kadri Karp** Breeding of half-high blueberry varieties in Estonia

11:00 – 11:30 | Conference photo, discussion and coffee break

11:45 – 12:00 | **Stanislaw Pluta and Edward Żurawicz** Recent situation and perspectives of the cultivation and breeding of high-bush blueberry (*Vaccinium corymbosum* L.) in Poland

12:00 – 12:15 | **Judita Žukauskienė, Algimantas Paulauskas, Remigijus Daubaras, Laima Česonienė** *Vaccinium oxycoccus* Morphology and RAPD Marker Characterizations

12:15 – 12:30 | **Alena Gajdošova, Gabriela Libiakova, Maria Gabriela Ostrolucka, Djurdjina Ružić** Elaboration of efficient regeneration protocol for genetic transformation of selected small fruit species

12:30 – 12:45 | **Liga Vilka, Regina Rancane, Maija Eihe** Fungal diseases of *Vaccinium macrocarpon* in Latvia

12:45 – 13:00 | **Liga Vilka, Regina Rancane, Maija Eihe** Storage rots of *Vaccinium macrocarpon* spread and development in Latvia

**13:00 – 14:00** | **Lunch**

Conference session 3. “**Fruit quality, biochemical composition, nutritional value, postharvest and processing**”

Chairman: Laura Jaakola

14:00 – 14:30 | **Key Lecture. Solvita Kampuse** Fruit biochemical composition, nutritional value, postharvest and processing in *Vaccinium* L. genus and selected minor fruits

14:30 – 14:45 | **Solvita Kampuse, Kaspars Kampuss, Elga Berna, Zanda Kruma, Inta Krasnova, Inese Drudze** Biochemical composition and antiradical activity of rowanberry (*Sorbus L.*) cultivars and rowanberry hybrids with different *Rosaceae* L. cultivars

14:45 – 15:00 | **Harri I. Kokko and Sirpa O. Kärenlampi** Yield and anthocyanin content of new blueberry crossings for northern climatic conditions

15:00 – 15:15 | **Inger Martinussen, Eivind Uleberg, Jens Rohloff** Climatic effects on production and quality of bilberries (*Vaccinium myrtillus*)

15:15 – 15:30 | **Laura Jaakola et.al.** Nordic bilberry project

15:30 – 16:45 | **Poster session and Coffee break**

18:00 - ..... | **Conference dinner**

#### **Thursday, October 8**

09:00 – 09:30 Coffee break

#### Conference session 4. “**Cultivation and propagation**”

Chairman: Samir C. Debnath and Mintauts Abolins

09:30 – 10:00 | **Key lecture Samir C. Debnath** Propagation and Cultivation of *Vaccinium* Species and Less Known Small Fruits

10:00 – 10:15 | **Kazimierz Smolarz** Short Information about the History of Commercial Growing of Highbush Blueberry in Poland

10:15 – 10:30 | **Alexandr Yakovlev** Experimental and Research Works on some of *Vaccinium* taxa in Belarus

10:30 – 10:45 | **Ross H. Penhallegon** Lingonberry Yield Trial for the Pacific Northwest

10:45 – 11:00 | **Jiri Sedlak and Frantisek Paprstein** Micropropagation of Highbush Blueberry Cultivars

11:00 - 11:30 | **Mintauts Abolins, Rudite Sausserde, Marta Liepniece and Dace Sterne** Cranberry and Blueberry Production in Latvia

11:30 – 12:30 | **Lunch**

#### Conference Session 4 “**Cultivation and propagation**” and closing

Chairman: Laura Jaakola

12:30 – 13:00 | **Key lecture. Laura Jaakola** Fruit Development in *Vaccinium* Species

13:00 – 13:15 | **Tatjana Egoshina and Ekaterina Luginina** The Peculiarities of Yield Forming of *Vaccinium myrtillus* L. in Natural Populations in Taiga Zone of Russia

13:30 – 13:45 | **Eugeniusz Szwonek, Teresa Włodarczyk, Aneta Borkowska, Wojciech Stępień, Urszula Kotowska, Teresa Stępień** Accents of Denitrification Process as Studied at Fertilization Trial with Blueberry (*Vaccinium corymbosum* L.)

13:45 – 14:00 | **Conference closure**

15:00 – 20:00 | **Professional tour and Farewell party**

#### **Friday, October 9**

**7:00** Departure from main building of the University and **7:15** from Hostel University to commercial farm "Lienama Aluksne" (Aluksne region, eastern part of Latvia).

## POSTER SESSION

1. **Laima Česonienė and Remigijus Daubaras** Perspective Clones of *Vaccinium oxycoccus* for the Selection of New Cultivars
2. **Remigijus Daubaras and Laima Česonienė** The Evaluation of European Cranberrybush (*Viburnum opulus*) for Breeding in Lithuania
3. **Juris Bergs, Jānis Bierands and Baiba Melece** Optimisation of the Drying Process of Cultivated Cranberries and Decreasing the Consumption of Energy
4. **Sonia Gaul, Evans Estabrooks, Charles Vincent and Kenna MacKenzie** Presence of *Rhagoletis mendax* (Diptera: tephritidae) in Lowbush Blueberry Fields in Northwestern New Brunswick, Canada
5. **Aleksey Gorbunov** Comparative Efficiency of *Ribes Atropurpureum* c.a. Meyer Propagation by Soft-Wood and Combined Cuttings
6. **Jens Rohloff, Rolf Nestby, Arnfinn Nes and Inger Martinussen** Volatile Profiles of European Blueberry: Few major players, but complex aroma patterns
7. **Natallia Kaltun, Sviatlana Yartchakovskaya and Ryta Mikhnevich** Dominant Phytophages of Edible Honeysuckle (*Lonicera edulis* Turcz. ex Freyn) in Belarus and the Efficiency of Biological Preparations Application Against Them
8. **Andis Karlsons, Anita Osvalde and Vilnis Nollendorfs** Research on Mineral Composition of American Cranberry and Wild Cranberry Fruits in Latvia
9. **Valery Konovalchuk and Vladimir Konovalchuk** Resources of Small Cranberries (*Vaccinium oxycoccus* L.) and their use on Natural Swamps of Ukrainian Polissya
10. **Bohdan Koziński** The Evaluation of Growth and Yielding of Several Highbush Blueberry Cultivars Propagated by Traditional and “In Vitro” Methods
11. **Elena Kutas** Results Acclimatization of Micropropagated Plantlets *Vaccinium* ssp.
12. **Anja Lähti, KR. Riihinen, PS. Kainulainen** Screening of Anthocyanins and Flavonols in Bog Bilberry (*Vaccinium uliginosum* L.) Populations in Finland
13. **Alfreds Ripa, Biruta Audriņa** Rabbiteye Blueberry, American Cranberry and Lingonberry Breeding in Latvia
14. **Zhanna Rupasova, Nikolai Pavlovskij, T. Kurlovich, F. Pyatnitsa, A. Yakovlev, A. Volotovich, Yu. Pinchukova** Variability of Structure of Biochemical Composition of Fruits of the Highbush Blueberry
15. **Daliya Seglina, Inta Krasnova, Gundega Heidemane, Silvija Ruisa.** Influence of drying technology on the Quality of Sweet Dried *Chaenomeles japonica* During the Storage
16. **Mária Gabriela Ostrolucká, Emília Ondrušková, Alena Gajdošová, Gabriela Libiaková** The Influence of Different Carbohydrate Source on in Vitro Shoot Regeneration in *Vaccinium* spp.
17. **Jolanta Pormale, Anita Osvalde, Vilnis Nollendorfs** Comparative Study of Cultivated Highbush and Wild Blueberry Nutrient Status in Producing Plantings and Woodlands of Latvia
18. **Eniko Prokaj, Anita Medve, Attila Ombodi, Judit Dimeny** Examination of Cornel (*Cornus mas* L.) Fruits in Borsod-abauj-zemplen County (Hungary)
19. **Lydmila Prokopyeva, V.L. Semerikov, N.V. Glotov** Research on Genetic Structure of a Cowberry Population (*Vaccinium vitis-idaea* L.) in the RESERVE «BOLSHAYA KOKSHAGA» (REPUBLIC OF MARI EL)

20. **Gun Werlemark and Helena Mattisson** Clone Size in Swedish Wild Growing Bilberries, *Vaccinium Myrtillus*, Estimated With Issr
21. **Justyna Wójcik-Seliga** Fruiting of New Blackberry and Rubus Hybrids in Central Polan
22. **Andreas Åkerström, Åsa Forsum, Kimmo Rumpunen, Anders Jäderlund and Ulla Bång** The Source of the Source - what Affects Bilberry Fruit Anthocyanins
23. **Solvita Kampuse, Elga Sne, Dace Sterne and Inta Krasnova** Chemical Composition of Highbush Blueberry Cultivars

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## ORAL PRESENTATION

### HIGHBUSH BLUEBERRY BREEDING

**Jim Hancock**

Michigan State University, East Lansing, USA

Most of the blueberry cultivars now grown in the world came from the breeding programs of Frederick Coville (1908-1937), George Darrow (1938-1958) and Arlen Draper (1965 - present) of the United States Department of Agriculture, and Paul Lyrene (1978 - present) of the University of Florida. Until about 30 years ago, highbush blueberry cultivation was restricted to cold climates, as the original cultivated species *Vaccinium corymbosum* required about 800 - 1000 chilling hours below 7 C for normal floral development. To expand the range of highbush blueberry cultivation into the southern USA, Ralph Sharp of the University of Florida and Darrow hybridized the original northern highbush types with native southern species to develop what are called "southern" highbush blueberries. There are now essentially three types of highbush blueberry varieties available - Northern, Southern and Intermediate. These vary in the number of chilling hours they require for normal floral development and their level of tolerance to winter cold. Northern highbush varieties are adapted to quite cold mid-winter temperatures below -20 C, but grow well anywhere there are 800 - 1000 hours of chilling. Cultivar examples include 'Bluecrop', 'Duke', 'Elliott', 'Liberty', 'Aurora' and 'Draper'. These are grown primarily in Australia, France, Germany, Michigan, New Jersey, New Zealand, the Pacific Northwest, Poland and Chile. Southern highbush varieties do not tolerate winter temperatures much below freezing and require chilling hours under about 350 hours. Cultivar examples include 'O'Neal', 'Star', 'Emerald' and 'Jewel'. They are grown primarily in Australia, Argentina, California, Florida, Chile and southern Spain. Intermediate highbush varieties have a wide range in chilling requirements from 400 - 800 hours. They generally fail in the colder climates because they bloom too early and are too slow to harden in the fall, resulting in freeze damage to the flower buds. Cultivar examples are 'Legacy', 'Ozarkblue' and 'Reveille'. The Intermediate highbush types are grown primarily in Arkansas, Chile, North Carolina and the Pacific Northwest.

Key words: *Vaccinium corymbosum*, varieties, cultivars.

### GERMPLASM COLLECTIONS OF CULTIVATED *VACCINIUM* GENETIC RESOURCES IN CZECH REPUBLIC

**Frantisek Paprstein, Jarmila Ludvikova, Jiri Sedlak**

Research and Breeding Institute of Pomology Holovousy Ltd., Czech Republic

Cultivated *Vaccinium* germplasm was evaluated within a project focusing on underutilized fruit species. In the Czech Republic, *Vaccinium* fruit species are prospective crop for marginal agricultural areas and protected areas such as national parks and surroundings of water sources. In 1996, the *Vaccinium* genebank was established at the Research and Breeding Institute of Pomology (RBIP) in Holovousy

at an altitude of 320 m, with an annual temperature of 8.14 °C and a precipitation of 654.7 mm. Since its establishment, new accessions have been continuously supplemented into the collection. Three plants represent each cultivar. Twenty nine cultivars of highbush blueberry (*Vaccinium corymbosum*) and four cultivars of lingonberry (*Vaccinium vitis-idaea*) were successfully introduced into genebank and studied. The evaluation of economically important vegetative and fruit characters was carried out. Based on the present evaluation results, highbush blueberry early ripening cultivars 'Duke' and 'Spartan', medium ripening cultivars 'Bluecrop' and 'Toro' and late ripening cultivars 'Brigitta' and 'Elliott' were preliminarily recommended for growing in the Czech Republic.

Acknowledgements: This work was realized in the framework of projects QH82232 from National Agency for Agricultural Research (MZe CR) and NP MZe CR 20139/2006-13020.

Keywords: genebank, highbush blueberry, evaluation, character, cultivar.

### **CLOUDBERRY BREEDING IN NORWAY**

**Eivind Uleberg, Gunnlaug Røthe, Inger Martinussen**

Norwegian Institute for Agricultural and Environmental Research

Cloudberry breeding in Norway is done by the Norwegian Institute for Agricultural and Environmental Research, at the department of Arctic Agriculture and Quality in Tromsø. Two female (Fjellgull and Fjordgull) and two male (Apollen and Apolto) cultivars have previously been released as a result of the breeding program. Selection criteria have been number of pistils or stamens per flower, number of flowers and number of shoots per m<sup>2</sup>. Currently 9 different female clones collected from different parts of Norway, as well as from England and Spitsbergen, are being tested and compared to the previously released cultivars. Preliminary results from harvesting 2005, 2006, 2007 and 2008 indicate good production potential for a couple of the tested clones. In addition to prior selection criteria based on berry yield, new evaluations will also consider berry contents, such as level of antioxidants.

Key words: Cloudberry, breeding, clone, antioxidant.

### **BREEDING OF HALF-HIGH BLUEBERRY VARIETIES IN ESTONIA**

**Taimi Paal<sup>1</sup>, Marge Starast<sup>2</sup> and Kadri Karp<sup>2</sup>**

<sup>1</sup>Estonian University of Life Sciences, Institute of Forestry and Rural Engineering

<sup>2</sup>Estonian University of Life Sciences, Institute of Agricultural and Environmental Sciences

In 1998 from a very fruitful half-high blueberry bush in Canada (Prince Edward Island) seed was collected. Seedlings were planted in 2000 in Metsa farm in South-Estonia on mineral soil mixed with milled peat. Since 2002 every year winter hardiness, yield per bush and weight of one berry was counted. In 2005 first selection among blueberry bushes was made. In account was taken stability of yield, taste of berries, winter hardiness of bushes, ripening time of berries, weight of one berry, shape of bush and berry clusters, wax coating on berries. 15 best bushes were selected for comparison. Preferred were late ripening bushes, why there is North Blue variety,

whose berries are ready for picking in the first week of August. In 2008 last selection was made. Control variety for comparison was North Blue. 5 bushes were selected for micropropagation and for establishing of variety testing trial. Those bushes have two weeks later ripening time than North Blue, they are highly cold tolerant in winter, with bigger crop, berries are smaller, but taste of berries is better than North Blue has. 5-years average yield of the selected blueberry bushes is 1,5 – 2 kg per bush, in the same time yield of North Blue has only about 1 kg per bush.

Key words: selection, *Vaccinium*, yield.

## **RECENT SITUATION AND PERSPECTIVES OF THE CULTIVATION AND BREEDING OF HIGH-BUSH BLUEBERRY (*VACCINIUM CORYMBOSUM L.*) IN POLAND**

**Stanislaw Pluta and Edward Żurawicz**

Research Institute of Pomology and Floriculture

The high-bush blueberry (*Vaccinium corymbosum* L.) is relatively new and economically important small fruit crop cultivated in Poland. Admittedly, in Poland plants of this crop have been known since 1960's, the first commercial plantations were established only on turning point of years of 1970/1980. At present blueberry plantations cover the acreage of about 2.500 ha. The majority of them are young plantations, below 4-5 years and therefore, only 9.000-10.000 tones of fruits are harvested. However, with such production Poland takes actually the 1st. place in Europe. New plantations are still being established, what in the nearest years should lead to the further increase of the blueberry production in Poland. Majority of the blueberry plantations are quite big in size, from a few up to several dozen hectares. Few plantations exceed the acreage of 100 ha. Plantations are located in different areas of the country, what shows the good adaptation of blueberries to the Polish agro-climatic conditions. Plantations are established in opened field, but recently new plantings are also planted under covers (plastic tunnels). Applying of sawdust, bark, different organic mulching, sulphur, proper fertilizing and drip irrigation are a base of the cultivation technology of the high-bush blueberry in Poland. The most commonly grown cultivar is 'Bluecrop'. Plants of cultivars: 'Duke', 'Spartan', 'Toro', 'Patriot' and 'Nelson' are planted on smaller scale. The newest cultivars are 'Brigitta Blue', 'Chandler', 'Draper', 'Liberty' and 'Aurora'. However, the production value of these last cultivars has not been fully studied in Poland. Having in mind the health and nutritional value of blueberry fruits, relative easiness of the export of fresh fruits into European market and still comparatively cheap costs of labour, we predict increasing trend of the development in the blueberry cultivation in Poland. Therefore, in 2008 the breeding program of high-bush blueberry was started at the Research Institute of Pomology and Floriculture (RIPF) in Skierniewice, Poland. The main goal of this program is obtaining of new cultivars, which are better adapted to natural conditions of Poland, than foreign cultivars planted presently. We assume that new, Polish cultivars will be more productive and produce better quality fruits (firmness, size, taste and high shelf life). Much attention will be devoted to the differentiated ripening time and concentrated ripening of fruits. Both of these characters are important features of the cultivar making easier picking of fruits by harvester. One of the big blueberry grower in Poland has already got such harvester and others consider the

possibility to purchase of such machines. Certainly, growing costs of the labour will speed up this trend.

Key words: blueberry, cultivar, ripening, blueberry growers.

### **VACCINIUM OXYCOCCUS MORPHOLOGY AND RAPD MARKER CHARACTERIZATIONS.**

**Judita Žukauskienė<sup>1</sup>, Algimantas Paulauskas<sup>1</sup>, Remigijus Daubaras<sup>2</sup> and Laima Česonienė<sup>2</sup>**

<sup>1</sup>Vytautas Magnus University, <sup>2</sup>Kaunas Botanical Garden of Vytautas Magnus University

Plant morphogenesis has provided useful systems for physiological, biochemical, and molecular biological studies on plant development. The diversity in plant form is produced mainly because different parts of the plant grow at different rates. Furthermore, the growth of an individual structure is different in various dimensions. Such differential growth rates are very well orchestrated by genetic factors.

Understanding the relationships among wild cranberry morphologic and genetic characteristics may provide insights for better utilizing germplasm. The objectives of this research were to determine the relationships between genotype and development of morphologic features. Eleven morphologic characteristics (vegetation parameters and flowering time, ripening start and ending, weight and size of berry mass leaf shape, steepness of upright, berry form) of 56 morphologically diverse genotypes from the 4 Lithuanian bogs were analyzed using random amplified polymorphic DNA (RAPD) classifications. To compare morphologic characteristic were used 213 RAPD bands of wild cranberry (*Vaccinium oxycoccus*). Comparing wild cranberry genetic and morphologic features were found some significant variations.

Key words: genetic and morphological correlation; morphological characteristics; RAPD characterization, *Vaccinium oxycoccus*.

### **ELABORATION OF EFFICIENT REGENERATION PROTOCOL FOR GENETIC TRANSFORMATION OF SELECTED SMALL FRUIT SPECIES**

**Alena Gajdošová<sup>1</sup>, Gabriela Libiaková<sup>1</sup>, Mária Gabriela Ostrolucká<sup>1</sup>, Djurdjina Ružić<sup>2</sup>, Miroslava Látečková<sup>1</sup>**

<sup>1</sup>Institute of Plant Genetics and Biotechnology SAS, <sup>2</sup>ARI SERBIA Fruit and Grape Research Centre

Increasing demand for small fruits requires effective production of high quality plant material with improved agronomic traits. Genetic transformation has opened a powerful approach to introduce genes of interest and accelerate the breeding process for many crops. Transformation is particularly suited to blueberry since it has a polyploid genome. Several factors influencing gene transfer in blueberry and raspberry were studied till now, but the available genetic transformation techniques are still inefficient and unreliable. However the application of genetic engineering requires the development of efficient *in vitro* regeneration systems. The aim of the study was optimization of regeneration protocols for selected cultivars of *Vaccinium corymbosum* L. and *Rubus fruticosus* L., testing for tolerance to different

concentrations of antibiotics kanamycin, hygromycin, geneticin (G 418) and cefotaxin which will be used in genetic transformation by *Agrobacterium tumefaciens*. Successful adventitious shoot regeneration in *V. corymbosum* cv. 'Berkeley' was obtained on the leaves of *in vitro* plants cultivated horizontally with adaxial surface on WPM medium with 25 g l<sup>-1</sup> sucrose, 8 g l<sup>-1</sup> Phyto agar, pH adjusted to 4.8-5.0, supplemented with 2.2 mg l<sup>-1</sup> TDZ. The multiple adventitious shoots were formed after 5 weeks of cultivation produced mainly via direct regeneration. Efficient adventitious shoot regeneration in *R. fruticosus* cv. 'Cacanska bestrna' was achieved on MS medium, with 30 g l<sup>-1</sup> sucrose, 8 g l<sup>-1</sup> phyto agar, pH 5.6-5.8, supplemented with TDZ 1 mg l<sup>-1</sup> and IBA 0.05 mg l<sup>-1</sup>.

For selection of transformed cells and tissue in both species kanamycin in concentrations 0, 25, 50, 75, 100 and 150 mg l<sup>-1</sup>, hygromycin and G418 in concentrations 0, 5, 10, 15 and 20 mg l<sup>-1</sup> were tested. For *Agrobacterium* elimination cephotaxime in concentrations 0, 200 and 400 was tried.

Acknowledgements: The work was supported by Slovak Grant Agency VEGA, project no. 2/0004/08 and MVT-S-COST 863 Action.

Key words: *Vaccinium*, *Rubus*, *in vitro* regeneration, antibiotics.

## FUNGAL DISEASES OF *VACCINIUM MACROCARPON* IN LATVIA

Liga Vilka, Regina Rancane, Maija Eihe

Latvian Plant Protection Research Centre

American cranberry (*Vaccinium macrocarpon* Ait.) is known for fifteen years, but fungal diseases are investigated only last years in Latvia. Upright dieback and berries rot were observed several years ago, but growers did not know causal agents of these symptoms. For causal agent detection samples of upright dieback in summer and berries during the harvesting from different regions of Latvia were collected. Berries were stored in cold camera (+5°C) until March to detect causal agent of storage rot. Causal agents of cranberry diseases were isolated in pure culture. Uprights were bronzing brown, top sloped and died. From upright dieback *Botrytis cinerea*, *Fusicocum putrefaciens* (teleomorph *Godronia cassandrae*), *Phomopsis vaccinii* (teleomorph *Diaporthe vaccinii*), *Pestalotia vaccinii*, *Discosia artocrea*, *Physalospora vaccinii* were detected. In field berries rot was caused mainly by *Botrytis cinerea*, *Allantophomopsis cytispora*, *Fusicocum putrefaciens*, *Phomopsis vaccinii* and *Pestalotia vaccinii*.

During storage time from rotted berries were isolated mostly *Fusicocum putrefaciens*, *Coleophoma empetri*, *Phyllosticta elongata* (teleomorph *Botryosphaeria vaccinii*), *Physalospora vaccinii* and to lesser extent - *Botrytis cinerea*, *Allantophomopsis cytispora*, *Phomopsis vaccinii*, *Pestalotia vaccinii*, *Coleophoma empetri*, *Discosia artocreas*, *Gloeosporium minus*. In the future *Fusicocum putrefaciens* and *Phomopsis vaccinii* could become the most harmful fungi in the cranberry plantations, because it is difficult to control them. Only one stage of cranberry diseases causal agents were detected, but mostly all of them have two stages, so it is necessary to continue investigations.

Key words: cranberry diseases, upright dieback, field rot, storage rot.

## **STORAGE ROTS OF *VACCINIUM MACROCARPON* SPREAD AND DEVELOPMENT IN LATVIA**

**Liga Vilka, Regina Rancane, Maija Eihe**

Latvian Plant Protection Research Centre

American cranberries (*Vaccinium macrocarpon* Ait.) have been cultivated for ten years in Latvia and their plantations have a tendency to enlarge every year. Latvian cranberry growers realize mainly fresh berries, because it is difficult to keep quality during prolonged storage. One of the main why quality is reduced is berry rot caused by different fungi.

Berries from six cranberry plantations in different regions in Latvia for rot detection were taken at harvest time.

Different berry rot appeared on 61 % of all berries in storage. In the berries *Botrytis cinerea* (yellow rot), *Allantophomopsis cytisporea* (black rot), *Fusicocum putrefaciens* (end rot), *Phyllosticta elongata* (Botryosphaeria fruit rot), *Physalopora vaccinii* (blotch rot), *Phomopsis vaccinii* (viscid rot), *Pestalotia vaccinii* (Pestalotia fruit rot), *Coleophoma empetri* (ripe rot), *Discosia artocreas* (Discosia fruit rot) were detected. Causal agents of berry rot had different dynamics of development. These fungi had different incubation periods. This is important information for the growers that helps to determine the real time for realization, before rotting is started.

After four months of storage, the amount of causal agents was different from each plantation area.

In further investigations it is necessary to establish conditions influencing the development of causal agents.

Key words: cranberry, storage rot, causal agents.

## **BIOCHEMICAL COMPOSITION AND ANTIRADICAL ACTIVITY OF ROWANBERRY (*SORBUS L.*) CULTIVARS AND HYBRIDS WITH DIFFERENT *ROSACEAE L.* CULTIVARS**

**Solvita Kampuse<sup>1</sup>, Kaspars Kampuss<sup>2</sup>, Elga Berna<sup>1</sup>, Zanda Kruma<sup>1</sup>, Inta Krasnova<sup>3</sup> and Inese Drudze<sup>4</sup>**

<sup>1</sup>Faculty of Food Technology, Latvia University of Agriculture (LUA), <sup>2</sup>Faculty of Agriculture, LUA, <sup>3</sup>The Latvia State Fruit Growing Institute, Dobele, Latvia, <sup>4</sup>Pure Horticultural Research Centre

Rowanberry (*Sorbus aucuparia* L.) is a common yellowish, wild berry that grows in the Northern part of Europe. Rowan has been described as an important source of flavonoids and their antioxidant activity affects reactive oxygen species and lipid peroxidation. The aim of this study was to evaluate biochemical composition of 8 rowanberry cultivar fruits and fruits of their hybrids with *Rosaceae* L. cultivars and to establish correlation of biochemical composition with antiradical activity. The experiments were done at the Faculty of Food Technology, Latvia University of Agriculture (LLU) and in Latvia State Fruit Growing institute, Dobele. Contents of ascorbic acid, total phenols, anthocyanins, carotenoids, soluble solids, titrable acids, tannins and antiradical activity of fresh and frozen rowanberry×hawthorn 'Granatnaya', rowanberry×chokeberry 'Likiornaya', rowanberry (*Sorbus aucuparia*) 'Rosina', rowanberry (*Sorbus aucuparia*) 'Zholtaya', wild rowanberry (*Sorbus*

*aucuparia*), rowanberry×pear 'Alaya Krupnaya', rowanberry (*Sorbus aucuparia*) 'Rosina Variegata', rowanberry (*Sorbus aucuparia*) 'Krasnaya Krupnaya' were analysed. There were no significant differences between chemical composition of fresh and frozen rowanberry samples. The highest content of ascorbic acid was in fruits of rowanberry 'Rosina', 'Rosina Variegata', 'Krasnaya Krupnaya', and 'Zholtaya' (49-53 mg 100 g<sup>-1</sup>). The highest content of carotenoids were detected in rowanberry×hawthorn 'Granatnaya' (13.04 mg 100 g<sup>-1</sup>), but the highest phenol content was detected in rowanberry and chokeberry hybrid 'Likiornaya' (484.9 mg 100 g<sup>-1</sup>). 'Likiornaya' showed also the highest antiradical activity (11.2 g of berries per 1g of DPPH radical).

Key words: ascorbic acid, phenols, antiradical activity (DPPH), frozen, fresh.

### **YIELD AND ANTHOCYANIN CONTENT OF NEW BLUEBERRY CROSSINGS FOR NORTHERN CLIMATIC CONDITIONS**

**Harri I. Kokko and Sirpa O. Kärenlampi**

Department of Biosciences, University of Kuopio

Commercial blueberry cultivation with half-high blueberry cultivars Northblue and Northcountry (*V.angustifolium* x *V.corymbosum*) has started in Finland in the beginning of the 1990s. Interest in blueberry production has increased and based mainly to half-high blueberry production, which is mainly targeted for fresh market. Therefore the quality, size and taste of berries are among the most important characters. At the moment only early ripening cultivars like Northblue, Northcountry, Chippewa, Polaris, Aino and Alvar seem to be suited for the conditions prevalent in central Finland, because the temperature drops rapidly after September and the probability of night frosts becomes very high. We have use breeding donor *V.angustifolium* in the generation of these new test clones to receive better winter hardiness and shorter growth period. The aim of this study is to select the best candidates from the seedlings of *V.angustifolium* and blueberry hybrids, by following beneficial properties in the Finnish/northern climatic conditions. The anthocyanin-rich bilberry *V.myrtillus* has great commercial potential because of the health image of its berries based on high polyphenolic content and antioxidant properties. Having this in mind, total phenolics and anthocyanins of the selected winter-hardy blueberries have been analysed and used as a selection criteria for the new cultivars.

Keywords: *Vaccinium angustifolium*, anthocyanin, winter hardiness.

## **CLIMATIC EFFECTS ON PRODUCTION AND QUALITY OF BILBERRIES (*VACCINIUM MYRTILLUS*)**

**Inger Martinussen<sup>1</sup>, Eivind Uleberg<sup>1</sup> and Jens Rohloff<sup>2</sup>**

<sup>1</sup>Norwegian Institute for Agricultural and Environmental Research, Bioforsk Nord Holt, <sup>2</sup>Department of Biology

The effect of climate on production and the quality of bilberries have been studied in a controlled experiment using clonal material. In the experiment individual plants from two northern clones and two southern clones of bilberry have been grown on 12 and 18 °C. At each temperature 3 different light treatments have been tested; 1) 24 hour (h) natural light (long day); 2) 24 h natural light with addition of red light and 3) 12 h light (short day). All plants were kept outside during flowering to ensure pollination by insects. Berries were sampled when ripe, weighed and stored at -80 °C for later analysis of pH, sugars, acids, total phenols, total anthocyanins and total antioxidant activity.

Key words: bilberry, clonal differences, European blueberry, quality, temperature effects.

### **NORDIC BILBERRY PROJECT**

**Laura Jaakola<sup>1</sup>, Mika Paassilta<sup>1,5</sup>, Marko Suokas<sup>1</sup>, Inger Martinussen<sup>2</sup>, Kristiina Antonius<sup>3</sup>, Andreas Åkerström<sup>4</sup>, Asdis Helga Bjarnadottir<sup>5</sup>, Anja Hohtola<sup>1</sup>,  
Simo Moiso<sup>6</sup>, Olavi Junttila<sup>7</sup>, Ulla Bång<sup>4</sup> and Hely Häggman<sup>1</sup>**

<sup>1</sup>Department of Biology, University of Oulu, <sup>2</sup>Bioforsk, <sup>3</sup>Nordic Gene Bank (NordGen), <sup>4</sup>SLU, Department of Agricultural Research for Northern Sweden, <sup>5</sup>Agricultural University of Iceland, <sup>6</sup>Arctic Flavours Association, <sup>7</sup>University of Tromsø, Department of Biology,

Wild berries are characteristic part of the Northern nature and a potential speciality of Nordic countries. Wild berries are also a rich and valuable resource that is yet to be exploited even on a satisfactory level. Approximately 90–95 per cent of the whole wild berry crop yield is left unpicked in the Nordic forests every year. The challenges of the wild berry utilization are similar in Nordic countries - the logistics of berry picking including traceability, fragmented sector structure as well as the high share of unprocessed raw material in export. The Nordic project focusing on bilberry (*Vaccinium myrtillus*) “Bilberry: Towards functional food markets” (2007-2009) is a part of the New Nordic Food programme funded by the Nordic Innovation Centre. The programme aims to enhance cooperation and innovation among companies that utilize the natural resources in the Nordic countries. The aim of the project is to improve wild berry production and utilization in the Nordic and global market. To achieve this goal a network between the Nordic experts presenting the different fields of the wild berry sector has been established. The project has focused on marketing research, quality issues, biodiversity and traceability of wild berries, especially bilberry. The results of the marketing survey were published in November 2008. The aim of the survey was to generate an overall picture of the companies working with wild berries in Nordic countries and gather information on the existence and willingness of the berry companies to cooperate for instance in wild berry supply,

logistics, marketing or research and development. According to the results, a general agreement for the need of increased cooperation at the Nordic level was highlighted.

Key words: Bilberry, quality, marketing survey, New Nordic Food.

## **PROPAGATION AND CULTIVATION OF VACCINIUM SPECIES AND LESS KNOWN SMALL FRUITS**

**Samir C. Debnath**

Atlantic Cool Climate Crop Research Centre, Agriculture and Agri-Food Canada

The production of *Vaccinium* species crops has recently been the subject of much interest globally because of an improved understanding of the important role of dietary fruit in maintaining human health. Cloudberry (*Rubus chamaemorus* L., family Rosaceae), a less known small fruit of medicinal importance, and the *Vaccinium* species are genetically heterozygous and do not reproduce progeny from seed that are similar to the seed parent. Tremendous progress in plant tissue culture, resulting in great advances in micropropagation, has occurred in these crops. Of particular significance has been the evolution of the technology permitting multiplication of these plants through bioreactor micropropagation. The *in vitro* morphogenesis seems to be highly dependent on plant growth regulators and media used for culture, which is again genotype specific. Although automation of micropropagation in bioreactors has been advanced as a possible way of reducing propagation cost, optimal plant production depends upon better understanding of physiological and biochemical responses of plant to the signals of culture microenvironment and an optimization of specific physical and chemical culture conditions to control the morphogenesis of berry plants in liquid culture systems. Clonal fidelity can be a serious problem and molecular strategies have been developed in order to reduce the variation to manageable levels. The paper focuses on conventional and bioreactor systems used for *in vitro* culture of *Vaccinium* species and cloudberry, cultivation of micropropagules, and employment of molecular markers in micropropagated plants for the assessment of genetic fidelity, uniformity, stability, and true-to-typeness among donor plants and tissue culture regenerants.

Key words: cloudberry, propagation, micropropagation, *in vitro*, genotype.

## **SHORT INFORMATION ABOUT THE HISTORY OF THE COMMERCIAL CULTIVATION HIGHBUSH BLUEBERRY IN POLAND**

**Kazimierz Smolarz**

Institute of Pomology & Floriculture, Pomologiczna 18, 96-100 Skierniewice, Poland

The first notes concerning highbush blueberry cultivation in Poland appeared about the year 1935 -1939. The results obtained at that time were not positive. Also the first trials with the cultivation of these plants soon after the Second World War were negative. The problem was in choosing improper soil for the blueberry. The further experiments concerning the quality of soil and mineral fertilization brought interesting results and caused an increase of interest in blueberry cultivation on large scale.

The experimental field in Skierniewice, belonging to the Warsaw Agriculture University has plots with different long-term soil mineral fertilization and different pH status since 1923. On those plots the first methodical experiment with the highbush blueberry was begun in 1976 on drained soil with 1,3 % of humus.

This experiment brought very interesting and important results. It explained some basic problems, first of all the meaning of pH value and fertilization of soil for blueberry cultivation. It appeared that blueberry did crop well when soil pH, determined in KCl is between 3,5 – 4,0. The soil should be rather light and level of ground water not higher than 40 – 50 cm below the surface. It was also found that blueberry reacts badly for lack of nitrogen and to a lesser degree, for deficiency of P and K.

The growth and yield of blueberry plants on single plots was differentiated and depended mainly on soil pH and nitrogen fertilization.

The plants of cultivars 'Bluecrop' and 'Jersey' still grow well, though they are 32 years old. Now the rejuvenation pruning research is being done on them.

Keywords: *Vaccinium corymbosum*, fertilization, soil pH, cultivar evaluation, pruning, yield.

## **EXPERIMENTAL AND RESEARCH WORKS ON SOME OF VACCINIUM TAXA IN BELARUS**

**Alexandr Yakovlev**

Central botanic garden of NAS of Belarus

Carrying out of the experimental and research works on the study of plants of genus *Vaccinium* in Belarus can be divided into several stages. The first stage is the study of biological and resource potential of wild-growing berry plants: cranberry (*V. oxycoccus* L.), bog blueberries (*V. uliginosum* L.), cowberry (*V. vitis-idaea* L.), bilberries (*V. myrtillus* L.). The second stage is the introduction of the cultivars of large cranberry (*V. macrocarpon* Ait.), of highbush blueberry (*V. corymbosum* L.), of lingonberry in the conditions of Belarus, building the first experimental and industrial plantations. The third stage is the preparation of scientific manpower, the formation of scientific school, the development of production schedules of the estate berry culture. The fourth stage is the dilating of the assortment of *Vaccinium* taxa used in the culture, the augmentation of the areas of plantings under berrylike cultures.

Key words: berry plants, natural resources, berry culture, Belarus.

## **LINGONBERRY YIELD TRIAL FOR THE PACIFIC NORTHWEST**

**Ros H. Penhallegon**

Lane County Extension Service, Oregon State University

Lingonberries are being studied as a potential new crop for the Pacific Northwest. Lingonberries are primarily grown in Scandinavian and European countries, namely Norway, Sweden, Germany, Finland, Estonia, and Russia. A number of European and a few North American cultivars have been released and this research aimed to determine the cultivars that were best adapted to the Pacific Northwest based on fruit yield, berry size, and berry soluble solids for fruit harvested during the summer and

autumn seasons. Twenty-one genotypes were evaluated from 1999-2007. In a 9-year study, lingonberries were evaluated for Brix (% soluble solids), individual berry weight, ripening date, summer yield (first week of August), autumn yield (last week of October) and total yield. Yields from several cultivars showed commercial potential. Some cultivars had excellent summer yield ('Erntesege', 'Koralle', and 'Sanna') or autumn yield ('Erntesege', 'Koralle-G', 'Ida'). 'Erntesege' had the greatest total yield (171 kg·100 m<sup>-2</sup>) and 'Regal' had the lowest (25 kg·100 m<sup>-2</sup>). Other cultivars ('Erntesege', 'Ida' and 'Koralle-G') had excellent yield in both seasons and a high total yield. The Brix for both summer and autumn harvest ranged from 13.9% for 'Erntesege' to 10.2% for 'Erntekrone'. Berry weight ranged from the largest in 'Ida' (0.45 g) to the smallest in 'Erntedank' (0.175g). 'Erntesege' and 'Ida' rated well for Brix, individual berry weight and yield and are recommended for commercial planting in the Pacific Northwest. Data from these trials suggest that multiple cultivars should be grown in the Pacific Northwest.

Keywords: *Vaccinium vitis-idaea* L., lingon, small fruits, yields, yield trials, new crops.

## **MICROPROPAGATION OF Highbush BLUEBERRY CULTIVARS**

**Jiri Sedlak and Frantisek Paprstein**

Research and Breeding Institute of Pomology Holovousy Ltd.

The aim of this study was to determine an efficient micropropagation system for highbush blueberry cultivars 'Spartan', 'Bluecrop' and 'Berkeley'. Shoot tips of selected three genotypes were successfully established *in vitro* using mercuric chloride in a concentration of 0.15 % as a sterilization solution. Anderson's rhododendron medium (AN), half-strength Murashige and Skoog medium (half-MS) and McCown woody plant medium (WPM) containing the cytokinin zeatin in concentrations 0.5, 1 or 2 mg l<sup>-1</sup> were tested. Multiplication rates varied depending on the cultivar, medium and concentration of zeatin. The highest multiplication 4.8 ± 0.2 was noted for 'Berkeley' on WPM medium with zeatin (2 mg l<sup>-1</sup>). Out of three media tested, WPM medium was found to be more effective than the AN medium and half-MS medium for shoot multiplication. The *in vitro* rooting on WPM medium is also reported.

Acknowledgements: This work was realized in the framework of projects QH82232 from National Agency for Agricultural Research (MZe CR) and NP MZe CR 20139/2006-13020.

Keywords: explant, *in vitro*, zeatin, multiplication, rooting.

## **CLIMATICALLY DETERMINATE PROJECTIONS OF THE VACCINIACEAE WILD BERRY PLANT RESOURCES IN BELARUS TO THE YEAR 2050**

**Valeriy V. Grimashovich**

Forest Institute of NAS of Belarus

Objective: making a climatically determinate projection of the Vacciniaceae wild berry plant resources to the year 2050.ite: forest fund of the Republic of Belarus.

Methods: the investigative methodology is based on a system complex biogeocenotic approach. Results: using the prognostic dynamics of the forest fund against the backgrounds of the global climate change a climatically determinate projection has been made of the *Vacciniaceae* wild berry plant resources in Belarus to the year 2050 at an interval of five years. It is anticipated that moorberry and bilberry resources will increase, while lingonberry and bog blueberry resources will decrease towards the end of the predictive period. On the whole the total wild berry plant resources will increase by 11 percent.

Key words: *Vaccinium vitis-idaea* L., *Vaccinium uliginosum* L., *Vaccinium myrtillus*, *Oxycoccus quadripetalis* Gilib, projection, resources.

**CRANBERRY AND BLUEBERRY PRODUCTION IN LATVIA**  
**Mintauts Abolins, Rudite Sausserde, Marta Liepniece and Dace Sterne**  
Latvia University of Agriculture, Institute of Agrobiotechnology

Large cranberries (*Vaccinium macrocarpon* Ait.) and highbush blueberries (*Vaccinium corymbosum* L.) are relatively new cultures in Latvia. The first commercial cranberry plantation was established in 1985. Nowadays, the area of cranberries is approximately 100 ha which makes it the third largest in the world. The blueberry plantations compared to other European states are not so large - 170 ha. The largest part of the area of high moss peat bogs was drained and is now being used as cranberry fields – a bogs area of approximately 10000 ha. The examination of the situation of cranberry and blueberry production started in 2007/2008. Cranberry and blueberry plantations were surveyed in all four fruit-growing areas of Latvia. The following parameters were examined: varieties and plantation sizes, the physiological status of the plants of different varieties after overwintering, growing technologies - characterisation of the soil or substrate, plantation location, growing distances; yield and yield quality. The most popular varieties of cranberries are 'Stevens', 'Bergman', 'Ben Lear', etc. The most popular cultivars of blueberries are 'Bluecrop', 'Patriot' and 'Northland'. The newest cultivars in the Latvian plantations are 'Toro', 'Rubel', 'Blue Gold', 'Hanna', 'Klara', 'Drapers' and 'Bonus'. Planting technologies of highbush blueberries: 1) mineral soil (78 % of farmers – with specific preparation of the soil before planting; 2) peat – 22 % of farmers.

Key words: *Vaccinium macrocarpon*, *Vaccinium corymbosum*, cultivars, area, technologies.

**FRUIT DEVELOPMENT IN VACCINIUM SPECIES**

**Laura Jaakola**

Department of Biology, University of Oulu

Fruit development and ripening represent one of the most complex developmental processes in plants. Functionally, the role of fruits is to cover the developing seeds and promote the dispersal of mature seeds through the production of attractive colour, flavour and aroma compounds. After fertilisation, the first phases of fruit development include the division and the expansion of the cells. The ripening phase is initiated after the completed seed maturation. Tissue softening and accumulation of

flavour compounds, aromatic volatiles and pigments occurs during the ripening phase. The quality of fruits is determined by the different developmental steps via the signalling cascade that is responsible for the metabolic and structural changes during the ripening phenomenon. Genus *Vaccinium* is widespread over the world and it includes many economically important cultivated and wild berry species. Fruits of the *Vaccinium* species are non-climacteric and anatomically they belong to false berries, many-seeded fleshy fruits in which the inferior ovary along with floral tube ripens into an edible pericarp. *Vaccinium* berries are especially rich with phenolic compounds that are known to possess antioxidative properties. This review focuses on characteristics of fruit development in both cultivated and the wild *Vaccinium* species.

Keywords: berries, fruit development, *Vaccinium*.

### **THE PECULIARITIES OF YIELD FORMING OF *VACCINIUM MYRTILLUS* L. IN NATURAL POPULATIONS IN TAIGA ZONE OF RUSSIA**

**Tatjana Egoshina and Ekaterina Luginina**

Russian Research Institute of Game management and Fur Farming

As a result of long-term studies of yield forming of *Vaccinium myrtillus* in taiga zone of Russia it was defined that coniferous-deciduous and coniferous forests provide optimum conditions for bilberry. The yield values vary depending on plant cenosis type and its geographic localization. There is a tendency to yield decrease from middle taiga subzone towards the edge of northern taiga and forest-steppe. Maximum productivity is marked for bilberry and bilberry-sphagnum spruce and pine forests, aged 80 – 100 years, with 0.6 – 0.7 canopy density. The results of dispersion analyses show that the process of fructification (the level of fructification) is under control of several factors, the main of which are considered to be the average daily air temperature and quantity of precipitation during spring – summer period.

The loss of generative buds during winter is on average 10.6%. Part of formed flower buds (6.8 to 29.8%) is lost during autumn – winter and early spring periods from freezing and is eaten by animals. Falling of buds, flowers and ovaries in spring – summer period is caused by unfavorable meteorological conditions (frosts, excessive dryness of air or long rains during flowering period). During 1 month birds ate up 20 – 80% of bilberry yield, average value for the region is 30%.

Investigations of peculiarities of yield forming allowed working out measures for increase of bilberry productivity in natural populations, modeling optimum conditions and picking out the most valuable forms for cultivation.

Key words: bilberry, productivity, yield forming.

**ACCENTS OF DENITRIFICATION PROCESS AS STUDIED AT  
FERTILIZATION TRIAL WITH BLUEBERRY (*VACCINIUM  
CORYMBOSUM* L.)**

**Eugeniusz Szwonek<sup>1</sup>, Teresa Włodarczyk<sup>2</sup>, Aneta Borkowska<sup>2</sup>, Wojciech  
Stępień<sup>3</sup>, Urszula Kotowska<sup>2</sup> and Teresa Stępień<sup>1</sup>**

<sup>1</sup>Research Institute of Pomology and Floriculture; Skierniewice, <sup>2</sup> Polish Academy of  
Sciences Institute of Agrophysics, <sup>3</sup> Warsaw Agricultural University

It is a long term fertilizer trial carried out in Skierniewice. The part of the Experimental Field of the Warsaw University of Life Sciences has been treated since 1926 with mineral fertilizers only. The treatments: 0, CaNPK, NPK, PK, PN, KN were there established. Since 1976 the following sources and doses of minerals were applied: CaCO<sub>3</sub> -1400 kg.ha<sup>-1</sup>, ammonium sulfate - 60 kg N.ha<sup>-1</sup>, single superphosphate 60 - P<sub>2</sub>O<sub>5</sub> kg.ha<sup>-1</sup>, potassium chloride - 110 kg K<sub>2</sub>O.ha<sup>-1</sup>. In 1976 blueberry cv. Bluecrop were planted. Their growth and yielding were influenced and modified by variants of fertilization. The one of purpose of study was to estimate denitrification capacity of differently treated soils too. In 2006 soil from the upper horizon was sampled and potential of denitrification was evaluated. It is to state that: (a) investigated soil under control condition and all tested treatments showed an ability of nitrous oxide released, (b) investigated soils differ from denitrification capacity, (c) the highest denitrification capacity was found in case of CaNPK treatment but the lowest one in KN treatment, (d) in three cases of control variants i.e. CaNPK, PK and 0 nitrate oxide sorption was found, (e) nitrate addition into the all variants of soil influenced N<sub>2</sub>O/N<sub>2</sub> relationship.

Key words: blueberry, fertilizers, minerals, denitrification, yield.

## POSTER PRESENTATION

### PERSPECTIVE CLONES OF *VACCINIUM OXYCOCCUS* FOR THE SELECTION OF NEW CULTIVARS

Laima Česonienė and Remigijus Daubaras

Kaunas Botanical Garden of Vytautas Magnus University

The unique collection of European cranberry genetic resources was established in Kaunas Botanical Garden of Vytautas Magnus University with the purpose to preserve valuable clones. 120 clones of European cranberry were selected during expeditions in the strictly protected areas Čepkeliai, Žuvintas, and Kamanos in 1995-2004. These clones with distinctive phenotypic peculiarities were propagated and planted into acid peat (pH 3.5-4.0) in the field collection of Kaunas Botanical Garden for further investigations. Results of comprehensive evaluations of phenotypic and genetic diversity of European cranberry were crowned with selection of the most valuable clones.

Aim of this study was to compare the best Lithuanian clones with Estonian and Russian cultivars. Berry size, yield and amounts of biologically active substances were evaluated. It could be stated that accessions evaluated are characteristic of exceptional biological and biochemical peculiarities. Five Lithuanian clones 'Amalva', 'Žuvinta', 'Vaiva', 'Vita', and 'Reda' were proposed to approve the cultivars status.

Key words: cranberry, genotype, quality, biological, biochemical peculiarities.

### THE EVALUATION OF EUROPEAN CRANBERRYBUSH (*VIBURNUM OPULUS*) FOR BREEDING IN LITHUANIA

Laima Česonienė and Remigijus Daubaras

Kaunas Botanical Garden of Vytautas Magnus University

The investigations were carried out in *Viburnum opulus* L. collection at Kaunas Botanical Garden of Vytautas Magnus University in 1999-2005. The biological peculiarities of eight cultivars and clones were estimated according to the methods of evaluation of horticulture plants. Reliable differences were determined between accessions with respect to productivity, number of fruit per cluster and mean weight of a fruit. The investigations of biochemical composition of fruit of different cultivars and clones revealed significant differences in the amounts of phenolic compounds (anthocyanins and flavonols), benzoic and ascorbic acids. The accession of Lithuanian origin P1 was typical of the largest amount of ascorbic acid (46.1 mg/100g). Fruit of the cultivar 'Leningradskaja otbornaja' accumulated the largest amounts of anthocyanins (39.0 mg/100g). The cultivar 'Krasnaja grozd' as well as the clone P2 were distinguished for the largest benzoic acid amounts (16.3 and 14.0 mg/100g, respectively). The value of the most productive European cranberrybush accessions were determined by the number of fruit in a cluster. The results of biochemical investigations corroborated that selection of European cranberrybush

accessions in respect of benzoic acid, anthocyanins and ascorbic acid amounts could be advisable.

Key words: evaluation, biochemical composition, cultivars, productivity, breeding.

### **OPTIMISATION OF THE DRYING PROCESS OF CULTIVATED CRANBERRIES AND DECREASING THE CONSUMPTION OF ENERGY**

**Juris Bergs<sup>1</sup>, Jānis Bierands<sup>2</sup> and Baiba Melece<sup>3</sup>**

<sup>1</sup>Research Institute of Agricultural Machinery, Latvia University of Agriculture,

<sup>2</sup>Strelnieki Farm, <sup>3</sup>Lienama Aluksne SIA

The total area of cultivated cranberry plantations in Latvia has exceeded 100 ha, and it is still growing. An increasing share of the berry yield is being sold in a processed form as products that are ready for use. The most popular of them are: juices, jams, compotes (stewed fruit), cranberry halves in syrup, and dried cranberries (cranberry raisins). The processing of the product needs certain consumption of consumption of labour and energy. The most energy intensive operation is drying the berries under the conditions of the process that ensure maintaining the best qualities of the product – preservation of its gustatory and biological value. For this purpose batch-operated shaft driers are used. By applying a drying technology with the use of a heat pump for heating the air, continuous air recirculation and moisture removal in the form of a condensate, it is possible to ensure stability of the drying process and save up to 50% of electric energy.

Key words: cranberry, drying technology, *Vaccinium oxycoccos*.

### **PRESENCE OF *RHAGOLETIS MENDAX* (Diptera: Tephritidae) IN LOWBUSH BLUEBERRY FIELDS IN NORTHWESTERN NEW BRUNSWICK, CANADA**

**Sonia Gaul<sup>1</sup>, Evans Estabrooks<sup>2</sup>, Charles Vincent<sup>3</sup> and Kenna MacKenzie<sup>1</sup>**

<sup>1</sup>Agriculture and Agri-Food Canada Atlantic Food and Horticulture Research Centre,

<sup>2</sup>Evans & Associates Agricultural Consulting, <sup>3</sup>Agriculture and Agri-Food Canada, Horticultural Research and Development Centre

The distribution of *Rhagoletis mendax*, the blueberry fruit fly, is expanding within eastern Canada. To investigate the current distribution within N.B. standard yellow sticky traps were placed in selected fields of lowbush blueberries to the north and west of known areas of blueberry maggot infestation. Capture numbers of adult flies were recorded and in addition fruit was harvested and larval counts were obtained. Adult flies were trapped in 4 fields, and larvae were found in fruit from 2 fields of the 11 sites monitored over a 1-4 year period. The *R. mendax* counts and associated site characteristics are presented.

Key words: blueberry fruit fly, traps, blueberry maggot.

## **COMPARATIVE EFFICIENCY OF *RIBES ATROPURPUREUM* C.A. MEYER PROPAGATION BY SOFT-WOOD AND COMBINED CUTTINGS**

**Aleksey B. Gorbunov**

Central Siberian Botanical Garden, SB RAS

The goal of the research was to compare the rooting ability and the peculiarities of root system formation of soft-wood and combined cuttings of *Ribes atropurpureum* under the action of growth regulator, and study growth of rooted cuttings in the nursery. The study was carried out in the polyethylene film greenhouse and the nursery of CSBG in 2007-2008. Soft-wood and combined cuttings 15-20 cm long were treated with 1% tellura-M for 20 hours. The replication was 4-fold, each with twenty five cuttings. Rooting ability of cuttings, branching, number and length of roots and parameters of plant growth were registered at the end of the vegetative period. Statistical treatment of data was carried out using Statistica 5.0. Influence of propagation methods and growth regulators on cutting rooting ability and growth of roots and rooted cuttings in the nursery was evaluated by dispersion method. Reliability of difference between average values of samples was estimated with the help of t-criterion (criterion of Student). Grafting of *Ribes atropurpureum* by soft-wood and combined cuttings represents suitable methods of propagation. But grafting by soft-wood cuttings is a more effective method as considerably more roots of order I of ramification are formed.

Key words: propagation, combined and soft-wood cuttings, growth regulators, *Ribes atropurpureum*.

## **VOLATILE PROFILES OF EUROPEAN BLUEBERRY: FEW MAJOR PLAYERS, BUT COMPLEX AROMA PATTERNS**

**Jens Rohloff<sup>1</sup>, Rolf Nestby<sup>2</sup>, Arnfinn Nes<sup>3</sup>, and Inger Martinussen<sup>4</sup>**

<sup>1</sup>The Plant Biocentre, Department of Biology, Norwegian University of Science and Technology, <sup>2</sup>Bioforsk Grassland and Landscape Division, Norwegian Institute for Agricultural and Environmental Research, <sup>3</sup>Bioforsk Arable Crops Division, Norwegian Institute for Agricultural and Environmental Research, <sup>4</sup>Bioforsk Arctic Agriculture and Land Use Division, Norwegian Institute for Agricultural and Environmental Research

As part of a project on cultivation and industrial exploitation of European Blueberry (*Vaccinium myrtillus*) started in 2008, berries from different wild populations from South, Mid and North Norway were investigated. One aspect of fruit quality analyses was to identify and describe blueberry aroma profiles. Volatiles were extracted by headspace solid-phase microextraction (HS-SPME) and analysed by gas chromatography/ mass spectrometry (GC/MS) (Rohloff, 2004). More than 100 compounds could be identified based on MS database search and retention indices, also comprising aroma impact compounds not being described in blueberries earlier (Sydow & Anjou, 1969). Detected aliphatic and aromatic structures belonged to chemical groups such as alkanes, acids, alcohols, aldehydes, esters, ketones and mono- and sesquiterpenes. Ten major compounds (mostly C<sub>4</sub>-, C<sub>6</sub>- and C<sub>9</sub>-structures) accounted for averagely 65–75 % relative amount of all detected peaks. However,

HS-SPME analyses revealed complex volatile profiles including terpenes (>20 compounds, e.g. *p*-cymene, 1,8-cineole, linalool) and aromatic structures (>10 compounds, e.g. benzaldehyde, ethyl benzoate, 2-phenylethyl acetate, benzyl benzoate), which contribute to the characteristic and flavourful blueberry aroma.

Keywords: *Vaccinium myrtillus* L., headspace (HS), solid-phase microextraction (SPME), gas chromatography/ mass spectrometry (GC/MS), aroma, quality.

**DOMINANT PHYTOPHAGES OF EDIBLE HONEYSUCKLE (*LONICERA EDULIS* Turcz. ex Freyn) IN BELARUS AND THE EFFICIENCY OF BIOLOGICAL PREPARATIONS APPLICATION AGAINST THEM**  
**Natallia Kaltun, Sviatlana Yartchakovskaya and Ryta Mikhnevich**  
Institute of Plant Protection, Belarus

The objective of our researches was the study of specific and structural diversity of phytophages in honeysuckle plantations and the generalization of optimization system of their phytosanitary condition. The phonological observations on the development of host plant and phytophages were carried out in 2005-2008 in plantations of the Institute of fruit growing Minsk region. The pest records were accomplished every 10 days, starting with «buds breaking» on not less than 10 bushes of every variety. The experiments on the evaluation of biological preparations efficiency against the main honeysuckle phytophages were accomplished in 4 times repetition (3 bushes per repetition). The biological preparations against the dominant pest species were applied during the most vulnerable for the noxious organisms development periods. It is determined that the main pests both by occurrence and number in honey suckle plantations of Belarus are honeysuckle – cereal aphid - *Rhopalomyzus loniceræ* Siebold, rose leafroller - *Archips rosana* L., bud codling moth - *Spilonota ocellana* Den. et Schiff. The sporodical damage is brought by spider mite - *Tetranychus urticae* Koch. and European fruit lecanium - *Parthenolecanium corni corni* Bouch. Among three being on study varieties ('Goluboe vereteno', 'Vasilievskaya' and 'Lakomka') the variety 'Lakomka' is less damaged by pest complex. Also this variety was not damaged by the specialized honeysuckle pest – honeysuckle - cereal aphid.

It is determined that the biological preparation baciturine, ps, titre 45-60 mlrd spores g<sup>-1</sup> manufactured based on *Bacillus thuringiensis*, var. *darmstadiensis*, strain №24-91 at the Institute of Microbiology National Academy of Sciences of Belarus and the Institute of plant protection at the rate of application 6 l ha<sup>-1</sup> decreases rose leafroller caterpillars number for 42-55%. The efficiency of the experimental batch of a biological preparation lecanicil application also produced in Belarus based on the fungus *Lecanicillium (Verticillium) lecanii* (Zimm.) Zare et W. strain BL-1 6 l ha<sup>-1</sup> against honeysuckle-cereal aphid makes 22-42%.

Key words: entomocoenosis, phytophage, Edible honeysuckle, biological preparations, efficiency.

## **RESEARCH ON MINERAL COMPOSITION OF AMERICAN CRANBERRY AND WILD CRANBERRY FRUITS IN LATVIA**

**Andis Karlsons, Anita Osvalde and Vilnis Nollendorfs**

Institute of Biology, University of Latvia

Wild cranberry (*Vaccinium oxycoccos* L.) is one of the small fruit species of commercial importance in Latvia, traditionally used in folk-medicine and food. Typically, there are wide fluctuations in yield annually and between different parts of the country. The commercial cultivation of American cranberry (*Vaccinium macrocarpon* Ait.) was successfully started during last 15 years and today Latvia is the fourth major cranberries producing country. With the increase in consumption of cranberries, widely considered being as one of the healthiest foods, it becomes important to have detailed information on the nutritional content of cranberries. The aim of this study was to compare the contents of twelve biologically essential elements (N, P, K, Ca, Mg, S, Fe, Mn, Zn, Cu, Mo, B) in berries of two *Vaccinium* species: *V. oxycoccos* and *V. macrocarpon*. Together 78 (leaf and berry) samples were collected from 4 main cranberry producing sites and 3 native bogs during autumn 2004. The present study revealed significant differences in the mineral composition of *V. oxycoccos* and *V. macrocarpon*. Cultivated cranberry fruits had a higher content of P and Fe while wild cranberries showed higher levels of Ca, Mg Mn, Zn, Cu and B. Plant leaf analysis revealed organ-specific distribution of mineral elements in both cranberries studied. The present study shows that fruits of both *V. macrocarpon* and *V. oxycoccos* are a valuable source of the microelements: Mn, Fe, Cu, Mo, and B in human nutrition. Since the wild cranberry has a especially high concentrations of Mn, 100 g of fresh berries could supply 121% of the adult daily requirement.

Key words: *Vaccinium oxycoccos* L., *Vaccinium macrocarpon* Ait., fruit mineral composition.

## **RESOURCES OF SMALL CRANBERRIES (VACCINIUM OXYCOCCUS L.) AND THEIR USE ON NATURAL SWAMPS OF UKRAINIAN POLISSYA**

**Valery Konovalchuk<sup>1</sup> and Vladimir Konovalchuk<sup>2</sup>**

<sup>1</sup>National University of Life and Environmental Sciences of Ukraine, <sup>2</sup>Bridges  
Agribusiness Consulting Company

The area of wild swamp cranberries in Ukraine decreased during the last decade due to intensive agricultural use of swamps and peat extraction. Swamp cranberries are common on upper hill and transitional swamps and are rare on lower swamps. A relationship is found between swamp cranberry yields and swamp type in Ukrainian Polissya. To determine the existing resources of cranberries (area and crop) area of peat swamps of different types was used. The data was obtained from the Peat Fund of Ukraine. Necessary measures on preservation and efficient use of swamp cranberries in Ukraine have been outlined.

Key words: cranberry, peat swamp, yield, wild berries, natural swamps, natural resources, preservation.

## **THE EVALUATION OF GROWTH AND YIELDING OF SEVERAL HIGHBUSH BLUEBERRY CULTIVARS PROPAGATED BY TRADITIONAL AND *IN VITRO* METHODS**

**Bohdan Koziński**

Research Institute of Pomology and Floriculture

The experiment was established in spring 2003 in the Pomological Orchard in Skierniewice. Six cultivars of highbush blueberry: 'Bluecrop', 'Nelson', 'Hardyblue', 'Olimpia', 'Sierra', 'Rubel', planted at the density of 2,1 x 1,0 m, was evaluated. 'Nelson' and 'Bluecrop' nursery material was prepared with two methods: traditional (with semi-woods cuttings) and *in-vitro*. 'Bluecrop' cultivar was the control combination in the experiment; it was prepared in the traditional way. The field experiment was designed in a randomized blocks with 4 replications, five plants per plot. Each spring, single, nitrogen fertilization rate (N - 100 kg/ha) in form of ammonium sulphate and also potassium and phosphorus rates (K - 85 kg/ha and P - 25 kg/ha) in form of potassium sulphate and superphosphate, were applied. The aim of the investigation is a pomological evaluation of five highbush blueberry cultivars in comparison with 'Bluecrop' cultivar. In the experiment, morphological and biological features of two highbush blueberry cultivars, propagated by traditional and "in vitro" methods will also be compared, because the "in vitro" method becomes even more popular in the production. In years 2003-2008 the bushes health condition was good. The frost buds' damages were not observed during the winter periods. Moreover, a serious flower buds damages had not been noted even after the spring frost. During the experiment, 'Bluecrop' (*in-vitro*) bushes had the highest one-year-old shoots number. 'Rubel' cultivar had slightly lower number of the one-year-old shoots (>10 cm). The lowest shoots number was noted with the 'Nelson' cultivar – reproduced by the traditional method. Both 'Nelson' and 'Bluecrop' bushes obtained by the in vitro had visibly stronger growth than those, which were obtained by the traditional method. 'Bluecrop' (*in vitro*) cultivar had the highest summary yield in years 2003-2008. 'Bluecrop' had also the biggest berries. Also the 'Olympias' bushes yielded good. Other cultivars fructified in a lower level and weaker than the control one. 'Rubels' bushes had the lowest fruits mass. 'Bluecrop' (*in-vitro*) bushes yielded better and had bigger fruits than the bushes obtained in a traditional way. In case of 'Nelson', bushes obtained in a traditional way had higher yield and bigger fruits, however there was only a slight difference with the *in-vitro* plants.

Key words: highbush blueberry, cultivar, growth, yielding, in-vitro.

## **RESULTS ACCLIMATIZATION OF MICROPROPAGATED PLANTLETS *VACCINIUM* SSP.**

**Elena N.Kutas**

Central Botanical Garden of the NAS of Belarus

Comparative analysis of the results of six year long investigations of seasonal development of Bog bilberry (*Bluecrop*) and Clusterberry (*Koralle*) received in sterile culture and by traditional cuttings has demonstrated that in their development they were not worse than the plantlets developed from cuttings and some characteristics

were even better. The plantlets propagated in sterile culture and by cuttings had different flowering and fruiting indices. The number of flowering clusters per one plant, the number of flowers in a cluster, the number of berries in a cluster, the weight of berries from one plant were higher for plants grown from sterile culture than for plants developed from cuttings. Almost all phenological phases started simultaneously and did not depend on the method of propagation except for two phenophases: maturation of berries and end of vegetation period which came later for the plants from sterile culture. This method of propagation had the most substantial influence on the number of basal suckers and crop of the investigated plantlets. These indices were twice as high for the plants from sterile culture independent on year and weather conditions. It might be explained by the increase of the synthesis of endogenous cytokinins and as a result increase of suckers leading to numerous blossoming and high crop.

Key words: seasonal development, phenological phases, sterile culture, cuttings, berries, method.

#### **SCREENING OF ANTHOCYANINS AND FLAVONOLS IN BOG BILBERRY (*VACCINIUM ULIGINOSUM* L.) POPULATIONS IN FINLAND**

**Anja Lähti<sup>1</sup>; KR. Riihinen<sup>2</sup> and PS. Kainulainen<sup>1</sup>**

<sup>1</sup>Department of Environmental Science, <sup>2</sup>Department of Biosciences, University of Kuopio

Anthocyanins and flavonols of wild bilberries and blueberries (*Vaccinium* sp.) are suspected to promote various health effects. The profiles of these phenolic classes are closely linked to their genetic background being characteristic for every species. However, wild berry stands are mixtures of genotypes of the same species which may differ markedly in their abilities to produce these compounds. Furthermore, the bioactivity seems to vary according to the chemical structure of the compounds within each phenolic class. Thus, the screening of the variation of these compounds at geographical, population and individual level is essential. The ripe bog bilberries (*V. uliginosum* L.) were collected from 137 individual bog bilberry bushes (genotypes) from 15 populations on a south-north axis of about 1000 km in Finland in August 2005. The 17 anthocyanins and 8 flavonols were analyzed by a previously optimized RP-HPLC-DAD method and further confirmation of the peaks was performed by ESI-MS. There were large differences in delphinidin/cyanidin –ratios among genotypes. The malvidin glucosides were the most prominent anthocyanins, but not in all studied samples. There were commonly genotypes which consisted more of flavonols than anthocyanins. The highest total content of these phenolic classes was about 2200 mg/100 g dry weight. Bog bilberries contained lower amounts of total anthocyanins but were clearly higher both in malvidin glycosides and flavonols compared to previously studied bilberry (*V. myrtillus* L.). This information can be used e.g. for authenticity or quality control purposes or development of herbal cosmetic products.

Key words: bog bilberry; *Vaccinium uliginosum*; flavonols; anthocyanins; population; variation; HPLC-DAD, ESI-MS.

## **RABBITEYE BLUEBERRY, AMERICAN CRANBERRY AND LINGONBERRY BREEDING IN LATVIA**

**Alfreds Ripa and Biruta Audrina**  
National Botanic Garden of Latvia

The purpose of the breeding work was to create adapted to the climatic conditions of Latvia and disease resistant cultivars of rabbiteye blueberry (*Vaccinium ashei* Reade), American cranberry (*Vaccinium macrocarpon* Ait.) and lingonberry (*Vaccinium vitis-idaea* L.). The main task was the breeding of cultivars with large berries, high productivity and different ripening time. Breeding research has been carried out in National Botanic Garden of Latvia since 1980. In the work, classic plant breeding, interspecific breeding and polyploidy breeding have been employed, and wild lingonberry clones were used. The rabbiteye blueberry cultivar 'Salaspils Izturīgā' was selected from seedlings of open pollination of the cultivar 'Tifblue' in 1993 and the cultivar 'Lielogu' was selected from the hybrid ('Delite' x 'Woodart') seedlings in 1995. From the hybrid (cranberry cultivar 'Franklin' x lingonberry) seedlings were selected the cultivar 'Dižbrūklene' in 1997, the cultivar 'Salaspils Agrās' in 1996 and the cultivar 'Tīna' in 2006. The lingonberry cultivar 'Salaspils Ražīgā' origin of the wild lingonberry clone was selected as cultivar in 1993; the cultivar 'Rubīna Lāse' was selected in 1988 from open pollination seedlings of the cultivar 'Salaspils Ražīgā', but the cultivar 'Jūlija' was selected in 1995 from open pollination seedlings of the clone 'Krasnojarska'.

Key words: clones, clusters, hybrid, phenological phases, pollination, resistance, upright, vine, yield.

## **INFLUENCE OF DRYING TECHNOLOGY ON THE QUALITY OF SWEET DRIED *CHAENOMELES JAPONICA* DURING THE STORAGE**

**Dalija Seglina, Inta Krasnova, Gundega Heidemane and Silvija Ruisa**  
Latvia State Institute of Fruit-Growing

The fruits of Japanese quince (*Chaenomeles japonica*) are very common in Latvia, Lithuania and in some other European countries. They are attractive for consumption due to their high content of organic acids, vitamin C and phenolic compounds and pleasant aroma. In the Baltic region, development of Japanese quince as a fruit for consumption started in Latvia in 1951. The interest for growing Japanese quince reached a peak in 1993, but the processing was not solved. Only juice and pure were produced. Therefore a new Japanese quince processing technology was worked out and patented (RL patent Nr. LV 12779 B) at Dobeles Horticultural Plant Breeding Experimental Station (presently Latvia State Institute of Fruit Growing) and Latvia University of Agriculture in 2002. In order to broaden product spectrum made from Japanese quince the investigations were conducted at the Latvia State Institute of Fruit-Growing during the year 2007. The aim of the present work was to characterize the influence of drying technology on the quality of sweet dried Japanese quince during storage for six months. Two different drying technologies were used: with forced air circulation and microwave vacuum. The sweet dried Japanese quince was tested for content of vitamin C, phenolic compounds and changes of colour by using CIEL\*a\*b\* colour system. The obtained data showed that the content of vitamin C

decreased on average for 40%, but content of phenolic compounds for 17% in the product. The over colour of product changed after two month during the storage.

Keywords: *Chaenomeles japonica*, products, technology.

### **THE INFLUENCE OF DIFFERENT CARBOHYDRATE SOURCE ON *IN VITRO* SHOOT REGENERATION IN *VACCINIUM SPP.***

**Mária Gabriela Ostrolucká<sup>1</sup>, Emília Ondrušková<sup>2</sup>, Alena Gajdošová<sup>1</sup> and Gabriela Libiaková<sup>1</sup>**

<sup>1</sup>Institute of Plant Genetics and Biotechnology, Slovak Academy of Sciences,

<sup>2</sup>Institute of Forest Ecology, Slovak Academy of Sciences, Branch for Woody Plants  
Biology

It is known that carbohydrates are the important components of culture medium for realization of the regeneration ability of plant tissue. The carbohydrates are necessary in tissue culture as energy source and carbon skeletons for biosynthetic processes, also as osmotic agents. The sucrose is universal used for micropropagation of different plant species. The purpose of our experiments was to determine influence of different carbon sources on frequency of shoot proliferation and regeneration ability of species *Vaccinium vitis-idaea* L. (cvs. 'Ida', 'Linnea') and *Vaccinium corymbosum* L. (cv. 'Goldtraube'). Nodal explants from in vitro plants were cultured on WPM medium supplemented with zeatin (0.5 mg.l<sup>-1</sup>) and different carbohydrates such as sucrose, glucose, fructose, maltose and sorbitol (15, 20, 25, 30 and 45 g.l<sup>-1</sup>). The obtained results demonstrate that tested carbohydrates effectively influence in vitro shoot proliferation (number of shoots per explant) and also shoot growth. Higher multiplication rate was achieved on the medium with sucrose and glucose and lower concentrations (15 and 20 g.l<sup>-1</sup>) were more effective. The least effectivity of shoot production was determined on media with manitol. The results indicate that the shoot proliferation intensity is cultivar dependent and optimalisation of the type and concentration of used carbohydrates is necessary. The study confirmed that sucrose as well as others saccharids can be utilized by plant tissues and used for in vitro regeneration and effective production of *Vaccinium* spp.

Key words: *Vaccinium vitis-idea* L., *Vaccinium corymbosum* L., carbohydrates, shoot proliferation, in vitro.

### **COMPARATIVE STUDY OF CULTIVATED HIGHBUSH AND WILD BLUEBERRY NUTRIENT STATUS IN PRODUCING PLANTINGS AND WOODLANDS OF LATVIA**

**Jolanta Pormale, Anita Osvalde and Vilnis Nollendorfs**

Institute of Biology, University of Latvia

Highbush blueberries (*Vaccinium corymbosum*) grown on more than 170 ha have become an important horticultural commodity in Latvia with high market demand. To realize the full potential of modern high yielding crop, balanced plant nutrition is vitally imported to ensure adequate growth and fruit production. The main aim of this study was to find out the actual mineral nutrition status of cultivated highbush and wild blueberries (*Vaccinium myrtillus*) in Latvia as well as to evaluate the

peculiarities of blueberry mineral nutrition in producing plantings and native woodlands. About 100 (soil and plant) samples were collected from different blueberry producing sites and 5 woodlands during summer 2008. Plant leaf analysis and soil testing were used to evaluate the blueberry supply with all of the biogenous elements (N, P, K, Ca, Mg, S, Fe, Mn, Zn, Cu, Mo, B). Our results suggest that only about 40 % of plant leaf nutrient indices and soil tests were in optimal range. Insufficient level of N, P, Ca, Mo, B and increased concentrations of Mn in highbush blueberry leaves as main problems were stated. In spite of high heterogeneity of the element concentrations in soils, deficiency of N, Zn, Mo, B was found in vast majority of samples analyzed. Although forest soils were characterized as acid nutrient poor environment, wild blueberries showed especially high efficiency of K, Ca, Mg, Fe, Mn, Zn accumulation in their leaves. The present investigation forms the basis for development of on scientific knowledge based blueberry fertilization practices in Latvia

Key words: *Vaccinium corymbosum*, *Vaccinium murtillus*, mineral nutrition, plant analysis, soil testing.

#### **EXAMINATION OF CORNEL (*CORNUS MAS L.*) FRUITS IN BORSOD- ABAUJ-ZEMPLEN COUNTY (HUNGARY)**

**Eniko Prokaj, Anita Medve, Attila Ombodi and Judit Dimeny**

Szent Istvan University, Faculty of Agricultural and Environmental Sciences, Institut  
of Horticultural Technology

The domestication of cornel has already begun in the neighbour countries by the selection of valuable individuals. The spontaneously growing North-Hungarian specimens could be a good material for similar selection and domestication because foreign cultivars may not adapt to the dry climate of Hungary. Gatherers are making from cornel berries delicious palinka (a kind of spirit) and jam. The needs of processing industry and the consumption, is larger than the gathering can provide, therefore culturing of new cultivars would be favorable. Our purpose was to show there are several valuable individuals in the Hungarian cornel population, which have outstanding qualities. We observed individuals growing in natural habitat in 2006, measured the weight of fruits, seeds, and the parameters of fruit length and width. The 19 samples were taken in the Aggtelek Karsts and the Bukk southern slopes. The measured fruits weighed between the averages of 1.2-2.85gramm, the seeds were 0.27-0.41gramm, so the calculated flesh ratios were average 72.93-86.66%. The average lengths of fruits were between 15.43mm and 20.02mm, and then the average widths of them were between 10.41-14.67mm. Visibly even in a small sample can be found valuable fruit types for further examination, although it is necessary to observe a wider range of samples to find a good cultivar which is adapted to the local climate. Keywords: cornel, fruit parameters, flesh:seed ratio.

**RESEARCH ON GENETIC STRUCTURE OF A COWBERRY POPULATION  
(*VACCINIUM VITIS-IDAEA* L.) IN THE RESERVE «BOLSHAYA  
KOKSHAGA» (REPUBLIC OF MARI EL)**

**Ludmila V. Prokopyeva<sup>1</sup>, V.L. Semerikov<sup>2</sup> and N.V. Glotov<sup>1</sup>**

<sup>1</sup>Mary State University, Yoshkar-Ola, <sup>2</sup>Institute of Plant Animal Ecology RAS,  
Ekaterinburg

Genetic structure of a cowberry population in the State Natural Reserve «Bolshaya Kokshaga» (Republic Mari El) was examined based on the analyses of 15 allozyme loci, 10 of those being polymorphic. Partial plants (spaced by no less than 10-15 m) were sampled along 3 routes, being 5-15 km distant from each other; the total number made 122 partial plants. Three samples demonstrated similar allele frequencies for the corresponding loci, the average allele number per locus made 1.8 -1.9; average heterozygosis values were 0.208-0.227; the observed genotype ratios differed from the values expected after the Hardy-Weinberg relation at 1-5% level of significance. Differentiation of the samples was very low ( $F_{st}=0,014$ ), yet statistically significant. Probably one should regard these three samples as parts of the same population.

Key words: red bilberry, genotype, population.

**CLONE SIZE IN SWEDISH WILD GROWING BILBERRIES, *VACCINIUM*  
*MYRTILLUS*, ESTIMATED WITH ISSR**

**Gun Werlemark and Helena Mattisson**

Balsgård - Swedish University of Agricultural Sciences

During the summer of 2008, bilberry (*Vaccinium myrtillus*) plants from wild growing stands were collected at three places in Sweden one in the south (Asa, 20 km north of Växjö), one in the middle (Siljansfors, 200 km north of Karlstad) and one in the north (Vindeln, 100 km west of Umeå). From each location, 50 plants were collected, 5 plants in a 2x2m square for every 10 m. The plants were transported to Balsgård, SLU, in the south of Sweden, where they now reside in pots. Leaves were collected from each plant, and DNA was extracted. The clonal sizes of these three localities will be estimated with inter simple sequence repeat (ISSR) markers. The ISSR-PCR method is simple, fast and relatively inexpensive with a high degree of polymorphism, and have shown to be more reproducible than RAPD-PCR method. Diversity in clonal size and genetic structure within and between the localities will be discussed.

Key words: bilberry, genetic, ISSR-PCR method.

## **FRUITING OF NEW BLACKBERRY AND *RUBUS* HYBRIDS IN CENTRAL POLAND**

**Justyna Wójcik-Seliga**

Research Institute of Pomology and Floriculture, Poland

The experiment was set in Skierniewice, Poland in year 2005. 13 new varieties were planted in Orchard of Pomology. They are new blackberry and *Rubus* hybrids: 'Black Butte', 'Boysenberry', 'Chester', 'Helen', 'Karaka Black', 'Kotata', 'Loganberry', 'Loch Ness', 'Loch Tay', 'Oregon', 'Silvan', 'Tayberry' and 'Tummel'. They are compared with two standard blackberry varieties 'Orkan' and 'Black Satin'. The collection dates and yielding of these varieties in central Poland conditions were checked.

Key words: blackberry, *Rubus* hybrids, fruiting.

## **THE SOURCE OF THE SOURCE - WHAT AFFECTS BILBERRY FRUIT ANTHOCYANINS**

**Andreas Åkerström<sup>1\*</sup>, Åsa Forsum<sup>2</sup>, Kimmo Rumpunen<sup>3</sup>, Anders Jäderlund<sup>4</sup>  
and Ulla Bång<sup>1</sup>**

Department of Agricultural Research for Northern Sweden, Swedish University of Agricultural Sciences<sup>1</sup>, Department of Forest Genetics and Plant Physiology, Swedish University of Agricultural Sciences<sup>2</sup>, Department of Plant Breeding and Biotechnology, Balsgård, Swedish University of Agricultural Sciences<sup>3</sup>, and Department of Forest Ecology and Management, Swedish University of Agricultural Sciences<sup>4</sup>

A study conducted in northern Sweden showed that higher anthocyanin concentration (AC) could be found in fully matured bilberries that reached maturity late in the season compared with earlier dates ( $P=0.046$ ). However, in one of three studied years AC had decreased at last sampling date. Correlated with thermal sum an overall quadratic relationship was found ( $R^2=0.889$ ;  $P=0.001$ ). AC in the berries varied significantly ( $p=0.017$ ) between years. No direct source was found for this variation and it was concluded that the variation was part of an over-time fluctuation due to the cost of producing secondary metabolites. The effects of temperature and light on the AC in bilberries were studied in climate chambers. High temperature treatment yielded higher AC in the berries than low temperature treatment. A simulated northern Swedish light resulted in higher AC compared to a simulated southern Swedish light, indicating that longer days promote higher AC even if the mean irradiation is equal.

Key words: anthocyanin, bilberries.

## CHEMICAL COMPOSITION OF Highbush BLUEBERRY CULTIVARS

Solvita Kampuse<sup>1</sup>, Elga Sne<sup>1</sup>, Dace Sterne<sup>2</sup> and Inta Krasnova<sup>3</sup>

<sup>1</sup> Faculty of Food Technology, Latvia University of Agriculture, <sup>2</sup> Faculty of Agriculture, <sup>3</sup> the Latvia State Fruit Growing Institute

Selection of blueberries has expanded so far that now varieties of highbush blueberries have reached several hundreds. Particularly widespread are only approximately 60. The chemical composition and suitability for processing of highbush blueberries has been researched quite extensively, mostly in USA but there are no such studies and data of blueberries grown in Latvia. Therefore **the aim** of this investigation was to compare biochemical composition of different highbush blueberry cultivars grown in Latvia.

The experiments were done at the Faculty of Food Technology, Latvia University of Agriculture (LLU), Jelgava, and at Latvia State Fruit Growing Institute, Dobeles during the year 2008. The samples of highbush blueberry cultivars were collected from blueberry collection of Institute of Agrobiotechnology (LLU). Contents of titratable acids, soluble solids, ascorbic acid, total phenols, and anthocyanins of frozen fruits of highbush blueberry cultivars 'Northland', 'Spartan', 'Barkeley', 'Duke', 'Chippewa', 'Bluecrop', 'Jersey', 'Blueray', 'Chandler', and 'Bluejay' were analysed.

The cultivars with the highest anthocyanin content were 'Northland' and 'Jersey' (in average 118.73 and 113.76 mg 100 g<sup>-1</sup>), the highest phenol content was detected in highbush blueberry cultivar 'Spartan' (in average 381.14 mg 100 g<sup>-1</sup>), the highest content of ascorbic acid was in cultivar 'Bluejay' (in average 11.8 mg 100g<sup>-1</sup>), the highest titratable acids content in berries of cultivar 'Chandler' (1.35%), and the cultivar with the highest soluble solids content was 'Duke' (in average 12.99% soluble solids).

Key words: *Vaccinium corymbosum*, ascorbic acid, soluble solids, phenols, anthocyanins, titratable acids.

## VARIABILITY OF THE STRUCTURE OF THE BIOCHEMICAL COMPOSITION OF THE FRUITS OF THE Highbush BLUEBERRY

Zhanna Rupasova<sup>1</sup>, N. Pavlovskij<sup>1</sup>, T. Kurlovich<sup>1</sup>, F. Pyatnitsa<sup>1</sup>, A. Yakovlev<sup>1</sup>, A. Volotovich<sup>2</sup>, Yu. Pinchukova<sup>3</sup>

<sup>1</sup> Central Botanical Garden of the NAS of Belarus, <sup>2</sup> Polesky State University, <sup>3</sup> Mogilev State University of food technologies

In this article the values of the coefficients of variation of 30 indicators of the biochemical composition of the fruits of the blueberry in a three-year cycle of supervision are presented. Signs with resistance against the complex influence of meteorological factors based on the level of the variability of traits are designated. On the basis of the comparative analysis of the averaged variation coefficients calculated for a varietal row of *Vaccinium corymbosum* L. during a long-term cycle of observation it has been established that the parameters of accumulation of solids, fructose, total soluble sugars, flavonols, total bioflavonols, benzoic acid, nitrogen, potassium, calcium and magnesium in fruits can be characterized by the smallest degree of genotypic variability and, consequently, of intervarietal distinctions,

whereas the content of free organic acids, anthocyanins proper and the values of a sugar-acid index in fruits are characterized by the highest degree of genotypic variability.

Key words: *Vaccinium corymbosum* L., cultivars, biochemical composition, fruits.

## List of Participants

### **BELARUS**

---

**Grimashevich V.**

Forest institute of NAS of Belarus  
220012 Belarus Minsk str.  
Surganova, 2v, Belarus  
[grimashevich@gmail.com](mailto:grimashevich@gmail.com)

**Pavlovskij N.**

Central botanical gardens of NAS of Belarus  
220012 Belarus Minsk str.  
Surganova, 2v, Belarus  
[pavlovskiy@tut.by](mailto:pavlovskiy@tut.by)

**Yakovlev A.**

Central botanic garden of NAS of Belarus,  
220090, Belarus, Minsk, street Shyrokaja, 36-518, Belarus  
[alyakovlev@tut.by](mailto:alyakovlev@tut.by)

**Kostyukov A.**

Farm „Yagodka”  
v.Zeleny Bor, Belarus, Minsk region,  
[andrej@yagodka.info](mailto:andrej@yagodka.info)

**Kaltun N.**

Institute of plant protection,  
223011 Mira Str.2., Minsk region, Belarus  
[belizr@tut.by](mailto:belizr@tut.by)

**Pinchukova Yu.**

Mogilev State University of food technologies  
[mti@mogilev.by](mailto:mti@mogilev.by)

**Yartchakovskaya S.**

Institute of plant protection,  
223011 Mira Str.2., Minsk region, Belarus  
[belizr@tut.by](mailto:belizr@tut.by)

**Kutas E.N.**

Central Botanical Garden of the NAS of Belarus  
220072 Minsk, Surganova, 2v, Republic of Belarus  
[vinogradova-kira@tut.by](mailto:vinogradova-kira@tut.by)

**Rupasova Zh.**

Central botanical gardens of NAS of Belarus  
220012 Belarus Minsk str.  
Surganova, 2v, Belarus  
[rupasova@basnet.by](mailto:rupasova@basnet.by)

**Volotovich A.**

Central botanical gardens of NAS of Belarus  
220012 Belarus Minsk str.  
Surganova, 2v, Belarus  
[volant777@tut.by](mailto:volant777@tut.by)

### **CANADA**

---

**Debnath S.C.**

Atlantic Cool Climate Crop Research Centre, Agriculture and Agri-Food Canada, P.O. Box 39088, 308 Brookfield Road, St. John's, NL A1E 5Y7, Canada.  
[Samir.Debnath@AGR.GC.CA](mailto:Samir.Debnath@AGR.GC.CA)

**Vincent C.**

Agriculture and Agri-Food Canada, Horticultural Research and Development Centre, 430 Gouin Blvd., Saint-Jean-sur-Richelieu, QC J3B 3E6

**Estabrooks E.**

Evans & Associates Agricultural Consulting  
207 Shaw Lane, New Maryland, NB, E3c 1J2, Canada  
[enebrooks@primus.ca](mailto:enebrooks@primus.ca)

**MacKenzie K.**

Agriculture and Agri-Food Canada Atlantic Food and Horticulture Research Centre, 32 Main St., Kentville, NS B4N 1J5;

**Gaul S.**

Agriculture and Agri-Food Canada Atlantic Food and Horticulture Research Centre, 32 Main St., Kentville, NS B4N 1J5;

### **CZECH REPUBLIC**

---

**Paprstein F.**

Research and Breeding Institute of Pomology Holovousy Ltd.  
Holovousy 1, 508 01 Horice, Czech Republic,  
[fp@vsuo.cz](mailto:fp@vsuo.cz)

**Sedlak J.**

Research and Breeding Institute of Pomology Holovousy Ltd.  
Holovousy 1, 508 01 Horice, Czech Republic,  
[sedlak@vsuo.cz](mailto:sedlak@vsuo.cz)

**Ludvikova J.**

Research and Breeding Institute of Pomology Holovousy Ltd.  
Holovousy 1, 508 01 Horice, Czech Republic

## ESTONIA

---

**Paal T.**  
Estonian University of Life  
Sciences, Institute of Forestry  
and Rural Engineering  
Kreutzwaldi 5, 51014 Tartu,  
Estonia  
[taimi.paal@emu.ee](mailto:taimi.paal@emu.ee)

**Starast M.**  
Estonian University of Life  
Sciences, Institute of Forestry  
and Rural Engineering  
Kreutzwaldi 5, 51014 Tartu,  
Estonia  
[marge.starast@emu.ee](mailto:marge.starast@emu.ee)

**Kadri K.**  
Estonian University of Life  
Sciences, Institute of Forestry  
and Rural Engineering  
Kreutzwaldi 5, 51014 Tartu,  
Estonia

## FINLAND

---

**Jaakola L.**  
Department of Biology,  
University of Oulu, POB 3000,  
FIN-90014 Oulu, Finland,  
[laura.jaakola@oulu.fi](mailto:laura.jaakola@oulu.fi)

**Kokko I.H.**  
Department of Biosciences,  
University of Kuopio  
[harri.kokko@uku.fi](mailto:harri.kokko@uku.fi)

**Lätti A.**  
University of Kuopio,  
Department of Environmental  
Science,  
P. O. Box 1627, FI-70211  
Kuopio, Finland  
[Anja.Latti@uku.fi](mailto:Anja.Latti@uku.fi)

**Irmelin Nyman**  
Ass. Of Rural Advisory Centres  
SLF/ Liisankatu 21 B 12,  
00170 Helsinki, Finland  
[irmelin.nyman@slf.fi](mailto:irmelin.nyman@slf.fi)

## HUNGARY

---

**Prokaj E.**  
Szent Istvan University, Fac. of  
Agricultural and Environmental  
Sciences, Institute of  
Horticultural Technology,  
Godollo, Pater Karoly ut 1. 2100-  
Hungary  
[Prokaj.Eniko@mkk.szie.hu](mailto:Prokaj.Eniko@mkk.szie.hu)

**Medve A.**  
Szent Istvan University, Fac. of  
Agricultural and Environmental  
Sciences, Institute of  
Horticultural Technology,  
Godollo, Pater Karoly ut 1. 2100-  
Hungary

**Ombodi A.**  
Szent Istvan University, Fac. of  
Agricultural and Environmental  
Sciences, Institute of  
Horticultural Technology,  
Godollo, Pater Karoly ut 1. 2100-  
Hungary

**Dimeny J.**  
Szent Istvan University, Fac. of  
Agricultural and Environmental  
Sciences, Institute of  
Horticultural Technology,  
Godollo, Pater Karoly ut 1. 2100-  
Hungary

## ICELAND

---

**Bjarnadottir A.H.**  
Agricultural University of  
Iceland, Hvanneyri, 311  
Borgarnes, Iceland

## LATVIA

---

**Abolins M.**  
Latvia University of Agriculture,  
Liela Street 2, Jelgava, Latvia,  
LV-3001  
[Mintauts.Abolins@inbox.lv](mailto:Mintauts.Abolins@inbox.lv)

**Audriņa B.**  
National Botanic Garden of  
Latvia,  
1 Miera street, LV-2169,  
Salaspils, Latvia

**Bergs J.**  
Research Institute of Agricultural  
machinery, Latvia University of  
Agriculture  
[uzc@apollo.lv](mailto:uzc@apollo.lv)

**Bierands J.**  
Strelnieki Farm,  
Babites pag., Rigas raj.  
[janis.bierands@strelnieki.lv](mailto:janis.bierands@strelnieki.lv)

**Kampuse S.**  
Latvia University of Agriculture  
Liela Street 2, Jelgava, Latvia,  
LV-3001  
[skampuse@inbox.lv](mailto:skampuse@inbox.lv)

**Kampuss K.**  
Latvia University of Agriculture,  
Liela Street 2, Jelgava, Latvia,  
LV-3001  
[Kaspars.Kampuss@llu.lv](mailto:Kaspars.Kampuss@llu.lv)

**Karlsons A.**

University of Latvia, Institute of  
Biology,  
Miera iela 3, Salaspils, Latvija,  
LV-2169  
[augi@email.lubi.edu.lv](mailto:augi@email.lubi.edu.lv)

**Liepniece M.**

Latvia University of Agriculture,  
Liela Street 2, Jelgava, Latvia,  
LV-3001  
[marta.liepniece@inbox.lv](mailto:marta.liepniece@inbox.lv)

**Pormale J.**

University of Latvia, Institute of  
Biology,  
Miera iela 3, Salaspils, Latvija,  
LV-2169  
[augi@email.lubi.edu.lv](mailto:augi@email.lubi.edu.lv)

**Ripa A.**

National Botanic Garden of  
Latvia, 1 Miera street, LV-2169,  
Salaspils, Latvia  
[informacija@nbd.gov.lv](mailto:informacija@nbd.gov.lv)

**Sausserde R.**

Latvia University of Agriculture,  
Liela Street 2, Jelgava, Latvia,  
LV-3001, [ruditei@inbox.lv](mailto:ruditei@inbox.lv)

**Seglina D.**

Latvia State Institute of Fruit-  
Growing  
[dalija.seglina@lvai.lv](mailto:dalija.seglina@lvai.lv)

**Šterne D.**

Latvia University of Agriculture,  
Liela Street 2, Jelgava, Latvia,  
LV-3001  
[Dace.Sterne@llu.lv](mailto:Dace.Sterne@llu.lv)

**Vilka L.**

Latvian Plant Protection  
Research Centre,  
Lielvarde 36/38, Riga, LV-1006  
[regina.rancane@laapc.lv](mailto:regina.rancane@laapc.lv)

**Rudzate M.**

Latvian Fruitgrowers Association  
Riga, Bezdēlīgu 12, Latvia, LV  
1048  
[laas@laas.lv](mailto:laas@laas.lv)

---

**LITHUANIA**

**Daubaras R.**

Kaunas Botanical Garden of  
Vytautas Magnus University  
Z.E.Zilibero 6, LT-46324,  
Kaunas, Lithuania  
[r.daubaras@bs.vdu.lt](mailto:r.daubaras@bs.vdu.lt)

**Česonienė L.**

Kaunas Botanical Garden of  
Vytautas Magnus University  
Z.E.Zilibero 6, LT-46324,  
Kaunas, Lithuania

**Jasutiene I.**

Food Institute of Kaunas  
University of Technology  
[ina.jasutiene@lmai.lt](mailto:ina.jasutiene@lmai.lt)

**Paulauskas A.**

Vytautas Magnus University,  
Vileikos 8, Kaunas, Lithuania

**Žukauskienė J.**

Vytautas Magnus University,  
Vileikos 8, Kaunas, Lithuania  
[j.zukauskiene@fc.vdu.lt](mailto:j.zukauskiene@fc.vdu.lt)

---

**NORWAY**

**Martinussen I. and Jakobsen K.**

Norwegian Institute for  
Agricultural and Environmental  
Research  
Bioforsk Nord Holt, Box 2284,  
N-9269 Tromsø, Norway  
[inger.martinussen@bioforsk.no](mailto:inger.martinussen@bioforsk.no)

**Junttila O.**

University of Tromsø,  
Department of Biology,  
Dramsveien 201, N-9037 Tromsø  
Norway

**Nes A.**

Bioforsk Arable Crops Division,  
Norwegian Institute for  
Agricultural and Environmental  
Research, N-2849 Kapp, Norway

**Nestby R.**

Bioforsk Grassland and  
Landscape Division, Norwegian  
Institute for Agricultural and  
Environmental Research, N-7500  
Stjørdal, Norway

**Rohloff J.**

Department of Biology, Bioforsk  
Nord Holt, Box 2284, N-9269  
Tromsø, Norway  
[jens.rohloff@bio.ntnu.no](mailto:jens.rohloff@bio.ntnu.no)

**Røthe G.**

Norwegian Institute for  
Agricultural and Environmental  
Research  
Bioforsk Nord Holt, Box 2284,  
N-9269 Tromsø, Norway

**Uleberg E.**

Norwegian Institute for  
Agricultural and Environmental  
Research  
Bioforsk Nord Holt, Box 2284,  
N-9269 Tromsø, Norway  
[eivind.uleberg@bioforsk.no](mailto:eivind.uleberg@bioforsk.no)

## POLAND

---

**Basak A.**  
Research Institute of Pomology  
and Floriculture  
Str. Pomologiczna, 18; 96-100  
Skierniewice; Poland  
[abasak@insad.pl](mailto:abasak@insad.pl)

**Koziński B.**  
Research Institute of Pomology  
and Floriculture (RIPF)  
Pomologiczna 18 Str., 96-100  
Skierniewice, POLAND,  
[Bohdan.Kozinski@insad.pl](mailto:Bohdan.Kozinski@insad.pl)

**Stępień T.**  
Institute of Pomology and  
Floriculture  
ul Pomologiczna 18, 96 – 100  
Skierniewice, Poland

**Wojciech S.**  
Institute of Pomology and  
Floriculture  
ul Pomologiczna 18, 96 – 100  
Skierniewice, Poland

**Borkowska A.**  
Institute of Pomology and  
Floriculture  
ul Pomologiczna 18, 96 – 100  
Skierniewice, Poland

**Pluta S.**  
Research Institute of Pomology  
and Floriculture  
96-100 Skierniewice,  
Pomologiczna 18, Poland  
[spluta@insad.pl](mailto:spluta@insad.pl)

**Szwonek E.**  
Institute of Pomology and  
Floriculture  
ul Pomologiczna 18, 96 – 100  
Skierniewice, Poland  
[Eugeniusz.Szwonek@insad.pl](mailto:Eugeniusz.Szwonek@insad.pl)

**Wójcik-Seliga J.**  
Research Institute of Pomology  
and Floriculture,  
street Pomologiczna 18, 96-100  
Skierniewice, Poland  
[justyna.wojcik@insad.pl](mailto:justyna.wojcik@insad.pl)

**Kotowska U.**  
Institute of Pomology and  
Floriculture  
ul Pomologiczna 18, 96 – 100  
Skierniewice, Poland

**Smolarz K.**  
Institute of Pomology and  
Floriculture  
ul Pomologiczna 18, 96 – 100  
Skierniewice, Poland  
[ksmolarz@insad.pl](mailto:ksmolarz@insad.pl)

**Włodarczyk T.**  
Institute of Pomology and  
Floriculture  
ul Pomologiczna 18, 96 – 100  
Skierniewice, Poland

**Żurawicz E.**  
Research Institute of Pomology  
and Floriculture  
96-100 Skierniewice,  
Pomologiczna 18, Poland  
[Edward.Zurawicz@insad.pl](mailto:Edward.Zurawicz@insad.pl)

## RUSSIA

---

**Egoshina T.**  
Russian Research Institute of  
Game management and Fur  
Farming, 79 Engels st, 610000  
Kirov Russia  
[etl@inbox.ru](mailto:etl@inbox.ru)

**Luginina E.**  
Russian Research Institute of  
Game management and Fur  
Farming, 79 Engels st, 610000  
Kirov Russia  
[e.luginina@gmail.com](mailto:e.luginina@gmail.com)

**Gorbunov A. B.**  
Central Siberian Botanical  
Garden, SB RAS,  
Zolotodolinskaya st. 101,  
630090, Novosibirsk, Russia  
[gab\\_2002ru@yahoo.ca](mailto:gab_2002ru@yahoo.ca)

**Prokopyeva L.V.**  
424002 Faculty of Biology and  
Chemistry, Chair of Botany and  
Mycology, Mari State University,  
60 Osipenko Street, Yoshkar-Ola,  
Russia  
[procopjeva@mail.ru](mailto:procopjeva@mail.ru)

**Glotov N.V.**  
424002 Faculty of Biology and  
Chemistry, Chair of Botany and  
Mycology, Mari State University,  
60 Osipenko Street, Yoshkar-Ola,  
Russia

**Semerikov V.L.**  
424002 Faculty of Biology and  
Chemistry, Chair of Botany and  
Mycology, Mari State University,  
60 Osipenko Street, Yoshkar-Ola,  
Russia

## SLOVAK REPUBLIC

---

**Gajdošová A.**  
Institute of Plant Genetics and  
Biotechnology Slovak Academy  
of Sciences,  
Akademická 2, P.O.Box 39A,  
950 07 Nitra, Slovak Republic  
[alena.gajdosova@savba.sk](mailto:alena.gajdosova@savba.sk)

**Ondrušková E.**  
Branch for Wood Plants Biology  
Nitra, Akademická 2, P.O.Box  
39A, 950 07 Nitra, Slovak  
Republic; [ondruskova@savzv.sk](mailto:ondruskova@savzv.sk)

**Ostrolucká M.G.**  
Institute of Plant Genetics and  
Biotechnology Slovak Academy  
of Sciences,  
Akademická 2, P.O.Box 39A,  
950 07 Nitra, Slovak Republic  
[gabriela.ostrolucka@savba.sk](mailto:gabriela.ostrolucka@savba.sk)

**Libiaková G.**  
Institute of Plant Genetics and  
Biotechnology Slovak Academy  
of Sciences,  
Akademická 2, P.O.Box 39A,  
950 07 Nitra, Slovak Republic  
[gabriela.libiakova@savba.sk](mailto:gabriela.libiakova@savba.sk)

## SWEDEN

---

**Åkerström A.**  
SLU, Department of Agricultural  
Research for Northern Sweden,  
P.O.B. 4097, SE-90403 Umeå,  
Sweden  
[Andreas.Akerstrom@njv.slu.se](mailto:Andreas.Akerstrom@njv.slu.se)

**Antonius K.**  
Nordic Gene Bank (NordGen),  
P.O.B. 41, SE-23053 Alnarp,  
Sweden

**Bång U.**  
SLU, Department of Agricultural  
Research for Northern Sweden,  
P.O.B. 4097, SE-90403 Umeå,  
Sweden

**Jäderlund A.**  
Department of Forest Ecology  
and Management, Swedish  
University of Agricultural  
Sciences

**Forsum Å.**  
Department of Forest Genetics  
and Plant Physiology, Swedish  
University of Agricultural  
Sciences

**Mattisson H.**  
Balsgård, Swedish University of  
Agricultural Sciences,  
Fjälkestadvägen 459, 29194  
Kristianstad, Sweden

**Rumpunen K.**  
Department of Plant Breeding  
and Biotechnology, Balsgård,  
Swedish University of  
Agricultural Sciences

**Werlemark G.**  
Balsgård, Swedish University of  
Agricultural Sciences,  
Fjälkestadvägen 459, 29194  
Kristianstad, Sweden  
[Gun.Werlemark@lj.slu.se](mailto:Gun.Werlemark@lj.slu.se)

**Alstrom S. and Paul L.**  
Forest Mycology and pathology,  
SLU, Sweden  
[sadhna.alstrom@mykopat.slu.se](mailto:sadhna.alstrom@mykopat.slu.se)  
[les.paul@mykopat.slu.se](mailto:les.paul@mykopat.slu.se)

## UKRAINE

---

**Konovalchuk V.**  
Institute for Forestry and  
Landscape Architecture  
National University of Life and  
Environmental Sciences of  
Ukraine, 15 Geroiv Oborony  
Street, educational bulding 1,  
office 100, KYIV, 03041,  
Ukraine  
[Konovalchuk@twin.nauu.kiev.ua](mailto:Konovalchuk@twin.nauu.kiev.ua)

**Konovalchuk V.**  
Bridge Agrobusiness Consulting  
Company,  
Ukraine

## USA

---

**Hancock J.**  
Michigan State University, East  
Lansing, USA,  
[hancock@msu.edu](mailto:hancock@msu.edu)

**Penhallegon R. H.**  
Oregon State University,  
OSU/Lane County Extension  
Service,  
950 W 13 Avenue, Eugene, Oregon,  
USA 97402  
[ross.penhallegon@oregonstate.edu](mailto:ross.penhallegon@oregonstate.edu)

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Lauksaimniecības fakultātē, Agrobiotehnoloģijas institūtā  
Lielā iela 2  
Jelgava  
Tālrunis: +371 63005630  
e-pasts: [Dace.Sterne@llu.lv](mailto:Dace.Sterne@llu.lv)

