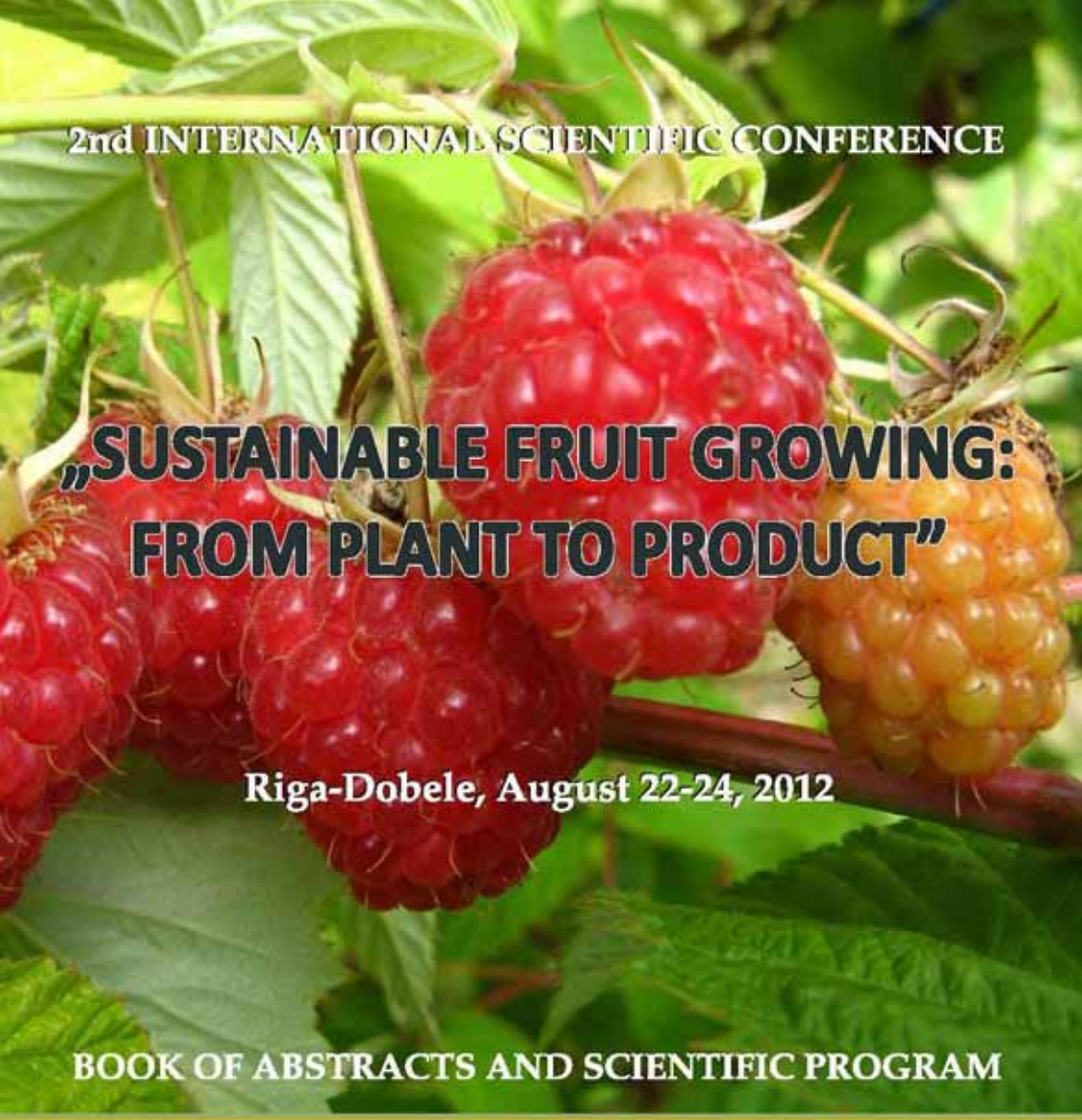


2nd INTERNATIONAL SCIENTIFIC CONFERENCE

# „SUSTAINABLE FRUIT GROWING: FROM PLANT TO PRODUCT"

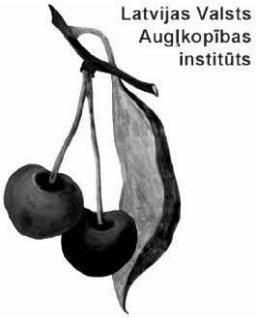
Riga-Dobele, August 22-24, 2012

BOOK OF ABSTRACTS AND SCIENTIFIC PROGRAM

Organized by:

Latvijas Valsts Augļkopības Institūts

Latvia State Institute of Fruit-Growing

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# „SUSTAINABLE FRUIT GROWING: FROM PLANT TO PRODUCT”

**August 22 - 24, 2012**

**Riga-Dobele**

**Organized by:**

Latvia State Institute of Fruit-Growing
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# Opening session

# SITUATION AND DEVELOPMENT OF FRUIT SCIENCE AND COMMERCIAL FRUIT PRODUCTION IN LATVIA

**Edīte Kaufmane, Māra Skrīvele, Edgars Rubauskis, Sarmīte Strautiņa**
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According to the data of the Latvia Fruit Growers Association, there are about 800 farms specializing in fruit growing in Latvia. Small farms with orchard area 1 to 3 hectares dominate and only 6 % are larger farms over 15 hectares. Insufficient cooperation is an obstacle to faster development of fruit growing, although there are some cooperatives formed. Specialized farms dominate. Integrated growing system was introduced in most farms since 2006.

Apples are by far the most widely grown fruit crop in all types of orchards in Latvia. Yet only 15 % ha of these are commercial orchards (larger than 1 ha and planted to produce fruits for market). The largest part of commercial orchards was planted in the last 14 years. The variety of apple cultivars grown is too high for the needs of supermarkets. The most widely grown are 'Auksis', 'Sinap Orlovskii', 'Antei'. Farms still use mostly traditional cool storage; research has only started to promote implementation of modern storage technologies. The proportion of other tree fruit crops (pears, plums and cherries), which present more risks in production and which have few well-adapted cultivars with good fruit quality, is low.

The areas of currants, raspberries and strawberries also have rapidly increased during the last 10 years. So far technologies reducing risks are not widely used, but there are trends to introduce innovative technologies. Relatively stable yields are obtained from new crops which are well-adapted to Latvian climate – seabuckthorn and cranberries. Their total areas are still small, but show increase. There are also successful solutions in the harvesting and processing of the produce. The cultivation of highbush blueberries so far has problems with well adapted cultivars and in applying risk-reducing technologies.

Fruit growing has a potential in Latvia, as - the products are various; income from 1 ha is high in intensive orchards; original processed products have good market potential, processing SME are developing; the market and consumer demand increase for locally grown fruits. On the other side the crops and cultivation methods are highly different, the plantations need long-term investment with relatively slow return, so fruit growing needs scientific expertise and long-term research.

Several research institutions work in the field, the leading one is Latvia State Institute of Fruit-Growing. Research is done in the following directions:

- Breeding of disease resistant, climate adapted cultivars, using Latvian and introduced genetic resources and effective breeding methods;
- Development of environment friendly, sustainable technologies for more widely grown crops in different conditions;
- Research of fruit crop pathogens in Latvia, their distribution, development biology and control; introducing of healthy plant material propagation system in Latvia;
- Recommendations for storage of fruit and berry cultivars, development of innovative fruit processing methods and products.

**Key words:** growing area, farm size, fruit market, risk-reducing technologies, breeding, fruit crop pathogens, propagation, storage, processing

# Session 1:
# Orchard management and variety testing

# ORAL PRESENTATIONS

## THE BLACKCURRANT PRODUCTION TRENDS IN POLAND AND EUROPE

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The blackcurrant (*Ribes nigrum* L) is commercially grown in Poland on large acreage of cultivation with a fully mechanized management of plantations, including fruit harvest. For many years, Poland has been the top producer and exporter of blackcurrants with high production level ranging between 115-147.000 Mt. The fruit production of blackcurrants is mainly destined for processing and freezing industries. Majority of the fruit is used for production of concentrated juice and other processed products as well as for freezing. Also fruits of dessert type cultivars are produced for fresh market. Growing of blackcurrant fruits for fresh market is beneficial for consumers by enhancing the fresh fruit market and enriching the human diet in health benefits. It allows growers to introduce an innovative production technology (open field, protected cultivation, off season production) and provide increasing profitability of production of these fruits. Till now Scottish cultivars of "Ben" series ('Ben Lomond', 'Ben Connan', 'Ben Alder' and 'Ben Hope') are commonly cultivated on existing plantations. However, most recently the new Polish cultivars ('Tisel', 'Tiben', 'Ruben', 'Ores' and 'Gofert') have been introduced in the commercial production. These cultivars are well adapted to the local agro-climate conditions, possess high production value, are resistant to the main fungal diseases and are suitable for the machine fruit harvest. Their fruits have also better quality and usefulness for processing than old cultivars like 'Ojebyn' and 'Titania'. To get further development in the blackcurrant production in Poland, at the Research Institute of Pomology and Floriculture (now Research Institute of Horticulture) in Skierniewice a very intensive breeding program has been conducted. The last release of this program is the newest cultivar 'Polares'. It is the first Polish cultivar genetically resistant to the harmful pest – gall mite (*Cecidophyopsis ribis* West.). The fruit prices of blackcurrants and the profitability obtained by growers depend frequently on the weather conditions influencing the production level. In Poland the weakest point of the blackcurrant production is fluctuating profitability obtained by growers, which is mainly caused by the lack of the fruit grower's organization.

Blackcurrant has also been grown commercially in some European countries. According to the official data from the International Blackcurrant Association (IBA) Poland has recently been the largest world producer of blackcurrants, followed by the United Kingdom, Denmark, France and Germany. Large-scale production also takes place in New Zealand and China. The fruit production and selling of blackcurrants in the EU countries and New Zealand is based on the written contract agreements made between processing industries and growers. The same concerns the grower's organization. Well organized fruit producers are established in different countries, where blackcurrants have been grown commercially.

Main problems with blackcurrant fruit production in Poland and other countries are connected with spreading of the gall mite (*C. ribis* West.) and blackcurrant reversion virus (BRV) due to lack of sufficient chemicals against this pest. Recently, several cultivars resistant to the pests and BRV have been released from breeding programs in different countries.

**Key words:** blackcurrant, *Ribes nigrum* L., fruit production, crop, prices, cultivars, main problems

[1]the International Blackcurrant Association (IBA) - www.internationalblackcurrantassociation.com

# STRAWBERRY AND RASPBERRY PRODUCTION AND RESEARCH IN POLAND

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In Poland strawberry is ranked as an economically important horticultural berry crop. In the past couple of years, the production of strawberries has been stable at about 180-200 thousand MT annually, an exception was 2012 when due to a very severe and snowless winter a great part of strawberry fields had to be liquidated. Because of that the total strawberry production in 2012 only slightly exceeded the level of 100 thousands MT of fruits and the total area of plantations was decreased to about 35.000 ha. For many years strawberries have been grown only in the open field and the traditional, extensive narrow matted row system of cultivating dominated. The main cultivar was 'Senga Sengana', destined mainly for processing and freezing industry and also for fresh market. 'Senga Sengana' still predominates the Polish strawberry production, however its share in the structure of cultivars has decreased to about 50%. Deep changes in production of strawberries in Poland took place about 20 years ago and were stimulated by the rising demands of consumers interested in buying high quality desert fruit in the extended season. From that time on the different programmed cultivation methods of dessert cultivars for fresh market started including cultivation for early and late harvest in the open field and under protection. New cultivars like 'Elsanta', 'Honeoye', 'Kent', 'Darselect', 'Selva', 'Albion' and others were imported and introduced into commercial production. In favorable conditions these cultivars produce high quality fruit, but they also have some disadvantages, like low level of winter hardiness or susceptibility to soil-borne fungal diseases. To overcome the problems connected with strawberry production different research activities are being carried out like breeding of domestic cultivars, improvement of cultivation methods for off season production, integrated pest management, etc.

Raspberry is another berry crop that has been produced in Poland on large scale for many years. The official statistical data show that raspberry plantations occupy an area of about 20.000 ha and the total fruit productions well exceeds the level of 100.000 MT (in 2011). Primocane and floricane cultivars are grown. Majority of fruits is obtained from plants cultivated in the open field (more than 95 %) – most of plantations are managed as free-standing (primocane) or in hedgerow system (floricane). Only some plantations are furnished with irrigation or fertigation system. Less than 5 % of fruits are produced under cover – in plastic tunnels or under roof type cover. The plants are grown mostly in the soil, but in some cases in the pots. Harvested fruits are destined mainly for processing and freezing industry (65 – 70%), the remaining 30-35 % is used by the fresh market. Both primocane and floricane cultivars are grown, however in production dominate floricane Polish bred cultivars 'Polana' and 'Polka', with increasing economic importance of 'Polka'. Main cultivation problems are the low level of winter hardiness of foreign cultivars like 'Wilamette', 'Glen Ample' or 'Tulameen', susceptibility of 'Polka' to Raspberry Bushy Dwarf Virus, and lack of cultivars fully suitable for mechanical harvesting of fruits. To solve the problem the main research activities are focused on breeding of new cultivars well adapted to the local environment and suitable for the mechanical harvesting as well as on the improvement of the existing fruit harvesters.

The strong point of the Polish strawberry and raspberry production is a long tradition in growing these crops, skilled and well motivated growers, favorable agro climatic conditions and good quality of the fruit harvested. The most important weak point is the insufficient organization of the fruit growers and not stable profitability of the production.

# EVALUATION OF WINTER HARDINESS AND PRODUCTIVITY OF HIGHBUSH BLUEBERRY CULTIVARS IN LATVIA

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Winter hardiness is very important for introducing and commercial cultivation of blueberries in North Europe. Winter survival in the field is influenced by multiple factors that are affected by uncontrollable environmental parameters. Four farms which produce highbush blueberries were surveyed in three different fruit-growing areas of Latvia. The study period was years 2007 - 2011. We were interested in the plant winter hardiness (estimated using a ten-point scale: 0 points – a plant is dead, 1 point – very low winter hardiness, all branches damaged up to the soil level, 9 points – very high winter hardiness), yield (kg per bush), berry weight (g) and berry size (mm). In all study sites 12 highbush blueberry cultivars and 5 half-highbush blueberry cultivars were evaluated. The lowest winter hardiness in all fruit-growing areas was observed in 'Duke' and 'Brigitta'. 'Patriot', 'Chippewa' and 'Northland' had the highest winter hardiness and average yield throughout the evaluated period. In half-highbush blueberry group 'Northcountry' had the lowest yield and smallest berry size. Cultivar 'Chandler' had the largest berry size - most of the berries had a diameter of 20 mm.

**Key words:** *Vaccinium corymbosum* L., *Vaccinium corymbosum* × *Vaccinium angustifolium*, yield, berry weight, berry size

# AGRONOMICAL CHARACTERS OF INTRODUCED NEW BLACKCURRANT CULTIVARS

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Blackcurrants (*Ribes nigrum* L.) are the most important bush fruits grown commercially in Lithuania. The main goals of *Ribes* breeding programs are fruit yield and quality, resistance to pest and fungal diseases, suitability for processing and fresh market, adaptability to local environmental conditions. There a still a strong need for new blackcurrant cultivars. The objective of this study was to evaluate agronomical characters of nine blackcurrant cultivars.

Blackcurrant cultivars 'Abanos', 'Ronix', 'Deea', 'Geo' (Romania), 'Almo' (Estonia), 'Narve Viking', 'Varde Viking' (Norway), 'Mikael' (Finland), with standard cultivar 'Ben Tirran' (Scotland) were tested at the Institute of Horticulture, Lithuanian Research Centre for Agriculture and Forestry in 2009-2012. Two-year-old bushes were planted in an orchard in 2009. Bush parameters (vigor and width, m), resistance to anthracnose (*Pseudopeziza ribis*) and leaf spot (*Septoria ribis*), weight of 100 fruits, yield (t $ha^{-1}$) and biochemical composition were studied.

Investigations showed that 'Almo', 'Geo' and 'Varde Viking' were most resistance to fungal diseases. Fruits of 'Ronix', 'Abanos' and 'Narve Viking' were the biggest. Yield of cultivars 'Ronix', 'Abanos' and 'Deea' were the highest. Biochemical composition of new introduced cultivars is provided.

**Key words:** *Ribes nigrum*, cultivar, yield, fungal diseases, biochemical composition

# EVALUATION OF PEAR ROOTSTOCKS IN THE PROJECT "BALTIC ROOTSTOCKS STUDIES"

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In 2001 investigations were established, where trees of Latvian origin pear cultivar `Suvenirs` grafted on seven pear rootstocks (QA, QC, BA29, Pyrodwarf, OH×F333, Kirschentaler Mostbirne and Kazraušu) were planted in Polli (Estonia), Pūre (Latvia) and Babtai (Lithuania). The aim of the investigation was to evaluate rootstocks in different climatic conditions in the Baltic region. In Polli all trees were planted in a dense planting, therefore the trunk cross-section area did not differ significantly between rootstocks. The most vigourous tree habit was observed in Lithuania on the rootstocks Kirschentaler Mostbirne and OH×F333, but in Latvia on Kirschentaler Mostbirne and Kazraušu. On rootstock QC the smallest trees were observed in both places – Latvia and Lithuania. The highest cumulative yield from the orchard area was stated for trees grafted on rootstocks of the quince group in all three locations of investigation. Nevertheless the wintering ability of quince group rootstocks is not sufficient for Baltic climatic conditions. Good overwintering in Latvia and Lithuania was observed for trees on Pyrodwarf. In its turn surviving rate of trees on Pyrodwarf in Estonia was unsatisfactory. The worse overwintering in Lithuania was observed for trees grafted on OH×F333. Intensive development of offshoots should be noted as drawback of Pyrodwarf rootstock. The rootstocks included in the investigation have dwarfing influence on trees, but no one of them can be recommended as perspective for commercial orchards in Baltic agro-climatical conditions.

**Keywords:** *Pyrus*, vigour, tree survival, yield

# EFFECT OF DRIP IRRIGATION AND WOODCHIP MULCH ON YOUNG SOUR CHERRY GROWTH AND YIELD

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The trial was established at the Latvia State Institute of Fruit-Growing in 2007 to investigate the effect of drip irrigation and woodchip mulch on sour cherry growth and yield. The cultivars 'Bulatnikovskaya', 'Desertnaya Morozovoi', 'Latvijas Zemais', 'Orlica', 'Shokoladnica', 'Tamaris' and 'Zentenes' were planted in the plots with drip irrigation, woodchip mulch and control. The data of vegetative growth, generative development, yield and yield quality were summarized from 2007 to 2011. Drip irrigation and woodchip mulch advanced trunk and canopy growth. The amount of spur and proportion of pruned branches as well as flowering and fruit set did not differ among treatments. Cultivars 'Bulatnikovskaya', 'Orlica', 'Tamaris' and 'Zentenes' were more responsive to drip irrigation, giving larger yields. The yield in drip irrigation variant was significantly higher for these cultivars in 2011. Yield of the cultivars 'Latvijas Zemais', 'Desertnaya Morozovoi' and 'Shokoladnica' was higher with woodchip mulch. The yield in woodchip mulch variant was significantly higher in 2010. Cultivar 'Bulatnikovskaya' showed the highest productivity in first three yielding years. The content of total soluble solids in the fruits was slightly lower for the cherries grown in the woodchip mulch variant. Fruit weight, fruit flesh weight, the content of total acids and total phenols were not influenced by drip irrigation or woodchip mulch treatment.

**Key words:** *Prunus cerasus*, trunk, canopy, soluble solids, total acids, phenols

# COLORED PLASTIC MULCH MICROCLIMATES AFFECT STRAWBERRY FRUIT YIELD AND QUALITY

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Significant reduction of strawberry (*Fragaria x ananassa* Duch.) fruit yield and quality,as a consequence of practicing traditional cultivation method, is common in the Caspian Sea region, Iran. Recently, growers started using plastic mulches to overcome these shortcomings. As these mulches have different thermal and radiation properties, these could influence plant radiation environment, therefore; it is assumed that fruit weight and quality might be affected. To test this assumption, a completely randomized block design with four kinds of plastic mulches: red, black, and white, along with traditional method, as control, in four replications were established for 'Camarosa' cultivar, at Sari region, Iran in 2010-2011. Plants were dripped irrigated and dressed with NPK fertilizers. Harvested fruits were weighed with an accurate balance and graded based on their size. Colored plastic mulches had highly significant effect on fruit size, weight and flavonoid content. In most harvest times, mean fruit weight was significantly higher in red plastic compared to white and control treatments. Total fruit weight on plastic mulches weren't significantly different, while all were statistically higher than control. The red plastic mulch produced the lowest fruit numbers, but the biggest fruits, while in control variant the fruit numbers were the highest, but size of fruits the smallest. The contents of phenolic compounds and IC-50 on colored plastics weren't significantly different from control, while fruits on red plastic had higher flavonoid contents relative to other treatments. conclusion, colored plastic mulches could affect strawberry fruit weight and quality through altering strawberry light environment.

**Key words:** *Fragaria x ananassa*, colored plastic, light environment, antioxidant

# FERTIGATION TIMING AND VERMICOMPOST AFFECT VEGETATIVE GROWTH OF STRAWBERRY (*FRAGARIA×ANANASSA* DUCH.)

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Providing nutrient at right stage of growth and controlling soilborne pathogens are two major factors in production of strawberry. Fertigation, supplying crops with fertilizers through irrigation water, is an excellent method for controlling timing, amount and concentration of fertilizers. In addition, soilless medium supplemented with vermicompost could be an alternative to methyl bromide (MB) fumigation in strawberry production. In present study, the effect of fertigation timing and vermicompost on vegetative growth of 'Camarosa' strawberry plants was investigated in a pot experiment at Sari Agricultural Sciences and Natural Resources University, Sari, Iran, in 2011-2012. Treatments were seven soilless media; a peat + perlite (1:1) base medium, supplemented with either 10%, 20% and 40% vermicompost, or 10%, 20% and 40% cattle manure in combination with four fertilization timings: fall, spring, fall + spring and no fertigation. The results showed that the effects of culture media, fertigation timing and their interaction were highly significant ($P< 0.01$) on all measured parameters. Leaf area was 75% higher in medium supplemented with 10% vermicompost and fall fertigation as compared with control plants. Medium containing 10% vermicompost and fall + spring fertigation produced the highest number of leaves. Strawberry plants in medium containing 20% vermicompost and fall + spring fertigation had the highest petiole length (45.8 mm) and petiole diameter (2.0 mm). The highest crown diameter (12.3 mm) and chlorophyll content (52.6 *μg/l*) were observed in base medium with fall fertigation. It can be concluded that the fall fertigation and vermicompost had positive effects on vegetative growth of strawberry.

**Key words:** fertigation, vermicompost, strawberry, soilless media

# POSTER PRESENTATIONS

## MODIFICATION OF SOIL PROPERTIES FOR BLUEBERRY (*VACCINIUM CORYMBOSUM* L.) CULTIVATION

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The research objective was to test the main soil characteristics as a result of soil modification in highbush blueberry plantation. Research was carried out at Ogre district Mazozoli parish „Bîsnes" farm in 2011 where plantation was established 7 years ago. Experimental plots were arranged in complex slope, by choosing different parts of terrain. Soil – Base–unsaturated brown soil or *Haplic Cambisol*, sandy loam. Original topsoil's reaction was pH KCl – 5.37. Five experimental plots each of them consisting of 7 bushes were set up. Soil reaction was determined potentiometrically, organic matter in mineral soil according to the Tyurin method, in organic materials – by wet digestion, total nitrogen by the Kjeldahl method. Phosphorus and potassium were detected in organic materials– by dry combustion, but in mineral soil – by Egner–Riehm method. Samples of leaves from each experimental plot were taken during the vegetation for the NPK nutrition diagnostics. Research showed that modification of topsoil significantly changes the physical and agrochemical properties of soil. Soil bulk density reduces, porosity and soil aeration increases. Sphagnum peat (pH KCl 3.0) as a soil modifier allows efficiently reduce soil reaction in the soil root zone and provides an optimal environment for blueberries. Soil is not the determinant factor that limitates productive establishment of a blueberry plantation in Latvia. Soil properties adjusted accordingly to the requirements of highbush blueberry give a possibility to establish plantations also in typical mineral soils that have developed on low calcareous moraine.

**Key words:** highbush blueberries, cultivation in Latvia, soil properties

# THE INFLUENCE OF PLASTIC MULCH ON SOIL MICROBIAL ACTIVITY IN STRAWBERRY FIELD

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Growth and productivity of strawberries can be significantly influenced by soil microbial community. The aim of this study is to understand the influence of different plastic mulches on soil microbial activity in strawberry planting. The experiment was carried out in Pûre Horticultural Research Centre, Latvia, in 2011. The evaluation was done in two different plantings: in planting of 2009, where white plastic mulch with black lower side (white on black) and no mulching were used, and in planting of 2011, where black plastic mulch and no mulching were used. Intensity of soil respiration, activity of dehydrogenase and cellulase were used as indicators of microbial activity. Soil samples were collected 3 times during vegetation season – in July, August and September. It was stated that the average soil respiration and activity of dehydrogenase were similar for all growing technologies. The soil respiration and activity of dehydrogenase in the lder planting were insignificantly higher than in the newer planting. Flax textile samples were used to determine cellulase activity in the soil. Higher cellulase activity was observed in planting of 2011 compare to planting of 2009. In the planting of 2011 complete decomposition (100% cellulose activity) of flax textile samples in soil was observed after 2 months in both variants - mulched with black plastic and bare ground. In the planting of 2009 cellulase activity ranged between 54 and 65%. Higher cellulase activity was observed on bare soil compared to white on black plastic mulch.

**Key words:** *Fragaria x ananassa* Duch., activity of enzymes, cellulase, dehydrogenase, soil respiration

# INFLUENCE OF ROOTSTOCK ON PLUM FLOWERING INTENSITY IN DIFFERENT GROWING REGIONS

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The choice of rootstock is the main precondition for establishing of a high yielding and sustainable plum orchard. Flowering intensity is one of indicators for evaluating of plant overwintering and subsequent yield. The aim of the investigation was to evaluate the influence of different rootstocks on the flowering intensity of two plum cultivars: `Kubanskaya Kometa` (*P. salicina x cerasifera*) and `Victoria` (*P. domestica* L.) in different agro-meteorological conditions. Sixteen rootstocks known in Europe – eight vegetatively propagated (St. Julien A, Brompton, Ackermann, Pixy, GF 8/1, G 5/22, GF 655/2, Hamyra) and eight generatively propagated (St. Julien INRA2, St. Julien d'Orleans, St. Julien Noir, Brompton, Wangenheims Zwetsche, St. Julien Wädenswil, Myrobalan, *P. cerasifera* ssp. *divaricata*) were used. The evaluation was done in experimental orchards in Latvia, Estonia and Belarus. Orchards were established in spring of 2001. Trees were planted at a spacing 5x3 m in four replications, three trees per plot. The obtained data of years 2008–2012 are presented. The influence of rootstock on flowering intensity in spring differed between years and growing regions. It closely correlated with meteorological conditions during wintering period.

**Key words:** *Prunus*, cultivar, flower buds, meteorological conditions, Latvia, Estonia, Belarus

# THE BEHAVIOUR OF SOME PEACH AND ALMOND CULTIVARS IN CLIMATICAL CONDITIONS OF SOUTH EASTERN ROMANIA

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The experiment was caried out at Research Station for Fruit Growing, that is located in south-eastern Romania. The main objetive was to test some peach and almond genotypes having as aim the identification and selection of the most resistent/tolerant of long period of dry and extreme temperature

The climate in south eastern Romania has low rainfalls, winters with frost and strong winds. The soils are good, well supplied with organic matter and mineral elements.

Observations regarding frost and drought resistance, phenology, tree vigour, quality and quantity of the yield were made on the studied cultivars of peach and almond.

The results showed as three cultivars of peach ('Redhaven', 'Filip', 'Catherine sel. 1') and four cultivars of almond ('Preanîi', 'Ferragnes', 'Autofertil 1' and 'Autofertil 2') are well adapted and must be extended in regional orchards.

**Key words:** *Prunus persica, Prunus dulcis*, frost resistance, drought resistance, vigour, yield quality

# INFLUENCE OF CALCIUM AND BORON TO DECREASE TEMPERATURE STRESS OF DOMESTIC PLUMS

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As a result of climate change the harsh weather conditions in winter negatively affect the quality of plum plantations. So growers should look for solutions to increase the winter hardiness of trees. Winter hardiness of tree and buds are significantly affected by both abiotic and biotic factors. Among of the main factors disturbing plant development are temperature and balanced composition of nutrient status. The high temperature fluctuations which occur in winter in recent years, lead not only to freezing of buds, but also trees. Calcium (Ca) and boron (B) have significant impact on both plant vegetative and generative growth and development. The aim of the study was to determine influence of Ca and B fertilization by spraying to decrease the stress caused by environmental factors. The chlorophyll fluorescence activity was measured and the fluorescence parameter ratio determined. In the trial were included Latvian cultivars 'Sonora' and 'Lāse', and 'Duke of Edinburgh' as control. Preliminary results show that fertilizer spraying caused no significant improvement in 2011 with extreme temperature fluctuations in winter and spring period. The cultivars had significantly different ability to resist environmental stress. If the optimum Fv / Fm ratio is 0.83, in 2011 the ratio was 0.81 for control, but with treatment of Ca and B - 0.80. The statistical analyses show significant effect of treatments and difference between periods of measurement also.

**Key words:** *Prunus domestica* L., abiotic stress, chlorophyll fluorescence

# PERFORMANCE OF SOME APRICOT CULTIVARS IN THE NURSERY IN SOUTHEAST ROMANIA

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The research was carried out at Research Station for Fruit Growing Constanta, Romania, during 2009-2010, with the aim to study the behaviour in the nursery trials of eight apricot cultivars, bred in our Research Station: 'Traian', 'Tudor', 'Sirena', 'Fortuna', 'Cristal', 'Amiral', 'Orizont' and 'Augustin' grafted on two rootstocks for apricot: Constanta 14 and C74-8 P2. We compared the performance of these combinations concerning to: the grafting success, vigour, yield of total grafted trees and tree quality in the nursery. We found that the investigated cultivar-rootstock combinations behaved very well in the grafting process (the effectiveness of budding was over 77%) and had high production of grafted trees per 1 ha. The cultivars had good compatibility with the rootstocks and exhibited no external deformations. We also observed different vigour of grafted trees, depending on rootstock and cultivar.

**Key words:** *Prunus armeniaca*, tree quality, rootstock, grafted trees

# SURVEY OF FOLIAR NUTRIENT STATUS OF HIGHBUSH BLUEBERRY IN LATVIA: 2007-2011

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Highbush blueberries (*Vaccinium corymbosum* L.) cultivated on more than 170 ha in Latvia have a great potential to become a commercially important small fruit crop with high market demand and processing possibilities. Although fertilization requirements for blueberries are relatively low compared to most fruit crops, balanced nutrition is vitally important to ensure adequate growth and fruit production. Therefore there is an urgent need to estimate the nutrient status of blueberry crop in Latvia to evaluate actual fertilization practices, revealed main problems, and prevent limitations. From quantitative techniques, plant analysis is generally preferred to diagnose mineral nutrition of blueberries. The main aim of this study was to find out the foliar status (N, P, K, Ca, Mg, S, Fe, Mn, Zn, Cu, Mo, B) and main trends in mineral nutrition of highbush blueberry in Latvia during 2007–2011. Together 140 leaf samples were collected from different blueberry producing sites in Latvia. Our results suggest that only about 40 % of leaf nutrient indices were in optimal range. The present study revealed the main problems in blueberry supply with essential nutrients - low levels of N, Ca, Mo, increased concentrations of Mn, and high variability of Cu in blueberry leaves. Positive tendencies in nutrient status of blueberries were found from 2007 to 2009: mean concentrations for N, Ca, Mn, and Cu become more corresponding to tissue standards; however significant decrease in nutrient supply was found in 2011 – in general, blueberry leaves pointed out deficiency of N, P, S, Zn, Cu, and Mo.

**Key words:** *Vaccinium corymbosum*, mineral nutrition, foliar analysis

# EFFECT OF UNFAVORABLE WINTER CONDITIONS ON APPLE RESISTANCE

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The main limiting factor for the successful cultivation of fruit trees in the middle zone of horticulture of Russia is severe winters. The aim of this paper is to assess the winter-hardiness of apple cultivars and to identify characteristics of resistance by physiological and biochemical methods. Local apple cultivars demonstrated high winter hardiness during their studying (1972-2010). Stability at the level of 'Antonovka Obiknovennaya' during severe winters in 2005/06 was revealed in cultivars 'Augusta', 'Orlik', 'Orlovskoe Polosatoe', 'Sinap Orlovskii', 'Veteran',' Kulikovskoe', 'Pamyat Voinu', 'Orlinka', 'Orlovim', 'Vita', 'Orlovskaya Zarya' and 'Nadezhnoe'. New scab resistant cultivars of VNIISPK breeding (gene $V_f$) obtained by hybridization of local adapted cultivars with the donor of immune system also displayed the resistance to unfavorable winter conditions in the middle zone of Russia: 'Imrus', 'Bolotovskoe', 'Svezhest', 'Venyaminovskoe', 'Orlovskoe Polesie', 'Solnishko', 'Yablochnii Spas' and 'Rozhdestvenskoe'. The application of physiological and biochemical methods allowed revealing some peculiarities of resistance formation and its response to unfavorable winter conditions. Various reactions of cultivars to influence of extreme variable temperatures in the end of winter were established: water losses in the tissues of shoots of central-Russian and new cultivars of apple were lower in comparison with western-European ones which are more subject to solar burns. Higher maintenance of sacharose, anthocyanins, cyanidins, proline in first-year branches of the most winter-hardy cultivars 'Antonovka', 'Krasa Sverdlovska', 'Imrus', 'Svezhest', 'Sinap Orlovskii' was detected in comparison with cultivar with low level of winterhardiness 'Priam'. By electrophoresis the polymorphism of the ferment system of peroxidase in leaves was demonstrated. It was established that the isoferment structure changes depending on a genotype and influence of negative temperature. In winter, the peroxidase activity in the first year shoots decreased in winter-hardy cultivars 'Antonovka Obiknovennaya', 'Imrus', 'Svezhest', and remained at high levels in 'Priam', which indicates its incompleteness of the formation of resistance. A model of winter-hardy apple cultivar was designed.

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**Key words:** *Malus,* winter hardiness, cultivars, artificial freezing, physiological and biochemical methods

# SUITABILITY OF 'JONAGOLD' CLONES FOR COMMERCIAL GROWING IN LITHUANIA

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Seven clones of cultivar 'Jonagold': 'Red Jonaprince Red Prince', 'Jonagold Boerekamp Early Queen', 'Jonagored Supra', 'Jonaveld First Red', 'Decosta Jonagold DeCoster', 'Jonagold Novajo' and 'Jonabel' were tested at the Institute of Horticulture in Babtai in 2003–2011. Significant differences among cv. 'Jonagold' clones were recorded in yield, fruit quality parameters and winterhardiness. The highest total yield was recorded for cultivars 'Early Queen' and 'Red Prince', the lowest – for cultivar 'Novajo'. Average fruit weight of cultivar 'Novajo' was significantly lower. 'Red Prince' fruits had the best colouration. 'Jonagored Supra' fruits had the best aappearance according to the test panel. During the 2009 – 2010 winter 30% of 'Red Prince' trees were frozen. No losses were recorded for 'Jonagored Supra'. During the experiment tree losses due to frost and disease damages were 25 – 60 % and depended on the clone.

**Key words:** *Malus* sp., yield, fruit quality, winter hardiness

# AVERAGE FRUIT WEIGHT AS THE FRUIT QUALITY PARAMETER FOR EVALUATION OF PEAR CULTIVARS GROWN IN LATVIA

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Average fruit weight is one of the most important quality parameters of pear fruits that may determine fruit use, prices and marketing success. Fruit size can be affected by thinning, environmental conditions and genotype. High importance has the precipitation during initial fruit development stages, especially during the cell division, since the total number of cells significantly influences the final fruit size. Therefore fruit evaluation data acquired during six years from 37 pear cultivars grown at the Latvia State Institute of Fruit-Growing have been analysed. The common fruit average weight did not showed significant differences among years of evaluation, however statistically significant differences were found among tested cultivars. The largest average fruit weight in all study years was found for cultivars 'Bojniczanka' (385 g) and 'Jubileen Dar' (363 g), whereas the lowest - for cultivar 'Talgarskaya Krasavitsa' (137 g). Important cultivar evaluation character is stability of fruit size. Large variation in the fruit average weight among years was found for cultivars 'Jubileen Dar' and 'Fritjof'. Very stable average fruit weight among years was established for 'Condo', which was evaluated for two years, and 'Clara Fries' (tested for all six years). The possible correlation between average fruit weight and yield was analyzed; however it did not show strict relationship between both characters in the set of tested pear cultivars.

**Key words:** *Pyrus communis*, yield, fruit quality, evaluation

# PRODUCTIVITY OF PLUM CULTIVAR 'VICTORIA' ON SEEDLING AND CLONAL ROOTSTOCKS

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The results of cultivar-rootstock combination studies for plum cultivar 'Victoria' are analyzed. The aim of the research was to find plum rootstocks ensuring high yield in orchard and local climate conditions. The studies were done in an orchard established in 2011. Planting distances were 5×3 m with density 666 tree per/ha. The object of research was plum cultivar 'Victoria' on clonal rootstocks St. Julien A, Ackermann, Pixy, *P.cerasifera* Hamyra, Brompton, Marianna GF 8/1, GF 655/2 and seedling rootstocks St. Julien INRA 2, St. Julien d'Orleans, St. Julien Noir, Brompton S, Wangenheims Zwetsche, St. Julien Wadenswill, Myrobalan. Seedling rootstock *P. cerasifera* was used as a control. The data of 2008-2010 years are presented. The influence of rootstocks on tree productivity and growth intensity was studied. According to the obtained results combinations with clonal rootstocks, Marianna GF 8/1, GF 655/2, St. Julien A and seedling rootstocks Wangenheims Zwetsche, St. Julien d'Orleans are the most productive in climatic conditions of Belarus.

**Key words:** *Prunus*, growth intensity, yield, Belarus

# EFFECT OF MANUAL FRUIT THINNING ON FRUIT QUALITY OF APPLE CULTIVAR 'AUKSIS'

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Manual fruit thinning is an important yield and fruit quality control method in the conditions of Latvia. A trial was carried out in 2010-2011 with cultivar 'Auksis' on rootstock B 9. Seven variants of thinning were established, in 3 replications, one tree per replication: control (no thinning), 2 thinning times – (1) after June drop and (2) beginning of August; both times applying 3 thinning methods – (a) leaving 1 fruitlet per 13-15 cm of shoot, (b) 1 fruitlet in a cluster or (c) removing all fruitlets on the lower side of branches. All harvested fruits were counted, weighted and calibrated. Analyses of fruit inner quality were done for 70-75 mm fruits. The results showed significant effect of the year on fruit average weight, proportion of 70-75 mm and 65-70 mm fruits, and fruit flesh firmness (p-value = 0.000). Interaction year/variant was significant for average weight, 65-70 mm fruit share and brix content. On the other side, significant effect of variant was found only for brix. Each year June thinning resulted in larger fruits than August thinning, but the proportion of size groups varied between years. Both years average fruit weight for thinning to 1 fruit per cluster in June or August was lower than control. The share of 70-75 mm fruits was the highest for removing fruits from branch lower side in June.

**Key words:** *Malus domestica*, thinning time, thinning method, fruit size, flesh firmness, brix

# PRELIMINARY OBSERVATION OF „VOEN" RAIN-COVER INFLUENCE ON PHOTOSYNTHESIS ACTIVITY AFFECTED PARAMETERS OF SWEET CHERRY LEAVES

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Technologies that reduce risk of fruit production to obtain good quality yield are used around the world. They demand both investments and knowledge about different technology suitability for particular conditions of growing – climate, as well as cultivars and rootstocks. The trial for investigation of cultivar and rootstock compatibility was established at Latvia State Institute of Fruit-Growing, Dobele, in 1998. This trial was used to modify another trial to investigate „Voen" cover influence on growth, yielding and fruit quality of cherries in 2008. One of the aims is to find out the influence of cover on photosynthesis efficiency of leaves. Data about parameters influencing activity of leaf photosynthesis of cultivars 'Iput' and 'Krupnoplodnaya' on rootstock Gisela 5 were obtained in 2011. Leaves of both cultivars under cover were larger and broader that proved statistically significant. The difference between cultivars was demonstrated with high level of credibility, but the interaction of both factors was not found. Cover influence on chlorophyll content index was not ascertained. The total content of nitrogen in leaves of the trees under cover increased. Day and night fluctuations of both temperature and relative air humidity decreased under cover.

**Key words:** leaf size, chlorophyll content, nitrogen, relative humidity, temperature

# THE EFFECT OF „VOEN" COVER ON THE GROWTH AND YIELD OF TWO SWEET CHERRY CULTIVARS

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Research was performed at the Latvia State Institute of Fruit-Growing on the base of a trial planted in 1998. The growth and yield of sweet cherry cultivars 'Iput' and 'Krupnoplodnaya' were studied depending of different rootstocks and fertigation. Constructions necessary for the cover were set up for a part of orchard in 2008. Considerable lowering of canopy and renewing pruning were carried out. The cover was set up before flowering in spring and uncovered after harvesting. Since trees on vigorous rootstock F 12/1 were proved as improper for cover and excluded, the influence of cover on the growth and yield was tested only of trees grown on rootstocks Gisela 4 and 5, as well as Weiroot 154. Larger volume of canopy before renewal pruning was ascertained for cultivar 'Iput', which was proved with rather high credibility. Canopy volume was reduced considerably after the limiting pruning. Cover influence was not verified in the subsequent years, however, the tendency of increase of canopy volume was found. Trees of both cultivars were about the same height before covering. Tree height was nearly the same after canopy limitation and covering also, therefore increasing of canopy volume was related with canopy width rising. The yield under cover was similar to the yield without cover in the first season with cover and no cultivar effect was found. Positive influence of cover increased a little bit during the next years, although it was not proved every year. The effect of cultivar on fruit weight was ascertained, but the influence of the cover was found in the third year of observation.

**Key words:** trunk, canopy volume, fruit size, tree height

# THE EFFECT OF CROWN RESTRICTION ON THE GROTH AND PRODUCTIVITY

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The trial was performed at the Latvia State Institute of Fruit-Growing in Dobele on the base of an experiment planted in 1998, where compatibility of two sweet cherry cultivars with four different rootstocks was studied. Since sweet cherries were grown under cover, their canopy had to be adapted to such a system by lowering, narrowing and renewing them at the end of summer 2008. Tree growth and productivity parameters were compared for 3 years before canopy restriction and 3 years after restriction. It was found that rootstocks affected the trunk cross-section area and volume of canopy. The biggest trees with wider canopy both before and after canopy restriction were observed on F 12/1. Limiting pruning of trees on Weiroot 154 did not cause stronger shoot growing, therefore volume of canopy reduced. It was just a little bit bigger than for trees on Gisela rootstocks. Canopy volume was bigger for 'Iput' before their adaption to cover system than for 'Krupnoplodnaya', but after tree restriction no cultivar difference appeared. After canopy reducing fruiting wood renewed relatively slowly therefore yield per tree even at the third year after pruning was almost two times less than before pruning. In average, a little higher yield was obtained from the cultivar 'Krupnoplodnaya'. This cultivar renewed fruiting wood faster, so it was a little bit more productive than 'Iput'. Productivity renewed more rapid for trees on rootstocks reducing vigour, especially on Gisela 5. Cultivar effect was significant only for 'Krupnoplodnaya', fruits were bigger both before and after pruning. Of the tested rootstocks, F 12/1 was found as not perspective for plantations under cover.

**Key words:** canopy, trunk, fruit weight, rootstocks, rain cover

# USING RAIN COVERS TO IMPROVE SWEET CHERRY FRUIT QUALITY

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A great part of sweet cherry (*Prunus avium* L.) cultivars with large and firm fruits are susceptible to rain induced fruit cracking during fruit ripening in wet summers which occur very often in our country. Cracked fruits are much more susceptible to the entry of fungus rots and loss of quality. To avoid losses and to obtain qualitative sweet cherry yield for fresh market synthetic rain covers were used in the trials for the first time in Latvia. Four cultivars of sweet cherries on Prunus mahaleb rootstock and two cultivars on rootstocks Gisela 5, Gisela 4 and Weiroot 154 were grown under VOEN type plastic cover. Trees were covered from beginning of June and throughout the harvest period in 2010-2012. Fruit cracking reduced significantly under rain cover: for early producing cultivar 'Iput' it diminished 2.1 times; for late producing cultivars 'Bryanskaya Rozovaya' – 2.3 times, 'Lapins' – 2.9 times, but 4.2 times for the cultivar 'Tyutchevka' if compared to growing without cover. Diminishing of fruit rots under rain cover was significant: 2.7 times for more susceptible cultivar 'Lapins'. Outcome of marketable fruits varied from 48.5 % to 58.6 % without cover and from 75 % to 88.1 % under cover. Fruits under cover can be harvested in their optimal ripening period and even in rainy days. This makes it possible to store fruits longer and to improve sales in a rainy season.

**Key words:** *Prunus avium*, fruit cracking, fruit rots, VOEN

# GROWING OF RED RASPBERRY CULTIVAR 'GLEN AMPLE' UNDER HIGH TUNNELS IN LATVIA

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Raspberries are one of the most important berry crops in Latvia, but precipitation in July, which is the main harvest period, lowers the quality of the berries and the volume of yield. One of the possible solutions for this problem is using light type covers in the cultivation of raspberries. The aim of this study was to compare different covering systems for raspberry growing in Latvia. The trial was established in the orchard of Latvia State Institute of Fruit-Growing (LSIFG) in the fall of 2009. The cultivar 'Glen Ample' was tested. The raspberry cultivar was grown in two types of tunnels: Haygrove and FVG (Folien-Vertriebs GmbH), and on the open field. The study was done for two years - 2011 and 2012. The following parameters were studied - raspberry yield, dynamic of yield, average berry mass and quality of yield. Also in the harvest period were compared climatic factors for different growing systems: temperature (max., min. and average), relative air humidity (RH) (max., min. and average) and precipitation (mm). By analyzing the temperature measurements from tunnels it was concluded that FVG tunnel got significantly higher air temperatures for the whole growing season, which resulted with lower berry quality. In the Haygrove tunnel the temperature was close or even below of those on the open field - that was more favorable for the growth and production of raspberries. Relative air humidity in the FVG tunnel was higher than in the Haygrove tunnel, but lower than on the open field, for this reason damages of grey mould (*Botrytis cinerea*) were observed less under tunnels, than on the open field. The fruit quality was better in the Haygrove tunnel, than in the FVG tunnel or on the open field.

**Key words:** *Rubus idaeus*, Glen Ample, yield, berry quality, tunnel types, cover systems, climatic factors

# NITROGEN REMOVAL FROM APPLE ORCHARD INFLUENCED BY FERTIGATION AND MULCHING

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Nitrogen (N) is one of the most important nutrients necessary for many life functions of plants. The aim of this study was to determine the amount of nitrogen removal from an apple orchard with apple vegetative parts and yield. The investigation was done in 2008 – 2011, on the basis of an established field experiment planted in 1997 with apple cultivar `Melba` (rootstock B9), trees spaced at 1.5 × 4 m distances. Three kinds of soil water treatments in tree strips were compared: control – no regulation, sawdust mulch and drip irrigation - fertigation. In the mulch treatment soil surface was covered with 10 – 20 cm layer of sawdust, renewed every three years. The irrigation provided effective moistening of a 1 m wide zone or about 25% from orchard area. Inter–row strips were covered by grass vegetation (*Lolium perenne* L. and *Poa pratensis* L, in proportion 1:3). Soil of the experimental plot was Pisocalcic Cutanic Luvisol (Hypereutric, Hyposkeletic); loam. Organic matter – 25 g $kg^{-1}$, soil reaction $pH_{KCl}$ 6.5. Spring pruning of trees was done in the 1st decade of April, summer pruning in 2nd decade of July, the fruits were harvested at the end of August, samples of fallen leaves collected during leaf fall – end of October. Total nitrogen was determined using Kjeldahl method. Removal of nitrogen was calculated as kg $ha^{-1}$. The content of N in apple-tree parts and in yield was significantly influenced both by the applied soil moisture treatment and by the crop load. Removal of N with branches during the spring pruning was 6,8 – 8 kg, with branches during the summer pruning 11,3 – 12,7 kg, with yield 0,4 – 33,6 kg, with fallen leaves 1,9 – 5,5 $K_2O$ kg $ha^{-1}$.

**Key words:** nutrient removal, fertigation, mulch

# CRANBERRY (*VACCINIUM MACROCARPON* AIT.) POLLINATION EFFICIENCY DEPENDING ON THE POLLINATOR AND THE INITIATOR

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Pollination is the planned work, which are destined to increase crop yields. Bumble bees and other wild pollinators are more important for crop pollination than previously thought. Pollination was studied in latvia only in 1965. These studies were not continued for the last fifty years. The experiment was carried out at the Institute of Agrobiotechnology, Latvia University of Agriculture, Jelgava, in year and 2011. The aim of this experiment was to evaluate the effects of the pollinators and initiators on the cranberry pollination. Shoots with flowers, flowers and berries were determined. The bumblebees (*Bombus terrestris*) and bees (*Apis mellifera*) were used as pollinators in the open field and covered field. In the trial one cranberry cultivar 'Stevens' was used and 4 different variants per field (open + covered + bumblebees + bees) were employed. Sugar syrup was used as initiator. Vertical shoot records showed that in the two years of study in the open field (with the initiators - 1760, no initiators - 1890 pcs. $m^{-2}$) density of vertical shoots significantly differed from the other options. Flower and fruits ratio significantly differed in the open air with and without initiator (0.30 and 0.27 in 2010) and bumblebees to the initiator (0.36 in 2011) and bees without initiator (0.31 in 2011).Our results showed that 'Stevens' gave more fruits in all variants when the initiator and bees were used. In these variants the flower and fruit ratio was 460:380 in 2010 and 518:460 in 2011, respectively. Without initiator flower and fruit ratio was 421:265 in 2010 and 482:390 in 2011. flower and fruit ratio without initiator in open field 502:300 in 2010 and 321:260 in 2011.

**Key words**: cranberry, pollination, yield, bees, bumblebees, initiator

# Section 2:
# Processing and storage

## ORAL PRESENTATIONS

# CHANGES OF INTERNAL QUALITY OF SOME APPLE CULTIVARS DURING STORAGE PERIOD IN ESTONIA

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The experiment was carried out in two seasons (2009/2010 and 2010/2011) on nine apple cultivars grown in Estonia. Fruit samples were harvested from 5-9 year old trees at the experimental orchard in Polli. Fruits were stored for 8 months in a cold room at +2 °C, at normal atmosphere. The flesh firmness, soluble solids and titratable acidity were determined at harvest and in January, March and May. As expected, significant differences in firmness retention of fruits of the evaluated cultivars were observed. After 6 and 8 months of storage high firmness was characteristic for 'Sinap Orlovski' and 'Krista' in season 2009/2010 and for 'Ligol' and 'Krista' in season 2010/2011. The ratio of soluble solids to organic acids increased with storage time. After 4 months of storage higher value of that ratio was found in 'Katre' and 'Ligol' in 2009/2010 and in 'Krista' and 'Auksis' in 2010/2011. After 6 months of storage higher ratio of soluble solids to organic acids was found in 'Ligol' and 'Alesya' in 2009/2010 and in 'Krista' and 'Ligol' in 2010/2011.

**Key words:** *Malus domestica,* fruit firmness, soluble solids content, storage

## POSTER PRESENTATIONS

# CHANGES OF FRUIT QUALITY OF NEW APPLE CULTIVARS DURING STORAGE

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Common storage is still most widely used by Latvian farmers, and suitability of cultivars for storage determines their choice. Storage of disease resistant apple cultivars recently recommended for commercial apple platations in Latvia – 'Alesya' (Belarus), 'Dace', 'Edite', 'Gita' (Latvia, LSIFG), was studied at Latvia State Institute of Fruit-Growing in 2007-2010. Most widely grown commercial cultivar 'Auksis' was used as standard. Of these, 'Auksis', 'Dace' and 'Gita' have medium harvest time, 'Alesya' and 'Edite' - late harvest. From trees grown on rootstock B9, samples of uniform fruits of average size were harvested at the optimal maturity and put into common storage at 3±1 $^{o}$C. Content of soluble solids (brix %), titrable acids (%) and fruit flesh firmness (kg cm$^{-2}$) were evaluated at the time of harvest and each 2 weeks during storage, each time on 10 fruits.

Cultivar 'Alesya' showed the longest storage, followed by 'Edite', but both demonstrated some physiological problems. 'Dace' and 'Gita' had shorter storage than 'Auksis', but no physiological problems during it. Changes of biochemical content of the cultivars during storage will be discussed.

**Key words:** brix, total acids, flesh firmness, common storage

# THE EFFECT OF THE GOOSEBERRY CULTIVAR TYPE, PRIMARY PROCESSING AND RIPENESS STAGE ON THE SENSORIAL ATTRIBUTES OF THE DRIED CANDIED PRODUCT

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Gooseberries contain vitamins C and E, carotene, folic acid, and unripe they are a rich source of pectin. In Latvia gooseberries are grown for both fresh consumption and processing. The priorities of dried berries are longer shelf life and high content of nutritional compounds. The choice of suitable cultivars and ripeness stage of berries, as well as primary processing is the most important aspects to produce dried candied gooseberries with the good quality. The aim of the study was to evaluate the suitability of the gooseberries grown in Latvia for production of dried candied product.

The research was conducted in the Unit of fruit and berry experimental processing of the Latvia State Institute of Fruit-Growing in 2010. Nineteen gooseberry samples of three different ripeness stage and four types of primary processing were used in the research. Sensory evaluation of the dried candied gooseberries was performed to determine the preferences of final product.

Dried candied gooseberries of hybrid "N 323-9", harvested half ripe and squeezed before candying, were evaluated as the best. Gooseberry cultivars with big seeds were not accepted for producing of dried candied gooseberries.

**Key words:** dried candied gooseberries, processing technology, sensory evaluation

# EFFECT OF ANTI-BROWNING INHIBITORS ON THE QUALITY OF FRESH-CUT PEARS DURING STORAGE

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Pears are used as ingredients in the production of fresh-cut salads. Fruit browning in food industry is one of the main problems which has to be prevented in processing since it causes remarkable damages. Therefore to maintain the quality of fresh-cut pears, different anti-browning inhibitors are used.

The aim of the research was to evaluate the effect of treatment by anti-browning solutions on fresh-cut pears during storage depending on packing type. Pears (*Pyrus communis*) of cultivar 'Belorusskaya Pozdnaya' were peeled, cut in 1-1.5 cm pieces, and soaked in solutions of: ascorbic acid (1.5 %) or Japanese quince (*Chaenomeles japonica*) juice (20%). Solutions were poured off and pieces were packed in biodegradable polylactic acid (PLA) and polypropylene (PP) boxes, and stored at 4 ±1 $^{o}$C for 8 days. Colour, content of soluble solids and pH of pear pieces were analyzed on the first, fourth and eighth day.

Colour changes of fruit pieces during storage were different and dependent on packaging type and anti-browning solutions. Whiteness index of samples treated with Japanese quince juice reduced for 11% in PLA boxes, but with ascorbic acid – for 11.2 %. However, in PP boxes for samples treated with ascorbic acid it reduced for 14.4 %, but with Japanese quince juice – for 15.4%. Changes of soluble solids and pH in treated pear pieces were unremarkable. The treatment with ascorbic acid compared to Japanese quince juice ensured better quality of fresh-cut pears during storage.

**Key words:** *anti-browning solutions*, colour changes, pH, packaging

# INVESTIGATION OF PACKAGING MATERIALS ON THE SHELF LIFE EXTENSION OF DIPLOID PLUM CULTIVAR 'KOMETA'

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Polymers (films and boxes made from polypropylene, polyethylene, low and high density polyethylene and other materials with different thickness) are the most widely used materials for packing in fresh fruit trade. Dishes (trays) manufactured from polystyrene and wrapped in PVC film or hermetically sealed by melting the polymer film, are also used for packaging of soft products (including fruit, berries and vegetables). Product shelf life is dependent on the packaging material barrier properties, including permeability of $CO_2$ and $O_2$.

The study was done in year 2008, and focused on the uses of environmentally friendly biodegradable packaging materials for fresh fruit storage. Polypropylene (control), polylactic acid boxes (biodegradable material) and cardboard boxes placed in polylactic acid material bag (thickness 40 ìm) were selected as packaging materials for the shelf life extension of diploid plum cultivar 'Kometa' ('Kubanskaya Kometa'). Plums were stored at the temperature +4 ± 1 °C for 20 days. Qualitative characteristics of the plum weight, density, soluble solids content and colour changes were evaluated. Sensory evaluation was performed using a 9-point hedonic scale.

The plums in good quality could be stored at the temperature +4 ± 1 °C for 12 days on average. Polylactic material selective gas and moisture barrier properties in hermetical containers ensured minimal weight loss, but promoted plum ripening and hence a reduction of the storage period. The quality of plums packed in biodegradable boxes showed that the packing material is recommendable for manufacturers. The results suggested that biodegradable packaging materials can be a successful alternative to the conventional polymer for plum packaging, and it could offer essential contribution to reduce environmental pollution.

**Key words:** packaging materials, fresh plum, quality indices

# SEA BUCKTHORN VEGETATIVE PARTS – A GOOD SOURCE OF BIOACTIVE COMPOUNDS

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In recent years, due to health problems and better life expectancy natural sources of bioactive substances have gained a wide interest. Sea buckthorn is well known as a valuable plant and widely used in traditional medicine for the treatment of diseases and disorders. A considerable amount of literature has been published mostly on sea buckthorn berries, although all parts of sea buckthorn plant are considered as a source of a large amount of biological active substances and believed to have beneficial health effects. Therefore vegetative parts would be good raw material not only for medicinal, cosmetic and pharmaceutical properties but also for food industry. This has increased research on different sea buckthorn vegetative organs and their extracts' activity and toxicity.

Sea buckthorn leaves have attracted interest during the past few years as the most promising source of active compounds after the berries. They contain a wide range of hydrophilic and lipophilic bioactive compounds which exhibit remarkable anti-oxidant potential together with anti-bacterial, anti-viral, anti-tumour and anti-inflammatory activity. Therefore extracts of this plant leaves could be used as natural replacements for synthetic additives and for food products with functional properties. This creates the need to investigate the biochemical content of seabuckthorn vegetative parts grown in Latvia.

**Key words:** *Hippophae rhamnoides* L., food processing

# Session 3:
# Breeding and genetics

# ORAL PRESENTATIONS

## BREEDING OF NEW APPLE CULTIVARS IN BELARUS

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Apple breeding has old traditions at the Institute for Fruit Growing in Belarus. At present there is especial attention to new adaptive dessert apple assortment. As a result of the second stage of apple durable resistant breeding programme for years 1994-2010, 6 new Belarusian apple cultivars were introduced to State Testing of the Republic of Belarus. The cultivars were selected from the apple hybrid fund obtained in 1994-2000. 252 progenies with a total number of more than 22300 seedlings were assessed for their susceptibility to scab after artificial inoculation in the isolated nursery and almost 5000 seedlings continued to show spontaneous infections after natural inoculation in orchards, where they had grown without any chemical sprays against the disease. After evaluation of three cropping seasons 120 selections were propagated on rootstock 62-396 (B.396). After screening the best selections with combined resistance to fungal diseases and winter frost, most productive and also with attractive fruit were new cultivars 'Belana', 'Diyament', 'Krasavita', 'Navavita', 'Sakavita' and 'Zorka'.

**Keywords:** apple, scab resistance, selection, new cultivars, Belarus

# RESULTS OF SMALL FRUIT BREEDING IN LATVIA

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In Latvia, successful breeding programs have been conducted in several small crops. Winter hardiness is the most important limiting factor for the possibilities of cultivating a variety of small crops in Latvia. Winter-hardiness is a complex trait consisting of several components. The most important of these are the combination of high cold resistance with the ability to regain hardiness after long thaw periods, especially in the second half of the winter, when deep dormancy of most small fruits has ended. The breeding of raspberry cultivars adapted to the local conditions is done at LSIFG since 1980. In the period of 1984-2008 raspberry cultivars 'Arta', 'Dita', 'Ina', 'Lina', 'Liene' and 'Viktorija' have been . By present observations, the most hardy of these cultivars are 'Liene' and 'Lina', the most productive are 'Lina' and 'Ina', while the best quality and the largest berry mass are from cultivars 'Ina' and 'Viktorija'. The most important work in black currant breeding was been done in National Botanical Garden, at Salaspils in the 1960 –ties -1990ies. Cultivar 'Mara Eglite' is the result of this breeding work. The breeding was continued in LSIFG. The result of breeding program involving Swedish Pomological Science Centre and Lithuanian Institute of Horticulture was black currant cultivar 'Karina'. The breeding work of strawberries done at Pūre Horticultural Research Centre resulted in the highly productive strawberry cultivar 'Suitene'.

**Key words:** raspbery, black currant, strawberry, cultivars, winter-hardiness

# APPLICATION OF MOLECULAR GENETICS METHODS FOR FRUIT CROP GENETIC RESOURCES CHARACTERIZATION IN LATVIA

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A diversity of fruit crop varieties is maintained at the Latvia State Institute of Fruit-Growing genetic resources collection, which consists of landraces and selections of local breeding as well as germplasm that result from years of scientific exchange and co-operation with other breeding institutes. The main feature of fruit crop germplasm in Latvia is adaptability to the local climate and growing conditions. Presently the germplasm collection comprises about 2700 accessions of 19 fruit crops; 724 accessions are designated as national genetic resources. Conservation of germplasm itself has little value without characterization and further utilization of the stored plant material. To intensify these activities DNA based technologies have been implemented in the characterization of germplasm. In general, two main groups of molecular markers have been utilized for PGR characterization: markers for detection of the structure of genetic resources collections and relatedness of available plant material, and gene specific markers, subsequently applicable for Marker Assisted Selection (MAS). At the moment genotyping methods based on SSR and RAPD markers for eleven fruit crops have been developed to use in the plant material identification, True-to-Type verification as well as evaluation of genetic diversity and internal collection structure. These marker sets were harmonized with ECPGR WG recommended ones to ensure data including in the international data bases. 723 accessions of nine crops have been genotyped. Gene specific molecular markers have been applied for apple (resistance to scab), sweet cherries and plums (*Sf* – self-incompatibility gene), which ensure essential information for germplasm utilization in MAS and breeding.

**Key words:** germplasm, molecular markers, MAS, SSR, RAPD, gene specific

# BLACKCURRANT BREEDING AT I.V. MICHURIN ALL-RUSSIA RESEARCH INSTITUTE FOR HORTICULTURE AND PERFORMANCE OF SOME CULTIVARS IN LATVIA CONDITIONS

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The breeding of blackcurrants in I.V. Michurin All-Russia Research Institute for Horticulture (Michurin ARRIH) has 55 years history. Joining of high productivity and quality of fruits, technological properties and resistance to abiotic and biotic stress in the new generation cultivars nowadays is the main concept in breeding of blackcurrants. One of perspective directions, which is not widely used yet, is increasing of photosynthetic potential of existing cultivars and breeding of new cultivars with high photosynthetic activity. At the beginning of the 21st century, 11 new blackcurrant cultivars were developed: 'Charovnica', 'Elevesta', 'Malenkii Princ', 'Tamerlan', 'Chernavka', 'Shalun`a', 'Karmelita', 'Sensey', 'Divo Zvyaginoy', 'Talisman' with black colored fruits and 'Izumrudnoye Ozherel`e' with green colored fruits. New cultivars have different ripening times, early beginning of production and good quality of fruits.

In 2004 several cultivars from Michurin ARRIH breeding programme: 'Charovnica', 'Elevesta', 'Malenkii Princ', 'Tamerlan' and 'Talisman' were planted in the collection planting of Pūre Horticultural Research Centre, Latvia, for evaluation of cultivar adaptability to local agro-meteorological conditions. Cultivars 'Elevesta' and 'Talisman' showed the best results between the tested cultivars.

**Key words:** *Ribes nigrum* L., varieties, resistance, yield, quality

# THE USE OF BIOTECHNOLOGICAL TECHNIQUE FOR CREATING OF NEW GENOTYPES OF HORTICULTURAL PLANTS

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The main aim of our investigation was the creating of new genotypes by means of biotechnological technique. As far as growing transgenic forms in Russian Federation is officially prohibited we paid the much attention on the more traditional methods such as embryo culture. The work was carried out in the biotechnological department of All-Russian Horticultural Institute for Breeding, Agrotechnology, and Nursery of Russian Academy of Agricultural Science. The work was started in 1990ties.

During our work the traditional method of embryo culture was significantly improved. First of all we modified the nutrient media composition to avoid dormancy period for isolated embryos. For increasing total output of seedlings the nutrient media was enriched with cytokines. The other modification consisted in the using of cotyledons as the additional sources hybrid tissues for obtaining of adventitious shoots.

Among the number of hybrid seedlings obtained by means of worked out technique two interesting hybrids were selected. After 17 year of growing and fruiting they showed the good fruit quality, rather high winter hardiness and high yielding capacity. The parents of these selections were the hybrid cultivar of myrobalan (*Prunus salicina x cerasifera*) 'Kubanskaya Kometa' and domestic plum cultivar 'Narach'.

The cytological analysis detected that both hybrids were tetraploids and PCA test confirmed their hybrid nature.

At present moment these selected seedlings passed through State Varieties Trials and had got the names 'Velitchavaya' and 'Tuliza'.

**Key words:** plant breeding, embryo culture, regeneration, isolated cotyledons, interspecific hybrids

# POSTER PRESENTATIONS

## THE RESULTS OF PEAR BREEDING IN PURE HRC

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In total 77 crossing combinations from Pure Horticultural Research Centre (breeder I. Drudze), and 35 combinations received from breeding point „Iedzeni" (breeder R. Dumbravs) were evaluated. 42 perspective hybrids were selected till 2011, and propagated for more detailed evaluation. Nine hybrids are found as most promising with potentially commercial value or with some rare traits for pears.

Hybrids P-78-2, P-65-9, and P-67-23 have bicolour yellow – orange fruits. Trees have natural semi dwarf habit. Fruit quality, winter hardiness and disease resistance for these hybrids are suitable for commercial growing.

`Figaro` (D-53-10-7) has very plastic fruit flesh structure. Slices can be folded in different shapes.

Top twigs of P-85-5 have no apical dominance, therefore all young twigs grow in short, uniform length, grouped in curled clusters. Rounded, compact crown develops as a result. Fruits are small, green, sweet and tasty, with good storage potential – probably suitable as "baby pears" in the market. Hybrid can be interesting as ornamental as well.

Hybrid P-68-9 is selected from Nashi pear group. In addition to typical juicy, sweet and crispy flesh structure of the Nashi pear group, this hybrid has strong and pleasant aroma.

P-72-15 has good yielding, taste and winter hardiness. Fruits are long shaped, green skinned, pink fleshed, sweet, early winter ripening time.

Two hybrids are selected as potentially suitable for winemaking. The fruits of P-85-6 are very sweet and juicy, with tannins in the skin. High sweetness and muscat aroma are combined in P-95-1.

**Key words:** *Pyrus,* cultivars, hybridization, pink flesh, aroma

# NEW ROMANIAN PEACH AND CLINGSTONE CULTIVARS

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Peaches are appreciated fruit for their nourishing and terapeutical qualities, and are recommended for fresh consumption and for processing. Peaches are considered as being "fruit of healthy and long life" and are indicated for people with heart problems and anemic, diabetic and renal diseases. Thousands of peach cultivars are grown in the world and annually the breeders obtain and register new ones. The peach is a species with good adaptation and development under Romanian climatical and soil conditions.

The Romanian breeders have made effort to create valuable native peach and pavie varieties, with high quality; new shape, flavour, colour of fruit; constant productivity of trees; different habitus of trees; various ripening time, etc..

The authors present some new peach and clingstone cultivars with standard and dwarf trees, created at Research Station for Fruit Growing Constanta, as: 'Raluca', 'Cecilia', 'Catherine Sel.1', 'Craita', 'Florin', 'Filip' and 'Monica', which improve the present assortment.

**Key words:** *Prunus persica*, pavie, quality of fruit, processing, dwarf

# EVALUATION OF DOMESTIC PLUM (*PRUNUS DOMESTICA* L.) SELF-INCOMPATIBILITY ALLELE DIVERSITY USING DNA-BASED S-GENOTYPING

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Domestic plums (*P.domestica* L.) have limited information on genetics of self-incompatibility. In comparison with other *Prunus* species, there have not been worked out S-allele specific markers for the identification of compatibility groups; genetic diversity of self-incompatibility alleles is not clear. Therefore six S-locus-specific markers previously used in other Prunus species have been used to study genetics of self-incompatibility in plums. There have been found 14 – 31 alleles per marker (19.8 in average), showing high genetic diversity. Marker PasPcons-F1/PaC1cons-R1 amplified the highest number of alleles (31 alleles, fragment length range 236-422 bp), followed by EM-PC2consFD/EM-PC3consRD marker (20 alleles, fragment length range 270-3000 bp). Nineteen alleles were detected for markers EM-PC2consFD/EM-PC5consRD (length range 490-2500 bp) and F-Box50A/F-BoxIntronR (length range 196-235 bp). The smallest number of alleles was found for the markers PruT2/PCE-R (16 alleles, fragment length range 700-2600 bp) and PruC2/PCE-R (14 alleles, fragment length range 300-1970 bp). Significant differences were found between the total numbers of alleles in different compatibility groups. The highest number of alleles was found in group of self-incompatible plums (101), the smallest - in group of self-compatible plums (65). Group of self-incompatible plums had the highest number of the unique alleles (26). Seven unique alleles were identified in groups of self-compatible and partly self-compatible plums. The obtained results showed that taking into account the complicated genome structure of domestic plums the diversity of alleles has a significant role in ensuring of self-incompatibility reaction.

**Key words:** *Prunus,* plums, self-incompatibility, genetics, molecular markers

# COMPARISON OF MITOCHONDRIAL ORGANIZATION OF DIVERSE CYTOPLASMIC TYPES IN APPLES

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Mitochondrial (mt) DNA was used to characterize the cytoplasmic diversity of a range of apple cultivars and landraces. mt *cox1* and atp9 gene probes detected RFLPs, which enabled classification of apple genotypes into three cytoplasmic groups: 'Golden Delicious' type, 'Delicious' type, and 'McIntosh' type. In two cultivars, 'Golden Delicious' and 'Delicious', *cox1* was found to exist as one full-length version (intact copy, termed *G-cox1* and *D-cox1*) and one truncated version (pseudocopy, G-*φcox1* and D-*φcox1*), and the two intact cox1 and two pseudocopies had an 1115 bp segment in common. It is also suggested that recombination events may have occurred within the 1115 bp repeats to creat the two distinct mitochondrial genome organizations characteristic of the 'Golden Delicious' and 'Delicious' cytotypes. PCR assay demonstrated that the G-cox1 and G-φcox1 sequences occur in substoichiometric amounts within the mitochondrial genome of 'Delicious' whereas substoichiometric molecules carrying D-φcox1 are present in the 'Golden Delicious' mitochondrial genome. Moreover, the atp9 gene sequence of 'Golden Delicious' was found to exist in one intact version and two truncated versions (φatp9-1 and φatp9-2). Interestingly, the ?atp9-1 sequence is maintained at high copy number in the six 'Golden Delicious' cytotype cultivars examined but present substoichiometrically in eight 'Delicious' cytotype cultivars. Our data also indicate that φatp9-1 originated in a homologous recombination event mediated by the short repeat in a common ancestral mitochondrial genome of 'Golden Delicious' and 'Delicious', and was preferentially amplified in an evolutionary lineage that gave rise to the 'Golden Delicious' type genome.

**Key words:** apple, *Malus*, cytoplasm type, mitochondrial genome

# RAPD POLYMORPHISM LINKED WITH THE STRAWBERRY SUSCEPTIBILITY TO *GNOMONIA FRAGARIAE*

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Strawberry root rot and petiole blight caused by the fungus *Gnomonia fragariae* Kleb. reduces yield and fruit quality. Recently it was found that the pathogen is involved in the strawberry root rot complex both in Latvia and Sweden. The disease is widespread and severe in perennial strawberry cultivation in Latvia. The root system of infected plants usually is poorly developed, with very few lateral roots and covered with irregular shaped, black lesions which enlarge. The growth of infected plants is severely affected and may result in plant death. Significant differences in resistance level to this pathogen among strawberry (*Fragaria × ananassa*) cultivars have been found. However, little is known about the genetic basis that controls strawberry resistance to *Gnomonia fragariae*. In this investigation molecular analysis of strawberry cultivars was performed using the random amplification of polymorphic DNA (RAPD) markers. DNA was extracted from young strawberry leaves collected from 10 resistant and 10 susceptible cultivars. Genomic DNA was pooled into two samples – resistant and susceptible. Totally 300 RAPD primers were screened to detect the polymorphism among resistant and susceptible genotypes. Several RAPD primers generated specific fragments and showed linkage between resistance and these markers.

**Key words:** *Fragaria x ananassa*, resistance, RAPD, *Gnomonia fragariae*

# NEW DONOR OF RESISTANCE TO APPLE POWDERY MILDEW OF BELARUSIAN BREEDING

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The aim of our research was to study donor abilities of resistance to powdery mildew of elite selection 86-56/78 ('Orlovskaya Girlyanda' × BM41497). Leaf and shoot lesions were evaluated by 6-point scale: 0 – no symptoms, 5 - more than 50% leaves and shoots are infected. The hybrid progeny of selection 86-56/78 was assessed for resistance to mildew in the conditions of moderate disease development in field nursery. Seedlings were obtained from direct and reverse crosses with cultivars with possessed various susceptibility to powdery mildew in Belarus conditions (2003-10/8, 2003-10/21 ('Beloruskoe Malinovoe' × 'Liberty'), 'Dyament', 2003-10/40 ('Beloruskoe Malinovoe' × 'Liberty'), 'Gala Must', 'Askolda'). It was determined that from 53 to 100% hybrid progeny of selection 86-56/78 had high resistance to powdery mildew (0-1 points), the part of susceptible seedlings did not increase 12% (4-5 points). High combination ability of the studied parental form is revealed. The distribution of apple hybrids distinguished by high degree of resistance to Podosphaera leucotricha was corresponded to results obtained from analysis of a control plant group created with ?ultivar 'Imant' (the donor abilities were confirmed earlier). It revealed the most effective hybrid combinations – ('Beloruskoe Malinovoe' × 'Liberty') × 86-56/78, 2003-10/8 ('Beloruskoe Malinovoe' × 'Liberty') × 86-56/78, 86-56/78 × 'Gala Must'. In these combinations from 83 to 100% highly resistant hybrids were obtained.

**Key words:** apple breeding, seedling, resistance, powdery mildew, *Podosphaera leucotricha,* Belarus

# RESULTS OF PEAR DEVELOPMENT IN BELARUS

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The pear breeding started since 1932 in Belarus. During 1932-1996 more than 200 pear accessions from different ecological and geographical regions have been collected. 15 Belarusian cultivars were created though hybridization and selection of the best seedlings from open pollination of some cultivars. These are 'Bere Loshitskaya' (1961), 'Bel?russkaya Pozdnyaya' (1989), 'Dukhmyanaya' (1999), 'Zabava' (2005) and 'Lagodnaya' (2005) which were included in the State Registry of cultivars of tree and shrub species of the Republic of Belarus.

The pear collection is enriching constantly and has now 660 accessions, including our own best selections. The new hybrid fund was created as a result of involvement in the breeding program of the best Belarusian cultivars and selections, the introduced cultivars including genoplasm of *Pyrus ussuriensis* Maxim. (Seyanetz Jakovleva 104, Beurre Zimnaya Michurina, Mramornaya, Severyanka), *P. pyrifolia* (Burm.) Nakai (Druzhba, Dekanka Novaya, Vostochnaya Zolotistaya) and *P. bretschneideri* Rehd. (Bretfelps, Bretfelps №2). The most promising cross combinations are – 'Belorusskaya Pozdnyaya' x 'Conference'; 6/89-100 [('Belorusskaya Pozdnyaya' x ('Bere Seraya' x 'Dulya Ostzeiskaya')] x 'Maslyanaya Ro'; 96/40 (Bergamotnaya x Druzhba) x pollen mix of three cultivars (Yurate + 'Bere Zolotaya' + 'Mlievskaya Rannaya') and 16/62 ('Sapezhanka' x 'Druzhba') x 'Lagodnaya'. The promising hybrids 90-32/18 ('Belorusskaya Pozdnyaya' x 'Maslyanaya Ro'), 90-39/65 90-39/80 (6/89-100 x 'Maslyanaya Ro') were selected. The new pear cultivars 'Yasachka', 'Prosto Mariya' and 'Kudesnitsa' are characterized by a complex of economically valuable characters: winter hardiness, resistance to the basic diseases (scab, septoria spot, bacterial canker disease), an early maturity and fruit quality. They were included in the State Registry of Belarus in 2011.

**Key words:** *Pyrus,* selection, cross combinations, hybrid, cultivar, resistance

# GENETIC RESOURCES OF BLUE-BERRIED HONEYSUCKLE (*LONICERA* L.) AT THE BOTANIC GARDEN OF VILNIUS UNIVERSITY

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The blue-berried honeysuckle (*Lonicera* L.) is considered as non-traditional horticultural plant in Lithuania that grows in individual's plots and botanical gardens. The extra-early ripening of berries is the most important feature of this plant. Berries are an excellent source of dietary phytochemicals (phenolic acids, flavonoids, anthocyanin's, etc.) and can be used as natural antioxidants.

Since 1814 the blue-berried honeysuckle was known as dendrology object at the collection of VU Botanic Garden. The breeding of honeysuckle as berry plant started in 1975, when the Pomology Department was established. In the fifteen years since 1994 researchers of the department participated in the Lithuanian fruit plants genetic resources programme and the collection was supplemented by new accessions.

The collection of blue-berried honeysuckle contains four species, four subspecies, 27 cultivars and 35 genetic lines. Plants of genetic lines were grown from seeds of wild populations (collected in forests of the Russian Altay region).

Morphological characterization of accessions (weight, size and chemical composition of fruits, shrub and leaves characteristics), identification of plant disease agents and plant resistance was carried out. In 2007 we started work on genetic variation and phylogenetic analysis of species, genetic lines and cultivars using molecular markers techniques (RAPD, ISSR, cpDNA sequencing). AMOVA and UPGMA analyses of RAPD variation showed that the group of genetic lines is significantly different from the group of elite cultivars and can be used as a source of additional diversity in honeysuckle breeding programs.

**Key words:** blue-berried honeysuckle, *Lonicera* L., berry characteristics, disease resistance, genetic variation

# Session 4:
# Plant protection

# ORAL PRESENTATIONS

## ACHIEVEMENTS AND FUTURE TRENDS IN BIOLOGICAL CONTROL OF FRUIT TREE DISEASES

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Trees are ecosystems in which microorganisms play an essential role in their functionality. Microbial interactions with plants may be beneficial or detrimental and are of extreme importance in the exploitation of trees in agriculture as crop production systems. Fruit trees are of great economic importance buttheir production is affected by several diseases that limit the productivity in certain areas. Fungal and bacterial fruit tree diseases have been controlled in the past on the basis of chemical fungicides and bactericides, but in the last years health and environmental concerns about the use of chemical pesticides have resulted in strong regulatory actions and have stimulated the development of beneficial microorganisms as microbial biopesticides. Up to now several microorganisms have been registered in different countries and in the EU as biocontrol agents (BCA) covering aerial and soil-borne bacterial and fungal diseases and postharvest fruit fungal rot. The key aspects in the success of this technology for disease control are related to biosafety and environmental impact of biocontrol agents, the traceability and fate in the environment and food chain, the improvement by physiological, genetical engineering or the use of mixtures or formulations as well as the development of delivery systems for treatment application to trees.

**Key words:** microorganisms, fruit tree productivity, biocontrol agents

# ESTABLISHMENT OF NUCLEAR STOCK COLLECTIONS FOR POME FRUITS IN LATVIA

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In Latvia a certification programme for virus-free planting material is not established yet and planting material of pome fruits produced correspond to *Conformitas Agraria Communitatis(CAC)* standard. In order to establish nuclear stock collections for pome fruit cultivars, candidate graft material from 10 apple cultivarsand 10 pear genotypes were budded on seedling rootstocks each year starting from 2006 and grown into sterilized substrate in an insect proof greenhouse. The mother trees in the field and candidate material were tested for the presence of *Apple mosaic virus, Apple leaf chlorotic virus, Apple stem grooving virus and Apple stem pitting virus* by RT-PCR. Two year-old candidate plants were subjected to thermotherapy for 40 or 70 days. The shoot tips of the heat-treated plants were grafted onto seedling rootstocks. In the next two vegetation seasons candidate trees were tested by RT-PCR for the presence of four common viruses. Apple cultivars 'Auksis' and 'Antonovka' after 40 day heat treatment were negative to all tested viruses during two vegetation periods. Cultivars 'Antei' and 'Sinap Orlovskii' remained infected with ASGV, which was detectable only in the second year after thermotherapy. Pear genotypes 'Belorusskaya Pozdnaya' and 'P 67-21' remained infected with ApMV. The work is in progress to evaluate efficiency of thermotherapy conditions by retesting candidate mother plants for several growing seasons with RT-PCR and woody indicators for viruses and other graft-transmittable organisms included in EPPO guidelines for pome fruits.

**Key words:** *Malus x domestica, Pyrus communis*, ACLSV, ASPV, ApMV, ASGV, RT-PCR, certification

# MONITORING SAWFLY POPULATIONS IN PLUM AND APPLE ORCHARDS USING VISUAL TRAPS

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The investigation of black (*Hoplocampa minuta Christ*.) and yellow (*H. flava* L.) plum sawfly and apple sawfly (*H. testudinea Klug*) populations using white sticky traps Rebell®bianco was carried out in plum and conventionally and organically managed apple orchards of Institute of Horticulture of Lithuanian Research Centre for Agriculture and Forestry in 2010–2011. Abundance of both plum sawfly species was high during both years of the study, black plum sawfly being more abundant than yellow. More favorable conditions for development of both species were on 2011, abundance of both species nearly reaching economic threshold. Moreover, the period of highest sawfly adult abundance coincided with flowering period of plum cultivar 'Stanley'. These reasons resulted in higher harmfulness of both species than in 2010. Abundance, dynamics during flight period and harmfulness of apple sawfly varied significantly between study years, type of the orchard and different apple cultivars. In 2010 conditions were more favorable for pest distribution – apple sawfly was more abundant and harmful than in 2011 and economic threshold of 30-40 individuals per trap type Rebell®bianco was reached. The extent of damage varied between different apple cultivars. 'Aldas', 'Vitos' and 'Rubinola' suffered the highest damage in organic orchard, meanwhile, the highest extent of damage was observed in 'Noris', 'Auksis' and 'Lobo' in conventional garden. The severity of damage depended on the coincidence between the highest intensity of adult flight and egg-laying period and the phenological phase BBCH 62-64 of certain apple cultivars, when apple blossoms were the most susceptible of sawfly female attack. Trials of insecticide efficacy against sawflies demonstrate that accurate timing allows reducing number and doses of pesticide treatments meanwhile ensuring effective control of these pests.

**Key words:** *Hoplocampa minuta, Hoplocampa flava, Hoplocampa testudinea*, cultivars

# EFFECT OF ABIOTIC FACTORS ON POPULATION FLUCTUATION OF *BACTROCERA* FRUIT FLIES INFESTING PEACH IN NORTHERN-WESTERN INDIAN HILLS

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Fruit flies are considered as the most damaging insect pests to fresh fruit and fruiting vegetables all over the world. Fruit fly problem exists in India too, infesting many commercially important fruit crops including peach (*Prunus persica* (L.) Batsch)). Oriental fruit fly (*Bactrocera dorsalis* Hendel) and peach fruit fly (*Bactrocera zonata* Saunders) are one of the most destructive pests of peach. Present studies carried out on population fluctuation of peach fruit flies during 2009 – 2010, with the help of attractant-insecticide (suspension and ply board wooden block) traps revealed the presence of oriental fruit fly (*Bactrocera dorsalis* Hendel) and peach fruit fly (*Bactrocera zonata* Saunders) in the traps. The adults were highly active during the month of July with the peak activity during 28th (74.5) standard week (SW) and 27th (63.8) SW during 2009 and 2010, respectively. The peak population period coincided with the ripening stage of peach crop during both the cropping seasons. A positive correlation was observed between fruit fly activity and abiotic factors (temperature, relative humidity and rainfall). Among suspension (containing 0.1% methyl eugenol + 0.05% malathion) and ply board wooden block (presoaked in a solution of ethyl alcohol+methyl eugenol+ malathion in the ratio of 6:4:1) traps, the latter trapped more adults and proved much better. Further, in wooden blocks, the need of recharging the traps weekly after each counting got obviated as they were effective upto about six months and hence proved less labour intensive. Based on these studies the wooden block traps can be used for mass trapping of adults which should be installed in the month of April with the initiation of fruit fly activity so that the population in the ecosystem gets reduced.

**Key words:** *Prunus persica, Bactrocera dorsalis, Bactrocera zonata,* abiotic factors, population fluctuation, mass trapping

## POSTER PRESENTATIONS

# TAXONOMIC POSITION OF *"GNOMONIA" FRAGARIAE* AND RELATED SPECIES WITHIN *DIAPORTHALES*

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The genus *Gnomonia* Ces & De Not. and the *Gnomoniaceae* family *(Diaporthales)* have been the subject of detailed morphological and molecular studies over last decade. The new concept of *Gnomonia* has reduced the number of accepted species from 280 to only a few species, which shared common phylogenetic, morphological and host characteristic features. Our previous studies on molecular characterization of *Gnomonia fragariae Kleb.*, a cause of root rot and petiole blight of strawberry, demonstrated that the genus Gnomonia was polyphyletic and G. *fragariae* and G. *rubi* (Rehm) G. Winter, the causal agent of *Rubus* cane canker, were genetically distant from the type species of *Gnomonia, G. gnomon*, and family *Gnomoniaceae*. Phylogeny of *Diaporthales* inferred from rDNA sequences showed that G. *fragariae* and G. *rubi* belong to *Sydowiellaceae*, a family, which harbors genera with diverse morphology, host range and habitat. In the present work we continue our studies on taxonomy of G. *fragariae* and the related species by comparison with other taxa potentially belonging to *Sydowiellaceae*. Multiple gene analysis of nucleotide sequences of rDNA and *tef-1a* gene from living cultures together with extensive morphological examination of type and authentic specimens of the taxa have been carried out to resolve the taxonomic position and nomenclature of these *Gnomonia*-like species within *Sydowiellaceae*. Evident common morphological features shared among the members of this family were also determined.

**Key words:** pathogenic fungi, phylogeny, rDNA, tef-1α gene

# DISTRIBUTION OF VIRAL DISEASES IN PLUM ORCHARDS IN LATVIA

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Accurate detection of viral infections and elimination of infected trees from the orchards are the key points in preventing the spread of viruses. In our previous studies the presence of viruses in plum orchards were detected visually and by ELISA. In this study the distribution of *Apple Mosaic Virus* (ApMV), *Prunus Dwarf Virus* (PDV), *Prunus Necrotic Ringspot Virus* (PNRSV) and *Plum Pox Virus* (PPV) in plum orchards was investigated by RT-PCR and detection rates were compared with previously obtained ELISA data. During 2008, 654 leaf samples of different cultivars were collected randomly from several plum orchards. In total, 47.6% of the samples were infected at least with one of the tested viruses. The most widespread viruses in plums orchards were PNRSV and PDV, which were detected in 30.1% and 16.4% of the tested samples, respectively. ApMV in plums was not widespread and was detected in 1.8% of the samples. Several plum trees were infected in combination of two viruses among which the most widespread was mixed infection of PDV+PNRSV (11%). Observed chlorotic rings characteristic for PPV infection on leaves were confirmed with RT-PCR by strain specific primers. In all PPV positive samples D strain was detected. As expected, comparative analyses showed that RT-PCR was more sensitive than ELISA. With RT-PCR the number of positive samples for PNRSV and PDV was almost two times higher than obtained by ELISA. Therefore methods based on nucleic acid analysis are now widely used and considered more reliable for diagnosis of fruit tree viruses than ELISA.

**Key words:** *Prunus domestica*, ApMV, PDV, PNRSV, PPV, RT-PCR

# MAIN PEAR CULTIVAR RESISTANCE TO PEAR PSYLLID COMPLEX

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In Belarus there are pear orchards though not the big ones in every fruit-growing farm. In these stands prevail autumn and winter cultivars, which occupy 47.9% and 33.1% area under crop, accordingly. The share of summer cultivars is 19.0%. The most widespread in plantings of Belarus are the following cultivars: 'Byelorussian Pozdnyaya', 'Byelorusochka', 'Dyushes', 'Limonka', 'Liflyandskaya Maslyanistaya', 'Bere Loshitskaya', 'Mramornaya', 'Maslyanistaya Loshitskaya'.

Recently in pear plantings the highest damage to the crop is brought by specialized pests - pear psyllids. There is information that these phytophages bring the highest damage to autumn and winter maturing cultivars. However, in Belarus the information on cultivar damage is absent.

Evaluation of cultivar damages caused by psyllids was carried out in the 2010-2011 at RUC "Institute of Plant Protection" of the Republic of Belarus.

While carrying out records, all shoots were counted on every tree, damage quantity and a degree of injury of each damaged shoot was marked. A degree of shoot damage by psyllids was defined using five-point scale. The mean point of tree damage by pear psyllids was determined by multiplying the quantity of shoots with an identical evaluation point by a digital indicator of the last, and dividing the result by total number of the inspected shoots.

Analyzing the biennial data, it is possible to say that the basic, most wide-spread pear cultivars were damager by pear psyllids to average degree. To a strong degree - one autumn pear cultivar 'Maslyanistaya Loshitskaya' and to very strong degree – summer cultivar 'Liflyandskaya Maslyanistaya' and an autumn cultivar 'Bere Loshitskaya'.

**Key words:** psyllids, *Pyrus*, cultivars, damage, Belarus

# VEGETATIVE COMPATIBILITY IN STRAWBERRY PATHOGEN *"GNOMONIA" FRAGARIAE*

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*Gnomonia fragariae* Kleb. is a pathogenic fungus which causes root rot and petiole blight of strawberry. The disease is widespread in Latvia and severe in perennial cultivation. The *G. fragariae* was examined through identification of compatibility groups among isolates of different geographic origin from Latvia, Sweden and the United Kingdom. A set of isolates originated from different strawberry genotypes grown in one field in Latvia and from single perithecia was also included in this study. Single-ascospore or hyphal tip cultures were used in all the tests and vegetative incompatibility reactions were characterised on potato dextrose agar, potato carrot agar and oatmeal agar media. Plates were evaluated after one month of incubation of isolates at room temperature and 12 h of light/darkness cycle. Several vegetative compatibility groups were detected and incompatible and intermediate interactions were characterized. In most cases isolates that were in same vegetative compatibility group were originated from same location or were associated with movement of planting material. This study suggests that Latvian population of *G. fragariae* has considerable diversity and further genetic analyses are needed to elucidate the population structure of the pathogen in strawberry cultivations.

**Key words:** plant pathogenic fungi, root rot and petiole blight

# DEVELOPMENT OF NEW ENVIRONMENTALLY FRIENDLY PLANT PROTECTION PRODUCT AGAINST *BOTRYTIS* ROT

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Botrytis rot (*Botrytis cinerea* Pers.) is one of the most important diseases of berry crops, especially for strawberry and primocane raspberry. There is a lack of plant protection products for organic farming against this disease. The development of new environmentally friendly plant protection product against *Botrytis* rot was started in 2010. This project is a joint effort of several institutions. During 2010 to 2011 several laboratory and field investigations were carried out to test effectiveness of different pine and spruce bark extracts against *B. cinerea*.

Laboratory tests were done in the Institute of Biology. On the basis of extracts 11 different formulations were created and characterized. The effect of formulations was tested in vitro on the mycelial growth of *B. cinerea* test cultures, applying fungal radial growth test. The impact of formulations on plants after spraying was evaluated using micro-propagated strawberry plants. The chlorophyll content and chlorophyll fluorescence were estimated. All formulations had inhibitory effect on mycelium growth (inhibition rate >50%) using the concentration 2 g $L^{-1}$ in medium. Extracts did not show significant effect ($p<0.05$) on the chlorophyll content in strawberry leaves.

Field investigations on strawberry cultivar 'Senga Sengana' and primocane raspberry 'Gerakl' were done in the Pûre Horticultural Research Centre. None of tested coniferous extract preparative forms showed higher effectiveness than fungicide Signum. After one year of field testing pine bark NaOH extract and spruce bark ethanol extract showed the most promising results against *Botrytis* rot for both crops.

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**Key words:** *Botrytis cinerea* Pers., strawberry, raspberry, damage, pine extract, spruce extract

# SPECIES COMPOSITION AND HARMFULNESS OF *MONILINIA* FUNGI – APPLE MONILIOSIS PATHOGENS IN THE ORCHARDS OF BELARUS

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The aim of our research was to characterize species diversity of fungi of the genus *Monilinia* and their harmfulness on apple. During 2008-2011 the itinerary inspections of apple orchards in various regions of Belarus for the purpose of collection of infected material and isolation of pathogens on pure culture were carried out. Fungi identification has been done by cultural-morphological features using the Lane synoptic key of differences included 7 characteristics. It is determined that under Belarus conditions moniliosis of apple mainly is caused by the *Monilia fructigena* fungus. Firstly in Belarus the fungus *Monilia laxa* has been registrated. Currently the collection of isolates of *Monilinia* fungi which consists of 65 monoconidial strains is created. The dominant species in the collection (92%) is *M. fructigena*. In the orchards of Belarus the more spread form of apple moniliosis is brown rot which develops both in the vegetative period and in storage. Under favorable conditions for the pathogens development harvest losses of apple from moniliosis can exceed 50%. The last years in apple orchards the increase of spring form of moniliosis harmfulness– monilial blight was noted. Monilial blight of twigs and fruit formations (fruit-bearing branches) was caused by fungi *M. fructigena* and *M. laxa*. The increase tendency of this form of disease incidence was revealed in the orchards elder than 10 years.

**Key words:** apple-tree, moniliosis, species of the genus *Monilinia*, strain, harmfulness

# A DISTRIBUTION AND DAMAGE OF CURRANT BY CLEARWING MOTH *SYNANTHEDON TIPULIFORMIS* CL. IN LATVIA

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The present study aims at establishing the distribution and prevalence of currant clearwing moth in Latvia.

In 2008 -2009, trials were carried out in blackcurrant plantations aimed at establishing the prevalence of currant clearwing moth across the territory of Latvia. To achieve this goal, 13 horticultural farms having blackcurrant plantations were surveyed (in Dobele, Ikškile, Jelgava, Kekava, Lubana, Pargauja, Saldus, Talsi, Tukums, Viesite municipalities). In 2009, the research was continued in Jelgava, Pargauja, Tukums municipalities.

For assessing of prevalence and identifying the level of damage incurred by the currant clearwing moth two methods were used: cutting of branches and search of larvae. 5 branches were cut from each of the bushes, totally 30 branches from each field; pheromone traps with dispensers (of company PHEROBANK) were distributed in each trial farm with density 1 trap per ha. In the laboratory all trapped clearwing males were counted.

In 2008 and 2009 the presence of the clearwing moth was established in all 13 horticultural farms surveyed. Analyses of the branch samples demonstrated the pest invasion in 6.7% to 70% of the branches tested. With the help of pheromone traps, from 2.5 to 35 adults were identified. The highest proportion of the invaded branches in the year 2008 (70 %) as well as the number of males found in pheromone traps in the year 2009 (35 in one trap) was established in Jelgava municipality. Currant clearwing moth is widely distributed in blackcurrant growing locations across the whole territory of Latvia.

**Key words:** currant clearwing moth, distribution in Latvia

# COMPOSITION OF PHYTOPHAGOUS INSECTS ASSOCIATED WITH STRAWBERRY IN LATVIA

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Insects are important components of agro-ecosystem. More than 560 different insect species have been reported on strawberries. Most of them are phytophagous. The investigation was carried out on strawberry plantings of the Pure Horticultural Research Centre located in Tukums District (Northwest Latvia). The aim of this study was to obtain data on the phytophagous species composition of insects associated with strawberry, their abundance and seasonal activity.

The study was conducted during growing seasons from 2000 to 2004. Insects were collected from strawberry fields by pitfall trapping, sweep netting and leaf sampling methods.

During the study 171 species of phytophagous insects were identified: Coleoptera (46 species), *Homoptera* (31), *Lepidoptera* (25), *Diptera* (25), *Thysanoptera* (20), *Heteroptera* (15), *Hymenoptera* (9). Order *Coleoptera* was represented by 17 families, *Lepidoptera* – 9, *Heteroptera* – 7, *Diptera* – 7, *Homoptera* – 5, *Thysanoptera* –3, *Hymenoptera* – 2. From these recorded insects 49 species are known as general strawberry pests.

**Key words:** *Fragaria x ananassa*, phytophagous insects, abundance, seasonal activity

# THE EFFECTIVENESS OF SOME ENVIRONMENT-FRIENDLY PROTECTION METHODS TO CONTROL *RHAGOLETIS CERASI* (L.) (DIPTERA: TEPHRITIDAE) ON THE EARLY RIPENING SWEET CHERRY CULTIVARS

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European cherry fruit fly *Rhagoletis cerasi (Diptera: Tephritidae)* is one of the most economically important pests in the cherry orchards in Europe. There are different methods how to reduce the population of this pest in the orchards. The aim of this work is to test the effectiveness of some environment-friendly methods in reducing the damaged yield of the early ripening sweet cherry cultivars by *Rhagoletis cerasi*.

In 2010 and 2011 four methods were tested in the orchard of Latvia State Institute of Fruit-Growing on the early ripening sweet cherry cultivars. Each year there were three treatments with four replicates, four trees in the each replicate. In 2010 the effectiveness of the turning over the soil in the depth of 15 cm and the fence of the crop cover around the replicate in 1.5 m height were tested. In 2011 one treatment was a control, in one treatment the soil milling and mass trapping with yellow sticky traps were used, in the third treatment the turning over the soil in the depth of 15 cm and the fence of the crop cover around the replicate in 1 m height were used. 500 cherries from each replicate were analyzed.

The tested plant protection methods had not significant effect in the reducing of damaged yield of the early ripening sweet cherry cultivars. The amount of the damaged cherries did not exceed 3.4 %, even in the controls.

**Key words:** European cherry fruit fly, environment-friendly plant protection, early ripening sweet cherries

# INVESTIGATION OF *BOTRYTIS CINEREA* RISK FORECASTING MODEL IN STRAWBERRIES

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Grey mould caused by *Botrytis cinerea* is one of the most important diseases of strawberry in Lithuania and worldwide. Research on the efficiency of forecasting models for pests and diseases in horticultural plants under Lithuanian climatic conditions using internet forecasting system iMETOS®sm (Pessl Instruments, Austria) was started at the Institute of Horticulture in 2007. detailed grey mould iMETOS®sm forecasting model in strawberries was observed in 2010-2011. The aim of investigation was to analyze *B. cinerea* disease risk probability in different agro-climatic conditions at various regions of Lithuania. Grey mould riskforecasting model indicates the risk of infection periods on the basis of the interaction between air temperature and leaf wetness duration. *B. cinerea* a capability to develop at the temperature from 2 °C to 28 °C, optimal conditions for grey mould is 20 °C and leaf wetness periods above 80 %, witch lasts more than 4 hours. calculates how favorable is periods for the risk of infection. In periods where risk is consistent (more than one day) higher than 60 points a spray against grey mould should be applied. iMetos®sm forecasting model allow more efficient, ecological and economical accepted control of strawberry grey mould. Grey mould iMetos®sm risk forecasting model gives the opportunity to optimize the usage of fungicides and sometimes reduces number of applications.

**Key words:** grey mould, *Fragaria x ananassa*, iMetos®sm, wetness, air temperature

# AGRESSIVENESS OF *"GNOMONIA" FRAGARIAE* AND SUSCEPTIBILITY OF STRAWBERRY CULTIVARS TO ROOT ROT AND PETIOLE BLIGHT

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*Gnomonia fragariae* Kleb. is a pathogenic fungus which causes root rot and petiole blight on strawberry. The root rot and petiole is widespread and severe disease on perennial strawberry in Latvia. The aggressiveness of the pathogen and susceptibility of strawberry cultivars was evaluated in two detached leaf assays in laboratory and two greenhouse experiments for two years. In detached-leaf assays performed in laboratory 57 strawberry genotypes were inoculated with young mycelial plugs of seven *"Gnomonia" fragariae* isolates originated in Latvia and Sweden. Development of necrosis was monitored daily and total necrotic area was measured after 10 days. In the greenhouse experiments micro-propagated strawberry plants of eight genotypes were inoculated around crown by mycelial plugs of the same isolates used for laboratory tests. Development of symptoms was recorded once a week. At the end of the experiments disease severity was evaluated and root and shoot weight measured. Re-isolation of the pathogen was performed at the end of the experiments or when the dead plants were noticed. Statistical analysis of the data was done by SPSS software and mean values compared by Duncan's multiple range test *(P=0.05)*. Significant differences among the cultivars in susceptibility to the pathogen were detected in detached leaf assays and greenhouse experiments. The tested isolates of the pathogen showed substantial variations in their aggressiveness in detached leaf assays and specific interactions were observed in combinations of isolates and cultivars. These results indicate diversity in *G. fragariae* isolates and suggest that there is resistant genetic material available for strawberry breeding.

**Key words:** plant pathogenic fungi, virulence, pathogenicity, *Fragaria x ananassa*

# PSYLLIDS (PSYLLIDAE: HEMIPTERA) ON FRUIT PLANTS IN LATVIA

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Some psyllid species are pests of plants with economical importance. Main faunal studies of this group of plant suckers were done in mid of 19th century by Gustav Flor and unambiguously for Latvia he reports 37 psyllid species. During 20th century psyllid fauna in Latvia was studied by several authors but main attention was dedicated to psyllids feeding on plants with economical and ornamental importance. In this period 8 new species were mentioned for Latvia territory by different authors and for one species, *Trioza apicalis*, its bionomics was studied seriously by Edgars Ozols.

Information about psyllids feeding on different fruit plants is available since Gustav Flor's (1861) work. But data about psyllids on fruit plants are fragmentary, and it was necessary to compile all available information. Until today by different authors in Latvia on traditional and non-traditional fruit plants there are reported 7 psyllid species: *Cacopsylla crataegi* on hawthorns; *Cacopsylla mali* and *Cacopsylla picta* on apples, *Cacopsylla pyri*, *Cacopsylla pyricola* and *Cacopsylla pyrisuga* on pears; *Cacopsylla sorbi* on rowans.

Today in Latvia the main importance have psyllids on pears *(Cacopsylla pyri, Cacopsylla pyrisuga)* and *Cacopsylla* sp. on seabuckthorns. Psyllids on seabuckthorns are distributed in several plantations and in some years are observed in high density. *Cacopsylla mali* is mainly important in non-commercial plantations on older apple-trees. Fauna of psyllids on hawthorns and related plants needs to be revised. Two species – *Cacopsylla picta*, Cacopsylla pyricola probably are rare in Latvia.

**Key words:** *Cacopsylla*, apples, hawthorns, pears, rowans, sea-buckthorns, species diversity

# EVALUATING THE RESISTANCE TO THE *PLUM POX VIRUS* OF CERTAIN APRICOT CULTIVARS AND HYBRIDS IN THE SOUTH-EASTERN PART OF ROMANIA

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Right now in Europe, the *Plum pox virus* (PPV) causes one of the most serious diseases that affect the stone fruit species (plums, apricots, peaches, nectarines, almonds and cherries) in all countries that cultivate them. Romania is one of the countries in which this virus has been present for several years now and where the contamination level is very high (Smith, Candresse and Dosba, 1994).

The disease causes considerable damage because the infected trees have few fruit, which are small, deformed, lacking in flavour and with a low content of sugar and which can neither be consumed, nor industrialised. Therefore, for the areas in which the *Plum pox virus* is present, the cultivation of highly resistant (tolerant) genotypes represents the only possibility available in order to reduce this damage.

In this view, the purpose of the research was to identify the cultivars which are tolerant to the attack of the virus and to monitor the manner in which the resistance gene is transmitted to their hybrid descendants.

The material which was studied consisted of apricot cultivars from the national collection of the Research Station for Fruit-Growing Constanta. The presence of the *Plum pox virus* was determined by means of the biological method consisting in tests performed on the 'Luizet' wooden indicator and the biological method through the ELISA test.

The cultivars which were identified as having a higher resistance to the attack of the plum-pox virus, such as 'Stark Early Orange', NJA 17, 'Sulmona', were used as genitors in intraspecific hybridisations for the selection of hybrids to which this characteristic was transmitted. Among these, we noted the following selections VT 48/45, VT 51/45, VT 47/112, H 9/5.

**Key words:** sharka, resistance, serological method, biological method

# INCIDENCE OF CRANBERRY (*VACCINIUM MACROCARPON* AIT.) STORAGE ROT IN LATVIA

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The American cranberry *(Vaccinium macrocarpon Ait.)* is a perspective and marketable fruit crop in Latvia and foreign markets as well. The aim is to find out for how long time berries can be stored. The investigation of storage rot is very important for farmers in the future.

Two hundred sound berries (of in total 1200) were collected randomly and by hand along a diagonal from six different cranberry plantations from all over Latvia. Berries were kept in plastic bags and refrigerated at +7° C for up to 4 months. At the end of each month (November - February) berries were sorted and rotten berries were separated from the sound ones.

Spread of fruit rot increased every year. In 2007, after a month of storage, the rot had damaged an average of 11% of the berries, but the level of incidence after three years had already reached 35%. The rapid incidence of fruit rot was observed at the end of December 2010, when an average of % of all the berries was decayed. At the end of February, the incidence of fruit rot was 50-88% during the three years of inspection. A rapid rate of storage rot spread in the first months in storage was observed.

Storage rot is a problem in cranberry samples from all inspected plantations in Latvia, and further on the incidence of fruit rot will increase.

**Key words:** American cranberry, storage rot, shelf-life

# MOLECULAR CHARACTERIZATION OF *COLLETOTRICHUM ACUTATUM* FROM DIFFERENT FRUIT CROP HOSTS IN LATVIA

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*Colletotrichum acutatum* (Simmonds) is an important fungal plant pathogen worldwide, but in Latvia it was detected only on rhododendrons, not on the fruit crops. In different studies before it has been discovered that *C. acutatum* belongs to eight A1-A8 distinct molecular groups that are related to the geographical distribution of host plants. During this study samples of *C. acutatum* from different fruit crops (blueberry, strawberry, apple, cherry, and strawberry, raspberry) were collected and analyzed. For analysis rDNA ITS1 – 5.8S – ITS2 region was sequenced, using ITSF1 and ITS4 primers, sequencing were performed by Macrogen Europe Inc. (Netherlands). DNA sequence data were analyzed using MEGA 5.1. (Tajima, Nei, 1984). All isolates of Colletotrichum sp. from Latvian fruit crops were identified as *C. acutatum*, and during phylogenetical analysis of sequences it was found, that isolates belongs to different molecular groups, related to origin of planting material. Isolates from blueberries belonged to molecular groups A3, and A4. Isolates from strawberries belonged to group A4 and A2, and group A2 is more specific for South part of Europe, and in this case origin of planting material was Italy.

**Key words:** *Colletotrichum acutatum*, molecular groups, blueberry, strawberry

# LATE ABSTRACTS

## THE INFLUENCE OF PRE- AND POST-HARVEST FACTORS ON STORAGE DISORDERS OF APPLES AND PEARS

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Postharvest fruit and vegetables losses worldwide are up to 30 to 40% of the total crop, or even more in some developing countries. The following factors contribute to postharvest losses: environmental conditions (temperature, precipitation, etc), mechanical damage (during harvest, storage and handling), improper crop protection programme, orchard management (crop load, minerals content, fruit position on the tree, etc), fruit maturity at harvest and postharvest management (storage conditions, rate of cooling, handling conditions). Efforts to control these factors are often very successful in reducing the incidence of storage disease.

Storage loses include fungi diseases and physiological disorders. Apple and pear disorders (noninfectious) may occur at harvest, during storage and handling stage. Depending on causes of their development numerous type or groups of the disorders could be distinguished and will be discussed in relation to:

- Pre-harvest factors (bitter pit, sunscald, water core, alfalfa greening, black end);
- Senescence (senescent breakdown, vascular breakdown, mealy breakdown);
- Storage conditions (low temperature breakdown, soft scald, freezing injury, flesh browning, external and internal carbon dioxide injury, low oxygen injury);
- Pre-harvest factors and storage duration (superficial scald, Jonathan spot).

The most obvious factors contributing to the disorders have been maturity stage of fruit at harvest and storage conditions. The methods and indicators for determination of optimum harvest date of apples and pears will also be discussed.

**Key words:** apples, pears, disorders, optimum harvest date, storage technology

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