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FLORISTIC RESEARCH OF POPULATION OF *POLYGONUM AMPHIBIUM* L.

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Polygonum amphibium L. is a perennial herb. Medicinal vegetative raw material of this species is widely used in formal and traditional medicine. Botanical research was conducted to determine the definition of reserves and description of the habitats of *Polygonum amphibium* as the demand for herbal drugs tends to grow. One of the populations of *P. amphibium* was found on the lake Frunzensky territory near the village Ostemir, Talgar district of Almaty region. The length of the lake is 1 km 39 m, width – 121 m. In the frame of floristic composition – there plant cover is presented by pondweed–knotweed association (*Potamogeton lucens*, *P. natans*, *P. pamiricus – Polygonum amphibium*) in water. Projective cover of the water surface in the densest thickets is 60–65%. In places where *P. amphibium* is distributed evenly the projective cover is 34–40%. On the remaining part of the pond the density of coverage does not exceed 15–20%. Underwater thickets of plants are very densely overgrown, especially in the shallow part, closer to the shore. We noticed that some species of algae of the genus *Chara* grow there too.

Xerophytic grasses grow predominantly somewhat higher in the watersheds such as *Lasiagrostis splendens, Calamagrostis dubia*, *Artemisia terrae-albae, A. vulgaris, Marrubium vulgare*; of weeds: *Cannabis ruderalis, Urtica cannabina*, *Peganum harmala,* etc. Lake's floristic composition of higher plants is not rich, except the coastal marsh plants. We identified and defined four species of pondweed directly in the water: *Potamogeton natans* L., *P. perfoliatus, P. lucens, P. pamiricus*. Additionally, you can see *Najas marina* and *Polygonum amphibium*, wetland plants such as *Phragmites australis*, *Bolboschoenus maritimus*, *Typha angustifolia*, *Juncus compressus*, *Butomus umbellate*, *Sparganium stoloniferum, Rorippa palustris*. Thus, we registered six species of higher aquatic plants belonging to three families and three genera in the Frunzensky lake and listed five of the six species higher aquatic plants as hemicryptophytes. *Najas marina* is ascribed to therophytes.

Key words: *Polygonum amphibium,* plant association, projective cover, hemicryptophytes, therophytes

POTENTIAL OF ALGAE AND CYANOBACTERIA FOR RURAL DEVELOPMENT

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Algae and cyanobacteria comprise heterogenous groups of eukaryotic and prokaryotic organisms. These organisms comprise a wide diversity of forms, pigments, reserve products, life cycles, habitats and flagellation. Moreover, these have the potential to fertilize crop fields, especially of rice paddy with nitrogenous compounds, providing nutraceuticals through *Spirulina*, promising as primary producers, biofuels and a variety of phycocolloids for various industrial applications. Their contribution to development of rural technology for biofertilizers and nutraceuticals would be discussed. Since thalli of these organisms are used completely and no waste materials are produced, this system involving algae and cyanobacteria is highly valuable compared to chemical fertilizers and other agrochemicals. Their regulated presence in the water bodies provides an efficient carbon sequestration system as also production of oxygen. In addition, some of these organisms provide antioxidants, cosmetics, polyunsaturated fatty acids and one of the favourable experimental system for a variety of morphological, physiological, genetical, biotechnological and evolutionary studies. Survival of human beings and animals is closely related to these organisms.

Key words: algae and cyanobacteria, fertilization

THE RESULTS OF INTRODUCTION OF SPECIES AND SORTS OF FAMILY *AMARYLLIDACEAE* J. ST.-HIL. TO THE BOTANICAL GARDEN OF V. N. KARAZIN KHARKIV NATIONAL UNIVERSITY

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The results of the study many years of morphobiological features of species and varieties of *Amaryllidaceae* J. St.-Hil. family (10 species, one form, 169 varieties) in conditions of the Botanical Garden of V. N. Karazin Kharkiv National University are presented. The species composition of the collection is as follows: 5 species and one form of the genus *Galanthus* L. (G. *bortkowitschianus* C. Koss, *G. nivalis* L., *G. nivalis* f. *pleno*, *G. plathyphyllus* Traub et Moldenke, *G. plicatus* Bieb., *G. woronowii* Losinsk.), two species of *Leucojum* L. (*L. aestivum* L., *L. vernum* L.), *Lycoris squamigera* Maxim., 2 species and 169 varieties of the genus *Narcissus* L. (*N. angustifolia* Curt., *N. papyraceus* Ker Gawl.). Based on the study of regrowth periods, duration of vegetation, the start and the end of flowering, winter severity, resistance to diseases and pests, decorativeness, phenorhythmotypes, rhythms of flowering and success of introduction were determined for all the studied species and varieties. The sorts of all groups of daffodils are represented in the collection. The groups of Trumpet Daffodils of Garden Origin, Long-Cupped Daffodils of Garden Origin, Double Daffodils of Garden Origin and Split-Corona Daffodils of Garden Origin are most numerous. The agricultural techniques facilitating the successful cultivation of *Amaryllidaceae* family in the north-east of Ukraine were determined.

Key words: morphobiological features, species, varieties, *Amaryllidaceae*

BLUEBERRY (*VACCINIUM* × *COVILLEANUM*) COLLECTION AT THE KAUNAS BOTANICAL GARDEN OF VYTAUTAS MAGNUS UNIVERSITY

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Establishment of the collection of blueberries (*Vaccinium* × *covilleanum* Butkus et Pliszka) at Kaunas Botanical Garden of VMU was started in 1993. Presently, there are 97 different samples of blueberries in the collection, and 49 of them are cultivars. As a result of long years of selection work and investigations the first two approved by Lithuanian cultivars were selected at Kaunas Botanical Garden of VMU by name 'Freda' and 'Danute' in 2011. The new Lithuanian cultivars are different from other blueberry cultivars because of higher amount of anthocyanins in the berries.

Productivity and other features important for growers of 40 cultivars were evaluated during many years of investigation. According to the quality of berries and productivity, 'Reka', 'Toro', 'Patriot', 'Nui', 'Puru', 'Spartan', 'Bluejay', 'Putte' and 'Danute' were considered the best cultivars.

Key words: blueberry, *Vaccinium x covilleanum*, collection, cultivar, productivity

ALLELOPATHY AND PHYTOTOXICITY OF INVASIVE *HERACLEUM SOSNOWSKYI*

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Increasing human activity has resulted in a concomitant increase of alien *Heracleum sosnowskyi* migration and spread into new habitats suppressing native species due to its giant size, intensive reproduction of high seed yield and biochemical activity. Total plant generative production ranged between 7 722 and 8 082 mericarps. The preliminary bioassay *ex situ* showed different phytotoxicity of 1- and 2-years old plant extracts due to variation in the accumulated phenolics content. The extracts inhibited seed germination and the level of inhibition was concentration dependent. Phenolics contents vary throughout the plant age (0.22–81.03 mg ml^{-1}), growth stage (0.17–81.03 mg ml^{-1}) and across different plant parts (2.97–92.61 mg ml^{-1}) inhibiting the acceptors plants germination. The results suggested that invasive *Heracleum sosnowskyi* possesses allelopathic activity therefore may acquire spreading advantage in new territories through use of allelochemicals. Nonetheless, species evidence for allelopathic effects should also include more research.

Key words: allelopathy, acceptors, environment, germination, *Heracleum sosnowskyi*, phenolics

THE IMPACT OF PLANT DENSITIES AND BIOLOGIC FERTILIZERS UPON THE WEEDINESS OF ORGANICALLY GROWN WINTER WHEAT

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The weediness of organically grown winter wheat was investigated at the organic production farm in the Training Farm of Aleksandras Stulginskis University on a loamy (PLB-g4) *Endohypogleyi-Eutric Planosol* (*PLe-gln-W*) field during 2006–2009. The aim was to assess the effect of biological fertilizers extracted from organic matter, namely Bioplant Flora (BF), Provita (Pv), and decomposer of organic matter Penergetic-k (Pk) on weediness of organically grown winter wheat.

BP application decreased weediness by 59–67% in spraying treatments due to increased wheat mass accumulation and density and thus improved wheat competition and weed suppression in agro-community. Application of Pv fertilizers on organically grown winter wheat in spring during the period of tillering did not have any essential effect on the weediness of wheat crop. Nevertheless, a trend for organic nitrogen fertilizers to increase weediness of organically grown winter wheat crops was observed.

Pre-sowing spray organically grown winter wheat with decomposer of organic matter Pk and application of organic nitrogen fertilizers Pv did not have a significant effect on the number of wheat leaves in autumn during the period of leafing stage. However, this fertizing essentially (by 0.83 g m^{-2} or 27.40%) increased the mass of dry weed matter in winter wheat. Pk and Pv fertilizers essentially (by 26.31 units m^{-2} or 18.42%) increased the number of weeds in winter wheat crops in spring at tillering stage in spring as compared to control. Nonetheless, this fertilizing has no significant effect on dry matter mass of weeds in the crops of organically grown winter wheat. Pre-sowing spray of Pk and Pv application essentially increased the number by 70.63–79.37 units m^{-2} or 41.1–48.68% and dry matter mass by 55.23–75.43 g m^{-2} or 28.84–44.03%) of weeds in the crop of organically grown winter wheat at the end of vegetation period during the stage of wax maturity compared to unfertilized winter wheat and spraying with Pk. Though these treated fertilizers stimulated wheat growth and crop density, thus improving wheat competition, nonetheless crop weediness also increased during fertilized treatments.

Key words: weediness, organic farming, winter wheat, biologic fertilizers

DIVERSITY OF THE MARTAGON LILY (*LILIUM MARTAGON* L.)

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The genus Lilium L. includes approximately 100 species distributed throughout the cold and temperate parts of the northern hemisphere. One of the best known wild lilies is martagon lily (*L. martagon* L.). Of all the lily species, it is distributed across the largest growing area – from western Portugal through Europe and Asia. To evaluate the natural habitat of martagon lily, research was carried out in locations of Aizkraukle, Ventspils, Kuldiga and Tukums region in Latvia. Research results indicate that diversity in genotypes varies according to location and distribution. The individuals of each biotope were characterized by stable inherited traits: colour, shape and flower diameter, stem length and bulb colour. The colour of flowers was basically consistent, but there were variations in intensity from pale to bright violet-pink. Spotting was also extremely variable, ranging from a few small spots in the centre to spotting that covered the entire flower to the tips of the tepals. Diameter of flower varied between 3.5 and 6.0 cm. The height of these plants varied within 114–130 cm. The flowering time was from mid June to mid July and seeds ripen in September. Wild martagon lily found in these regions grew in calcareous soils among shrubs in river valleys and semi-shaded deciduous forests. Bulbs were about 10 to 20 cm under the ground.

Key words: phenological observations, variability, wild species

PHENOLOGICAL PECULIARITIES OF SEED BEARING AND SEED CAST OF SILVER (*BETULA PENDULA* ROTH.) AND DOWNY (*BETULA PUBESCENS* EHRH.) BIRCH

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The studies were conducted in pure birch stands of Central Lithuania (the portion of birches in stand composition – not less than 10). The study objects were chosen on sites of the most characteristic for silver and downy birches hydrotopes (N, L, U and P). Phenological studies of over three years (2004–2006) were conducted in five 40–70-year old birch stands (three stands of silver birch and two stands of downy birch) growing on sites of similar fertility (c, d). Species identification was done applying chemical (sediments) method, based on the reaction of inner bark with 2,4-dinitrophenylhydrasine (Lundgren et al., 1995).

The cast of silver birch seeds begins (when about 10% of seeds are dispersed) on average on 1–5 August, while that of downy birch – on 14–16 August, i. e. 2 weeks later. Mass seed cast of silver birches (when about 50% of seeds are dispersed) starts on average on 15–18 August, while that of downy birch – on 25 August–1 September, i. e. also 2 weeks later. The most intensive seed cast of silver birch has been recorded since 30 July till 3 September (about 35 days), while that of downy birch – from 14 August to 8 September (about 25 days). In other words, the seed cast of downy birch is more intensive, i. e. about 80% of birch seeds fall down over a ten days' shorter period than the seeds of silver birch.

Key words: silver and downy birch, phenology and dynamics of seed cast

NEW SELECTIONS OF *PICEA ABIES* (L.) H. KARST. IN DUBRAVA ARBORETUM

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One of the aims of Dubrava Arboretum is to collect, evaluate and conserve bioecological diversity of native Lithuanian flora. Since 2005 native woody plants with atypical morphological features in Dubrava Nursery, Girionys Park, Dubrava Forest Enterprise plantations and other locations are identified and registered. These plants are propagated by grafting, budding or cuttings and grown in Dubrava Arboretum. Presently, 14 examples of *Picea abies* (L.) H. Karst. selections with atypical morphological features are collected in the Arboretum. To date, our findings suggest that the plants are different and distinguishable from other cultivars of *Picea abies* by their morphological and ornamental features. Currently, the selections will be evaluated over several years and locations to test the veracity of their ornamental features and determine their adaptability to climatic conditions together with resistance to pest and disease. If our plants are an improvement on the existing cultivars the process of registration and naming should be contemplated. The plants are evaluated not only for potential use as cultivars, but also as locally adapted propagation material, as genetic resources for diversity of wild plants and as material for subsequent hybridisation and selection.

Key words: native plant, *Picea abies*, diversity, plant morphology, genetic resources

INTRODUCTION AND RESEARCH OF ASTILBE (*ASTILBE* BUCH.-HAM. EX D. DON) GENUS PLANTS IN KAUNAS BOTANICAL GARDEN OF VYTAUTAS MAGNUS UNIVERSITY

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The results of research of 25 varieties of astilbe, grown in Kaunas Botanical Garden of Vytautas Magnus University, are presented in this article. *Astilbe* introduction started in 1975. The tests of morphologica l – decorative features were made during the period 2010–2012.

Decorativity of astilbe varieties was evaluated based on all decorative criteria: height of plant, colour of leaves and flowers, shape, density, length and diameter of in florescence and flowering period.

Key words: *Astilbe*, observations of phenological events, biometric measurements

COMMON YEW – *TAXUS BACCATA* L. IN LATVIA

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Common yew (*Taxus baccata* L.) is a rare and endangered species included into the Red Data Book of Latvia. The species grows on the eastern edge of its distribution area. It was found mainly in SW parts of Kurland near the Baltic Sea coast and the Gulf of Riga (in some localities). Mostly yew is the understory plant and grows well in the shade, in climatic zones with mild winter and cool summer. As this conifer has high landscape value and is a relict since Atlantic times, it needs protection. In Kurland, a restricted area "Rucavas īvju audze" ("Yew grove of Rucava") was established situated in the SW of maritime territory in the Bārtavas lowland – 206 ha area. The highest common yew tree (14 m) grows in the Zentenes Park (in district of Tukums).

This paper also presents a collection of taxa of yews which have been planted in the Arboretum of Rucava during 15 years.

Key words: *Taxus baccata*, Latvia, distribution, conservation, propagation

ARCHITECTURAL RHYTHMS IN A LANDSCAPE DESIGN

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Complex contemporary architecture and creative landscape design solutions are vital components for development and advancement of modern society. The most prominent challenges for landscape design are enrichment of architectural space with vegetation, which makes spaces more ecological, aesthetical, and in particular instances more functional. Landscape design can also act as a harmonizing link between historical and modern architecture. While organizing and implementing landscape projects in urban territories, various connections of shapes of plants and rhythm are interconnected: starting from a small flower garden or alpinarium and moving on to blocks in the cities and parks, where solutions depend on the function of the space. Here I investigate landscape design challenges arising from several cases of modern and contemporary architecture and how the harmony can be achieved through the theory of composition. In addition, I emphasize the need of more complex vegetation (possibly genetically engineered) in order to meet the needs of complicated contemporary architectural projects. Contemporary architecture and modern landscape design harmony is a complex problem which requires interdisciplinary solutions by joint effort of architects and botany scientists.

Key words: architectural rhythms, modern landscape

PLANT REGENERATION INDUCED IN SOMATIC TISSUES OF *SEDUM* L.

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Regeneration of ornamental plants *in vitro* is important for a wide range of application. The effect of different levels of 1-naphthylacetic acid (NAA) and 6-benzylaminopurine (BAP) on plant regeneration of four *Sedum* species was studied. Isolated explants of *Sedum rupestre* 'Angeline', *S. reflexum* 'Cristatum', *S. fosterianum* 'Elegans', *S. maximum* 'Autumn joy' were grown on Murashige ir Skoog (MS) nutrition medium with different content of growth regulators. Adventitious shoots were transferred to MS culture medium for rhizogenesis induction. The highest shoot formation frequency of cultivars 'Elegans' and 'Cristatum' has been obtained under influence of 0.75 mg l^{-1} BAP. The 3.0 mg l^{-1} BAP concentration in culture medium resulted in highest shoot regeneration frequency of cultivar 'Angeline'. All isolated explants of 'Autum joy' formed adventitious shoots in the medium supplemented with 3.0 mg l^{-1} BAP + 0.5 mg l^{-1} NAA and 4.0 mg l^{-1} BAP + 0.5 mg l^{-1} NAA, while 0.75 mg l^{-1} BAP in culture medium stimulated shoot formation of cultivar 'Elegans'. The highest shoots number per explant of variety 'Angeline' has been establishing in medium with 0.75 mg l^{-1} BAP and 3.0 mg l^{-1} BAP. Medium supplemented with 3.0 mg l^{-1} BAP resulted in highest shoots number per explant of 'Cristatum'. Explants of cultivar 'Autum joy' formed the highest shoots number per explant in medium with 3.0 mg l^{-1} BAP + 0.5 mg l^{-1} NAA and 4.0 mg l^{-1} BAP + 0.5 mg l^{-1} NAA. Although shoots of cultivars 'Elegans' and 'Angeline' formed the most intensive roots *in vitro* however the highest number of plants regenerants has been obtained growing variety 'Autumn joy' leaves segments in culture medium supplemented with 4.0 mg l^{-1} BAP + 0.5 mg l^{-1} NAA.

Key words: growth regulators, regeneration *in vitro*, *Sedum* L.

NITRATE REDUCTASE, GLUTAMINE SYNTHETASE, AND GLYCOLATE OXIDASE ACTIVITY AND PROLINE CONTENT IN LEAVES OF C4 AND C3 CROPS IN RELATION TO WATER AND PHOSPHOROUS DEFICIENCY

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An eight-week pot experiment was conducted under semi-controlled conditions to investigate the interactive effect of phosphorous (P) deficit and drought stress on nitrate reductase (NR), glutamine synthetase (GS), and glycolate oxidase (GO) activity and proline content in leaves of different C_4 and C_3 crops. Two water treatments were applied to get 70% (well watered) and 30% (drought stress) of soil water holding capacity, respectively. The soil used for the pot experiment was classified as loamy sand and indicated a suboptimal P status. Two C_4 plants, such as *Sorghum bicolour* (L.) Moench × *Sorghum Sudanese* (Piper) Stapf. and *Amaranthus cruentus* L., as well as two C_3 plants – *Glycine max* (L.) Merr. and *Secale cereale* were studied. Drought stress induced a significantly high inhibitory effect on soybean leaf NR activity, reducing enzymatic activity for about 3.3 times compared to activity values of well watered plant leaves. The NR activity of rye and amaranth leaves decreased under drought conditions. In contrast, the level of NR values from sorghum leaves were not affected by water supply. The GS activity in leaves depended on the type of photosynthesis. The C_3 investigated crops (soybean, rye) were more sensitive to the stress factors of drought and P limitation than C_4 crops (amaranth, sorghum). Soil P and water defficiency significantly increased GO activity in the leaves of both C_3 and C_4 photosynthesis types. Drought stress resulted in increased proline contents in the leaves of all investigated crops compared to the well watered crops. The highest values of proline accumulation were observed in stressed leaves of rye. The results suggest crop specific reaction on water shortage and P deficiency.

Key words: phosphorous deficiency, drought stress, C_4 and C_3 crops, nitrate reductase, glutamine synthetase, glycolate oxidase, proline

SEASONAL DYNAMICS OF SOLUBLE PEROXIDASE IN *BUXUS SEMPERVIRENS* L. LEAVES

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Throughout the year plants, perennial species in particular, are exposed to multiple seasonal stressful environmental factors. Considerable seasonal temperature fluctuations represent one of the most prevalent abiotic stresses for plants. Plant cells exposed to extremely low or high temperature accumulate reactive oxygen species (ROS). The latter include not only free radicals, but also H_2O_2 molecules which are very toxic for vegetal tissues. For the annihilation of ROS in plant cells, among other antioxidative enzymes, peroxidases (PO) are activated. The aim of this study was to investigate the modifications of PO specter and activity in *Buxus sempervirens* L. leaves in different seasons of the year. The leaves of this evergreen plant are suitable for investigating the mechanisms of plants adaptation to temperature stress. The leaves were collected from adult *B. sempervirens* plants, grown near the Institute of Genetics and Plant Physiology. Total activity of PO was determined in soluble proteins fractions extracted from the leaves. The specter of PO was analysed by using vertical gradient polyacrylamide gel electrophoresis. The obtained results showed that the PO activity of extracts from boxwood leaves reach maximum values in periods when temperature regime was stressful (in July and January, the months with the highest and lowest ambient temperature). The analysis of PO isoenzymes patterns has revealed two zones of bands distribution: the first – in the cathode part of the gel; and the second – in the middle part of the gel. Although the intensity of isoenzyme bands is specific in extracts from leaves taken in different seasons of the year, the specter of isoenzymes bands is similar. These results confirm the participation of PO in plant adaptation to extreme temperatures.

Key words: *Buxus sempervirens* leaves, soluble peroxidase, isozyme pattern, seasons

EVALUATION OF PROSPECTIVE HIGHBUSH BLUEBERRY CULTIVARS

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Blueberry species are economically important berry plants in Europe. Their berries are a source of very valuable chemical components such as anthocyanins, organic acids, sugars, and other biologically active compounds. Growing of highbush blueberry started in Lithuania in 1965, however, modern cultivars have been under investigations at Kaunas Botanical Garden of VMU only since 1995. The comprehensive morphological and biochemical characterization of highbush blueberry *Vaccinium* × *covilleanum* genotypes is very important for cultivar identification and assessment of cultivars prospectivity. The aim of this study was to select highbush blueberry cultivars distinguished by berry quality, high productivity, and large amounts of biologically active components. Winter hardiness and resistance to late spring frosts were accomplished also. The cultivars of highbush blueberry 'Toro', 'Nui', 'Bluecrop', 'Patriot', 'Spartan', and 'Sunrise' were selected because of high productivity and good berry quality.

Key words: berry, chemical components, cultivar, genotype

DYNAMICS OF DEAD WOOD DECOMPOSITION IN NORWAY SPRUCE WOODS IN THE KEMERI NATIONAL PARK, LATVIA

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In order to improve biological diversity in managed and protected forests it is necessary to develop suitable management methods. Woody debris, especially with large diameter, is of great importance for sustaining biodiversity. To maintain this diversity, continuity of woody debris in space and time is required. There is a lack of knowledge about decomposition rate of woody debris in the boreo-nemoral zone. In order to develop management plans and to ensure continuity of woody debris such knowledge is important. We selected 9 circular plots (15-m radius) in relatively undisturbed (by humans) Norway spruce (*Picea abies* (L.) Karst.) stands located in the southern part of Kemeri National Park. Diameter of snags and logs was measured, only those with diameter ≥0.2 m at 1.3 m above the original ground level were used for our study. All logs were classified according to decomposition stage using a 5-point scale. To determine time since death of a tree, we collected cross-sections and cores for cross-dating. For the master chronology we used cores collected from living trees growing nearby. In cases when cross sections and cores were considered undatable, due to high degree of wood decomposition, cross sections of saplings and cores from nearby trees were collected for "growth release" analysis. In total, 70 logs were measured and dated.

Key words: dead wood, dendroecology, forest dynamics, *Picea abies*

CHARACTERIZATION DESCRIPTORS FOR *PAEONIA LACTIFLORA* CULTIVARS

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Chinese peony and their first cultivars were introduced to Lithuania from Western Europe. Lithuanian flower breeders S. Eicher-Lorka, O. Skeiviene, E. Tarvidiene and J. E. Tarvidas developed Lithuanian peony cultivars. 48 Lithuanian peony cultivars were attributed to National plant genetic resources. The Guidelines for the conduct of tests for distinctness uniformity and stability for trees peony were prepared by UPOV in 2011. There are no prepared descriptors for the evaluation of morphological and ornamental traits of herbaceous peonies. This article discusses the descriptor of morphological and decorative traits of herbaceous peonies (*Paeonia lactiflora* Pall.) cultivars. The description of vegetative and generative parts of peony plants was prepared according to methodological material of M. Vasiljeva, J. Vaidelys, S. Dapkūnienė and BI advice for developers of descriptors. Evaluation of morphological parameters of the plants was carried out according to J. Dagys' textbook. The observations were performed when plants were completely developed, at the beginning of flowering. 10 plants or their parts were evaluated.

Key words: herbaceous peony, *Paeonia lactiflora*, characterization descriptor

PRIMROSE (*PRIMULA* L.) MORPHOLOGICAL CHARACTERIZATION OF ORNAMENTAL DESCRIPTION

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Lithuanian cultivars of primroses (*Primula* L.) are created by Ona Skeivienė and Jonas Evaldas Tarvidas. The cultivars of *Primula malacoides* were collected and analysed at the Floriculture Department of Kaunas Botanical Garden of Vytautas Magnus University and at the Floriculture Plant Collections Department of the Botanical Garden of Vilnius University. In total, all cultivars of primroses were assessed and there is a big variety of their morphological characteristics. The characterization descriptors of *Primula* were prepared for the characterization of primroses and a tentative descriptor list was developed for the genus considering the recommendations of the Bioversity International.

Key words: *Primula*, genus, morphological, characterization descriptors

NEW BERRY PLANTS FOR THE LANDSCAPE GARDENING AT AGRO-TOURISM FARMS

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The popularity of agro-tourism continues to grow in Lithuania during the last decades. People are fond of spending time in the countryside. New horticultural plants with valuable decorative and economic properties should be used for landscape gardening at farms of agro-tourism. The seasonal development, winter hardiness, resistance to late spring frosts as well as morphological properties of genera *Actinidia* and *Vaccinium* were investigated. The lianas *Actinidia kolomikta* and *A. arguta* are suitable for planting in arbours and pergolas. Male plants of *A. kolomikta* are more ornamental because of their intensive leaves variegation, meanwhile female clones are also valuable because of berry yield. A comparison of both *Actinidia* species revealed high cold tolerance in winter, however, the cultivars of *Actinidia kolomikta* were more winterhardy under Lithuanian climate conditions. The bushes of highbush blueberry (*Vaccinium* × *covilleanum*) are very attractive during flowering and berry ripening phases as well as because of their dark purple coloration of leaves in autumn. The early and medium-early cultivars of highbush blueberry 'Chandler', 'Reka', 'Earliblue', 'Nui', 'Toro', 'Spartan' with long period of berry ripening should be used for landscape gardening in agro-tourism farms. American cranberry (*Vaccinium macrocarpon*) and cowberry (*Vaccinium vitis-idaea*) are evergreen species which are very popular horticultural plants in Lithuania. The most decorative cultivars of cowberry 'Erntekrone', 'Erntesegen', 'Red Pearl' as well as some clones were selected and recommended for growing in the garden-plots. American cranberry cultivars look very attractive during blooming and they produce very valuable berries in autumn.

Key words: horticulture, landscape gardening, plant, species

CHAENOMELES: GENE POOL AND NEW CULTIVARS IN NATIONAL BOTANICAL GARDEN OF UKRAINE

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The results of many years research of Japanese quince in NBS NAS of Ukraine are described. The gene pool represented by 3 species and more than 50 cultivars and hybrids of their own and foreign breeding. There are 4 cultivars breeding NBS in the Register of Plant Varieties of Ukraine. Their biochemical composition and medical significance were evaluated.

In the studied feedstocks the presence and quantity of content of carbohydrates, amino acids, fatty acids, aliphatic and hydroxycinnamic acids, procyanidins, tannins, flavonoids, saponins, chlorophylls, carotenoids, macro- and microelements were established, in leaves of Japanese quince it was done for the first time. The extract of Japanese quince leaves of sort "Jan" shows hepatoprotective activity, of sort "Holiday" – antidiabetic properties, of sort "Exclusive" – antiulcer effect. The extract of Japanese quince fruit of sort "Exclusive" stimulates all aspects of hematopoiesis.

Key words: Japanese quince, cultivars, volatile components, fatty acids, organic acids, markers

THE SELECTION OF RESISTANT TAXA OF TREES FOR COLD REGIONS OF WESTERN SIBERIA

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In the north of Western Siberia in Yamal-Nenets Autonomous District (YNAD) were surveyed 15 localities, in which were 75 taxa of native and adventitious trees and shrubs, including 52 taxa in the tundra.

Analysis of the previous studies on the introduction of trees in the 1970's and 80's, held in Labytnangi in environmental research station, showed that at that time planting of five tree species in the region was recommended.

Our research in 2011–2012 showed that this list can be expanded by species growing in similar climatic conditions. For example, 10 trees can be recommended to Salekhard tundra area, and for the species of the more favorable conditions in the area the list of trees contains 42 taxa.

According to the analysis of literature and our data were identified major parameters on which the selection of trees from areas of climate analogues for climatic subregions YNAD: the average temperature in January, the absolute minimum temperature, the amount of accumulated temperature above 10 °C and above 5 °C.

Only selected 52 taxa of trees that are recommended for growing and testing in YNAD, including for tundra – 33 taxa of trees. And if you ignore the selection of the absolute minimum temperature, 125 taxa can be recommended to the test in the YNAD (with January temperatures below –20 °C).

Key words: trees, resistant, Western Siberia

ECONOMIC DEVELOPMENT AND PLANT BIODIVERSITY LOSS IN EUROPE

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It is widely accepted that economic development is causing high rates of biodiversity loss. However, very little is known about the possible mechanisms of the economic development impacts on biodiversity. We tested how strongly the loss of plant biodiversity is related to different socio-economic, geographical and ecological features of 44 European countries. To study statistical dependence between variables we used Pearson's correlation coefficient (r) and Spearman's rank correlation coefficient (r_s) according to Wessa (2013).

We found a positive correlation between the number of threatened species (NTS) and the total length of road network (r = 0.58; r_s = 0.71), Gross Domestic Product (GDP) (r = 0.55; r_s = 0.74), the number of botanic gardens (r = 0.45; r_s = 0.72) and the total population (r = 0.47; r_s = 0.77) of the countries of Europe.

Intermediate values of the correlation coefficients were obtained when comparing the NTS and the number of invasive species (r = 0.27; $r_{s = 0.50)}$. At the same time, there was no any sufficient difference between Pearson's and Spearman's correlation coefficients for the NTS and Human Development Index (HDI) variables (r = 0.21; $r_{s = 0.24).}$

We observed the most dramatic disproportions between levels of the Pearson's r and Spearman's r_s correlation coefficients when the NTS and forest area (r = 0.08; r_s = 0.60), as well as the NTS and the territory of the country (r = 0.09; r_s = 0.63) were compared. The same was true for the NTS and GDP (per capita) variables (r = 0.06; r_s = 0.36).

It should also be noted that in the groups of 44 European and 27 EU countries absolute values of the correlation coefficients for the identical pairs of variables may differ significantly (Filimonov, 2013).

Key words: economic development, plant biodiversity loss, socio-economic indicators, Europe

COMPARATIVE EVALUATION OF INTRODUCED SPECIES PERSIMMON (*DIOSPYROS* SPP.) IN DIFFERENT CLIMATIC ZONES OF UKRAINE

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In this work a group of persimmon species oriented on the fruit size gained in two extreme cultivation localities of Ukraine was evaluated. In the experiments three introduced cultivars from USA – Meader, John Rick and Weber (*Diospyros virginiana* L.) were used. At the same time were evaluated five cultivars named Nikitska Bordova, Rossiyanka, Mount Goverla, Mount Rogers and Mount Roman-Kosh bred in Ukraine using inter-species crossing (*D. Virginiana* × *D. kaki*).

Key words: persimmon, *Diospyros* spp., cultivars, climatic zones, Ukraine

IN VITRO MULTIPLICATION AND CULTIVATION OF *ACTINIDIA ARGUTA* IN MOLDOVA

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Actinidia arguta is a perennial fruit liana, not characteristic for natural flora of Moldova. This species is interesting for gardeners due its high ornamental value, as well as for exotic fruits (kiwifruits). During eight years the research had been carried out at the experimental station of the Institute of Genetics and Plant Physiology of the AS of Moldova. Particular attention was paid to optimization of the methods of vegetative propagation and conditions of cultivating resistant and high-productive clone Tatiana, previously selected from the generative propagated plants. The apical meristems from adult plants served as a source for elaborating the method of *in vitro* micropropagation. As a result, there were determined the optimal cultural medium and conditions of cultivation, allowing the propagation of plants with the multiplication factor equal to seven. Plants adaptation to *ex vitro* conditions was ensured by varying light intensity and gradually reducing the relative humidity from 95% to natural. The resistance of plants to fungal diseases was correlated with the activity of chitinase which changed depending of leaf age, plant sex and seasons. *A. arguta* that grows in conditions of the Central Moldova gives 2–6 kg of kiwifruits per plant with valuable organoleptic and biological properties. In 100 g of fresh kiwifruits we determined 85,50 ± 0,45 mg of ascorbic acid, 127,64 ± 6,09 mg of total polyphenols, including flavonols – 7,30 ± 0,36 mg, oxycinnamic acids – 1,80 ± 0,09 mg. Due to high content of ascorbic acid and polyphenols kiwifruits juice can become a valuable source of nutrient substances. The antioxidant activity of juice, determined by the potentiometric method and expressed in equivalent of vitamin C (VCEAC), was equal to 9.26 ± 0.28 μMol/g (per dry residue).

Key words: *Actinidia arguta*, micropropagation, hardy kiwifruits, phenolics, antioxidant activity

A NEW *PHYTOPHTORA ALNI* ASSOCIATED ALDER MORTALITY IN LITHUANIA

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New *Phytophtora* taxon that causes diaback for alder has been detected in the UK in 1993, later to be identified in other European countries. After ten years of study, *P. alni* was confirmed as a new species to science. For the first time in Lithuania *P. alni* was isolated and identified from *Alnus glutinosa* and *A. incana* damaged subcortical tissue during 2001–2004. Three *P. alni* areas were discovered and tested. Alder sanitary conditions were evaluated in two regions: in south-western and northeastern Lithuania. There is a correlation between the permanent presence of tree roots humidity and disease manifestation. Economic damage to trees is obvious.

Key words: *Phytophtora alni*, *Alnus glutinosa*, *A. incana*, Lithuania

ASSESSMENT OF TULIPS BIOLOGICAL DIVERSITY AT THE VINGIS DEPARTAMENT OF BOTANICAL GARDEN OF VILNIUS UNIVERSITY

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Tulip collection of the Vingis department of Botanical Garden of Vilnius University was established in 1997. During the research period (1997–2011) a broad scope analysis of 474 tulip species and cultivars was carried out. The collection includes tulips of 15 classification groups: 1) Single Early Tulips make up 2% of the studied tulips; 2) Double Early Tulips – 3%); 3) Triumph Tulips – 22%; 4) Darwin hybrid Tulips – 8%; 5) Single Late Tulips – 15%; 6) Lily Flowered Tulips – 7%; 7) Fringed Tulips – 8%; 8) Viridiflora Tulips – 4%; 9) Rembrandt Tulips – only a single cultivar; 10) Parrot Tulips – 7%; 11) Double Late Tulips – 6%; 12) Kaufmanniana varieties and hybrids – 4%; 13) Fosteriana varieties and hybrids – 4%; 14) Greigii varieties and hybrids – 4% and 15) Other species and their varieties and hybrids – 6%. Within the research period, the following studies were carried out: 1) approbation of tulip species and cultivars; 2) assessment of tulip ornamental quality; 3) registration of the beginning and end of tulip flowering; 4) recording of blooming length; 5) assessment of resistance to *Tulip breaking potyvirus*; 6) assessment of resistance to *Botrytis tulipae*.

Among the investigated 15 classification groups of tulips grown in the collection, Darwin hybrid Tulips, Kaufmanniana, Fosteriana, Greigii varieties and hybrids and Other tulip species and their varieties and hybrids are the most resistant to *Tulip breaking potyvirus*. Cultivation of these tulips in Lithuania is recommended primarily. Single Early Tulips, Double Early Tulips, Darwin hybrid Tulips and Other tulip species and their varieties and hybrids are the most resistant to *Botrytis tulipae*. Manifestation of *Botrytis tulipae* on tulips depends upon particular climatic conditions.

Key words: *Tulipa*, diversity, ornamental quality, diseases

INTRODUCTION OF MEDICINAL PLANTS AND PHYTOCHEMICAL ANALYSIS OF *VIOLA TRICOLOR* L. GROWN AT KAUNAS BOTANICAL GARDEN OF VYTAUTAS MAGNUS UNIVERSITY

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Medicinal (aromatic) plants are widely used for the prophylaxis and treatment of diseases. The diversity of their species and varieties is important from the scientific and practical point of view. At the end of the 21th century, specific attention was paid to cultivation and preservation of medicinal, aromatic plants, evaluation of their quality and quantity. Production of many preparations of plant origin, immunostimulating among them, is limited by the deficiency of officinal herbal raw materials. It is essential to increase the assortment of cultivated medicinal plants, to accumulate and study samples of the introduced plants in collections now and in future, thus preserving and enriching the genetic fund of the useful plants of Lithuania.

The collections of medicinal plants as well as test plantations of Sector of Medicinal Plants of Kaunas Botanical Garden of Vytautas Magnus University (VMU), are the gene pool of seedlings and seeds of rare species of medicinal plants, a scientific, informational, educational base as well as the centre of preparation, storage and distribution of raw material, which make a major contribution to the development of science of medicinal plants in Lithuania.

The research work presents details of introduction of Wild pansy (*Viola tricolor* L.) since 1986 in the collection of medicinal plants of Sector of Medicinal Plants at Kaunas Botanical Garden of Vytautas Magnus University and its phytochemical analysis results in Instrumental Analysis Laboratory at Department of Biochemistry and Biotechnologies of VMU. The raw material of this medicinal plant was collected and dried in 2012. *Viola tricolor* L. is an annual herbaceous plant belonging to *Violaceae* Batsch family. The plant is rich in biologically active compounds, such as polyphenols (flavonoide). The aim of the studies was to determine the polyphenols (flavonoide), content and the total scavenging activities in the dried flowering aerial parts *Viola tricolor* L. – *Violae herba cum flore*.

Liquid extraction with aqueous methanol was carried out for spectrophotometric analysis of total amount of phenolic compounds, total amount of flavonoids and DPPH radical scavenging activity. Phenolic compounds were identified and quantitated using high performance liquid chromatography. For the assessment of radical scavenging of individual phenolic compounds the on-line post-column DPPH reaction detection was carried out.

The obtained results demonstrate the variety and complexity of the biologically active compounds present in *Viola tricolor* L. grown in climatic conditions of the Middle Lithuania. The results suggest that the majority of compounds are in the blossom and the major is rutin which have a primordial influence in the anti-oxidant activities. Lithuania has very good preconditions to produce raw material for many medicinal and aromatic plants, especially from organic production.

Key words: *Viola tricolor* L., introduction, phytochemical analysis, Lithuania

EVALUATION OF TOTAL PHENOLIC CONTENT AND ANTIOXIDANT ACTIVITY OF DIFFERENT *ROSMARINUS OFFICINALIS* L. ETHANOLIC EXTRACTS

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Botanical extracts are one of the richest sources of antioxidants that counteract both free radicals and oxygen reactive species. The solvent and extraction conditions used in the extraction may influence the quantity, antioxidant composition and biological activity. Ethanolic extracts of rosemary leaf were produced by maceration and percolation and different ethanol concentration (30%, 40%, 50%, 60%, 70%, 80%, 90% and 96%) were used for extraction. Influence of ethanol concentration and extraction method on the amount of total phenolic content and antioxidant activity by and 1,1-diphenyl-2-picrylhydrazyl (DPPH) radical inactivation was determined spectrophotometrically. The most potent solvent concentration was 50% for the evaluation of total polyphenols 47.39 ± 0.21 mg/mL RAE. All tested rosemary extracts showed high DPPH radical inactivation, which ranged from 75.96 ± 1.12% to 85.81 ± 0.14%. The dry residue was also evaluated and it was higher in the liquid extracts than in tinctures.

Key words: rosemary extract, total phenolics, antioxidant activity

ACARICIDAL ACTIVITIES OF SOME ESSENTIAL OILS

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The fact that essential oils contained in some plants are distinguished by acaricidal properties has been observed long time ago. The objective of the research was to identify the effectiveness of essential oils of some widespread plants in Lithuania – *Aegopodium podagraria* L., *Armoracia rusticana* P., *Arctium tomentosum* Mill., *Artemisia absinthium* L., *Tanacetum vulgare* L., *Ribes nigrum* L., *Petroselinum sativum* Mill., *Artemisia vulgaris* L. – in the treatment of bees against *Varroa destructor* mite. All the plants applied in the study showed acaricidal effect, but the greatest one was obtained when *Aegopodium podagraria* L. was selected.

Key words: apiculture, acaricides, *Varroa destructor*

NICELY BLOOMING SHRUBS: INTRODUCTION AND PROPAGATION FEATURES IN CONDITIONS OF SOUTHEAST UKRAINE

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Modern planting is generally developing as a branch of general culture, using the best achievements of different areas of knowledge and kinds of arts. In conditions of modern intraspecific stage of introduction, which has started in the 1990s and is characterized by spreading of sorts, cultivars and forms of ornamental plants, our native dendrologists emphasize the need of in-depth study of introducents. The foreground job is to select from the wide assortment of introduced plants the most promising ones for the region with the emphasis on their ornamentality. The aim of our research was to study bioecological features of growth and development of nicely blooming species and cultivars of woody shrubs, which are rare in planting of the region, and to develop the techniques for their propagation to obtain the mass planting material of local origin. The objects of our study were plants of the genera *Spiraea* L., *Weigela* Thunb., *Philadelphus* L., species and cultivars of *Buddleia davidii* Franch., *Viburnum carlesii* Hemsl., *Caryopteris* × *clandonesis* Simmonds. We investigated bioecological features of the plants studied during 2004–2012 in Donetsk Botanical Garden of the NAS of Ukraine. Introduction study is based on phenological observations. Phenological data reveals to what extent ecological factors of the introduction point meet the natural bioecological requirements of introducents. For wide implementation of introducents into culture, it is important to obtain the planting material by the effective and rather easy method like stem cutting. Therefore our research is aimed at the in-depth study of growth and development rhythms of plants, the dependence of their regenerative ability on bioecological features in conditions of introduction. The study revealed high correlation between the phases of growth and development of shoots and rooting of cuttings taken from shoots in the relevant growing phases. This allows to approach to forecasting of the cutting results, determine the expedience of using a particular part of shoots to yield more rooted cuttings. In southeast Ukraine we were the first to investigate the features of rhizogenesis of stem cuttings of the species and cultivars mentioned. The research revealed the possibility to improve the assortment of ornamental woody plants for urban areas according to modern trends in planting. The developed methods of their propagation allow to obtain the high quality planting material of local origin in a relatively short time.

Key words: introduction, stem cuttings, regenerative ability, planting material

THE INFLUENCE OF CADMIUM CHLORIDE AND HYPERTHERMIA ON THE FATTY ACID COMPOSITION OF HIGH AQUATIC PLANTS FROM ANGARA RIVER

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Fatty acid composition of higher aquatic plants from the Angara River under the influence of hyperthermia 30 °C, and cadmium chloride 100 mg/l was investigated. The changes of the fatty acid composition in response to hyperthermia and cadmium chloride have been found. The differences in the fatty acid composition changes of the studied species have been shown after 24 and 48 h of exposure. Differences in the metabolism of fatty acids should be considered for the development of methods of biomonitoring and bioassay.

Key words: *Myriophyllum spicatum*, *Elodea canadensis*, high aquatic plants, Baikalian region, hyperthermia, cadmium chloride, fatty acids

THE ROLE OF BOTANICAL GARDEN IN THE CONSERVATION OF BIOLOGICAL DIVERSITY

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Botanic gardens have been at the centre of plant exploration and cultivation for the past 500 years. It is only in the last 30 years that plant conservation has become of a major role. This role must become increasingly important as the world's flora continues to be impoverished (Oldfield 2010). The Global Strategy for Plant Conservation, agreed by parties to the Convention on Biological Diversity (CBD), has helped stimulate a renewed commitment to saving the world's plants (http://www.bgci.org/). The main aims are conservation of biological diversity, sustainable use of its components at a global, regional, national, and local level.

Botanical gardens have a variety of chances to participate in biodiversity conservation programs. They are important for plant genetic resources conservation over the natural habitat, seed collection centres can contribute to valuable habitat for plant vitality supporting, or participate in the reproduce, rehabilitation of strongly blasted or extinct habitats. Local flora in a botanical garden is a collection of biodiversity banks, where vanishing species can be preserved by artificial conditions in the region of the origin.

Botanical Garden of Šiauliai University in collaboration with Jelgava Agricultural University pursues research *in situ* of plants in biovariety, to inventory and conserve natural resources of Žiemgala region.

Create new flora collection for research of rare and endangered plants naturalization, ethnobotanical studies, society's ecological education.

In Botanical Garden of Šiauliai University exposition are offered typical plants of northern Lithuania, excluding rare and vanishing plants, typical medical, utility plants, weed. There introduced the European interest steppe meadows with typical and characteristic species: *Agrimonia eupatoria*, *Trifolium montanum, Veronica teucrium, Fragaria viridis*, *Anthyllis vulneraria, Cirsium acaule, Medicago falcata, Campanula glomerata,* protected *Molinietum caeruleae* community with typical species: *Molinia caerulea, Gladiolus imbricatus, Selinum carvifolia, Potentilla erecta*, particularly rare *Seslerietum uliginosae* plants community with typical species *Sesleria caerulea*. The community frequently formed *Cyperaceae* family species: *Carex flacca, Carex flava, Carex panicea.*

In the collection noteworthy are Žiemgala region peculiar plants, excluding frequent species of northern Lithuania: *Sesleria caerulea, Deschampsia flexuosa*, *Carex flacca*, *Cirsium acaule*, *Primula farinosa*, considerably frequent *Trollius europaeus*, *Carex hostiana, Empetrum nigrum, Euonymus europaeus, Festuca arundinacea, Pastinaca sativa var. pratensis, Pinguicula vulgaris, Rubus chamaemorus,* etc.

In Botanical Garden are pursued observations of phenology phase of the rare plant species, gathering seeds, viability research, accumulation of knowledge about ecological and biological species features.

Key words: plant conservation, biological diversity, Botanical Garden, rare species, plant collections

NON-TRADINIONAL HORTICULTURAL PLANTS IN THE REGISTER OF SORTS OF PLANTS OF UKRAINE

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The results of long-term work on introduction and selection of non-traditional fruit plants in Ukraine are presented. Among them are *Asimina triloba, Castanea sativa, Cornus mas, Cydonia oblonga, Mespilus germanica, Morus alba, Zizyphus jujuba*, different species of *Actinidia, Diospyros, Sambucus, Sorbus,* etc. Perspective cultivars of these species are in "Register of Plants Varieties of Ukraine".

Key words: non-traditional, fruit plants, cultivar, register, Ukraine

ASSESSMENT OF POPULATIONS OF THREE SPECIES OF ORCHID OF CRIMEA FLORA

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All species of the *Orchidaceae Juss.* family belong to rare and endangered plant species (Собко, 1989). To determine the status and prospects of orchids' population, a large-scale monitoring is required and the valuable information provides assessment of vitality of individuals in it. The complex of vitality indications reflecting their growth, the level of productivity and formation of individuals is understandable as vitality. That is why the analysis of individuals' vitality allows us to characterize the condition of its life (Злобин, 1989).

The aim of this research was to recognize the value of population *Dactylorhiza romana (Seb. Et Mauri) Soy, Platanthera chlorantha (Cust.) Reicheb*. and *Neottia nidus-avis* (L.) *Rich*. near Sosnovka village (Mountainous Crimea). All populations are in *Quercetum (petraea) poosum (nemoralis)* association and are in similar ecological conditions. Analysis of the state of vitality generative individuals in the flowering stage was made and based on three morphometric parameters: the total phytomass individuals, leaf surface and reproductive effort. As a result, the ranking of individuals on the investigated parameters was found that all the investigated populations are characterized by a predominance of individuals of the third grade of vitality and belong to depressive.

Studying the vitality of another *Dactylorhiza romana* population that is located on the opposite side of the exposure (north-east) and is lower 300–400 m than that we have described, allowed us to estimate it as prosperous.

Therefore, identification of low viability of three orchids populations needs a detailed research of the complex ecological factors specific habitats to determine the limiting factor. Such research will be a considerable support for the conservation of rare species.

Key words: orchids, population, vitality, Crimea

THE REVIEW OF THE COLLECTION OF GLADIOLUS X HYBRIDUS HORT. IN THE CENTRAL BOTANICAL GARDEN OF NAS OF BELARUS

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The collection of *Gladiolus x hybridus* hort. is the most dynamic and representative in the quantitative composition of monocollection of ornamental herbaceous plants of the Central Botanical Garden NAS Belarus. 870 taxa are represented here. All sorts of modern garden groups by size and colour of the flower are collected. We arrange introduction of new taxa of personal collections of originators in Russia, Ukraine, USA, Canada, Czech Republic, Moldova, and the Baltic countries. In 2013, the gene pool of the collection involved a unique selection heritage of Slovak originator Igor Adamovich in the amount of 285 varieties, 40 of them are fragrant. We studied morphological and physiological differences of varieties of different ecotypes. According to the results of the study, recommendations for the amateur assortment of floriculture and industrial cultivation of marketable corm were given. The gene pool of the collection is widely used in breeding work. On the basis of the best samples of crosses of the outlying breeding, the centres received 67 perspective hybrids of the early and middle blooming periods with valuable economic and biological decorative properties. Native Belarussian and European species of the genus *Gladiolus* L. (*G. imbricatus* L., *G. palustris* Gaudin, *G. communis* L., *G. byzantinus* Mill., *G. Italicus* Mill.) are also to be included. The collection includes old varieties which are considered milestones in the history of hybridization. The first wave of breeding hybrids (*G.* × *primulinus, G.* × *nanus, G.* × *ramosus, G.* × *colvillei, G.* × *tubergenii*) was collected. Using the vast collection we annually carry out the study of the effect on the growth and development of new complexes of fertilizers and protection against pests and diseases of the complex in the field. For popularization of culture of *Gladiolus* × *hybridus* hort. and new trends in breeding we annually arrange exhibition in the city with participation of collectors and breeders of Belarus. To create a database of reference materials developed system of description of varieties carried herbarization collection of samples on the unique scheme and photo documentation.

Key words: *Gladiolus* × *hybridus* hort., breeding hybrids, Belarus

THE DIVERSITY OF MICROSCOPIC FUNGI IN RHIZOSPHERE OF PLANTS IN THE GREENHOUSE IN KAUNAS BOTANICAL GARDEN OF VYTAUTAS MAGNUS UNIVERSITY

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In 1999–2009 after the mycological analysis of rhizosphere of plants grown in the greenhouse of Kaunas Botanical Garden of Vytautas Magnus University, 115 fungi species belonging to 36 genera, 3 families, 3 ranges, 3 classes and 3 divisions (described according to the system of P. M. Kirk et al. (2001)) were isolated and identified. The least amount of fungi was isolated from substrata of cool subtropic section: 43 species belonging to 23 genera; and the largest amount – from substrata of humid tropic section: 58 species, 19 genera. Fungi of genus *Penicillium* had dominated, it had diversity of 39 species and detection frequency – 72%. More rarely there were detected fungi of genus *Mortierella* (isolated 6 species, 33%), *Aspergillus* (8; 29%), *Mucor* (7; 23%), *Acremonium* (6; 13%). Potential root rot and wuilt agents from *Fusarium* (7 species), *Verticillium* (2) and *Pythium* (2) were isolated.

Key words: microscopic fungi (species, genus), rhizosphere, greenhouse

INTRODUCTION OF *ASTER* L. GENUS PLANTS TO KAUNAS BOTANICAL GARDEN OF VYTAUTAS MAGNUS UNIVERSITY

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Perennial *Aster* L. genus plants started to grow in Kaunas Botanical Garden of Vytautas Magnus University since its establishment in 1923. These plants grow in the collection of perennial flowers and are exhibited in the central part of Botanical Garden near monoculture plants such as *Astilbe*, *Phlox paniculata*, *Iris*, *Paeonia*.

Research into introduction data and assortment was made during the period 2009–2012.

Presently *Aster* genus plants collection consists of 48 taxons. These plants have been obtained from other botanical gardens by seed exchange and from other plant collectors.

Key words: genus, species, taxon, introduction

CACTUS VIRUSES IN FASCIATED PLANTS

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In plants of the *Cactaceae* A. L. Juss. family occurrence of fasciated shoots and cristation of stems is frequently observed. Many studies have shown differences in the intensity of expression growth factors and genes associated with fasciation (cristation). We tested nine samples on viral infection including *Mammillaria elongata* A. P de Candolle f. cristata, growing on their own roots. The scions: *Mammillaria elongata* A. P. de Candolle f. cristata*, Echinopsis chamaecereus* H. Friedr. & Glaetzle f. cristata, *Echinocereus pectinatus* (Scheidw.) Eng. f. cristata, *Echinopsis* sp. Zucc. f. cristata, which grow on the stocks *Eriocereus jusbertii* (Rebut) A. Berg., *Echinopsis macrogona* (Salm-Dyck). Basing on bioassay and morphological properties the detected viruses are related to *Cactus virus 2, Cactus virus X* and genus *Tobamovirus.* As the same viral particles were found in the scions and stocks, we can assume that viruses cannot cause fasciation in the investigated species.

Key words: fasciation, *Cactaceae, Cactus virus 2*, *Cactus virus X*

THE INFLUENCE OF FERTILIZATION AND SPRAYING WITH HERBICIDES ON THE WEED ECOLOGICAL GROUPS CHANGES IN WINTER RYE MONOCROP

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The field experiment was carried out in 2003 and 2010 at the Experimental Station of Aleksandras Stulginskis University with soil – *Endocalcari-Epihypogleyic Cambisol*. The objective of this investigation was to determine the influence of fertilization and spraying with herbicides on weed ecological groups changes in the winter rye (*Secale cereale* L.) monocrop.

In 2003 the highest abundance of weed belonged to indifferent to nitrogen, moderately acid soil, especially in the winter rye monocrop with mineral fertilizers, moderately moist and moist soil weed species. In 2010 the highest abundance of weed belonged to indifferent to soil pH, nitrogen and moisture, more frequent on poor nitrogen rich soil than on moderately and nitrogen rich soil and moist soil weed species in the winter rye monocrop without mineral fertilizers and without / with spraying with herbicides.

Key words: winter rye, monocrop, fertilization, spraying with herbicides, weed, ecological groups

PHENOLOGICAL VARIATION AND PRODUCTIVITY OF *ERYSIMUM CHEIRANTHOIDES* L.

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A diverse set of 17 wallflower mustard (*E. cheiranthoides* L.) accessions were evaluated for variation in eight traits related to phenology and productivity over a 2-year period in fields of the Experimental station., Among wallflower mustard samples, the seed ripening depended on the year, differed by 8–17 days, the seed yield per plant varied from 0.5–13.2 g and mass of seeds of particular individuals was up to 19.2 g. The amount of oil found in seeds of wallflower mustard ranged from 32.2 to 42.5 percent (on average 37.8 ± 2.6 pct). Fatty acids composition was dominated by dietary acids – oleic (7.3%), linoleic (27.2%) and linolenic (29.1%). Wallflower mustard samples, originated from the western part of Lithuania, flowered and ripened later like samples that originated from the eastern and southern part.

Key words: *Erysimum cheiranthoides,* productivity, seed yield, oil, fatty acids

AGROBIOLOGICAL POTENTIAL OF SOME OIL CRUCIFERS OF LITHUANIAN SPONTANEOUS FLORA

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116 seed samples of spontaneus crucifer (*Brassicaceae*) species (*Thlaspi arvense* L., *Descurainia Sophia* L., *Erysimum cheiranthoides* L., *Cakile baltica* Jord. Ex Pobed, *Alliaria petiolata* (M. Bieb.)) for the agronomical trial were collected all over Lithuanian territory. Samples were sown in autumn (2008–2009) and spring (2009–2010) in fields of the Experimental station, soil – *LVg-p-w-cc(sc)-Calc(ar)i-Epihypogleyic Luvisol.* Phenological observation and assessment of productivity parameters were performed. All the investigated autumn sowing species, except *T. arvense,* raised higher stems and exceeded the spring sowing plants by surpassing their productivity parameters. Meanwhile, for *T. arvense* the weather conditions had more influence than the time of sowing. The most stable parameters for the study period were the amount of oil in seeds and number of silicles. The most unstable parameters were the number of inflorescences and seed yield per plant. The largest single plant productivity and stability of features were exhibited by *D. sophia*. Among the studied species *E. cheiranthoides* distinguished itself by the highest and the most stable oil content in the seeds.

Key words: *Brassicaceae,* productivity, seed yield, silique, oil

THE METHODOLOGY OF DETERMINATION OF BIOLOGICALLY ACTIVE COMPOUNDS IN MEDICINAL (AROMATIC) PLANTS USING COMPLEX EVALUATION METHODS

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At present and in the future it is necessary to enrich the assortment of cultivated medicinal plants. For this purpose, species of medicinal (aromatic) plants have been introduced *ex situ* in the medicinal plants collection of Kaunas Botanical Garden, Vytautas Magnus University since 1924. Medicinal (aromatic) plants, their raw material and biologically active compounds were investigated. The aim of this study was the investigation of introduction of medicinal plants from various geographical regions, analyses of local flora, phytochemical analyses and selection of the most perspective species and varieties, protection of genetic resources and biodiversity. Phytochemical analysis of medicinal plant extracts was performed using the following methods: gas chromatography, high performance liquid chromatography, capillary zone electrophoresis and spectrophotometry. The biodiversity of medicinal, spice (aromatic) plants species and varieties, and their biologically active compounds is important from the scientific and practical point of view.

Key words: medicinal (aromatic) plants, phytochemical analysis, biologically active compounds

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THREATS OF FORESTS IN THE UKRAINIAN CARPATHIANS – CURRENT AND FUTURE STATE

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The important economic and environmental issue for Carpathian region is drying of spruce forests. The largest areas of drying plantations have been found in the spruce forests derivatives created in the territories of fir, beech and oak forests. In early 2012 the following areas of drying spruce stands derivatives in state forests of the Carpathian region were identified: in Lviv Region – 8.7 thousand ha (43.5% of the spruce stands derivatives), in Ivano-Frankivsk Region – 6.0 thousand ha (15.3%), in Transkarpatia Region – 3.8 thousand ha (13.5%) and in Chernivtsi Region – 0.7 thousand ha (6.8%).

The processes of dying of spruce forests derivatives are affected by root rots – the area of their pockets for the last 10 years have been increased by 2–3 times. The processes of this drying are accelerated by xylophagus insects, especially the bark beetle. A tendency for their areas to be increased is observed. Results of research on the plots show that complete drying tree stands in spruce stands derivatives process may last from 5–6 to 1–2 years. In fact, it makes a significant mortality threat of spruce tree stands derivatives for the next 20–30 years.

In recent years, drying processes have also been found in the zone of native spruce tree forests (at altitudes of above 1 000 m). The largest areas of drying in native spruce tree stands have been recorded in Lviv and Ivano-Frankivsk Regions – 9.7 and 5.2 thousand ha.

Furthermore, the main reasons that accelerate weakening and drying of spruce forests are as follows: weather conditions in recent years (high temperatures in April and June, lack of precipitation, sudden fluctuations of the weather), lack of sanitary and health measures, ineffective fighting with bark beetle and other xylophagus insects.

Moreover, a new threat to the Carpathians is the spreading of *Phythophthora* diseases, bacterial and cancer diseases and root rot in beech tree forests stands. Hence, according to preliminary data, in Ivano-Frankivsk Region more than 1.5 ha of beech forest with signs of *Phythophthora* diseases have been revealed. However, the degree of damage and area of spread disease in these forest types of Carpathians requires a more detailed study. On the other hand, the situation is complicated by the fact that the *Phytophthora* species affect plants for planting in the nurseries and consequently that threatens the future of forests.

Key words: spruce, fir, beech and oak forests drying processes, diseases

VARIABILITY OF QUANTITY AND LOCATION OF PITCHY CHANNEL IN DIFFERENT SPECIES OF GENUS *PINUS* IN THE LEFT-BANK FOREST-STEPPE AND STEPPE ZONE OF UKRAINE

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The variability of quantity and location of pitchy channel in pine-needle in different species of genus *Pinus* are investigated in two areas of introduction: in the left-bank Forest-Steppe (10 species) and left-bank Steppe zone (16 species) of Ukraine.

Most of quantity of pitchy channel have been identified in pine-needle of *P. thunbergiana* Franco (9.3 ± 0.15), *P. funebris* Kom. – 8.5 ± 0.18, *P. nigra* Arnold. – 7.3 ± 010, *Pinus nigra* Arnold. subsp. *pallasiana* Lamb. Holmboe – 5.8 ± 0.16; fewest – in pine-needle of *P. peuce* Grisseb. (2), *P. pumila* (Pall.) Regel (2) and *P. strobus* L. (2 ± 0.02), *P. sibirica* Mayr – 3.1 ± 0.03 in the left-bank Forest-Steppe. Maximum level of variability of characteristic was found in *P. nigra* subsp. *pallasiana* – 17.8%, *P. densiflora* Siebold et Zucc. – 13.4%, *P. funebris* – 13.3%, minimum level – *P. peuce, P. pumila* and *P. koraiensis* Siebold. et Zucc – 0% in this region.

In the left-bank Forest-Steppe most of quantity of pitchy channel have been identified in pine-needle of *P. laricio* Poiv. (7.4 ± 0.22), *P. funebris* (6.8 ± 0.22), *P. densiflora* Siebold et Zucc. "Oculus-drakonis" (5.9 ± 0.38), *P. mugo* Turra (5.1 ± 0.2); fewest – in pine-needle of *P. strobus* (1.8 ± 0.06), *P. banksiana* Lamb. (1.8 ± 0.08), *P. excelsa* Wall. (1.9 ± 0.06), *P. flexilis* James. (1.9 ± 0.04), *P. monticola* Dougl. (1.9 ± 0.12). Maximum level of variability of characteristic was found in *P. scopulorum* Lemm. (48.4%), *P. ponderosa* Dougl. (37.8%), *P. mugo* (27.0%), *P. nigra* (26.7%), *P. monticola* (26.0%), *P. banksiana* (23.5%), *P. densiflora* "Oculus-drakonis" (22.6%), average level – *P. excelsa* (14.6%), *P. strobus* (16.0%), *P. funebris* (16.1%), *P. koraiensis* (17.6%), *P. laricio* (17.3%), *P. mugo* Turra "Winter Gold" *(*17.5%), minimum level – *P. Cembra* L. (0%), *P. peuce* (0%) and *P. flexilis* (8.1%) in the left-bank Steppe zone of Ukraine.

Key words: *Pinus* L., pine-needle, quantity and location of pitchy channel, variability

CULTIVATION OF LITHUANIAN HYBRIDS AND CULTIVARS OF *PAEONIA LACTIFLORA* IN KAUNAS BOTANICAL GARDEN

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The phenological observations, morphological and decorative properties were studied in 19 *Paeonia lactiflora* hybrids and cultivars at Kaunas Botanical Garden of Vytautas Magnus University during 2005–2011. The ornamental characteristics of peony cultivars were investigated (described) by duration of blooming, blossom size, form and colour of flowers, number of generative stems, height of the plants. It was established that species of Lithuanian peony had varied.

The morphological–ornamental features of the *Paeonia lactiflora* are of large variety: plant blooming duration lasted 10–20 days, blooming abundance – 12–35 blossoms on one plant, size of blossom – 14–20 cm, height of plants –70–114 cm, form of blossoms – hollow and simple. According to average height, two phenorhythmotypes were distinguished: 1) medium height (50.0–79.0 cm), 2) high (80.0 cm and more). These results are relevant for grouping different types of peony intended for planting in green areas of urban territories.

Key words: *Paeonia lactiflora,* ornamental features, phenorhythmotypes

VARIATION OF ESSENTIAL OILS, PHENOLIC COMPOUNDS COMPOSITION AND RADICAL SCAVENGING ACTIVITY OF INTRODUCED PLANTS IN LITHUANIA *CERCIDIPHYLLUM JAPONICUM* SIEBOLD ET ZUCC., *LIRIODENDRON TULIPIFERA* L. AND *GINKGO BILOBA* L. EXTRACTS DURING THE VEGETATION PERIODS

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Cercidiphyllum japonicum Siebold et Zucc., *Liriodendron tulipifera* L. and *Ginkgo biloba* L. are woody, introduced plants in Lithuania. The aim of the work is to evaluate variation of essential oils, phenolic compounds composition and radical scavenging activity of *C. japonicum* Siebold et Zucc., *L. tulipifera* L. and *G. biloba* L. extracts during different vegetation periods. Raw material of investigated plants was prepared using different sample preparation methods (maceration, in tube extraction, static headspace solid phase microextraction and direct headspace injection) and analysis methods (spectrophotometry, high performance liquid chromatography, gas chromatography with mass spectrophotometry).

While analysing the samples it was determined that the highest amount of phenolic compounds, flavonoids and radical scavenging activity are in *C. japonicum* Siebold et Zucc. leaves. The analysis of phenolic compounds in extracts of plants was carried out using a high performance liquid chromatography which allows identification of these phenolic compounds: chlorogenic, gallic, o-coumaric, sinapic, protocatechuic acids and rutin in extracts. Comparing different sample preparation methods for gas chromatography, it was determined that static headspace solid phase microextraction is the most effective method. The highest concentration of volatile compounds of analysed samples was in *C. japonicum* Siebold et Zucc. leaves; the lowest concentration of essential oils was in *G. biloba* L. leaves.

Key words: *Cercidiphyllum japonicum* Siebold et Zucc., *Liriodendron tulipifera* L., *Ginkgo biloba* L., volatile compounds, GC/MS, HS, SPME, ITEX

THE 90-YEAR LONG ROUTE OF KAUNAS BOTANICAL GARDEN

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Kaunas Botanical Garden was founded in 1923 as the centre of botanical sciences of Lithuanian (later Vytautas Magnus) University. The stimulating initiative for its establishment was shown by two outstanding leaders in the contemporary biology science – botanist prof. Liudas Vailionis and zoologist prof. Tadas Ivanauskas. They claimed that botanical garden is the prerequisity for the development of very recently established Lithuanian University if it aims at achieving the best standards of European universities. A spacious green area with the old park, picturesque ponds and several buildings of the former estate of Auk toji Freda were provided for establishing the Botanical Garden at that time and it preserved a strong historical spirit and beauty until nowadays. Professor Konstantin Regel from Tartu University was invited to direct Kaunas Botanical Garden. His dedication and great enthusiasm combined with high professional skills provided very strong impetus for the development of the garden.

The Botanical Garden was granted the area of 74 hectares in the former estate of Joseph Godlewski on 15 February, 1923. On 8 July of the same year, the Botanical Garden was sanctified and President Aleksandras Stulginskis placed the cornerstone for the Greenhouse. A famous garden architect Karol Rauth from Hanover was invited to create a detailed project for the Botanical Garden. Kaunas Botanical Garden built up very rapidly with the help of other Botanical gardens, especially those of Berlin Dahlem, Konigsberg and St. Petersburg. Over a few years, the Botanical Garden has become an educational base of biological, medical and pharmaceutical students – an important plant science centre. Much attention was paid to plant introduction, heredity, diseases, systematics. The first catalogue for the seed exchange was published in 1924. The same year prof. Kazys Grybauskas founded the Department of Medicinal Plants. In the summer of 1925, the collections of Kaunas Botanical Garden were opened for individual visitors and excursion groups. Very soon nicely handled green area of Kaunas Botanical Garden became one of the most favourite sites for the educative leisure of Kaunas citizens and numerous guests.

In 1931 the first volume of the journal of the selected articles by the botanists of Kaunas Botanical Garden "*Scripta Horti Botanici Universitatis Vytauti Magni*" was published and disseminated among other botanical gardens. At the same time the composition of herbarium of Lithuanian flora "*Flora Exsiccata Lituana*" was started (quite a number of well preserved items have survived until now) and used for the exchange with foreign botanists. In 1926 the collections consisted of 4 650 plant taxa, in 1932 this number reached 5 987, in 1934–7180.

In the later years Kaunas Botanical Garden has passed a complicated route of surviving difficulties of the war and post-war, changing of political situation as well as institutional affiliations. In 1940, K. Regel left Lithuania and prof. Kazys Grybauskas became the director of the Botanical Garden. He made every effort to save the garden during a complicated period of the war and also in the post-war years. During the World War II Kaunas Botanical Garden suffered rather drastic losses. A new stage of the garden development was started after the war. The destroyed plant collections and expositions were re-established, and the new ones were originated. In the Soviet time Vytautas Magnus University was closed but gave origin to numerous other universities in Lithuania. Meanwhile, in 1941 Kaunas Botanical Garden became the institution

of Lithuanian Academy of Sciences (LAS), in 1946 – the department of the Institute of Biology of LAS, in 1959 – the department of the Institute of Botany of LAS. Finally, in 1992 Kaunas Botanical Garden again became a part of the re-established Vytautas Magnus University. During this period of the development the garden was directed by Marija Lukaitienė (from 1952 till 1961), dr. Algimantas Morkūnas (from 1961 till 1974), dr. Aloyzas-Ramunis Budriūnas (from 1975 till 2000), dr. Remigijus Daubaras (from 2000 till 2008), and by prof. Vida Mildažienė (from 2008 till recently).

Large collections of plants gathered in Kaunas Botanical Garden, VDU are an invaluable treasure of Lithuania that was created by efforts of several generations. The Botanical Garden together with its botanical expositions and collections, the Greenhouse, a big park and an impressive pond system have a big potential for plant research and studies, as well as for all modern forms of interactive education, cultural tourism, community use, international cooperation, and representation of Kaunas City. Today by size Kaunas Botanical Garden, VMU takes the second place among botanical gardens of Lithuanian universities. It occupies the area of 62.5 hectares. More than 7.300 different plants comprise the collections and expositions that are open for public attendance and cover the area of about 30 ha. Kaunas Botanical Garden accepts more than 55 thousand visitors per year. Kaunas Botanical Garden, VMU consists of five collection sectors – Medicinal plants, Dendrology, Pomology, Floriculture, and Plant Pathology.

By now Kaunas Botanical Garden undertakes special attempts for the further development of all possible plant conservation and research measures including collections and expositions, strengthening international activities and cooperation with other botanical gardens, fostering educative functions that are finally directed towards the increasing of public environmental awareness with the particular concern on the human impact on the maintenance of biodiversity and importance of plants for life on our planet.

Key words: international practical studies, volunteer activities, public events, Fascination of Plants Day, educative tourism

DAYLILY (*HEMEROCALLIS*) SEEDS GROWING INSIDE

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The seedlings were disseminated in November. Firstly, the seeds have been soaked in a solution made of water and peroxide (9 parts water, 1 part peroxide). Then, germinated seeds have been disseminated into trails and placed under the fluorescent lamp. Most of those seeds have germinated but most of them have been lost during vegetation period because of the cervical cancer. Such unexpected situation happened due to irrational watering and fungus gnat brought upon by excess of water.

Key words: daylily (*Hemerocallis* L.), hybridization, seeds, seedlings, cultivation inside

USING BIOTECHNOLOGY METHODS FOR CONSERVATION OF PLANT GENETIC RESOURSES

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Introduction and propagation of valuable species and cultivars, conservation of plant biodiversity are the main tasks of botanical gardens, both in Ukraine and abroad. The main biotechnology methods of plant conservation are cryopreservation and storage of plants in the form of slow-growing collection of *in vitro* (germplasm preservation). For creation of plant growing collection *in vitro* 32 rose cultivars (*Rosa* sp.) of 9 garden groups, 2 species and 2 cultivars of orchid (*Cymbidium* sp. and *Dossinia* sp.), 16 cultivars of clematis (*Clematis* sp.), 2 species of yucca (*Yucca aloifolia*, *Y. torreyi*), 2 forms of feijoa (*Feijoa sellowiana*), 4 cultivars of kiwifruit (*Actinidia deliciosa*), 9 cultivars of sweet plum (*Prunus cerasus*), plum (*Prunus domestica*), apricot (*Prunus armeniaca*) and peach (*Prunus persica*) have been selected from the collection of Nikitsky Botanical Garden–National Scientific Centre (NBG-NSC, Yalta, Ukraine). At the beginning for each species and cultivars the methods of somatic embryogenesis and organogenesis have been developed. As explants the microshoots of roses, clematis, orchids, yuccas, peach, apricot, plum, prune, kiwi, feijoa, protocorms of orchids and somatic embryos of clematis have been used. High viability of explants during 36 months of conservation with active regeneration capacity after transferring to standard conditions have been obtained due to optimal factors, such as temperature 5 ± 1 °C, light intensity 1.25 μM m^{-2} s^{-1}, ½ Murashige & Skoog, Gamborg & Eveleigh, Quoirin & Lepoivre and Knudson C mediums, supplemented with 60–90 g l^{-1} sucrose and 0.2–0.4 ml l^{-1} CCC.

Key words: biotechnolohy methods, plants, explants, slow-growing collection, *in vitro*

CHARACTERIZATION POPULATIONS OF RARE SPECIES OF GENUS *CRAMBE* L. IN CRIMEA

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To evaluate the degree of threat of species of significant importance is the accumulation of data on their distribution, population size and structure. In the last edition of the Red Data Book of Ukraine (RDBU, 2009), not all species are given such information. Among them, 8 species of *Crambe* L. (Fam. Brassicaceae), 4 of which are endemic to the Crimean peninsula. All these species need to monitor the status of populations and recommended to clarify their distribution. Therefore, the aim of this study was to investigate coenopopulations of 6 species: *Crambe maritim* L., *Cr. koktebelica* (Junge) N. Busch, *Cr. tataria* Sebeok., *Cr. pinnatifida* W. T. Aiton, *Cr. aspera* M. Bieb., *Cr. Mitridatis* Juz. in Eastern Crimea. Particularly relevant is the observation of the local endemic, one of which is *Cr. koktebelica*, known only from the Kara-Dag Nature Reserve and Koktebel valley.

The study was conducted during 2010–2012. We have determined the location, area of seven coenopopulations of 6 species of *Crambe*. We established that there are individuals in populations of all age states indicating that they belong to the normal type of populations. For biennial and perennial monocarpic plants such age spectrums indicate the sustainability of development. The obtained data on the number and structure is primary data, we intend to continue monitoring to identify the speakers.

Study of the spatial distribution of individuals showed that the number of plants *Cr. maritima, Cr. mitridatis* and *Cr. koktebekica* increases with the decrease of grasses projective cover in the plant community, whereas *Cr. tataria* and *Cr. aspera* do not show such properties. Plant communities with species studied have several things in common: poverty floristic composition; fam is among the leaders in the number of species. *Asteraceae* and *Poaceae*, which are typical for the whole flora of the region; in communities *Anisantheto tectorumae – Artemisiosum caucasici* and *Cakileto euxinae* increasing role of fam. *Brassicacea* in the structure of plant communities, the prevalence of xeromesophyte heliophyte herbaceous perennials. Greater biomorphological diversity was observed in phytocenosis *Brometo squarossae – Aegilopsosum triunciali*.

As part of the studied plant communities on mountain Djan Kutaran 4 species listed in the Red Data Book of Ukraine were found, one kind is in the RDBU and the European Red List, which certainly increases the importance of this area for the conservation of rare species.

Key words: coenopopulation, phytocenosis, rare species

APPLICATION OF THE BIOINDICATIVE METHOD FOR AIR QUALITY ASSESSMENT IN THE REGION OF KLAIPĖDA

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Sixteen (16) points (and one – control) of analysis were selected for the assessment of the environmental air quality in the territories with different levels of urbanisation in Klaipėda, Gargždai, Vėžaičiai, and Švėkšna. Air pollution was assessed by a bio-testing method. Midway Peat Moss (*Sphagnum magellanicum* Brid.) was used as the bio-absorbent, and Garden Cress (*Lepidium sativum* L.) was used as the bio-test. The aim of this research was as follows: the assessment of the environmental air quality based on the bio-indicative method. In two months, peat moss was collected, grinded, and moistened with distilled water. Garden Cress was seeded into the prepared mass in Petri dishes, with the same number of seeds in every dish. Garden Cress was cultivated for five days in temperature of 24–26 °C. Afterwards, the measurements of height, rootlet length, and biomass of Garden Cress were performed.

As shown by the research, the height of sprouts of Garden Cress grown on peat moss exposed in the various locations varied from 3.977 cm (peat moss exposed in the central part of Klaipėda) to 5.244 cm (peat moss exposed in the central part of Švėkšna Manor). The rootlet length varied from 3.568 cm (peat moss exposed in Klaipėda Castle site next to Pilies Street) to 6.695 cm (peat moss exposed in the central part of Švėksna Manor). The total length of sprout varied from 7.621 cm (peat moss exposed in the central part of Klaipėda) to 11.938 cm (peat moss exposed in the central part of Švėkšna Manor). The greatest biomass was observed for Garden Cress cultivated on the bio-absorbent that was exposed in Švėkšna Manor Park, Švėkšna town, Vėžaičiai town, the Botanical Garden of Klaipėda University.

Key words: air quality, bioindication, *Sphagnum magellanicum* Brid., *Lepidium sativum* L.

GROWTH AND DEVELOPMENT OF ARTIFICIAL OAK-ASH TREES

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The features of the growth and development of oak and ash plantations of artificial origin are investigated at thinning operations. This model allows evaluation of the implementation of a method of thinning, while clearly defining the terms of aftercare.

Verification of the model is based on the data of the trial areas of oak and ash plantations.

Key words: system dynamic model, oak and ash plantations, thinning operations

HUMULUS LUPULUS L. RESEARCH DEVELOPMENT IN KAUNAS BOTANICAL GARDEN OF VYTAUTAS MAGNUS UNIVERSITY

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Hop cones – raw material with unique composition of active substances, so far non-synthesized and irreplaceable in beer, pharmaceuticals, cosmetics, parfumery and food industries. In Lithuania as well as around the world hop cones are mostly consumed in manufacture of beer – about 200 tons per year. Another 3–5 tons are consumed by pharmaceutical industry, some part of cones is bought from Lithuanian hop producers, but the vast majority of cones are imported. It is noteworthy that research which has been performed in Kaunas Botanical Garden of VMU since 1924 have long proved a great potential of growing hops in our country and having a source of high-quality cone material.

Key words: hop cones, *Humulus lupulus* L.

THE ASSESSEMENT OF CONIFERS INJURIES AFTER THE WINTERS OF 2009–2011 IN THE NURSERY OF KAUNAS BOTANICAL GARDEN OF VYTAUTAS MAGNUS UNIVERSITY

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Injuries of 720 conifer decorative trees and bushes after the winters of 2009–2011 were evaluated in the nursery of Kaunas Botanical Garden. Injuries of these plants during both winters were comparable. Larger injuries were caused by: 1) longer-lasting negative temperature in winters of 2010–2011; 2) conifers were nipped off and burned by sun because the end of winter was cold and sunny. Frost injuries of conifers in winters of 2009–2010 were determined by a sudden temperature change in early spring from below zero to above zero. Owing to this the above-ground part of plants started the vegetation, while the roots remained frozen.

Key words: conifer decorative trees, Botanical Garden

PHYTOPHTHORA SPECIES, NEW PATHOGENS IN LANDSCAPE AND GARDENS *(POLAND)*

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Phytophthora is a cosmopolitan genus comprised of already more than 100 species and varieties, many of which are important plant pathogens. In the end of XX century *Phytophthora* root and stem rot was mainly recorded on some coniferous and ericaceous plants. In total, 11 species of *Phytophthora* were recorded on ornamentals including coniferous, decidous, ericaceous and perennial plants. Losses of ornamental nursery plants due to wilting, necrosis of aerial parts or death varied from a few percent to even 100%. Studies of Orlikowski, Ptaszek, Orlikowska, Trzewik (2007) indicated at widespread of *Phytophthora* in Polish streams, rivers and standing water including nursery ponds. Till now 16 *Phytophthora* species were detected from diseased plants growing in hardy ornamental nurseries and in greenhouses. Most of them caused stem base and root rot. In HNS and some gardens water taken from local streams, canals or rivers could be the source of *Phytophthora.* Instalation of sandy filters in nurseries and gardens using other water than from walls may strongly decrease the spread of *Phytophthora.*

Key words: *Phytophthora* spp., ornamental plants, Poland

FIRST RECORDS OF *PHYTOPHTHORA* SPP. BASED ON DNA ANALYSIS IN LITHUANIA (POLAND, LITHUANIA)

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The assessment of alien invasive species of *Phytophthora* genus causing serious tree diseases was carried out in Lithuania. The presence of *Phytophthora* spp. DNA was recorded for the first time using real-time PCR analysis on 23 DNA samples. The sampling included wood from diseased trees, shrubs, leaves baited in water, and soil samples taken around the diseased plants. Extracted DNA was tested for the presence of *Phytophthora*. All analysed samples were positively recognized by *Phytophthora*-specific probe during real-time PCR which proved the presence of pathogens in environmental samples.

Key words: *Phytophthora* spp., trees, real-time PCR analysis, Lithuania

AMINO ACID COMPOSITION OF *ACTINIDIA KOLOMIKTA* FRUITS

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Fruits of *Actinidia* are a good source of minerals, dietary fibres, various organic acids, vitamin E, carotenoids, flavonoids, and other useful compounds. Although *A. kolomikta* fruits contain proteins in small amounts, but almost all of essential amino acids were found. The purpose of the work was to investigate crude proteins and amino acids in fruits of *Actinidia kolomikta*. The fruits of *Actinidia kolomikta* were obtained from Aleksandras Stulginskis University teaching and research orchard. Four varieties – 'Laiba', 'Lanke', 'Lande', 'Paukstes Sakarva' – were investigated. The amount of crude protein was determined by Kjeldahl method. Amino acids were separated by the method of ion-exchange chromatography and detected photometrically. The crude protein content of the investigated *A. kolomikta* fruits ranged within 0.96–0.24%. No significant differences among different varieties of fruits were established. The protein content of *A. kolomikta* fruits is similar to another species of *Actinidia chinensis*. Glutamic acid was the most predominant amino acid with values ranging from 1.37 to 2.00 g kg^{-1} of *A. kolomikta* fruits. Higher ratio of essential and nonessential amino acids was in 'Laiba' fruits, accordingly 3.31 ± 0.41 and 7.05 ± 0.86 g kg^{-1}. In fruits of all varieties have been determined recommended ratio of total essential amino acids to the total amino acids which ranged from 29.67% in 'Lanke' fruits to 31.99% in 'Lande' fruits. These amounts did not exceed the recommended ratio.

Key words: *Actinidia kolomikta*, proteins, amino acids

MUSEUM OF KAUNAS BOTANICAL GARDEN: DEVELOPMENT, EXHIBITS, EDUCATIONAL VALUE

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In 1924 prof. K. Regelis, the first director of Kaunas Botanical Garden, began building the museum which at that time was a teaching exposure of Botany Cabinet. From the exhibits of that time still remained only cones which prof. K. Regelis brought from Switzerland (*Saxifraga oppositifolia*, *Abies nordmanniana*), in 1930 from Brazil (*Araucaria araucana*, *Anona* sp.) and from Norway (*Cladonia alpestris*). The museum exhibits were also supplied by other researchers of Botanical Garden: K. Grybauskas, prof. T. Ivanauskas, prof. A. Minkevičius, prof. J. Dagys. In 1958 from Michurinsk fruit moulages, among them presently defunct Lithuanian aquatic plant *Trapa natans* were purchased. Herbarium has a high educational, cognitive value, in particular – the two herbarium books with shrubs, trees, herbaceous plant samples collected in Caucasus by an unknown author in 1888–1889. The text was written in Polish providing plant names in Latin, sometimes in Russian. Currently the museum of Kaunas Botanical Garden of Vytautas Magnus University has herbarium containing more than 1708 exhibits (excl. herbarium).

Key words: Kaunas Botanical Garden of Vytautas Magnus University, museum, exibits, educational value

THE IDEA OF THE STRATEGY FOR KAUNAS BOTANICAL GARDEN OF VYTAUTAS MAGNUS UNIVERSITY IN THE PERSPECTIVE OF CONTEMPORARY LANDSCAPE ARCHITECTURE THEORY

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Kaunas Botanical Garden of Vytautas Magnus University is faced with making important decisions. The innate qualities of the area's historical value, multi-dimensional spatial structure and natural resources, and, above all, the importance for the city and for Lithuania in general, make the decisions about the Garden's further development responsible and challenging. The agreement between Vytautas Magnus University in Kaunas and Wroclaw University of Environmental and Life Sciences, established in 2012, provides a basis for reflection on the subject. On the basis of the considerations made the programme that distinguished a coherent system of dealing with the garden existing values and give direction for new investments.

The concept is based on two assumptions: on the one hand, the holistic recognition of qualities and resources of the present Kaunas Botanical Garden, on the other hand, the introduction of contemporary landscape architecture. Such a combination introduces new aspects that have a chance to save and improve the quality of the Garden in a creative way.

Key words: modern landscape architecture, planting design, the Dynamic Landscape, the Planetary Garden, the Landscape of Changes

SCREENING RESULS OF *BACILLUS THURINGIENSIS* STRAINS AGAINST *TETRANYCHUS URTICAE* KOCH

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The tendencies of creating ecologically safe biopreparations with complex activity based on *Bacillus thuringiensis* are viewed. Data on the assessment of entomopathogenic bacillus to protect greenhouse plants against major sucking pests is presented. Screening of crystal-carrying bacilli in relation to greenhouse pests has allowed to select high-activity *Bacillus thuringiensis* strains in relation to spider mite *Tetranychus urticae* Koch and cotton aphid *Aphis gossypii* Glov. The results of the insecticidal activity of *Bacillus thuringiensis* strains against *Tetranychus urticae* Koch. are presented. It is shown that 11 strains from 28 renders an insecticidal action on tick. As the effective inhibitors of development eggs the strains of *Bacillus thuringiensis* C-10, 16–91, 16–91, 25–91 are marked. Testing results have shown that the degree of crystal-carrying bacilli influence on greenhouse pests depends on strain and pest species. Strains 12–91, 13–91, 25–91 have caused cotton aphid death, the biological efficiency has made 40.0, 86.0 and 70.0%, accordingly. Spider mite's high susceptibility to *Bacillus thuringiensis* bacillus marked, the biological efficiency of strains 13–91 and 26–91 has exceeded 90%.

Key words: screening, *Bacillus thuringiensis*, *Tetranychus urticae*, *Aphis gossypi*

BOTANICAL GARDEN OF THE POLISH ACADEMY OF SCIENCES AS GENE BANK FOR WORLD AND CULTIVATED PLANTS

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Botanical Garden in Warsaw was established by the Polish Academy of Sciences as a special research unit for plant genetic resources conservation in 1974. The first research studies and conservation efforts were devoted to rye, the leading at that time cereal crop in Poland. Our efforts were focused on the primitive germplasm of genus *Secale*: wild *Secale* species, local landraces and old cultivars of rye. Genetic resources of *Secale* were collected from all over the world. For the long-term storage of rye caryopses the seed bank was organized. Seeds desiccated to 7–8% moisture content were stored at –25 °C in vacuum conditions in hermetic sealed aluminum polyethylene bags. The *Secale* collection was established in very close collaboration with the USDA-ARS research units, especially with the National Center for Genetic Resources Preservation in Fort Collins, Colorado and rye germplasm was preserved in both places: in Warsaw and in Fort Collins. At present the *Secale* collection comprises 2.608 accessions, among them 89 wild *Secale* species, 1588 local landraces and 490 cultivars, as well as 380 accessions of genetic and breeding lines. In our seed bank 61 wild species related to cereals of *Triticinae* subtribe is also preserved.

The second germplasm collection in Botanical Garden, started in 1985, was genus *Malus*, especially old or historical cultivars of apple trees. At the beginning the *Malus* collection was preserved as trees in pomological orchard opened for public display. Thanks to collecting efforts in Poland and in neighbouring countries: Ukraine, Lithuania and Slovakia 1046 accessions were collected, and 445 of them were identified as cultivars. Thanks to cooperation with the Kazakh Academy of Sciences the collection of *Malus sieversii* from natural localities in Kazakhstan was also established. In recent years the cryogenic storage was also developed for the preservation of dormant apple buds, as a supplementary conservation method for apple trees genetic resources. At present more than 100 accessions of historical apple cultivars are stored in liquid nitrogen.

The long-term storage of seeds was also applied for *ex situ* conservation of rare and endangered species of Polish vascular flora. Seeds collected from natural localities are also preserved in cryogenic conditions at temperature ca. –150 °C in vacuum of liquid nitrogen. For this purpose, special studies on seed germination biology of wild species had to be developed. These studies were performed in the framework of two EU projects: ENSCONET and FLORNATUR. At present the seeds of 120 species of Polish native plants, represented by 385 natural populations are stored in our cryogenic seed bank.

Key words: *ex situ* conservation, plant diversity, seed banks, endangered plants, genetic resources, *Secale, Malus,* Polish flora

INVESTIGATION INTO PLANT ANATOMY FOR ECONOMIC BOTANY RESEARCH: WOODY PLANT SPECIES USED BY MEDIEVAL CRAFTSMEN

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Modern trend to use more environmental-friendly materials makes wood desirable renewable resource in various fields. Different species of wood have different properties, both technological and decorative, therefore specific plants should be used for specific needs. Knowledge of wood utilization traditions could help in selecting suitable plants. Inspection of species-specific micro anatomical features is the most reliable method for wood species identification, especially in old wood objects. The potentiality of anatomical method to identify plant taxonomy of degraded archeological wooden artifacts is demonstrated in the presented study. A collection of more than 500 wooden artifacts from archeological excavation in the Vilnius Lower Castle was studied and 18 woody plant genera or species were identified, some not native in Lithuania. Significant differences in the species spectra of different functional groups of the artifacts were established indicating plant selection strategies by medieval craftsmen.

Key words: wood species identification, history of wood utilisation, boxwood combs, Vilnius Lower Castle

THE BOTANICAL GARDEN OF TAURIDA NATIONAL V. I. VERNADSKY UNIVERSITY: THE EXPERIENCE TRANSFORMATION OF THE MUNICIPAL PARK TERRITORY INTO A SCIENTIFIC AND EDUCATIONAL OBJECT

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The Botanical Garden of Taurida National V.I. Vernadsky University was set up on the basis of the Salgirka Park in 2004. The Salgirka Estate is one of the oldest in Crimea. In 1808 academician Peter S. Pallas, a famous Russian and Crimean naturalist, became its owner. In 1833 the Governor General of the Novorossiyskiy Region, Count Mikhail S. Vorontsov, purchased it. By the 20–30s of XIX century the arboretum with area around 2 ha was founded. Part of the flora planted during that period can be seen at present. In 1895 the School of Gardeners was opened, which later was transformed into the School of Horticulture, Gardening and Viticulture. Since the 70s of XX century this territory has enjoyed the status of the municipal recreation park. In 2004 the Park-Monument of Landscape Art "Salgirka" was given to University for establishing Botanic Garden.

At present the arboretum collection contains near 1 000 taxa. During the last years about 10 thousand saplings of trees and bushes have been planted. There are more than 1 800 species and sorts of the ornamental plants. The biodiversity conservation program includes 75 species, among them 15 Crimean endemic plants. The increase of Botanic Garden collections goes along with creation of landscape art objects. Every year is marked with the setting up of a new exposition: the Rosarium, the Syringarium, the Iris garden, the Water plants exposition, the Continuous flowering garden, the Labyrinth, the exposition "Ukrainian Botanic Gardens and Arboretums".

Presently Botanic Garden is an intensively developing scientific structure with research in field of introduction, landscape design, floriculture, biodiversity preservation. The scientific achievements find their practical realization when creating new landscape art objects. The territory of Botanic Garden is the base for students' field studies. It becomes of particular importance for training students of specialty Forestry and Horticulture at Biological Faculty.

Key words: Botanic Garden, plant collection, park, landscape art objects

IDENTIFICATION OF NOVEL ANTIMICROBIAL PEPTIDES IN VARIOUS ORGANS OF EPHEMERAL PLANT – COMMON CHICKWEED (*STELLARIA MEDIA* L.)

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Antimicrobial peptides (AMPs) are the major compounds of plant innate immunity against pathogens. Most of them possess a wide range of action and can be considered as a novel class of promising antimicrobial agents. AMPs reveal the ancient and the most collective compounds of constitutive defense systems against pathogens typical for all multicellular organisms. At present more than 1 000 AMPs that possess diversified structure, amino acid composition and mode of action are well known. Some of AMPs develop a high receptor independent specificity to pathogens, whereas others may interact with determined receptors on the pathogen cellular membrane or intracellular targets. Plant AMPs are estimated as polypeptides no longer than 100 amino acid residues. Wild flowering plants that possess a higher resistance to stressful environmental factors are the richest sources of AMPs. In applying liquid chromatography methods in aggregate with MALDI time-of-flight mass spectrometry and Edman sequencing seven cysteine-rich peptides were isolated from various organs of chickweed (seeds, leaves, stems and flowers). Their molecular mass, complete amino acid sequences and biological activity have been determined. The obtained polypeptides are perspective for genetic transformation of cultivated plants for the purpose of increasing their resistance to fungal diseases.

This work was supported by Russian Foundation of Basic Research (grant no. 11-04-00190-a).

Key words: antimicrobial peptides, common chickweed, different plant organs, biological activity

DISEASES OF MEDICINAL AND SPICE PLANTS CULTIVATED IN KAUNAS BOTANICAL GARDEN OF VYTAUTAS MAGNUS UNIVERSITY IN SPRING SEASONS

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The results of medicinal and spice plants diseases detected in Medicinal plants sector collections and expositions in Kaunas Botanical Garden of Vytautas Magnus University in 2006–2012 spring seasons are presented. The most dangerous infectious diseases were rust, leaves spots and rot. Every year at the beginning of vegetation it is possible to notice spots on last year leaves on some perennial plants (*Bergenia crassifolia*, *Hedera helix*, *Oenothera biennis, Primula veris*). The first development stages of some rust agent also damages medicinal plants (*Alium* spp., *Sanguisorba minor*, *Viola* spp.). Peonies (*Paeonia anomala, P. officinalis*) are resistantless to *Botryris* rot. 10 genera and 8 species were damaged by pathogenic fungi. During spring season less diseases are detected compared with summer seasons when diseases become more abundant.

Key words: medicinal and spice plants, diseases, spring season

THE PHYTOPATHOLOGICAL STATE OF *TILIA CORDATA* MILL. IN CITIES GREENERY IN SOUTH LITHUANIA

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Tilia cordata is the dominant tree species in city greeneries therefore evaluation of phytopathologic state and identifying causes of state changes is important. The state was assessed in 2009–2012 in the middle of August at seven parks, two places, nineteen streets in Alytus city greeneries (South Lithuania). For the evaluation of the state, a complex tree state assessment methodology, fitted to specific city conditions, was used. It was found that the greatest negative impact on the state of small leaf linden had physiological damages (defoliation, dischloration, leaf necrosis, dry branches) and biotic factors: fungal disease (sooty disease, *Apiognomonia errabunda*, *Mycoshaerella microsora*, *Schizophyllum commune*) and pests (*Caliroa annulipes*, *Eryophyes tilia-nervalis*, *Eucalipterus tilime*, *Schizotetranychus tiliarum*).

Climatic impact on trees growing at streets protective green plantations was stronger than on those growing in recreational greeneries (parks, squares). Susceptible to moisture shortage small-leaf linden growing by the streets are first to react to drought. Soils of Alytus city are light thus lack of moisture is especially felt and prolonged dry summer periods provoke premature defoliation. This went through 2009 – average defoliation damage score was from 1.01 ± 0.08 to 1.26 ± 0.2 points, in 2010 and 2011 more favourable climate conditions dominated, accordingly the defoliation was more insignificant (up to 1.10 ± 0.06). Pest C*aliroa annulipes* leaf injuries may be potentially dangerous for the state of linden in the future. In 2010 this pest was detected in single cases, later the average damage score increased: in 2011 in street greeneries it was 1.08 ± 0.01, in 2012 – 1.11 ± 0.01–1.10 ± 0.05 points. The impact of negative anthropogenic factors was observed: trunk injuries by lawn mowers. In 2012 linden were in their most satisfactory state.

Key words: *Tilia cordata*, phytophatological state, city greenery, South Lithuania

DEVELOPMENT OF PHYTOPATHOLOGY SCIENCE IN KAUNAS BOTANICAL GARDEN

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In 1925 in Kaunas Botanical Garden prof. A. Mickevičius, the pioneer in phytopathology, started his work. He described 176 species of *Uredinales* on 305 host plants, investigated *Erisiphaceae* family and other parasites and had published many popular articles. Later assoc prof. dr. L. Žuklys not only diagnosed diseases and pests but also investigated the techniques of their prognostication and counter measures, etc. In 1960–1979 dr. Petrauskaitė studied the biology of ornamental plant diseases and means of fighting against them. Assoc prof. dr. A. Vengaliauskaitė studied pest biology, spreading, diversity (*Homoptera, Psylinea* etc.). In 1976–2009 assoc. prof. dr. V. Juronis was the head of phytopathology work, he studied ornamental and medicinal plant aphid fauna, feeding relationships, biology characteristics. He described 98 species and 2 subspecies of aphids on medicinal plants, among them 34 species and 2 subspecies and 8 species in Baltic countries were first discovered (Juronis, 1988. *Aphids of medicinal plants in Lithuania SSR*). In 1982–1993 the bacterial pathogens were investigated (Snieškienė, 1993. *Greenhouse flower bacterial diseases and biological properties of their agents*). In 1989–2000 the mycological analysis of rhizosphere of plants grown in greenhouses of Kaunas Botanical Garden was intensively carried out, 115 fungi species belonging to 36 genera, 3 families, 3 ranges, 3 classes and 3 divisions were isolated and identified (Stankevičienė, 2000. Mycological characteristics of substrata used for flower cultivation in greenhouses). At present applied phytopathology research of introduced plants is carried out with the key topic: the study of introduced plant pathogen diversity and their bio-ecological features under the influence of climate change and environmental pollution effects (promoters: dr. V. Snieškienė and dr. A. Stankevičienė).

Key words: phytopathology, research, Kaunas Botanical Garden, Lithuania

MONITORING AND ASSESSMENT OF *TILIA CORDATA* MILL. TREES HEALTH CONDITION IN URBAN ENVIRONMENT

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The aim of the research was to assess health condition of *Tilia cordata* Mill. on the local scale in Vilnius city (Lithuania) green areas according to the impact intensity of fungal diseases and morphological indicator parameters (crown defoliation, foliage discolouration, amount of dead branches and fruiting grade). The damage of trees by the most frequent fungal disease agents (*Cytospora leucosperma*, *Diaporthe eres*, *Discula umbrinella*, *Flammulina velutipes*, *Fumago vagans, Nectria cinnabarina*, *Passalora microsora, Pholiota aurivella*, *Polyporus squammosus*, *Schizophyllum commune* and *Tyrostroma compactum*) was assessed along the streets and in recreational plantings of Vilnius city in 2006–2010. It was found that the intensity of diseases depends on meteorological conditions: in dry and hot summer of 2006 the disease occurred to a lesser extent (average disturbance grade V varied from 1.3 ± 0.1 to 1.5 ± 0.0) and in the wet and warm summer (2010) – stronger (V varies from 2.5 ± 0.1 to 2.6 ± 0.0). It was assessed that the greatest part (70.7%) of sampled trees was moderately defoliated (crown defoliation 26–60%); slightly defoliated (11–25%) ones constituted 29.3% of the assessed trees. Slightly discolourated (foliage discolouration 11–25%) trees comprised 85.7%, moderately discolourated (26–60%) – 14.1% of the assessed trees. In recreational areas crown defoliation and foliage discolouration of trees were of a lesser extent than in street plantings. Increasing crown defoliation and foliage discolouration are the signs of serious damages of the investigated trees.

Key words: urban environment, *Tilia cordata* Mill., monitoring, health condition, fungal diseases, morphological parameters

THE STUDY OF HOST-ASSOCIATED GENETIC DIFFERENTIATION OF *THRIPS TABACI* (INSECTA: THYSANOPTERA) AND *TETRANYCHUS URTICAE* (ACARI: TETRANYCHIDAE)

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Pest species adaptation can cause genetic differentiation which leads to the pest adaptation to new host plants, new pest races or strains. *Thrips tabaci* Lindeman and *Tetranychus urticae* Koch are one of the most important polyphagous plant pests in Lithuania. The aim of this work was to study whether the genetic structure (COI sequences) of *T. urticae* and *T. tabaci* can be reflected to their host plants assortment and their geographical distribution. The material was collected in five localities in Lithuania. *T. urticae* were collected from cucumbers, apple-trees, currants and strawberries; *T. tabaci* – from cabbages, apple-trees and onions. DNA extraction and PCR reactions were performed in the Nature Research Centre, sequencing was performed Macrogen Inc.

Five different haplotypes of *T. urticae* were detected during the investigation. The highest haplotype diversity was registered in north-middle parts of Lithuania. Genetic distance between different haplotypes was on average 1.1%, and diversed up to 4.2% comparing with sequences from Genbank. Results did not reveal the relationship between COI gene polymorphism of *T. urticae* and different host plants.

Four different haplotypes of *T. tabaci* were detected during the investigation. The highest haplotype diversity was registered in middle Lithuania. Genetic distance between different haplotypes was on average 1.4%, and diversed up to 2.9% comparing with sequences from Europe (the Netherlands, the UK, France) deposited in Genbank. Our sequences differed by more than 10% comparing with sequences from other countries. Some authors point out that differences between *T. tabaci* populations can reach up to 12.9% and genetic differences between species can be 16–27.5%. *T. tabaci* COI gene differences partly reflect the geographic distribution, but results did not reveal the relationship between COI gene polymorphism of *T. tabaci* and different host plants.

Key words: *Thrips tabaci, Tetranychus urticae*, host plants, COI diversity

MONITORING OF THE STATE OF PARK TREE STANDS IN URBAN AREAS IN THE SOUTH-EAST OF UKRAINE

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Green areas in cities create favourable microclimate and better sanitary conditions, contribute to the functional organization of the territory, and enhance artistic expression of architectural ensembles. It is possible to solve the problem of optimizing of tree stands in the urban environment using a science-based approach to the formation of their species composition and their maintenance.

List of tree species in the park stands comprises 185 species, 60 cultivars belonging to 75 genera and 34 families. The species of *Rosaceae* family are the most numerous – 43 (23%), as well as those of the Cupressaceae family – 26 (14%), Berberidaceae family – 13 (7%), *Salicaceae* family – 12 (6.4%), Pinaceae family – 11 (6%). The genera with the richest species composition are as follows: *Juniperus* – 7 species (8%), *Populus* – 6 species (7%), *Acer* – 5 species (6%), *Ulmus* species – 4 (5%). The most common species in the stands are *Robinia pseudoacacia* (10%), *Acer campestre* (9.7%), *A. platanoides* (7.5%), *Aesculus hippocastanum* (7.2%), *Betula pendula* (5.3%), *Fraxinus excelsior* (4.9%), *Tilia cordata* (2.9%). Participation of other species does not exceed 1–2. Among shrubs there is a significant occurrence of *Physocarpus opulifolius* (11.5%), *Spiraea japonica* (7.1%), *Juniperus sabina* (5%), *Ligustrum vulgare* (4.7%), *Spiraea vanhouttei* (2.6%), *Philadelphus coronarius* (1.4%).

Trees of the fourth level of height dominate in the stands (48–67%): *Sorbus aucuparia*, *Morus alba*, *Juniperus virginiana*. Trees of the first level of height are absent from the structure of parkland. Among the shrubs the low-height ones make the dominant group: *Juniperus squamata* 'Blue Carpet', *Spiraea japonica*, *Juniperus* × media 'Old Gold'. As far as the age structure is concerned, trees aged 11–20 years dominate, trees aged 21–30 and 31–40 years are less common; trees aged 51–60 years are represented by single specimens of *Populus nigra* var. *piramidalis*. The distribution of the trees by their growth rates is as follows: fast-growing ones – 53–58%, average growing – 34–52%, slow growing – 6–8%.

Viability of woody plants depends on the intensity of their growth. Viability decreases in slow growing trees most rapidly and slowest of all it decreases in average growing ones. In the industrial cities dieback of the apical shoot and some lateral branches of trees begins in individuals with a rapid pace of growth upon reaching the age of 30, in average growing ones it occurs upon reaching the age of 40 years, in slow growing ones it is observed upon reaching the age of 25 years. These results should be considered in the course of planning of activities concerning the reconstruction of stands.

Key words: cities, green areas, tree species

FRUITS AND SEEDS OF *HEBE PINGUIFOLIA* (HOOK. F.) COCKAYNE ET ALLAN IN LITHUANIAN CONDITIONS

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Some plants of New Zealand such as *Clematis paniculata* Gmel., *Gaultheria rupestris* (Forst.) G. Don, *Hebe buxifolia* (Benth.) Ckn. et Allan, *H. pinguifolia* (Hook. f.) Cockayne et Allan, *H. ochracea* 'James Stirtling' are cultured in Lithuania. The climate of New Zealand is very different from that in Lithuania. In Lithuania the temperature in winter can drop to –25–30 °C. Hebe blooms in Lithuania, but there is no data about its fruits (Januškevičius et al., 2006). Grafting is the only way to propagate hebe. *H. pinguifolia* is cultured in Kaunas Botanical Garden of VMU since 1997–1998. Hebe was fructified in 2008–2009. This article presents a description of fruits and seeds of *Hebe pinguifolia*. The size, colour, surface form and other features of fruits and seeds are specified in the article. Germination of *H. pinguifolia* seeds is also discussed.

Key words: seed, fruit, introduction, propagation

COLLECTIONS OF HERBACEOUS ORNAMENTAL PLANTS IN THE BOTANICAL GARDEN OF VILNIUS UNIVERSITY

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The Floriculture Department of Botanical Garden of Vilnius University was established in Kairenai in 1992. Its main goals are introduction of herbaceous decorative plants (field flowers) and accumulation of plants for collections, their maintenance, conservation and creation of plant exposition. Herbaceous ornamental plants collections rich in genera, species, cultivars and hybrids (3 000 plant names of 78 families and 312 genera) have been accumulated and preserved. At present genetic resources collections consists of 600 flower taxa developed by Lithuanian plant breeders. Lithuanian flower breeders released a lot of new cultivars of *Crocus* L., *Dahlia* Cav., *Gladiolus* L., *Hemerocallis* L., *Iris* L., *Lilium* L., *Paeonia* L., *Primula* L., *Tulipa* L., etc. Lithuanian Coordination Centre for Genetic Resources and Protection of Ornamental Plants is established in Botanical Garden of Vilnius University. Forty-four cultivars of *Paeonia lactiflora* Pall (originators O. Skeivienė, E. Tarvidienė and J. Tarvidas) and four cultivars of *Paeonia suffructicosa* Andrews (originator S. Eicher-Lorka), fourteen cultivars of *Primula* L. (originators O. Skeivienė and J. Tarvidas), thirty nine cultivars of *Iris* L. (originators P. Balčikonis, A. Gražys, J. A. Liutkevičius, J. Tarvidas, G. Klimaitis, O. Griniuvienė, D. Zigariene), fifteen cultivars of *Gladiolus* L. (P. Balčikonis, J. A. Liutkevičius, A. Markevičius, A. Lukoševičius, P. Ciplijauskas, L. Skibiniauskas) and five species of wild flora (*Helianthemum nummularium* (L.) Mill., *Tulipa bifloriformis* Ved., *Trolius europaeus* L., *Salvia officinalis* f. *rubicunda* and *Lathyrus maritimus* (L.) Bigelow are confirmed as National Plant Genetic Resources by Orders of Minister of Environment.

Key words: *Gladiolus* L., herbaceous decorative plants, Lithuanian flower breeders

SPECIES OF GENUS *CYNOXYLON* RAF. IN FOREST-STEPPE OF UKRAINE

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The place of genus *Cynoxylon* in the system of family *Cornaceae* has been described and the species in the forest-steppe of Ukraine: *C. japonica, C. florida, C. capitata.* We have analysed the morphological features and morphometric characteristics of the generative and vegetative organs, investigated reproductive capacity, constructed the phenological spectrums of them.

Key words: *Cynoxylon,* morphometric characteristics

SOLID STATE FERMENTATION AS A VALID ALTERNATIVE FOR ENVIRONMENTAL CONTROL

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The wood preservatives have been extensively used in the last few decades to enhance the life expectancy of woody materials for external uses against natural and biological decay.

The popular waste disposal options available for these expended materials nowadays, such as burning and land filling are not acceptable due to economic, health and environmental concerns. The development of alternative and environmental friendly methods for disposal of these waste materials is of major importance.

Recently the use of microorganisms, such as white-rot fungi, capable to tolerate and / or degrade high pollutant concentrations for their chemical transformation into less hazardous compounds through Solid State Fermentation (SSF) processes has been seriously investigated.

This presentation discusses a novel approach for bioremediation of creosote-treated railways wood sleepers by Solid State Fermentation of white-rot fungi and the possibility to combine it sequentially with phytoremediation in the frame of the EUSFA project VP-3.1- MM-10V-02_010 (BIOREM).

Key words: bioremediation, phytoremediation, creosote, Solid State Fermentation, white-rot fungi, wood sleepers

INTRODUCTION OF MULBERRY GENUS (*MORUS* L.) IN KAUNAS BOTANICAL GARDEN OF VYTAUTAS MAGNUS UNIVERSITY

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Research into mulberry genus introduction was conducted in Kaunas Botanical Garden of Vytautas Magnus University in 2012. Three species were investigated: white (*Morus alba* L.), black (*M. nigra* L.), and red mulberry (*Morus rubra* L.). The study comprised 36 plants introduced during the period of 1948–2011. Dynamics of growth and resistance to environmental factors were evaluated during this research. All three observed species can be successfully cultivated in Lithuania.

Key words: mulberry, introduction, Kaunas Botanical Garden of Vytautas Magnus University

RESOURCES OF ORNAMENTAL PLANTS IN KAUNAS BOTANICAL GARDEN OF VYTAUTAS MAGNUS UNIVERSITY

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Sector of Floriculture comprises 5356 taxons of ornamental perennial plants grown in expositions and collections of lignified and herbaceous ornamental plants. A unique Flora taxonomy collection provides view on plant taxonomy and enables to see very rare species. This collection consists of 67 families and more than 577 taxons of local and introduced plants that are displayed in taxonomic order. A large collection of bulbous and other monoculture plant species and sorts is grown in the pond island.

The *National Ornamental Plant Genetic Resources Conservation Program for 2006–2015* (ANGI) is coordinated by the Ministry of Environment of Lithuania. In Kaunas Botanical Garden of VMU Sector of Floriculture is an institution in charge of ornamental plants. The major aim is to find out, collect and conservate local cultivars and species of ornamental. Characterization descriptors of primrose and lilies are one of plant genetic resources documents corresponding to the Bioversity International requirements. The plants of genetic resources are collected and analysed in the Floriculture education sector from the Kaunas Botanical Garden of VMU, prepared the methodology of evaluation and description varieties for ornamental plants.

Key words: ornamental, conservation, introduction, tropical, subtropical

DEVELOPMENT OF SEED EXCHANGE IN KAUNAS BOTANICAL GARDEN OF VYTAUTAS MAGNUS UNIVERSITY

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Lithuanian cultivars of primroses (*Primula* L.) are created by Ona Skeivienė and Jonas Evaldas Tarvidas. The cultivars of *Primula malacoides* were collected and analysed in the Floriculture Department of Kaunas Botanical Garden of Vytautas Magnus University, other – at Floriculture Plant Collections Department of Botanical Garden of Vilnius University. Totally, all cultivars of primroses were assessed and there is a big variety of its morphological characteristics. The characterization descriptors of *Primula* were prepared for the characterization of primroses and a tentative descriptor list was developed for the genus considering the recommendations of the Bioversity International.

Key words: *Primula*, genus, morphological, characterization descriptors

COLLECTION OF TROPICAL AND SUBTROPICAL PLANTS AND GATHERING PRINCIPLES IN GREENHOUSES

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The gathering principles of tropical and subtropical plant collection in greenhouses of Kaunas Botanical Garden of Vytautas Magnus University were analysed in 2012–2013. This collection was accumulated in the period of over 90 years since 1923. Currently it covers the area of about 665 m^2. A large collection was accumulated of the world's plant diversity starting with *Selaginella* genus plants and ferns, ending with the youngest flowering plant groups. *Polypodiopsida* – 8 families with 35 species (2.33%); *Pinophyta* – 10 families associated with 23 species (1.53%) and *Magnoliophyta* – 96 families associated with 1 442 species (96.13%). The collection was accumulated based on two criteria: accumulate a large taxonomic diversity and individual plant taxonomic complexes.

Key words: tropic, subtropic, plants, collection, greenhouses

THE CHEMICAL COMPOSITION OF AROMATIC PLANTS AND THEIR APPLICATION TO FOOD SAFETY AND QUALITY

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Food molecules (lipids, proteins, carbohydrates) can be widely involved in oxidation reactions. A great number of medicinal, aromatic, spicy and other plants contain chemical compounds exhibiting antioxidant properties.

However, scientific information about antioxidant properties of various plants, particularly those that are less widely used in culinary and medicine, is still rather scarce. Therefore, the assessment of such properties remains a challenging and useful task, particularly for finding new sources for natural antioxidants, functional foods and neutraceuticals.

Biodiversity of plant resources, scarce information on bioactive compounds and their properties in many species, including those growing in Lithuania, as well as increasing demand for naturalness of food were the main motivation aspects of the present study.

The studies of aromatic and medicinal plants grown in Lithuania by using various methods so far have resulted in the evaluation of antioxidant properties of some less investigated plants and identification of new antioxidants. These findings also encouraged to initiate this work. Preliminary it was aimed at screening of radical scavenging activities of the extracts isolated from some plants introducing *ex situ* in the medicinal and spicy–melliferous plants collection of Kaunas Botanical Garden of Vytautas Magnus University since 1924.

Key words: aromatic plants, bioactive compounds, food safety and quality

PATHOGENS OF *PHYTOPHTHORA* GENUS THAT DAMAGE *ALNUS GLUTINOSA* IN KAUNAS BOTANICAL GARDEN OF VYTAUTAS MAGNUS UNIVERSITY

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In Europe most species of *Phytophthora* were detected on trees of *Alnus* and *Quercus* genera. From 2009 *Alnus glutinosa* with marks of damage which are specific for *Phytophthora* spp. are being observed in Kaunas Botanical Garden of Vytautas Magnus University. In four years the number of damaged trees increased from 1.11% (in 2009) to 26.67% (in 2012). Disease tends to spread on *Alnus glutinosa* trees of various age that grow not further than 5 m from water, especially in places which are being inundated for 1–2 months or are very damp.

Key words: *Phytophthora* spp., *Alnus glutinosa*, Kaunas Botanical Garden of Vytautas Magnus University

GENETIC CHARACTERISTICS OF *JUNIPERUS COMMUNIS* L. FROM DIFFERENT ECOTYPES

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Throughout the world populations of common juniper (*Juniperus communis* L.) are registered in various environments according to water supply and light: this species might grow in both dry and wet soils, opened areas and pine forests, densely or rarely. The forest ecosystems are more stabilized compared with open areas, due to hold of the groundwater. Sand-dune communities are limited in freshwater reservoir very close to a salt environmental and intensive evaporation process. In Lithuania common juniper sites belong to forest series like *Cladoniosa*, *Vacciniosa*, *Vaccinio-myrtillosa*, *Myrtillosa*, *Cariso-spagnosa*, *Oxalidosa*, *Myrtillo-oxalidosa*, *Calana-mixtoherbosa* and *Filipendulo-mixtoherbosa*. Our study aimed at evaluation of the extent of polymorphic DNA loci of Lithuania common juniper populations differing in ecotypes and geography. For the survey juniper samples were collected from *Cladoniosa*, *Vacciniosa*, *Vaccinio-myrtillosa* and *Myrtillosa* forest types. In total, fourteen populations (10 individuals in each) were sampled. Only growing at least in 5 m distance from each other female adults were sampled. Shoots at a height of ~0.5–5.0 m were used. The needles from current-year shoots were taken. Our molecular studies included 140 specimens. DNA was extracted by a modificied CTAB method. Estimations of molecular characteristics of common juniper were done according to ISSR loci. The analyses were done by protocol of ISSR–PCR for agarose gel electrophoresis. We have tested 15 oligonucleotide markers, 9 of them provided reproducible fragments. Such natural factors as soil structure, density, relief, precipitation amount and underground water level could play an important role forming distinct structure and functions of separate plant populations. Molecular diversity in relation to ecotypes and geography of populations is discussed.

Key words: *Juniperus communis* L., ecotypes, molecular diversity, ISSR markers

PHYTOPHTHORA SPP. – DISEASES AGENTS OF BROADLEAVES TREES IN LITHUANIA

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Plant status is influenced not only directly by climate changes, but also by these changes related activity of other organisms: pathogens and pests. Some of these organisms in past 10–20 years have been spreading very aggressively and make a lot of damage to different types of plants. Several decades ago in Europe a spread of aggressive pathogen from *Phytophthora* genus fungi was noticed. In Europe most species of *Phytophthora* were detected on trees of *Quercus* and *Alnus* genera; 4–8 species – *Acer*, *Betula*, *Aesculus*, *Tilia*, *Fraxinus*; 1–2 species injure *Salix*, *Populus*, *Prunus*, *Campinus*, *Corylus*. During 2009–2012 in 17 districts of Lithuania trees with infection signs to *Phytophthora* genus pathogens from 14 genus and 22 species were documented. The higest percentage of disturbed trees was observed among *Acer* genus (52%). More than a half of documented treees were young individuals growing nearby water sources. Typical disturbance symptoms of trees are bleeding spots on stem.

Key words: *Acer* L., *Phytophthora* spp., Lithuania

CRIOGENIC PRESERVATION OF FRUIT TREES GENETIC RESOURCES

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In 2009–2012, thanks to the project of the National Centre of Research and Development in the Polish Academy of Sciences Botanical Garden–Centre for Biological Diversity Conservation in Warsaw a gene bank of historical cultivars of apple trees (*Malus* Mill.) using cryogenic techniques has been established. In the course of the project, about 150 varieties of this species from Central Europe were collected and preserved in liquid nitrogen. The work was based on apple dormant buds cryo-conservation. This method was used after a successful application in other research centres in the USA and Japan, while trying to check and adapt it to the conditions of Central Europe. Also, studies on the induction of frost tolerance under controlled conditions were carried out. The usefulness of the method for selected cultivars of sweet cherry (*Prunus avium* L.) and pear (*Pyrus communis* L.) was also checked. The results confirmed the usefulness of the chosen cryo-preservation method, its simplicity and the effectiveness for fruit trees genetic resources conservation as a supplementary method. However, in case of pear and sweet cherry cultivars not fully satisfactory results indicated the need for further optimization of cryopreservation method, including pretreatment techniques methods, hence these studies are in progress.

Key words: cryo-conservation, dormant buds, apple, pear, sweet cherry, LN_2

INVESTIGATION OF THE GENUS *POTENTILLA* L. IN CRIMEA AND DEVELOPMENT OF *IN VITRO* PROPAGATION METHODS

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Genus *Potentilla* L. is presented in Crimea by 20 species, including two endemic *P. taurica* Willd. ex Schlecht. and *P. depressa* Willd. Many of *Potentilla* species are so ornamental and due to the secondary metabolites are used in various industries. To study the accumulation of biologically active substances and conservation of biodiversity the morphogenetic capacity of organs and tissues *in vitro* of some *Potentilla* species has been identified. As explants the leaves, petioles, meristems, roots of *P. depressa*, *P. recta* subsp. *laciniosa* (Waldst. et Kit. ex Nestler) Nyman, *P. inclinata* Vill., internodes and seeds of *P. recta* have been taken. For plant material sterilization 70–96% ethanol and 0.375–1.125% Cl_2 (*Dez Tab*, Ukraine) have been used. The sterilization of *P. recta* seeds 1 min by 70% ethanol and 10 min by 0.375% Cl_2 provided possibility to obtain 71.4% aseptic explants, from which 40% have been viable. Plants from seeds on Monnier medium have been developed. Thus on ½ Murashige & Skoog medium with 0.4–0.8 mg l^{-1} BAP and 0.05–0.1 mg l^{-1} IBA microshoots with small leaves have been formed. From root explants, leaf pieces, petioles of *P. depressa*, *P. recta* and *P. inclinata* callus have been formed on MS medium, supplemented with 0.2–0.6 mg l^{-1} kinetin and 0.8–1.2 mg l^{-1} NAA, 0.4–0.8 mg l^{-1} BA and 0.05–0.1 mg l^{-1} IBA, 1–1.5 mg l^{-1} BA and 1–1.5 mg l^{-1} NAA. On the internodes on MS medium with 0.2–0.6 mg l^{-1} kinetin and 0.8–1.2 mg l^{-1} NAA indirect regeneration has been induced.

Key words: *Potentilla* sp., explants, morphogenetic capacity, propagation, *in vitro*

FATTY ACID COMPOSITION AND ACTIVITY OF THE MITOCHONDRIAL RESPIRATORY CHAIN COMPLEX I OF PEA SEEDLINGS UNDER WATER DEFICIT

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We studied the effect of insufficient watering and plant growth regulator melaphen (melamine salt of bis(oxymethyl)-phosphonic acid) on the fatty acid composition and the energy of 5-day etiolated pea seedling mitochondria (*Pisum sativum*). It has been shown that insufficient watering results in alteration of fatty acid composition in mitochondrial membranes of seedlings. The ratio of the content of C_{18} – unsaturated fatty acids to the stearic acid content decreases by 1.5 times. Significant changes are observed in the content of fatty acids with 20 carbon atoms: the ratio of unsaturated fatty acids to saturated fatty acids decreases by 3.3 times. The treatment with melaphen protects the unsaturated fatty acid from LPO and prevents thereby from changes in the fatty acid composition of seedling membranes in conditions of insufficient watering. The changes in fatty acid composition of mitochondrial membranes are in correlation with changes in maximum rates of NAD-dependent substrates oxidation (the Pearson's coefficient of correlation for C_{18} fatty acids is 0.676; for C_{20} fatty acids – 0.963).

Key words: germs of *Pisum sativum* L., fatty acid composition, mitochondria, respiratory chain, insufficient watering

MOLECULAR DIVERSITY OF LITHUANIAN *IMPATIENS GLANDULIFERA* BASED ON INTER-SIMPLE SEQUENCE REPEAT MARKERS

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Himalayan balsam or policeman's helmet (*Impaties glandulifera* Royle) is an annual ornamental plant with attractive flowers. Introduced to Europe in the XIX century from Himalayas Mountains quickly it became a garden favourite but nowadays had become a prodigious weed occupying natural habitats. The objective of the research was to analyse genetic diversity of different in geography populations of *I. glandulifera* growing in Lithuania. Four most contrasting according to the geography *I. glandulifera* populations (Dieveniškės, Piktuižiai, Švėkšna, Zarasai) were selected for the investigation. Genetic diversity of *I. glandulifera* populations was evaluated using inter-simple sequence repeat (ISSR) markers. Selected ISSR primer generated between 18 and 21 DNA bands each. In total, 80 DNA bands were recorded and all of them were polymorphic. Percentage of polymorphic DNA bands for separate populations of *I. glandulifera* ranged between 34 and 61, the mean being 43. Nei's gene diversity interval was 0.104–0.198 and Shannon's information index ranged between 0.160–0.303. Pairwise genetic distances between populations ranged from 0.165 to 0.317. Results of analyses of molecular variance showed quite similar intra and inter variation between populations (45% within and 55% among populations). The UPGMA dendrogram revealed a clear differentiation between the populations. The obtained results revealed that chosen ISSR markers are valuable for the evaluation of molecular diversity of *I. glandulifera* populations.

Key words: Himalayan balsam, genetic diversity, ISSR markers

EFFECT OF PHOTOPERIODIC CONDITIONS ON THE DEVELOPMENT AND CONTENT OF NITROGENOUS COMPOUNDS IN THE *VRN* NILS WHEAT *TRITICUM AESTIVUM* L.

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The results of modern molecular genetic studies have shown that genes *VRN*, which control the need for vernalization and determine the type of development (spring or winter) in soft wheat (*Triticum aestivum* L.) are interconnected with each other and can be expressed or repressed under the impact of the photoperiodic signal. The purpose of this study was to investigate the genetic determination of the content and distribution of nitrogen compounds in organs of the main shoot in the photoperiodic induction of short day (9 hours) in isogenic *VRN* lines soft wheat of two cultivars – Mironovskaya 808 and Olviya. The results have shown that all the isolines cultivar Olviya develop faster than cultivar Mironovskaya 808 both in the short (9 hours), and in conditions of natural duration (16 hours) of the day. In all isolines of both studied cultivars the effect of short photoperiod extends the period germination-ear formation. In the heading-flowering phenophases distribution of total nitrogen between the parts of the main shoot took place as follows: the maximum nitrogen content was in leaves, less in the emerging spikes and the minimum in stems. The study of free amino acids in different organs of the main shoot in the photoperiodic induction of short day showed the same type of response isolines of both cultivars. Short photoperiod stimulated the biosynthesis of free amino acids in all plant organs: leaves, stems, and especially in emerging ears. The study of protein content of grain has shown that isolines cultivar Olviya protein content in grain is higher than in grain lines cultivar Mironovskaya 808. Thus, in the course of these experiments we established that the genetic determination of gene *VRN* controlled rate of development soft wheat under short photoperiod indirectly influences the processes of assimilation, distribution between organs and accumulation in the grain of the total nitrogen.

Key words: *Triticum aestivum* L., NILs, *VRN* genes, photoperiod, development, nitrogen compounds

MUTUALISTIC INTERACTIONS ARE CRUCIAL FOR MAINTAINING PLANT BIODIVERSITY

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Recent advances in complex networks research allow to take a closer look at various ecological interactions that involve both plants and animals at the level of ecosystems. Especially mutualistic interactions (eg. pollination) play a crucial role in generating and sustaining biodiversity of terrestrial ecosystems. Many authors regard them as "architecture of biodiversity" because usually they connect dozens or even hundreds of species, forming large and complex networks of reciprocally beneficial interactions. The structure of such networks is highly heterogeneous and asymmetric: most of the species are rather weakly connected, while some of taxa develop much stronger relationships. Based on our studies in semi-natural habitats in NE Poland we will demonstrate how new mathematical tools allow to analyse the pollination network structure and can be farther applied to indicate "keystone" species which may be important in determining the stability of the studied ecosystems.

Key words: conservation, keystone species, meadow, networks, pollination

THE EXPOSITION COLLECTION OF LILACS (*SYRINGA* L.) IN BOTANICAL GARDEN OF VILNIUS UNIVERSITY

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The genus *Syringa* is divided into two subgenus: *Syringa* and *Ligustrina*. *Syringa* subgenus has four series: *Pinnatifoliae* Rehder, *Pubescentes* (C. K. Schneider) Lingelsheim, *Syringa* and *Villosae* C. K. Schneider. Subgenus *Ligustrina* included only *Syringa pekinensis*, *S. reticulata*, *S. reticulata* var. *reticulata* and *S. reticulata* var. *amurensis*. Various species or cultivars of lilacs present them as 'garden plants'. Botanical Garden of Vilnius University has more than 140 taxa of *Syringa*. The goal of this report is to present lilacs growing in the exposition collection of Botanical Garden of Vilnius University.

Key words: exposition collection, *Syringa*

INVESTIGATION OF BLUE-BERRIED HONEYSUCKLE (*LONICERA* L.) AT BOTANICAL GARDEN OF VILNIUS UNIVERSITY

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The blue-berried honeysuckle (*Lonicera* L.) is considered a non-traditional horticultural plant in Lithuania that grows in individual 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, anthocyanins, etc.) and can be used as natural antioxidants.

Since 1814 the blue-berried honeysuckle was known as dendrology object at the collection of VU Botanical 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, 37 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) was carried out. Identification of plant disease agents of the aboveground part of bushes and plant resistance was carried out in 2003–2006 and 2009–2010. 24 fungal agents from 22 genera were identified. *Diaporthe pardalota, Nectria cinnabarina* and *Fusarium oxysporum* var. *orthoceras* made the most serious damages for plants.

In 2007 we started working 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.), characteristics of berries, diseases resistance, genetic variation

PATHOLOGICAL CONDITION OF *LARIX* SPP. IN LITHUANIA

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Conditions of *Larix* genera tree in forests of Lithuania were studied. *Larix decidua* and *L. polonica* are considered as perspective species for growing in Lithuania. Acclimatization of *L. laricina*, *L. sibirica* and *L. leptolepis* is restricted by disease agents and pests, edaphic and climatic conditions. *Larix* trees growing in good conditions are in much better state than those growing in low and moist areas. *Larix* species was observed in all *Lachnellula willkommii* infected trees. *L. decidua* was more resistant. *Adelges laricis* and *Cholodkovskaya viridana* were sporadically detected. *Coleophora laricella* is more frequent and more abundant.

Key words: *Larix* spp., diseases, pests, Lithuania

LILY GENETIC DIVERSITY EVALUATION IN THE COLLECTION OF KAUNAS BOTANICAL GARDEN OF VYTAUTAS MAGNUS UNIVERSITY

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Classification type of lilies (*Lilium*) has been established several centuries ago. DNA technology helped to better identify individual species and to evaluate their diversity (Persson et al., 1998; Wen & Hsiao, 2001; Horning et al., 2003). About 100 species of lily family have a great genetic diversity which has been assessed in different ways. True kinds of seedlings were obtained using inbreeding or hybridization with the same species, usually such kind of plants has the same phenotype. New species which are grown traditionally are adapted to severe climatic conditions. This is the source of production of healthy and resistant varieties.

Worldwide genetic studies of lilies were done analyzing Chinese and Korean populations using molecular techniques (Weihua et al., 2011). For a long time Lithuanian ornamental plant genetic resources and biodiversity have not been thoroughly studied, recorded and stored. Thus a lot of unique cultivars have been permanently lost. Research into all kinds of evaluation and assessment has just started. Selection of valuable and perspective species is required to continue and add new species. Therefore it is important to identify pre-existing varieties and hybrids using morphological features characteristic and DNA markers. Investigated and adapted molecular techniques to decorative plant crops can help faster and better perform many breeding work processes. Whenever possibility to control the variability and stability between plant regeneration, it is possible to predict the variability in reproduction and plants storage *in vitro*.

The aim of this work was to use an inter-simple sequence repeats (ISSR) method in order to evaluate the genetic variability of different lily kinds in the collection of Kaunas Botanical Garden of Vytautas Magnus University.

Key words: *Lilium,* genetic variability, ISSR method