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ORAL PRESENTATIONS

"Hairy" Root Culture Of Medicinal Plants As A Source Of Biologically Active Compounds: From Laboratory To Pharmacy

Nadiia Matvieieva[1], Anatolij Shakhovsky[1], Natalia Kobylinska[2], Olena Khainakova[3], Bogdan Morgun[1], Olha Lakhneko[1], Yakiv Ratushnyak[1], Volodymyr Duplij[1], Mykola Kuchuk[1], Saulius Mickevicius[4]

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Abstract

Plant-mediated "green" synthesis of compounds with medicinal properties attracts great interest for many years. "Hairy" root cultures can synthesize numerous compounds including phenols, flavonoids, essential oils, sugars etc. The possibility to increase the amount of these compounds due to transfer of *rol* genes from *Agrobacterium rhizogenes* was confirmed. In this work we compared the effect of *rol* genes transfer on the flavonoids accumulation and spectrum, antioxidant activity of the extracts from the root cultures of *Artemisia spp, Bidens pilosa, Cichorium intybus* medicinal plants. "Hairy" root cultures were obtained after *A. rhisogenes* A4 wild strain transformation and were subcultured in *in vitro* conditions. HPLC method to identify and quantify flavonoids in plant-derived extracts was used. Antioxidant activity was measured by the scavenging of DPPH* radical. Expression of *pal* and *chs* genes coding biosynthesis of flavonoids was studied by Real-Time PCR.

Increase of the total flavonoid content up to 140 mg/g DW as well as the increase of antioxidant activity were found in the "hairy" root cultures for all plants studied. The increase of flavonoids content correlated with the expression of *pal* and *chs* genes. Kaempherol, rhamnetin, silibinin, luteolin, epicatechin, casticin, apigenin known by their anticancer activity were identified in the ethanolic extracts. Propagation of "hairy" root cultures in a liquid bioreactor allowed us to enlarge root biomass without addition of growth regulators.

So, we selected "hairy" root cultures of medicinal plants which can be cultivated in bioreactors and used for production of the compounds with antioxidant and anticancer activity.

Keywords: medicinal plants, *Agrobacterium rhizogenes*-mediated transformation, "hairy root" culture, biologically active compounds, gene expression

A Circular Economy Eu Life Project: Algae Economy-Based Ecological Service Of Aquatic Ecosystems

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Abstract

Anthropogenic eutrophication promotes primary production in aquatic ecosystems. Cyanobacteria scums and macroalgal mats are the first sign of water body deterioration. They cause environmental problems and socioeconomic losses. Therefore, three interlinked elements were proposed in the circular economy project AlgaeService for LIFE (2018–2023) that seeks to address integrated management of nutrients and organic pollution: 1) constructing of prototypes for cyanobacteria and macroalgae biomass harvesting to improve water quality and provide ecosystem service; 2) validation of distant methods to define hot-spots of algal agglomerations in real conditions; 3) redesigning of harvested waste biomass into valuable bioproducts for recycling of environmental resources and restitution of ecosystem service costs.

The project highlights that proposed demonstration measures can be applied and replicated in various types of water bodies in other countries. Project actions *contribute* to the *implementation* of some EU directives. It supports green economy concept by testing harvested biomass for high value bioproducts, biogas production, slow-release fertilizers. Implementation of project will take place in lakes, ponds and rivers in Lithuania and Poland, and in the Curonian Lagoon with the purpose to abate eutrophication of the Baltic Sea. Project also aims to increase public awareness on eutrophication, algal blooms and sustainable use of algae biomass.

The project is implemented by the Nature Research Centre (LT); business companies: Baltic Environment (LT), SPILA (LT); non-governmental organization Nature Heritage Fund (LT); Adam Mickiewicz University in Poznan (PL), Institute of Nature Conservation (PL).

Keywords: algal blooms, bioproducts, eutrophication, freshwaters

Abundance Of Deer Keds Among Different Species Of Cervids And Their Infection With Bartonella Spp. In Lithuania

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Abstract

Deer keds from genus *Lipoptena* are bloodsucking ectoparasites which typically infest wild ruminants. However, the information on the distribution and abundance of deer keds on their mammalian hosts is still scarce, especially in Lithuania. Few years ago *Lipoptena cervi* has been confirmed as vector of some *Bartonella* species. This study represents abundance of deer keds from cervids with the presence of *Bartonella* pathogens in Lithuania. The furs of cervids such as roe deer, red deer and moose harvested through the hunting or founded road kill during 2015-2017 were examined for deer keds. Taxonomic identification of deer keds was based on description of morphological characteristics of adults and sequence analysis of mitochondrial COI gene. Our investigation demonstrates that cervids in Lithuania are infested with two different species of deer keds *Lipoptena cervi* and *L. fortisetosa*. Intensity of infestation was the highest in moose (*Alces alces*) and varied from 374 to 2981 ectoparasites per host. PCR and sequence analysis of *rpoB* gene and 16S-23S rRNA intergenic spacer region (ITS) were used for detection and molecular characterization of *Bartonella* spp. in deer keds. *Bartonella* DNA was detected in both species of deer keds with high prevalence (more than 90%). *Bartonella* strains detected in deer keds were heterogenetic and showed 96-99 similarity with *B. schoenbuchensis*, *B. chomelii* and *B. capreoli*.

Key words: *Lipoptena cervi*, *Lipoptena fortisetosa*, cervids, *Bartonella*

Aggregation Of The Sup35 Proteins From Various Yeast Species

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Abstract

Prions are self-perpetuating aggregated proteins, associated with human and animal diseases, and controlling yeast heritable traits. Cross-species prion transmission is impaired by differences between protein sequences involved in intermolecular interactions. However, this barrier could be overcome, *e. g.* in case of 'mad cow' disease transmission to humans. We are studying cross-species interactions between derivatives of the yeast prion protein Sup35 from different yeast species. Transmission of prion state occurs between the Sup35 proteins of very distant species, *Ogateae methanolica* and *Saccharomyces cerevisiae*, with only 40% of amino acid similarity in their prion domains, although it is not detected between Sup35 proteins of more closely related species. This shows that transmission barriers do not always correlate with the sequence identity. We present data on the sequence features and aggregation properties of *O. methanolica* prion domain that may explain this phenomenon. Comprehensive studies of the parameters of protein aggregates formed by Sup35 prion domains of different origins and structures in the *S. cerevisiae* cells are also performed.

This work was supported by grant 18-74-00041 from RSF, and performed with the help of the SPbSU Resource Centers «CHROMAS» and «Molecular and Cell Technologies».

Keywords: prion, interspecies barrier, yeast, Sup35.

Analysis Of Matrix Metalloproteinase (Mmps) Activity At Aortic Stenosis In Humans

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Abstract

Aortic stenosis is the most prevalent of all valvular heart diseases in developed countries because the average age of the population increases[1].

There are two scientists positions concerning the etiology of valve calcification: secondary calcification resulting from valve endothelium ruptures due to long mechanical valve overstrain and chronic inflammation, which leads to sclerosis and calcification[2]. Anyway, calcification is a result of extracellular matrix remodeling, which occurs due to injury or inflammation. The increased degradation and fragmentation of collagen and elastin fibers by matrix metalloproteinases (MMPs) is observed in vascular diseases[3].

The MMP-9 concentration in serum of patients with aortic stenosis (AS) does not differ from the control group[4]. But the MMP-2 level is increased in the AS tissue, and the gelatinolytic MMP activity is dramatically increased in the stenotic valve tissue[5].

Only the activity of MMP-2 and MMP-9 in the AV and aorta tissues was analyzed in given study, because only the active proteases degrade the extracellular matrix proteins. Biopsy material for analyses from patients with AS (51 samples - pathology) and donors without this pathology (9 samples - control) was taken during the operation in Almazov National Medical Research Centre. MMPs activity was analyzed by zymography. Calcified valve tissue was compared with aortic tissue from patients and with donor tissues. Obtained results show that MMP-2 and MMP-9 activities were higher in AS aortic tissue than in AS valve, while in control group the levels of MMPs activity in aortic and valve tissues were comparable.

Keywords: Aortic stenosis, aortic valve calcification, MMPs

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Application Of Computational Fluid Dynamics In Planning Of Extra-Intracranial Bypass Operation

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Abstract

The prevalence of intracranial aneurysms in the general population is up to 3% [1]. Aneurysm rupture is the most common cause of non-traumatic subarachnoid hemorrhages. Sometimes the only way to isolate an aneurysm from the normal circulation is to perform extra-intracranial bypass (EAB) surgery [3]. EAB redirects the blood flow around the affected artery, and the artery with aneurysm is ligated. Computational fluid dynamics can be helpful in the difficult process of planning this operation [2]. In the experiment we used the data of a patient with a giant aneurysm of the internal carotid artery (ICA). A three-dimensional patient-specific model of the vessels was constructed using CT angiography data and MultiVox workstation. We modified 3D reconstruction by adding an anastomosis between the external carotid artery and middle cerebral artery (MCA) and complete ICA overlap to study the effect of shunting on hemodynamics. The patient also underwent ECG-synchronized phase-contrast MRI with registration of average blood flow rate in several sections. The obtained data was used to set boundary conditions and for verification. The calculation was carried out in the software module ANSYS CFX 18.2., that allows us to estimate the values of hemodynamic parameters in different areas of the three-dimensional model. After the bypass was connected the distribution of blood flow between the branches of the MCA was approximately the same as before, what means that sufficient blood supply to the relevant areas of the brain will be maintained. That was confirmed after the operation.

Keywords: intracranial aneurysms, computational fluid dynamics, extra-intracranial bypass

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Application Of Microbiological Indicators To Assess Soil And Sediment Quality

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Abstract

Soil and sediment microorganisms play an important role in the processes of degradation of compounds polluting the environment and restoration of contaminated ecosystems. Moreover they can serve as easy and reliable tools to detect and assess the level of contamination and the dynamics of restoration process. Microorganisms quickly respond to changes in environmental conditions due to their physiological and genetic features. High sensitivity of microorganisms provides an opportunity to use microbial activity as indicators of quality and health status of contaminated environment. The present study focused on the investigation on the enzymatic activities (dehydrogenase, catalase, urease and phosphatase) as well as the related environmental factors in contaminated soils of the North-West Russia and the Baltic Sea sediments. We compared the results obtained by single microbial parameters with results given by microbial indices expressing the average response of the microbial community. The integrated parameters were the most sensitive and accurate tools for evaluating changes in soil and sediment quality. They better expressed how much the response of microbial parameters changes in polluted sites as compared with those from an appropriate control site. The results indicate that microbial activity indices can be useful in describing and making prediction about ecosystem's function, quality and dynamics.

Keywords: microorganisms, enzymatic activities, pollution, Baltic Sea, North-West Russia.

Biological Perspective To Material Science

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Abstract

As is known very well, chemically synthesized materials have side effects on organisms and environment so they are toxic to organisms and nature. Instead of chemically synthesized materials, it is very important to produce natural bio-based materials thanks to their biocompatibility, biodegradability, antimicrobial and antioxidant properties. In this study, it was aimed to isolate, modify and characterize any valuable micro and nano materials (like biosilica, chitin, chitosan, cellulose, sporopollenin etc.) obtained from diverse organisms such as Arthropoda, Porifera, Bryozoa, mushrooms and some plant species. In this regard, newly obtained and patent applied biosilica porous micro beads were presented by giving its isolation procedure, modification and characterization. Preparation of films for food packaging was introduced by using different kinds of biogels such as chitosan, mucilage and starch. As a result, possible application areas of the obtained biomaterials in pharmacy, biomedical, water purification, optic, catalyst in chemistry, invisible wire in telecommunication were discussed. As a conclusion, it is observed that all the produced materials by BIPEMAS group have potential to be used as high-tech product in industry.

Keywords: Invertebrates, Biopolymers, Biomaterials, Biodegradable films, Biosilica

Chemiluminescent Microplate-Based Assays For Detection Of Nucleic Acids

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Abstract

Detection of DNA sequences is of great importance for cancer diagnostics, pathogen determination and forensic analysis. DNA detection techniques are often based on hybridization reaction. Although homogeneous methods are more rapid and simple, heterogeneous methods are more sensitive and less prone to matrix effect in real samples analysis. In our work some formats of microplate sandwich assay for DNA detection with different capture and reporter conjugates have been developed. DNA sequence of hepatitis B virus was used as a model target. Since the surface of microplate wells is limited, the highly sensitive detection system based on HRP-catalysed chemiluminescence with the use of phenothiazine enhancers was applied.

This work was supported by the Russian Science Foundation (Grant No. 17-14-01042).

Keywords: Chemiliminescence, nucleic acid, amplification, plate-based assay.

Cryosensitivity Of Human Dental Pulp Stem Cells

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Abstract

Isolation of dental pulp stem cells (DPSCs) has led to rapid progression in the field of regenerative dentistry. Currently, reliable and effective cryopreservation methods are required for successful translation of the latest achievements into clinical practice.

The aim of the study was to evaluate the functional properties of human DPSCs before and after cryopreservation with non-toxic DMSO concentrations.

Human DPSCs were isolated from third molars of adults using an enzymatic method. To characterize cell population, immunophenotyping, differentiation and proliferation assays were performed. Prior to cryopreservation, DPSCs were subjected to pretreatment including culture with sucrose for 24 hrs. Following cryopreservation was carried out in the media with varying percentages (1–10%) of cryoprotectant DMSO. The survival rate and viability of cells were assessed by trypan blue staining and Alamar blue test.

The identity of isolated DPSCs was confirmed by expression of specific antigens. The average population doubling time, assessed during 5 passages, was 40 hrs. Culture in the presence of specific adipo- and osteogenic inducers led to the formation of lipid droplets or calcium deposition, respectively.

Cryopreservation of DPSCs without cryoprotectant caused the death of 96% cells. Pretreatment procedure increased cell viability in the same conditions up to 58%. Addition of 1% and 2% DMSO into the cryoprotective media significantly improved preservation outcome. When DMSO concentration was raised to 5%, the survival rate reached the level of non-cryopreserved control.

To sum up, this study demonstrates the benefits of using a sucrose pretreatment procedure for DPSCs cryopreservation with reduced DMSO concentrations.

Keywords: dental pulp stem cells, cryopreservation, pretreatment

Cytogenetic Anomalies In Congenital Heart Defects

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Abstract

The work presents current data on the effect of genetic abnormalities on the formation of congenital heart defects (CHD). The severity spectrum of CHD varies from a minor to the complex and multiorgan lesions that are incomparable with life. The proposed hypothesis of multifactorial etiology of CHD, so-called polygenic model, assumes the type of inheritance, while a genetic predisposition of individual interacts with the environmental factors. Genetic studies allow us to understand the etiology of the CHD occurrence, provide an understanding of pathologic physiological changes, evaluate the risk assessment, clinical communication and counseling for the children. The first clinical situation for the recommendation to performing the genetic research in CHD is the presence of a syndromic phenotype. Cytogenetic studies have shown that syndrome DiGeorge was registered in age groups: up to one year, 1-2, 2-5, 5-10, over 10 years old with a frequency of 34.3%, 46.7%, 23.5%, 26.5% and 35.7%, respectively. In the presence of CHD and the absence of syndromes DiGeorge and Williams, the Kleinfelter and Edwards syndromes were recorded, as well as structural anomalies of chromosomes in mosaic karyotypes, i.e. 16qh-, add(22)(p11), inv(3)(p21p23), inv(11)(q21q23). The diagnosis DiGeorge syndrome was confirmed in 64 cases, of which in six cases a mosaic variant of the disease was recorded. Of interest, are the cases with a decrease in the size and intensity of the probe manifestation, namely 22q11.2(TUPLE1dim×1).

The question concerning the critical role of genes, which are transcription factors, is discussed, explaining the dominant type of these genes inheritance.

Keywords: hereditary syndromes, congenital heart defects, chromosome abnormalities, regulation mechanisms

Cytogenetic Effects In Root Meristems Of High Aquatic Plants From Chornobyl Exclusive Zone

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Abstract

The impact analysis of low doses of ionizing radiation on the breathers in natural populations is an important part of radiobiological studies of non-human biota. The main aim of our studies was to investigate the rate of chromosome aberrations in four species of higher aquatic plants: common reed (Phragmites australis), sagittaria (Sagittaria sagittifolia), flowering rush (Butomus umbellatus) and manna (Glyceria maxima) from different water bodies within the Chornobyl accident exclusion zone such as – Glyboke Lake and Daleke-1 Lake (left-bank flood lands of the Prypyat River), Azbuchin Lake and Yanovsky Crawl (right-bank flood lands of the Prypyat River), cooling pond of the Chornobyl NPP as well as Prypyat River and Uzh River. The absorbed dose rate for littoral emergent plants in sampling water bodies was varied from 0,06 to 34 μGy h^{-1}. The highest rate of the damages – up to 17 %, was registered in plants from the most contaminated water bodies. The rate of chromosome aberration in closed and slow-running water bodies within the right-bank flood land of the Pripyat River was in 3-4 times higher than spontaneous mutagenesis level. It seems that spectrum of the main types of chromosome damages in plants of the right-bank flood land determines mostly by chemical mutagens – up to 69 % of single fragments. The type of chromosome damages distribution in plants of the left-bank flood land points to generally radiation effects – 34-49 % of bridges, 23-38 % of fragments and 6-32 % of multiple aberrations. There was determined the non-linear positive correlation between absorbed dose and chromosome aberration rate. The data obtained from the complex analysis of natural populations of the literal plants from the radioactive contaminated water bodies testify about rather high level of genetic efficiency of low doses of long-term exposure.

Detection Of Double-Stranded Mycobacterium Tuberculosis Using Dna Nanomachine Based On Binary Deoxyribozyme Sensors

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Abstract

Current hybridization probes are required for sequence-specific recognition of bacterial and viral strains. The later problem is solved by producing single stranded (ss) DNA either by employing asymmetric PCR or by digestion of dsDNA amplicons by exonuclease λ. We designed deoxyribozyme (BiDz) based DNA nanomachine that can bind dsDNA with improved affinity and recognize a single base mutation with high selectivity We applied the machine for detection of dsDNA amplicons of mycobacterium tuberculosis (MtB) DNA for future detection of drug resistant MtB strains.

All hybridization probes and nanomachines were initially optimized using synthetic ssDNA analytes. Mtb DNA was obtained was kindly provided by Dr. MV. Zaychikova.

It was found that DNA nanomachine has roughly the same LoD of 30 pM (after 60 min assay) with regards to ssDNA as for BiDz sensor. However, a decrease in fluorescence of BiDz with dsDNA analyte is found, while DNA nanomachine was observed to detect 20 nM of ds-MtB amplicon after 1 h of incubation and 1 nM after 3 h. Then we tested the ability of sensors and DNA nanomachine to differentiate amplicons containing SNS. vapC38-2 sensor detected corresponding matched analyte with the highest SF ~ 76% among researched.

The strategy enabled detection of 20 nM of dsDNA amplicon with signal to background ratio of ~1.4 after 1 h of assay. The results obtained indicate threefold improvement in LoD of the DNA nanomachine with regards to dsDNA owing to the 3 short DNA binding arms of a DNA scaffold that improve analyte-robot hybridization.

Keywords: DNA nanomachine, binary deoxyribozyme, Tuberculosis, Nucleic acid sensors.

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Dna Barcoding In Some Belarusian Insects

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Abstract

The loss of species diversity has currently risen to an alarming scale, being due to a number of factors an anthropogenic load on ecosystems, the reason for environmental changes and competition between native and invasive species. One of the prospective approaches to remedy the current state and halt the loss is the International project "Barcode of Life".

The report describes the results of molecular genetic research on the insect representatives of such squads as Coleoptera (beetles), Lepidoptera (butterflies), and Trichoptera (caddisflies) using the cytochrome c oxidase subunit 1 of the mitochondrial region (*COI*). We proposed a technique for the sampling of biological material to isolate DNA from the hind legs of individuals. The technique allowed not to remove the individuals of the most valuable species collected on the territory of the Republic of Belarus from their habitats. A collection of DNA samples of the investigated squad representatives was carried out. For the subfamily Cetoniinae (flower chafer), there were significant differences in haplotypes among the representatives of the Belarusian and European parts of their areal. For Trichoptera, it was shown that the *COI* gene has high variability to differentiate species. It was also revealed that some caddisflies species, which Belarusian researchers believe to be synonymous ones, have sequences with serious differences according to the BoldSystem database. This fact should be explored in the future.

So, our analysis allows you to consider the *COI* gene as a pretty good marker for the species identification in Belarusian insects' taxa studied.

Keywords: DNA barcoding, butterflies, beetles, caddis flies, Belarusian populations.

Does Pectin Content Impact Flax Fiber Quality?

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Abstract

Flax is an important crop used for fiber and oil production. Fiber flax cultivars contain significantly more qualitative fiber than their wide ancestors or linseed flax. When compared with fiber flax, the tensile strength of bast fiber is four times higher than of fiber from linseed. The aim of our work is to identify the genetic mechanism, which allows improving bast fiber quality.

We have analyzed the expression of genes involved in cell wall biogenesis by the RT-qPCR method in three plant groups: fiber flax, linseed and wild flax species (*L. angustifolium, L. bienne*). We have found a significant difference in the transcript level of genes that are connected with the rhamnogalacturonan I (RG-I) metabolism. The glycosyltransferase genes, members of 92 and 47 families (Lus10038387, Lus10013790) potentially encoding RG-I biosynthesis enzymes were expressed 5 and more times higher in the fiber extracted from fiber flax than from linseed flax. Genes encoded RG-I modifying enzymes rhamnogalacturonanlyase (Lus10004281) and β-galactosidase (Lus10028848) were expressed three and more times stronger in the fiber of fiber flax than in the bast fiber of linseed.

We analyzed buffer-extractable pectic polymers of fibers by chromatographic methods. We determined that the RG-I yield was, on average, 3 times higher in fiber flax than in linseed flax of all the analyzed samples.

Thus, we can suggest that a stronger expression of RG-I metabolism genes leads to higher RG-I yield and better flax fiber quality.

The work was partially supported by the Russian Science Foundation (project 17-76-20049).

Keywords: Glycosyltransferase, Pectin, RT-qPCR, Flax, Fiber.

Dynamics Of Electrophysiological Activity Of Brain Under The Influence Of Music Of Various Types And Its Molecular Biological Correlates

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Abstract

Three groups of normal Russian young urban dwellers, each one comprising from 20 to 22 subjects, were studied, prior to passing a two-week course of audiotherapy (1.5 hours a day), and right after it. The first group listened to light classical European music, the second one, to modern designer music, the third one (control group) passed a course of nature sounds. Each study comprised registration of brain activity in the electroencephalography (EEG) bandpass, and the ultra-slow one (1.5 to 30 Hz, and 0.05 to 0.5 Hz, respectedly). Both spectral power of signals, and their level of coherence were analyzed in each case. Generalized, common trend, consisting in activation of frontal zones (especially in the alpha-1 and -2 bandpasses), accompanied by slowdown of other ones, was demonstrated to dominate in the first group. As to the second one, absence of generalized, common trends was demonstrated to dominate in the EEG bandpass. At the ultra-slow bandpass, general trend towards reduction of spectral power of signals was demonstrated for members of the first group, which should be linked to general activation of the functional state of the organism. This regularity tended to be most characteristic for the male part of the group, thus being gender-specific. In the case of the second group, lack of common trends in the ultra-slow bandpass prevailed. Interpretation of this set of regularities consists in conclusion that the perception of stereotypic information (light classical music, belonging to the realm of cultural heritage of the subjects) is provided by brain mechanisms which are quite common and simple. As to non-stereotypic information (designer music), its perception tended to follow individual strategies, possibly linked to enhanced creativity. Increase of telomere length was proved to be most characteristic of the first group. As to the second one, absence of such tendency was registered, occurring at the background of considerable activation of telomerase. As both molecular biological parameters applied in our study are currently firmly linked to stress adaptation and life expectancy, the first strategy is regarded by us as adaptive, the second one – as compensatory, and/or, most possibly, stressful.

Keywords: music perception, brain, bioelectric activity, telomeres, telomerase, adaptation.

Ecological Impact Of Phytoinvasions In Ukraine

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Abstract

By the decision of the United Nations Conference on non-native species (Trondheim, Norway, 1996), an obligation was made to conduct comprehensive studies of adventitious plants, animals and microorganisms, to develop regional strategies to control their introduction and distribution. The ecological problem of the expansion of advents has the second place in the conservation of biota after the destruction of ecotops of their existence. An interdepartmental working group on invasive alien species has been established at the Ministry of Ecology and Natural Resources of Ukraine. The list of invasive species of flora of Ukraine is discussed and includes from 40 to 70 species (*Acer negundo* L., *Ambrosia artemisifolia* L., *Amorfa fruticosa* L., *Asclepias syriaca* L., *Azolla caroliniana* Willd., *Cenchrus longispinus* (Hack.) Fernald, *Conyza canadensis* (L.) Cronq., *Echinocystis lobata* (Michx.) Torr. et A. Gray, *Elaeagnus angustifolia* L., *Elodea canadensis* Michx., *Padus serotina* (Ehrh.) Ag., *Quercus rubra* L., *Reynoutria japonica* Houtt., *Robinia pseudoacacia* L., *Solidago canadensis* L., etc.). There are 95 species with highly invasive ability in total, of North American and Asian origin. Environmental hazards are quarantine, allergenic plants, transforming species that transform the local landscapes. A feature of invasive plants is their high adaptation, performance, intensive distribution, competition. Therefore, the environmental effects of phytoinvasions are very significant, especially for protected areas. Aboriginal vegetation cover varies, rare local species displaced. The most vulnerable are aquatic ecosystems, meadows, steppes, forests, coastal coasts. Less phytoinvasions in mountain regions (Carpathians, Crimea), sphagnum bogs (Polissia). Thus, given the high environmental risks of phytoinvasions, it is necessary to develop a strategy for invasive adventitious species of Ukraine. Priority measures relate to the prevention of spread, eradication, control and monitoring of phytoinvasions.

Keywords: alien plants, invasions, ecology safety, Ukraine

Ecology Of Water Caltrop Trapa L. In The Southern Urals

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Abstract

Water caltrop *Trapa* L. is a rare and relict aquatic plant included in the Red List of Threatened Species in 36 regions of Russia and protected in most of the EU countries. Its habitats with most severe and continental climate might be in the Republic of Bashkortostan and in Novosibirsk and Altai mountains. We analyzed the plants and their habitats in Bashkortostan and more southern and warm region Orenburg Oblast. We aslo searched for nearby lakes appropriate for introduction of this endangered plant. The number of plants in the reservoirs can change dramatically through the years depending on climate, pests and human factor. 2017 and 2018 were good years for the plant and the population size increased. However, in Bashkortostan in 2018 it was attacked by *Galerucella nymphaea* which is originally a pest of yellow water-lily (*Nuphar luteum*) that grows together with water caltrop in this region. *Lymnaea stagnalis* and aphids also damage the plants. In Orenburg Oblast bogging is the most dangerous threat to the survival of water caltrop. Despite unfavorable pH of 8,4-8,6 and high mineralization, leaf rosettes were 30% bigger than in Bashkortostan, where, however, the biggest and the smallest seeds were found. The reported study was funded by Russian Science Foundation according to the research project № 18-74-00056.

Keywords: *Trapa* L., *Trapa natans*, water caltrop, water chestnut

Epiphytic Lichen And Bryophyte Diversity On Oaks In Habitats Of Hermit Beetle (*Osmoderma Eremita)*

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Abstract

Veteran oaks, a habitat for numerous species, are getting scarce in whole Europe. Hermit beetle (*Osmoderma eremita*), living in hollows of such trees, is known as indicator and umbrella specie and has the highest conservation priority in European Union habitat directive.

The aim of the study was to investigate hermit beetle relations with epiphytic lichen and mosses. 12 study sites, 5 veteran oaks in each, were studied: 3 manor parks and 3 forests with hermit beetle present; 3 manor parks and 3 forests with hermit beetle potentially present.

Species richness in park and forest sites with hermit beetle present and potentially present did not differ significantly, however, species composition differed significantly between these sites. 2 lichen (*Arthonia byssacea, Lecanactis abietina*) and 3 mosses species (*Hypnum cupressiforme, Leucodon sciuroides, Radula complanata)* are indicators of sites with *Osmoderma eremita* present. 5 lichen species (*Anaptychia ciliaris, Lecanora chlarotera, Phlyctis argena, Reichlingia leopoldii, Xanthoria parietina)* - for sites with *Osmoderma eremita* potentially present.

Two species, included in Lithuanian Red List of Threatened Species - *Calicium quercinum* and *Sclerophora coniophaea*, were found. *Caloplaca lucifuga*, previously found only in two sites in Lithuania, was found in two more sites during our study. Three out of four sites with these rare lichen species were found in sites with hermit beetle present.

Legal protection of veteran oaks has to be ensured in both forests and parks. This would maintain habitats for hermit beetle, epiphytic lichen, mosses and also numerous other species, dependent on veteran trees.

Keywords: *Osmoderma eremita*, epiphytic lichen, moss, indicator species, umbrella species.

Functional Morphology Of The Sting In Two Digger Wasps (*Hymenoptera: Crabronidae*) With Different Types Of Prey Transport

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Abstract

Adult Crabronidae are herbivorous, but females also hunt for various terrestrial arthropods, sting and transport them to the nest as food for their carnivorous larvae. Representatives of the genus *Oxybelus* transport their prey to the nest in a very peculiar way – impaled on the sting, that is not inherent to other Crabronidae. Whether the sting morphology correlates with this specific type of prey carriage is still unclear.

We examined the sting morphology in two phylogenetically close digger wasp species *Crabro scutellatus* (von Scheven, 1781) and *Oxybelus quatuordecimnotatus* Jurine, 1807, which have similar prey spectrum, but transport prey in different ways: holding with legs or impaled on the sting, respectively. Light microscopy, scanning electron microscopy and confocal laser scanning microscopy were used in this study, to obtain structural details of sting. The homogeneity of sting material within the species and the similarity of material composition between them suggest that the material itself does not play a substantial role in the functional differences of the stings. However, the curvature of the sting shaft and the shape of sclerites, which may affect structural stability of the sting under mechanical loads, are different. Our results shed light on the relationship between morphology, material composition and function of the sting in digger wasps. We believe that structure-function relationships of digger wasp stings may be interesting in the context of biomimetics/bionics.

Keywords: CLSM, ovipositor, female genitalia, cuticle composition, curvature.

Gas Exchange Characteristics And Chlorophyll Fluorescence Of Three Dominant Boreal Tree Species During The Vegetation Season In Hemiboreal Zone, Lithuania

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Abstract

Current climate scenarios predict rising air temperature along with increasing frequency and intensity of summer drought in the Central and Eastern Europe. Severe drought episodes affect physiological processes in trees such as transpiration, photosynthesis and carbon allocation. Understanding gas exchange between plants and the atmosphere is important in woody plant research. The aim of this study was to evaluate differences in gas exchange characteristics and chlorophyll fluorescence of tree species prevailing in Lithuania (Scots pine, Norway spruce and Silver birch) and their physiological response to water stress. The study was conducted in Aukstaitija integrated monitoring station, Lithuania. Gas exchange parameters and chlorophyll fluorescence were measured during the vegetation season. Meteorological parameters were obtained from the monitoring station. Under moderate drought conditions all investigated tree species demonstrated reduced photosynthetic rates, lower stomatal conduction transpiration rates, water use efficiency and instantaneous carboxylation efficiency. During moderate drought, intercellular CO_2 concentration of Norway spruce was higher and this species demonstrated the highest decrease in instantaneous carboxylation efficiency. No significant changes of maximal chlorophyll fluorescence (Fv/Fm) among species were detected during different weather periods except Silver birch. The investigated tree species reacted differently to weather conditions. The Scots pine demonstrated the highest tolerance to different weather conditions. The study confirmed the sensitivity of Norway spruce to drought conditions. The Silver birch was the least sensitive to temperature and humidity conditions variation.

Keywords: deciduous trees, climate change, coniferous trees, photosynthesis.

Genetic Diversity Of European Beech Populations Based On Phenological Forms In Lithuania

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Abstract

Due to climate warming, especially milder winters, European beech is spreading northwards to Lithuania. This spreading is especially strong is western part of Lithuania due to more favorable climate in sea side lowland. In western Lithuania, European beech stands were planted by German foresters before the Second World War. There are two scientific problems with plantations of European beech in Lithuania. The first problem is unknown origin. The second problem could be low genetic diversity. Low genetic diversity will lead to the introduction failure because of tree injuries (low adaptability), low viability, inbreeding depression (low genetic diversity). First results of the study revealed high morphological and phenological variation among and within the European beech stands in Lithuania. Spring leave onset phenology varied from early flushing form (leaves fully open) to late flushing form (no bud burst at all over whole tree crown). This indicates high genetic diversity of introduced beech stands to Lithuania and diverse material for further genetic improvement of this tree species.

Keywords: phenology, genetic diversity, beech, introduction.

Green Synthesis Of Non-Spherical Gold Nanoparticles

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Abstract

Nanotechnology is a new fascinating field of science which opens the opportunities for discoveries in the field of biotechnology, electronics, energy, medicine and life sciences. Metal nanoparticles are of great interest due to their specific function, determined by their composition, crystallinity, size, and shape. The last few years have witnessed remarkable attention to the synthesis of non-spherical metal nanoparticles. However, the existing methods for irregular shaped nanoparticle synthesis require a shape-directing surfactant which often is hazardous what is dramatic for biocompatibility of gold nanoparticles solutions. Therefore, nowadays controlled synthesis of metal nanoparticles with well-defined size and shape belongs to one of the most fascinating aspects of nanoparticle research. Biological systems, e.g., plant extracts, have been already frequently used in the synthesis of metallic nanoparticles with the purpose to eliminate hazardous reagents. Such a green chemistry approach becomes an innovative way in the development of alternative protocols to prepare also much desired non-spherical nanoparticles. In plant extracts, a vast number of substances or group of components can work both as reducing and capping agents in the synthesis of nanoparticles. The existing number of plant species gives infinite possibilities in this field.

In the present study, we report the results of the green synthesis of non-spherical gold nanoparticles through the bio-reduction of tetrachloroauric acid using leaf extracts of selected plants (lemon balm, peppermint, juniper etc.). Nanoparticles were characterized using UV-Vis spectroscopy, infra-red spectroscopy, transmission electron microscopy, and energy dispersive X-ray spectroscopy.

Keywords: phytosynthesis, nanoplasmonics, nanoprisms, nanotriangles

History of invasion into Lithuania and present state of *Echinocystis lobata* (Michx) T. & G.

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Abstract

Riparian ecosystems are a valuable part of nature, containing numerous animals and plants of socio-economical importance, accommodating most of the rare and endangered species. Novadays inland waters are disturbed by variety of anthropogenic factors including pollution, eutrophication, fragmentation, land-use changes, climate change, overexploitation by tourists. As a result of adverse pressure, aquatic sites turn to be more accessible to invasive organisms. For Europe of temperate climate, many noxious weeds are related to aquatic environment as a main or facultative habitat. It is true in case of Elodea canadensis, Heracleum sosnovyi, Impatiens glandulifera, Bidens frondosa, Rumex confertus, Solidago gigantea. For such category, wild cucumber, Echinocystis lobata might be also attributed. When compared to the other invaders, distinctive feature of this alien, is relatively late arrival to Europe, more northern countries of continent, in special. For Baltic States history of the wild cucumber starts from the second part of the former century. Spatial and temporal aspects of Echinocystis lobata will be discussed in relation to features of the species and environmental factors facilitating spread of this species.

Keywords: alien plant, invasion, anthropogenic impact, aquatic macrophyte, wild cucumber, Cucurbitaceae.

Investigation Of The Interaction Of Peroxiredoxin 6 With Some Thiols

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Abstract

Due to the high potential of Prx6 as an effective medicine, we suggested that various thiol compounds could be used as potential reducing agents. We studied the interaction of peroxiredoxin 6 and thiols (captopril, DMPS, and DTT as a control reducing molecule) *in silico* and *in vitro*. Captopril and unithiol were chosen as compounds that already used in medical practice from our primary selection - cystamine, captopril, DMSA, DMPS, and short cysteine-containing peptides.

According to our previous computer simulations, we assumed that captopril could be an effective reducing agent [1]. Our next step was to check these patterns *in vitro*. These experiments had shown that captopril works as an efficient inhibitor of Prx6 when added to samples and exhibits insignificant inhibitory properties after 30' incubation. With regard to unithiol was able to reduce peroxides itself and to decrease Prx6 activity by five times after incubation. We suggest that this diversity among thiols could be explained by differences in their structures, electrochemical properties, etc.

The work was supported by RFBR (project no. 19-04-00080a).

Keywords: peroxiredoxin 6, thiols, molecular modeling, peroxides

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Investigation Of The Kinetics Of Amino Acid Synthesis Biocatalytic Reactions In The Organic Raw Material Fermentation Conversion

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Abstract

The process of organic raw material fermentation bioconversion with ascorbic acid salts introduced as stimulators has been studied. According to the experimental data obtained kinetic models describing the dynamics of free amino acids synthesis biocatalytic reactions have been suggested. Amino acid synthesis kinetics is shown to be accurately enough described by a degree equation similar to the equation of the chemical kinetics of fractional order.

The results of the kinetic parameters computation have proved that the rate constant and the reaction order show high sensitivity to the nature of the stimulator used. Such an effect is probably connected with the process of activation of different biocatalytic systems – amino acids producers under the influence of metals cations-part of stimulators. Kinetic parameters can also change considerably at varying the stimulator concentration that is the transformation of biocatalytic reactions mechanisms takes place.

The reverse problem of chemical kinetics has also been solved at various temperature of incubation. The computation results show that introduction of stimulators results in the increase of apparent activation energy. Simultaneously, the value of pre-exponent increases by several orders. These parameters correspond to analogous physicochemical characteristics of biocatalytic processes of amino acids synthesis. It proved that the number of reaction centers increase in amino acid synthesis reactions.

The analysis of the results obtained during the kinetic modeling allows to draw the conclusion about the important role of ascorbic acid salts in the process of activation of biocatalytic reactions of amino acids formation.

Keywords: Organic Raw Material, Amino Acid Synthesis, Fermentation Conversion, Ascorbic Acid Salts, Kinetic Modeling, Kinetic Parameters.

This work was supported by the Russian Foundation for Basic Research (grant № 18-08-00460).

Long-term investigations (1995–2018) on vectors and vector-borne pathogens in Lithuania

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Abstract

Vector-borne diseases constitute a major health problem in many parts of the world. In the past three decades, many vector-borne pathogens have emerged, creating new challenges for public and animal health in Europe. The factors that drive the emergence of vector-borne diseases are difficult to identify due to the complexity of the pathogen-vector-host triad. Long-term studies are important because they may improve our understanding of the ecological factors that shape the dynamics of vector-borne pathogens. In Lithuania, the first studies on vectors and vector-borne pathogens began in 1995. Analysis based on long-term datasets (1995–2018) of the incidence of vector-borne diseases in humans and animals in Lithuania demonstrated that exposure to ticks, mites, fleas and mosquitoes was an important factor influencing vector-borne diseases incidences in human and animals in Lithuania. The geographical and spatial distributions of some European vectors have been changing in the last few decades, and new viral, bacterial and protozoan tick-borne pathogens have been detected in former non-endemic areas. Climate changes over recent decades have led to a wider spatial distribution of ticks, and an extension in their periods of activity in Lithuania. Mosquitoes and mosquito-borne diseases have become widely established across Europe. Climatic changes, the significant increase of tourism and travel of dogs across Europe have caused an increase in the geographical range of canine babesiosis and human and canine Dirofilaria infections. Currently, the Baltic countries are an endemic area for a number of vector-borne diseases such as Lyme borreliosis, tick-borne encephalitis, anaplasmosis, babesiosis, bartonellosis, rickettsiosis, dirofilariosis. The advances in molecular biology during the last two decades and using of molecular diagnostic techniques have allowed researchers to better diagnose, trace and genetically characterize the vectors and causative agents of important endemic vector-borne diseases and have led to the discovery of new emerging vector-borne pathogenic organisms in Lithuania.

Keywords: long-term studies, vector-borne diseases, Lithuania

Management Of Digestate And Energy Production Under Anaerobic Digestion Process As Sustainable Organic Waste Treatment Strategy

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Abstract

Anaerobic digestion process is of great interest for advanced organic waste treatment management and energy recovery. Seven feedstocks suitable for biogas production were evaluated in terms of the biomethane potential: chicken manure, pig manure, grinded wheat straw, ensiled grass, grain brans, discarded food waste and grease waste resulting in 450, 353, 280, 287, 145, 540 and 929 m^3 biogas/t TS, respectively.

As a side product for energy produced (in the form of biogas), anaerobic digestion facilities generate significant quantities of collateral biomass known as digestate. The effect of solid (28% TS) and liquid (5% TS) fractions of as a biofertiliser product was evaluated on marginal eroded soil and its organic carbon, nitrogen and other chemical properties in one-year field experiment. The immediate effect on soil nitrogen, phosphorus, potassium and other chemical properties were observed in the top soil layers compared to blank (non-fertilized) fields. Digestate addition to soil gave positive effect on the yield of biomass generated during the grassland growth season, resulting in doubled dry biomass yields where 170kg N/ha fertilization rates were applied.

Such holistic approach when anaerobic digestion process is considered both as energy production and quick release biofertiliser technology should make the agricultural anaerobic digestion process the dominant technology for the waste treatment approach.

Keywords: Biogas, Agriculture, Anaerobic digestion, Waste treatment, Biofertilizer, Digestate, Waste management

Method Of Lactase Immobilization On Ceramic Membranes For Lactose-Free Milk Production

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Abstract

Today, one of the urgent problems of food industry is the development of the sector for the production of low-lactose and lactose-free products. To solve the problem of lactase activity preservation used in these processes, the technology of enzyme immobilization is being improved. Ceramic membranes possess high thermal stability, mechanical strength and bacterial resistance that makes their applying in biotechnology as a support for enzyme immobilization more preferred among other materials. Covalent enzyme immobilization, using glutaraldehyde as a cross-linker, is one of the easiest and widely investigated methods of immobilization. The purpose of this research is obtaining of enzyme ceramic membrane by lactase immobilization in a polymer layer on its surface. Structural properties of enzyme ceramic system were studied by scanning electron microscopy, functional composition was analyzed by IR-spectroscopy. To determine the activity of lactase photocolorimetric method using a glucose oxidase reagent was applied. According to the results of the experiment, the dependence of the enzyme activity on the number of cycles of its use was obtained. It is shown that the enzyme remains active for at least 3 cycles.

This work was supported by Russian Foundation for Basic Research according to the research project № 18-38-00905.

Keywords: enzyme immobilization, lactase, enzyme ceramic membrane.

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Morpho-Genetic Differentiation Of Scots Pine Mtdna Haplotypes And Bog Populations

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Abstract

The genus *Pinus* has a long evolution history and that is one of the main reasons why species of this genus have a different morphology, are adapted to different habitats and some of them are relict species. The maternally inherited mitochondrial DNA (mtDNA) haplotypes of Scots pine may have preserved distinct features attributable to their post glacial environments. Scots pine bog population because of stronger reproductional isolation may have preserved different haplotypes and specific gene pool in order to survive in harsh conditions.

The two mitotypes of Scots pine are identified by DNA markers at the Nad7.1 locus of the mtDNA: (a) the type A, mitotype originating from the southern refugia (type A) and (b) type B mitotype, originating from a northerly refugium west of the southern Ural Mountains (lacking the 5bp indel at the Nand7.1 locus). There is no significant difference between the mitotypes in seed wing shape and other seed and cone properties. Our study indicates that the connection between the present-day cone and seed morphotype, bark type and the postglacial origin in Scots pine is uncertain and no reliable morphological markers can be observed.

There are significant differences in genetic structure and diversity between bog and nearby dry site populations. AMOVA revealed significant differentiation of bog pines. Scoring for rare alleles showed two fold more rare alleles in bog pines. All this information is very important for the further genetic investigation of Scots pine and selection researches.

Keywords: bog, cone, genetic diversity, mtDNA, Scots pine, seed.

Multispectral High-Throughput Phenotyping In Evaluation Of Plant Physiological Traits Under Effects Of Various Abiotic Factors

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Abstract

In field conditions, crops are faced to huge number of abiotic and biotic factors that cause stress which negatively affects crop growth leading to yield losses. Monitoring of vegetation can prevent yield losses and thus complete one of the main tasks of modern sustainable and adaptive agriculture. Therefore, there is a demand for effective diagnostics methods that will allow performing monitoring of plant physiological status in a quick and effective manner and without damages to the crop. One of them is multispectral imaging which can be used for non-invasive phenotyping of plant traits. Multispectral analysis is based on spectral reflectance of leaf tissues, which depends on pigment content, and photosynthetic activity of plant organism. Therefore, multispectral analysis can identify stress in plants even before it becomes visible by human eye. Today multispectral data is acquired with remote sensing technologies from UAV or satellites equipped by multispectral sensors.

To determine plant physiological status several indices were described based on visible and near-infrared reflectance. Several remote sensing indices were applied to determine plant stress and check their effectiveness in stress identification in present study. We examined multispectral data obtained by imaging plants exposed to osmotic shock and herbicide influence. Results of the study can be used to evaluate adaptive potential of different crop cultivars to drought, salinity and herbicide damage.

Keywords: multispectral analysis, phenotyping, drought, herbicide damage, wheat, corn.

New Species And Records Of Philosciidae And Scleropactidae (Crustacea, Isopoda, Oniscidea) From Brazilian Caves

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Abstract

Terrestrial isopods (Oniscidea) comprises more than 3,800 species in 38 families, occurring in almost all types of terrestrial habitats, including caves[1]. In whole South America, Brazil holds the highest number of recorded caves, approximately 15,000 (15% of the total estimated, ca. 100,000)[2]. Currently, more than 190 species of terrestrial isopods are known from Brazil, of which 40 are recorded from caves and 16 are considered troglobiotic[3,4]. A large collection of terrestrial isopods has been examined from caves of the Brazilian states of Bahia, Minas Gerais, Pará, Sergipe and São Paulo. Thirteen species are recognized in nine genera of the families Philosciidae and Scleropactidae: *Alboscia* (1 sp.), *Androdeloscia* (1 sp.), *Atlantoscia* (1 sp.), *Benthana* (5 spp.), *Metaprosekia* (1 sp.), *Paratlantoscia* (1 sp.) (Philosciidae), *Amazoniscus* (1 sp.), *Circoniscus* (1 sp.), and *Microsphaeroniscus* (1 sp.) (Scleropactidae). The species recognized in the genera *Alboscia*, *Androdeloscia*, *Atlantoscia*, *Metaprosekia*, *Amazoniscus* and *Microsphaeroniscus* are new to Science. Three species in the genera *Atlantoscia*, *Amazoniscus* and *Microsphaeroniscus* can be considered troglobiotic. *Benthana longicornis*, *B. picta*, *B. olfersii*, *B. taeniata*, and *Paratlantoscia rubromarginata* are recorded for the first time in cave environments, and *Benthana iporangensis*, *B. taeniata* and *Circoniscus bezzi* have their occurrence in caves extended. The total number of Brazilian Oniscidea species is still far to be complete, including cave-dwelling species. As in many ecosystems around the globe, the subterranean environment is threatened by anthropic actions. It is necessary to increase researches on cave biodiversity, which allows to propose conservation strategies according to the current legislation[5].

Keywords: Oniscidea, new species, biodiversity, subterranean environment, Neotropical region.

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Novel Methodological Approach To Discover Super Resistant To Copper(II) Microorganisms As The Base For Environmental Biotechnologies

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Abstract

Mining of ore deposits and wastewater of enterprises are the sources of toxic copper leading to the destruction of ecosystems [1, 2]. Concentrated copper containing sewage is the most hazardous since there is no technologies of its detoxification. Therefore, theoretical background of microbial interaction with Cu^{2+} at high concentration is necessary for development of novel environmental biotechnologies. The aim was to theoretically justify and experimentally confirm the possibility of growth and interaction of soil microorganisms with toxic compounds of Cu^{2+} at super high concentrations (up to 1.0 M/L). Thermodynamic prognosis was used as the theoretical background for investigation of microbial growth and interaction with toxic Cu^{2+} at super high concentrations. Microbial resistance was determined by the number of cell forming units (CFU) on solid medium contained Cu^{2+} (100-10000 ppm) and by growth in liquid medium contained 10000-63546 ppm Cu^{2+}. Accumulation of Cu^{2+} in colonies was confirmed by H_2S. Reduction of Cu^{2+} was confirmed by formation of insoluble brown Cu_2O in colonies. Four bacterial strains of different natural ecosystems were able to grow and interact with Cu^{2+} at its super high concentrations, up to 1.0 M/L (63546 ppm). The strains were identified as *Pseudomonas* spp.. Microorganisms accumulated Cu^{2+} in colonies and then reduced to insoluble Cu_2O. The methodological approach allows isolating copper-resistant microorganisms from natural ecosystems of all geographic zones of the globe. The copper accumulation in cells and its reduction to insoluble compounds is theoretical base for development biotechnologies of super concentrated copper-containing wastewater purification and bioremediation of copper-contaminated ecosystems.

Keywords: copper(II)-resistant microorganisms, environmental biotechnologies, bioremediation, copper(II) accumulation, copper(II) microbial reduction

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Outer Membrane Vesicles (Omvs) Of Gram-Negative Bacteria *Serratia Grimesii*: A Role In Bacterial Invasion

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Abstract

Outer Membrane Vesicles (OMVs) of Gram-negative bacteria are spherical membrane-enclosed entities of endocytic origin. Enriched with bioactive proteins, toxins, and virulence factors, OMVs play a critical role in bacteria-bacteria and bacteria-host interactions. We have previously demonstrated that non-pathogenic *S. grimesii*, able to invade eukaryotic cells, can produce spherical outer membrane vesicles (OMV) ranging from 20-250 nm in size and the amount of these vesicles depends upon bacterial growth stage and environmental conditions. In this study, we analyzed the influence of non-pathogenic bacteria OMVs on epithelial cell lines. To prove the effect of *S. grimesii* OMVs on bacterial invasion HeLa and CaCo cells pre-incubated with different doses of OMVs and were subsequently infected with *S. grimesii*. Bacterial invasion was determined by colony forming unit (CFU) assay. Treatment of these cell lines with OMVs prior to infection enhanced penetration of bacteria in HeLa cells 4-fold and up to 5 fold in CaCo cells. We also analyzed influence of *S. grimesii* OMVs on macrophage THP-1 cells, similarly infected by bacteria. OMVs pre-treated macrophages became more permissive for bacterial invasion than untreated cells, and showed reduced pro-inflammatory cytokine IL-6, IL-10 induction. Proteomic content of OMVs reveals proteins which can mediate bacterial invasion like porins OmpA, OmpC and immunomodulatory molecules GroEL. Immunofluorescence staining revealed the co-localization of OMVs with clathrin near the host-cell plasma membrane, implying their uptake in clathrin-coated pits. Disruption of lipid rafts with filipin decreased entry of OMVs into cells up to 2 fold. This work was supported by RFBR grant 17-04-00558.

Keywords: *S. grimesii*, OMVs, bacterial invasion.

Pah Destruction In Oxygen Deficient Conditions By *Pseudomonas Putida* Strain Bs3701

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Abstract

Oxygen is essential for most living organisms and with the exception of anaerobic bacteria they depend on its presence in the environment. The respiration process requires the reduction of molecular oxygen (O_2) to form water and incomplete reduction may result in the production of ROS.

The efficiency of biological preparations of individual bacterial strains or consortia can be half-reduced while transferring the experiment from laboratory to real environmental conditions. The oxygen availability can influence the process of PAH destruction where microorganisms have become an instrument for purification from petroleum products.

Using RT-qPCR method we had reliably showed that activity of PAH destruction genes *naphthalene 1,2-dioxygenase* and *salicylate hydroxylase* decreases depending on reduced oxygen availabitity. However in case of *catechol 1,2-dioxygenase* we had demonstrated that microaerophilic conditions results in significant increasing of mRNA level.

In the regulatory region of naphthalene and salicylate conversion enzymes the binding site of master hydrogen peroxide-inducible genes activator OxyR was found using Visual Footprint tool. OxyR is known to modulate the expression of the oxyR regulon, which consists of several genes so oxygen limitation was verified by analysing underconrolled genes *kat* and *ahpC*.

Further experiments involve characterisation of OxyR DNA-binding ability using recently designed strains *E.coli* BL21(DE3)pLysE_pET29a.oxyR.

The research was supported by RFBR (project No.18-29-05071)

Keywords: Oxygen, Pseudomonas, Polycyclic aromatic hydrocarbons, Bioremediation

Pleminary results of cloud seeding using nano materials

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Abstract

Possible Mechanisms Of Relations Between Thermal Neutrons Field And Biosphere

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Abstract

During the global monitoring of the neutron component of the secondary cosmic rays near the Earth surface we detected the unexpected feature. This is an anomalous two-orders increase of the thermal neutron flux in biocenoses. Laboratory experiments have shown that this may be due to the effect of a virtual thermal neutron trap in heterogeneous systems. Radiative capture of thermal neutrons or spontaneous decay of free neutrons also leads to high-amplitude low-frequency oscillations of heterogeneous materials.

Keywords: Thermal neutrons, earth neutron fields, biocenoses, cosmo-biosphere relations.

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Production Of Antistaphylococcal Protein Lysk528 In *E. Coli.*

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Abstract

LysK is the phage protein with the prominent ability to lyse live staphylococcal cells disregarding any type of their antibiotic resistance[1]. Here we describe our approaches that allow obtaining the highly active recombinant antistaphylococcal protein in a relatively large amount.

On the first stage the codon composition of the LysK gene was optimized, sequence was synthesized by PCR and cloned into *E. coli* BL (DE3) cells. Within the cloning procedure several truncated derivatives of the original LysK gene were obtained and corresponding proteins were tested for antistaphylococcal activity. LysK consists of three conservative domains: two of them are catalytic and the C-terminal is cell-wall binding domain[2]. We confirmed that variants of LysK lacking C-terminal domain are much more active than original protein so derivative consisting of only two catalytic domains (called LysK528) was chosen for following application.

Unfortunately, LysK528 as well as original LysK expressed in insoluble inclusion bodies which was referred to as unrefoldable[1]. We applied several strategies for the soluble protein obtaining, including synthesis of the set of fusion-proteins and the optimization of expression conditions, but non of them brought us significant success.

Thus we decided to recover LysK528 from the inclusion bodies. The partially denaturated protein was solubilized in 6M urea followed by matrix-assisted refolding on cation exchanger SP sepharose. We managed to obtain up to 0,4g of the active LysK528 from 1L of the cell culture using this method.

Keywords: phage lysine, antistaphylococcal, inclusion bodies

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Production Of Biofuel Using Microalgae Harvested From Eutrophic Reservoir

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Abstract

Increasing the load of nitrogen and phosphorus in many water systems in the world brings algal blooms. In recent years, the potential of microalgae for sustainable energy development have been extensively reviewed, and it is foreseen that the microalgae will be the future of fuel. In this study, it was aimed to harvest the hazardous algae from water using biologically synthetized magnetic nanomaterials to consequently produce a biofuel. The lipid content of the harvested biomass was measured as 5.6%. It was determined that the obtained oil was composed of 97.7% saturated oils. In addition, the presence of mono- and di-unsaturated fatty acids has also been identified. Biodiesel is obtained by transesterification of oils and the physicochemical properties of the biodiesel were characterized. High butyric acid (43.4%), heneicosanoic acid (22.4%), heptadecanoic acid (16.7%) and undecanoic acid (12.8%) were determined in the biodiesel. It is predicted that all parameters, except acid value, meet international criteria and can be used commercially with acid modification.

Keywords: γ-Fe_2O_3, magnetic nanoparticle, biofuel, algal bloom

Research Of Bryophytes Of The Emerald Network Of Ukraine (Vinnytsia Region)

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Abstract

Bryophytes are the important component of the biocenosis, characterized by high morphological and taxonomic diversity.

The purpose of the work was to determine the bioecological structure of the mosses in the territory of the Vinnytsia region belonging to the Ukrainian part of the Emerald network of Europe. In total, 41 bryophytic species, which pertain to one division, to 3 classes (*Bryopsida, Polytrichopsida, Sphagnopsida*), to 9 orders, to 16 families and 23 genera of *Bryophyta*, were revealed during expeditionary period of June 2018. In the study of samples, 3 species of bryophytes, which were not previously mentioned in literary sources for the Vinnytsia region, were identified. [1,2].

Analyzing the herbarium material, the following was determined: the correspondence of mosses species to different types of substrates (epiphytes and epigenes predominate – 32 species), the rest are epilits; the vast majority of species with a life form – carpet (22 species).

The further prospects of the research are grounded on insufficient coverage of the issue concerning the distribution and species composition of bryophlora of the Ukrainian Emerald network.

Keywords: mosses, bryophytes, Emerald network of Ukraine, species composition.

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Residential Exposure To Road Traffic Noise In Children Population Near Major Lithuanian Roads

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Abstract

Exposure to traffic noise is considerable in agglomerations and has been associated with health effects for adults and children. Children are vulnerable to traffic noise, especially during sensitive stages of their development and researchers are investigating their health responses. More studies have investigated school or kindergarten exposure in agglomerations. Residential exposure to traffic noise is less investigated, though children spend more time at home than at school. Moreover, nighttime exposure is very important, because traffic noise at normal urban levels has been associated with sleep disturbance and its consequencies. Residential exposure to road traffic noise in children population is less investigated than exposure to the most annoying noise type - airport noise. There is a lack of investigations of road traffic noise outside agglomerations. The study is based on the results of strategic noise mapping near major Lithuanian roads (total length of the mapped network is 750 km). NMPB-Routes-96 method and the standard XPS 31-133 were used for road traffic noise (L_{den}, L_{night}) calculation with the specialized computer programme IMMI. Precise traffic measurements data were used as input data. GIS was applied for the analysis of noise exposure and children population. Residential exposure to road traffic noise was analysed for the years 2006, 2011 and 2016. The zone of noise negative impact is expanding due to increasing traffic intensity and the maximum allowed speed in some sections. The noise zone of L_{den} > 65 dBA was 109,70 km^2 in 2016 near major roads. And the estimated number of people (in hundreds) and their dwellings that were exposed to the values of L_{den} > 65 dBA in 4 m above the ground on the most exposed facade from major road sources were 36 hundreds and 1400, respectively. In average 17 percent of the inhabitants near major roads are 0-14 year old children. The study provides further insight into the scale of major roads traffic noise exposure on children population.

Keywords: road traffic noise, residential exposure, children population

Review of Projects carried out at the Instrumental Analysis Open-Access Centre

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Abstract

This presentation will focus on the recent and present research projects carried out in the Instrumental Analysis Open Access Centre in Faculty of Natural Sciences at Vytautas Magnus University. All the ongoing activities can be classified into fundamental and applied research. Fundamental research includes development of new separation and analysis methods, materials and apparatus [1]. Applied research includes downstream biotechnology and analytical methods application for revealing of quantitative and quantitative composition of the biological objects and matrices, industrial products, pollutants etc [2]. Trends in instrumental analysis, development of miniaturized, integrated analytical methods and wirelessly operated tools will be reviewed. Several approaches to increase food safety and quality using medicinal plant based biotechnologies will be presented [3]. Different approaches for fractionation and separation of the phytochemicals will be discussed.

The importance of the interdisciplinary and multidisciplinary cooperation searching for biologically active phytochemicals will be demonstrated based on the outcomes of the cooperative research projects.

Keywords: instrumental analytical methods, research projects.

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Seasonal And Daily Ungulate-Vehicle Collision Variation Analysis

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Abstract

Ungulate-vehicle collisions (UVC) are a serious problem for road planners and biologists concerned with traffic safety, species conservation and animal welfare. The ratio of UVC collision numbers increased significantly over time, suggesting a growing importance of traffic over ungulate management. Wildlife mortality caused by vehicles is a serious conservation and economic problem as collisions with large mammals are global, persuasive and increasing. Large mammals that participate in UVC are the most critical for drivers due to the animal body sizes and the respective impact consequences. To check whether ungulate-vehicle collisions indicate different seasonal and daily variation, we analysed ungulate-vehicle collision time for six major ungulate species (roe deer, red deer, moose, wild boar, fallow deer and bison) within the 2002-2017 period in Lithuania. The temporal distribution of ungulate-vehicle collisions differed, had significant tends and was animal species dependent. Our findings suggest that efforts to reduce wildlife collisions should also focus on driver attitudes because of high seasonal and daily UVC variation.

Keywords: road safety, accident analysis, ungulate-vehicle collisions, temporal risk zones

Seckel Syndrome As A Model For Studying Dna Repair Deficiency And Accelerated Aging

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Abstract

Seckel syndrome type 1 (microcephalic primordial microsomia) is a severe autosomal recessive hereditary disease characterized by advanced neurodegeneration, increased risk of tumor development, and sharply reduced life expectancy. Mutation in the *atr* gene, encoding ATR protein kinase (Ataxia telangiectasia and Rad3-related kinase), one of effector kinases of global cellular DNA damage response (DDR), serves as the cause of Seckel syndrome type 1 [1]. DDR is a signaling mechanism that coordinates cell cycle transitions, DNA replication, DNA repair, and apoptosis. When describing primary fibroblasts from patients with Seckel syndrome, significant differences were found from other progeroid syndromes, i.e. Hutchinson-Gilford syndrome [2], Cockayne syndrome [3], Louis-Barr syndrome (ataxia-telangiectasia) [4;5]. Study of the panel of aging markers (SA-β-gal, γ-H2AX, 53BP1, HP1-γ, SIRT1, SIRT6, 3meH3K9, 3meH3K27), as well as disturbances of the nuclear lamina structure and telomere shortening, it was shown that in patients with Seckel syndrome only part of these, associated with the accumulation of DNA damage and DNA repair defects, demonstrates accelerated aging, while, on the contrary, the other part, associated with epigenetic changes, corresponds to a 'younger' or, even tumor phenotype. Data obtained corroborate our hypothesis that there exists arrange of several independent patterns of aging markers [6], which allows us to consider Seckel syndrome as segmental progeria. Consequently, cell lines obtained from such patients may be applied as a model for studying aging processes and carcinogenesis, and for the purpose of testing geroprotectors, and anticancer drugs.

Keywords: primary fibroblasts**,** premature aging, ATR, Seckel syndrome, aging markers

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Simulated Forest Ecosystems Of Eurasia In The M.M. Gryshko National Botanical Garden Nas Of Ukraine

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Abstract

The M.M. Gryshko National Botanical Garden NAS of Ukraine represents plants from different places of the world, including forest ecosystems of Eurasia, which requires the creation of appropriate conditions. Results of the creation of Eurasia forest ecosystems outside of their natural habitats were summed up.

Nowadays in the M.M. Gryshko National Botanical Garden there are created 8 botanical and geographic areas, where vegetation cover modeling was carried out by introducing artificial phytocoenoses by analogy with natural ecotops, reliefs. On three botanical and geographic areas – the "Caucasus", "Far East" and "Altai" – forest ecosystems, located far beyond Ukraine, were simulated.

The botanical and geographic "Caucasus" area occupies about 6 hectares of the Botanical Garden. Today mature broadleaf forest trees are formed: beech, low-lying unsaturated forests, maple-hornbeam and lime-hornbeam, Talysh, big-bilberry-oak-crowned, arid woodland and birch and patch groves, as well as coniferous trees.

The "Far East" area occupies up to 6 hectares of garden area. It presents the main floristic complexes of the Far East: the Manchurian with cedar-broadleaf, oak and valley forests (Urem), hunting spruce-deciduous forest and the East Siberian forest with a predominance of larch and birch of Daur.

The "Altai" area occupies 1.8 hectares. Artificial phytocoenoses of typical forest groups are formed in its territory: light coniferous, dark coniferous and black taiga, as well as relict forest vegetation.

Thus, 8 sections have been formed at the botanical and geographic areas of the M.M. Gryshko National Botanical Garden, in which the flora and vegetation of forest ecotopes of the Far East, Altai and Central Asia are represented.

Keywords: M.M. Gryshko National Botanical Garden NAS of Ukraine, artificial phytocoenoses, botanical and geographic areas "Caucasus", "Far East" and "Altai".

Stable Isotopes In Dietary And Palaeodietary Studies

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Abstract

Stable isotope, mainly carbon ($\delta^{13}C$) and nitrogen ($\delta^{15}N$), analysis is common tool in both dietary and palaeodietary investigations and can be used to study either short-term or long-term diets. Moreover, in palaeostudies it can sometimes be the only source of evidence, particularly when the other sources are missing. Primarily, carbon stable isotope ratios were used to distinguish between C_3 and C_4 plants as well as terrestrial and marine resources. Meanwhile, nitrogen stable isotope ratios were used to infer trophic levels.

In this presentation, will be presented the examples of dietary studies of ancient coastal and inland Lithuanian communities as well as examples of studies conducted on modern plant and human hair samples, which provide valuable information on isotopic "baselines" and dietary preferences of individuals and can also be helpful to interpret the paleo data.

Keywords: Diet, stable isotopes, trophic relationships, isotopic baseline

Structure And Dynamics Of Soil Microbial Communities Of Natural And Transformed Ecosystems

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Abstract

Soil microbial communities play an important role in ecosystems functioning and are on the field scale essential for plant nutrition and health. On a larger scale, they contribute to global element cycling. Furthermore, they are involved in turnover processes of organic matter, breakdown of xenobiotics and formation of soil aggregates. From structure and activity of soil microorganisms is depend ecological state of soils.

The results of soil monitoring in various natural and climatic zones of Ukraine showed a clear trend for the correlation between the agroecological conditions and activity of microbiocenosis. The soil of natural ecosystems is characterized by a high total count of the microorganisms with a balanced structure of various ecological-trophic groups and balanced of mineralization-immobilization processes, organic matter decomposition and humus accumulation.

The most significant influence of agricultural activity on the soil microbiota can be observed on the poorly soddy-podzolic and gray forest soils, where the crops cultivation without fertilization resulted in a decrease in the total count of microorganisms in 2.2-4.5 times. Application of agricultural measures aimed at achieving maximum productivity, specifically the combination of mineral, organic and biological fertilizers, contributes to an average 1.3-4.1 times increase in the total count of microorganisms in the soil, compared to non-fertilized variants.

Soils with low content of organic matter and acidic medium, soddy-podzolic and gray forest soils, were characterized by a high number of micromycetes: 36-185*10^3. CFU/g soil, and a relatively low number of eutrophic and nitrogen-fixing microorganisms - 1.0-11.6*10^6 CFU/g soil.

Keywords: soil, microorganisms, ecosystem, community, monitoring**.**

Structure And Properties Of Biopolymer Nanocomposite Films Modified In Supercritical Carbon Dioxide

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Abstract

The development of antibacterial, biocompatible, biodegradable and porous films could solve the problem of the infection occurrence in the postoperative period which leads to serious postoperative complications, such as infective endocarditis.

Biocompatible, antimicrobial and wound healing biopolymers - chitosan and polyvinyl alcohol (PVA) were chosen as components of the composite films. To enhance its antimicrobial properties silver nanoparticles (AgNPs) were applied. AgNPs were synthesized in a 1% solution of chitosan in acetic acid for 10 hours (22±20°C), one silver ion accounted for 5 chains of the chitosan molecule. Then a solution of 1%PVA was added (1/3,1/2,1/1,2/1,3/1). The films were made by irrigation method. Dried composites were modified in supercritical carbon dioxide ($scCO_2$) for 2 hours (300 atm., 50°C). Tests on biofilms stability in human model blood solution (HMBS) (bovine albumin in 0.9% NaCl, pH 7.4, 50 mM HEPES) were taken to select the most time-sustained samples.

Using IR spectrometry in transmission mode, the chemical bonds of a biocomposites were studied. Cytotoxicity was assessed on a human fibroblast culture, antimicrobial properties were shown against Gram(+) and Gram(-) bacteria. TEM showed a uniform distribution of metal nanoparticles in the thickness of the samples. Nanocomposite structure of the samples has clear separation in PVA/chitosan phases. SEM showed that processing in $scCO_2$ leads to an increase in porisity of samples. Chitosan prevalence in the composition increase in the stability of composite biofilms in the HMBS by 2.5-12 times, as well as their treatment in $scCO_2$ (2-7 times).

Keywords: supercritical carbon dioxide; nanocomposite wound healing films; silver nanoparticles; polyvinyl alcohol; chitosan.

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Switching Of Actin Isoforms In Rat Neonatal Cardiomyocytes Is Accompanied By Changes In Integrins And Extracellular Matrix

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Abstract

Cardiomyocytes in primary culture undergo reversible rearrangement of their contractile apparatus with conversion of typical myofibrils into the structures of non-muscle type. Previously we have shown that this rearrangement is accompanied by transient replacement of cardiac actin by its smooth muscle isoform and depends on the extracellular matrix. The connection between cells and extracellular matrix is provided by integrin receptors, which are capable to transfer mechanical stimuli from extracellular matrix into the intracellular signaling via associated kinases. Here we show with Western-blot and immunofluorescent analysis that actin isoform switching in cultured rat neonatal cardiomyocytes is accompanied by changes in the level and distribution of integrins and integrin-dependent kinases, which changes correlate with the dynamics of extracellular matrix. The obtained results suggest that the expression of actin isoforms in cardiomyocytes may be regulated by extracellular matrix signals via integrin-mediated mechanotransduction.

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The First Dna-Machines Against Antibiotic Resistant Bacteria

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Abstract

The number of antibiotic resistant strains of bacteria is increasing. Due to this problem, by 2050 10 million people a year will being die from bacterial infections. The list of antibiotics is almost exhausted. Therefore, developing new approach to combat antibiotic resistance is important. We propose to address the drug resistance problem using deoxyribozyme based DNA-machines (DDM). We designed DNA-machine that can recognize antibiotic resistance marker and cleave mRNA of streptomycin resistance cassette with high efficiency. The proposed technique can potentially become a remedy against antibiotic-resistant bacteria.

Keywords: antibiotic-resistance, bacteria, DNA-machine, deoxyribozyme.

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The Influence Of Avena Sativa Extract On Redox Processesand Fatty Acid Composition Of Lipids In Geese Tissues

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Abstract

The use of antioxidants in bird feeding helps to eliminate the harmful influence of negative factors of various etiologies. Feeding down the natural antioxidant additives has a number of advantages if compared with traditional synthetic additives. In the grass of common oat, in addition to known bioflavonoids, there were found more compound matters of phenol nature - avenantramids, which were characterized with 10-30 times higher antioxidant activity than other natural antioxidants. **The purpose** of this research was to find out the influence of the extract of common oat Avene Satíva on the state of the redox system and the fatty acid composition of the lipids of liver and heart tissues and skeletal muscle of the geese.

In the day-old age, according to the principle of analogues, 2 groups of geese (control and experimental) were formed, each of them consisted of 26 birds. The aqueous solution of oat extract was added to the standard diet of the experimental group of geese from the 7th till the 56th day. This interval in the ontogenesis of geese includes periods of physiological stress due to the formation of a contour and juvenile feathers. The effectiveness of the Krebs cycle was evaluated by the activity of its dehydrogenases, antioxidant system was evaluated by the composition of the end products of lipids peroxide oxidation and the activity of antioxidant enzymes. At the same time, the fatty acid composition of lipids as a substrate of biological and peroxide oxidation was determined in these tissues. Coincidently, the live weight and the formation of the geese coat were controlled.

It was established that oat extract stabilized the redox system of geese during the whole period of the experiment in all studied tissues. From the 28th day, the antioxidant activity of the tissues of liver and myocard of the experimental group of geese was significantly higher. At the end of the experiment, the unsaturation of fatty acids, which is defined as the total equivalent concentration of relatively multiple bonds, increased by 11.7% in the liver, by 7.22% - in the myocardium, due to the increase in the content of polyunsaturated fatty acids, primarily arachidonic (by 29.2% and 21.5% respectively), and in the liver the increase of docosahexaenoic acid was also observed (by 34.2%). The comparative analysis of the state of coat in the investigated groups of geese indicated the significant differences and confirms better results of the geese of the experimental groups. Thus, it is proposed to conduct similar research on wild species of birds, for which the state of feather coat plays a vital role.

The Linkage Between Microbial Parameters And Density Fractions Of Soil Organic Matter In Post-Agricultural Phaeozems And Chernozems

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Abstract

After ceasing of agricultural use, degraded arable lands undergo self-restoration and development towards natural ecosystems involving the full range of physicochemical and biological processes of pedogenesis. We studied the linkage between microbial properties and density fractions of soil organic matter during post-agricultural restoration of former arable lands and estimated the duration of full recovery of soil properties after ceasing agricultural use depending on climate.

The chronosequence study was conducted in two contrasting bioclimatic zones of European Russia: deciduous forest (Albic Phaeozems) and dry steppe (Haplic Chernozems). Each chronosequence included an arable soil, 3–4 soils with increasing periods since abandonment (from 7 to 35 yrs), and reference sites with native or completely recovered soils. Soils were sampled from the toplayer 0–5 cm.

The basal respiration (BR) and microbial biomass (C_{mic}) were correlated with the content of soil organic carbon (C_{org}), total nitrogen (TN), and SOM density fractions: free particulate organic matter (fPOM), occluded particulate organic matter (oPOM), and mineral fraction (mineral–SOM). The greatest increase was found for fPOM and oPOM fractions (by 1.5–2.5 times), C_{mic} (1.9 times), and BR (1.5–2.5 times). Generally, the full restoration of all properties was faster in dry steppe (Chernozems) compared to deciduous forest (Phaeozems). To restore C_{org}, TN, and C_{mic} contents in 0–5 cm layer after the ceasing of agricultural use ca. 40–120 and 20–30 yrs are required for Phaeozems and Chernozems, respectively.

Keywords: self-restoration, carbon sequestration, microbial biomass, density fractionation

Thermodynamic Prognosis Method For Development Of Novel Environmental Biotechnologies

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Abstract

The total amount of different type of waste in environment is continuously increasing. Thus, toxic food waste filtrate, metal-containing wastewater and liquid radioactive waste are a significant hazard to environment. These problems have not yet been solved at the world level. The reason of such situation is the following. First, the enormous volumes of such waste, second, a wide range of toxic metals and radionuclides, third, extreme toxicity of each compound to organisms (Hg^{2+}, Cu^{2+}, Cd^{2+}, Co^{2+}, $^{90}Sr^{2+}$, $^{137}Cs^{+}$ etc.). Thermodynamic prognosis is universal method for development of novel environmental biotechnologies. It is the universal approach, that allows theoretically substantiating and applying all types of microbial interaction with metals and radionuclides for their detoxification. Microbial accumulation of metals and radionuclides due to their stereochemical analogy with macroelements, reduction and their precipitation by microbial exometabolites can be effectively used in biotechnology. Wastewater treatment provided purification from 10000 to 20 ppm of total carbon and trace concentration of toxic metals. Liquid radioactive waste purification allowed several orders decrease in its activity within 4-5 days. These environmental biotechnologies are promising for their industrial implementation with simultaneously valuable products obtaining - pure water and metal concentrates.

Keywords: thermodynamic prognosis, food waste filtrate, metal-containing wastewater, liquid radioactive waste, biotechnologies.

Use Of Plant Stress Response For Increasing Plant Biomass, Harvest And Production Of Biologically Active Compounds

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Abstract

Seed germination and seedling growth can be improved by the pre-sowing seed treatment with cold plasma (CP) and electromagnetic field (EF), however the molecular mechanisms of these effects remain elusive. Our experiments were performed on perennial woody species (*Morus nigra* L., *Rhododendron smirnowii* Trautv., *Picea abies*), perennial medicinal plants (*Echinacea purpurea* (L.) Moench, *Trifolium pratense L*.) and annual plant species (*Helianthus annuus, Raphanus sativus; Fagopyrum esculentum*). We report novel findings important for understanding of CP and EF effects: (i) the extent of the observed effects on germination is dependent on seed dormancy status characterized by seed hormonal balance (the most important is ratio between absisic acid and gibberrelins); (ii) seed treatments with CP and EF induce changes in the amount of secondary metabolites and antioxidative activity in tissues of growing plants. That is an important part of plant stress response leading to increased seedling establishment, defense and communication potential; (iii) results of differential proteomic analysis performed on *H. annuus* seeds and leaves of seedlings showed that CP and EMF treatments induce changes in expression of more than 30 proteoforms in seeds and more that 100 proteoforms (mostly involved in photosynthesis) in leaves, indicating that plant stress response induced by seed treatment with CP and EF involves multiple changes in plant gene expression, (iv) The results of the long-time field observations showed that CP and EMF effects on *P. abies* growth persist for more than 4 years and have impact on plant UVB stress response; seed treatments almost twice increased biomass production and seed harvest of *F. Esculentum.*

Keywords: Biomass production, Cold plasma, Electromagnetic field, Phytohormones, Plant stress response, Proteomics, Secondary metabolites, Seed germination

Variability Of Maize Endospermic Mutants On The Content Of Oleic Acid Glycerides In Oil

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Abstract

High-oleic oils are not found in the most cultivated crops, which need in genetic improvement for increasing oleate content. One of the most effective methods to solve this problem is to use the effect of endosperm mutations. Our research was aimed to establish the variability of oleate content in maize depending on the genotype and growing climatic conditions.

We have examined the unrelated maize inbreds carrying *o*$_2$, *sh*$_1$, *sh*$_2$, *su*$_1$, *se*, *sh*$_2$, *su*$_2$, *ae* and *wx* endosperm mutations (10 inbreds of each type) compared to 10 inbreds of wild - type maize for three years. Analysis of the oleate content was carried out by gas - liquid chromatography method.

The oleate content in the maize mutants was established to be mainly regulated by loci of chromosomes 3, 4, 6 and 5, linked to the *su*$_1$, *su*$_2$, *sh*$_2$, and *ae* loci, and their effect is modified by polygenic complexes. However, linkage between the oleate -coding loci and the loci of endosperm structure is likely to be not close, because the oleate content in the different inbreds – carriers of each mutant gene varied within fairly wide limits.

A higher oleate content was registered under higher growing temperature. At the same time, the mutant inbreds with narrow range of response to growing conditions were identified and they fairly stable reproduced the oleate content year by year.

It was revealed that the effective method of increasing oleate content is to use the non – allelic interactions between the mutant genes of the endosperm structure.

Keywords: maize, endospermic mutants, oleate content

Where Do The Rare Alleles Hide Themselves In Scots Pine Populations?

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Abstract

Climatic change fastens the evolutionary clock for long-lived forest tree populations. Already over a single generation trees face drastic change in the adaptive targets along with new abiotic stresses and pest invasions. Evolutionary, forest trees meet these challenges by accumulating genetic diversity reserves. Rare alleles and genotypes are one of the genetic diversity tools required for species evolution. The problem is that common commercial forest management practice may purge way the rare alleles out of the forests. We also do not really know which genepools accumulate rare alleles in Scots pine and other forest trees. Objective of our study was by the aid of DNA markers assess the effects of forest tending on loss of rare alleles in Scots pine stands. We genotyped 400 trees in a single artificially established stand of Scots pine prior to the pre-commercial thinning at 6 gene based and 6 genomic nSSR loci. Age of the trees was 20 years. We measured the diameter of the genotyped trees and assigned the trees to be eliminated by a simulated thinning based on the diameter value (thinnest trees were removed first). The results showed that up 30 percent thinning intensity no marked loss of rare alleles with frequency below 5% occurs. However, with high thinning intensities loss of rare alleles becomes significant. We conclude that intensive commercial forest management reduces rare allele frequencies. To retain rare alleles a network of conservation forests must be maintained.

Keywords: biodiversity, genetic diversity, silviculture, sustainability.

POSTER PRESENTATIONS

A Nocturnal Migrant Songbird Regularly Makes Prolonged Non-Stop Flights Of 12-60 Hours When Migrating Over The Mediterranean-Sahara Barrier

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Abstract

The Great Reed Warbler (*Acrocephalus arundinaceus*) is a medium-sized songbird that breeds in reed marshes across Europe and Western Asia. It is a long-distance nocturnal migrant wintering in sub-Saharan Africa. Like many other tropical migrants, great read warblers have to cross large barriers, notably the Sahara Desert and Mediterranean Sea. Whether songbirds use night-time flights (8-11 h long; landing and resting during intervening daytime periods) only, or prolonged (into day-light; 12-24 h) or even longer (24-64 h) non-stop flights when crossing these barriers remains a controversial issue.

In this study, we analysed geolocator data collected from migrating great reed warblers breeding in southern Central Sweden. In total, data from 28 individuals in 2012-2016 were analysed. By combining data on light level variation during the day and changes in temperature before/after vs. during flight (collected with the same geolocator), we found compelling evidence that a large proportion (68% in autumn and 78% in spring) of the great reed warblers prolonged their flights beyond the normal norm of a one-night flight (i.e., 8-11 h) when crossing the Mediterranean-Sahara barrier. Our findings showed that the most commonly used migration strategy for this medium-sized nocturnal songbird when crossing large barriers was to prolong the migration flight at least several hours into day-light, and that a large percentage (34%) even continued their flights during night and day for 24-60 hours non-stop, despite the considerable physiological strains predicted by such a strategy.

Adventitious Fish Species Of The Ukrainian Forest-Steppe Zone

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Abstract

Human large scale intervention in aquatic ecosystems especially intensively occurred in Ukraine in the last century: creation of reservoirs, canals, drainage of wetlands, the development of a wide network of water transport routes that connected various basins. The development of fish farming has led to the introduction into the reservoirs, along with commercial and some non-commercial species. The development of aqua design, in turn, has created prospects for the introduction of fish not characteristic for the water bodies. All this complex of circumstances led to the fact that the structure of the fish fauna of the water bodies of Ukraine as a whole, and the Forest-Steppe, in particular, has undergone significant changes. Part of the species disappeared, their place was taken by adventive species. Currently, in Ukraine, the aboriginal fish fauna has 221 species, 25 of them are adventitious.

To clarify the scale of introduction of small alien fish in 2016-2018, we carried out expeditionary studies of 9 reservoirs and 5 ponds of small rivers of the Forest-Steppe of Ukraine. In these water bodies we identified the following commercial species: *Hypophthalmichthys molitrix* (Valenciennes, 1844), *Ctenopharyngodon idella* (Valenciennes, 1844), *Carassius gibelio* (Bloch, 1782). In addition, non-commercial species were recorded: *Pseudorasbora parva* (Temminck et Schlegel, 1846), *Perccottus glenii* Dybowskii, 1877, *Lepomis gibbosus* (Linnaeus, 1758), *Pungitius platygaster* (Kessler, 1859), *Gasterosteus aculeatus* Linnaeus, 1758, *Syngnathus abaster* Risso, 1827. The first two species are objects of fish farming and are annually reproduced artificially. *C. gibelio* in large quantities were brought to Ukraine in the 1950 s. The conditions of the Ukrainian water bodies for this species were favourable. It successfully settled down and now has become dominant in all water bodies. Having a wider range of food, *C. gibelio* practically supplanted aboriginal *Carasius carasius* (Linnaeus, 1758), which we did not notice in any of the water bodies. Among other invaders, three species should be noted as they significantly affect native ichthyobiomes. *P. parva*, reaching a considerable number, undermines the reserves of plankton and significantly reduces the food base of planktonphagus fish. *P. glenii*, in adition to the fact that it significantly destroys benthos stocks, also destroys the other species caviar in large quantities. The shallow predator, *L. gibbosus*, significantly reduces the number of juveniles of valuable commercial fish.

In general, with a significant anthropogenic load on reservoirs (industrial, domestic, sewage, overfishing) the influence of species-invaders increases and leads to a transformation of water bodies ecosystems. Studies of the structure of populations, morphometric parameters and dynamics of the number of adventive species indicate a significant degradation of natural water bodies in Ukraine. The way out of this situation is a deep study of the processes of antropogenic impact on the biota of water bodies, the identification of patterns of stable functioning of aquatic systems and the development of measures to optimize the vital processes of water bodies.

African Swine Fewer Virus Fragments Sequence Analysis In Samples Collected From Wild Boars And Domestic Pigs

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Abstract

The ASFV genome is a linear double-stranded DNA molecule that ranges in length between isolates from about 170 to 193 kbp. ASFV encodes for between 151 and 167 open reading frames (ORFs) and the differences in genome length and gene number are largely due to gain or loss of ORFs from the multigene families (MGF) encoded by the virus. Sequence analysis of virus genomes have established that central region is conserved but large length variations occur at the terminal ends, particularly within 40kbp of the left end of the genome, bur also within 15kbp from right end of genome. ASFV genotyping is based on the analysis of three regions located at the conserved central area of the ASFV genome : sequencing of C-terminal end of the gene B646L encoding protein p72; sequencing of the central variable region within B602L-gene (CVR); sequencing of intergenic region between I73R and I329L genes in African swine fever virus and characterized by the presence of TRS.

For ASFV-positive clinical samples (spleen, kidney, lung, bone marrow, blood) collected in 2014-2016 years from infected wild boars and domestic pigs initial genetic characterization was performed by using standardized genotyping procedures on virus DNA extracted directly from homogenized tissues bone marrow and from blood samples. We compared the nucleotide sequences obtained from PCRs with those of Caucasus 2007 previously described representative isolates. We used Clustal Omega (http://www.clustal.org/) to perform multiple sequence alignments.

Keywords: ASFV, DNA, CVR, p72, genotyping

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Agricultural Production In Ukraine: Ecological Challenges And Effect On Life Quality

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Abstract

The main ecological challenges of agricultural production in Ukraine under conditions of the European integration are considered. The urgency of the chosen topic is justified by the high agricultural potential of Ukraine, which has common values and general interests in the European economic space. This is confirmed by the benchmarking analysis of the availability and efficiency of land utilization in Ukraine among 28 EU-countries. It is known that the quality of society's life depends on the environmental status, level of intensification of production and processing in the agrarian sector. It is established that Ukraine is behind the European countries by the indicators of social development. Therefore, the issue of implementing a program for the protection of Ukrainian soil resources from degradation and their effective use, taking into account social needs and environmental risks, is a problem not of a single country, but of the whole Europe as a single ecological system. The authors have identified the directions of intensification of agricultural production in Ukraine taking into account the requirements for the quality and safety of products. The approach of harmonization of normative legal acts regulating production of agricultural products is grounded and the sustainable development of ecosystems under the principles of green economy is substantiated.

Keywords: green economy, agricultural production, benchmarking of land utilization, index of social progress, intensification, organic production.

Agrogenic Biotope Transformation Of Forest-Steppe Animals Of Kazakhstan

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Abstract

Within the forest-steppe zone of Kazakhstan, there are a total of over 325 species of vertebrate animals, including mammals - 34, birds - 270, reptiles - 3, amphibians - 5, fish - 14 species. Under the conditions of continuous agricultural development the fauna of forest-steppe landscapes has undergone significant changes in terms of the reduction of species and decrease in the number of populations.Under the conditions of continuous agricultural development, the fauna of forest-steppe landscapes has undergone significant changes in terms of the reduction of species and decrease in the number of populations.It has been established that with various forms of agricultural mechanization, about 20 species of mammals and birds are subjected to powerful pressure, but the main influence accounts for the most massive widespread species whose lifestyle is related to meadow spaces totally transformed into agricultural geosystems.Within the forest-steppe landscapes, they are 12 species including only 3 mammal species (snowshoe hare, hare, and roe deer) and 9 bird species, in particular, black grouse, gray and white partridges, quail and 6 duck species.Under the influence of the anthropogenic (in our case, agrogenic) factor, the reduction of the faunistic diversity of the forest-steppe takes place and eloquently illustrates a profound transformation of natural complexes and the loss of their resistance. Within the forest-steppe landscapes of Kazakhstan, the following processes are most pronounced in this regard:

1. Destruction of individual aboriginal species.
2. Reducing the number.
3. The emergence of new species.
4. Reducing the number of dominant species due to the transformation of biotopes.

One of the reasons for the dynamics of abundance is the fluctuation of the levels of North Kazakhstan lakes. This process is mostly natural, but in recent decades it has become almost completely dependent on the state of the catchment areas. In half of the lakes of the region they are plowed 50-87%, another quarter - by 30-49%. Often, arable land is closely approached to the water edge, which leads to destabilization of the hydrological regime of water bodies, reduction of nesting areas for wetland birds, and concentration of feathered predators throughout the rest of the territory.

Analysis Of Raised Bog Humidity Conditions Using Modis Ndvi

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Abstract

Degradation of wetlands is being understood as a desiccation process due to anthropogenic factors or changing climate that have an effect on these ecosystems. However, raised bogs dominated by *Sphagnum* mosses are very sensitive to both: shortage of available water, leading to the desiccation effect, followed by the succession of woody vegetation and vise versa – the excess of available water (after extreme precipitation events, during snow melting season), leading to the saturation of *Shpagnum* cover and decrease of peatland surface. However, hydrological measurements in peatlands are rare and discrete due to the inaccessibility of the area what impedes the detection of degrading peatland areas and constrains the selection of adequate protection means. The application of cost effective remote sensing methods for assessment of humidity conditions affords the view over a large area. Therefore, we assessed the links between hydrological parameters and Normalized Difference Vegetation Index (NDVI) as well as identified spatial and temporal patterns of the raised bog vegetation condition according to NDVI in the Čepkeliai raised bog – a semi-pristine peatland in Southeastern Lithuania. The results show statistically significant relationships between NDVI and hydrological indicators of the raised bog. Considering the NDVI+/- 1SD values three vegetation condition intervals were distinguised and Čepkeliai raised bog vegetation condition maps were developed for each growing season during 2000-2018. To conclude, NDVI could be considered as the appropriate indicator for vegetation condition assessment in peatland, in order to designate temporal and spatial patterns as well as the degradation processes of the raised bog ecosystem.

Keywords: Raised bog, NDVI, humidity conditions, vegetation condition.

Antimicrobial Peptides From Plants As Components Of "Next-Generation" Hybrid Fungicides

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Abstract

It is well known that a modern integrated plant protection against fungal diseases preliminary based on chemical fungicides, usually applying in combination as a tank mixture to achieve the most significant effect. This strategy leads to deceasing quality of total yield and accumulation of some residual quantities of pesticides in plant production followed by health problems in human. A novel application in progressive plant protection is consisted of creation co-called "hybrid fungicides" based on known active chemical compound with addition of AMP-rich concentrate. This approach can allow decreasing chemical capacity on agrocenosis due to awaiting synergistic action with plant AMPs which usually possess different molecular mechanisms of antifungal action (fungistatic and fungicidal). Our studies could get positive results led to suppression of root rots (*Fusarium* spp., *Bipolaris* spp.) on wheat (*Triticum aestivum* L.) in laboratory conditions in comparison with commercial fungicide only. This work was supported by the Russian Science Foundation (project № 18-74-10073).

Keywords: antimicrobial peptides, plants, hybrid fungicides, fungal diseases, biological plant protection.

Association Between Mmp8 Rs11225395 Gene Polymorphism And Laryngeal Cancer

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Abstract

Proteins of the matrix metalloproteinase (MMP) family are involved in the breakdown of extracellular matrix in normal physiological processes, such as embryonic development, reproduction, and tissue remodeling, as well as in disease processes, such as arthritis and metastasis [1, 2]. MMP-8 has both cancer-promoting and anti-cancer properties [3, 4]. However the association between MMP-8 and laryngeal cancer has not been elucidated. According to that we aimed to determine the association between *MMP-8* rs11225395 single nucleotide polymorphism (SNP) and laryngeal cancer development.

Our study involved 569 participants including 226 patients with laryngeal cancer and 343 healthy persons from control group. DNA from peripheral blood samples was extracted using genomic DNA purification kit (Thermo Fisher Scientific, Waltham, MA, USA) according to the manufacturer's recommendations. Genotyping was carried out using real-time polymerase chain reaction (RT-PCR) method. Statistical analysis was performed with „SPSS version 20.0".

Regression analysis adjusted by age and gender showed that *MMP-8* rs11225395 each minor A allele copy significantly reduce the odds for laryngeal cancer development (OR: 0.49, 95% CI: 0.04-2.19, p = 0.048). Also *MMP-8* rs11225395 AA genotype is associating with smaller primary laryngeal tumor size (T) than GG carriers p = 0.023. Smoking habits and gender has significant effect to laryngeal tumor size too.

In concussions *MMP-8* rs11225395 polymorphism and smoking habits have a prominent interface with a primary laryngeal tumor size.

Keywords: Laryngeal cancer, matrix metalloproteinase, *MMP-8* rs11225395

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Biocatalytic Properties Of Recombinant Methylobacteria Methylobacterium Extorquens Pcm160 And Biocatalysts Based On It

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Abstract

Aerobic methylobacteria is a special group of microorganisms using methanol and it oxidized and substituted derivatives as an only carbon and energy source. Methylobacteria have periplasmic localization of PQQ-dependent methanol dehydrogenase (MDH) and can be used for the development of C_1-compounds biosensors. In this research recombinant strain of methylobacteria *Methylobacterium extorquens* pCM160, constructed on the basis of the wild strain *M. extorquens* AM1 was used. The recombinant strain contains the gene of the large subunit α-MDH - mxaF, cloned in the vector pCM160. Recombinant MDH from *M. extorquens* pCM160 has been purified to an electrophoretically homogeneous state by affinity metal-chelate column chromatography on Ni^{2+} NTA-agarose and characterized. Study of catalytic activity of recombinant biocatalysts were carried out using an amperometric transducer potentiostat IPC-Micro «Volta» (Russia). Whole cells *M. extorquens* pCM160, a cell-free extract and the isolated enzyme MDH were used as biomaterial. An effective method of enzyme immobilization using a ferrocene as mediator of electron transport and hydroxyapatite to modify graphite paste was selected. It is shown that the most selective biocatalyst is the MDH. The cell-free extract of *M. extorquens* pCM160 is the most multipurpose biocatalyst for the amperometric biosensor, since it has good analytical characteristics and is easy to perform a biosensor analysis, excluding the enzyme purification stage. The linear range of the electrode based on cell-free extract of *M. extorquens* pCM160 was: 0,01 – 0,08 mM, the detection limit was 0.0033 mM, the sensitivity coefficient was 17000 ± 1000 nA/mM (for methanol).

Keywords: methylobacteria, recombinant enzyme, methanol dehydrogenase, amperometric biosensor, biocatalysts, methanol, electron transport mediators, ferrocene.

Biochemical And Photochemical Evaluation Of Wheat (*Triticum Aestivum* L.) Genotypes Differing In Flooding Tolerance

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Abstract

Flooding is influence on photosynthesis, growth, development, significant reduction of plant productivity. In flooding the gas exchange between soil and air decreases and root hypoxia stress triggers the formation of reactive oxygen species (ROS) and induces oxidative stress in plants. To evaluate the mechanisms involved in flooding tolerance the flooding-induced changes in enzymatic (catalases (CAT), superoxide dismutase (SOD) activity) and non-enzymatic antioxidants (carotenoids, phenolic compounds) , lipid oxidation (malondialdehyde level (MDA)) and membrane electrolyte, composition of photosynthetic pigments and chlorophyll fluorescence parameters (Fv/Fm) in cell was investigated in leaf of some Latvian commercial winter wheat (*Triticum aestivum* L.) varieties .

Growth of seedlings was occurs in a climate chamber under controlled conditions (light/dark cycle, day/night, temperature, relative humidity and light intensity). The one-week seedling was separated on two groups: one group continue growth in this condition, but others group was subject to flooding. After 1-week flooding the first leaf was cut and enzymatic and non-enzymatic antioxidants, membrane damage, photosynthetic pigments and chlorophyll fluorescence parameters was investigated in leaf.

It was shown, that antioxidant capacity, membrane lipid peroxidation, composition of photosynthetic pigments and chlorophyll fluorescence parameters may be markers of flooding tolerances of wheat (*Triticum aestivum* L.) genotypes.

Keywords: antioxidants, lipid oxidation, membrane electrolyte, photosynthetic pigments, chlorophyll fluorescence, winter wheat.

Biological Activity Evaluation Of Biodegradable Thin Films With Different Azo Dyes

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Abstract

Dyes have a long history and it is an important component in our daily lives. They are widely used within the food, pharmaceutical, cosmetic, textile and other industries. Their molecules are complex aromatic structures, polar substituents and water-solubilising groups. These compounds are applied to various substrates, synthetic or natural fibres. For the natural fibres are used direct, reactive, sulphur and azo dyes. Due to their biological activity they are suitable for biocidal treatment. It is a result of some antiseptic groups present in their molecule.

However, the traditional application field of the synthetic azo dyes still remains the textile industry, but its antimicrobial properties is of great interest.

Microorganisms are playing an important role, directly affecting the environment. Antimicrobial resistance is a worldwide problem. It occurs when microorganisms evolve resistance to antimicrobial substances. There are different solutions proposed to solve this problem. One of those could be alternative molecules having antibacterial properties.

The present study is focused on the development of eco-friendly films with different azo dyes exhibiting biological activity. In this study we have work out the biodegradable thin films preparation techniques. The films containing different azo dyes were investigated with different types of *Salmonella enterica* bacteria. Their antimicrobial activity screening performed employing the disk diffusion technique. The study of their interaction with *Salmonella enterica* bacteria, the determination of effective azo dye concentration and the susceptibility of the thin films will be presented.

Bleomycin Electrotransfer Enhancement By Using Plasmid Dna

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Abstract

Over the last decade a new cancer treatment method termed electrochemotherapy has emerged. Such anticancer therapy is based on the process of electroporation. This process initiates when applied electric field is increasing transmembrane voltage of the affected cells, hence increasing cell membrane permeability that leads to increased uptake of exogenous molecules such as anticancer drugs. Currently, the combination of anticancer drug (mainly bleomycin) and the method of electroporation is used in clinics. Once inside the cell, the anticancer drug bleomycin induces the cellular DNA cleavage, that in turn leads to cell death. Previously it has been shown that big molecules (dextrans) with high net charge increase electrotransfer of bleomycin into the cells. Here we show the enhanced bleomycin electrotransfer when plasmid DNA (as a big molecule with charge) was in the media during the electroporation

We analysed bleomycin electrotransfer in Chinese Hamster Ovary (CHO) cells. For that different concentrations of anticancer drugs were used together with pDNA transfection. pMAX FGP coding plasmid in concentraton of 200 µg/ml was used. The anticancer drug bleomycin was used for electrotransfer experiments in the concentrations ranging from 0.1 to 20 ng/ml. Electroporation was performed by using combination of 1 electric pulse that induced electric fields at the amplitude of 1400 V/cm for the duration of 100 µs. Afterwards, comet assay was performed to evaluate DNA damage. In addition, clonogenic assay was done to evaluate cell viability.

Obtained results showed bigger bleomycin electrotransfer after usage of combination of bleomycin, pDNA and electroporation. In conditions of 1HV electroporation intensity, 200 µg/ml pDNA and 20 ng/ml BLM concentrations, DNA cleavage reaches up to 10%. Meantime, while electroporating the cells together with the highest BLM concentration, DNA damage reaches only circa 5 %.

Botanical Evidence of the Second World War — First Results of Research On The Territory of The Smolensk Region of The Russia

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Polemochore plants are alien plants that turn out to be outside the native habitat as a result of the military activity. This definition was used by Finnish botanists when describing the alien plants of the wars of 1939—1940 and 1941—1945, and only in the 21st century it became used for similar findings in Russia.

In Russia, the most of the locations of western species outside the main range were considered relict, such plants were included in the regional Red Books. We tried to generalize the materials on such findings. At first, we compiled criteria for classifying Central European species as polemochores of World War II. Then — for sites that are promising for the search for these species.

On its basis in 2016—2018 we conducted the field survey in the western regions of Russia: Kaluga, Orel, Smolensk and Tver regions. The initial list of polemochores included 8 species. After the 2018 survey the list was expanded to include about 30 species.

In 2018, survey was conducted on the territory of the Smolensk region. Almost at all sites considered as promising for the search for polemochores, during field survey we discovered some Western European species. In the Smolensk region in the Red Book of the region at least two species were listed, which, in our opinion, were of "military" origin (*Geranium phaeum* L. and *Primula elatior* (L.) Hill). They were known only in the western part of the region on the territory of "Krasny Bor" located in vicinity of Smolensk (in the valley of Dnieper). During the war, German storage facilities of the Heeresgruppe Mitte group were located in Krasny Bor. In 2018, in vicinity of the storage facilities of Krasny Bor we discovered 9 species, which we considered to be polemochores. It is interesting that *Geranium phaeum* had not been discovered anywhere else in Smolensk region before by the Smolensk State University scientists, while *Primula elatior* was discovered only in 2000s by the Komarov Botanical Institute of the Russian Academy of Sciences scientists near Velizh town (also at the location of the German troops). In 2018, we found both species in the new site in the south-east of the region near the village of Kobelevo (in the valley of Ugra), in the place of German storage facilities. Likewise 10 more Western European species were found near Kobelevo, including *Pimpinella major* (L.) Huds, which was first noted in the region (despite the specific search of botanists from Smolensk), and was also discovered in 2018 at the site of several discharge railway stations near Prechistoye settlement, where the German storage facilities had been located too.

The largest number of polemochore species (14 species) was found at the site of two German storage facilities located in pine forests with deciduous trees: in Krasny Bor, to the west of Smolensk in the Dnieper valley, and in vicinity of Kobelevo village in the southeast of the region in the Ugra valley, moreover, the ¾ of species coincide. The role of skidding with fodder is significant, and so far underestimated. This can be confirmed by the relatively large number of new findings of species in the region at the scene of military activity (as a result of our work, 6 species were noted for the first time in the Smolensk region), the ability to predict the place of their growth and the coincidence of their composition in different locations.

Keywords: alien plants, military activity, World War II, Smolensk region of the Russia.

C_3 And C_4 Plants As Potential Feedstocks For Conversion Into Bioenergy Products

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Abstract

The EU countries are becoming increasingly more aware that plant biomass is the raw material not only for food, forage, fibre, future industry, but also for energy (Nielsen et al., 2007). The decreasing animal production and demand for herbaceous forage in Lithuania and other European countries have shifted the interest to biofuel production from herbaceous biomass. The assessment of biomass potential for the production of useful energy will be based on the choice of optimal plant harvesting time, investigation of appropriate biomass composition, the best biogas output and composition (methane) using the laboratory equipment of the new generation available at Institute of Agriculture, LAMMC. The aim of the research work is to comprehensively investigate and scientifically validate the feasibility of use of perennial herbaceous plants for the production of bioproducts using innovative technologies.

The experiment was performed with the manometric OxiTop Control system. Biogas release of the 4 plant species (*Phalaroides arundinacea, Festuca arundinacea, Dactylis glomerata, Panicum virgatum*) from 3 diferents cuts.

The largest biogas and methane yield was given by *Festuca arundinacea* (245.1 NL / kg bw 160 NL CH4 / kg g.m., compared to other research objects. The higher biogas and methane yield of these plants can be attributed to the water-soluble carbohydrates amount in biomass (WSC 20.1%), which led by faster fermentation and degradation. *Dactylis glomerata* (38.2 NL CH4 / kg g.m.) and *Phalaroides arundinacea* (41.1 NL CH4 / kg g.m.) biomass were produced the lowest the amount of biogas and methane.

Keywords: bioenergy, biogas, energy plants OxiTop system.

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Cadmium Induced Changes In Membrane-Associated Processes Of Mitochondrial Isolated From Triticum Aestivum Seedlings

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Abstract

Heavy metals are considered the major pollutants of the environment, especially cadmium (Cd), which is highly toxic in trace amounts for humans, animals and plants. Cd was found to result in oxidative stress by either inducing oxygen free radical production or by decreasing concentrations of enzymatic and non-enzymatic antioxidants. But the mechanism of its toxicity is still not well understood, particularly in cellular and subcellular level.

So, an experiment was conducted to examine the effects of different concentrations of $CdCl_2$

(5μM, 10μM, 15μM for 5 min at 25^0 C) on mitochondria isolated from wheat seedlings. The malondialdehyde (MDA) level, ATPase and catalase (CAT; EC. 1.11.1.6) activities, and mitochondria swelling rate were studied.

For this, seeds of wheat (*Triticum aestivum L.* of "Bezostaya" variety) were moistened in water for 12 hours and then germinated on wet filter paper in Petri dishes at 25^0 C in the dark for 8 days. An increase was recorded in the MDA-level of isolated mitochondria, meanwhile the high catalase activity in mitochondria controls tended to decrease depending on the concentration of cadmium. Our results also come to show that cadmium significantly inhibits the ATPase activity through the reduction of the ATP hydrolysis. In addition, cadmium caused an increase in mitochondria volume leading to the swelling of these organelles.

Following our results, it appeared that heavy metal cadmium generates in wheat isolated mitochondria a concentration dependent oxidative stress.

Key words: Cadmium, wheat seedlings, mitochondria, MDA, ATPase, catalase, seeling.

Calcium Electroporation Efficiency Dependence On Calcium Concentration And Administration Time

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Abstract

Calcium ion distribution between extra and intracellular compartments plays a crucial role in cellular response to various external stress conditions. Necrotic and apoptotic processes are associated with intracellular calcium ion overload, because once calcium ions reach their threshold in the cytoplasm they cause changes in activity of enzymes, proteins and organelles ultimately leading to cell death. Intracellular calcium levels leading to cell death can be regulated by electroporation. This calcium electroporation is currently investigated as a novel anticancer treatment.

In this study, we have investigated Chinese hamster ovary (CHO) cell viability dynamics after calcium electroporation. Cells were electroporated using 1 high voltage (1400 V/cm, 100 µs) electric pulse in the presence of $CaCl_2$ at different concentrations (0; 0.25; 0.5; 1 mM) and different administration time points after cell treatment with electric pulses (0; 30; 60; 120; 240; 300; 600 s). Our results have shown that after electroporation cell viability was decreasing with increasing $CaCl_2$ concentration and was dependent on administration time. Further evaluation of cell viability in dependence of cytotoxic agent administration time after electroporation in the presence of calcium ions shows that calcium ions can affect pore resealing dynamics.

Keywords: Calcium electroporation, CHO, cell death, pore resealing

Cell Sensitization Induced By Application Of Microsecond Electric Fields *In Vitro*

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Abstract

Electroporation (EP) is a method that is used to induce a temporal increase of cell membrane permeability for hydrophilic molecules. Moreover, other cellular properties change as a result of cell membrane permeability deviations caused by EP. EP is triggered by inducing transmembrane potential that can be estimated with Schwan's equation. According to the stated equation the transmembrane potential has a direct dependence on the cell size. There had been articles published that indicate cell swelling after application of electric fields [1]. Induced cell swelling can increase electric field triggered transmembrane potential. Hence, the cell sensitivity to electric field can change. Such phenomena is termed electrosensitization [2,3]. Such processes could influence membrane permeability for hydrophilic molecule and are important for modelling the applications of EP. The aim of this research is to examine influence of cell size changes to the subsequent electroporation induced molecule electrotransfer.

CHO cells were subcultured a day before the experiment. For cell size measurements we used high voltage (HV) electric pulses with amplitude from 800-2000 V/cm for the duration of 100 µs, after electroporation and incubation of 10 min we took photos of cells by using Kern OCO-255 inverted microscope. Sizes of the cells were measured by using open source ImageJ software.

For PI electrotransfer efficiency measurements, we used 2 or 8 HV, 1400 V/cm pulses and after 1, 5, 10 and 15 min time interval PI (40 µM) was put with an application of additional 1 HV pulse. Then, cells were plated for flow cytometry measurements were performed 10 min after the incubation procedure.

The results indicate that cells can decrease or increase in size depending on applied electric field. According to Schwan equation this deviation can change the induced transmembrane potential, thus altering the EP and subsequent process of molecule electrotransfer. Nevertheless, we indicate that PI electrotransfer is independent on cell size change. Therefore, induced PI electrotransfer does not go directly with the estimation of triggered transmembrane potential (according to Schwan equation). This allow us to experimentally obtain both sensitization and desensitization phenomenon in cells affected with microsecond electric field.

Keywords: electroporation, eletrosensitization, PI electrotransfer, cell swelling

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Cell-Iq Microscopy And Rtca For Real-Time Investigation Of Multipotent Mesenchymal Stromal Cells Cocultured With Leukemic Jurkat T Cells

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Abstract

Leukemia initiation and progression are connected with a disfunction of multipotent mesenchymal stromal cells (MMSCs). Continuous monitoring of MMSC and tumor cell interaction is a promising tool for cellular biology, biotechnology and environmental research. An average velocity of cell division (AVCD) of human adipose-derived MMSCs (hAMMSCs) contacted *in vitro* with Jurkat line of human leukemic T lymphoblasts (Jurkat T cells) was studied by means of Cell-IQ v2 MLF integrated phase-contrast microscopic platform for real-time surveillance imaging of living cells. Both 70 μL suspensions (5×10^4 viable karyocytes) of the CD73CD90CD105+ adherent cells and Jurkat T cells were applied into the center of the well of 12-well plastic plates for 7 days at 100% humidity in a 5% CO_2 atmosphere at 37°C until the formation of a monolayer. A nutrient medium was once replaced. To determine cell invasion (chemotactic motility) through 8 μm pores the real-time cell analysis (RTCA DP Analyzer; Roche Diagnostics GmbH, Germany) with the CIM-plate was used.

AVCD of fibroblast-like adherent hAMMSCs was 0.27-0.63 divisions/h. No Jurkat T cells influenced statistically. RTCA system showed significant hAMMSC invasion toward to tumor cells and not vice versa. For all this, cellular interaction led to increasing Jurkat T cell and decreasing hAMMSC viability. Thus, Jurkat T cells could promote leukemic stromal microenvironment for their progression and metastasis. Cell-IQ and RTCA could be useful tools for *in vitro* real-time simulation and imaging of morphofunctional interplay between health and tumor cells. The investigation was funded by the Russian Science Foundation (grant number 16-15-10031).

Keywords: Cell division, invasion, viability, in vitro.

Change Of Soil Phosphatase Activity During Inoculation Of Sugar Beet Seeds By Polymycobacterium And Agrofil

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Abstract

Enzymes of the soil, including phosphatase, are the product of the metabolism of soil biocenosis. [1]. Under the influence of mineral fertilizers, pesticides, weather conditions, the microflora and the enzymatic activity of the soil changes, that accurately reflects the biological properties of the soil and their changes under the influence of anthropogenic factors [1]. As a result of long-term agricultural production, the biologically valuable microflora of the soil has been decreased. The coefficient of phosphorus use is no more than 0,60. As a result of the facts meaned above a number of mineral phosphorus insoluble in soil solution and organic phosphorus in different soils5-24 t / ha in terms of P_2O_5 has been accumulated. To reduce the anthropogenic impact of pesticides, mineral fertilizers and soil phosphorus solumobilization, the phosphate mobilizing bacterial drug Polymixobacterium - based on strain of bacteria Bacillus polymixa strain - KB [3], Agrofil - a nitrogen fixing agent based on the strain of associative bacteria Agrobacterium radiobacter 10 that inoculates seeds of sugar hybrids beets have been used. The research was conducted on the gray forest oxidized dust-soils alkaline soils at the Vinnytsia SSGDS and the research field of VNAU. Determination of phosphatase activity was carried out by the method of I. T. Geller and K. E. Ginzburg. The research was carried out in 2000-2018 at various organoleptic mineral feeds (without fertilizers, N_{160} P_{120} K_{160} and N_{160} P_{120} K_{160} + Manure, 32 t / ha) and in different weather conditions. During inoculation with Polymycobacterin, an increase in the phosphatase activity of the soil in the rhizosphere of sugar beet root crops was found to be 15-38% ($P>0.95$) in comparison with control. When co-inoculated with Polymycobacterin and Agrofil, the soil phosphatase activity in the root crop rotation was increased by 21-46% ($P>0.95$) with a significant trend increase in phosphatase activity during vegetation in both experimental variants.

Keywords: phosphatase, sugar beet, phosphate solumobilization, nitrogen fixing.

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Characterization Of Oxidative Stress In Tobacco Shoot Culture *In Vitro*

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Abstract

Agrobacterium mediated plant transformation is the most efficient way of introducing new genes into various plant species. *Agrobacterium* is a genus of Gram-negative bacteria that are widely used for T-DNA transfer and integration into the plant genome [1]. Prolonged plant exposure to *Agrobacterium* infection has a detrimental effect to plant health and in some instances may result in cell apoptosis or plant tissue necrosis [2]. The most efficient for *Agrobacterium* elimination after the transformation, and least deleterious for the plant is antibiotic timentin. Timentin belongs to a class of β-lactam antibiotics that provoke bacterial death of Gram-negative bacteria by cell wall lysis [3]. However, a common problem in plant regeneration after transformation, is a poor plant growth during and after the antibiotic treatment. Most likely, this decline in plant growth can be related to oxidative stress, where tissue lipid peroxidation and accumulation of reactive oxygen species (ROS), such as hydrogen peroxide (H_2O_2) and superoxide (O^{2-}) radicals indicate that the plants are under stress.

The aim of this study was to evaluate stress related biochemical characteristics of several tobacco shoots grown on media supplemented with timentin. Stress related production of O^{2-} and H_2O_2 were measured using Nitro blue tetrazolium (NBT) and 3,3′-diaminobenzidine (DAB) staining, together with lipid peroxidation (MDA) assay. Our results showed that exposure to the timentin affects the accumulation of the oxidative stress related byproducts. As these products have the capacity to cause oxidative damage, it is an important factor for tobacco regeneration and overall growth. Further research aims to establish plant stress reducing methods that could improve shoot regeneration and growth while still using the same antibiotic for efficient elimination of *Agrobacterium* from the transformed plant tissues.

Keywords: *Agrobacterium*, tobacco shoots, timentin, oxidative stress, ROS, *in vitro*.

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Cleavage Of Ompx With Protealysin Can Regulate *Serratia Proteamaculans* Invasion

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Abstract

Bacteria *Serratia* sp. are facultative pathogens able to cause nosocomial infections. Previously, we have shown that *Serratia proteamaculans* 94 can penetrate into eukaryotic cells. This capability correlates with the activity of actin-specific protease protealysin. However, inactivation of the protealysin gene resulted in a more than twofold increase in the invasive activity of *S. proteamaculans* Pln(-). This tempted us to search for other *S. proteamaculans* virulence factors which activity could be regulated by protealysin. By the combination of 2D-electrophoresis and mass-spectrometry, one of the bacterial substrate for protealysin was determined as the outer membrane protein OmpX. OmpX is a key participant in the pathogens invasion. It is also known that the iron limitation leads to OmpX accumulation [1]. The aim of our work was to reveal the effect of iron depletion on activities of the virulence factors and invasion by wild-type *S. proteamaculans* and *S. proteamaculans* Pln(-). Iron depletion increased activity of known virulence factors, the pore-forming toxin ShlA and serralysin, in wild-type *S. proteamaculans* 2-3 times more than in *S. proteamaculans* Pln(-). In contrast to these effects, the iron depletion increased invasion of *S. proteamaculans* Pln(-) 5 times more than that of wild-type *S. proteamaculans*. Apparently the lack of protealysin in *S. proteamaculans* Pln(-) promotes accumulation of uncleaved OmpX, which can contribute to the invasion. Thus, accumulation of outer membrane protein OmpX may lead to the increased *S. proteamaculans* invasion, and protealysin can regulate this process. *This work was supported by the RSF grant 17-74-10045*.

Keywords: virulence factors, bacterial invasion, protealysin, Serratia, outer membrane protein OmpX

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Climate Related Changes Of Spring Barley Phenology In Lithuania

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Abstract

Global warming is gaining significance as a threat to ecosystems, since temperature is one of the major abiotic constraints to productivity. Considering that better understanding of the effects of climate change on phenological development of field crops may help to optimize their management schemes and increase productivity. But most of attention is concentrated on winter crops leaving spring crops aside. The purpose of this study was to trace long-term spring barley phenology trends, and to predict changes in different phenological phases timing and duration, for the current century. The purpose of this study was to trace long-term spring barley phenology trends, and to predict changes in different phenological phases timing and duration, for the current century. The temporal and spatial phenological trends of spring barley (*Hordeum vulgare* L.) over the period of 1961-2015 were analyzed using data of the phenological observation network at 7 phenological sampling sites located throughout Lithuania. Over the investigated period mainly two cultivars (Auksiniai II and Auksiniai III) were grown in the study area. For future climate, five global circulations models (GCMs)(MPI-ESM-LR; IPSL-CM5A-LR; CNRM CM5; HadGEM2-AO and HadGEM2-ES), were selected, together with two highest contrasting future climate change scenarios - RCP2.6 and RCP8.5. For the phenological analysis the amount of accumulated temperature required for the occurrence of the following phenological phases of spring barley were evaluated: sowing, emergence, heading, and harvest. It was found that temperature increase significantly affected agricultural management schedule by altering the occurrence of sowing and emergence dates. Retrospective trend of spring barley harvest dates showed rather a slight delay. Such changes resulted in the prolonged total vegetation period of spring barley by more than 12 days over the investigated period of 1961-2015. Lithuania is situated by the side of Baltic Sea, an increase in temperature was characteristic along with an increase in distance from the sea over the last 55 years. According to RCP 2.6 and RCP 8.5 climate change scenarios projected changes of spring barley phenological phases differ in the occurrence significantly from analysed historical changes, also advancement of all phenological phases have been projected. According to the pessimistic (RCP 8.5) climate change scenario a shortening of the total vegetation time by 5 days is expected for the far (2071-2100) future.

Keywords: Spring barley, phenology, climate change, projection

Cloning And Characterization Of Recombinant Protein Cpf1 From V Type Crispr/Cas System From Moraxella Bovis

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Abstract

CRISPR system is known as last generation tool for genome editing. Searching for new nucleases from CRISPR systems is important work to expand the potential sequences types for targeted modification. Cpf1 has some advantages over Cas9 such as less off-target activity and another PAM-site recognition but there are just a few described enzymes. Bacteria of the genus *Moraxella* are known to have CRISPR / Cpf1 systems but they have been poorly studied. In this study, our goal was to obtain Cpf1 from genus *Moraxella* and characterize it.

Gene *cpf1* was detected in two available *Moraxella* strains: *M. bovis* and *M. nonliquefaciens*, complete nucleotide sequence was determined for *cpf1* from *M. bovis*. The gene encoding the enzyme was cloned into pET15b vector and expressed in two forms – with and without N-terminal 6X-His olygopeptide. Purification method developed for His-tag variant include three steps of HPLC using such resins as Ni-NTA, Sephacryl S-200 and hydroxyapatite and resulted in almost homogeneous preparation of active protein. It was shown that Cpf1 from *Moraxella bovis* exhibits nuclease activity in vitro using the sequence TTTN as PAM site. It was found that optimal NaCl concentration during DNA hydrolysis is 100 mM and pH 7.0-8.5 in the range of 7.0-8.5 does not affect the efficiency of hydrolysis.

Keywords: CRISPR/Cas, Cpf1, genome editing

Combined Effect Of Future Climate And Uv-B Radiaton On Garden Lettuce

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Abstract

Climate change, apart from direct effects on living organisms, may change their sensitivity to other environmental factors. This study was designed to investigate the shift of UV-B resistance of leafy vegetables at current and future climate. The garden lettuce (Lactuca sativa L. "Grand rapids"), garden rocket (Eruca sativa Mill. „Rucola") and spinach (Spinacia oleracea L., „Emilia H") were grown in pots in Phytotron growth chambers under current (21.5/16 ℃ day/night temperature, 800 ppm CO_2) and future climate (CC and FC, respectively) conditions with and without additional UV-B radiation (0 vs. 6 kJ/ m^{-2} d^{-1}). FC conditions corresponded RCP 6 and RCP 8: 23.5/18 ℃ day/night temperature, 800 ppm CO_2 and 26.5/20 ℃ day/night temperature, 800 ppm CO_2, respectively. UV-B radiation under the current climate stimulated plants growth, it was especially obvious in spinach (51% increase in dry above-ground biomass and 76% increase in leaf area). Increase in photosynthetic pigments concentrations and reduction of membrane oxidative damage was also detected in all investigated plant species. Future climate positively affected plants growth, and physiological parameters; however, tended to reduce their resistance to UV-B radiation. UV-B reduced shoot height of all investigated species under FC conditions. The strongest UV-B induced reduction in leaf area, and dry above-ground biomass were detected in garden lettuce (49 % and 31%, respectively), nevertheless these vegetables maintained low leave MDA concentration under combined FC and UV-B treatment. In contrast, dry biomass and leaf area were little affected by UV-B under FC conditions in both garden rocket and spinach. However, oxidative damage was increased due to UV-B radiation in the leaves of these plants, grown under FC (RCP 8) conditions.

Keywords: Climate change, UV-B radiation, leafy vegetables, oxidative stress.

Concentration Dependence Of The Effect Of Egfr Ligands On Human Endometrial Mesenchymal Stromal Cells

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Abstract

The mesenchymal stromal cells derived from desquamated human endometrium (enMSC) express epidermal growth factor receptor (EGFR) at the levels similar to cancer cell lines such as HeLa and A549. EGFR was shown to be involved in endometrium functioning, but its role in MSC is studied poorly. EGFR has 7 ligands that lead to various physiological responses depending on differential regulation of EGFR endocytosis and signaling. Thus, TGF-α and amphiregulin (AREG) are known to route EGFR to the recycling pathway, while EGF cause lysosomal degradation of majority of the receptor. In cancer cell lines EGF and some other ligands in concentrations less than 0.01nM was shown to activate proliferative MAPK cascade, but high concentrations suppress cell proliferation, despite the same level of MAPK cascade activation.

We have shown that under stimulation with 10 nM EGF or 20 nM TGF-α the proliferation rate was similar, but higher than in unstimulated enMSC. Surprisingly, EGFR was delivered to lysosomes after binding with the both TGF-α and EGF and the dynamics of Erk activation was similar in enMSC. Here we analyze the effect of the two EGFR ligands and AREG in enMSC depending on their concentration. We obtained concentration dependence of proliferation and activation of downstream signaling molecules, such as Erk, Akt and Stat3. The result will be discussed.

The reported study was funded by RFBR according to the research project № 18-34-00188.

Keywords: mesenchymal stromal cells, epidermal growth factor receptor.

Cooperation Of Free-Living Nematodes *Turbatrix Aceti* With Oil-Degrading Bacteria *Alcanivorax Borkumensis*

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Abstract

Microorganisms that use oil as a food source are crucially in bioremediation of oil-contaminated habitats. Nematodes can be efficient in oil degradation, because they are able to regulate the diversity of microbial communities and stimulate the reproduction of microorganisms in the oil-contaminated soil [1]. The cooperation between nematodes and oil-degrading bacteria can be exploited the for new biotechnological strategies to accelerate the processes of bioremediation of the environment. The goal of this study was to investigate the relationship between free-living nematodes *Turbatrix aceti* and oil-degrading bacteria *Alcanivorax borkumensis*.

According to the results of nematode chemotaxis assay using the bacteria *A. borkumensis* (2.2×10 9 CFU) and *Escherichia coli* (2.2×10 9 CFU) as a control, we found that *A. borkumensis* bacteria do not repel nematodes (chemotaxis index was -0.2), and nematodes have approximately the same preference for both – *E. coli* (52 %) and *A. borkumensis* (48 %). Nematodes of the same age were cultivated in three different media: in oil-contaminated nematode growth medium with and without bacteria and in pure (no oil added) medium with bacteria.

Using various microscopy techniques, oil was detected along the entire length of the nematode digestive system. We found that nematodes, cultured in the absence of bacterial food in oil-contaminated medium passed through all stages of development, although they had a low reproductive potential. In oil-contaminated medium supplemented with oil-degrading bacteria the nematodes developed in the same way as in a standard nutrient medium enriched with bacterial food.

The study was performed within the Russian Government Program of competitive Growth of Kazan Federal University and supported by RFBR Grant #18-34-00778mol_a.

Keywords: bioremediation, oil-degrading bacteria, *Alcanivorax borkumensis*, nematode, *Turbatrix aceti*

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Cryoprotective Solution As A Vehicle For Local Cell Delivery

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Abstract

Cryopreservation ensures long-term storage and on demand availability of cellular material for therapeutic applications. Toxicity of conventional cryoprective media, including 10% DMSO, impedes direct administration of cellular product immediately after thawing.

The aim of this study was to assess the possibility to apply blood plasma based cryoprotective medium as a vehicle solution for local cell delivery into wounded skin area.

Adipose tissue derived MSCs from passages 4-6 were used in the study. Prior to cryopreservation, MSCs were pretreated with sucrose. Cryoprotective solution consisted of platelet poor plasma (PPP), sucrose, and non-toxic 1% DMSO. After thawing, cell recovery was assessed by Alamar Blue test. To examine the potential benefits of PPP as a system for cell delivery to a damaged area, cryoprotective solution was mixed with calcium chloride and serum. Obtained gel-forming carrier with MSCs was applied on skin excision wound model in mice. Healing rate was evaluated throughout the 2-week period by planimetric and histological examination.

Cryopreservation of cells in PPP with only 1% DMSO and sucrose ensured high post-thaw viability (up to 77%). Addition of calcium chloride to the PPP-based cryoprotective solution led to gel formation in situ. Application of MSCs in hydrogel provided 2 times faster wound closure at day 3 compared to self-healing control, and this stimulating effect persisted over a week. Complete restoration of the damaged area by day 14 was observed.

Our results demonstrate the possibility to apply cryopreserved cells immediately after thawing using cryoprotective medium as a vehicle solution.

Keywords: multipotent mesenchymal stromal cells, cryopreservation, localized delivery, wound healing.

Decision Support System For Water Quality Assessment Based On Long-Term Monitoring And Biological Modelling

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Abstract

Monitoring, risk estimation and prediction of changes in water quality are important tasks in environmental sciences. Good indicators of water quality are phytoplankton, zooplankton and zoobenthos populations, which are often monitored either by scientists or environmental authorities.

We propose a Geographic Information System (GIS) with biological models backed up by long-term monitoring data that together form a Decision Support System (DSS) for water quality assessment. GIS part provides visualization for accumulated monitoring data and results of biological modelling. The designed web-based GIS provides several interfaces to access and manipulate biological monitoring data such as visual query builder, heatmap visualization tool, report generation tool and RESTful API for data access.

We apply methods of control theory to synthesize control laws for population processes in "predator-prey" ecological system described by Lotka-Volterra equations, as well as more complex models. Those models are used to investigate relationships between nutrients, phytoplankton and other species in the water body. The task of managing population dynamics with a system of differential equations can be achieved by synthesis of control laws that are able to keep "prey" and "predator" populations inside a predefined range. Introduction of additional parameters allows to fine tune models so they reflect a water body state under specific initial conditions. Behavior of synthesized models is investigated under different initial conditions and modelled results are compared with real monitoring data from the Neva Bay and the Eastern part of the Gulf of Finland.

Keywords: geographic information system, predator-prey model, Lotka-Volterra equations, control theory.

Design And Verification Of The Functioning Of Genetic Constructs For Dna Vaccine Against Pcv2

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Abstract

Porcine circovirus type 2 (PCV2) causes a number of infections and syndromes known under the general term porcine circovirus associated diseases which provoke a great economic damage in pig farming worldwide [1]. This study is focused on design of genetic constructs which can be used for development of DNA vaccine against PCV2. Two genetic constructs were derived from the commercial plasmid vector pVAX1 («Invitrogen»), one of them contains full-size native open reading frame (ORF) of circovirus capsid protein and the second has an ORF corresponding to the same protein without the first thirty N-terminal amino acids coding the nuclear localization signal [2]. The Kozak sequence and appropriate sites for restriction enzymes were introduced upstream of both ORFs by PCR [3]. Each construct was cloned in the *E.coli* XL-1 Blue cells. The purified plasmids were used for calcium phosphate transfection of the HEK 293 cell line. Transfected cells were lysed followed by examination for the presence of the PCV2 capsid protein using ELISA. The received data showed expression of the circovirus capsid protein in all tested samples but in small amounts. Nevertheless, expression of the truncated protein was more intensive than the native one.

As a result of this work two genetic constructs based on the plasmid vector pVAX1 were obtained: one with the full-size and another with the shortened ORF of the PCV2 capsid protein. Both of our DNA constructs showed detectable expression level of the antigenic proteins in mammalian cells that meets preliminary requirement for DNA vaccine development.

Keywords: porcine circovirus, DNA vaccine, genetic construct.

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Development Of A Method For Enriching Ngs Libraries With Extracellular Dna Sequences Carrying Somatic Mutations

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Abstract

Determination of point mutations in extracellular DNA from blood plasma is a promising method for diagnosing colon cancer due to its high specificity and non-invasiveness. However, the proportion of DNA carrying somatic mutations is extremely small in the blood plasma (0.01–5%), and the sensitivity of existing methods for detecting mutations using Next Generation Sequencing (NGS) is not sufficient for effective analysis. In this regard, the development of a method for enriching NGS libraries with extracellular DNA sequences carrying somatic mutations becomes an urgent task.

One of the methods being developed includes enriching libraries with mutant sequences by forming heteroduplexes. On a model of plasmid DNA containing the PIK3CA gene sequence with the mutation c.3140A> G (nucleotide substitution) and wild type, heteroduplexes were formed and the change in the proportion of mutant DNA in them was evaluated. It was established that with the heteroduplex formation, it is possible to increase the proportion of mutant sequences in the analyzing samples on a model of plasmid DNA.

An alternative method is the enrichment of NGS-libraries of tumor DNA, based on the difference in the lengths of tumor and leukocyte DNA fragments, which are supposed to be separated from each other using gel electrophoresis. To date, the preparatory stage of work has been carried out - the optimal concentrations of enzymes have been selected for ligation of adapter sequences for the MiSeq platform. Selected enzyme concentrations allow efficient ligation even with a low amount (0.4 ng) of the original DNA template.

Keywords: cancer, diagnostics, extracellular DNA, NGS-libraries, heteroduplex.

Dna Analysis Of Parasitic Dermanyssoidea Mite Species From Small Rodents In Lithuania

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Abstract

Dermanyssoidea (Mesostigmata) mites are facultative and obligate parasites, which distinguished by microscopic size and usually found on small mammals. Dermanyssoidea is an extremely diverse mite superfamily. The species identification of Dermanyssoidea mites due to their morphological similarity is complicated. Identification is also aggravated by a lack of knowledge on this mites family, as there is relatively little information on the morphological characteristics that can be used as taxonomic keys. Therefore, DNA-based molecular methods could be useful tools for accurate identification of dermanyssoid mites. The aim of this study was to genetically characterize mites parasitizing small rodents using molecular methods. A total of 413 parasitic mites were collected from small rodents of six different species caught in Lithuania during 2015-2016. For taxonomic molecular analysis, 31 specimens from different rodent hosts were selected. After primary morphological analysis, using appropriate identification key, six species of ectoparasites were identified as *Laelaps agilis*, *Lealaps hilaris*, *Hyperlaelaps microti*, *Haemogamassus nidi*, *Eulaelaps stabularis* and *Myonyssus gigas*. For the determination of phylogenetic relationships among dermanyssoid mites, the 28S region (domains 1-3) of the nuclear ribosomal DNA was used. Sequences were edited, aligned and subjected to phylogenetic analysis using Mega 6.0 software. The present study is the first genetic characterization of *L. agilis*, *L. hilaris*, *H. microti*, *Hg. nidi*, *E. stabularis* and *M. gigas* mites. Our results provide new information on phylogeny of Laelapidae mites.

Keywords: Dermanyssoidea, Laelapidae, mites, molecular taxonomy, Lithuania

Dna Methylation-Based Age Prediction From Blood: The Level Of Methylation Of 5 Cpg Markers

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Abstract

In 2018, the methylation level of 5 CpG markers for peripheral blood samples from [Naue et al.] It was analyzed for 150 people of Belarusian nationality (Minsk, Republic of Belarus) using SNaPshot technology. 2017] - cg14361627 (KLF14 gene, Kruppel like factor 14, NCBI Gene ID - 136259), cg16867657 (ELOVL2 gene, ELOVL fatty acid elongase 2, NCBI Gene ID - 54898), cg16054275 (F5 gene, coagulation factor V, NCBI Gene ID - 2153), cg06784991 (ZYG11A gene, zyg-11 family member A, cell cycle regulator, NCBI Gene ID - 440590), Chr3: 51741152 (GRM2 gene, glutamate metabotropic receptor 2, NCBI Gene ID - 2912).

The lowest methylation level was noted for CpG cg14361627 (KLF14 gene) - 4.74 ± 2.40%, the highest - for cg16867657 (ELOVL2 gene) - 54.83 ± 14.02%. The widest range of values obtained is noted for cg16867657 (ELOVL2 gene) - 27.80-80.00%. The highest correlation coefficient (R) characterizing the CpG potential for solving the problem of determining the chronological age by DNA methylation level was shown for CpG cg14361627 (KLF14 gene) - 0.570 ($p = 0.0002$), then, in order of decreasing R, CpG markers cg06784991 (ZYG11A gene) - 0.529 ($p < 0.0001$) and cg16867657 (ELOVL2 gene) - 0.521 ($p = 0.0129$). For CpG markers cg16054275 (F5 gene) and Chr3: 51741152 (GRM2 gene), no statistically significant associations were found between the methylation level and chronological age.

The results obtained will be used to construct a regression model for determining the chronological age of an individual in blood samples.

The study was carried out within the framework of the Union State Scientific and Technical Program “Development of innovative geno-geographical and genomic technologies for identifying individuals and individual human characteristics based on studying gene pools of Union State regions” (“DNA identification”), Measure No. 2 “Developing a method for determining the likely age of an individual characteristic of its DNA ”(Minsk, Republic of Belarus).

Dna Methylation-Based Age Prediction From Saliva: The Level Of Methylation Of 7 Cpg Markers

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Abstract

In 2018, within the framework of the Union State Scientific and Technical Program "Development of innovative geno-geographical and genomic technologies for identifying individual human characteristics based on the study of gene pools of Union State regions" ("DNA Identification"), Activity No 2 "Development of a method for determining the probable age of an individual characteristic of its DNA "(Minsk, Republic of Belarus). According to the Activity, the methylation level of 7 CpG markers in buccal epithelium (saliva) samples from [Hong et al. 2017] for 150 people of Belarusian nationality - cg14361627 (KLF14 gene, Kruppel like factor 14, NCBI Gene ID - 136259), cg08928145 (TSSK6 gene, testis specific serine kinase 6, NCBI Gene ID - 83983), cg00481951 (SST gene, somatostatin, NCBI Gene ID - 280932), cg12757011 (TBR1 gene, T-box, brain 1, NCBI Gene ID - 10716), cg18384097 (PTPN7 gene, protein tyrosine phosphatase, non-receptor type 7, NCBI Gene ID - 5778), cg07547549 (SLC12A5 gene, solute carrier family 12 member 5, NCBI Gene ID - 57468); cg19671120 (CNGA3 gene, cyclic nucleotide gated channel alpha 3, NCBI Gene ID - 1261).

The potential of each CpG for solving the problem of determining the chronological age by the level of methylation (in %) can be characterized based on the calculation of the coefficients of correlation and determination. The highest correlation coefficient (R) was detected for CpG cg07547549 (SLC12A5 gene) - 0.801 ($p < 0.0001$), then in descending order of R we located CpG: cg14361627 (KLF14 gene) - 0.747 ($p < 0.0001$), cg12757011 (TBR1 gene) - 0.632 ($p < 0.0001$), cg00481951 (SST gene) - 0.542 ($p < 0.0001$), cg18384097 (PTPN7 gene) - 0.382 ($p < 0.0001$), cg08928145 (TSSK6 gene) - 0.356 ($p < 0.0001$). For the CpG marker cg19671120 (CNGA3 gene), statistically significant associations between the methylation level and chronological age were not found. The lowest level of methylation was noted for CpG cg14361627 (KLF14 gene) - 6.71 ± 3.89%, the highest - for cg08928145 (TSSK6 gene) and was 44.40 ± 9.26%. The widest range of values obtained is noted for cg18384097 (PTPN7 gene) - 2.10-92.60%.

The results will be used in constructing a regression model to determine the chronological age of the individual in saliva samples (buccal epithelium).

Keywords: chronological age, DNA methylation, epigenetic markers, saliva, buccal epithelium

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Dynamics Of Changes In The Content Of Anti-Ice Materials Salts In The Soils During The Growing Season

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Abstract

Anti-ice materials that are applied in winter to prevent ice and snow deposits in cities are one of the most harmful anthropogenic factors. The study of their affecting on soils, vegetation and soil microorganisms is important task for improvement of the urban environment. The paper presents the results of laboratory and field studies of the new anti-ice materials. The dynamics of changes in salts concentration in soddy-podzolic soil during the vegetation season under influence of external factors was revealed. Twelve anti-ice materials of various chemical groups, such as chlorides, acetates and formates, were studied by chemical analysis methods. The laboratory experiments showed that high doses of chloride reagents have increased the salt content in soils to levels corresponding to low salinity. Such concentrations are potentially dangerous to plants and soil microorganisms. At the same time in field conditions eventually salt content in the soil decreased. Salts were washed out from the upper soil horizons by atmospheric precipitation. By the end of vegetation season, the maximum concentration actually corresponded to background indices. Accordingly, the contaminated soils' toxicity for plants and microorganisms decreased. Based on the results of research, the least environmentally harmful anti-ice materials have been identified. These include acetate and formiate reagents "Nordway" and "Clearway". Magnesium chlorides ("Bishofit" and "Rockmelt") proved to be less dangerous among the anti-ice materials of chloride group. Also the permissible doses of anti-ice materials for the urban streets were recommended.

Keywords: anti-ice materials, soils, plants, experiment, salt content

Ecological And Zoogeographical Features Of Species Composition Of Molluscs Of Rivers Of The Northern Pryazovia

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Abstract

Distribution and species diversity of molluscs of rivers of the Northern Pryazovia are determinated, at first, by the specific ecological conditions which are necessary for the survival of these invertebrates. In the researched region quantitative indicators of the environmental factors are not as limitative as their constant short-term changes: from minor fluctuations of hydrochemical indicators to complete drying up of the riverbed. The mentioned dynamics of the ecological conditions causes the same dynamics of the species composition, number and distribution of molluscs.

According to our data, the modern species composition of molluscs in the investigated region has 37 species belonging to 23 genera and 16 families. 24 of these species belong to the class Gastropoda, and 13 – to Bivalvia. The vast majority of molluscs are typical inhabitants of freshwater reservoirs of the North-European-West-Siberian subarea of the Palearctic. Ponto-Caspian brackish water complex is represented by a single species – *Theodoxus astrachanicus* Starobogatov in Starobogatov, Filchakov, Antonova et Pirogov, 1994, which was first noticed in the Azov Sea pool relatively recently. The third group consists of 4 types of euryhaline marine migrants of the Mediterranean and Lusitanian subtropical zoogeographical region and periodically get into the mouths of the rivers.

We have established ecological and zoogeographical peculiarities of the molluscs in the region. It was shown that the ecosystems of the small rivers of the Northern Pryazovia are characterized not only by the changes of the species composition and the ratio of the groups of the autochthonous fauna of molluscs, but also the phenomenon of inverse recurrences and replenishment of the adventitious species from the other zoogeographical regions.

Keywords: *freshwater molluscs, ecology, zoogeography, Northern Pryazovia.*

Ecological Assessment Of Soybean Varietal Resources Under Conditions Of The Forest-Steppe Of Ukraine

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Abstract

Soybean varieties with substantial adaptive potential can provide stable yields under different environmental conditions, while varieties having low adaptive potential have high yields under favourable conditions and low yields under unfavourable condition of cultivation.

Parameters of ecological plasticity were calculated by the method of S.A. Eberhart and B.A. Rusell.

It was revealed that by the rate of seed yield in the group of early varieties (00) such varieties as Diadema Podillia, Kioto, Mentor, Merlin belonged to highly plastic varieties with coefficient $b > 1$; in the group of mid-early varieties (0) – Almaz, Suziria, Cheremosh; in the group of mid varieties (I) – Monada, Kardiff, Kent, Padua, Sultanaa.

If the index of plasticity ranged within $1 > b = 0$, the variety was considered to have low plasticity. In the group of early varieties (00) there were such varieties as Almaz, Suziria, Cheremosh; in the group of mid-early varieties (0) – Anastasiia, Brunensis, Legenda, Senator, Terek, Khorol, Champion; in the group of mid varieties (I) – Triada and Sihalia.

In addition, it was observed that early varieties (00) of soybean Diadema Podillia, Kioto and Mentor appeared to be intensive by the level of seed yield. In group of mid-early varieties (0) of soybean, the intensive type includes Aligator, in the group of mid varieties (I) – Monada and Cardiff.

Keywords*: soybean, variety, maturity group, yield, seed, plasticity, stability*.

Ecological Factors And Productivity Of Potato

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Abstract

In duration of 2015-2017 years was spending scientific works on studying 106 samples of a potato in various ecological conditions of the Republic of Tajikistan. Experimental works on studying of adaptation ability of different samples of potatoes were carried out in various agroecological conditions the following zones above sea level in the Republic of Tajikistan: Huroson district (550 m above sea level), to the city of Dushanbe (840 m over sea level), the Vahdat district (Yavroz, 1500 m over sea level and Kanask, 2550 m over sea level), Lakhsh district (2700 m over sea level), Shugnan district (3600 m over sea level). We to have come to a conclusion that such ecological factors as: height above sea level, quantity in coming deposits and monthly average temperature of air during vegetation of plants play an important role in the course of formation productivity potentials various samples of a potato. Our experiences showed that the most optimum zone for cultivation of a big crop of potatoes the mountain zone of Kanask of the city of Vahdat (The Gissar valley of the Central Tajikistan) at the height of 2550 m above sea level where the productivity of potatoes was 28.5 t/hectare is considered. Rather poor harvest of potatoes of-14.0 t/hectare is received in the conditions of the hottest climate of Huroson district (the Vakhsh valley of Khatlon Region of the Southern Tajikistan) at the height of 550 m above sea level (drawing). It is established that the optimal condition for reception of a high yield of a potato to 25-29 t/hectares are ecological factors, as: height within 2550-2700 m above sea level; an amount of precipitation within 80-120 mm and middle month air temperature in limits 18-200C during the vegetative period samples of a potato.

Key words: ecology, potato, meter above sea level, productivity.

Ecological Methods Of Soils Fertility Increase Of Light Granulometric Composition Of Belarus

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Abstract

On the territory of Belarus is widely distributed soil easy granulometric composition – of the sandy and sandy loam. Among the arable fields their share of land is 31.5 %. Adverse physico-mechanical properties lead to exceptional poverty of their humus and elements of mineral nutrition. To enhance them fertility perspective is the development of eco – friendly and biologically based, farming systems in which it is not excluded the use of chemicals and mechanization, but put forward very strict environmentally sound regulatory requirements for doses, forms, terms and methods of their application. To use of organic meliorants is a long-term and fundamental factor of stabilization soil fertility. A significant reserve of such are sapropels and peat.

The paper presents the results of studies conducted at the loosened sod-podzolic soil when optimizing its high doses – 100, 200, 300 and 400 t/ha (tons per hectar) (sapropel), and analysis of the dynamics of properties sod-podzolic sandy loam soil under the influence of making similar peat doses 30 years after optimization.

In the initial state, the score of the bonus selected for optimization soil differences ranges from 18 to 30 points (on a 100-point scale.) The results of the research showed that after optimization by introduction of high doses of sapropel and peat changes granulometric the composition of the soil, decreasing rate of the specific gravity increases porosity steadily increases the field moisture content of the arable layer, changes in total and capillary moisture capacity, maximum water absorption and water storage, and a score of bonitet increases to 55-65%.

Keywords: soils, optimization of soils, soils fertility.

Ecophysiological parameters of Lithuanian populations of *Phalaris arundinacea*

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Abstract

Nowadays big attention is paid to the quality of inland waters. Data on quantity of pollutants in the environment are insufficient for understanding of straight consequences of adverse compounds on aquatic flora and fauna. Among water macrophytes of Lithuanian rivers, Phalaris arundinacea plays essential role as the most abundant and frequently occurring species. Nitrogen (N) is the most important nutrient for the plants. Plant productivity depends on processes ongoing in the leaves. In many studies, plant saturation with N is extrapolated from the Ellenberg indicatory values, although data about plant N still remains poor. Our study was aimed to compare leaf N concentrations among riparian populations of Phalaris arundinacea (project was sponsored by Lithuania Research Council; SIT-02/2015). Over 60 populations of Phalaris arundinacea were sampled along basin of the river Nemunas. Only healthy, undamaged leaf blades were used for analyses, done by Kjeldahl method. Examined populations differed in leaf N concentration 1.22 times ($p < 0.05$). When compared to the other tested riparian species, high enough N concentrations were characterized for Phalaris arundinacea populations. It could be assumed, that present quantities of the N, entering aquatic ecosystems, are big enough to cause eutrophication. For climatic and edaphic conditions of Lithuania, Phalaris arundinacea serves as riparian species accumulating excess N omitted from the agriculture and urban areas.

Keywords: anthropogenic impact, aquatic impact, Kjeldahl method, Poaceae, reed canary grass, water macrophytes

Effect Of Damp Water Steam On Mycological Pollution Of Oak (*Quercus Robur* L.) Acorn

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Abstract

By controlling the spread of pathogenic fungi, treaters remain one of the most widely used tools for reducing the damage caused by seed-borne fungal diseases. However, their intensive use pollutes the environment. One of the possible ways of bio-control is the humidity of 100℃ damp water steam, which can be an effective means of reducing seed contamination by pathogenic fungi or limiting their spread. Different damp water steam effects (2-14 s) for acorn contamination by microscopic fungi established in the laboratory, by agarized nutrient media method. Acorn were contaminated with *Fusarium*, *Penicillium*, *Alternaria*, *Mucor*, *Stemphylium*, *Cladosporium*, *Rhizomucor* spp. fungi. Fungi have been contaminated on the prevalent species: *Fusarium oxysporum*, *Alternaria alternata*, *Cladosporium cladosporioides*. The studies have shown the effect of 100℃ damp water steam on the oak acorn mycological contamination. The effect of 2 s damp steam on the oak acorn surface destroyed *Rhizomucor* spp., 6 s - *Alternaria* spp., 8 s - *Penicilium* spp., 14 s - *Mucor* spp. fungi.

Keywords: biological control, damp water steam, microscopic fungi, oak acorn

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Effect Of Farming Systems On Mineral Composition In Potato Tubers

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Abstract

The purpose of the study was to estimate the effects of different farming systems on mineral composition in potato tubers. Five potato cultivars (Laura, Tornado, Red Emmalie, Violetta, Salad Blue) were cultivated at a farm in the Širvintos district (Lithuania). Potatoes were grown following traditional potato production technology in conventional, organic and biodynamic farming systems. The contents of K, N, P, Mg, Ca, Fe, Mn, Cu, Zn and B in potato tubers were determined by inductively coupled plasma atomic emission spectrometry (ICP-AES).

The results show that the organic potato contained significantly more K, P, Ca, Mg, Fe, Mn, Zn and B in comparison with the conventional potato. However, the K, Ca, Mg, Mn, Zn and B contents showed no significant difference between the conventional and biodynamic treatments. The cultivar effect on the content of selected minerals in the samples was also observed. Red Emmalie contained more K, N, P and B. Salad Blue had the highest contents of Fe, Mn and Zn in comparison to other studied cultivars. This study confirms that the farming systems may have a significant impact on quality of potato tubers. The organic potatoes appeared to be richer in macro and microelements.

Keywords: Biodynamic, conventional, organic, iron, potatoes, potassium.

Acknowledgement

The study was funded by the Ekhagastiftelsen for application ”Effect of Farming Systems on the Accumulation of Biologically Active and Anticancer Compounds of Potato Tubers with Coloured Flesh” (No. 2017-33).

Effect Of Medium Composition On *In Vitro* Direct Organogenesis Of *Miscanthus X Giganteus*

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Abstract

Miscanthus x giganteus J. M. Greef, Deuter ex Hodkinson from the *Poaceae* family, belongs to C4 type of plants, is the most cultivated species with respect to biomass production. The advantage *of Miscanthus x giganteus* is undoubted of its high biomass, high productivity in cold climates, low requirement for fertilizers and pesticides, of its resistance to diseases and pests, capacity to grow in marginal land areas. Market demand for *Miscanthus* is rapidly increasing. In commercial use *Miscanthus* plants have been micropropagated by the *in vitro* tillering method as it costs less than traditional rhizome propagation. The objective of the present investigation was to evaluate the effect of different media and growth regulators on *in vitro* direct organogenesis and shoot proliferation of *Miscanthus x giganteus.* Research was carried out in Institute of Biology and Plant Biotechnology of Agriculutre Academy of Vytautas Magnus University in 2017-2018. Segments of *Miscanthus x giganteus* internodes were cultivated on Murashige and Skoog (MS) and Woody Plant Medium (WPM) media supplemented with different concentrations of BAP, ISR and IAR. Our results showed that on the WPM medium without growth regulators shoot formation frequency and shoot number per explant were significantly higher in comparison with MS medium without growth regulators. In the presence of growth regulators, the highest shoot proliferation frequency (48.75 %) with highest shoot number (24.06) per explant have been obtained on the WMP medium supplemented with 3.0 mg l^{-1} BAP + 0.4 mg l^{-1} ISR + 0.01 mg l^{-1} IAR. While on the MS medium the combination of 4.0 mg l^{-1} BAP + 0.4 mg l^{-1} ISR + 0.01 mg l^{-1} IAR resulted in the highest shoot proliferation frequency (16.5 %) with highest shoot number (9.45) per explant.

Keywords: *Miscanthus* × *giganteus*, direct organogenesis, medium composition.

Effect Of Phytohormones On The Accumulation Of Steviol Glycosides In *Stevia Rebaudiana*

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Abstract

Stevia rebaudiana Bert. (Bertoni) is economically important for its natural sweeteners, steviol glycosides (SGs), mainly stevioside (St) and rebaudioside A (RebA). Stevia seed germination is poor; therefore, plant regeneration *in vitro* could be a tool to obtain a homogenous plant population. Administration of different phytohormone enhances the production of plants with good agronomical traits and SGs content.

The aim of this study was to determine the effect of phytohormones and its combination on the accumulation of St and RebA in callus, stems and leaves. Additionally, other biochemical traits such as amount of total phenolics, total flavonoids and antiradical scavenging activity were determined. In callus supplemented with KIN, TPZ or BAP, RebA concentration was the same (0,23-0,28 mg/g), however the concentration of St was the 2- and 4-fold higher with BAP and KIN than with TDZ (0,87 mg/ml). Stems formed in NAR and NAR+BAP supplemented media had very low concentration of SGs (0,04-0,32 mg/g) mainly due to decrease of St. In leaves, SGs concentration decreased from 0,87 mg/g to 0,40 mg/g with increase of NAR from 1 to 3 µmol. BAP (1 µmol) slightly increased SGs when combined with 2 or 3 µmol NAR but decreases with 1 µmol NAR. There is a strong correlation of SGs in leaves and stems with total amount of fenolics and flavonoids excluding an outlier of NAR (1 µmol). It can be concluded that micropropagation conditions are crucial for SGs accumulation, however, further investigations of the sustainability of SGs concentration differences during plant development are needed.

Keywords: Stevia rebaudiana, micropropagation, stevioside, rebaudioside A.

Effects Of Different Salinities On Green Microalga *Tetraselmis Suecica* Growth And Pigments Concentrations

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Abstract

Changes of medium salinity due to evaporation or addition of pure water is one of major factors influencing algae cultures growth and biomass quality. Our study evaluates the effect of different salinities on growth and pigment (chlorophyll and carotenoids) content of the green microalga *Tetraselmis suecica*. Four different concentrations (15 g l^{-1}, 30 g l^{-1}, 60 g l^{-1}, 90 g l^{-1}) of artificial sea salt were used to prepared f/2 medium for outdoor cultivation of *T. suecica*. The highest growth (up to 0.66 g l^{-1} per day) was obtained using 15 g l^{-1} salinity. Higher salinity tends to reduce biomass yield. Change of salinity and biomass concentration in the culture affect concentrations of chlorophyll and carotenoids in the biomass. Chlorophyll and carotenoids contents in the biomass obtained under different salinity varied from 2% to 5.5% and from 0.35% to 1.1%, respectively. Higher salinity resulted in not only higher overall content of chlorophyll and carotenoids, but also in the higher variation of concentration of these compounds during the cultivation. There was weak positive correlation between chlorophyll and carotenoids content and biomass concentration of the culture. Carotenoids concentration had strong correlation with chlorophyll concentration.

Keywords: medium salinity, *Tetraselmis suecica*, algae cultivation, chlorophyll, carotenoid.

Effects Of Isoflavones Formononetin And Biochanin A On Powderly Mildew Infection On Red Clover Leaves

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Abstract

Certain plant isoflavones exert antimicrobial activity and inhibit disease development through different mechanisms. The aim of this study was to estimate the effects of externally applied isoflavones formononetin (F) and biochanin A (BA) on the development of mildew infection on red clover (*Trifolium pratense* L.) leaves.

Red clover was sown and grown in a phytotron under controlled conditions for 2 months and then plant leaves were sprinkled with water containing mildew infection agent. Young contaminated leaves were cut and incorporated by 3 units into 0.5% agar medium Petri dish (5 groups in 4 replicates). Compounds for the treatments were injected by 10 µl aliquotes once in 3 days at a distance of 5-7 mm from a leave stem. The leaves were exposed to different combinations of isoflavones using different stock isoflavone solutions in DMSO: 1) 124 mM F; 2) 164 mM BA, 3) 112 mM F + 176 mM BA (F/BA=0.6); 4) 153 mM F + 128 mM BA (F/BA=1.2); 5) DMSO solution was used as a control. The amounts of applied isoflavones were close to those detected in red clover leaves before flowering (F/BA=1.2) and after flowering (F/BA=0.6). The development of powderly mildew infection was monitored for 13 days and the degree of infection was evaluated using 1-5 scale.

Mildew agent *in vitro* did not settle on young seedling leaves and required high humidity, while it was spreading quite fast on leaves of seedlings at flowering stage. F treatment stimulated mildew infection spread on red clover leaves in vitro: after 13 days infection degree change was 28 % higher than in control. Treatment with BA had opposite effect – it strongly delayed infection development and no statistically significant change of mildew infection degree was estimated at the end of experiment. The inhibitory impact of BA on mildew spread was obvious also when combinations of isoflavones were applied. BA and combinations of BA with F stimulated rooting of red clover leaves *in vitro*. At the end of the experiment there were 8.3% more rooted leaves in BA treated group, 16.7% – in F/BA=0.6 and 25.0% – in F/BA=1.2 in comparison to control. For the first time links between F and BA amount and fungal disease agent were estimated.

Keywords: Powdery mildew, *Trifolium pratense*, Formononetin, Biochanin A.

Encapsulation Of Microbial Cells Within Ormosils: Cell-Mediated Formation Of Biohybrid Architectures And Potential To Biotechnology

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Abstract

Living cells can be considered as highly efficient biocatalysts, but fragile biocatalysts. By combining cells with silica materials in an appropriate way, novel «living material» technologies can be designed. The synthesis of «living materials» (bio-hybrids) is carried out by using three-dimensional (3D) encapsulation of microbial cells from silica sol-gel chemistry. Silica encapsulation allows protecting cells from the harsh environment. The range of potential applications of these «living materials» currently encompasses major fields of materials science at its interface with living systems, with a particular interest in biotechnology, bioremediation and tissue engineering. Here, we report a base-catalyzed sol-gel process of the cell encapsulation enabling to design the functional ORMOSIL-living cells hybrid materials. The results demonstrated the influence of the silane precursors and the polymeric organic compounds (PEG, PVA) on the 3-D architecture of the sol-gel bio-hybrids. Under optimized experimental conditions, yeast cells have become the centers for the self-organized formation of the «cell-in-shell» structure. For the first time, we have registered the dynamic process involved in the formation of the ORMOSIL shells around yeast cells using optical and scanning electron microscopic techniques. The ORMOSIL shell protects yeast cells from exposure to heavy metal ions, UV radiation, and acid. This research suggests the use of new hybrid biomaterials as biocatalysts (biofilters) [1] and biosensing elements or surfaces (biosensors) [2].

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Keywords: Encapsulated microbial cells, ormosil, sol–gel, «cell-in-shell», bio-hybrid materials, silane precursors, polyethylene glycol, polyvinyl alcohol.

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Establishment Of Plant Regeneration Of *Physalis Peruviana* L. From Leaf Petioles

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Abstract

Physalis is a new edible plant which finds its application in agriculture and even in medicine [1, 2]. Recently, *Physalis* became a new model object for CRISPR/Cas9 gene editing manipulations [3].

The object of investigation was *Physalis peruviana* L. After conducting a series of experiments**,** an effective culture medium for the plant regeneration of *Physalis peruviana* was established. The most effective media for shoot regeneration from leaf explants were MS_{30} + 1mg/l Kin + 3 mg/l BAP and MS_{30} + 2mg/l Kin + 1 mg/l BAP (33,33% of regeneration on both media).

Quite good results were obtained on the media MS_{30} + 1mg/l Kin + 2 mg/l BAP (28,57% explants regenerated) and MS_{30} + 2mg/l Kin + 3mg/l BAP (26,31 % of regeneration).

Excellent results for root induction from stem and leaf explants were obtained on medium MS_{30} with NAA (0,2 mg/l; 0,5 mg/l), IAA (0,2 mg/l; 0,5 mg/l). Root induction frequency on these media was 100%.

The obtained regenerants were grown on the medium MS_{30} with 1 mg/l of BAP for elongation, and then on a medium MS_{30} or MS_{30} with 0,2 mg/l NAA for subsequent rooting.

After one month of cultivation on mediums MS_{30} or MS_{30} with 0,2 mg/l NAA were successfully received adult plants.

Keywords: *Physalis peruviana*, regeneration.

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Evaluation Of Oxidative Effects In Male Wistar Rats Following Extremely High Frequency Electromagnetic Irradiation Exposure

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Abstract

Low intensity electromagnetic fields (EMF) of extremely high frequencies (EHF) are wiedly employed in electrical applicants and different equipments. Biological effects of such exposures have been noted frequently, although the implication for specific health effects is not that clear. The molecular mechanism(s) through which EHF EMFs can influence cellular behavior is not well understood yet. There is a hypothesis that EMFs could interfere with chemical reactions involving free radical production. In our previous work we reported that exposure of rats with 50,3 GHz frequency EMI significantly increases malondialdehyde (MDA) rate in brain and slightly elevated it in liver of animals.

The purpose of this work was to study the effects of multiple (1 hour/day, 5 days) exposure to EMI of 50,3 GHz frequency (power density 64μWt/cm^2) on lipid peroxidation (LPO) and antioxidant enzymes activity in brain, liver, and blood of rats.

EMI EHF was produced with generator G4-141 Model (State Scientific-Production Enterprise "Istok", Russia) with working range of frequencies 37, 5-53,5 GHz. 20 adult Wistar male rats with 100-120 g body weight were used for this study. The animals were exposed in pairs inside the double box transparent plastic container. MDA concentration, superoxide dismutase (SOD; EC1.15.1) guaiacol peroxidase (GPX; EC 1.11.1.7) and catalase (CAT; EC 1.11.1.6) activities was assayed in obtained organs.

Our observations indicate that EMI had a negative influence and induced an oxidative stress in liver and especially in brain of experimental animals. Data show a significant decrease of SOD and GPX activities in experimental rats brain and liver, whereas CAT activity significantly increased in the same organs compared to control. At the same time slight decrease was recorded in level of pinal melatonin in whole brain of exposed group of animals as compared to sham control.

Key words: Low intensity electromagnetic fields, antioxidant enzymes, melatonin, brain, rat.

Exploration Into The Structure Of *Trachemys Scripta* Ribosomal Repeat

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Abstract

In eukaryotes, the 18S, 5,8S and 28S genes of ribosomal RNA have a chromosomal location in the region of nucleolar organizer (NOR). These three genes are clustered, and multiply repeated clusters are separated by intergenic spacers (IGS). Due to the high repeatability and considerable size of the repeating unit, the complete decoding of the NOR remains a challenge, despite the current extensive research on the genomes decrypting.

For assembling the ribosomal repeat sequence of the red-eared slider (*Trachemys scripta*), the ribosomal cluster sequence of the diamondback terrapin (*Malaclemys terrapin*) was used as a reference. Sequence assembly was performed in Geneious 9.1.7 software package using original Geneious algorithms.

The length of the cluster of pre-RNA genes was established as around 9643 bp. The length of the IGS is approximately 6000 bp. The *T. scripta* ribosomal repeat region is generally enriched with GC-pairs, the average content of which is 65.3%.

The sequence of the IGS contains several extended repeating regions. When analyzing the decoded IGS sequence, 5 groups of repeats were revealed. The sequences of all studied repeats groups are found to be degenerated in length and nucleotide composition. However, the repeats within the groups have very conservative motives, allowing them to differentiate reliably. The results show the complex structure of *T. scripta* IGS.

Ribosomal gene copy number per *T. scripta* diploid genome averaged 214 copies.

Technical and financial support: “Chromas” and “Molecular and Cell Technologies” Research Resource Centers of Saint-Petersburg State University; RFBR grant # 18-04-01276.

Keywords: ribosomal repeat, Trachemys scripta, red-eared slider

Extraction Of Chitin From Horse – Fly (*Tabanus Bovinus* L.)

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Abstract

Chitin is a widely distributed polymeric polysaccharide, which is included in the exoskeleton structure of insects. Individual parts of the insect body have different functions and have a well-defined structure. Insect eyes are a unique facetic composition. It can have a distinct niche of application, for example, in contact lens manufacturing. *Tabanus Bovinus* L. is a dangerous agricultural pest, which attacks cows, horses and other warm-blooded animals. It characterized by two, distinctly large eyes, hard body structure, large mouth. Chitin is extracted from the eyes of the horse – fly by a conventional chemical method. For the first time in the history of research three-dimensional chitin has been isolated, separated and photographed from the eyes of the horse-fly. Differences between the inner and outer corneal lenses have been identified. The inner side of the corneal lens is smooth and sleek, the outer side is convex with bright hexahedron structures. The FT-IR analysis showed that corneal lens chitin was in the α –form.

Keywords: Chitin, horse–fly, corneal lens.

Extraction Of Complexes Of Biologically Active Substances Of Marine Invertebrates And Evaluation Of Their Biochemical Activity

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Abstract

Biologically active substances extracted from marine hydrobionts, in particular invertebrates, have unique properties. These unique properties are related to the conditions of existence of hydrobionts in the aquatic environment. Hydrobiont metabolites are characterized by significant diversity and exhibit high antioxidant, immunomodulatory, antitumor activities.

Evaluation of antioxidant, antibacterial and mitogenic activity of complexes of biologically active substances of marine invertebrates (black sea mussels and rapans) is presented in this work.

Extraction of biologically active substances was performed by the method of two-phase extraction in combination with ultrasound. This allowed the simultaneous extraction of water-soluble and fat-soluble compounds.

Antioxidant activity (AOA) of the obtained extracts was determined by the volumetric method, as the concentration of biologically active substances of a reducing nature in terms of quercetin.

The antimicrobial activity of the extracted complexes of biologically active substances was evaluated by germination in a nutrient medium with optimal values of AOA in the oil and water-alcohol phases.

The growth and mitogenic activity of blood lymphocytes was evaluated in vitro when exposed to complexes of biologically active substances extracted from mussels.

The results of investigation allow us to consider the obtained extracts of complexes of biologically active substances as promising components of pharmacological compositions with antioxidant effect, cellular recovery and protection from oxidation processes, as well as with pronounced mitogenic activity allowing to stimulate and regulate the growth of individual tissues.

Keywords: biochemical activity, biologically active substances, marine invertebrates, antioxidant activity, cellular recovery.

Features Of Metabolic Processes In Carp (Cyprinus Carpio L.) Influenced By Waste Water From Livestock Enterprises

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Abstract

Analysis of chemical composition of waste water which result from operation of pig enterprises and gets into the natural reservoirs used for fishery purposes, including ponds, showed that they contained a variety of end products of organic matter exchange of proteins and amino acids, carbohydrates, hormones and hormone-like compounds, growth stimulators, antioxidants, vitamins, macro-and micronutrients, means of protecting animals from infectious and invasive diseases that impair the organoleptic properties of water and can be toxic to fish (1-3).

It is found that with increasing content of waste water in aquariums, the blood hemoglobin content in fish increased by 2,8% (second experimental group), 8,3% (third experimental group), 16.0% (fourth research group compared with control). The decreased activity of alkaline phosphatase by 15,8% (second experimental group), 25.1% (third experimental group), 35.7% (fourth experimental group) compared with control indicates the inhibition of reaction of tissue respiration in the tissues and blood of fish. This pattern is observed as a result of corresponding increase of waste water in water tank and is possibly related to the lowering of hydrolysis processes of macroergic compounds in tissues of fish.

The increase of total protein in blood plasma of carp by 3,5% (first experimental group), 19,5% (second experimental group), 27.5% (third experimental group), and 33,4% (fourth research group) compared with control in conditions of high concentration of waste water from pig farms in aquariums indicates the intracellular redistribution of proteins in tissues and, is possibly associated with the role of protective proteins of γ-globulin fraction.

Keywords: carp, blood, total protein, enzyme activity.

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Genetic Diversity Of *Monilinia* Spp. Species Within Laccase Gene

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Abstract

Pome and stone fruit plants play important role in fruit production all over the world. The biggest damage to the *Rosaceae* family pome and stone fruit plants is caused by brown rot disease. Brown rot is caused by world wide spread *Monilinia spp*. pathogens: *Monilinia laxa, M. polystroma, M. fructigena* and *M. fructicola*. *Monilinia laxa* and *M. fructigena* are common in Europe, *M. polystroma* – in Japan, while *Monilinia fructicola* is indigenous in USA and Australia. Despite *M. fructicola* was identificated in several European countries this pathogen is in the list of quarantine pathogens in Europe, and still absent in Lithuania. Knowledge about the genetic diversity of *Monilinia* spp. is required for the management of this disease spread. The whole sequenced genomes of all four *Monilinia* spp. pathogens are available on National Center for Biotechnology Information (NCBI) GenBank database. Relationship between pathogens can be investigated according to polymorphism of certain genes. Laccase coding gene is important for *Monilinia* spp. fungal pathogens for biosynthesis and lignin degradation, pigment biosynthesis and morphogenesis. In NCBI GenBank database 1879 records for *Monilinia spp*. were found while only 2 records in NCBI Refseq data base. For the genetic diversity analysis of *Monilinia* spp. pathogens multiple sequence alignment (MSA) and phylogeny analysis were performed with 18 *Monilinia* spp. Oxidoreductase component Laccase (lcc2) gene sequences from NCBI GenBank using MEGA X software [1]. The results showed that quarantine pathogen *M. fructicola* is genetically most different from other *Monilinia* spp. Genetically closest pathogens are *M. laxa* and *M. polystroma*.

Keywords: *Monilinia,* Brown rot, laccase, genetic diversity

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Genetic Diversity Of Silver (*Hypophthalmichthys Molitrix*) And Bighead (*Hypophthalmichthys Nobilis*) Carp Producers From Aquaculture In Belarus

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Abstract

In this study we evaluated the genetic diversity of 63 silver (Hypophthalmichthys molitrix) and 66 bighead (Hypophthalmichthys nobilis) carp producers grown from aquaculture in Belarus. Genotyping was obtained for 11 STR-loci (Hmo11, Hmo13, Hmo15, Hmo25, Hmo26, Hmo31, Hmo33, Hmo 34, Hmo36, Hmo37, Hmo40) from Gheyas et al.

For producers of silver carp have been identified 73 alleles and for bighead carp – 108 alleles. The average number of alleles for silver carp was 6,636±1,038 and for bighead carp – 9,818±0,761 alleles per locus, respectively. The average value of the Shannon index (I), which reflects the complexity of the community structure and calculated for all 11 STR-loci, was 1,209±0,158 for silver carp producers and 1,716±0,142 for bighead carp producers, which indicates the average complexity of the community structure of the studied samples. The lowest values of observed heterozygosity (Ho) for silver carp producers were observed for Hmo15, Hmo34 and Hmo40, for bighead carp producers – for Hmo15 and Hmo25. The highest calculated values of the F_{IS} coefficient for silver carp producers were shown for the loci Hmo15, Hmo34 and Hmo40, with an average of 11 STR loci of 0.457±0.117. For bighead carp producers the highest F_{IS} value was found for the Hmo25 locus with an average value of 0.202±0.072.

The obtained results indicate moderate (for silver carp) and sufficiently high (for bighead carp) genetic diversity of the studied samples of carps, up to the possibility to allocate several groups for subsequent work on obtaining linear material and further reproduction, including commercial fish. However, to achieve these goals, it is necessary to pay special attention to the selection of pairs of producers, taking into account the results of molecular genetic analysis.

Keywords: silver carp, *Hypophthalmichthys molitrix*, bighead carp, *Hypophthalmichthys nobilis*, short tandem repeat (STR), genetic diversity, allele, heterozygosity, Shannon index, F_{IS} fixation index

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Genetic Population Structure Of European Wild Boar (*Sus Scrofa*) In Lithuania Before The Spread Of African Swine Fever

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Abstract

Wild boar (*Sus scrofa*) are among the most widely distributed large mammals in the world. The natural range of the species extends from Western Europe and the Mediterranean basin to Eastern Russia, Japan and South-east Asia. Every year, the number of wild boar populations in Lithuania is increasing, as wild boars are perfectly capable of adapting to adverse environmental conditions. The regulation of the number of wild boar populations through hunting partially solves the threat of ASF (African Swine Fever) spreading to new regions, but it is not known how the intensive reduction of population numbers will affect the genetic structure of wild boars in the future. The objectives of this study to evaluate the genetic structure of wild boar before 2014-2015 ASF breakthrough in Lithuania using microsatellite analysis. In total, 105 wild boar specimens were used for the study, collected from eleven locations in Lithuania. The microsatellite analysis of wild boar indicated high levels of genetic diversity within the population. The genetic differentiation among subpopulations based on Nei's genetic distances and FST analysis was very low. The separation between the subpopulations of Lithuania was evidenced in the PCoA Subpopulation from Marijampolė district was slightly differentiated from the others. The Bayesian clustering analysis in STRUCTURE identified 4 genetic clusters among sampled wild boar that could not reveal a clear separation between subpopulations. Future studies will be helpful for understanding and comparing the detailed structure of wild boar populations in Lithuania before and after the spread of African Swine Fever.

Keywords: Genetic structure, wild boar, microsatellite, Lithuania.

Genetically Modified Lettuce And Tobacco Plants Caring The Gene Of Sweet-Tasting Protein Thaumatinii

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Abstract

The constant increase in the number of people suffering from obesity and diabetes worldwide calls for more healthy food devoid of excessive sugar. In this context, non-caloric sweeteners are attracting special interest. Thaumatin is one such intensive non-caloric sweetener protein extracted from the fruit of African bush *Thaumatococcus danielli*. Thaumatins are 2000-3000 times sweeter that sucrose on a weight basis. Natural thaumatin is a mixture of four proteins with thaumatin II being the sweetest form. Transgenic crops expressing gene of thaumatin II protein have been reported to have an improved sweet taste but unexpectedly also carry a trait of enhanced resistance to fungal diseases. Since the commercial thaumatin is isolated from plants grown in African rainforests and the product source is limited and the harvesting ecologically damaging, transgenic plants expressing thaumatin II gene could represent an alternative source of low-calorie sweetener.

The goal of our work was to produce transgenic lettuce (*Lactuca sativa*) plants expressing thaumatin II gene to enhance organoleptic properties and improve resistance to fungal diseases. Also, a model plant *Nicotiana tabacum* has been used to compare the level of transgene expression in these two species. The vector for genetic transformation of plants contained thaumatin II gene with apoplast targeting signal peptide along with a selective gene *bar* (phosphinotricin resistance gene).

As a result of *Agrobacterium*-mediated genetic transformation experiments, the transgenic tobacco and lettuce plants were generated. The transgenic nature of the plants was confirmed by PCR analysis.

Keywords: thaumatin II, sweetener protein, *Lactuca sativa*, transgenic plants.

Genome-Wide Identification And Characterization Of Dehydrin Gene Family In *Eucalyptus Grandis*

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Abstract

Eucalyptus grandis (*E. grandis*) is a plantation crop which spreads widely in tropics and subtropics areas. It is commonly found in nature in Australia, and it is considered an important plant for plant scientist because, of its extreme ability to adapt to both climate and soil. Genome-wide identification of dehydrin (DHN) genes has been performed in several plant species, but not for *E. grandis*. Therefore, our aim was to identify and characterize DHN genes in *E. grandis* via *in silico* genome-wide analysis approach. Our results showed a total of six DHN genes that were present located on 3 out of 11 chromosomes of *E. grandis*. The intron and exon numbers of *Egra-DHN* genes ranged from 0 to 2 and 1 to 3, respectively. To detect expression levels in different plant tissues, mRNA analysis of *Egra-DHN* genes were performed using publicly available expression data in Phytozome v12.1. In addition, the putative cis acting elements of *Egra-DHN* genes (approximately -2 kb upstream region), were also detected with the use of the promotor sequences obtained from Phytozome v12.1 database. As the current study being the first in the identification of DHN genes in *E. grandis*, could be considered as a useful source for future DHN genes studies in either *E. grandis* or comparative different plant species.

Keywords: Dehydrin, genome-wide identification, *Eucalyptus grandis*, bioinformatics

Genome-Wide Identification Of Common Bean (*Phaseolus Vulgaris*) Lipoxygenases And Their Expression Profiling During Salt Stress

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Abstract

The biosynthesis of some plant stress hormones such as JA (jasmonic acid) is catalyzed by lipoxygenases (LOX) and hence LOX genes are known to play important role in abiotic/biotic stress response in plants. To date, genome-wide identification of LOX genes has been performed in several plant species, except for *P. vulgaris*. Therefore, our aim was to identify and characterize LOX genes in *P. vulgaris* via in silico genome-wide analysis approach. Our results showed a total of 31 LOX genes that were identified and observed on 7 out of 11 chromosomes of *P. vulgaris*. In the phylogenetic tree, these LOX genes were clustered into 9-LOX, 13-LOX type I, and 13-LOX type II categories. The intron and exon numbers of *Pvul-LOX* genes ranged from 4 to 8 and 5 to 9, respectively. Six gene couples (*Pvul-LOX-2/ Pvul-LOX-10; Pvul-LOX-3/ Pvul-LOX-17; Pvul-LOX-4/ Pvul-LOX-18; Pvul-LOX-5/ Pvul-LOX-30; Pvul-LOX-9/ Pvul-LOX-13; Pvul-LOX-14/ Pvul-LOX-16*) were found to be segmentally-duplicated. To detect expression levels in different plant tissues, mRNA analysis of *Pvul-LOX* genes were performed using publicly available expression data in Phytozome v12.1. In addition, the putative cis acting elements of *Pvul-LOX* genes (approximately -2 kb upstream region), were also detected with the use of the promotor sequences obtained from Phytozome v12.1 database. Moreover, the responses of *Pvul-LOX* genes to salt stress, were also examined via RNAseq. Due to this study being the first in the identification of LOX genes in *P. vulgaris*, could be considered as a useful source for future LOX gene studies in either *P. vulgaris* or comparative different plant species.

Keywords: LOX, genome-wide identification, *P. vulgaris*, bioinformatics

Geophysical Prognostication Directions Of Dangerous Geoecological Influence Of Mining Waste-Storages In Central Ukraine

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Abstract

Modern mining processes in Central Ukraine are accompanied by environmentally hazardous geomechanical events, including activization of exogenous geological processes and local increased induced seismicity. Numerous facts testify to the active influence of faults on near surface sustainability (including dynamics of underground water, changes in the filtration characteristics of water reservoirs, vertical filtration and transit flow between different-level aquifers, etc.). Using the example of Kryvyi Rih iron ore basin (Kryvbas), the interrelation between increase in technogenic overload and modern geodynamic activization is shown.

Complex macro-seismic (on the base of instrumental observations on local seismic station UK-15) with macro-seismic research in deep mines solves the problem of determining of basic parameters of induced seismicity and hazard of exogenous geological processes of not-seismic old-industrial Kryvbas. These data are necessary to prevent accidents at mining hydraulic facilities (and first of all – tailing ponds, which transform into technogenic resources) and successfully design their increase.

On an example of geophysical research (complex macro-seismic with macro-seismic research in deep mines and conventional gravimetric, magnetic and electrometric observations) near the storage pond of highly mineralized mine waters in Svistunovo gorge (Southern Kryvbas) is shown that emergency sites of hydraulic objects can be not only dams, but also the bottom. Here intensive tectonic fragmentation of rocks (on joint interpretation of gravimetric, magnetic and electrometric observations) is the reason for increasing filtration parameters and deterioration of physical and mechanical properties of rocks and, as a result, intensification of exogenous geological processes, an emergency emptying of the pond and contamination of underground water.

Keywords: geoecological influence, geophysical data, highly mineralized mine waters, mining hydraulic facilities

Global Dna Methylation Levels And Individual Growth Rates Of Non-Indigenous Snail *Potamopyrgus Antipodarum* In Populations Of Different Age Of Invasion

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Abstract

In recent years it was well documented, that global DNA methylation level (GDML) is likely involved in the process of biological invasions - affects gene expression and enables rapid reaction of an organism to environmental changes. Significant reduction of global methylation level was indicated during the expansive phase of particular invasive species, while it decreased progressively during later stages. Decreased methylation was interpreted as a rapid way of increasing phenotypic plasticity that would help invasive populations to thrive. In current study, lower GDML and higher individual growth rates of globally widespread invasive aquatic snail *Potamopyrgus antipodarum* were suspected in recently invaded lakes. To check this assumption, GDML and individual growth rates of *P. antipodarum* were analysed. GDML level were evaluated in four populations of different age. Meanwhile growth rates of the snails collected from two ecosystems (recently invaded and relatively old populations) were estimated under laboratory conditions. The obtained results indicated significantly different methylation levels in populations of different age of invasion – in recent populations GDML were significantly lower, than in oldest known populations. Such results agree with the results of other studies. Meanwhile the results of snail growth rates together with main conclusions will be presented during the conference.

Keywords: Successful invasion, growth rates, epigenetic signatures, population stabilisation

Heavy Metals in Urban Areas Soil

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Abstract

The industrial development and economic activities are increasingly concentrated in urban areas where resources consumption and contamination load on the atmosphere are growing. Urban areas are unique in the sense of biogeochemical processes. The assessment of concentrations of heavy metals in soil can be used for evaluation and risk prediction of future inputs of heavy metals in order to avoid heavy metals pollution and long term risk for people.

There is a need for indicators to monitor the use and potential impact of hazardous chemicals in a country. The Seventh Environmental Action Program includes such target as "assessment and minimizing risks to the environment and health associated with the use of hazardous chemicals". The scope of the indicator is limited, it does not include all possible impact on human health or the environment and the ways where exposure may occur.

There are plenty of indexes used for the evaluation and prediction of the pollution of different environmental compartments. For environmental pollution prediction and assessment of the various factors, modeling can be used.

Heavy metals such as nickel (Ni), lead (Pb), copper (Cu), mercury (Hg), chromium (Cr), cadmium (Cd) can pose a serious hazard to the human health and environment.

Keywords: Heavy metals, urban areas.

Hygienic Evaluation Of Oxiacetamide, Triazinone And Bipyridiliums Herbicides Behavior In Soil, Prediction Of Ground Water Contamination Risk And Its Danger For Human Health

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Abstract

Pesticides pose serious threats to both human health and the environment. Ability of pesticides accumulate in the soil may lead to contamination of the environment (agricultural crops, ground and surface water).

Purpose of work was a comparative risk evaluation of the soil and groundwater contamination of Ukraine and other European countries with herbicides, as well as risk assessment of the adverse effects of these substances on human health while contaminated groundwater consumption.

We have studied the most widely used in agriculture perspective representatives of herbicides chemical classes: oxiacetamide (flufenacet), triazinone (metribuzin), bipyridiliums (diquat).

Field hygienic experiments with studied active ingredients (a.i.) of pesticides were carrying out according to in different soil and climatic conditions of Ukraine which corresponds to different soil and climatic zones of Europe: Polissia (Kiev region or West and North Europe), Forest-steppe (Vinnitsa, Kyiv, Poltava region or Central and East Europe) and Steppe (Odessa, Kherson region or South Europe).

Prediction of possibility of pesticides migration into groundwater was carried out by: Groundwater ubiquity score (GUS) and Leaching potential index (LEACH).

For determination of potential risk to the environment and human health by drinking water containing the pesticide screening model of maximum concentration of a pesticide in groundwater determination SCI-GROW, developed by the Agency for Environmental Protection (EPA) USA, was used. For the evaluation of the parameters SCI-GROW - a method of comprehensive assessment including establishing of the maximum possible daily intake of pesticide with water and subsequently compared with acceptable daily intake of pesticide with water was used.

The results of field studies and evaluation of GUS index showed that risk of leaching into groundwater of herbicides based on metribuzin during application in soil and climatic conditions of Ukraine is a high (probably leached), flufenacet - medium and diquat – low.

SCI-GROW value formetribuzin 7.58×10^{-01} μ/day, flufenacet – 1.94×10^{-01} μ/day, diquat – 9.00×10^{-03} μ/day and daily intake with 3 L of water: 2.274 μ/day, 0.5820 μ/day, 0.0270 μ/day, respectively.

It was proved that the maximum possible concentration of studied classes herbicides in groundwater SCI-GROW significantly lower than allowable, which is associated primarily with low application rates and indicates the relative safety for human health when consuming water, which could be contaminated with test compounds.

Key words: groundwater, herbicides, risk, forecasting, health.

In Silico And In Situ Analysis Of The Repetitive Component In Sterlet Genome

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Abstract

Sturgeon are of great interest from comparative genomics point of view due to their paleopolyploid states, basal position within the Actinopteri, slow rates of genomic evolution and cryptic sex chromosomes. Sterlet (*Acipenser ruthenus*) genome assembly is important for genomic research and can be used as a reference genome of sturgeons because of the lowest ploidy level. The composition of the repeated DNA elements of sturgeons remains unexplored but such studies can shed light on the cryptic sex chromosomes and the structure of the subgenomes of the paleopolyploids.

The genomic DNA of the sterlet male and female were sequenced and assembled. Identification of tandem repeats was carried out using the k-mer analysis directly on raw reads. In addition, *de novo* identification of repeated elements was carried out on raw short Illumina reads and genomic assembly using specific bioinformatic tools. As a result, a comprehensive library of repeated elements was obtained.

Tandem repeats were identified, including those differing in content between male and female, but the FISH-analysis showed that these differences resulted from an intraspecific polymorphism. However, we were able to identify chromosome-specific satellites, including those which allow us to distinguish between paralogous chromosomes, resulted from ancestral polyploidization. Further, these tandem repeats were successfully used to analyze the genomic organization of Siberian sturgeon (*Acipenser baerii*).

The analysis of mobile DNA demonstrated predominance of DNA transposons and LINE retroelements. The analysis of transcripts showed activity of the investigated transposable elements. Our results show the importance of studying the repeated elements of non-model organisms and may help to identify new ways of the genome evolution.

The work was supported by the Russian Science Foundation (RSF) grant number 18-44-04007

Keywords: bioinformatics, genomics, sterlet, genome assembly, repetitive DNA

In Vitro Antagonistic Dual-Culture Assays Against Causal Agent Of Ash Dieback *Hymenoscyphus Fraxineus*

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Abstract

Ascomycetous fungus *Hymenoscyphus fraxineus* Baral et al. is an alien invasive pathogen, which causes ash dieback. The disease weakens trees and usually leads to premature plant death. *H. fraxineus* was first recorded in the '90s in Poland and Lithuania and since then has widely spread across the whole Europe continent. Eventually it has negatively affected the wood industry as well as the biodiversity of woodlands. The exact area of origin of the pathogen is unknown, although there is a suggestion it is native to Eastern Asia.

The amount of data on this disease control, however, is limited given the scientific and public interest. Thus, it is important to gather more information about the pathogen in order to manage this major issue. Our aim was to find a microorganism(s) that potentially acts as an antagonist(s) for *H. fraxineus*. It is suggested that the remedy for this threatening disease may be potentially antagonistic microorganisms that inhabit tolerant ash species. It is important to find a novel, alternative control ways with environment–friendly approach. In order to do so, representative isolates of two genetically different pathogen forms were tested *in vitro* for compatibility on 31 groups of ash endophytes which were isolated from healthy trees of two ash species, *Fraxinus excelsior* L. (native to Lithuania) and *Fraxinus pennsylvanica* Marshall (introduced species in Lithuania).

Keywords: *Hymenoscyphus fraxineus*, ash, *Fraxinus*, dieback, invasive, pathogen, antagonist, dual-culture assay, *in vitro*

Infection Of *Bartonella* Spp. And *Rickettsia* Spp. Pathogens In Cats' Fleas (Siphonaptera)

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Abstract

Fleas are blood-sucking ectoparasites of mammals and birds. Fleas may infest new hosts and change hosts during short contact with animals. *Bartonella* spp. and *Rickettsia* spp. are vector-borne bacteria causing zoonotic diseases. Cat fleas are vector for transsmision of the infection agents among cats and human. The aim of this study was to investigate the presence of *Bartonella* and *Rickettsia* infections in cats' fleas. A total 102 fleas representing two species (*Ctenocephalides felis, Ct. canis*) were collected from cats. *Bartonella* DNA in samples was detected using a nested-PCR of the *16S-23S rRNR* ITS region gene. *Rickettsia* DNA in samples was detected using a nested-PCR of the *gltA* gene. Positive PCR products were selected for DNA sequencing. *Bartonella* species were detected in 20.6% tested fleas. *Rickettsia* species were detected in 22.5% tested fleas. *B. henselae, B. clarridgeiae, R. felis, R. raoultii* and *R. helvetica* were found in infected fleas.

Keywords: *Ctenocephalides felis, Ctenocephalides canis,* Lithuania.

Influence Of Broiler Chickens Meat Consumption On Human Immune

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Abstract

The immune system of the organism is affected by various factors: environmental ecology, healthy lifestyle, human activity, balanced nutrition, physical activity, etc.

Stress of various nature, depressed state of the organism, using of some drugs are destructive factors for the immune system.

Consumption of low-quality food and alcohol, the wrong diet and malnutrition, drugs using leads to a change in the composition of the symbiotic microflora of the digestive tract and to the decrease of the organism's resistance.

It should be remembered that meat and dairy products obtained from animals in a stress state during transportation or before slaughter may not be suitable for consumption. The influence of such foods on the immunity of the human body is not enough attention.

The purpose of the research: to determine and to study of the peculiarities influence of livestock products consumption, taking into account the pre-slaughter stress of animals on the functional state of some human immunity parameters.

In previous research (model experiment) was established the effect of the pre-slaughter state on the phagocytes' index and cortisol level in blood plasma of rats and broiler chickens.

In the blood of animals that received immunomodulators and anti-stress compounds in addition to the food for five days, the phagocyte index increased significantly by 43% ($P < 0.01$) and the cortisol concentration decreased by 57% ($P < 0.05$).

The neutrophil stimulation index increased in the humans blood, when they were consuming meat of broiler chickens, which received the spleen extract as an antistresses and immunomodulators before the slaughter.

The neutrophil stimulation index was decreased in people, who consumed animal meat in pre-slaughter stress period and without the addition spleen extract to their diet.

Increasing of the content of polyamines such as putrescin, spermine and spermidin was found in the tissues of broiler chickens, which additionally introduced into the main ration the spleen extract. The total amount of polyamines in the pectoral muscle was greater by 45% ($P \leq 0.05$) compared to the control. Probably polyamines can affect on humans immune system.

The obtained data has established that natural origin biologically active substances reduce impact and correct pre-slaughter stress in animals and thus improve the quality of their meat.

Consumption of such meat leads to an increasing of the neutrophils stimulation index in human blood and increasing the organism resistance.

Influence Of Different Water On Leguminous Germinated Seeds

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Abstract

Sprouted seeds have a bigger value than not sprouted. The seeds are rich in various nutrients, because of that when there are favorable conditions many of them becomes vulnerable to micromycetes and seeds becomes unusable. For the investigation of reduction and contamination in sprouted seeds for food different types of water were chosen. Three seeds were taken to be sprouted: organic lentils (*Lens culinaris* L.), alfalfa (*Medicago sativa* L.) and mung beans (*Vigna radiata* L.) The different types of water used for soaking and irrigation of seeds - drinking water, drinking water filtered with device "PAZDROID MED – 1500“ and ionized water. The seeds were sprouted for 96 hours. Pathogens in seeds were set up immediately after sprouting. Comparing different sprouted seeds number of colony-forming units, most colonies were in sprouted alfalfa. Using filtered water with a redox potential lower than that of a drinking water for seed irrigation the number of colonies decreased substantially, except for sprouted alfalfa seeds for food. Ionized water affected only sprouted alfalfa seeds.

Keywords: sprouted seeds for food, filtered water, ionized water, microbiological contamination.

Influence Of Environmental Properties On Solar Cell Efficiency

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Abstract

The intensity of solar radiation in a particular area depends on the environmental characteristics, so both natural and artificial environment has been chosen for albedo investigation. Studies were performed under different meteorological conditions: cloudiness, precipitation, air temperature. The reflected radiation registered of artificial and natural surfaces. These decking surfaces chosen because of their applicability in the design of a solar power plant in an urban or rural area. The surface of the water studied as it is one of the most analyzed surfaces due to the albedo coefficient. Water surface albedo may vary by as much as 15 % due to meteorological conditions. The solar power plant on the surface of the water makes it possible to reduce water evaporation from the perspective of nature protection. The water surface is a good choice for solar cell temperature changes and cooling. Of the natural surfaces, the largest albedo has snow, the lowest - grass. With an artificial surface, such as concrete and paving tiles, we have determined a higher albedo coefficient for paving tiles, the albedo of concrete surface was similar and less variable in the daytime. The smallest albedo set on the asphalt surface. The difference between the pad albedo coefficient and the asphalt is about 20 %. Wet and dry underlying of the same deck surface reduces the wet surface albedo coefficient by 3–5 %. Electromagnetic radiation reflected on different surfaces can increase the efficiency of solar cells from 2 % to 15 %.

Keywords: UV radiation, albedo, solar cell.

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Influence Of The Symbiotic Bacteria *Paenibacillus Sp.* On The European Larch (*Larix Decidua* Mill.) Buds Vitality *In Vitro*

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Abstract

The aim of the research is to determine the influence of the symbiotic plant bacteria, previously isolated from the hybrid aspen tissue (*Populus tremuloides* × *P. tremula*) and identified as *Paenibacillus sp.* , on the European larch (*Larix decidua* Mill.) viability. Previous studies by other authors have showed that bacteria release certain substances that promote plant growth, vitality, and adaptation to the environment in order to provide a more favorable environment for growth for bacteria itself. In order to investigate *Paeniacillus sp.* effect on the viability of European larch buds, larch explants were infected with bacteria in *in vitro* culture. Later, changes in morphological parameters such as shoots and needles length were observed. European larch explants were grown on four different nutrient variants: 1) control, bacteria free, Woody Plant Medium (WPM), 2) WPM with bacteria cultivated on LB medium, 4 weeks before research, 3) WPM with bacteria and apical larch explants cultivated on LB medium, 4 weeks before research, 4) WPM, produced and infected with bacteria 4 weeks before research. The study showed that the maximum length of the shoots and needles was fixed on the WPM, produced and infected with bacteria 4 weeks before start of the investigation. The apical explants that grew on this medium were almost twice as large as those on other types of media. As the bacteria grows into the nutrient medium, it is likely that certain chemicals have been released that have led to the growth of larch needles and shoots. It can be concluded that the bacteria *Paenibacillus sp.* and European larch (*Larix decidua* Mill.) apical explants growing in one *in vitro* culture had a positive effect on the viability of buds and further growth.

Keywords: apical, buds, bacteria, explants, *in vitro, Larix decidua* Mill., medium, needles, *Paenibacillus sp.,* shoots.

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Inhabitants Of Hollow Veteran Trees

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Abstract

Old deciduous trees are specific habitats suitable for saproxylic and other groups of invertebrates, epiphytic plant species and fungi.

The research of inhabitants of hollow veteran trees was carried out in 2016-2018 in old parks and forests of Lithuania. The windows traps and trap with γ-decalactone were used to catch beetles.

Contents of hollow (weight 0,5 kg) was taken in plastic bags and later the sample was placed on Tulgren Funnel. After five days extraction fallen into a collecting container with ethanol 70 vol-% solution invertebrates were preserved for examination, labelled and identified.

In hollow trees we founded more than one hundreds invertebrates species: three species of Pseudoscorpiones, Arachnida (*Neobisium carcinoides* (Hermann, 1804), *Allochernes wideri* (C.L. Koch, 1843), *Pselaphochernes scorpioides* (Hermann, 1804)), one species of Machilidae, Archaeognatha, Insecta, one species of Orthoptera, Insecta (*Meconema thalassinum* (De Geer, 1773)), four species of Hymenoptera, Insecta (*Vespa crabro* Linnaeus, 1758, *Formica rufa* Linnaeus, 1761, *Lasius fuliginosus* (Latreille, 1798), *L. niger* (Linnaeus, 1758)). Beetles (Coleoptera) make up the majority of all inhabitants. There were representatives of families Staphylinidae (24 species), Chrysomelidae (7 species), Leiodidae, Elateridae and (each 5 species), Curculionidae, Nitidulidae (each - 4 species), the rest of family were represented by 1-3 species.

Five beetles species new for Lithuania were collected during this research: *Philonthus temporalis* Mulsant & Rey, 1853, *Orchesia undulata* Kraatz, 1853, *Rhizophagus perforatus* Erichson, 1845, *Brachygluta haematica* (Reichenbach, 1816), *Pentaphyllus testaceus* (Hellwig, 1792).

Keywords: biodiversity, invertebrates

Interleukin-6, Calprotectin And 14-3-3-Eta Protein As Potential Biomarkers For Chronic Nonbacterial Osteomyelitis Diagnosis

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Abstract

Chronic nonbacterial osteomyelitis (CNO) is a chronic inflammatory bone disease of unknown etiology. The imbalance between pro- and anti-inflammatory cytokines is the main cause of disease development [1]. Due to the lack of specific laboratory markers, CNO remains difficult to diagnose.

The aim of our study was to evaluate the plasma levels of interleukin-6 (IL-6), calprotectin (CP) and 14-3-3-eta protein in CNO patients and to compare results with juvenile idiopathic arthritis (JIA) and to healthy controls (HC).

Methods: 3 groups of patients were included: CNO patients (n=37), JIA patients (n=16) and HC (n=5). Plasma levels of target proteins were measured using ELISA. The obtained data were compared to the non-specific inflammatory markers (ESR, CRP). Statistical analysis was performed using SPSS SigmaStat 3.0 software.

Results: Statistically significant differences were discovered between 3 groups of patients (Kruskal-Wallis *H* test, Dunn post-hoc test). CNO patients had higher levels of CP (5,8±0,2 ng/ml) than patients with JIA (3,1±0,1) and HC (0,8±0,1). The levels of IL-6 (45,5±1,2) and 14-3-3-eta protein (22,6±1,1) for CNO patients were lower than for JIA (62,0±1,0 and 69,0±2,0 for IL-6 and 14-3-3-eta, respectively), but higher than for HC (4,9±1,4 and 3,4±1,2 for IL-6 and 14-3-3-eta, respectively). The positive correlation (r=0,45, p=0.01) between 14-3-3-eta protein level and ESR for CNO patients was discovered.

Conclusion: The measured plasma biomarkers levels can serve as the basis for producing the CNO laboratory diagnosis tests, allowing to complement existing diagnostic criteria.

The Russian Foundation for Basic Research (grant № 18-515-57001) supported this work.

Keywords: Chronic nonbacterial osteomyelitis, pediatric disease, biomarkers, interleukin-6, calprotectin, 14-3-3-eta protein, laboratory diagnosis.

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Investigation Of Babesia Microti In Small Rodents In Europe

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Abstract

Although *Babesia microti* is main causative agent of human babesiosis in the USA, serological evidence of *B. microti* infection have been reported in Europe. Recently, two asymptomatic cases of human infection with *B. microti* have been reported in Poland. *B. microti* was reported in Europe and USA in different species of wild-living rodents, which are considered reservoir hosts of this parasite. In Europe identified four *B. microti* strains 'Jena/Germany', 'Munich/Germany', 'USA', and 'Baltic' which was only detected in *I. persulcatus* ticks collected from Latvia and Estonia. The phylogenetic analysis of Lithuanian *B. microti* isolates from *Ixodes ricinus* showed that all sequences were identical to the 'Jena/Germany' strain potentially pathogenic to human. However, there still is a lack of knowledge on prevalence of *B. microti* strains in rodents. Small rodents representing eight species - *Apodemus flavicollis, A. agrarius, Mus musculus, Micromys minutus, Myodes glareolus, Microtus oeconomus, M. agrestis* and *M. arvalis* were captured with live-traps in twelve different locations of Lithuania during 2013–2016. Prevalence of *Babesia* spp. was detected in 25% of *M. glareolus*, 7.3% of *A. flavicollis* and 3% of *M. minutus*. The sequence of 18S rRNA gene analysis shows that *Babesia* isolates from rodents were 99-100% similar to *B. microti* Jena/Germany type sequences deposited in GenBank.

This study is the first investigation of *B. microti* in small rodents from Baltic countries.

Keywords: *Babesia microti*, rodents, Lithuania

Investigation Of *Bartonella* Species In Mites Collected From Small Rodents In Lithuania

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Abstract

Bartonella spp. are Gram-negative facultative intracellular alphaproteobacteria belonging to the family *Bartonellae*. Many *Bartonella* species have been affecting human life for centuries and causing persistent bacteremia in humans and a wide variety of animals. Small rodents are reservoir hosts of this pathogen and their ectoparasites are considered potential vectors for various *Bartonella* species. However, the role of Laelapidae mites as vectors in *Bartonella* transmission among rodent hosts needs to be confirmed.The aim of this study was to investigate the prevalence of *Bartonella* infections in laelapid mites from small rodents in Lithuania. Altogether, 490 small rodents representing eight species of *Apodemus flavicollis*, *A. agrarius*, *Myodes glareolus*, *Micromys minutus*, *M. musculus*, *Microtus oeconomus*, *M. arvalis* and *M. agrestis* were trapped during 2015–2016. A total of 284 Laelapidae mites (55 pools and 38 individuals) were chosen for analyses of *Bartonella* spp.: (*Laelaps agilis* (n=219), *Haemogamasus nidi* (n=36), *Eulaelaps stabularis* (n=12), *Myonyssus gigas* (n=11) and *Hyperlaelaps microti* (n=6). *Bartonella* DNA in samples was detected using a real-time PCR. All positive samples were further analyzed by nested PCR amplification and sequence analysis of 16S – 23S rRNA ITS region. The overall prevalence of *Bartonella* spp. in mites was 12.3%. Sequence analysis of ITS region revealed the presence of *B. taylorii* in *L. agilis*, *Hg. nidi* and *M. gigas* mites, *B. grahamii* in *L. agilis*. This is the first investigation of *Bartonella* spp. in mites from small rodents in Baltic countries. To our knowledge, this is the first report of *Bartonella* spp. in *L. agilis*, *Hg. nidi* and *M. gigas* mites.

Keywords: *Bartonella* spp., Dermanyssoidea, mites, rodents, Lithuania

Investigation Of Microclonal Propagation *In Vitro Solanum Lycopersicum*

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Abstract

Growing *Solanum lycopersicum* is one of the most promising areas in the world [1]. However, improving the adaptation of valuable varieties to abiotic stress or a possible new feature (for example, the synthesis of certain proteins) can be improved by biotechnology [2]. To do this, investigate the conditions for growing tomatoes *in vitro*. Problems of growing and rooting of plants were studied. Varieties that were derived by breeding method in the territory of Moldova (Liana) and Siberia (Sybirsky Skorospely) were used in the work. Because they have different genotypes, it has been studied that different varieties of tomatoes differ in sensitivity to the action of phytohormones. It was investigated, that for the rooting of the Sybirsky Skorospely variety it is necessary to increase the content of phytohormones of auxins, and the Liana variety - well rooted in the nutrient medium of the MS with the addition of 0.1 mg /l NAA and 1 mg /l BAP.

Keywords: *Solanum lycopersicum*, microclonal propagation

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Investigation Of The Genetic Origin Of Monument- Tree The Witch Tree (Picea Abies) In Rambynas Regional Park

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Abstract

The Witch tree consists of several different genotypes (seedlings) created by debarking them and binding together so allowing the stems to fuse the cambiums info a single stem at a later age. About the Witch tree, it is a ca. 200 years old Norway spruce tree distinguishing by the large number of mature stems (>12); located in western Lithuania, near Šilutė in Rambynas Regional Park.

We sampled wood for DNA extraction from each the 12 stems of Witch tree and used 2 trees *of Picea abies* from Bubliškes park as controls. The research was carried out at Vytautas Magnus university Agriculture academy laboratory of Forest genetics. 10 polymorphic microsatellite DNA loci were used to assess the genetic identity of each of the 12 stems of the Witch tree. The alleles were scored on capillary electrophoresis with ABI310.

The DNA test showed that the 12 stems possess identical alleles at all 10 loci. This indicates that all 12 stems of the Witch tree belong to the same genotype, individual tree.

Keywords: *Picea abies,* DNA, microsatellites, Rambynas Regional Park.

Landfill Leachate Quantity And Attenuation Distance Of Inorganic Contaminants In The Groundwater Of Different Hydrogeological Systems: A Case Study Of Lithuania

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Abstract

This study examines the relationship between the quantity of landfill leachate and attenuation distance of inorganic contaminants in the groundwater of open, semi-open and closed hydrogeological systems. Nearly 2,000 groundwater samples were collected and 12 inorganic chemical parameters were investigated, of which NH_4^+, K^+ and Fe were considered the very groundwater polluting chemical parameters. Analytical modelling of pollution migration, multivariate statistical techniques and a single factor pollution index method were applied for data processing. The results showed that irrespective of waste volume, the degradation coefficients of NH_4^+, K^+ and Fe were by 36–90% higher in the groundwater of open hydrogeological systems, where attenuation distances were by 14–56% shorter compared with those in closed hydrogeological systems. Also, the degradation coefficients of NH_4^+, K^+ and Fe^+ in the groundwater of very small and small landfills were by 37–90% higher and attenuation distances were by 38–99% shorter compared with those in the groundwater of large and very large landfills. In groundwater of very small and small landfills the difference between NH_4^+, Fe and K^+ attenuation distance in open hydrogeological systems and in closed hydrogeological systems was about 89–97% lower than the difference in large and very large landfills. This finding indicates that the quantity of leachate is the main factor of attenuation of contaminants in groundwater. The results obtained in this research may be used to predict the dispersion of pollution in the groundwater of landfills located in similar hydrogeological systems and to take environmental protection measures.

Keywords: landfill, leachate quantity, inorganic contaminants, attenuation distance, hydrogeological systems.

Leaf Structural-Functional Organization Of Vesselless Plants In The Temperate Rainforest Of South-Central Chile

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Abstract

Gymnosperms with large leaf blades provoke attention due to the combination of large leaf transpiration surface and low wood water conduction efficiency. Temperate rainforest ecosystems in Chile give a unique opportunity to study such plants by comparing with homoxylar angiosperms growing in the same association. The aim of the study is to find the features of structural-functional organization of gymnospermous leaves with large blades illustrated in comparison of Podocarpaceae family and *Drimys* species. Plant specimens were collected in the natural habitats of south-central Chilean temperate rainforest. We revealed that in the leaves of *Drimys* species water conduction specialization is expressed in the great amount of petiole xylem, large tracheid lumens and in the reticulate venation. In the leaves of podocarps it is expressed in the presence of accessory transfusion tracheids (*Podocarpus salignus*) or in the apoplast water movement (*Prumnopitys andina*). This structural specialization type is combined with high transpiration rate, high stomatal conductance, high photosynthesis rate. Development of water storage tissue in the leaves of *Podocarpus nubigenus* and *Saxegothaea conspicua* is a part of water storing strategy, which combines with low rates of physiological parameters. The authors are grateful to the Core Centre 'Cell and Molecular Technology in the Plant Science' at the Komarov Botanical Institute and the Resource Center for Molecular and Cell Technologies and Resource Center «Chromas» of SPBU Research park. This study was supported by the RFBR (17-04-01213A to AAP) and government assignment of the Komarov Botanical Institute (AAAA-A18-118031690084-9 "Structural-functional basis of higher plants development and adaptation").

Keywords: *Podocarpus*, *Drimys*, Chilean temperate rainforest, leaf, anatomy, water storage tissue, photosynthesis, transpiration

Level Of Edcs In *Procambarus Virginalis* Organism At Developing Stages As Potential Hazard For Water Biota And Aquatic Culture Consumers

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Abstract

Many contaminants present in the aquatic environment both alone (in different concentrations) or in complex mixtures that may have an estrogenic disrupting action (Endocrine Disrupter Compounds - EDCs) and their lipophilic and persistent nature contributes to their bioaccumulation in marine organisms. Aquatic vertebrates, such as fish and shellfish, are particularly affected by aquatic anthropogenic contaminants; exposure can be lifelong and through multiple routes, including the skin and gills or through feeding on contaminated sediments or organisms and bioaccumulation is frequent. Water contaminants can impair reproduction, development, immune response and other physiological processes that ultimately can affect aquatic organisms survival. In addition to the direct impact of the water pollutants on the population of aquatic organisms that are included in the food chain when used by humans and wildlife, they pose human health risk and adversely affect the fisheries and aquaculture economy. The present work aimed to determine estradiol concentration in *Procambarus virginalis* at different developing stages from river Dnipro in Dnipro city. Estradiol concentration was determined by ELISA method in the spawn, embryos, and young crustacean carcasses. On investigation results in the spawn simples average estradiol level was 2107 ng/g fresh weight, embryos ones – 2876 ng/g and young crustacean carcasses – 4924 ng/g. These results highlight the ubiquitous bioaccumulation of estrogens in aquatic invertebrates, depending on the exposure duration. The study demonstrates the need of effect-based monitoring EDCs contaminants because of affect on water quality deterioration, serious toxicological influence on aquatic biota and human health for inhibit such potential.

Lipid Peroxidation In The Body Of Different Species Of Animals And Birds

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Abstract

Lipid peroxidation is a physiological process that ensures the full functioning of the body. According to the results of research conducted at the inter-faculty laboratory of biochemical and histochemical methods of the Bila Tserkva National Agrarian University, it was found that the content of lipid peroxidation products in the tissues of various animal and poultry species differs.

In the study of the organs and tissues of rabbits of the New Zealand breed, it was established that the content of total lipids is closely related to the processes of lipid peroxidation and the activity of antioxidant protection enzymes. An increase in the concentration of peroxidation products is accompanied by a decrease in the content of total lipids in the tissues of the heart of rabbits. A decrease in the content of TBA-reactive substanses in the brain tissue of rabbits from birth to 90 days of age was noted. A moderate ($r = 0.66$) correlation between the content of diene conjugates and lipid hydroperoxides, as well as a significant inverse ($r = -0.77$) between the content of diene conjugates and TBA- reactive substanses, was also found. In the heart of rabbits, an inverse moderate ($r = -0.62$) correlation between the content of diene conjugates and lipid hydroperoxides is noted.

In the course of studies of Large White breed boars ejaculate, the intensity of lipid peroxidation is characterized by the accumulation of TBA- reactive substanses, which exhibits a membrane-toxic effect and reduces the physiological ability of sperm. An increase in the content of TBA- reactive substanses in sperm promoted a decrease in the activity of antioxidant enzymes catalase, glutathione peroxidase and a deterioration in sperm quality indicators: sperm motility decreased, their concentration and survival increased, the number of pathological forms and dead sperm increased.

In the course of studies of the blood serum of 6-month-old African ostriches, a high content of diene conjugates was noted, which tend to decrease with age. So, in 9-month-old ostriches, the studied indicator is significantly reduced ($p < 0.05$). An increase in the content of diene conjugates is associated with an increase in the amount of lipid hydroperoxides in the blood serum, with a moderate correlation relationship found between them ($r = 0.50$). At 60 months of age, the number of diene conjugates increases by 1.7 times ($p < 0.01$) compared with the period of onset of egg laying (24 months). The content of lipid hydroperoxides in the blood of ostriches does not change significantly in the period from 6 to 18 months of age.

The pancreasof 1-day quail is characterized by a high content of lipid hydroperoxides and diene conjugates, as evidenced by a high positive correlative relationship ($r = 0.76$). After reaching the age of 5-6 weeks, the content of lipid hydroperoxides in the pancreas decreases (by 2.8 times) and diene conjugates (by 2.7 times).

Key words: lipid peroxidation, rabbits, ostriches, boars, heart, longest back muscle, brain, blood.

Lipidome Changing Of The Soft Coral Sinularia sp. Under Experimental Thermal Stress

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Abstract

Corals are the base of tropical reef ecosystems. The most of coral species contain intracellular symbiotic dinoflagellates (zooxanthellae). The loss of zooxanthellae (named coral bleaching) under environmental stress results in large-scale coral mortality. The most important stress factor is elevated sea surface temperature. This thermal stress is known results in changing of the lipid content and fatty acids composition of the corals. To date, the information on coral lipidomes (profiles of lipid molecular species) and lipidome variations in bleached corals is very limited. To evaluate the role of lipids in coral bleaching and coral symbiotic association, the changings of the lipidome of the soft coral *Sinularia* sp. under 36-h experimental thermal stress were examined. The content of chlorophyll, glycolipids, and 18:4n-3 acid (a part of the photosynthetic complex of zooxanthellae) in the stressed colonies reduced by half indicating bleaching activation. On this initial step, common lipid indicators, such as total lipid, polyunsaturated fatty acid (PUFA), and lipid class levels, did not show significant changes. At the same time, the level of several host molecular species of phosphatidylcholine with acyl markers of zooxanthellae (16:0alk/16:2, 16:0alk/16:3, 16:0alk/18:3, and 16:0alk/18:4) reduced by half. This reduction should be considered as a result of the blocking of PUFA transfer from symbionts to the host and an evidence of this transfer. During experiment, a response of the coral host is triggered and the quantity of the unusual oxidized phosphatidylethanolamine dramatically increases from 0 to 23% of total phospholipids indicating processes of apoptosis in coral symbiosoms.

Keywords: lipidome, lipid molecular species, lipid markers, soft corals, symbionts, tandem mass-spectrometry.

Long Term Response Of *Tillia Cordata* And *Tillia Tomentosa* Vegetation Period In Central Lithuania

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Abstract

Climate warming determines significant changes in plant phenology of temperate latitudes, thus making great impact on the duration of vegetation period. These changes are important in the context of plant species migration from their natural habitats. Silver (*Tilia tomentosa* Moench.) and small-leaved linden (*Tilia cordata* Mill.) are most popular linden in European cities. The aim of this study was to estimate the response of linden (*T. cordata* and *T. tomentosa*) vegetation period to changing climate in 1973–2018 in central Lithuania.

Long-term observation of linden phenology was carried out by dendrologists of Botanical Garden of Vytautas Magnus University. Data of small-leaved and silver linden phenology in paper archives were available from 1973 for both species. Possible error of observed phenological events was ±5 days. Data of mean monthly air temperature (°C) and precipitation amount (mm) were obtained from Kaunas meteorology station archives. Changes in 1973–2018 were approximated by linear trend method, taking the values in the beginning (start date) and the end (end date).

The change of mean annual air temperature in 1973–2018 was equal +1.83 °C ($p < 0.05$), and the change of annual precipitation amount – +9.18 (mm) ($p > 0.05$). In 1973–2018 mean annual temperature in the environment of sample linden rose by 0.04 °C per year. Mean vegetation period of small-leaved linden continued 207 ± 2.5 days and of silver linden – 214 ± 2.6 days in 1973–2016 year period. Bud swelling phenophase of small-leaved linden on average started on the 2nd of April and leaves ended falling on the 25th of October, while silver linden's bud swelling phenophase on average started one day earlier and the end of leave falling finished 5.5 days later. Vegetation period of *T. cordata* prolonged by 19.40 days and 25.52 days for *T. tomentosa*. Introduced linden species responded stronger than the local one.

Keywords: *Tilia cordata*, *Tilia tomentosa*, vegetation period, climate warming.

Long-Term Impact Of Reduced Intensity Tillage Systems, Straw And Green Manure Combinations On The Sustainability Of Agroecosystems

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Abstract

Soil tillage has long-term impacts on the agroecosystems. Understanding the structure and functions of the soil ecosystem, when applying soil tillage systems of different intensity or direct drilling is an essential condition for any future farming system. It is very important to ascertain not only the short-term but also the long-term effects of soil tillage on the ecosystem below and above the soil surface. Tillage intensity affects not only physical properties of the soil but also carbon stocks in it. Since 1999, a long-term field experiment has been done at the Experimental Station of Vytautas Magnus University (Institute of Agroecosystems and Soil Science) at 54º52′50 N latitude and 23º49′41 E longitude. The soil of the experiment site is *Epieutric Endocalcaric Endogleyic Planosol (Endoclayic, Aric, Drainic, Humic, Episiltic*) according to WRB (2014), texture at 0–20 cm depth is silty medium loam (33.7% sand, 50.3% silt, 16.0% clay), at 20–40 cm depth – silty light loam (35.4% sand, 51.1% silt, 13.5% clay). The aim of study set out to evaluate the impacts of long-term tillage of different intensities in combination with use of plant residues and green manure on the sustainability of agroecosystems.

The results of the effects on agrochemical soil properties, it can be stated that regular spreading of straw and shallow loosening and direct drilling significantly increased only the pH of the soil. In the plots where straw stayed on the soil surface the longest, until pre-sowing tillage (SR, GMR, NT), the soil pH and total nitrogen content increased. In the plough less tillage and direct drilling treatments, the contents of available phosphorus and potassium were highly differentiated and larger amounts were concentrated in the upper layer.

Long-term use of plant residues and green manure in combination with a complex application of reduced soil tillage and direct drilling has a positive impact on the sustainability of agroecosystems, i.e. on soil agrochemical, biodiversity components of agroecosystems and help maintain crop rotation productivity.

Keywords: tillage intensity, catch crop, residues, sustainability of agroecosystems

Manifestation Of Ovoid's Form In Nature And Human Life

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Abstract

The problem of an adequate description of the egg and the ratio of its shape and incubation process with various environmental conditions, development strategies, directions of evolution and the phylogeny of birds is relevant in modern ornithology. The egg, as a stage of ontogenesis, contains a significant amount of information that allows you to make many predictions about the incubation process, the quality of the future offspring, as well as some issues related to the state of populations of various bird species. However, many methods of describing the shape of bird eggs do not fully take into account the peculiarities of the ovoid shape, since the closed loop does not allow seeing its constituent parts. In this regard, the composite ovoid method, that we use, is more constructive. In accordance with it, the egg profile is considered as a set of arcs of different radii, which smoothly merge into each other. Such an approach makes it possible to compare various methods of describing an ovoid form that are not related to bird eggs. For centuries, mathematicians have developed many egg-shaped curves based on algebraic equations.

Architects and engineers have built various designs according to ovoid drawings. Jewelers have created different forms of Faberge style eggs. All of them were not ornithologists studying real egg forms. On the other hand, birds produce eggs that are identical by shape with different human designs.

The above shows that the egg-shaped form is a manifestation of the general law of morphogenesis, which manifests itself equally in mental and practical human activity, in the form of planetary orbits, in the form of bird and animal eggs, in the ovoid form of animals, plants and their organs.

All these aspects lead to the idea of a new look at the evolutionary process and the laws of its manifestation. Moreover, the research algorithm is also changing. Until now, the basis of any research included the accumulation of evidence, their synthesis and the search for patterns. The new algorithm is based on the knowledge of the general patterns. Knowing the parameters and the nature of the manifestation of patterns, we get the opportunity to objectively describe any particular object and predict possible ways of its variability. A wonderful example is the Pythagorean figure of Vesica piscis, from which all types of ovoid are derived, and, consequently, the variants of their realization in objects of nature and human activity. On the basis of this figure, we have developed a system of standards for the egg shape [1], which includes the geometric shape, its name and parameters. Only this approach allows us to find the correlation between the shape of the egg and its ability to provide optimal conditions for the development of the bird embryo.

Keywords: *eggs, ovoid shape, general pattern.*

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Memory Impairment In Patients With Surgically Removed Pituitary Adenoma

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Abstract

Pituitary adenomas (PA) are benign brain tumors causing hormonal imbalance, which frequently is followed by physiological symptoms and cognitive dysfunction. PA patients usually suffer from deficits in different memory domains, including working memory, recall and recognition, which are essential for everyday tasks. Neurosurgery is one of main treatment options for PA. It is presumed that after PA is surgically removed, some of cognitive functions including memory might recover over time, however research studies in this area are scarce.

The objective of this study was to assess whether longer period following PA surgery is related to better memory functioning. 36 patients (24 females and 12 males, mean age 50 (SD 13) years) participated in this study. Average follow-up duration after surgery was 82 ± 64 months. Memory domains (working memory, delayed recall and recognition) were measured by Lithuanian version of Hopkins Verbal Learning Test-Revised.

Results showed that one-third of participants still demonstrated significant impairments in delayed recall and recognition domains, and nearly one-fifth had impaired working memory. Correlation analysis revealed significant relationship between longer period following PA surgery and better performance on recognition task ($r = 0.361$; $p = 0.03$), however no significant relationships were found between longer period following PA surgery and better functioning in working memory and delayed recall domains.

In conclusion, memory impairment is prevalent many months after PA surgery. It seems, that working memory and delayed recall difficulties are relatively stable and do not improve over time, however recognition may recover after PA is surgically removed.

Keywords: memory impairment, pituitary adenoma, surgically removed, working memory, delayed recall, recognition

Micromycetes As Producers Of Human Plasma Proteins Activators

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Abstract

Recently, some activities of fungal proteases toward human plasma proteins were found. Thus, representatives from genera *Aspergillus, Acremonium, Artrhobotrys, Sarocladium* and *Tolypocladium* can produce proteases-activators of protein C, prothrombin, plasminogen and factor X. These reactions can be used in practical medicine, both in therapy and clinical diagnostics. The study of the properties of enzymes producing by *Aspergillus ochraceus*, *Aspergillus oryzae*, *Aspergillus sclerotiorum*, *Sarocladium strictum* showed their high activity with respect to proteins of the hemostasis system. Chromogenic peptide substrates were used for determination of studied enzymes activities. *S. strictum* and *A. oryzae* have shown a high ability to activate plasminogen (31,2 nanomoles pNA/(ml×min) and 16,01 nanomoles pNA/(ml×min)). Furthermore, *S. strictum* has shown a high ability to activate plasminogen on the urokinase type which was 56.7 nanomoles pNA/(ml×min). *A. ochraceus*, *A. oryzae* and *S. strictum* can activate factor X (34,6 nanomoles pNA/(ml×min), 4,47 nanomoles pNA/(ml×min) and 32,4 nanomoles pNA/(ml×min)). *A. ochraceus*, *A. sclerotiorum* and *A. oryzae* have high protein C activator activities (65,9 nanomoles pNA/(ml×min), 35,5 nanomoles pNA/(ml×min) and 11,48 nanomoles pNA/(ml×min)). This makes it very interesting for further study in connection with the development of therapy in direction of drugs-activators. Such drugs lyse blood clots by activating the patient's thrombolysis system. This significantly reduces the number of complications of conservative treatment.

Keywords: extracellular proteases of micromycets, proteases-activators of the hemostasis proteins.

Morphological Characteristics Of Nematode's Epicuticles

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Abstract

In recent decades, in many countries, biotesting has become widely accepted method in control system of ecosystem pollution with toxicants. Caenorhabditis elegans is widely used as a model in toxicology and for drugs screening. The nematode epicuticle is a very important protective barrier. In nematodes, it has a peculiar pattern consisting of ring-shaped structures. It is important to note that the epicuticle may change under adverse environmental conditions or be different in structure for certain mutant strains. Unlike traditional transmission and scanning electron microscopy (SEM), atomic force microscopy (AFM) allows obtaining the topography and nano-mechanical characteristics of living nematodes in their natural aquatic environment. Although the length of adults of T. aceti is significantly longer than that of C. elegans, the ring width and furrow depth in both species were almost the same. These phenomena suggest that the frequency and size of the ring can be quite conservative, even in systematically distant species. Our results about surface roughness and nanomechanical characteristics of the epicuticle show that AFM can be successfully used to characterize the surfaces of relatively large invertebrates living in the aquatic environment.

The work is performed according to the Russian Government Program of Competitive Growth of Kazan Federal University, and through funding under the state. tasks 16.2822.2017/4.6. Also, the work was partially carried out with the financial support of the Russian Foundation for Basic Research No.18-34-00778.

Keywords: Caenorhabditis elegans, Turbatrix aceti, Cuticle, Atomic force microscopy, PeakForce tapping.

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Morphological Characteristics Of *Viviparus Viviparus* (Gastropoda: Viviparidae) In The Rivers Of The Northern Pryazovia

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Abstract

The family Viviparidae Gray 1847 are typical representatives of the bottom fauna of various reservoirs, as well as in Ukraine, where today three species of genus *Viviparus* Montfort, 1810 are registered. In the rivers of the Northern Pryazovia, only one species is noted - *Viviparus viviparus* (Linnaeus, 1758). Clams of this species play an important role in freshwater ecosystems. In addition, they are indicator organisms that react subtly to change the state of the water environment. A characteristic feature of the biology of Viviparidae is the egg birth, that is, egg capsules from these mollusks are not deposite outward, but remain within the genital tract of females until they leave the young, which has a completely formed turtle; so they are, in fact, called *Viviparus*.

The dynamics of the hydrological and hydrochemical regimes of the rivers of different geographical zones causes a certain variability of the density of this species and its distribution. In this aspect, the rivers of the Northern Pryazovia are characterized by a significant specificity, the essence of which in the significant dynamics of the water environment. The latter is caused by the presence of the Sea of Azov and the high temperature of the air, which causes intense evaporation and, consequently, salinity of the rivers; In the summer, in some parts of the river, the region even dry up. All this negatively affects the life of all mollusks in general *Viviparus* - in particular. Therefore, in the region of research, the uneven distribution of *V. viviparus* populations is also observed: mollusks of this species inhabit exclusively in the Molochnaya river basin. The purpose of this report was to establish the morphological characteristics of the *Viviparus* population in the rivers of the Northern Pryazovia.

Comparing the size indices of turtles *V. viviparus* between these populations (according to our data) and from different natural and geographical zones of Ukraine, we found differences in both height and width of the shell.

Keywords: *mollusks, Viviparus viviparus, the rivers of the Northern Pryazovia, ecology*

Morphology of Echinocystis lobata grown in the garden

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Abstract

Most histories of biological invasions are related to human-mediated processes. Intensional and unintentional anthropogenic activities are recorded as initial sources for extention of species distribution range. Among alien plants, ornamental gardening is the most frequently documented reason of species arrival to the new sites, which significantly differ in geography, climate parameters and biotic neighbours. The northern countries are less rich in species numbers, compared to the southernmost regions. In colder climate conditions naturalisation of introduced species is presently facilitated by climate warming. Capacity of escape from the areas of cultivation to the wild nature depends on set of species morphological, physiological and biochemical traits. Size of aboveground part is crucial covercompeting neighbouring local plants, occupying bigger space for exposition of photosynthetic organs to the light, also for wider dispersion of the seeds. Compared to ongoing molecular evaluation of inders, morphophysiological traits of plants oftenly remains underestimated. In Lithuania Echinocystis lobata is distinct alien for its ongoing intensive spread. Biology of this species is insufficiantly analysed along its invasive distribution range. Our study was aimed at evaluation of morphological and physiological parameters of wild cucumber Echinocystis lobata grown in the garden. For this purpose two years study was performed, analyzing parameters of the aboveground part. Mass of separate organs, lengths of the 1st-5th order stems, number of fruits and seeds were recorded, comparing two year data. It could be concluded, that among the main reasons of aggressive spread of this species, is very intensive stem growth and production of numerous seeds in Lithuania climate conditions.

Keywords: introduction, ornamental plant, alien species, growth, productivity, Cucurbitaceae, wild cucumber, water macrophyte

Mosquitoes And Tick-Borne Pathogens Detection In Carnivores In Lithuania Using Multiplex Real Time-Pcr

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Abstract

The mosquitoes together with ticks are the major vectors of the spread of diseases around the world. Dirofiliaria is one of the many mosquito-borne diseases. The prevalence of dirofiliaria is rapidly expanding to the northern regions. This disease is caused by *Dirofilaria immitis* and *D. repens* nematodes. The main natural hosts for these worms are dogs and wild canids, such as foxes and wolves. People may also accidentally get infected. Tick-borne pathogens are also very important. The incidence of tick-borne diseases in Lithuania is growing year by year. The prevalence of these diseases is affected by climate change, the prevalence of ticks, their abundance, socioeconomic factors, human behavior. Wild animals are likely to be reservoir hosts of many pathogens. It is therefore important to identify the prevalence of ticks and mosquito-borne pathogens in wildlife. A total of 45 specimens of the spleen of the animals belonging to the group of predators (Carnivora) were collected. For pathogen detection were used classical, nested and real-time polymerase chain reaction techniques. The molecular markers of ITS-2 and IGS regions and 16S rRNA, 18S rRNA, 23S rRNA, ssrA, gltA, 17 kDa, msp2, msp4 genes were used in the study. *Babesia* spp. were found in 26 (57,8 %), *Anaplasma* spp. 19 (42,2 %), *Borrelia* spp. 11 (24,4 %), *Bartonella* spp. 10 (22,2 %) and R*ickettsia* spp. 3 (6,7 %) animals. Microfilariae are not detected in any of tested specimens.

Keywords: Carnivores, Vector-Borne pathogens, PCR

Multilocus Sequence Analysis Of Bartonella Strains Isolated From Small Rodents

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Abstract

In the ecosystem rodents play an important role as they are the main carriers of various infectious diseases causative agents. Rodents are considered the reservoir hosts for several *Bartonella* spp. According to the latest data, more than 20 *Bartonella* spp. have been detected in small rodents and at least 6 of them are associated with human diseases. The aim of our study was to investigate the presence and genetic diversity of *Bartonella* strains in small rodents using multilocus sequence analysis. We analysed 324 spleen samples, obtained from seven small rodent species (*A. flavicollis*, *A. agrarius*, *M. minutus*, *M. glareolus*, *M. oeconomus*, *M. agrestis*, *M. musculus),* trapped in Lithuania during 2015–2016. The presence of *Bartonella* DNA was detected by using real-time PCR targeting the *ssrA* gene. Characterization of genetic diversity of *Bartonella* strains were based on sequences analysis of two housekeeping genes (*groEL*, *rpoB*) and the 16S-23S rRNA intergenic spacer region (ITS). *Bartonella* pathogens were detected in 136 (*42 %)* individuals. Phylogenetic analysis of *Bartonella* isolates demonstrated the presence of six genetically different clades associated with human pathogenic *B. grahamii, B.rochalimae* and *B. tribocorum* species, and other species *B. taylorii, B. coopersplainsensis* and *B. doshiae* which pathogenicity to humans is still unknown. *Bartonella* strains belonged to *B. grahamii* and *B. taylorii* clades were heterogenic. Phylogenetic analysis based on each of the targets demonstrated high variability of *B. taylorii* and *B. grahamii* strains between different and either same rodent species. The frequent distribution and high genetic diversity of *Bartonella* species in rodents suggest that they may contribute to unidentified clinical infections, that shows the importance of further investigations.

Keywords: rodents, *Bartonella*, genetic diversity, Lithuania.

Native Fish Species As A Test - Objects For The Investigation Of The Hydroecosystem Existent State

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Abstract

The diagnostic method of first deviations in the most sensitive components of biotic groups is described. Morphological parameters of bone fish liver were used as biotest-systems of ecological monitoring. Forecasting of the toxicant influence on the native ichthyofauna state by morphometric indices of internal parenchymatous fish organs became possible. We have proved that protoplasmic and hemolytic toxicants have break the cell metabolism, causing dystrophy, erythrocyte decomposition, and cell necrobiosis in the fish liver.

The obtained results can be used for diagnostics of various types of hydroecosystems, and also they can be a scientific basis for preservation of biological diversity of the ecosystem in conditions of increased anthropogenic loading.

Keywords: anthropogenic loading, hydroecosystems, ichthyofauna, native fish species, liver, biomarkers, toxicants, reservoir, morphological parameters, pollutants.

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Native Predator-Invasive Prey Interaction: Can Invasive Snail *Potamopyrgus Antipodarum* Escape Native Benthivorous Fish *Tinca Tinca*?

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Abstract

Previous studies indicated the tench the only benthivorous fish species in lakes, which is able to crush the shell of invasive snail *P. antipodarum*. It consumed most of presented snails during the, laboratory trials, though only minor quantities of the snail were found in fish stomach during the field study. Structural or behavioural traits in the snail were assummed to act in predator avoidance. Two hypothesis were tested in current study. First, that spatial aggregation of the invader allows it to avoid predators due to encounter dilution effect. Lower consumption rate by fish specimens was expected in laboratory trials with higher density of *P. antipodarum*. The obtained results did not confirm the assumption. Second, that invader is less nutritionaly valuable than native snails. Higher shell crushing resistance and lower portion of soft tissues in body were expected in *P. antipodarum*. The obtained results indicated that shells of *P. antipodarum* and *B. tentaculata* requires very similar amount of power to crush them. Though native *R. balthica* and *B. tentaculata* were found to contain higher percentage of soft tissues in body than the invader. Additionaly, feeding selectivity of tench was evaluated in laboratory experiments, by presenting native and invasive snails. Results indicated that despite lower nutritional value, all tench specimens were able to crush the shells and consume most of presented snails. In general the obtained results indicate, that studied *P. antipodarum* traits can not explain low number of the invader in the diet of tench in nature.

Keywords: Predator avoidance, shell crushing resistance, body content, feeding selectivity

New Macromolecular Complexes Of Invadopodia Scaffold Protein Tks And Itsn

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Abstract

Invasive cancer cells form invadopodia, that facilitate cell invasion and metastasis. Key players of invadopodia formation include adaptor proteins TKS4, TKS5, ITSN1, ITSN2, kinase SRC, actin regulators CTTN, WIP and N-WASP and others. Although during the last two decades significant advances in our knowledge of the structure and development of invadopodia have been made, detailed mechanisms of their functioning are not yet available. We have identified a series of new TKS4 binding partners including adaptor proteins ITSN1, ITSN2, CRK, GRB2, NCK1, NCK2, kinase SRC, AMPH1, BIN1, PLCg1 and also another member of the TKS family – TKS5. Furthermore, we have found that TKS5 interacts with CR16, WIRE, SHIP2, Ruk/CIN85, AMPH1, BIN1 and CTTN. It may indicate the possible role of TKS4 in transport and sorting of cellular vesicles. Current data are supported by TKS4 interaction with AMPH1 and BIN1 proteins, since their main functions are membrane trafficking and remodeling. Adaptor proteins CRK, GRB2, NCK1, NCK2 and ITSNs are important for actin cytoskeleton rearrangements, endocytosis and signal transduction. We have identified and characterized new TKS4 isoform – TKS4-β. We suggest that an active state of TKS4 is regulated via intramolecular interactions between its proline-rich motifs and own SH3-domains. We have shown the interaction between ITSNs and other prominent component of invadopodia WIP and other members of this family CR16 and WIRE, which play an important role in reorganization of actin cytoskeleton. Altogether, these findings provide insights into the molecular mechanisms of invadopodia formation and identify ITSNs as scaffold proteins involved in this process.

Keywords: invadopodia, TKS, ITSN, protein partners

Nonrandom Characteristics Of Structural Chromosome Rearrangement Appearance In Lymphoid Cell Lines Of Monkeys

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Abstract

A cytogenetic analysis of 6 B-lymphoid cell cultures of monkeys was carried out. Continuous suspension B-cell lines MAL-1 and MB-20 were obtained by transformation of lymphocytes of healthy Macaca arctoides by PHA mitogen. The LUG-4 line spontaneously derived from lymphoid cell lines of hamadryas baboons with hemoblastosis; the sublines El-1, E9-1, E5-1 were established during the cloning of this line.

The only line of tumour origin - LUG-4 originally had a pseudodipploid karyotype with chromosome markers 17p+ ; the cells of other lines either had a normal diploid caryotype on the early stages of cultivation, or such a caryotype was dominant, In the process of permanent cultivation in the MB-20 line the increase of the part of the cells with abnormal caryotype was noted, and in the MAL-1 line a complete replacement of normal caryotype by 8 abnormal marker of chromosomes was found.

The site of chromosome rearrangement 17p+ in the cell line LUG-4 and the site of suppressor gene location in rhesus monkey also coincide.

It appears, that the chromosome rearrangements in the sites of these genes localization lead to functional changes of DNA sequences, and change the proliferate status and differentiation of cells. The occurence of a suppressor gene RB1 in the chromosome 17 and its inactivation is suggested to be a cause of malignization of the original material *in vivo;* the increase of the number of copies of the eighth chromosome in a monkey, and consequently of the dose of structural gene and gene product apparently affects the regulatory gene mechanisms and underlines the selective advantage of this cell clone.

Keywords: cytogenetic analysis, karyotype, chromosome rearrangement, genes localization.

Of Biofuel Ash And Compost Mixtures Influence On Soil In Field And Pot Experiments

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Abstract

The general aim of environmentally sound waste management is to bring the human material economy closer in line with nature's needs so that human consumption of resources and the generated wastes do not endanger the environment. Waste treatment methods and waste technology have developed dramatically during recent years in line with this thinking [1]. Biofuel ash is alkaline waste (pH ~ 13). In ash contains a lot of nutrients (K, P, Ca, Mg), which are necessary for plants and soil. Compost is utilised as a soil amendment or an organic fertilizer. Compost to soil increases the organic matter in the soil, improves the nutrient yield of plants, and favourably modifies the physico-chemical and biological characteristics of the soil. Compost also improves the structure of soil by enhancing clumping, and thereby improving the texture and the permeability to air and water [2]. The aim of the research is to evaluate the influence of biofuel ash and compost mixtures on the changes in soil pH, phosphorus, potassium, calcium, magnesium and heavy metals concentrations in time. The experiment was carried out under two conditions: fields and vegetation pots. Chemical composition (phosphorus, potassium, calcium, magnesium) was analyzed using the atomic-emission spectrometer (AAS) and heavy metals (cadmium, copper, chromium, zinc, lead, nickel) using the plasma optical emission spectrometry (ICP-OES). The concentrations of heavy metals (Cd, Cr, Cu, Pb, Ni, and Zn) in the biofuel ash and compost were sufficiently low not to prevent their use in agriculture fertilizer. Overall, the concentrations of nutrients (Ca, Mg, K, and P) were reasonably high.

Keywords: biofuel ash, compost, fertilizer, nutrients

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On The Peculiarities Of Vitamin E Influence On The Quality Of Geese Meat

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Abstract

Vitamin E is traditionally considered the main tissue antioxidant. However, the results of ample research in recent years testify that, depending on many factors, primarily, the dose of vitamin E has both positive and negative effects on the organism. According to Japanese biochemists, an excess of vitamin E stimulates the formation of osteoblasts that destroy bone tissue of animals. In this regard, further studies on the effects of vitamin E on metabolic processes should be aimed at optimizing the recommended doses of vitamin E in the animal's diet.

The aim of this work was to explore the effect of vitamin E double dose in the diet of geese on the quality of the produced meat. As an object of research the geese are chosen because their muscular tissues are characterized by a specific fatty acid composition with a high content of polyunsaturated fatty acids and, accordingly, by the ability to oxidative damage at a low temperature storage of this meat. The geese diet of the experimental group in the pre-slaughter period (from day 42 to day 63) differed from the control group diet with its twice as much (40 mg / kg) of vitamin E content. The geese meat was kept at -18ºC, the storage period was limited by State standards of Ukraine (210 days). The process of peroxide oxidation of lipids in meat was evaluated by the content of TBA-active products. For the integral evaluation of endogenous antioxidants in meat, the antioxidant activity ratio was applied. At the same time, fatty acid composition of lipids and the content of fat-soluble vitamins E, A and β-carotene were determined.

The results of the experiment show that the antioxidant activity of the 63-day geese thoracic muscles of the experimental group by 63.6% exceeded the corresponding index in the control group. During storage, the antioxidant activity of the geese meat of the control group decreased by 3.0 times and became less than the corresponding indicator of the experimental group by 81.8%. The total unsaturation of the fatty acids of the thoracic muscles of the 63-day-old geese of the control and experimental groups probably did not differ. However, during storage, this indicator of the control group decreased by 14.9%, while of the experimental one - remained at the initial level. At the end of the experiment, on the background of the same content of oleic acid, the geese meat of the experimental group was characterized by a significantly higher content of indispensable linoleic and linolenic acids (by 48.2% and 11.8%) and polyunsaturated docosapentaenoic and docosahexaenoic acids (by 71.4% and 80, 0%). The meat of the experimental group geese throughout the experiment had significantly higher content of vitamin E and 29.1% higher content of β-carotene at the end of the experiment. Consequently, adding the double dose (40 mg / kg) of vitamin E into the diet of the geese in the pre-slaughter period does both: increases the antioxidant activity of the geese muscle tissues, and inhibits the oxidative damage of the meat at low temperature storage, which is confirmed by the analysis of the fatty acid composition.

Opn And Ykl-40 Expression In Astrocytoma Patient's Tumour And Blood Serum Specimens

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Abstract

The most devastating diagnosis of all CNS cancers is glioblastoma (GBM). It spreads quickly and invades other brain parts. Median overall survival after GBM diagnosis is less than 15 months. Finding molecular markers for earlier GBM detection could be critical for more effective treatment and longer patients' survival. The most promising markers are OPN and YKL-40 proteins which functions are related with tumour invasiveness and angiogenesis.

The aim of this study was to verify proteins OPN and YKL-40 suitability as astrocytoma detection markers in patients' blood serum and tumour tissue samples.

As a study group different grade astrocytoma patients were chosen. ELISA method was used to measure proteins level in serum. Western Blot method – for relative proteins level in tumour tissue. To detect OPN-coding gene - *Spp1*, YKL-40-coding gene - *CHI3L1* -expression in mRNA level in astrocytoma patients' tumours qRT-PCR was used.

In this study were found significantly higher levels of both proteins in GBM patients' serum samples than in healthy control group. Difference investigating relative OPN level in patients' tumour tissues was noticed between low and high grade astrocytoma. Results also showed significant difference between grade II astrocytoma and GBM based on *CHI3L1* expression. Survival analysis demonstrated that shorter survival is related with higher OPN protein level in patients' blood serum and tumour samples, just like with higher YKL-40 protein level in blood serum and higher gene expression in tumour tissue.

Both proteins were confirmed as a potential diagnostic and prognostic astrocytoma markers in patients' blood and tumour tissue samples.

Optimization Of The Rooting Process In Cuttings Of Actinidia Plants Using Triazole Compounds

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Abstract

Cultivation of fruit plants provides humanity with an important food resource, as well as a source of biologically active compounds for health [1, 2]. Introduction of alien fruit plants enriches not wide enough species range in the steppe zone of Ukraine. Actinidia (genus *Actinidia* Lindl.) ripe fruits contain vitamins, pectin, sugars, fruit acids, actinidin. The spread of this useful crop is limited, since propagation by seeds worsens varietals qualities, whereas adult plants have poor survival. The aim of the work was to find the effective methods of rooting cuttings of Actinidia for reproduction by seedlings. The cuts of *A. polygama* shoots were taken from the collection of DNU Botanical Garden. Synthetic compounds (nitrogen-containing heterocyclic derivatives of triazole) were provided by Zaporozhye State Medical University (Ukraine). Known stimulator Charkor (Agrobiotech, Ukraine) was a standard of comparison. The cuts were kept for 20 h in aqueous solutions (100 mg / l), and then transferred to vessels with water. In the cuttings treated with PKR-177, the root average number was 11.8 ± 1.2 and exceeded that for PKR-135 and Charkor (respectively, 1.2 and 2.8 times); root average length reached 53.8 ± 12.8 mm and exceeded indicators for PKR-135 and Charkor by 21% and 6%. In addition, root branching occurred only under the influence of PKR-177. So, synthetic substances PKR-135 and PKR-177 caused the efficient formation of root system in *A. polygama* cuttings, and can be used to create the root growth stimulants.

Keywords: Actinidia, cuttings, rooting, synthetic stimulants

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Osmotolerance Of *Dunaliella Salina* Teod. Microalgae As A Factor In Enhancing Their Stability To Freezing

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Abstract

The ability of some representatives of the ecosystem to adapt is of particular interest in the context of expected global environmental changes. Halotolerant microalgae *Dunaliella salina* Teod. characterized by unique adaptation mechanisms that are used in the industrial production of natural carotenoids. Stress conditions also stimulate the production of the substances with cryoprotective properties: sugars and glycerol [1]. Therefore, it is logical to assume that the adaptation of the *D. salina* Teod. through cultivation in medium with a high salinity can increase the resistance of microalgae to freeze-warm for long-term storage.

One of the significant effects of freezing is an increase of the osmolarity of intracellular environment, therefore we induced the osmotic stress by significant change in the content of sodium chloride in the microalgae culture medium from 1.5 to 4 M. At the same time, the cells were instantly compressed, losing their motility, but they quickly restored their properties when returning to the original medium, indicating their osmotic stability.

Comparison of microalgae tolerance to freezing adapted to media with different concentrations of sodium chloride 1.5; 3 and 4M (cooling rate of 1°C/min to + 4°C; –10°C; –30°C and –40°C) showed no changes in morphometric parameters and cell survival after cooling to a temperature of –30°C, but if down to –40°C, the preservation of cells increased with a rise in the medium initial salinity.

Our results are important not only for predicting the survival of halophilic microalgae under extreme environment climatic conditions, but also for the scientifically-based optimization of their cryopreservation protocols.

Keywords: halotolerant microalgae, osmotolerance, viability, freezing

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Osteological Analysis Of Baculum In Representatives Of Canidae Population From Lithuania

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The aim of the study is to measure and compare the baculum (*os penis*) of Canidae family species from Lithuania – wolf, red fox, and raccoon dog – and to evaluate their pathological abnormalities.

Material and methods. The present study is based on the bone collection build and inventoried by the Kaunas Tadas Ivanauskas Museum of Zoology. In total, bacula of 13 adult wolves, 28 red foxes, and 13 raccoon dogs were analyzed. An osteometric analysis was performed by using A. Čanady's and L. Čomor's method [1]. The pathologies were evaluated visually with the naked eye, specified using literary data. Descriptive statistics, Kolmogorov–Smirnov test, one–way ANOVA were applied for statistical evaluation of osteometric data. The incidence of pathologies in different species was determined by Fisher's exact test.

Results and conclusions. Comparison of osteometric data showed significant differences of bacula parameters of investigated animals ($p<0.001$). The bacula of wolves were longer and wider than of red foxes and raccoon dogs.

The osteometric analysis also showed that bacula of red foxes were by 9.08 mm ($p<0.001$) shorter and by 0.61 mm ($p<0.05$) narrower than of raccoon dogs. The obtained result requires further deeper analysis. The red fox and raccoon dog are comparable in size, yet the differences of baculum parameters, length in particular, are rather significant.

Analysis of baculum pathologies showed that they are not frequent (11 %). The observed pathologies were of two kinds: shape pathologies and osteophytes. Yet the distribution of baculum pathologies between different species was statistically insignificant ($p>0.05$).

Keywords: wolf, raccoon dog, red fox, baculum, morphometry, pathology

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Pah Destruction In Iron Deficient Conditions By *Pseudomonas Putida* Strain Bs3701

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Abstract

Iron is essential nutrient for most living organisms: it is involved in a wide variety of important metabolic processes. Iron plays a crucial role as redox cofactor of important enzymes in many vital processes. However low solubility of iron in water limits the concentration of accessible iron to levels below that required for proper growth.

The efficiency of biological preparations of individual bacterial strains or consortia can be half-reduced while transferring the experiment from laboratory to real environmental conditions. The iron availability can influence the process of PAH destruction where microorganisms have become an instrument for purification from petroleum products.

Using RT-qPCR method we had reliably showed that activity of PAH destruction genes *naphthalene 1,2-dioxygenase* and *salicylate hydroxylase* decreases depending on reduced iron availabitity. However in case of *catechol 1,2-dioxygenase* we had demonstrated that low-iron conditions results in significant increasing of mRNA level.

In the regulatory region of naphthalene and salicylate conversion enzymes the binding site of master ferric uptake regulator Fur was found using Visual Footprint tool. Fur is known to repress the expression of the fur regulon that control iron uptake and storage in response to iron availability. Iron limitation was verified by analysing underconrolled genes *pvdS* and *sdh*. We also noticed that PvdS may also influence the fur regulon genes additional to Fur.

Further experiments involve characterisation of Fur DNA-binding ability using recently designed strains *E.coli* BL21(DE3)pLysE_pET29a.fur.

The research was supported by RFBR (project No.18-29-05071)

Keywords: Iron, Pseudomonas, Polycyclic aromatic hydrocarbons, Bioremediation

Peculiarities Of Distribution Of Colletopterum Piscinale (Nilson, 1822) (Mollusca: Bivalvia) In The Rivers Of The Northern Pryazovia Region

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Abstract

Of rivers of the Northern Pryazovia ecological conditions specifics is reflected in the peculiarities of the dissemination and structural-functional organization of mollusc populations in the region. To identify the impact of environmental conditions on the biotopic confinedness and distribution of molluscs, we have distinguished and studied in detail the *Colletopterum piscinale* as one of widespread mollusca species. According to the size of the shell, this mollusc is one of the largest bivalve mollusc in Europe. Due to its size (up to 15 cm), even at low density, it significantly affects the biomass of benthos. In this regard, the purpose of this work has been to establish the boundaries of current dissemination of this species in the region, identify seasonal changes in the *C. piscinale* size-age population structure.

The spread of Unionidae Rafinesque, 1820, including *C. piscinale*, is associated with a way of their life. The Colletopterum gives preference to rather solid (but not rocky) soils, because it has a filtration life mode - it inhabits the bottom of flowing waters half buried. As in rivers of the Northern Pryazovia prevail soft silt soils, its dissemination is mosaic. Silting is caused by the plain landscape of the region, by the influence of human economic activity on the hydrological regime - flow control, streambed straightening, shores plowing, etc. In the area at a rivers mouth, the existence of *C. piscinale* becomes problematic as a result of the continuous accumulation of soft sediments after every storm in the sea. According to the frequency of occurrence *C. piscinale* is the most represented bivalve molluscs in the region.

The above information shows that *C. piscinale* has a wide but uneven ("mosaic") dissemination in the region. These molluscs are found the most frequently in the Molochna River, in the River Berda and the Obytichna River in areas with sandy or clayey bottom with admixture of silt. Solitary specimens of this mollusk can be found in the rivers Lozuvatka and Korsak. In the rivers Big and Small Utliuk *C piscinale* has not been recorded by us.

Keywords: *Colletopterum piscinale, distribution, rivers of the Northern Pryazovia*

Pedot:Pss Matrix For Biofuel Cell Based On The Membrane Fraction Of The *Gluconobacter Oxydans*

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Abstract

Currently, due to the active consumption of available natural energy sources, it is of current interest searching for new environmentally safe and cheap energy sources like biofuel cells. These devices convert the energy of microbial metabolism or the catalytic energy of enzymes into electricity by the biocatalytic oxidation of organic or inorganic compounds. An important factor affecting the performance of biofuel cells is the stability of the biocatalyst, which directly depends on the immobilization of the biomaterial. Conductive polymers as poly(3,4-ethylenedioxythiophene) polystyrene sulfonate (PEDOT:PSS) can be used as a matrix for immobilization of biocatalyst and act as a supporting framework. This work was devoted to the development of a biofuel cell anode based on the membrane fraction of bacteria *G. oxydans* and PEDOT:PSS.

Co-immobilization of the membrane fraction of *G. oxydans* cells with a conductive PEDOT:PSS matrix was performed by mixing all components with glutaraldehyde. It is a bifunctional reagent and interacts with free amino groups of the membrane proteins. The resulting mixture was applied to the surface of a graphite electrode.

To assess the performance of the modified anodes measurements of the generated potential were carried out. In 5 min after the substrate addition the value of the potential reaches a maximum. When using the BFC based on the immobilized membrane fraction of *G. oxydans* bacteria with glutaraldehyde without a conductive matrix, the value of the generated potential was 232 mV, when the membrane fraction was immobilized together with the PEDOT:PSS the generated potential was 270 mV.

Keywords: biofuel cells, conductive polymer, *G. oxydans*, membrane fraction

Phenolic Compounds And Antibacterial Activity Of *Viburnum Opulus* Fruit Juices And Extracts

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Abstract

The use of plant extracts and other alternative forms of medical treatments is expected to provide an excellent alternative to antibiotics. In particular, *Viburnum opulus* fruits are noteworthy because of large amounts of biologically active substances, such as polyphenols, anthocyanins, carotenoids etc. [Česonienė et al., 2010]. The antibacterial activities of the *V. opulus* fruit juices and ethanol extracts were tested against foodborne and clinical bacteria. The antimicrobial properties of the fruit juices and extracts were evaluated using the agar well diffusion method. The evaluation of the sensitivities of the different bacterial strains to the fruit ethanol extracts revealed that *S. agona*, *S. typhimurium*, and *L. monocytogenes* were the most sensitive, with average inhibition zones of 23.6 mm, 20.7 mm, and 19.1 mm, respectively. *S. epidermidis* and *M. luteus* demonstrated the highest resistance; their inhibition zones were minimal, at 14.2 mm and 15.0 mm, respectively. The highest antimicrobial activities were observed against *S. typhimurium*, *S. agona*, and *L. monocytogenes* (with inhibition zones of 27.9 mm, 26.3 mm, and 26.5 mm, respectively). *M. luteus* and *S. epidermidis* displayed the greatest resistance, with average inhibition zones of 16.2 mm and 16.6 mm, respectively. These results corroborated that fruit juices more effectively inhibited the growth of the Gram-positive and Gram-negative bacteria than ethanol extracts. The conclusion of this study is that *V. opulus* fruits are potential antibacterial remedies.

Keywords: Bacteria, fruits, phenolics, *Viburnum opulus*

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Pinus Sylvestris L. Var. *Cretacea* Kalen. In The ”Kreidova Flora” Branch Of Ukrainian Steppe Nature Reserve: Current State And Conservation Measures

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Abstract

The "Kreidova Flora" branch of Ukrainian Steppe Nature Reserve was created in 1988 to protect unique cretaceous vegetation, including pine forests on chalk. The Standing Committee of the Berne Convention in 2018 added these forests to the list of endangered habitats as “G3.4G *Pinus sylvestris* forest on chalk in the steppe zone“. For the last 30 years, the area covered with pine trees has doubled, but there are threats of invasive plants, periodical fires and losses as a result of military actions since 2014. Satellite remote sensing data (Landsat archive) were used to analyze the distribution patterns and disturbances over 30-year period. The assessment of the stability and risks in this habitat shows its rareness, narrow prevalence, poor reproduction, very high (R> 83%) danger of destruction, and strong sensitivity to the environmental changes. Special set of monitoring and conservation measures are considered to provide successful protection of the habitat as a part of Emerald network.

Keywords: Scots pine, chalky outcrop, endangered habitat, Emerald network, biodiversity conservation

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Plant Life Assessment By The Morphological Parameters Of Stomata Leaves At The „Andreevskaya Valley“ Msw Landfill, In The Chechen Republic, Russia

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Abstract

The article presents the results of the of the plant life assessment by the morphological parameters of stomata leaves at the «Andreevskaya Valley» MSW landfill, in the Chechen Republic, Russia. First, the computer models of the «Andreevskaya Valley» MSW landfill have been constructed. Second, the pollutants compounds spreading such as (CO, NO2, SO2 and HsS) from the «Andreevskaya Valley» MSW landfill have been measured. Third, two experimental and one control area for the assessment of plant life condition have been noted. Fourth, the total number of stomata leaves, the weight and the length of stomata leaves on each sampling sites has been identified. As a result the effect of the pollution compounds spreading on the stomata leaves at the «Andreevskaya Valley» MSW landfill has been revealed.

Keywords: Stomata leaves, morphological parameters, environmental monitoring, plant life conditions, landfill, waste.

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Population Genetic Structure Of Wild Boar In African Swine Fever Infected Area Of Lithuania During 2014-2017

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Abstract

The wild boar is one of the most common mammals in Lithuania, which is currently facing a major challenge - African swine fever. The purpose of this study was to characterize a population of wild boar (Sus scrofa) in Lithuania, using microsatellite analysis. The analysis involved African Swine Fever infected animals during 2014 – 2017. The 16 microsatellite locus analysis were performed using 9 – plex and 7 – plex PCR amplification and fragment analysis with ABI3100 sequencer. Samples were collected from various regions of Lithuania: Vilnius, Kaunas, Šiauliai, Panevėžys and Alytus and are divided into four groups by year The study material blood or tissue collected from 215 hunted or dead animals. The average value of the observed heterozygosity was Ho = 0.525, the average value of expected heterozygosity He = 0.754, observed overall within – population inbreeding estimate F_{IS} = 0.316.

Keywords: Wild boar, microsatellite analysis.

Population Genetics Of Acipenseridae In Siberian Rivers

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Abstract

Population genetics allows us to answer questions connected with evolution and demographic history of species. Vulnerable species studies have a great importance for conservation biology. In fish industry Acipenseridae is valuable commercial fish. This taxon is believed to originate in Triassic. Modern family Acipenseridae includes 25 species and all of them are in IUCN Red List of Threatened Species, many species are endangered. All sturgeon species are characterized by late puberty, not annual spawning, and sensitivity to various external factors. In recent years, aquaculture of many sturgeon species including sterlet (*Acipenser ruthenus*) and Siberian sturgeon (*A. baerii*) has been actively developed, that puts emphasis on the need to control the status of populations of these fish species.

The aim of our work is to estimate genetic diversity of sterlet and Siberian sturgeon in Siberian rivers by the sequence of the control region of mitochondrial DNA and ascertain phylogenetic relationship between major haplogroups of both species based on analysis of whole mitochondrial genome.

An extensive collection of two sturgeon species was obtained from Siberian rivers. 98 haplotypes for sterlet and 43 haplotypes for Siberian sturgeon were first described. Genetic diversity of both species in Siberian rivers was evaluated. We also showed isolation of populations between river basins. Time of divergence of the major haplogroups within both species was estimated. For the first time, phylogenetic relationships based on the sequences of complete mitochondrial genomes have been established between the major haplogroups of both species.

The project was support by RSF №18-44-04007

Keywords: population genetics, sturgeon, conservation biology, mtDNA.

Population Structure Of Protected Isoetid *Lobelia Dortmanna* L. In One Softwater Lake

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Abstract

Isoetid are small, evergreen water plant species, characterized by slow growth rate [1]. Isoetids have some special adaptations, such as high porosity of the plants and the permeability of the roots in combination with the very low permeability of the leaves. These adaptations allow these species dominate in carbon and nutrient poor softwater lakes [2, 3].

Lobelia dortmanna L. is one of the protected isoetid species in Lithuania. The species occurs in some small mesotrophic lakes in eastern Lithuania, where the critical decline of whole populations was observed [4]. In this studies the main aim was to evaluate population density and structure of *L. dortmanna* in depth gradient in lake Eserinis. The results indicated statistical significant ($p<0.05$) negative correlation between the number of individuals and depth of the lake. Also statistical significant ($p<0.05$) relations was estimated on seedlings, juvenile and immature *L. dortmanna* individuals in lake Eserinis. The number of *L.dortmanna* individuals decrease with increasing depth of the lake. We conclude that *L. dortmanna* can be very sensitive and vulnerable to water level fluctuations.

Keywords: *Lobelia dortmanna* L., population structure, isoetids, softwater lake.

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Population Characteristics Of *Lymnaea Stagnalis* (Gastropoda: Lymnaeidae) In Reservoirs Of The South Of Ukraine

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Abstract

Great pondsnail *Lymnaea stagnalis* (Linnaeus, 1758) it is one of the most mass freshwater pulmonary shellfishes of fauna of Ukraine. It is located on all territory of Ukraine. Populations of *L. stagnalis* are usually characterized the high indexes of closeness of population. Great pondsnail is typical the representative of phytophilous groupments of shellfishes of Ukraine, that plays an important role in freshwater ecosystems. A south of Ukraine is a specific region that is characterized a number of features. First of all, it is a presence of sea of Azov, that lays on an imprint on all aquatic ecosystem of region. Moreover, high temperatures promote intensity of evaporation and, accordingly, salinity of the rivers considerably. Considerable vibrations are tested also by acidity of environment. The determined amount of the small rivers of he northern coast of the Sea of Azov, in southeastern Ukraine dries up even. Size indexes of *L. stagnalis* in the specific ecological terms of region of researches became reason of our report.

Basic materials for this work were tests of shellfishes from such rivers: Molochna, Obitochna, and Berda rivers and their tributaries, Velyky Utliuk, Maly Utliuk, Tashchenak, Korsak, Lozovatka. Data on the distribution and size of *L. stagnalis* are given in this work. It is specified that in the environment of small rivers in the Azov seaside as compared to the Forest-steppe zone and and to the marshy woodlands of Volhynia, great pond snail is under depression due to the specific ecological conditions of the region (Steppe zone). It is due to the specifics of the environmental conditions of the region. Limiting factors of the aquatorium are sharp volatility of salinity, lack of currents and high calcium content. As a result, the presence and the number of the species in certain river indicates its hydrological and hydrochemical conditions.

Keywords: *Lymnaea stagnalis, small rivers of Azov seaside, ecological conditions.*

Possible Factors Of The Bystander Mechanism Of Action Of The Fetal Brain Neurogenic Progenitor Cells

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Abstract

Development of state-of-the-art technologies for the treatment of central nervous system diseases using neurogenic stem / progenitor cells (NSC/NPC) is promising but for an objective assessment of their efficacy it is necessary to elucidate the main mechanisms for the implementation of their potential. It is known that NSC/NPC express and produce a wide range of biologically active molecules. NSC/NPC conditioned culture medium (NCCM) can be assumed as a key component of the microenvironment ("niche") of these cells. Aim of this paper is to study the composition of NCCM.

NCCM was obtained from suspensions ($6.0 \cdot 10^6$/ml) of neurogenic rat brain cells (E12-16). The protein concentration was determined and standardized to 1.0 mg/ml, electrophoresis in 10 % polyacrylamide gel and ELISA were performed.

NCCM contained three major prevailing protein fractions with molecular weight of 67, 46 and 25 kDa, as well as few minor protein fractions – 37, 38, 30 and 12 kDa. Also NCCM contained BDNF (115 pg/ml), TGF-β1 (12 pg/ml), IFN-α (7.4 pg/ml), IL-1β (0.9 pg/ml) and IL-4 (1.6 pg/ml).

As follows, the NCCM reveals their properties due to the produced constituent elements, in particular cytokines BDNF, TGF-β1, IFN-α, IL-1β, IL-4. These data suggest the benefit of assumptions regarding the modulating effect of NSC/NPC through the interchange of molecular signals with different types of cell microenvironment by releasing cellular regulators (morphogens, neurotrophins, cytokines, chemokines).

Keywords: neurogenic stem / progenitor cells, conditioned culture medium, modulating effect, cytokines.

Preliminary Data Of Genetic Monitoring Of The Natural Population Of European Smelt In The Southeastward Of Latvia, Ilzes-Geranimovas Lake, Based On Microsatellite Analysis.

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Abstract

The European smelt is a small fish species of the family *Osmeridae*. In last decades distribution range of freshwater smelt has being rapidly decreased and for the nine years, fish caught decreased by eight times. Genetic structure European smelt was analyzed for five years. Using seven microsatellite loci (MGPL Omo 1, MGPL Omo 6, MGPL Omo 11, Oep 1.35, Oep 5.39, Oep 6.1, Oep 6.42). Estimates of structure diversity based on allele number (Na and Ne), heterozygosity (Ho and He), and Shannon information index (I), revealed that the *o.e. spirinchus* was most genetically diverse in 2017 year (Na=4.143; Ne=2.999; I=0.899), and in 2012 year was least (Na=2.571; Ne=1.956; I=0.710). The highest degree of observed heterozygosity (Ho) was found in samples for 2012 (54%).

Keywords: *Osmerus eperlanus m.sprinchus*, European smelt, microsatellites, polymorphism, heterozygosity, differentiation, population.

Preliminary Study On Freshwater Leeches In Lithuania

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Abstract

Leeches (Annelida: Hirudinea) are common in freshwater habitats, however several species are terrestrial or marine. Close to one hundred species are found and registered in Europe. Leeches are well known as ectoparasites, sucking the blood, however majority of species are predators, hunting on other invertebrates. In ecosystems leeches are important as part of food network as food sourceof animals and as vectors of parasites (Trypanosomes; Cestodes, Trematodes). However, up to date, the leech fauna of Lithuanian is poorly studied. The presence of numerous under-collected areas, makes studies concerning these invertebrates from Lithuania relevant. In present study, review of information on Lithuanian hirudofauna is presented. Additionally, collection of leeches stored in Vytautas Magnus university, have been revised. Based on morphology 15 species of leeches belong to four families (Haemopidae, Hirudinidae, Glossiphoniidae, Erpodellidae) and 6 genera were identifed. Morphology was inssufficient for representatives of 5 taxa and are requaring of DNA analysis to state the exact systematic position in the future.

Keywords: Hirudinea, freshwater, diversity, Lithuania

Pre-Sowing Norway Spruce Seed Treatment With Cold Plasma And Electromagnetic Field Induces Long-Term Effects In Plants And Affected Plant Response To Environmental Stress

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Abstract

Norway spruce (Picea abies (L.) Karst.) is a tough conifer, that occupies about 20 % of forest area in Lithuania and is important tree in the forest economy of Lithuania. We investigated the effects of pre-sowing Norway spruce seed treatment with physical stressors – cold plasma (CP, 2, 5 and 7 min), electromagnetic field (EMF, 5, 10 and 15 min) and vacuum (7 min, V) on seed germination and plant performance. We reported earlier, that all applied seed treatments, except CP (7 min), stimulated germination and later observations revealed that CP (5 min) and CP (7 min) seed treatments increased 17 month-age seedlings height and branching in comparison to the control.

In this study we report results on long-term effects of pre-sowing seed treatments estimated by changes in the morphometric traits and secondary metabolite concentrations in spruce needles. In 39-month period after sowing plants grown from V and CP (5 min) treated seeds were higher (by 26 and 17 %, respectively) and had larger (by 33 and 21 %, respectively) number of branches, as compared with control group. In CP (7 min) treated group the number of trichomes in the matured needles was almost twice as higher as in control group. There was no changes among treated groups in total phenolic compounds concentration but pre-sowing seed treatment with CP (5 and 7 in) and EMF (10 and 15 min) reduced UVB stress-induced decrease in concentration of phenolic compounds in matured Norway spruce needles.

Thus, the obtained data indicate that short time pre-sowing treatment of seeds with V, CP and EMF induce multiple and long-term response leading to modulation of economically important plant traits – improved germination, stimulation of plant growth and change in plant response to stress.

Keywords: Cold plasma, Electromagnetic field, Germination, Plant stress response, Pre-sowing seed treatment, Norway spruce.

Prevalence Of *Mycoplasma* Spp. And *Bartonella* Spp. Pathogens In Shelter And Pet Cats In Lithuania

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Abstract

Mycoplasma spp. and *Bartonella* spp. are gram-negative parasitic bacteria identified as causers of domestic cats infections. Hemotropic mycoplasmas are causative agents of infectious anemia in animals. Also infections with novel haemoplasma species have been described in humans, as well as infections with species that have possibly originated in animals, including cats, raising the possibility of zoonotic infections. Bartonellosis has emerging zoonoses. Domestic cats are considered to be the natural reservoir for *Bartonella henselae* and *Bartonella clarridgeiae*, the causative agents of cat scratch disease (CSD). Prevalence of *Bartonella* and *Mycoplasma* species bacteraemia in Lithuanian cats is unknown. The aim of the present study was to identify prevalence of *Mycoplasma* spp. and *Bartonella* spp. pathogens in shelter and pet cats using molecular detection methods. Total of 162 cats bloods samples collected from shelter and pet cats were analyzed. Detection of pathogens was performed using real-time, conventional and nested PCRs and sequence analysis of a 600-bp region of the 16S rRNA gene (*Mycoplasma*) and 16S–23S internal transcribed spacer (ITS) (*Bartonella*). Molecular analysis allowed detection of *Mycoplasma* DNA in 11.11% (18/162) of cats and *Bartonella* DNA in 5% (8/162) of cats. The results of the present study provide knowledge of the distribution of *Mycoplasma* and *Bartonella* genotypes in cats in Lithuania, which allows for better evaluation of the zoonotic risk potential to the Lithuanian human population.

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Keywords: *Mycoplasma*, *Bartonella*, cats, molecular detection, Lithuania

Prevalence Of Zoonotic Mosquito-Borne And Tick-Borne Pathogens In Domestic Dogs From Lithuania

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Abstract

The incidence of vector-borne diseases has been reported to have increased worldwide in recent years, seriously threatening human and animal health. During the past decade, vector-borne diseases have been continuously spreading in Baltic countries including Lithuania. Information on canine vector-borne disease (CVBD) agents at the local and regional levels allows veterinarians to better recognize the pathogens that can affect dogs, thus facilitating diagnosis and treatment. Dogs could be infected with a large number of different CVBD agents such as *Anaplasma phagocytophilum*, *Borrelia* spp. and *Dirofilaria* spp. The filarioid nematodes *Dirofilaria* transmitted by the bite of infected mosquitoes have zoonotic significance, therefore accurate identification of *Dirofilaria* species in dogs is clinically important. Tick-borne diseases have great medical importance worldwide and affect dogs health through the transmission of pathogens by blood sucking Ixodidae ticks. The geographic distribution of infected ticks has expanded because of bird migration, environmental and climatic changes. Infection with *A. phagocytophilum* and *Borrelia* spp. in dogs is mostly asymptomatic or characterized by nonspecific clinical signs, therefore especially important to use appropriate methods for early diagnosis of pathogens. The aim of the present study was to investigate the presence of mosquito and tick-borne pathogens in domestic dogs using molecular DNA analysis methods. In total 193 blood samples were collected from domestic dogs in Lithuania during 2016-2018. DNA was isolated from EDTA-anticoagulated whole blood. Partial internal transcribed spacer region 2 (ITS2) of the ribosomal DNA and cytochrome c oxidase subunit I (COI) gene were used as targets in PCR for detection of canine microfilariae. For detection of *A. phagocytophilum* and *Borrelia* spp. DNA was used real-time PCR. Sequence analysis was used for molecular characterization of detected pathogens. Results of molecular analysis demonstrated the presence of *D. repens* in 32 %, *A. phagocytophilum* in 76 %, and *Borrelia* spp. in 28 % of examined dogs. Our findings show high infection rates of vector-borne pathogens in dogs in Lithuania. Further investigations of these zoonotically important pathogens applying modern effective diagnostic methods will ensure the surveillance of canine vector-borne diseases in Lithuania.

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Keywords: dogs, Lithuania, vector-borne diseases, *Dirofilaria* spp., *A. phagocytophilum*, *Borrelia* spp., molecular analysis.

Propagation Of Stress-Induced Premature Senescence In Culture Of Human Endometrial Stem Cells: Paracrine Effect Of Igf-Binding Protein 3

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Abstract

In previous studies, we showed that human endometrium-derived mesenchymal stem cells (MESCs) undergo a premature senescence under oxidative stress [1,2,3] and secrete a large variety of factors referred to as senescence messaging secretome (SMS). SMS factors contained in conditioned medium from senescent MESCs (CM-old) were capable of triggering the premature senescence mechanism in young cells [4]. By applying the both proteomic and bioinformatic SMS analysis, upregulated IGFBP3 was identified. Here, we have investigated phenomenon of IGFBP3 secretion by senescent cells and an impact of extracellular IGFBP3 on paracrine senescence induction in young cells, as well. Experimental approaches such as a specific IGFBP3 immunodepletion from CM-old, IGFBP3-knockout of cells with using CRISPR/Cas9 technology and the cell treatment with recombinant hIGFBP3 (rhIGFBP3) were utilized. The main senescence hallmarks, including SA-β-Gal activity and proliferative status of cells examined by staining with antibodies against proliferation marker Ki67, were tested. Oxidative stress-promoted senescence of MESCs was accompanied by gradually increasing in IGFBP3 concentration in CM-old. Unlike CM-old, IGFBP3-depleted CM prevented an appearance of senescence morphology in young cells along with decreasing in SA-β-Gal positive cells and increasing in the number of Ki67-positive cells, as well. Thus, the IGFBP3 immunodepletion reduced the pro-senescent impact of CM-old on young MESCs. IGFBP3-knockout suppressed the cell senescence whereas rhIGFBP3 was capable to reverse it, causing the senescence phenotype appearance in MESCs.
Overall, these results assume that among SMS factors, released by senescent cells, IGFBP3 appears to be an important paracrine factor inducing senescence in surrounding cells.

Keywords: mesenchymal stem cells, oxidative stress, premature senescence, IGFBP3, secretome, CRISPR/Cas9

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Reclamation Of Dusting Surface Of Tailings Of Beneficiation Plants

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Abstract

More than 50 billion tons of waste pollute the atmosphere from mining enterprises with various toxic gases and dust in Kazakhstan. These dusty pollutants are carried by air from one layer of the atmosphere to the other (from the troposphere to the stratosphere). The average length of tenure of non-deposited dust (light) is about 2 years in the stratosphere, 1-4 months in the upper troposphere and 6-10 days in the lower troposphere. As a result, the areas of pastures and arable lands are reduced, and various diseases of adults and children also appear. A significant reduction in dust and gas emissions from the surface of man-made waste (tailings of enrichment plants, waste dumps and slag ash, thermal power plants) is achieved by biotechnical reclamation, which involves sowing seeds of crops plants with the use of physiologically active drugs - plant growth stimulants derived from brown coal.

D. A. Kunaev. Institute of Mining developed a technology for obtaining humic preparations from brown coal, which was investigated under laboratory conditions and tested in an experimental field as a stimulator of various growing plants and crops. Laboratory experiments were performed according to the method of B.P. Strogonov in glasses with a capacity of 0.5 liters. The study was subjected to the seeds of wild plants, which were germinated in a thermostat in 5-fold repetition on strongly saline soil substrates in accordance with the standards adopted in Kazakhstan. Laboratory studies were carried out on the substrate of the tailings of the Zhezdinsk concentrator with the use of seeds of plants growing in this region - black wormwood, wheatgrass, parsnip, alabota, etc.

Scheme of experimental tests includes the following conditions: soil preparation, i.e. cultural survey; seeding rate for wormwood 4 kg / ha, for wheat grass - 15 kg / ha; depth of seeding of seeds of grains is 2 ÷ 3 cm, wormwood - without seeding; The method of sowing wormwood and grape grass with a row spacing of 15 cm. Based on the results of laboratory research has been established the consumption rate of wormwood seeds, alaboty, which is 4 kg / ha.

The results of observations showed that on the control plots sown with seeds of wormwood not treated with the preparation, germination rate was 18 ÷ 21%, and on the experimental plots 87%. The tests of the agro-method of pre-sowing treatment of seeds with the humic preparation made it possible to reveal its high efficiency on the tailing storage substrates, usually represented by gray sands of manganese ore beneficiation. The proposed technology can also be used in the biotechnical reclamation of overburden heaps and ash and slag waste of thermal stations of mining enterprises.

Regulation Of The P53 Tumor Suppressor By The Transcription Factor Zeb1 In The Process Of Epithelial-Mesenchymal Transition.

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Abstract

The epithelial-mesenchymal transition is a key mechanism determining the ability of cancer cells to form metastases. During this process, the expression of a number of genes changes leading to impaired stable intercellular adhesion, which in most cases is associated with suppression of the expression of *CDH1* gene, produces the E-cadherin transmembrane protein. The transcription factor ZEB1 serves as a major inhibitor of *CDH1* activity. In turn, the p53 tumor suppressor protein inhibits *ZEB1* thus preventing the appearance of metastases.

In the current work, it was established that inducible overexpression of the *ZEB1* gene in breast cancer cell line MCF7 with inducible activation of *ZEB1* leads to a decrease in the p53 protein level and in the level of the mRNA that belongs to *TP53* gene.

It was shown that ZEB1 causes an increasing of a resistance in MCF7 cells to genotoxic drugs by stopping the cell cycle. This is confirmed by rising of p27 level, which is known as a repressor of the cell cycle, and by a slowdown in the rate of apoptosis of the MCF7 cells with inducible activation of the *ZEB1* gene after the addition of the antitumor drug doxorubicin at a concentration of 1 μmol / ml, which is also demonstrated in this study.

These results show the importance of the role that ZEB1 plays in the process of metastasis and in the acquisition of resistance to anticancer drugs.

Keywords: epithelial-mesenchymal transition, EMT, p53, ZEB1, cancer.

This work was supported by grant RSF No18-75-10076 mol_a_ved.

Relations Between Hydrological Conditions And Raised Bog Surface Fluctuations: Case Study Of Čepkeliai Peatland, Lithuania

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Abstract

Cyclic peatland surface variability is influenced by hydrological conditions that highly depend on climate and anthropogenic activities. Long-term (2002-2018) water table and surface elevation measuring performed in monitoring sites of Čepkeliai peatland allow evaluating the influence of hydrological conditions toward the peatland surface and its feedback toward the water regime. The peatland surface decrease replaced the increase and *vice versa* when the average annual water table was ~27–30 cm. The water depth decline leads to the acceleration of the peatland surface increase. The fastest peatland surface increase, which was 7 cm y^{-1}, was detected in 2011 when the average annual water depth was 20–21 cm. The fastest decrease, which was nearly 6 cm y^{-1}, was in 2014 when the average annual water depth was 27–29 cm.

Draining river discharge was used for verification of hydrological conditions changes detected according to raised bog water table measurement. Rapid increase of peat layer might be influenced by the preceding wet period (2004-2013), that is reflected in the analysis of draining river runoff. The increase of peat layer and succeeding dry period (since 2014) may influence the decrease of water table depth almost to a critical limit (40 cm below surface).

Processes of peatland surface variability differ in time and in separate parts of peatland. Therefore, internal subbasins in peatland are formed. Cartographical data (topographical maps and LiDAR) were used for determination of the Čepkeliai surface variation, identification of drainage subbasins of peatland and scale of the surface changes.

Keywords: Peatland surface, Raised bog, Water table.

Relationship Between Genetic Structure And Habitat Type In Populations Of *Erigeron Annuus*

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Abstract

Daisy fleabane (*Erigeron annuus*) is an alien plant species that was introduced in Lithuania at the beginning of the 20th century. In the century since the introduction daisy fleabane has become an abundant weed of the Asteraceae family, especially in the southern part of the country. Now it is invasive in Europe and Lithuania. The native range of this species is in North America. Though this species usually colonizes disturbed and ruderal habitats, it also penetrates into stable semi-natural communities, such as dry meadows and pastures that can be considered as the primary semi-natural habitats of *E.annuus*. We studied whether habitat changes during the invasion process are related to genetic differentiation of *E. annuus*. Genetic structure analyses were performed for 37 populations of *E. annuus* based on inter simple sequence repeat (ISSR) markers. The genetic differences among the populations from the disturbed and semi-natural habitats were studied using an analysis of molecular variance (AMOVA) and a Bayesian cluster analysis and by calculating the genetic and genotypic diversity parameters. Bayesian cluster analysis and AMOVA revealed differences in the genetic structure of the *E. annuus* populations from the different habitats. According STRUCTURE analysis differences among the populations from the different habitats were evident. A hierarchical AMOVA of populations showed that genetic differentiation was high (Phi_{PT} = 0.606). 11% of the genetic variation occurred among habitats, 50% occurred among populations within habitats, and 39% occurred within populations. This differentiation of populations could be associated with founder effect or with different selection pressures among habitats.

Keywords: Plant introductions, molecular markers, genetic diversity, population genetics, biological invasions, stages of invasion.

Sarcocystis Species Diversity In Muscles And Intestines Of Common Raven (*Corvus Corax*) And Hooded Crow (*Corvus Cornix*)

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Abstract

Members of the genus *Sarcocystis* are cyst forming coccidian parasites infecting mammals, birds and reptiles. They are characterized by prey-predator two-host life cycle. Sarcocsyts are formed in muscles of intermediate hosts, while oocysts/sporocysts develop in small intestine of definitive host. Ominivores of genus *Corvus* may serve as intermediate or definitive hosts. *Sarcocystis* species are characterised in intermediate hosts. In the period of 2015-2018, having examined 14 common ravens and 6 hooded crows collected in Lithuania were examined for *Sarcocystis* spp. Sarcocysts were detected in 13 (65%) and oocysts/sporocysts in 12 birds (66,6%). *Sarcocystis corvusi* and *S. cornixi* were identified in muscles of birds using light microscopy (LM). By LM, two *Sarcocystis* species were differentiated according to the cyst wall appearance. *Sarcocystis cornixi* have striated cyst wall, which reached up to 2 μm, while *S. corvusi* have smooth cyst wall, about 1 μm in thickness. *Sarcocystis frondea*, *S. lari* and *S. oviformis* were determined in intestines of corvids using species-specific PCR, targeting highly variable ITS1 region. Intermediate host of following species are sika deer, roe deer and great black-backed gull. The researches carried out are important for disclosing definitive hosts of *Sarcocystis* species under the natural conditions.

Keywords: *Sarcocystis*, Common Raven, Hooded Crow, Light Microscopy, Species-Specific PCR.

Scattered Dose Effect To Relative Ros Generation In Media And Cells After X-Ray Irradiation

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Abstract

In this study we present experimentally obtained relative ROS generation with and without side scattering effect in affected media and in cells.

Black flat bottom 96 well plate (Thermo Fisher) was placed in a laboratory made PMMA phantom with 4 cm of build-up plastic below and above plate. We applied ionizing radiation dose of 8 Gy with a linear accelerator Varian Clinac DMX with 6 MeV energy X-ray photons and 4x4 cm^2 irradiation field. Dose distribution simulation were performed using AAA algorithm on Varian Eclipse treatment planning. Chinese hamster ovary cells (CHO-K1) were irradiated. Our recent study [1] showed that ROS generation during and after irradiation correlates to cell DNA damage and cell death, therefore we used DCFDA dye method for ROS evaluation. DCF fluorescence after irradiation was measured using spectrophotometer (TECAN Genios Pro 96/384). For the experiments with additional scattering material,100 µl of water were added between each well.

We found a significant ($p < 0.001$) increase of generated ROS in wells with scatter material in both in-field and out-of-field wells by 28.18 % for in-field and by 45.07 % for out-of-field wells. It is notable that scatter material increases relative in-field and out-of-field ROS concentration by 4.6 %, from 34.95 % to 39.56 %. The experimental results go with an agreement with dose distribution simulation.

Side scattering of an applied x-ray energy is significantly changing applied energy to affected cells in the in-field and out-of-field cells, thus in turn ROS generation is altered.

Keywords: ROS, DNA damage, ionizing radiation.

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Screening Of Microorganisms For Antagonistic Activity Against Pathogenic Fungi Of *Pinus* Spp.

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Abstract

Pine (*Pinus*) stands cover more than 34% of the forest area and it is one of the most ecologically and economically important trees in Lithuania. However, more than 1% of pine trees are damaged by fungal diseases every year [1]. Therefore, effective control measures should be applied. Biological control is an alternative to conventional management. For this purpose, in this study, pine needles, buds and twigs were collected in 2018. Healthy plant material and (or) with symptoms similar to those caused by *Neocatenulostroma germanicum*, *Lophodermium pinastri* and *Dothistroma septosporum*, was analysed. 340 fungal isolates from native and introduced *Pinus* spp. trees (*P. sylvestris* 'Beuvronensis', *P. mugo* 'Frisia', *P. strobur*, *P. nigra*, *P. banksiana* xp *contorta*, *P. ponderosa* var. *scopulorum* and *P. parviflora* 'Glauca') were obtained. 102 fungal isolates belonging to 50 morphological groups were subjected for analysis. 23 isolates had a high antagonistic activity against plant pathogenic fungi. As screening of potential biocontrol agents is essential for their further development and suitability to use them for disease management, further research will be followed with effects of the pathogen *in vivo*.

The research was performed by grant "InvazBio" (No. S-LU-18-10) from the Research Council of Lithuania within joint Lithuanian-Ukrainian Cooperation Programme in the Fields of Research and Technologies.

Keywords: biocontrol, antagonistic activity, *Pinus*, fungal pathogens

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Seasonal And Daily Activity Of Mammals In The Colony Of Cormorants

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Abstract

Great cormorants (*Phalacrocorax carbo*) transport nutrients from aquatic to terrestrial ecosystems and extremely change ecosystems in territories of the breeding colony. These changes affect mammals also.

The aim of our study was to investigate mammal activity in Juodkrantė colony, being one of the largest in Europe (ca. 3800 breeding pairs), using camera traps. Cameras were trigger/sensor activated to take a photograph when an animal is present. Pictures taken with at least 1 hour interval were treated as independent observations.

Sampling effort was 1376 trap days from 3 camera trap sites with 896 independent pictures taken. Nine mammal species were registered. Most numerous were wild boar, *Sus scrofa* (n=358), roe deer, *Capreolus capreolus* (n=319), moose, *Alces alces* (n=112) and red fox, *Vulpes vulpes* (n=68). Three non-native species were registered: raccoon, *Procyon lotor* (n=7), sika deer, *Cervus nippon* (n=16) and raccoon dog (*Nyctereutes procyonoides* (n=4). Other registered mammals were red squirrel, *Sciurus vulgaris* (n=10) and hare, *Lepus sp*. (n=2).

Mammals were mostly camera traps captured in the morning, 6:00–9:00 AM and in the evening, 18:00–22:00 PM. Red fox activity differs from other mammals, as they were active between 11:00 and 12:00 AM.

Foxes visited colony mainly in April (8.3 photos/100 days) and June (13.8 photos/100 days) (average – 3.4 photos/100 days in other months). Wild boars were active in June (21.0 photos/100 days), August (87.5 photos/100 days) and September (153.5 photos/100 days) (average – 7.1 photos/100 days in other months).

Keywords: Cormorant colony**,** mammals, seasonal and daily activity

Sediment Electro-Oxidation After Biodiesel Production

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Abstract

The EU's energy policy is to increase the energy of renewable sources to 15% by 2020 with the production of biodiesel being ~ 7% of the total energy produced. In the field of transport energy supply the EU policy is to support the reduction of polluting gases emissions [1].

It should be taken into account that biofuel is 1.5 times cheaper than gasoline and when biofuel is burned, just as much carbon dioxide (CO_2) is released into the atmosphere as absorbed by its plants which are its raw materials.

While working with various physicochemical methods (chromatographic, X-ray (DRON-2), IR spectroscopy (Specord), electrochemical (Sistem-500)), the electrochemical oxidation of sediment formed after biodiesel production was investigated [2,3].

Electro-oxidation was performed in an alkaline medium (7M KOH), on Raney nickel (Ni – Re) based catalysts modified with metal additives, prepared by various methods at different sediment concentrations and different temperatures [4].

The obtained results showed that sediments are a complex mixture of methyl and ethyl esters (C-16:0), methyl ester (C-22:0), monoglycerides, ethyl ester (C-18:0) and glycerol (85-95%). Electro-oxidation in an electrochemical reactor showed the ability to remove current densities of –10–20 mA/cm^2 and obtain products that can be used in householding: 1.3 dihydroxypropane (dioxyacetone); 2-oxo, 3-hydroxypropanoic acid (hydroxygravic acid); 2-oxopropanedioic acid (mesoxalic acid) - a component of lotions, emulsifiers, tanning intensifying creams; catalyst of esters synthesis.

Keywords: biodiesel, electro-oxidation, catalysts.

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Sema3a, Sema3c, Sema3f And *Nrp1* Genes Expression Associations With Glioma Progression And Patient Survival

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Abstract

Glioma is the most common tumor in the central nervous system. The scientists try to find a way to inhibit tumor development and identify potential biomarkers for an earlier glioma prognosis. The aim of this study was to analyze the changes of *SEMA3A*, *SEMA3C*, *SEMA3F*, and *NRP1* gene expression in different grade astrocytic glioma tumors and to identify the association between gene expression and patients' clinical data.

To achieve this goal, total RNA was extracted from frozen tumor tissue and cDNA was synthesized. The expression of *SEMA3A*, *SEMA3C*, *SEMA3F*, *NRP1* genes was determined by qRT–PCR analysis with SYBR Green fluorescent dye. Also, the correlation between expression of *SEMA3A*, *SEMA3C*, *SEMA3F* and their receptor *NRP1* in gliomas was evaluated.

69 tumor samples taken from patients with the diagnosis of I – IV grade astrocytic glioma tumors were analyzed. Increased *NRP1* and *SEMA3F* gene expressions were observed in higher grade (III-IV) gliomas. In contrast, increased *SEMA3C* gene expression was observed in lower grade (I-II) gliomas. The upregulation of *SEMA3A* was associated with poor patient prognosis in higher grade astrocytoma. Increased *SEMA3F*, *SEMA3A* and *NRP1* gene expressions were observed in older patients. In addition, the correlation between *SEMA3F* and *NRP1* expressions was found. These findings suggest that *NRP1* and *SEMA3F* genes could be used as a prognostic biomarkers for determining the malignancy grade of glioma, whereas changes in *SEMA3A* and *SEMA3C* gene expression could be used to predict the survival of patients.

Set7/9 Methyltransferase Expression Level As A Potential Biomarker For Her2-Positive Breast Cancer

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Abstract

Despite the obvious progress in approaches to the diagnosis and treatment of breast cancer, this disease is by far the most commonly diagnosed type of cancer and the most common cause of cancer mortality among the female population in the world [1]. The main biomarkers that are being studied for patients with breast cancer are the estrogen receptor ER, progesterone receptor PR, as well as the epidermal growth factor receptor HER2. HER2-positive form of breast cancer is characterized by an aggressive course, an unfavorable prognosis and an increased probability of resistance to standard chemotherapeutic drugs [2].

We found that the positive status of HER2 is associated with the increased expression of Set7/9 lysine-specific methyltransferase in breast cancer cells. This enzyme is directly involved in such cellular processes as the regulation of the cellular response to genotoxic stress, the cell cycle and apoptosis. Set7/9 methylates histone H3, as well as many transcription factors such as p53, E2F1, YAP, estrogen receptor ER, NFκB, and others [3]. At the same time, we have shown that Set7/9 mediates cell resistance to genotoxic chemotherapy. Thus, we propose that Set7/9 may be considered as an effective biomarker of HER2-positive form of breast cancer resistance to chemotherapy and an attractive target for drug design.

This work was supported by grant RFBR No18-315-20013 mol_a_ved.

Keywords: HER2-positive breast cancer, methyltransferase Set7/9, drug resistance

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Snp And Indel Polymorphisms In The Nf-Kb Gene Promoter Sequence Of Belarusian Long-Livers

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Abstract

A lot of scientific studies are aiming at the identification of genes that determine human life expectancy. Some genes encoding transcription factors are associated with longevity.

The purpose of our work was to compare the frequency of distribution of NF-kB gene polymorphic variants in Belarusian long-livers and the control group.

We analyzed the genome DNA samples obtained from 326 Belarusian citizens. 150 samples were submitted by long-livers and 176 samples belonged to the control group. The control group was represented by 118 volunteers under the age of 90 and 58 patients who died from chronic diseases. We used Sanger sequencing to detect rs2233406 and rs3138053 polymorphisms and a capillary electrophoresis method for the analysis of rs28362491tetra nucleotide INDEL polymorphism. Obtained data was processed using GraphPad InStat Version 3.05 and the on-line tool SNPStats (https://www.snpstats.net).

The Hardy–Weinberg equilibrium was not reached for the frequencies of rs28362491 polymorphism allelic variants in male long-livers only. This fact can indicate the presence of evolutionary influences.

CT and TT genotype carriers of rs2233406 polymorphism were most frequently identified in the group of Belarusian long-livers when compared to the volunteers under the age of 90 (p=0,034) and deceased patients of the control group (p=0,011). This polymorphism is associated with the reduced activity of the NF-kB transcription factor promoter, which in turn reduces the risk of cardiovascular, respiratory and immune diseases.

Keywords: Long-liver, Transcription factor, NF-KB, SNP, INDEL Polymorphism.

Soil Respirational Emissions In Agroecosystems Of Ecological Crops

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Abstract

Though terrestrial ecosystems have acted as a substantial sink for atmospheric CO_2, sequestering about one-quarter of anthropogenic emissions in an average year , however CO_2 concentration in the atmosphere has increased from ca. 277 ppm in 1750 the beginning of the Anthropocene to 410 in the North hemisphere in 2019 as NOAA Research indicated.

Investigations of soil respirational emissions in agroecosystems were carried out at the Training Farm of Agricultural Academy (former Aleksandras Stulginskis University) in 2014–2016. The aim was to investigate and compare environment conditions impact on carbon emissions rates of different crops of ecological farming during vegetation period.

Meteorological conditions mainly forced the soil respiration rates. Air and soil temperature exhibited positive interaction and correlation with soil respiration (r=0.5 in ley and 0.9 in wheat, p=0.03 and r=0.7 in ley and 0.9 in wheat and vetch +oat mixture, p=0.01–0.03, respectively) due to impact on multiple bioprocesses in soil of different agroecosystems. Soil humidity depended on precipitation, which higher norms inflicted anaerobic conditions, and thus negative correlation ((r= -0.3 in wheat and -0.6 in barley with ley undercrop; p=0.04).) with soil respiration was detected. Electrical conductivity was different in ecological crops and depended on precipitation norms (r =0.3) and soil temperature (r=0.2). However correlation between el. conductivity and soil respiration was detected weak ((r=0.1–0.6).

Keywords: soil respiration, emissions, environment, crop.

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Species Composition And Distribution Of Representatives Of The Family Gobiidae In The Freshwater Reservoirs Of The Forest-Steppe Zone Of Ukraine

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Abstract

The fauna of goby fish in the northern part of the Azov-Black Sea basin, adjacent to the mainland of Ukraine, has 35 species from 17 genera [1]. The initial ranges of these fishes are brackish and marine areas. Some species that are representatives of marine faunal complexes. Of the representatives of the Ponto-Caspian complex are: *Neogobius melanostomus* (Pallas, 1814); *Neogobius fluviatilis* (Pallas, 1814), *Mesogobius batrachocephalus* (Pallas, 1814); *Ponticola kessleri* (Günther, 1861), *Babka gymnotrachelus* (Kessler, 1857). The goat *Pomatoschistus marmoratus* (Risso, 1810) belongs to the East Atlantic-Mediterranean complex.

The large-scale hydro-construction in the second half of the 20th century led to a breakdown of isolation and restructuring of the interconnections between the rivers of the Azov-Black Sea, Caspian, Baltic and other sea basins, as well as the appearance of large artificial reservoirs on them. For some Gobiidae species, habitats in reservoirs have been found to be suitable and even more favorable than baseline ones. The ego was the reason for expanding the ranges and increasing the number of individual eurybiont species in new reservoirs [2].

In order to clarify the species composition, the extent of introduction and the role of goby fish in freshwater ecosystems, in 2016, 16 expeditions were carried out on the reservoirs and rivers of the Forest-Steppe of Ukraine. In addition, a comparative characterization of the morphometric parameters of Gobiidae from freshwater bodies with specimens from the Sea of Azov was made.

Of the 16 studied reservoirs, Gobiidae were registered in eleven. These are Kievskoye, Kanevskoye (r. Dnieper), Korsun-Shevchenkovskoe, Steblevskoe, Matyushanskoe (r. Ros), Yurkovskoe, Lotashovskoe (r. Gniloy Tikich), Zvenigorodskoe, Lisyanskoe (r. Gorniy Tikich), r. Stugna, r. Nyvka.

A comparative analysis of morphometric parameters showed that the Azovsky bulls are larger than the bulls from freshwater reservoirs and rivers, and the individuals from the reservoirs are larger than those from rivers.

Keywords: *Gobidae, rivers, reservoirs, Sea of Azov*

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Species Diversity Of Hydrobionts Communities In Steblevskyi Reservoir At The Ross River And Prospects For Aquaculture Development

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Abstract

Steblivske reservoir is located in the middle reach of the Ros river and is the second largest reservoir. It gets water around the upper watercourse of the river and, of course, carry the stream of the surface, industrial and domestic waste water. On the other side of the upper river sections a significant number of fish and other hydrobionts organisms come to the said reservoir during spring and autumn river bed washes. Due to this fact the purpose of the study was to determine the species composition, density and biomass of hydrobionts of Steblivske reservoir.

As result of studies it was found that there are 56 types of algae of 7 divisions within phytoplankton. In terms of biomass diatoms dominated in all samples. It should be noted that among them centric class dominated, including Stephanodiscus hantzschii Zooplankton includes 46 taxons of three main systematic groups. The dominating group by number were rotifers and copepods crustaceans, and by biomass - copepods by means of larvae and young cladocera and crustaceans. The Shannon index values indicate oligo dominant character, i.e. balanced zooplankton group. In species composition of macrozoobenthos it was found 42 types of invertebrates. Among taxonomic groups in the grouping in general a leading role played by mollusks and chironomids oligochaetes complex forming 64% of species total amount, other groups percent was within 3-5% of the total. Ichthyofauna composed of 30 fish types of 8 families. Maximum number of fish represented introduced by carp family Cyprinidae - 17 species.

Keywords: *hydrochemical regime, phytoplankton, zooplankton, macrozoobenthos, ichthyofauna, Steblivske reservoir, aquaculture*

Stability Of Amorphous State Of Plant Vitrification Solutions

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Abstract

The research aim was to investigate the stability of an amorphous state of plant vitrification solutions (PVS) by the DSC method. The objects of the study were PVS 1 modified (22% glycerol+13% 1.2-propylene glycol+13% ethylene glycol+6% dimethyl sulfoxide+0.4M sucrose), PVS 2, 88% PVS 3, PVS 4, PVS N (15% glycerol+15% ethylene glycol+34% sucrose). The thermograms were recorded after quenching of the samples in liquid nitrogen at a warming rate of 0.5 deg/min.

The temperatures of PVS1, PVS2 and PVS3 glass transition were at –109, –111.3 and –93.9°C respectively. No exo- and endothermic peaks have been recorded. This indicates that there was no crystallization, both at the cooling stage and at the heating stage.

In PVS4 and PVSN thermograms, besides the glass transition (–111.5°C and –110, respectively) there were ice devitrification peaks (–64 and –70.9°C, respectively) and ice melting peaks at –50.5°C. Heat of crystallization in PVSN was 2.8 times higher than in PVS4. This indicates that the crystalline phase was greater in PVSN than PVS4.

It should be noted that the development of crystallization in PVS4 and PVSN may be related to the low heating rate used in this work. At higher heating rates, this crystallization is likely to be avoided.

Thus, the PVS1, PVS2 and PVS3 have a high glass-forming ability and stability of the amorphous state. The stability of an amorphous state of of PVS4 and PVSN is significantly lower.

Keywords: Plant vitrification solutions, glass transition, amorphous state stability, devitrification, ice melting.

Staining Of Tremtode *Parafasciolopsis Fasciolaemorpha* (Fasciolidae) With Luminiscent Benzanthrone Am323

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Abstract

Trematode *Parafasciolopsis fasciolaemorpha* parasite in herbivore species of Cervidae family causes parafasciolopsosis disease. Natural host of *P. fasciolaemorpha* is elk (*Alces alces*). Trematodes are 3-7 mm long and about 2 mm wide, infect liver. Disease leading to anemia and weight loss of animal[1]. In current study mature flukes of *P. fasciolaemorpha* from elk's liver were used.

Confocal laser scanning microscopy is becoming more aplicable in parasite studies. Staining methods are very labour intensive, long-going, and are specific for tissue. The aim of this study is approbation of benzathrone luminophore dye AM323, and elaborating more efficient and less time consuming staining protocol for freshly fixed trematodes. Five fixatives: 70% ethanol, AFA, Bouin`s, Carnoy and 10% formaldehyde are utilized during the experiments. Visualisation and imaging was performed by a high speed multiphoton confocal laser scanning microscope.

The obtained results, using staining protocol with AFA fixative and AM323 luminophore, give detailed visualisation of the internal and external structure of the trematodes. Developed technique is less time consuming and more available.

The study funded by the project No. 1.1.1.1/16/A/211.

Keywords: *Parafasciolopsis fasciolaemorpha*, benzanthrone

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Steam Approach To The Process Of Future Teachers Training In Natural Sciences

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Abstract

STEAM education as an interdisciplinary concept, actively integrated into the educational space in different countries of the world and can act as one of the effective technologies of formation competencies to meet the diverse human needs.

STEAM education is aimed at interdisciplinary an integrated approach to the study of the object and process, allowing to study them simultaneously from different directions, and not consistently from the point of view different areas of expertise.

STEAM training classes must include a lab research and projects implemented in the process of group work. Exactly these forms determine the development of student's key competencies XXI century: creativity, critical thinking, teamwork, etc. The development of these competencies will allow students in the future to effectively solve problems of any level – both personal and and global.

To create an innovative model of training and education of teachers with professional interdisciplinary skills are required knowledge, able to use them and able to transfer these competences his students. But the question is especially relevant at the present stage

training of such specialists.

The first steps in this direction were taken in BSPU named after Maxim Tanka. Here we are working on the creation of a Pedagogical STEAM-Park. The developing and conducting a number of STEAM classes, which students – future teachers – acquire the skills of project work and improve their competencies for an effective professional activity. To work with students is conducted in two directions: development autonomy STEAM case and the STEAM development projects, which subsequently implemented by the students with students of different age group.

Keywords: STEAM education, key competencies XXI.

Succession Of Microbial Communities In Renaturalized Light Soils Of Eastern Lithuania

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Abstract

The present research was carried out in a long-term experimental plot in eastern Lithuania (arranged in 1995 in a sandy loam *Haplic Luvisols* former crop rotation field), including four sites of different land uses: cropland, divided into fertilized field and not fertilized field, managed grassland, divided into fertilized field and not fertilized field, fallow and afforested field with Scots pines. During a 24-year of arable land renaturalisation many factors were evaluated – changes of macromorphological, agrochemical soil properties and productivity, without any attention to soil microorganisms, which play a very important role in all ecosystems, especially in agrocenosis. Investigation on soil microbial communities was started in 2017. Soil samples were taken three times per vegetation and abundance of cultivable bacteria, fungi including yeast and yeast-like fungi was ascertained by standard dilution method. Three physiological bacterial groups were analysed: diazotrophic, organotrophic, and mineral nitrogen assimilating. Whereas there are no initial data about soil microbes diversity in investigated plots, we have manipulate only with short-term data yet. There were statistically significant differences among microbes' amounts in different experimental sites found. Biggest amount of bacteria were observed in summer samples of all sites excluding fallow and afforested fields: $5.18\pm0.04\times10^5$–$7.76\pm0.03\times10^5$ cfu/g. In fallow and afforested sites biggest amount of bacteria was detected in autumn: $4.64\pm0.03\times10^5$–$5.32\pm0.02\times10^5$ cfu/g. Amount of fungi reached peak in autumn up to $7.03\pm0.15\times10^3$cfu/g in Scots pines' site and a lot less in other ~$3.57\pm0.10\times10^3$cfu/g. The monitoring of soil microbial communities in renaturalised experimental plots will be carried out in the future.

Keywords: renaturalisation, microorganism communities, bacteria, fungi, yeast

Surgical Model Of Spinal Cord Injury In Sd Rats

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Abstract

Over the last years, the research trend has been focused on the replacement of post-traumatic glial scar with biological constructs capable to stimulate the regeneration of axons after the spinal cord injury.

The global review of spinal cord injury (SCI) biomodels demonstrates that only limited research data on inducing standard structural defects of the spinal cord that could be used for implantation procedures, are available [1].

Our study was designed to validate an original minimally invasive method to model a scar of the spinal cord conduction pathways with the aim of its further substitution with biomatrix.

In compliance with the 3R principle, a standard minimally invasive surgical access to the spinal cord of experimental animals was developed. Then, the screening of methods of experimental spinal cord injury was carried out to identify special conditions required for the reproducible modeling of the standard glial scar that will be used in promising implantation techniques.

Keywords: spinal cord injury, laboratory rat, biomodeling.

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Synthesis Of Graphene Oxide Coated With Silver Nanoparticles And Its Antibacterial Effects

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Abstract

Recently, graphene oxide (GO) nanoparticles have been introduced in many fields, such as biological pathogen detection, automotive catalysts, gene and drug delivery, solar panel creation, antibacterial research and many others. Graphene is a two-dimensional, extended-cell type cellular, composed of sp^2 carbon atoms; it has outstanding thermal, mechanical, optical and electrical properties [1]. The usage of graphene oxide as an antibacterial agent for the treatment of infections with multidrug resistance is increasing due to the unique physical and chemical characteristics, such as wide surface area, biocompatibility, excellent electrical and thermal conductivity. Our goal was to assess to what extent graphene oxide, thiolated graphene oxide and graphene oxide covered with silver nanoparticles have an effect on gram-positive i.e. *Staphylococcus aureus* and gram-negative bacteria i.e. *E.Coli*. Graphene oxide was synthesized out of activated carbon using Hummers, Modified – Hummers and Sun's methods. Out of three synthesis techniques, further experiments were carried out to find the best method. Finally, it was decided to determine the minimum inhibitory concentration (MIC) towards *Staphylococcus aureus* and *E.Coli* bacteria. Preliminary results show varying responses between gram-positive and gram-negative bacteria under different material treatment. It is to be believed that the results will contribute to the development of antibacterial tools materials by the usage of graphene oxide and its compounds.

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Tendencies In Alteration Of Environmental State, Climate Change And Population Health Features In The Black Sea Region Since 1980

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Abstract

Kherson, Mykolaiv, and Odesa oblasts, being adjusted to the Sea coast, are located in the steppe zone and constitute the Black Sea Region. Environmental parameters as well as health indicators of the population of the Region are sensitive to the impact of natural (e.g., climate change) and anthropogenic processes. Analysis of the satellite remote sensing data (NOAA NDVI series; SMOS, ASCAT and SMAP data) for assessment of the vegetation and soil moisture condition demonstrates increase in drought events frequency and duration in the Region during last few decades. Assessment of the data of meteorological observations over the past 100 years [1, 2] proved alterations of some bioclimatic indexes (values are increasing in winter and in summer (due to the increasing repeatability of anomaly high temperatures). Increasing number and variability of climate anomalies can provoke increase of cardiovascular and some other diseases of local population. At the same time, shows tendency to decreasing morbidity of digestion, breathing, endocrine, and circulatory systems [3]). Interrelations between environmental, climate change and population health indicators in the Black Sea Region are being discussed.

Keywords: Climate change, human health, morbidity, bioclimatic index.

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Testing And Optimization Of Polymorphic Microsatellite Primers At Different Populations Of Canadian Waterweed *Elodea Canadensis* (Michx.) In Latvia.

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Abstract

Elodea canadensis (Michx.) is an invasive plant in the Baltic Region and Europe with pronounced edificatory features. Previously the genetic studies of *E. canadensis* not carried out in Latvia and Baltics. Samples collected in natural ecosystems, in the Basin of Daugava River and nearby lakes from eight locations: Lake Svente, Lake Kisezers, Lake Ricu, Lake Stropins, and Daugava River (four sampling places). In the preliminary study, tested polymorphic microsatellite primers selected from GenBank ® (NIH genetic sequence database) for further investigation of the homogeneity of *E. canadensis* populations in Southeast Latvia and allow estimating the distribution level of this species. The first step in the further genetically analysis was the PCR optimization and testing of different conditions (Primers concentration, Cycling Conditions, Temperature of denaturation, annealing, and elongation) for selected primers. Ten pairs of polymorphic microsatellite primers selected: Ecan5b2; Ecan5c; Ecan16; Ecan45b; Ecan46Lb; Ecan55; Ecan58; Ecan60b; Ecan103; Ecan105.

This study partly funded by the Daugavpils University Programme: Grants for the Research, Project Nr. 14-95/16.

***Keywords*:** *Elodea canadensis*, Canadian water weed, Clonality, microsatellites, plant invasion, differentiation.

Testing Methods For Labeling Loci Of Lythrum Salicaria For Aflp Analysis

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Abstract

The present study reports a quick, simple and inexpensive method to isolate genomic DNA suitable for AFLP analysis and other PCR-based applications.

The modified CTAB protocol used in this study could be a useful protocol for extraction of high quality DNA for *Lythrum salicaria*. The DNA was then used for AFLP analysis. After optimization of the reaction conditions, AFLP was used to study genetic diversity among *Lythrum salicaria* accessions [1].

Our study was conducted within the biodiversity exploratories Kazakhstan and Lithuania. Our exploratory spans an area which study plots were established on types of to the river basin, to the river fragment state, to the land cover types of neighbouring areas, employing 3-level hierarchy Corine classification system. The plants were examined by AFLP analysis [2].

AFLPs are dominant markers, such that an individual either has or does not have at least one allele yielding a specific amplified fragment due to modification of restriction sites or changes in neighboring selective nucleotides. The selective amplification allows one to separate the amplified DNA fragments by size.

Statistical analyses of AFLP patterns were based on the ssumptions that AFLP markers are dominant markers with alleles either present or absent, and co-migrating fragments represent homologous loci [3].

Band profiles were scored on the basis of the presence or absence of strong, clear bands. Faint bands were excluded from the analysis. Total diversity was partitioned into that within regions or populations and from this the proportion of variation that was between regions or populations was calculated.

Keywords: *Lythrum salicaria*, AFLP, polymerase chain reaction, electrophoretic detection, genetic diversity

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Testing Methods For Marking Loci Of *Lythrum Salicaria* For Aflp Analysis

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Abstract

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Testing Of Biochemical Methods For Studies Of Energy Reserves Of The Freshwater Gammarids In Latvian Rivers

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Abstract

The Ponto-Caspian amphipods are one of the most successful invaders in Central European freshwaters and also in the Baltic States. But ecological and physiological studies comparing the alien and indigenous species' physiological traits are insufficient especially in Latvian freshwaters. The aim of this study was to test the biochemical methods for research of energy reserves (glycogen, lipids) in some freshwater gammarid's species (alien *G.varsoviensis, P.robustoides* and indigenous *G.pulex*). Energy reserves were assessed by measuring total lipid and glycogen contents. The levels of glycogen are representative of the energy available for current activities whereas lipids are used during starvation or reproduction periods. Gammarids samples were obtained in the Daugava River and the Lielupe River (May-August). Morphological parameters (length, weight) of specimens were measured. Gender-specific changes in major energy storage compounds in *G. varsoviensis* were assessed as well. Parameters related to energy reserves appeared correlated with gender and physiological status of organisms. Females showed 3-fold higher glycogen and 2-fold total lipid contents ($p<0.05$) than males despite the fact that the males were three times smaller than females ($p<0.05$). In future such energy reserves studies in relation on seasonal variation will allow us to understand relationships between physiological traits of gammarids and environmental factors as well as possible invasion success of alien gammarids.

This research was supported by the DU Research Project No. 14-95/3 "Research of contributing factors on biological invasions of alien amphipods (*Pontogammarus robustoides, Gammarus varsoviensis*)".

Keywords: energy reserves, gammarid, Latvian rivers.

The Aadvantages And Disadvantages Of Forest Education In Social Media In Poland

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Introduction. Forest education is conducted mainly in Poland by the State Forests. Events organized by them are usually directed to young people. Social media allow for easy communication, thanks to which content can go to different social groups [1] [2].

Aim. To explore how forest education on the Internet influences internauts. What are its pluses and minuses.

Material & Methods. Analysis of advantages and disadvantages based on own observations and available scientific literature.

Results. Forest education conducted in social media not only allows you to gain knowledge about various aspects of the forest, but also motivate you to collect herbs, fungi and forest tourism. An important advantage is the possibility of contact with specialists in natural sciences [1] However, it should be remembered that social media operate with their own rights. Published posts by various institutions and Internet users often have controversial slogans and content to attract readers. The appearance of such content often causes natural conflicts in social media and the production of fake news.

Conclusions. Forest education conducted in social media is effective and necessary, as it reaches wide-audience recipients. Unfortunately too often appearing controversial topics cause chaos and decrease confidence in foresters. Such activities may in the future reduce the effectiveness of forest education, which is necessary to understand the phenomena occurring in nature and forest management.

Keywords: adults educational, social media, nature education, forest education

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The Changes Of Bioactive Compounds In Different Genotype Of Rosehip Seeds

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Abstract

Finding new natural sources of antioxidants remains an important issue, as this will not only enable to enhance the food quality but also to generally improve people's life, wellbeing, and health. In the endeavours to find antioxidant producing plants, of particular interest are the seeds of rose plants (*Rosa* sp.), which have been long used as raw material for medications and vitamins. The aim of this research was to study bioactive compounds of five different rosehip seed species (*R. rugosa, R. rugosa 'Rubra', R. rugosa 'Alba', R. canina, R. villosa*), growing in Pakruojis area in Lithuania. Content of carotenoids and polyphenols in the seeds of rosehips species were determined by the method described by Hallmann (2012) with some modifications.

The results showed different content of carotenoid compounds in all investigated rosehips seeds species. In the *R. rugosa 'Rubra', R. villosa* rosehips seeds the identified α-carotene, lutein, zeaxanthin, lycopene: *cis*- and *trans* –lycopene. The α-carotene and lutein has not been detected in *R. rugosa 'Alba', R. rugose and R. canina* species seeds.

The total phenolic acid content varied from 111.59 to 177.03 mg g^{-1} DW and total flavonoids – 15.06 – 32.19 mg g^{-1} DW.

The results demonstrated that the significantly highest concentrations of polyphenols were identified in the *R. canina* species seeds (207.30 mg g^{-1} DW).

It was found that *R. rugosa 'Rubra'* and *R. villosa* were significantly rich carotenoid compound (respectively 1.19 and 1.07 mg g^{-1} DW), compared with the other species.

Keywords: seeds, species, carotenoids, polyphenols.

The Dynamics Of Pediculosis Spreading In Vinnytsia And Vinnytsia Region In The Time Period Since 2013 To 2017 Among Children Up To Seventeen

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Abstract

Human pediculosis is well-known and widespread disease. Even now, when pediculicides are available, many people suffer from pediculosis – especially children.

In this article we will explore pediculosis spreading in Vinnytsia region and Vinnytsia in the time period since 2013 to 2017. Objects of study are children up to seventeen, who live in Vinnytsia and Vinnytsia region.

In 2013 were 435 cases of pediculosis in Vinnytsia region and 83 in Vinnytsia proper. In 2014 this rate decreased for 16,55% in Vinnytsia region (363 cases). In Vinnytsia it also decreased for 16, 86 %, (69 cases). In 2015 this number increased for 11,02 % in Vinnytsia region (403 cases). In Vinnytsia it increased for 30,3 % (99 cases). In 2016 in Vinnytsia region the number decreased for 8,93 % (367 cases), and in Vinnytsia - for 47,76% (67). In 2017 the number increased again for 8,57% in Vinnytsia region (398 cases), in Vinnytsia it decreased for 29% (48 cases).

If we compare number of registered cases in 2015-2017 years, we can see that in Vinnytsia region it decreased for 8,5%, while in Vinnytsia it decreased for 42,2%, despite increasing of this number in 2015. Also we can see that in Vinnytsia region rate stays almost constant, slowly decreasing, while in Vinnytsia there are quite impressive leaps.

Most registered cases of pediculosis fall into school year when medical examinations of children happen, so we can say that infestations primarily happen in schools and kindergartens, where children are in close contact with each other.

Keywords: pediculosis, human lice, Pediculus humanus, Vinnytsia

The Effect Of Chlormequat-Chloride On The Productivity Of Faba Beans In The Forest-Steppe Of Ukraine

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Abstract

In conditions of the climate change, one of the tasks of modern agricultural production is the search for new ways aimed to increase the yield and quality of fodder bean grain, in particular, through the application of synthetic growth inhibitors having antihyberellin mechanism of action, namely chlormequat-chloride (CMC). It is known that CMC has a targeted effect on the donor-acceptor system of plants and redistributes photoassimilates for the formation and development of faba beans. Application of CMC provides increased fulfilment of the genetic potential of varieties of the intensive type.

It is established that the most favorable terms of applying CMC are the period of formation of generative organs, which affects the increase of the grain productivity and quality.

The research was conducted at the Institute of Feed Research and Agriculture of Podillia of NAAS on the gray forest mid-loamy soils. Faba bean variety Vivat was studied in the experiment. CMC was applied in the phase of the seventh leaf (V_7) at 0.4, 0.5, 0.6 and 0.7% concentrations.

It was established that the maximum grain yield of faba beans (3.84 t/ha) and the highest dry matter increase (8.97 t/ha) was observed on the experimental sites where there was applied spraying with 0.4% solution of chlormequat-chloride in the phase of the seventh leaf, which was 0.97 t/ha and 3.84 t/ha more, respectively, than on the control sites. It was noted that the subsequent increase in the concentration of CMC solution resulted in the significant reduction in the yield of fodder bean grain.

In conditions of the climate change, where moisture supply has become a limiting factor for faba beans, application of chlormequat-chloride is becoming an integral part of the technology of their cultivation.

Key words: faba beans, grain, yield, quality, chlormequat-chloride.

The Effect Of Cu And Cuo Nanoparticles Covered With Surfactant On The Viability Of *Escherichia Coli*

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Abstract

Nanoparticles, which distinguish themselves with antibacterial properties, are a lot discussed during two last decades. Nanoparticles can be found in different forms, sizes which range in 1 to 100 nm, compositions and charges, which cause different effect on bacteria viability. In our study we chose Cu and CuO nanoparticles, where our aim was to evaluate the antibacterial activity of investigated nanoparticles on *Escherichia coli* bacteria. Nanoparticles passages in to the cell depend on their size and coating, therefore we used 25 – 60 nm size nanoparticles. Sodium cholate (NC) is surfactant from bile salts, used to stop aggregation and stabilize nanoparticles. (Lin, Blankschtein, 2010). NC is anionic surfactant, widely used as absorption enhancer to maximize transport of substances into cell (Senel, Hincan, 2001). Concentration of NC in humans depend on its location – in duodenal it is 20 nm, in bile – 14 mM. (Moghimipour et al., 2015). In our study we used 20 mM and lower concentrations solutions of NC for the coating of nanoparticles.

Surface tension method was used to determine critical micelle concentration (CMC) of surfactant solution. Bacteria viability was evaluated by 96 well-plates spectrophotometric method.

The effect of polar CuO nanoparticles on viability of *E. coli* bacteria was higher compared with Cu nanoparticles. The same effect was noticed when nanoparticles were coated with sodium cholate. Viability of bacteria which were coated with sodium cholate was decreased almost two times compared with non-coated bacteria.

Keywords: nanoparticles, sodium cholate, bacteria, viability.

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The Effect Of Cytokinins On Organogenesis And Steviol Glycosides Accumulation Of *Stevia Rebaudiana* Bertoni

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Abstract

Stevia rebaudiana Bertoni is a perennial plant with many active compounds, especially steviol glycosides present mainly in the leaf and other plant parts. Researches and food industry began to take interested *Stevia rebaudiana* Bertoni for a natural sweetners in the last 20 years. Stevia is useful in many areas: for cavities, depression, diabetes, fatigue, heart support, hypertension, hyperglycemic, infections, obesity, sweet cravings, tonic, urinary insufficiencies and as a sweetners.

Research was carried out in Institute of Biology and Plant Biotechnology of Vytautas Magnus University in 2017-2018. Leaves and stems cultured on MS medium supplemented with 1.0 – 6.0 µM BAP, TDZ, KIN), 30.0 g l^{-1} sucrose and 8.0 g l^{-1} agar. It has been done HPLC analysis of steviol glycosides

Our results showed that on MS media without growth regulators shoot formation frequency from leaves was an average 3.89 %, from stem segments was an average 7.78 %. On the medium supplemented with TDZ shoots formation frequency from tested explants was significantly higher in comparison with BAP and KIN. The highest shoots formation frequency has been obtained from stem segments, cultured on the medium supplemented with 4.0 µM TDZ. Medium supplemented with 4.0 µM TDZ can be useful for production *Stevia rebaudiana* plants with increased rebaudioside A and stevioside ratio through somatic tissue culture. The results of this study reveal the possibilities for *Stevia rebaudiana* Bertoni regeneration from leaves tissues.

Keywords: *Stevia rebaudiana* Bertoni, growth regulator, *in vitro*, shoots formation frequency, rebaudioside A, stevioside.

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The Effect Of Outliers And Length Of Records On Design Flood Magnitude

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Abstract

Flood frequency analysis is of paramount importance for the design of hydraulic structures, bridges, flood mapping, and floodplain management. At the same time, it is a long and complicated procedure evaluating uncertainties originating from different sources, because of a variety of data employed. They are collected using different techniques and methods. Here we need digital terrain models (river bed bathymetry and floodplain elevation), must have a detailed hydrological analysis of existing data and finally, decide on methods to be used for flood mapping (hydrological and hydraulic models, spatial data analysis and interpretation). Design of hydraulic structures or production of flood risk maps are based on flood magnitude-frequency relationship at the site using observed data, estimating the magnitude of flood for recurrence period (e.g. 10, 100 or other) and converting it to flood extent. The length of time series and outliers can affect the results significantly and must be considered with the highest attention when performing flood frequency analysis. The term "outlier" is generally used to refer to single data points that appear to depart significantly from other data and may originate as from incorrect observations or appear as rare hydrologic evens. Including or excluding outliers may have a significant effect on design flood. The 60-year length of annual peak flow time series of 20 observation points was involved for data frequency analysis. Four scenarios of analysis performed: two different length of data series and series with and without outliers. The estimated effect of both factors is discussed.

Keywords: Hydrology, Frequency analysis, Outliers.

The effect of salicylic acid on photosynthetic resistance of *Ocimum basilicum* and *Thymus vulgaris* to drought stress under elevated climate conditions

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Abstract

The aim of this research was to investigate the effect of SA on photosynthetic response of basil (*Ocimum basilicum* L.) and thyme (*Thymus vulgaris* L.) under current and warmed climate conditions. The plants were grown in automatically controlled climatic conditions under current (400 ppm CO2, 21/14 ℃, day/night) and warmed (800 ppm CO2, 25/18 ℃) climates, and well-watered and drought stressed conditions. Half of the plants were sprayed with 2mM SA, other – with distillated water. There was obtained, that warmed climate increased the growth of both investigated plant and the effect was more pronounced for basil. Drought stress was decreasing growth parameters of basil, while for thyme the opposite tendency was detected. Salicylic acid effect on dry biomass of both plants was week and statistically insignificant in almost all treatment variants, with exception for basil grown under warmed climate, when dry biomass of plants sprayed with SA increased and decreased significantly ($p<0.05$) for well-watered and drought stressed plants respectively, compare to non-sprayed. Drought decreased photosynthetic rate of both plants ($p<0.05$) also and under warmed climate conditions slightly lower changes were detected for thyme. The effect of SA on photosynthetic rate of drought stressed plants under current climate conditions was week and statistically insignificant. While under warmed climate with SA sprayed plants had statistically significant higher photosynthetic rate than non-sprayed ones. SA increased not only stomatal conductance but also transpiration rate of drought stressed plants under warmed climate conditions, while under current climate stomatal changes of investigated plants marginally differed. Under warmed climate conditions the efficiency of II photosystem of drought stressed and SA-sprayed basil plants increased statistically significant ($p<0.05$) compare to non-sprayed, while the effect on thymus plants was opposite. Salicylic acid increased electron transport flux and normalized area above OJIP transient and decreased dissipated energy flux of drought stressed basil plants under warmed climate. The results indicate, that salicylic acid has changed photosynthetic response of basil and thyme to drought under warmed climate conditions and somewhat higher positive effect of salicylic acid was detected for basil.

Keywords: climate change, salicylic acid, drought, photosynthesis, chlorophyll *a* fluorescence.

The Effect Of *Sucrose Synthase 1* Nonsense Mutation On Freezing Tolerance In *Triticum Aestivum* L.

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Abstract

A significant portion of our population's daily nutrient intake comes from the endosperm of processed wheat – one of the most important cereals in the world [1]. Wheat occupies almost half of all agricultural lands in Lithuania, furthermore, two thirds of it is winter wheat. Winter wheat is known for going through the process of cold acclimation during exposure to low temperatures at autumn and is widely cultivated in temperate regions across the world due to its superior grain yield [2]. The freezing conditions, however, are often known to significantly decrease crop yields in the form of winterkill. Multiple groups of genes are activated during cold acclimation and it is vital to the freezing tolerance and winter hardiness of overwintering crops. Recent research has investigated the role of Sucrose Synthase 1 (Sus1) in freezing tolerance of winter wheat [3]. *Sus1* has been theorised to affect freezing tolerance in winter wheat, as its transcription is increased during cold acclimation [3]. A previous study applied the TILLING method and described a nonsense mutation in exon 8 of *Sus1*, which resulted in significantly decreased *Sus1* expression [3]. The aim of our research is to identify which of the three genomes of *Sus1* mutants carry this mutation, and to conduct a freezing test of selected 6th generation mutant sister lines and wild type to validate the role of *Sus1* in freezing tolerance formation of winter wheat.

Keywords: Sus1, winter wheat, cold acclimation, TILLING.

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The Effects Of Light Intensity On Organic Acids, Iron And Sulfur Metabolism In Vegetables

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Abstract

Vegetables and fruits are the essential part of balanced diet; they are good source of phytonutrients. Leafy vegetables are rich source of vitamins such as ascorbic acid, folic acid as well as minerals such as iron and sulfur. Phytochemicals have antioxidant activity and protect our cells against oxidative damage. In this study, we present how different light intensity produced by light emitting diodes (LEDs) influence the organic acid iron and sulfur metabolism in radich and tomatoes cultivated in the closed environment. Radish (*Raphanus sativus* L., ´Cherry Belle´) and tomatoes (*Solanum lycopersicum* ´Micro Tom´) were cultivated under combinations of red (660nm) and blue (445 nm) LED lighting under different photosynthetic photon flux density (PPFD). The samples were taken from leaves. Results has shown that light intensity differently affects ascorbic acid folic acid, iron and sulfur accumulation in different growth strategy vegetables. The highest contents of organic acids microelement's were found when vegetables were irradiated with 250 µmol $m^{-2}s^{-1}$ PPFD and during maturity stage were irradiated with 150 µmol $m^{-2}s^{-1}$. Tomatoes grown under 250 µmol $m^{-2}s^{-1}$ and during maturity stage irradiated with 150 µmol $m^{-2}s^{-1}$ accumulated about three times more treated investigated compounds than radish. The most favorable conditions for radish and tomatoes cultivation only under 250 µmol $m^{-2}s^{-1}$ PPFD and illumination by lower PPFD during maturity stage. Selecting plants, which naturally accumulates nutritional important metabolites and choosing particular light intensity during vegetation, enables manipulate the metabolic response.

Keywords: light emitting diodes, organic acid, folic acid, iron.

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The Genetic Variability Of The Holstein Blood Parts Having Lithuanian Black-And-White Cattle Breed

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Abstract

This report focuses on Lithuanian black – and – white cattle breed, which covers 70% of all cattle in Lithuania. It is highly genetically related to the Holstein cattle breed and the inspected individuals' samples contain Holstein blood parts, which are categorized in the groups depending on the presence of the blood parts percentage (from less than 50% to 100%). In the present study 26 individuals of Holstein and Lithuanian cattle breeds were genotyped using 16 fluorescently–labeled microsatellite markers (BOVIRBP, BTJAB1, BM6438, BM2830, TGLA122, ETH10, BM1225, BM1818, RT9, BM723, ETH121, BOVFSH, TGLA53, AGLA232, BM1824, RT29) to assess genetic variation and relationships among them. DNA amplifications results revealed that three loci (AGLA232, BM1824, RT29), either failed to amplify or amplified alleles were difficult to score. The genotypes were used to estimate the frequencies of the alleles, the genetic distances, private, dominant and different alleles in the breed groups and loci. A total of 250 alleles were identified with a number of alleles (N_a) at one locus ranging from 7 to 29. Nei's genetic distance estimates indicated relatively close genetic identity (0.132) between less than 50% with 71-78% Holstein blood parts having groups while 100% and 93.75% Holstein blood parts having groups were found most distinct (0.359). The principal component analyses distinguished clearly 100% Holstein group to the remaining groups. These results will be important to save the Lithuanian cattle breed's characteristics and production's quality.

Keywords: Black-and-White cattle, Holstein, genetic diversity, microsatellite markers, phylogenetic analysis

The Influence Of Liming With Different Liming Materials On Chemical Properties Of Soil

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Abstract

Soil acidification is an ongoing natural process in nature but it can be caused by acid rain, leaching of nutrients, using physiologically acid fertilizers and other [1]. Liming is the most economical method of ameliorating soil acidity [2]. The amount of liming material required will depend on the soil pH profile, lime quality, soil type, farming system and rainfall.

The objective of the study was to investigate chemical composition of different liming materials, to assess their quality and impact on chemical properties of soil. For the experiment we used five different liming materials. The liming rate 5 t/ha is calculated by the amount of active substance - $CaCO_3$ in liming materials. Spring barley was grown in vegetatation pots and in the first year of field experiment. The pot experiment was conducted in plastic containers maintaining optimum and excess moisture content of soil.

After the pot experiment was found that in both optimal and excessive moisture conditions after 14 weeks of liming, the highest pH values 7.1 and 7.5 reached granulated liming material 0.1-2. The amount of leached Ca and Mg ions were determined under excess moisture conditions. The largest amount of Ca and Mg ions leached from treatment which was limed with crushed liming material and the smallest amount leached from limed with granulated liming material 0.1-2. After the first year of the field experiment was found that after 16 weeks of liming, the highest pH value 6.2 reached powder liming material.

Keywords: Liming materials; liming; soil acidification.

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The Influence Of Meteorological Factors On Growth And Vegetation Rhytmics Of *Artemisia Pontica* L.

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Abstract

The seasonal development rhythms of the medicinal, spice (aromatic) plants (MAPs) match with the length of vegetation period and reflect seasonal and periodic climatic conditions [3]. These changes are important in the context of plant species introduction from their natural habitats to *ex situ* collections.

Previous studies have found that Lithuania's largest number of (MAPs) species − 46 are *Astraceae* (Bercht. & J. Presl) family [2]. In the plant kingdom, family *Asteraceae* is endowed with prospective plants, and among these plants, the genus *Artemisia* L. occupies top position for its bio-prospection. The genus consists of small herbs and shrubs, found in northern temperate regions and comprises of about 500 species [1].

The investigations were conducted in Spice − Melliferous plants collections in Scientific sector of Medicinal and Aromatic Plants of Botanical Garden at Vytautas Magnus University during vegetation periods in 2017-2018. The object of investigations was *Artemisia pontica* L.− a medicinal, perennial herbaceous plant of the largest *Asteraceae* (Bercht. & J. Presl) family, native of North America, Southern Europe, Southeast Asia.

The results of a study on the dependence of growth and vegetation process of *Artemisia pontica* upon meteorological factors are presented that the earliest beginning of vegetation and optimal climatic conditions for growth are when hydrothermic coefficient reaches 1.50-1.0 (optimal climatic conditions). Than conditions of excessive humidity for massive flowering and the end of flowering maturation are observed when hydrothermic coefficient increases to 1.6-2.0. Research found that 2017 all phenological phases of *Artemisia pontica* started earlier than 2018 about 20 days.

In conclusions, *Artemisia pontica* passes the whole development cycle under climatic conditions of Central Lithuania.

Keywords: *Artemisia pontica*, vegetation period, phenology

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The Joint Effects Of Drought, Heat And Elevated Co_2 On Photosynthetic Performance Of Spring Oilseed Rape

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Abstract

Together with the steady rise in atmospheric CO_2 concentration, extreme climatic conditions with extended drought periods and heatwaves, broadly defined as a period of consecutive days where conditions are hotter than normal, are predicted to increase in frequency and severity in many regions of the world. The aim of the present study was to determine the photosynthetic performance of spring oilseed rape (*Brassica napus* L.) under the 7-day drought, heatwave (HW, 21/14 *vs.* 33/26 ºC, day/night) and their combined treatments. Also, during the stress, a part of the plants was grown under elevated CO_2 concentration (800 µmol mol^{-1} *vs.* 400 µmol mol^{-1}), to investigate the possible mitigating its effect. Upon relief of the stressors and cessation of an additional CO_2, plants were allowed to recover under the control growing conditions. The obtained results revealed that drought and heat acted in a different manner. At the end of the treatment, drought significantly decreased the photosynthetic rate (A_{sat}), stomatal conductance (g_s), transpiration (E) and the ratio of intercellular to ambient CO_2 concentration (C_i/C_a), while increased water use efficiency (WUE). In contrast, well-watered plants grown under HW showed considerably increased the A_{sat}, g_s and E, while WUE decreased. Even so, the adverse effect of drought on gas exchange was highly exacerbated under HW with the combined stress leading to far greater reduction of A_{sat}, g_s, E and C_i/C_a. By improving WUE, CO_2 enrichment alleviated the adverse effect of combination of heat and drought on A_{sat}, during the stress, but it had no significant effect on the recovery. While plant affected by drought stress alone shown steeply and full recovery of gas exchange, after re-establishment of control growing conditions for 7 days, drought-stressed plants subjected to HW exhibited signally slower and incomplete recovery of A_{sat}, g_s, E and C_i/C_a after the cessation of these stressors' combination. These results highlight that, despite CO_2 enrichment, drought might fully negate all the advantages gained from hotter climate and confirm that combination of heat and drought results in a novel manner of stress that cannot be directly extrapolated from each of these different stressors applied individually.

Keywords: oilseed rape, heatwave, drought, photosynthesis, recovery

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The Monitoring Of State Of Street Greeneries In Lithuania

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Abstract

EU countries have been monitoring urban greeneries for many years. Only long-term monitoring and evaluation of plant status can predict trends in the development of urban greeneries. This is especially important now that the level of urbanization, climate conditions, soil characteristics are changing, further spread new pests, plant diseases etc.

In 2009–2018 performing contract work with Alytus and Kaunas city municipalities (under the program 'For the monitoring of green plantations and state of greeneries') the complex methodology for tree state evaluation was used. Status rates – defoliation, dechromation, leaf necrosis, number of dry branches, trunk damages, diseases and pests intensity, were assessed in August under the scale of 0–4 grades.

The state of matured trees, of which the predominant species in urban street greeney in 2009–2018 are: *Tilia cordata*, *T. platyphyllos*, *Aesculus hippocastanum*, *Acer platanoides*, in Alytus and Kaunas cities were sufficiently good. *Tilia cordata* were more sensitive to climatic conditions in summers with long periods of drought (year 2009, 2014, 2015, 2018) – had more physiological damages (defoliation, dechromation, dry branches), up to 3 grades. At places where soil contains more chlorides – leaf necrosis detected slightly frequently (2–3 grades).

Disease agents and pests did not cause significant damage to trees. Yet the activity of the invasive pest *Cameraria ohridella* (on *Aesculus hippocastanum*) at street greeneries was less harmful than at recreational green plantations. *Tilia cordata*, *Sorbus* x *thuringiaca* 'Fastigiata' and cultivars 'Eurostar', 'Columnare', 'Deborah' of *Acer platanoides* have adapted over a relatively short time period (2–3 years). *Aesculus hippocastanum* 'Baummanii' was of the worst condition. Damages to their trunks at all planting sites have reached up to 4 grades and a dead wood harvester *Schizophyllum comune* have developed it self on them. Presumably species of these trees are not suitable for planting at Lithuanian urban greeneries. *Aesculus* x *carnea* is now planted at street greeneries, as it proves to be quite resistant to our urban conditions.

Keywords: monitoring, streets greenery, condition of trees.

The Parallels And Co-Influence Of Historic Changes Of Hydrographic Network And Urban Structure In Vilnius Old City

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Abstract

The sculpture or relief and the hydrographic network of Vilnius city, the territorial complex of the confluence of Neris and Vilnia rivers were shaped by geo-formations genetically set out at the boundary of two ice ages so it determined the complexity of natural processes. The slopes of the deep valleys gave rise to many streams that flowed into the water collectors - the rivers of Neris and Vilnia.

In the study presented, the Paleo-reconstruction of Vilnius Medieval Terrain and Hydrography is based on geological and geo-engineering and historical material.

Streams, springs, other elements of Hydrographic network in urban territories have been transformed at different stages of urban development. Using the Palaeo-reconstruction method based on the location of the hard rocks and the investigation of the lithology of the territory of the historical periods of Vilnius, the indications of temporary water streams were estimated. One of the most notable flows was observed on the western side of Vilnius Old Town at the same rout as the first major streets/trails were.

The major water flows have made the most important section of Vilnius old town and divisions of its urban fabric. Also the surface waters were channelled due to defensive purposes while building the city's defensive wall. The hydrographic network was purposely used to strengthen the city's defence system and ensure the water supply. At first used as drinking water supply, the Vingre stream later became a city waste collector.

It is often said that the old town of Vilnius has a chaotic street network. It is the result not of the economically reasons but the harmonic adaptation to the natural conditions of abundant of waters terrain: street tracks were built in according to the optimal slope of the area (often at the places of the gravelly bedded water streams), that was important at the periods of carriage transport.

In further times the small water streams were not the significant barriers of Vilnius urban development. In the XIXth century the majority of the smallest parts of Vilnius hydrographic network was lost: water streams were drained in open manner or covered. The last parts of the smallest streams were lost in the XXth century.

Keywords: urbanisation, hydrographic network, urban development, geo-engineering studies

The Study Of Nuclear Dna Methylation Of Invasive Fish Species *Amus Sleeper*

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Abstract

Amur sleeper *(Perccottus glenii,* Dybowski, 1877*)* is a freshwater invasive fish species which has rapidly spread during the last two decades in many European countries. The total registered areal of *P.glenii* covers at least the in central and eastern part of Latvia also and we assume that the whole territory of the country potentially can be occupied to a greater or lesser extent by this species at present.

The study of invasion success must be considered complete with the evolutionary genetics, as it might be correlated with the genetic and epigenetic polymorphism of populations, which directly influence the invasive species capacity for dissemination. DNA methylation status is often associated with the process of colonization of new environments.

Before being subjected to epigenetic analysis, the age of *P.glenii* was determined by scales, the individuals belonging to some ecological different aquatic ecosystems from Latvia were morphometrically investigated by 23 plastic parameters which are most affected by environmental factors. For study of influence of environmental factors on global DNA methylation changes the LUminometric Methylation Assay (LUMA) was applied to ecological studies for the first time. DNA methylation levels were detected in invasive fish Amur sleeper in fist time and were compared with its others fish species. Total DNA methylation levels were detected and compered in *P. glenii* samples from ecological different aquatic ecosystems. It was shown; those on the same age, sex and size of *P. glenii* samples the total DNA methylation levels are different and under the global DNA GC-methylation level was increased to 40% under the anthropogenic influence. The role of epigenetic modifications in adaptation potential of Amur sleeper will be discussed.

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The Sun Artich (*Helianthus Tuberosus* L.) In The Conditions Of The Republic Of Tajikistan

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Abstract

A Sun artichoke (sun artichoke – (*Helianthus tuberosus L.*) is a perennial from family of сложноцветных, near relation to the sunflower, that can arrive at a height to 3-4 meters.

To Europe a sun artichoke was brought yet at the beginning the XVII century. Since in more than 500 cultivation of the very simple to the terms sprouting, a Sun artichoke got wide distribution in many countries of Europe, and presently the world breeders are show out more than 300 sorts of sun artichoke.

A Sun artichoke in Republic of Tajikistan was brought by arriving here from a number the specialists of agriculture from Russia as early as the twentieth of the last century (Litvinov, 1958г.). During 2009-2018 by the scientists of Center of innovative development of science and new technology of the Academy Science of the Republic of Tajikistan were was conducted researches on growing of sun artichoke in the conditions of mountain, near mountain zone and valleys. They are collect collection of sun artichoke, studied more than 20 samples got from the different countries of the world and researches are studying of nutrition and begun for hybridization of sun artichoke. On the basis of innovative approaches on the study of Sun artichoke a food value, feed meaningfulness, curative utility and bio-power ability of sun artichoke in a republic, is set. Experiments were conducted on dry earth (without watering), in irrigatione, without the use of fertilizers and with bringing in soil of mineral and organic fertilizers (on height of 840, 1700, 2000 and a 2700 m above see). Material for experiments the tubers of sun artichoke of variety served as "Interest" and “Sarvat”. The results of researches showed that the size of biological harvest of sun artichoke on area requiring irrigations hesitated in limits a from 66,5 to 94,2 ton/of ha, and on dry earth is a from 30,4 to 52,5 ton/of ha.

Especially important are the products made by us from general biomasses of Sun artichoke: ready-to-cook foods from the tubers of sun artichoke, flour, chips, juices, lemonade, syrups, can food, biotea, cooking, pilau, mantu, meat dumplings, sambusa, flat cakes, cellulose, grass flour, feet, green pet feed, flour for fishes, bioethanol (alcohol), biopropellant et. al. (more than 30 the name of products of the different use). Washed-up and cleared tubers of sun artichoke it is possible with success to use for canning for long storage and use in a fresh kind.

Growing of it in the young forests promotes protecting of young nursery transplants of the forest planting from rodents and predators.

In this connection to our opinion it is time rethinking of the folded situation and attitude toward a sun artichoke. It is for what necessary to strengthen scientifically a practical collaboration between scientists, farmers and businessmen of our republic on sun artichoke growing. In this plan the help of state structures is needed and international to organization, working in area of agriculture.

Thermodynamic Prognosis For Optimization Of Biotechnologies Of Biohydrogen Obtaining And Toxic Metals Removal Via Frementation Of Multi Component Organic Waste

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Abstract

The development of industry and husbandry over the past decades has led to a significant increase in the amount of pollutants. Among them, the most hazardous are huge amounts of multi component food waste as well as toxic metals accumulated in ecosystems leading to their destruction. Thermodynamic calculations allow determining theoretically possible metabolic pathways for effective degradation of organic compounds by microorganisms, simultaneously with the removal of toxic metals from the sewage. So, the goal of the work was application of thermodynamic calculations to provide effective destruction of model food waste, synthesis of biohydrogen and removal of model toxic metal CrO_4^{2-} at the concentration 100 ppm. Using experimental industrial installation (volume 240 L) optimal fermentation parameters were established. The pH was maintained at 6.5-7.0 and Eh = –200…–350 mV. The ratio of solid and liquid phases was determined as 1:8. Mixing mode was 2 minutes of mixing / 2 hours of pause. Such fermentation parameters provided high biohydrogen yield 90 L/kg of waste with the maximum concentration of H_2 in the gas phase 50%. The coefficient of waste destruction (*Kd*) was high – 140 times. Achieved during fermentation low redox potential provided fast reduction of high potential soluble CrO_4^{2-} to insoluble $Cr(OH)_3 \cdot nH_2O$ removing it from the model sewage loaded to the fermentation reactor. Thus, high efficiency of application of thermodynamic prognosis method was shown to become the base for effective biotechnology of destruction of environmentally hazardous food waste with simultaneous removal of toxic chromate and H_2 obtaining.

Keywords: environmental biotechnologies, thermodynamic prognosis, multi component food waste, toxic metals.

Thymus Pulegioides Chemotypes In Lithuania: Distribution And Influence Of Edaphic Factors

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Abstract

Chemical polymorphism is characteristic of essential oil bearing species *Thymus pulegioides*. Five chemotypes of *T. pulegioides* growing wild in Lithuania were defined according to the main essential oil compounds such as linalool, geraniol, thymol, carvacrol and α-terpinyl acetate. Although the chemotype of the plant is determined genetically but the qualitative composition of essential oils can be influenced by soil chemical conditions. The aim of the study was to establish distribution of *T. pulegioides* chemotypes in Lithuania and determine the influence of edaphic factors on the percentage of main compounds in essential oils.

One hundred and thirty one different habitats of *T. pulegioides* were investigated in Lithuania. Essential oils were analysed by GC/MS. Mobile phosphorus and potassium in soil was estimated – by flame photometry, fifteen elements – by x-ray fluorescence analysis.

Carvacrol was abundant and most frequent chemical compound (17.66 ± 9.43 %) in the essential oils of *T. pulegioides*. The individuals of geraniol chemotype were rarer in Lithuania (6.57± 8.70 %). The mean amount of thymol was 5.5 times lower than isomer carvacrol. The individuals of *T. pulegioides* linalool, α-terpinyl acetate chemotypes were rare in Lithuania. It was established that higher amounts of mobile phosphorus and sulphur in the soil can stimulate carvacrol accumulation in essential oils of *T. pulegioides*, higher amounts of natrium – limit the carvacrol accumulation. Amount of geraniol negatively correlated with the amounts of humus and chlorine in soil and positively with natrium. Influence of edaphic factors on the levels of thymol, linalool, α-terpinyl acetate was not established.

Keywords: *Thymus pulegioides*, chemotypes, edaphic factors.

Tick – Borne Encephalitis. Epidemiological Situation In Baltic Countries In 2003 – 2018

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Abstract

Tick-borne encephalitis (TBE) is a typical zoonosis disease mainly transmitted to humans by hard ticks from Ixodidae family, mainly *Ixodes ricinus* and *Ixodes persulcatus*. This viral infection affects the central nervous system and can occur in people of all ages. During last decades Baltic countries remain on the European list of countries with the highest number of reported TBE cases. The aim of this study was to analyze the annual incidence of TBE cases in Lithuania, Latvia and Estonia and to explain the reasons of high incidence in these countries. We investigated the reported cases of disease during 2003-2018 using several available sources and case definitions. We also analyzed climatic parameters and impact of climate to TBE epidemiology. Among the Baltic countries, Lithuania ranks first in the number of registered cases of disease. According to Communicable diseases and AIDS Center data, from 2003 till 2018 total 7104 TBE cases were registered with range 220-763 and peaks in 2003 (n=763) and 2016 (n=632) hospitalized cases (22,9 and 21,91 cases per 100000 population, respectively). In Latvia, total 3969 TBE cases were registered with range of 142 – 494 and pick in 2010 (n=494) (21,97 cases per 100000 population). Estonia ranks third: total 2358 cases with range of 81-250 and peaks in 2003 (n=237) and in 2011 (n=250) (17.5 and 18.7 cases per 100000 population, respectively). Research shows that warming undoubtedly has an effect on increasing incidence of TBE. According to Lithuanian Hydrometeorological Service, in 21th century, the average annual temperature in Lithuania rose by 0.7-0.9 °C as compared with the 20th century. An increase in air temperature leads to the spread of certain types of parasites, including ticks. But we cannot assert that this is the main cause of such a high incidence in Baltic countries.

Keywords: Tick-borne encephalitis, Baltic countries, seasonality, morbidity, *I. ricinus* and *I. persulcatus.*

Total Phenols And Phenolic Acids Content Of *Mentha Piperita* And *Mentha Spicata*

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Abstract

The aim of this study was to investigate total phenols and phenolic acids content of five mint varieties: *M. spicata* 'Moroccan', *M. spicata* 'Crispa', *M. piperita* 'Granada', *M. piperita* 'Swiss' and *M. piperita* 'Multimentha'. Mints were planted at Vytautas Magnus University Agriculture Academy experimental station in 2017. Plants were harvested in 2017 and 2018 year on 65BBCH stage of development. Total phenols, phenolic acids content and composition was analysed by HPLC method. Total phenols content in mints fluctuated from 98.61 mg $100g^{-1}$(DW) to 341.75 mg $100g^{-1}$(DW) depending on variety. *M. spicata* 'Moroccan' accumulated the highest content of phenols and phenolic acids, while the least *M. spicata* 'Crispa'. The highest content of phenols and phenolic acids was recorded by *M. piperita* 'Granada' comparing with others *M. piperita* plants. Major compound of phenolic acids identified in *M. spicata* 'Moroccan', *M. spicata* 'Crispa' and in *M. piperita* 'Granada', *M. piperita* 'Multimentha' mints was β-coumaric acid while in *M. piperita* 'Swiss' - chlorogenic acid.

Keywords: *Mentha piperita, Mentha spicata, phenols and phenolic acids.*

Tracing ^{14}c Redistribution In Aquatic Environment Of The Nuclear Power Plant Cooling Pond

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Abstract

Radiocarbon pollution from nuclear power plants (NPP) with RBMK type reactor is normally dominated by gaseous $^{14}CO_2$ form, whereas the liquid effluents normally contain only small quantities of ^{14}C.

The aim of this study was to provide detailed ^{14}C redistribution in various Lake Drūkšiai sediment fractions in order to determine the possible pollution extent circulating in the system. The lake water was used to cool the reactors of the Ignalina NPP (INPP), which operated two RBMK reactor units: Unit 1 during 1983-2004 and Unit 2 during 1987-2009.

For radiocarbon measurements two sediment humic fractions were chosen: the most refractory humin fraction (HM) and a more labile fraction of humic acids (HA). The sedimentation rate was estimated using ^{137}Cs and ^{210}Pb dating methods.

Until 1999s, the ^{14}C activity in both sediment HM and HA fractions varied similarly indicating the same origin of both fractions. The INPP operation increased the radiocarbon concentration by 2 pMC. However, in 1999s a sharp increase of 70 pMC in the ^{14}C activity was observed in the HA, while the ^{14}C concentration in HM did not change. During the period of 2005-2010s the ^{14}C activity increased by 20 pMC in the HA, whereas its increase in HM was only 8 pMC. Different radiocarbon activity in both fractions can imply that both sediment fractions could be impacted by different pollutant sources, whereas processes related to the formation of distinct sediment fractions and carbon exchange between these fractions are also important and are still unknown [1]

Keywords: radiocarbon, stable carbon isotopes, lake sediments, humin, humic acids.

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Treatment Of *Arabidopsis Thaliana* Seeds With Cold Plasma Induces Changes In Seedling And Plant Development And Protein Expression

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Abstract

Successful seed germination and seedling establishment are critical steps in agricultural production and in the maintenance of natural ecosystems. Seed treatment cold plasma (CP), is an emerging eco-agricultural technology that has been suggested to stimulate plant growth. In addition to sterilization effect, treatment of seeds with CP has been shown to have effect on a broad spectrum of plant development and physiological processes. Although the body of information on the biological effects of the CP is growing, the complex biological mechanisms involved in the plant response remains vague. To gain an insight into the cellular processes underlying response of *Arabidopsis thaliana* to the CP seed treatment, seedlings and plant morphological changes, production of reactive oxygen species (ROS) and differential protein expression was assessed. The most prominent morphological effect was observed after the seed treatment for 0,5-4,5 min at 3 mm distance from the dielectric barrier discharge (DBD) plasma source at 60-80% air humidity, after the seeds were stored for 7 days at 25 ^{o}C. The treated plants had more compact rosette and longer flower stems. Assessment of ROS production in germinated seedlings using nitro blue tetrazolium and 3,3′-diaminobezidine staining revealed increase in accumulation of superoxide and H_2O_2. The 2D-electrophoresis analysis revealed 34 and 4 proteoforms differentially expressed after CP treatment in seedlings and leaves, respectively. Proteins involved in biological processes of response to stress and metabolism were identified.

Keywords: 2D-electrophoresis, dielectric barrier discharge plasma, morphology, reactive oxygen species

Uv-B Radiation Effect On Chlorophyll *A* Fluorescence Parameters Of *Raphanus Sativus* Under Different Climates

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Abstract

The aim of this research was to investigate the UV-B radiation effect on the radish (*Raphanus sativus* L.) under elevated concentration of CO_2 and temperature. The plants were grown in chambers with controlled environment at three different climate conditions: first 21°C and 400ppm CO_2 (CC); second 23°C and 550ppm CO_2 (EC1); third 25°C and 800ppm CO_2 (EC2). When the radish unfolded 3 true leaves, 6 $kJm^{-2}d^{-1}$ UV-B radiation was started. The UV-B radiation lasted for 10 days. At the end of the experiment chlorophyll *a* fluorescence parameters were measured.

Ultraviolet B radiation decreased growth parameters of radish in all investigated climate conditions. Chlorophyll *a* fluorescence parameters contributed this tendency also. 6 $kJm^{-2}d^{-1}$ UV-B radiation decreased efficiency of II photosystem (Fv/Fm) and maximum quantum yield for primary photochemistry (φPo) statistically significant ($p<0.05$) under both (EC1 and EC2) elevated climates (about 5 %), while under current climate (CC) conditions the effect UV-B was insignificant (about 3 %; $p>0.05$). UV-B radiation caused reduction of maximum fluorescence under elevated climates, when it decreased by 34.6 ($p<0.05$) and 27.3 % ($p<0.05$), compare to reference treatments of EC1 and EC2 respectively. The effect of UV-B on maximum fluorescence under current climate was insignificant ($p>0.05$). The same tendency was detected for the changes of total complementary area between fluorescence induction curve, i.e. higher negative effect of UV-B was detected under elevated climates. If compare negative effect of 6 $kJm^{-2}d^{-1}$ UV-B radiation in two elevated climates, the effect of UV-B under EC1 conditions, i.e. 23°C temperature and 550ppm CO_2 concentration in air, was the strongest. Our results indicated that elevated climatic conditions have changed the intensity of negative effect of ultraviolet B radiation on photosynthetic parameters of radish.

Keywords: UV-B radiation, warmed climate, chlorophyll *a* fluorescence, radish.

Wetlands As Social Object Of Ecoturism: La Tembladera (Ecuador)

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Abstract

This paper aims to present the analysis of social aspects of the wetland La Tembladera within the framework of turism since one of the priority direction for the conservation of wetlands is their use as objects of ecotourism, thanks to its natural-resource potential. The current state of the environment, economic growth and social development of Ecuador depend on the quality of surface waters, including wetlands, as much of the areas of these water bodies are used to support alternative land activities, including agriculture, urbanization, and recreational activity. Ecuador has 19 Ramsar sites. Among them is La Tembladera wetland, which provides irrigation systems for agriculture and livestock with water. The territory adjacent to the object is mainly used for growing sugar cane, cocoa, lemon, pitahaya, mango, pasture grasses, as well as for grazing. This body of water is also used for fisheries purposes. This paper hightlights the importance of wetland conservation and social aspects for ecotourism purposes including the benefits at local and regional level.

Keywords: La Tembladera, wetland, Ecuador, social aspects, ecotourism, conservation.

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Xcelligence Rtca Investigation Of T-Lymphocyte Motility

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Abstract

T cell motility patterns are being actively studied at the present time. To determine cell invasion (directional movement through 8 μm pores), an RTCADP analyzer (Roche Diagnostics GmbH, Germany) with a CIM plate was used. 150 μl of blood mononuclear cells (98% $CD3^+$ cells) at a final concentration of 4×10^4 were added to the upper chamber of the CIM plate, incubated for 10 min in a CO2 incubator and placed in the RTCA DP Analyzer. In part of the chambers, T-lymphocytes were pre-cocultivated with $1x10^6$ anti-biotin MACSiBead ™ T-Cell Activation / Expansion Kit human particles ("Miltenyi Biotec", Germany), which simulates the interaction of T-lymphocytes with antigen-presenting cells (cell activation via CD2, CD3 and CD28 antigens).

It has been established that the spontaneous invasion of T-lymphocytes is 10 times less active compared to mesenchymal stem cells. In the presence of a T-cell activator, the index of the directed migration of T-cells doubled.

RTCA can be a useful tool for real-time modeling of the directed motility (invasion) of T-lymphocytes. The study was funded by the Russian Science Foundation (Grant № 16-15-10031).

Keywords: Cell division, invasion, viability, in vitro.

ABSTRACT ONLY

A Novel Role Of Scaffold Protein Itsn1 In The Functioning Of Rna-Binding Proteins

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Abstract

Scaffold protein ITSN1 that is known to be involved in the clathrin-mediated endocytosis was recently shown to undergo nuclear-cytoplasmic shuttling. As the functional role of the nuclear localization of ITSN1 is unknown, the current work aimed to identify new interactions between ITSN1 and RNA-binding proteins (RBPs) and to find out a possible functional consequence of the interactions. Using GST pull-down and immunoprecipitation assays it was found that ITSN1 interacts with RBP SAM68 involved in mRNA processing. In particular, using SAM68 truncated constructs and recombinant GST-fused SH3 domains of ITSN1, it was found that proline motifs located at the N-terminus of SAM68 mediate the interaction with the SH3A domain of ITSN1. Co-localization of the endogenous proteins ITSN1 and SAM68 in HeLa cells cytoplasm and nucleus was detected using immunofluorescent staining and proximity ligation assay. Next, it was shown that ITSN1 SH3 domains facilitate solubilization of SAM68 aggregates in vitro whereas the overexpression of ITSN1 and its accumulation in HeLa cells nuclei abolishes the formation of Sam68 nuclear bodies that are specific for some transformed cell lines. In addition, using bioinformatics analysis, it was found that human proteome contains more than 500 nuclear RBPs containing SH3 domain-interacting motifs that could specifically bind ITSN1. Overall, the current work demonstrates that ITSN1 interacts with RNA-binding protein Sam68 and modulates its aggregation properties suggesting the possible role of ITSN1 in the maturation of pro-oncogenic transcripts.

Keywords: ITSN1, RNA-binding proteins, Sam68

Activity Of Creatine Phosphokinase Of Blood Blades Of Different Stress Sensitivity

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Abstract

The enzyme creatine phosphokinase (CPK) (EC 2.7.3.2.) belongs to the phosphotransferases enzyme group phosphotransferases, carriers of the phosphate groups. The level of the enzyme indicates the sensitivity to the action of stressors. The CPK test allows group comparisons to be carried out and identify the predisposition of animals to stress without negative health effects [1]. For conducting research from pure-breeding sows of large white breed, the sows at the age of 30-35 days were taken to be used for repairing the herd. Stress sensitivity was determined using a halothane test. After determination of stress sensitivity the selected piglets were kept in nests. After weaning, the piglets were kept in a separate group. The movement of piglets occurred in accordance with existing industrial technology [2]. The activity of serum creatine kinase was determined using a standard set of chemical reagents manufactured by LAHEMA. The activity of creatine phosphokinase in the blood was determined at the age of 2, 4, 6, 8 months. And also before and after the effect of technological stress (animals were not fed during the day). As a result of the research, it was found that at the age of 2 and 4 months, stress-sensitive animals had significantly higher enzyme activity, respectively, at 66.7 and 45.2% at P>0.999, P>0.9. In the 6th and 8th months no significant difference in the activity of the enzyme has been established. It should be noted that the level of activity of the enzyme decreases with age from (2 months) 33.67 ± 2.51 (stress-resistant) 56.14 ± 3.9 (stress-sensitive) to 6.45 (8 months). At 8 months of age, pigs with different degrees of stress had the same level of activity of the enzyme. It was established that after the effect of technological stress in both experimental groups, the activity of creatine phosphokinase increased significantly by 54.6% and 84.5%, respectively. In this case, the activity of the enzyme in stress-sensitive animals was significantly higher by 29.9% (P>0.999). The level of CPK in the blood increases due to abnormal muscular reactions during stressful stresses [3].

Keywords: creatine phosphokinase, stress-resistant, stress-sensitive, halothane test, piglets

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Antiherpetic Activity Of Metabolites Of *Streptomyces Violaceus*

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Abstract

A promising approach for the treatment of diseases caused by herpes simplex virus is the use of antagonistic microbes and their metabolites. The filamentous soil *Actinobacteria* can be used as a source of the substances with the diverse chemical structures and spectrum of biological activity. The members of the genus *Streptomyces* are widely known as antagonists of humans and animals pathogens.

The aim of this work was to study the antiviral properties of metabolites of *Streptomyces*. Cytotoxicity and antiviral activity of the composite of the supernatant of culture medium with ethanol extract from the biomass of *S. violaceus* IMV Ac-5027 and the purified compounds of its antibiotic complex were determined using MTT assay.

It was shown that the composite caused inhibition of human herpes simplex virus type 1 (HSV-1) reproduction by 38%. The antibiotic complex isolated from *S. violaceus* metabolites consists of six compounds. All of them were non-toxic in concentrations 0.25-0.004 µg/ml, considering that the inhibition of cell viability did not exceed 13%. But only two compounds of antibiotic complex significantly inhibited the reproduction of HSV-1, their EC_{50} were 0.028 and 0.114 µg/ml, respectively. Their UV, IR, proton (1H) NMR spectra and molecular mass were determined, and a bioinformatical analysis was performed using the database StreptomeDB. The compounds were identified as anthracycline antibiotics by rhodilunancin A and rhodilunancin B.

The data indicate the presence of active antiherpetic metabolites of *S. violaceus* IMV Ac-5027 that opens the perspective for the creation of the new classes of antiviral drugs on their basis.

Keywords: human herpes simplex virus type 1, metabolites of streptomycetes, anthracycline antibiotics, antiviral activity

Antioxidative Properties Of Extracts Of Aerial Part Of Bupleurum Aureum, Hill-Growing Saltwort Herb, Fumaria Schleicheri And Cynara Scolymus In Vitro

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Abstract

In this work an oxidative state of blood serum and cytosol of rats liver has been studied in vitro through tetrachlormetane injection, and also influence of addition of herbal extracts of erial part of Bupleurum Aureum, Hill-Growing Saltwort Herb, Fumaria Schleicheri and Cynara scolymus on its rates. The data which have been obtained reveal that on condition of an oxidative stress development the herbal extracts injection in advance improves substantially oxidative state of examined objects. Antioxidizing properties of extracts in vitro have been studied on samples of spontaneous and ascorbate-induced Lipid peroxidation in rat liver homogenate. Numbers of extracts added to the incubative environment, have been calculated on basis of dose, that were more effective in prior researches (0,1 mg/g of liver). As comparative preparation α-tocopherol were used in dosage of 50 мg/kg. According to research results in incubation of liver's homogenate in buffered solution at temperature 37°C sizable accumulation of thiobarbituric acid-reactants was shown, that indicates intensive progress of the lipid peroxidation processes. Storage of thiobarbituric acid-reactants was more evidential after ascorbate addition in incubative environment as high-powered inductor of nonenzymatic lipid peroxidation. Thus, velocity of thiobarbituric acid-reactants storage in spontaneous LP during first 20 minutes of incubation equals 0,47 nM/l per 1 minute, in ascorbate-inductive LP – 0,57 nM/l per a minute. The obtained data indicate capacity of experimental herbal extracts to block lipid peroxidation processes already for the first minutes after beginning of incubation. Evidently, it's connects with presence of polyphenoles which are part of composition of experimental herbal extracts. It is known that polyphenoles exactly are capable to couple active oxid metabolites, that are lipid peroxidation inductors at an early stages. Capacity of experimental extracts to inhibited ascorbate-inductive lipid peroxidation may be connected with coupling of Ferrum ions by poliphenoles, needed for induction of lipid peroxidation by ascorbate. On addition of extracts of Bupleurum Aureum and hill-growing Saltwort herb to incubative environment we have registered less expressed TBB-reactants comparing to trials, to which extracts of Fumaria Schleicheri and Cynara Scolymus have been added. Herbal extracts of Bupleurum Aureum, hill-growing Saltwort herb, Fumaria Schleicheri and Cynara Scolymus may effectively block both, spontaneous and ascorbate-inductive activation of processes of lipid peroxidation in vitro, that is proved by their antioxidizing activity. There was founded that extracts of Bupleurum Aureum and hill-growing Saltwort herb have the most expressed activity.

Key words: herbal extracts, oxidative stress, antioxidative properties.

Application Of Gis Technology For Forecasting And Determining Flood Events On The Ishim River

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Abstract

The publication discusses the possibility of using modern geo-information technologies and methods for processing Earth remote sensing data. Which allow to collect, store and process spatial and attribute information for analysis and management decisions related to reducing the negative impacts of floods. As a result of this work, a large number of geo-information systems being in open access to the Internet were analyzed. Namely, the possibility of using these GIS to predict the area of flooding of the study areas at different rises in the level of flood waters. The program "GIS Sputnik" was chosen and tested, using the example of the recreational territory "Voroniy Island". With the help of which the 3D model of the territory "Voroniy Island" was built, located in the floodplain of the Ishim River. The model clearly demonstrated the forecasting of the flooded area of the study area, at various levels of water rise.

Keywords: Geo-information technologies, rise of flood waters, flood forecast.

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Application Of Lignohumate And Agrostimulin On Growth And Development Of Sudan Grass (*Sorghum Sudanense* L.) In The Conditions Of Northern Kazakhstan

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Abstract

The article contain information about the effectiveness of the use of humin fertilizers, like a Lighohumate and Agrostimulin and their comparison between themseves on growth and development of Sudan grass (*Sorghum sudanense* L.) in the conditions of Northern Kazakhstan. Applicated fertilizers does not used before to grow and get a harvest of Sudan grass in the conditions of North Kazakhstan. Results presented by figures, tables. Sudan grass very valuable feed crop for livestock because of it is a drought-resistant high-yielding crop, it has the property of growing well after mow down, ecological plasticity, universality of use, and high nutritional value. The work contain information about density of standing, linear growth, structure and productivity of plants of Sudan grass.

Keywords: Lignohumate, Agrostimulin, Sudan grass, field experience, vegetation period.

Assessment Of Trees Ecosystem Services In Urban Forest Stands

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Abstract

Ecosystem services assessment of urban forests and separated trees is crucial in efforts to expand knowledge of its benefits for human well-being. Here for this study next methods have been used: dendrochronological method of wood increment for growing trees, method of current increment estimation for growing trees [1], information-support data for estimation of trees live biomass, reference data for oxygen productivity assessment and estimation of energy content within biomass compartments. There was a survey of 3000 trees with measurements of tree height, diameter on breast height (1.3 m), height of lower live branch presence. Geographical coordinates were determined for each tree, then trees mapping was conducted using Google Maps application. With aim to estimate woody diameter increment for the last 10 years, we studied model trees for each tree species. Biophysical parameters for each tree were estimated for the ecosystem services, that is current live biomass increment, current carbon increment, and annual energy stock accumulation in live biomass and annual oxygen productivity of trees.

Keywords: live biomass, oxygen, carbon, energy.

Autumn Dynamics Of The Number Of Hunting Species Of Waterfowl In The North Kazakhstan Region

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Abstract

The paper discusses the results of studying the species composition and number of hunting species of waterfowl, their dynamics during the autumn migrations over a five-year period (from 2012 to 2016), as well as the conditions of migration. Some features of the seasonal migrations have been established. These features make it possible to supplement the ideas about migrations' terms and patterns, the number and ratio of species, the relationship of migration intensity with the state of the habitat in key migration areas. A number of natural and anthropogenic factors affecting birds and their habitat are identified.

For only 5 seasons of autumn migrations, 472813 birds of the considered group were counted. A characteristic feature was the steady growth of indicators from 2013 to the present, from 34319 individuals to 68144 individuals, that is, almost 2 times. This had a clear correlation with the filling of water bodies and the creation of favorable conditions for local and migratory birds. The maximum rate was noted in 2012, when the number reached 253754 individuals, and it fell on the period of a deep depression of water bodies.

Taxonomic composition was represented by 3 species of *Podicipediformes*, 20 species of *Anseriformes* and only 1 species of *Gruiformes*. The main part in the general population was occupied by *Anseriformes* - 443660 individuals, which made up 93.83% of all counted birds. *Gruiformes* were represented by a significantly smaller number - 23550 individuals, or 4.98%, and *Podicipediformes* - 5603 individuals - 1.18%. For the period of counting, the greylag goose *Anser anser* was the dominant species in the general population. Its number was 85639 individuals or 18,11% of total number of counted birds. The indicators of the Gadwall *Anas strepera* were slightly less - 78413 individuals, with a share in the total population - 16.58%. High numbers were typical for common goldeneye *Bucephala clangula* - 48989 individuals or 10.36%. It should be noted that the number of the white-fronted goose *Anser albifrons* (the most common species during the spring migrations) was only 38792 individuals, or 8.21% of the total population in the autumn.

Keywords*:* dynamics, migrations, number, waterfowl.

Bacteriostatic Effect Of The Milk Whey Proteins On The Causative Agent Of Potato Bread Disease

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Abstract

The problem of using milk whey proteins is due to a deficiency of complete protein in the diet of various groups of the population. Given that bread proteins are not balanced in amino acid composition, especially lysine, the issue of adequacy of bread products can be solved by enriching them with whey proteins. The fresh curd whey has been used in order to separate the protein fraction. The bread recipe with the addition of concentrated whey proteins has been made on the basis of the panloaf recipe from the first-grade wheat flour. The conventional methods have been used to determine the physico-chemical properties of the product.

The influence of functional components on the biotechnological properties of yeast has been studied. It has been established that adding of whey protein concentrate leads to an increase in the initial acidity of the dough during the fermentation process, makes a beneficial effect on the activity of yeast cells, accelerates the fermentation process and improves the dough rise fivefold.

The quality and safety of functional bread has been studied according to the Technical Regulations of the TS 021/2011 "On the safety of food products". Our experiments have proved that milk whey protein concentrates can make a bacteriostatic effect on the pathogen of potato bread disease. Potato disease is the most common disease of bread. Its causative agent is spore-forming bacteria belonging to the subspecies of *Bacillus subtilis* and *Bacillus mesentericus*. The test samples containing milk whey protein concentrates showed no signs of this bread disease, while a control sample made from the same flour but with no whey proteins had been affected by potato disease. This interesting phenomenon may be explained by the fact that in the experimental bread samples containing whey protein concentrates the acidity indexes are much higher compared with the control ones. In addition, the milk proteins include iron-containing protein lactoferrin known for its bacteriostatic, bactericidal and fungicidal properties. The bacteriostatic effect is proved by the fact that lactoferrin binds iron ions. Thus, it deprives the bacteria of iron - the substance essential for their growth and vital activity [1].

Keywords: whey proteins, functional product, bacteriostatic action.

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Biodiversity Of The Eastern Podilia - Basis Of Strategy Of Balanced Development Of The Region

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Abstract

Biodiversity conservation (BC) is one of the most important tasks of the human community to achieve its balanced development (BD). It is important for all spheres of human activity (economic, social, ecological), defining the culture, spirituality and mentality of society. This task was formulated in 1992 in Rio de Janeiro in the Program of Action "Agenda for the 21 century", the UN Convention on Biological Diversity, the World Ecological Summit documents, and the Pan-European Strategy for the Conservation of Biological and Landscape Diversity (Sofia, 1995). Most EU countries have already moved from the strategy of preserving BC units through their protection to the strategy of creating national environmental and Emerald networks, which must fulfill the leading functions of preservation of BC, balanced development (BD), non-exhaustive use of biological resources in economic activity.

Eastern Podilia occupies 4.5% of Ukraine, it is located within the most cultivated Right Bank Forest-steppe. Therefore, problems of preservation and reproduction of its BC, stabilization of ecological balance, increase of productivity of ecosystems, provision of BD of society are extremely relevant. In order to preserve the BC of the region it is reasonable to carry out a series of measures, introducing the EU Directives in the field of nature protection and the timetable for their implementation. To do this, it is necessary to implement the EU Directives in the regulatory framework of Ukraine, introducing economic incentives for landowners and land users, developing biological agriculture, introducing environmentally sound economic activities, balanced use of natural resources, education for sustainable development. Therefore, it is essential to consider many environmental issues at the sessions of the Vinnytsia Regional Council related to the preservation and reproduction of BC, the creation of new and expanding existing protected sites, optimization of agricultural land, support for the implementation of the improved regional environmental network and the creation of an Emerald Network.

Keywords: biodiversity conservation, balanced development, environmental network, Emerald Network, sustainable development, Eastern Podilia.

Biological Characteristics Of The Stone Cockscomb *Alectrias Alectrolophus* (Stichaeidae) Of Avacha Bay (Eastern Kamchatka)

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Abstract

Stone cockscomb *Alectrias alectrolophus* is a wide-spread in the northwestern Pacific representative of the Stichaeidae family [1]. As the data concerning the stone cockscomb biology in the Avacha Bay is insufficient nowadays, we carried out a research in 2014-2018, the results of which provide information on its size-age and size-sex structure and the diet.

The material for this report is presented by the author's collections, gathered in May-September 2014-2018 in two areas of the northeastern part of the Avacha Bay tidal zone. One area is located near the village of Seroglazka, the second one is at the foot of Nikolskaya hill in the center of Petropavlovsk-Kamchatsky city.

The results of the 2014-2018 studies lead to the conclusion that during low tides the stone cockscomb is the sole mass representative of ichthyofauna in the explored littoral areas. In our samples, the length of males varied from 60 mm to 113 mm, and the weight was 1.4–8.2 g, as for females, their length was 60–115 mm and the weight was 1.8–9.2 g. The maximum age of the fish was 6+. In the species of stone cockscombs sexual dimorphism is quite pronounced: males are smaller than females. According to scientific literature sources, the stone cockscomb is a benthophage that uses crustaceans, mollusks, and worms primarily for food [1, 2]. The results of our research show that the main objects of its diet in both areas explored in May–September were the amphipods (66.2–89.1%), among which *Anisogammarus tiuschovi* dominated.

Keywords: Stone cockscomb, *Alectrias alectrolophus*, length, weight, Avacha Bay.

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Biological, archaeological, and geological analysis of the coastal and underwater material of the Baltic Sea during the Early Holocene

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Abstract

The project ReCoasts&People "People of Mesolithic-Neolithic and the Baltic Sea: relict coasts and settlements underwater and on the coast (09.3.3-LMT-K-712-01-0171)" aimed to explore the habitats of the Early Mesolithic-Early Neolithic and reconstruct the natural-cultural landscapes of the Early Holocene in the present and flooded Baltic Sea coastlines. More than half hundred of Neolithic settlements dating back to the sub-boreal period have been found and explored in the coastal area of Lithuania. Many of them were established at the shores of the former lagoon origin lakes and paleorivers (Šventoji, Smeltalė). The flooded landscapes of relicts, the period of climate change and the development of vegetation will be identified in the research. Moreover, within project the migration of animals and people to the current territory of Lithuania coastland will be specified. In the present day and sea-flooded Baltic coastlines the settlements of Early Mesolithic-Early Neolithic communities will be explored and reconstructed the natural-cultural landscapes of Early Holocene. The ReCoasts&People project seeks to create an original research methodology to identify people's habitation sites on the seabed, the peculiarities of the climatic vegetation and fauna of the explored period in search of traces of human activities at the seabed. In 2016 the first traces of human activity were discovered during the research. The remnants of the pines, dating from Yoldia to the Ancylus period, indicates the former dryland, which was flooded by the Litorina transgression. It turns out that humans responded to the quickly changing landscape and left their settlements which were flooded by the rising sea level. The project would specify areas with surviving relicts and cultural landscapes and archaeological heritage on the coast and under water. This is essential not only for the planning of scientific and applied research but also for the development and implementation of projects for the sustainable use and sustainable development integrating into western and northern European projects around Baltic Sea and coasts.

Keywords: ReCoasts&People, Baltic sea, underwater and bioarchaeology

Biosynthesis Of Polyene Antibiotics By *Streptomyces Netropsis* Imv Ac-5025 Under The Action Of Exogenous Isopentenyladenosine

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Abstract

Secondary metabolites obtained from soil streptomycetes provide a potential source of many novel compounds with antibacterial, antifungal, antiparasitic and other properties. *Streptomyces netropsis* IMV Ac-5025 can simultaneously synthesize polyene antibiotics (pentaene and tetraene) and a complex of phytohormones, including cytokinins [1]. The aim of the work was to research the relationships between the biosynthesis by *S. netropsis* of polyene antibiotics and isopentinyladenosine (IPA).

The strain was grown by the deep method on synthetic liquid nutrient medium, in which IPA was exogenously added. The biosynthesis of polyene antibiotics and cytokinins were determined in the stationary phase of bacterial growth by quantitative thin-layer chromatography.

Exogenous IPA reduces the accumulation of the total quantity of polyene antibiotics and cytokinins in the biomass of producer. It was found the decreasing of tetrayene antibiotics biosynthesis and the amount of pentane antibiotic was not changed. The total content of synthesized by strain IPA in the biomass was reduced.

It is known, that from the universal predecessor acetyl-CoA synthesized isoprenoids through a series of intermediate reactions, and cytokininins synthesized from the precursor IPA. In the primary metabolism at the isoprenoid biosynthesis stage alkylating particles (α-methyl, ethyl, methoxy, hydroxy, amino groups) also involved in the polyene antibiotics biosynthesis. IPA, in turn, is used for the biosynthesis of other secondary metabolites. We hypothesized, that the crossing of metabolic pathways is occurs, and the adding of exogenous IPA can redirect them. The research of relationships between antibiotics and phytohormones biosynthesis provide new tools for understanding their functional significance for microbial cells.

Keywords: *Streptomyces netropsis,* streptomycetes, isopentinyladenosine, polyene antibiotic, metabolic pathways, biosynthesis.

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Biotic Relations Between Pathogenic Leptospires And Green Algae

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Abstract

Being a part of freshwater ecosystems, spirochaets *Leptospira interrogans* build complex ecological relationships with different species of alive organisms, as well as with numerous species of algae. As a result of these interactions population density of *L. interrogans,* as well as some abilities of these spirochaets can undergo changes. Taking into account the fact that the agent penetrates into a human body from ground and water, ecological factors that influence bacteria *L. interrogans* existence in the environmental domains become of prior epidemic and epizootic importance.

Interaction of the *L. interrogans* from the collection of the Institute of Veterinary Medicine of Ukrainian National Academy of Science and green algae (*Chlorophyta*) of type *Desmodesmus brasilisensis* from the collection of the Insitute of Hydrobiology Ukrainian National Academy of Science has been investigated. In order to conduct a study of allelopathic influence the seeweed of type *D. brasilisensis* was diluted with distilled water and was filtered through sterilizing cellulose filters with pores. Sterile distilled water then was added to the filtrate and of type *L. interrogans*. Control samples contained analogical correlation of Fitzgerald environment, distilled water and type *L. interrogans* species.

It has been found out, that in vitro algae *D. brasilisensis* showed allelopathic activity in direction of the populations of *L. interrogans.* Under conditions of controlled experiment the density of *L. interrogans* species declines influenced by biologically active substances produced by the algae of type *D. brasilisensis*, as compared with the control, *so* this fact can witness to their bacteriostatic action.

Keywords: *Leptospira interrogans*, green algae, allelopathic influence, *Desmodesmus brasilisensis*.

Cardiovascular System As An Adaptation Indicator Of Students

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Abstract

The system of circulation blood is an indicator of the adaptive capabilities of the whole organism. This is due to the leading role of the circulatory system in the adaptive reactions of the body, which is reduced to providing the necessary level of energy and metabolic processes, maintaining the functional state of the organism in accordance with the requirements of the environment. A labile indicator of the functional state of the cardiovascular system is the heart. It varies both during the growth process and under the influence of internal and external stimuli. In the process of age development there is a decrease in heart rate, which in the adolescent period is close to the value determined in adults.

Evaluation of the functional reserve of the cardiovascular system under conditions of mental and physical loads allows us to predict the level of functional readiness and the possibility of achieving a given result and, in addition, is the reference value when choosing the optimal and the maximum allowable training loads, is a convenient method of quantitative health characteristics or level of capacity for various types of adaptation, measurement of fatigue.

The cardiovascular system is the first to respond to physical and mental stress. High adaptive capabilities of the cardiovascular system, realized with systematic muscular activity, should be considered as evolutionarily fixed forms of adaptive reactions.

One of informative donozological integral indicators reflecting the features of adaptive-adaptive reactions of the organism in a healthy population of people is the type of self-regulation of blood circulation. The determination of the type of self-regulation of blood circulation makes it possible to assess the level of stress in the regulation of the cardiovascular system. Also, the index of functional changes of the cardiovascular system shows the degree of adaptation, functional reserves, predicts health.

The study involved students of North Kazakhstan State University named after M. Kozybayev. We surveyed students of the 1st, 2nd and 3rd courses. Students were monitored for blood pressure using the oscillometric and auscultatory method of Korotkov, anthropometry method. We determined the parameters of the cardiovascular system of students, the type of self-regulation of blood circulation and index of functional changes of the cardiovascular system and their influence on adaptation.

Centromeric And Associated Proteins Of Higher Metazoan: Comparative Analysis And Practical Recommendations

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Abstract

By studying different aspects of meiosis in mammals (human, rodents), reptiles (rock lizards), and some interspecies hybrids, we revealed difficulties in the application of commercial antibodies against the kinetochore proteins of different taxa. Particularly, we found that antibodies against mouse or human proteins were not active against the kinetochores of hamsters or lizards: this situation forced us to undertake a special analysis.

The main objectives of this study were: 1) to perform a comparative bioinformatical analysis of the centromeric and associated proteins in the abovementioned or related taxa, and 2) to estimate the cross-specificity of commercial antibodies, generated against some of these proteins (usually against human or mouse proteins).

The conservation of three centromeric proteins (CENP-A, CENP-C, CENP-E) and one associated protein (MAD1) was analyzed using four *in silico* parameters. The proteomes of some of the abovementioned genera are not yet annotated, and we used orthologs from related species. In total, 35 orthologs from the proteomes of nine vertebrate species were studied: the mammals *Homo sapiens*, *Mus musculus*, *Cricetulus griseus* and *Microtus ochrogaster*, bird *Gallus gallus*, reptilians *Anolis carolinensis*, *Gekko japonicus* and *Pogona vitticeps*, and amphibian *Xenopus laevis*. MAD1 and CENP-E were highly conserved: their N and C ends are appropriate for producing antibodies. Additionally, CENP-A was highly conserved (excluding its N terminus). On the contrary, the orthologs of CENP-C demonstrated similarity only in the C terminus of the molecules, and antibodies must only be generated against short protein fragments.

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Keywords: chromosomes, centromeres, appropriate proteins, bioinformatical analysis, antibodies

Configuring Sample Plots: Sample-Based Forest Inventory And Accuracy Implications

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Abstract

In this study, we have applied an experimental analysis of forest inventory accuracy using sample plots (total 156) with different configurations. Study site has been established in Kyiv region, with application of systematic sampling within forested area. Data collecting has been performed with use of field GIS «Field-Map» on circular sample plots (S = 500 m^2). Herewith, an alternative sampling was carried out through establishing the angle-count plots. Field survey with mapping location of tally trees provided two additional sampling configurations: nested sample plots with different plot radii and tree diameters to be measured, and combined sampling, i.e. coupled circular and angle-count plots. Results of basal area and trees number (per ha) estimation were compared to the data obtained from respective circular sample plots. Random error of 1 $m^2 \cdot ha^{-1}$ was occurred for basal area estimation using combined sample plots, with the maximum plot radius of 12.62 m and basal area factor (BAF) as 1. Herewith, BAF increase or plot radius decrease entails the increasing of root square error up to 6 $m^2 \cdot ha^{-1}$. Basal area estimation based on angle-count plots has shown relatively lower results, with mean value decrease 4 $m^2 \cdot ha^{-1}$. It can be explained by random missing of unobserved trees located a long distance from plot center. Considering accuracy and efforts spent for data collection the most effective plot configurations are those having plot radius 12.62 m or BAF = 1.

Keywords: sample-based forest inventory, fixed-area plots, angle-count sampling, truncated angle count plots.

Control Of Serum Enzyme Activity Using Ultrasonic And Electrostatic Fields

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Abstract

Experiments were performed *in vitro* on 5-ml-blood samples of healthy domestic animals. Biochemical, morphological and biophysical studies on red & white blood cells were conducted. For the sonication the ultrasonic therapeutic devices UST-1-01F; Ultrasound T-5, UST 1.02S, were used. The effect of the electrostatic field on the change in the functional characteristics of RBC & WBC, the permeability of their membranes (CPM), on the dynamics of oxygenation of hemoglobin, as well as on the change in the activity of cytosolic enzymes was studied, also. The constant electric field's (CEF) strength was $8.3 \cdot 10^2$ V/m, the exposure time was 1–60 min. To determine the CPM-permeability the plasmolysis inversion phenomenon was used, which was recorded turbidimetrically.

Destructive, cytolytic and nucleolytic effects of CEF and US-fields, generally correlated with the type and size of blood cells, were discovered. It was checked the possibility of the direct simultaneous action both on the CPM-structure and serum enzymes' activity. Data of the CPM-permeability constants for glucose showed that when exposed to CEF up to 10 min, the permeability decreases slightly, and starting from 15 minutes it increases 4–5 times. Analysis of the effect of electrostatic and ultrasonic fields on the activity of blood plasma enzymes showed that, depending on the type of animals, the effect causes an increase in the activity of lactate dehydrogenase in blood-plasma of cats 2.5–4 times; aspartate aminotransferase and lactate dehydrogenase activity in plasma of dogs increased 2–3.8 times; and activity of aspartate aminotransferase in plasma of horses increased 1.5–2.7 times. In the case of ultrasound, the effect occurs when the exposure is 10 times smaller. The I_{SATA}-spectrum affected the cells was identified — from 0.05 W/cm^2 to 0.7 W/cm^2, with the dose-dependent effect. Intensity above 1.0 W/cm^2 suppressed enzymatic activity irreversibly.

Keywords: ultrasound, electrostatic field, biological effects, blood cells, enzymes.

Correlation Between Resistance To Uv Irradiation And The Taxonomic Position Of Microorganisms

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Abstract

UV irradiation is known to cause harmful effects on microorganisms. As the result, microorganisms have developed protection against exposure to harmful UV irradiation. We suggested that resistance to UV might be specific characteristic of certain genera of microorganisms. So, the aim of the work is to assess whether there is a correlation between UV resistance and the taxonomic position of microorganisms or is it the adaptation of cells to extreme conditions. There were studied 67 strains from extreme ecosystems (phytocenoses and ornithogenic soil of the Antarctic, hypersaline ecosystems of the Crimea and the Dead Sea, the lake Baikal). Sequence of 16S rRNA genes, phylogenetic analysis and UV resistance were performed according to standard procedures. Phylogenetic analysis revealed live representatives of the following genera: *Pseudomonas*, *Serratia*, *Rheinheimera*, *Aeromonas*, *Buttiauxella*, *Brevundimonas*, *Sphingomonas*, *Sphingopyxis*, *Dermacoccus*, *Frondihabitans*, *Microbacterium*, *Rhodococcus*, *Janthinobacterium*, *Arthrobacter*, *Micrococcus*, *Kocuria*, *Sphingobacterium*, *Flavobacterium*, *Chryseobacterium*, *Bacillus*, *Staphylococcus*, *Paenibacillus*, *Sporosarcina*. Gram-positive bacteria were significantly more resistant to UV irradiation ($LD_{99.99}$ 750–1400 J/m^2). Gram-negative had lower resistance ($LD_{99.99}$ 35–150 J/m^2). Most pigmented strains were more resistant to UV than non-pigmented ones. According to the values of lethal doses of UV irradiation we suggest that investigated microorganisms have effective mechanisms to repair DNA damages. Resistance of microorganisms to UV, as a rule, was not related to the ecological features of their habitat. Thus, there is a correlation between the resistance of microorganisms to UV irradiation and their taxonomic position, which allows to consider UV resistance as a diagnostic feature at the genus level.

Keywords: UV irradiation, resistance, phylogenetic analysis, taxonomic position.

Cytogenetic Disturbances In Cells Of Bone Marrow And Thymus As A Possible Side Effect Of Laser Therapy

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Abstract

Currently, in practical medicine, the combined effects of lasers emitting in the red and near-infrared range of the light spectrum are widely used. However, it is known that laser irradiation can have both a stimulating and depressing effect on the immune system. The effect depends on the dose and mode of laser exposures. It should be noted that methodological approaches to laser therapy of damaged organs and tissues are still empirical and are based on clinical observations. In this case, one cannot exclude the possibility of an energy overdose of laser exposure.

Purpose: to study the possibility of cytogenetic disorders in the organs of the immune system under intensive laser therapy of both shins of rats.

Methods: in 20 adult mongrel laboratory white rats, an ana-telophase method was performed a cytogenetic analysis of bone marrow cells and thymus after combined effects by two types of lasers with different intensities and depth of penetration into biological tissues. The conditions of pulsed infrared laser exposure : 890 nm, 1500 Hz, 8W output power, 5 sessions in contact labile mode (180 one-second contacts with the skin of the shin in the area of the projection of the tibia, from the proximal end to the distal and back). The conditions of continuous red laser exposure: 632.8 nm, the beam was defocused with a lens, the irradiation field diameter 2.0–2.5 cm, power density was 2.5–3.0 mW/cm^2, 5 sessions in stable remote mode. The duration of the each procedure was 3 min. Each animal's shin was subjected to 10 exposures for two weeks, with daily alternation applied types of radiation. The dose of pulsed infrared radiation during one procedure was 0.54 J/cm^2. The radiation dose of a He-Ne laser during one procedure was 0.45–0.54 J/cm^2. Analysis of the experimental material was carried out on the following day.

Results: in bone marrow and thymus, the number of cells with chromosomal aberrations increased significantly compared with spontaneous aberrations the control. The number of chromosomal aberrations in bone marrow was equal to 18.31±2.41% in control rats, and 28.16±3.23% after irradiation, $p<0.02$. The number of aberrations in the thymus was equal to 15.72±0.21% for control animals, and 24.52±2.15% after irradiation, $p<0.01$.

Conclusion: received results showed the possibility of the destabilization of cell genetic apparatus and the reality of chromosomal aberration induction. Cytogenetic disorders were observed in rat bone marrow after intense combined laser irradiated shins, and also in the thymocytes as a result of the systemic effect of laser therapy both shins. The tested doses and mode of laser therapy reduce the functional activity of immune system, apparently as a result exceeding the physiological norm for organism.

Development Of Management Concept On Modern Animal Biodiversity Transformations In The Steppe Zone Of Ukraine Under Conditions Of Climate Changes

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Abstract

Growing rate of fauna depletion principally raises the urgent need to clear how adverse factors affect different animal taxa [1, 2]. Climate is a global factor that leads to changes in habitat biotopes, feeding and reproduction conditions; climate affects accordingly the number of animals in different systematic groups. Climate changes over the past decades have become global pattern and have received worldwide scientific confirmation. They are mostly manifested by rise of local average annual temperature and changes in precipitation behavior. At the same time, effects of these changes on animal biodiversity in the steppe zone of Ukraine are unclear. According to research from other countries, such effects can be significant and negatively affect species survival and ecosystem stability. This requires comprehensive research on both biodiversity transformation itself and management of biodiversity in the current conditions.

Regional increase in temperatures worsens conditions of some animal living, especially amphibians. First of all, it is associated with succession of ecosystems which are accompanied by drying up of forest lakes and the faster drying of temporary ponds used as amphibian breeding habitats. These factors generally raise the question of the most amphibian species survival in the steppe zone of Ukraine.

Captured climate changes resulted to disappearance of certain bird species from faunal groups in a number of European countries. A detailed analysis showed that significant proportion of nesting birds has changed its habitats within Europe, and most scientists concluded that the main factors of such changes were climate changes and farming patterns in native and agricultural lands. Result of this activity was creation of a series of prognostic scenarios on development of bird habitats under different conditions of management and climate changes. It should be noted that scenarios of climate change suggest very significant changes in bird habitats and transformation of their ecological niches.

Keywords: climate changes, Biodiversity concept, fauna transformation, steppe zone, Ukraine.

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Distribution Of Allergenic Tree Species In Kaunas

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Abstract

Urban green spaces are the most known elements of an urban environment. Urban vegetation is related not only with numerous health benefits, but also with potential risks. Anemophilous pollen grains of many trees are one of the most important allergy factors in humans. Varies studies have showed that the prevalence of allergic diseases is constantly increasing in the world. Particularly important are surrounding living place with a large number of allergic trees.

The aim of this study was to determine the distribution of allergic tree species in Kaunas city. The object of the study was Kaunas city allergenic tree species which have high pollen production: birch, alder, hazel, oak, maple and ash. The data were selected from the inventory of Kaunas green areas and the analysis was made using ArcGIS 10.3 software.

The results indicated that the most prevalent allergenic tree species in Kaunas are maple (44 %) and birch (28 %). Alder (1 %) and hazel (1 %) are very rare. The highest number of allergenic trees was found in Dainava district (24 %). Furthermore, Dainava district has the highest population density in Kaunas city. Ash (37 %) and birch (27 %) are the most common species in this district of the city.

Keywords: urban green spaces, urban environment, pollen, tree species.

Distribution Of Lymantriadispar In Forests Of Csi «Kyzylzharskoe Forestry»Of The North Kazakhstan Region

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Abstract

Lymantria dispar is one of the most dangerous, widespread forest pests. In most of its range this species gives periodic outbreaks of mass reproduction.

Its polyphage caterpillars can eat about 300 plant species, but they cause special damage to birch plantations.

Based on this, a number of studies on the distribution of the Lyman triadispar have been conducted in the Forestry Kyzylzharskoye in the North Kazakhstan region: accounting, collection, analysis of all stages of pest development.

Repeated outbreaks of pest activity were identified in researching territory in 3 zones: minor damage zone (the occurrence of foci less than 30%), periodic intensive damage zone (31–70%) and permanent damage (more than 70%).

Also pointed that prolonged drought for several years has a great influence on the duration of outbreaks of Lymantria dispar mass reproduction. It confirmed by our records of increasing amount of pests in 2016 and 2017 years.

With the aim of exterminating the pest and reducing the foci of infection of birch plantings with Lymantria dispar, CSI «Forestry Kyzylzharskoye» carried out forest treatment with the biological preparation «Hercules-48 %». This drug belongs to the 3rd class of danger and is safe for people, warm-blooded animals, birds, bees and useful entomofauna.

Ecological Aspects Of Drugs Use

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Abstract

Drugs are an integral component of medical practice. Their application ensures the preservation of the health of the population and, consequently, leads to increase the quality of life and longevity. At the same time, waste from the pharmaceutical industry has an impact on wildlife, as unused medicines are often thrown out or disposed of improperly. In the beginning of XXI century the European environment Agency identified the influence of active pharmaceutical substances on the environment as a new environmental problem. Given the steady increase in use of medicines in the absence of adequate response measures in the coming years we can expect deterioration of the situation. Since the metabolites of medicines are found in small amounts, their presence in the environment has been proven only recently with the development of analytical methods. Basically, all the medicines and their metabolites are water-soluble, and it is impossible to identify such compounds by means of gas chromatography, which is typically used to detect water pollutants. The need to use of drugs is not always a real. The results of studies conducted worldwide, show that about 50% of all medicines are prescribed, dispensed or sold inappropriately. In addition, according to the European Federation of pharmaceutical industries and associations, from 3 to 8% of selling medicines go unused, according to some estimates, this figure is much higher and can reach 50%, such as in France and the UK. From an environmental point of view the key stages of the life cycle of medicines include production and use, and waste management. Environmental pollution is possible in each of these stages, but it occurs mainly in the process of their use. It is found that from 30 to 90% of orally applied drugs and their derivatives get into the form of active metabolites into the environment in urine composition; a portion of the products of drug metabolism are excreted with feces. The cause of the contamination is often, and incorrect disposal of unused medicines. It is shown that unnecessary or expired drugs most often are discarded in general household waste (about 80%) and more than 15% of consumers send them down the drain. However, about half of the population is aware that such methods of disposal can harm the environment and is willing to support the initiative to collect expired and unnecessary medicines in special containers installed in drugstores, to further secure processing. The fight against pharmaceutical waste environmental pollution must be comprehensive and include measures to change the behavior of the end consumer of medicines and improving mechanisms for the collection and disposal of medicines. Only joint efforts can contribute to the successful solution of this problem.

Key words: ecology, pollution, drugs, utilization.

Effect Of Parp Inhibition On Has2, Cox2 And Grem1 Gene Expression In Ovarian Cumulus Cells Under The Condition Of Experimental Immune Complex Injury In Mice

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Abstract

A murine model of immune complex-mediated pathology was used to study the effect of poly(ADP-ribose) polymerase-1 (PARP-1) inhibitor, 4-hydroxyquinazoline (4-HQN), on mRNA expression for hyaluronic acid synthase-2 (HAS2), cyclooxygenase-2 (COX2) and gremlin-1 (GREM1) in ovarian cumulus cells. Mice (18-20 g, inbred strain CBA) were randomly divided into three groups: 1/ mice immunized with bovine serum albumin (BSA, intravenously 6 times every 7 days); 2/ mice immunized with BSA and receiving 4-HQN (100 mg/kg of body weight) twice each week); 3/ control group (received normal saline). mRNA expression was detected by reverse transcriptase polymerase chain reaction.

BSA injections reduced expression of COX2, GREM1 and HAS2 genes in follicular cells, which was accompanied by impaired oocyte meiotic maturation. Injections of 4-HQN to BSA treated mice enhanced the level of mRNA expression: COX2 (1.58-fold; $p<0.01$), GREM1 (1.45-fold; $p<0.01$) and HAS2 (1.34-fold; $p<0.05$) compared to immunized group. Studied genes play an important role in follicular development and cumulus expansion and therefore in the development and maturation of oocytes. Our research shown, that PARP-1 inhibition with 4-HQN improved the impaired oogenesis in immunized mice. Thus, PARP inhibition significantly improves oocyte quality reduced by immunization with BSA in mouse model of immune complex-mediated disease.

Keywords: Immune Complex-induced Failure, Cumulus Cells, Gene Expression, PARP-1 Inhibition, Mice

Environmental Stability And Plasticity Of Soybean Varieties In The Right-Bank Forest-Steppe Of Ukraine

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Abstract

The results of studies on the stability and plasticity of soybean varieties by the yields in the right-bank Forest-Steppe of Ukraine are presented. The effect of abiotic factors on the crop yield is established. Classification of soybean varieties was conducted, and the most plastic and suitable ones for the cultivation under intensive technologies are recommended for agribusiness. On the basis of long-term soybean research, estimation of the genotypes of the domestic breeding from the standpoint of the potential of ontogenetic adaptation taking into account the complex of their valuable farming traits and properties is carried out. It is established that hydrothermal conditions altered the elements of the productivity of soybean genotypes. Their research in the right-bank Forest-Steppe revealed that the highest seed yield was provided by such varieties as Millennium, Monada, Triada and Diadema Podillia under simultaneous high variability over the years. Such changes in the level of seed yield over the years show that hydrothermal conditions of the year are crucial for the formation of sustainable soybean productivity. It is determined that such varieties as Zolotysta, Triada, Diadema Podillia and Omega vinnytska had the highest environmental plasticity, while Artemis, KyVin, Oriana, Vezha, Kniazhna and Femida had the lowest environmental plasticity. Among the studied varieties, Hoverla, Triada, Prykarpatska 96 and Khutorianochka proved to be the most environmentally stable in the changing conditions of cultivation, as evidenced by low coefficients of variation and high homeostatic nature.

Keywords*: soybean, variety, yield, seed, indexes of plasticity and ecological stability*.

Environmental Trail As A Factor Of Sustainable Development Of Territories

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Abstract

This article discusses the concept of an ecological trail, the problem of ecological education and upbringing. The prerequisites for the development of ecological tourism are formulated, difficulties are described for the development of ecotourism, and possible ways to overcome them are identified. The importance of ecological paths in the development of ecological tourism is revealed. The forms of organization and stages of the ecological trail are considered. The ecological trail is considered as one of the effective factors for the formation of ecological culture and ecological education. The problem of the development of productive activities through the research and design activities of participants on the basis of a study ecological trail is discussed. The types, tasks, and stages of the organization of an ecological trail are studied. Creating an ecological trail is the first step towards preserving the environment. It has been concluded that eco-tourism certainly does not solve the problem of the destruction of the natural environment. It allows you to soften the blows inflicted by the carefree attitude of people towards it, preserving the corners of untouched nature and contributing to the enhancement of natural values not only through the environmental education of tourists, but also at the expense of funds from ecotourism income to solve such problems.

Key words: ecological trail, ecological tourism, ecological education, natural objects, educational activity.

Environmental Urbosystem Diagnostics With Cytogenetic Methods Using

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Abstract

Excessive anthropogenic load on the components of the cities environment, the violation of their sustainability is the main world problem. According to the World Health Organization, as a result of environmental pollution of urban areas, there is an increase in the disease of urban residents and an increase in their death rate. Therefore, ecological diagnostics of urbosystems with a combination of instrumental and bioindicative methods will allow promptly obtain information on the signs of environmental disadvantage of the urban environment and develop environmental measures that will be aimed at ensuring the environmental sustainability of cities and improving the quality of life population. In this work, detailed research of the Rivne environment urbosystem was conducted. Rivne is a large typical agroindustrial city in the Western region of Ukraine. The diagnosis of atmospheric air quality was performed on ten pollutants, the determination of the overall toxicity (or potential mutagenicity) of the environment using the "Sterility of pollen of plants bioindicators". For conducting bioindicative investigations, the territory of the city was divided into 39 test grounds (TG), which are grouped into 4 sectors. According to the instrumental measurements, the average annual concentrations of pollutants of nitrogen dioxide, phenol, hydrogen fluoride, ammonia and formaldehyde were significantly higher than the maximum permissible concentrations (MPC). The greatest airborne urbosystem is contaminated with formaldehyde, whose concentration varies from 1.3 MPC to 3.3 MPC. According to cytogenetic studies it has been determined that the range of the conditional index of damage in general for the city territory varies from 0.002 to 0.964. The average is 0.441 - the state of the territory is moderately dangerous. Established test sites where the environmental situation of the toxic-mutagenic background is extremely dangerous, dangerous, moderately dangerous and safe. It is established that the level of damage of roadside biosystems of the urbosystem is estimated as catastrophic The revealed causes of deterioration of the ecological condition of these areas of the city and proposed priority environmental measures aimed at reducing the anthropogenic load and improving the ecological situation of the urbysystem.

Keywords: urbosystem, cytogenetic methods, bioindicative research, ecological diagnostics

Evaluation Of Ecological Sustainability Of Agricultural Landscapes In North Kazakhstan Region

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Abstract

The article shows the results of study and assessment of ecological sustainability of agricultural landscapes in North Kazakhstan region. Assessment sustainability of agricultural landscape in main natural and agricultural areas of the region was held on the basis of complex soil-ecological properties. The conducted researches have allowed identifying of natural and agricultural areas with relative and low agrolandscape sustainability.

The purpose of the study concluded to assess ecological state and sustainability of present agricultural landscapes of NKR. Theoretical and methodological basis of the research is formed by the works of national and foreign scientists in the field of geoecology and landscape, agrolanscape and soil science [1-3, 5-7]. As initial information base for the research we used maps, archive materials and scientific publications of organizations and institutions of the industry [8, 9], space images from Landsat 8 and during summer field research works.

From our perspective, sustainable ecological state of agricultural landscapes involves the ability to withstand agricultural activities and their consequences while maintaining basic properties and specified production and environmental functions that ensure favorable conditions for agricultural plants and animals, as well as the ability of their self-regeneration. In study we used ecological state of soil and main soil-ecological qualities and parameters as an indicator of agrolandscape sustainability. We identified the following soil and ecological characteristics for the assessment: grain size distribution; humus layer thickness and amount of organic compounds; acidity-alkalinity of soil solution; providing soils with major nutrients; content of residual quantities of pesticides; trace amount of petrochemicals. The evaluation was performed by agricultural areas. The study used the method of scores. Depending on the score expressed we propose five levels of ecological sustainability of agrogeosystems: stable, relatively stable, less stable, unstable and highly unstable [4, 10].

Sustainability of ecological condition of the agrolandscapes of the two natural-agricultural areas is assessed to be as less stable. Sustainability of agrolandscape ecological state of the six natural-agricultural areas is estimated as relatively stable.

The conducted researches have allowed identifying of crucial problems of agricultural nature management in the region. Most issues come from decrease of ecological sustainability of agrolandscapes and necessity of certain measures for its optimization. An important tool to achieve ecological stability and sustainability of agrogenic landscape can be landscape-agroecological planning.

Keywords: agrolandscape, natural-agricultural area, sustainability, assessment, soil, agricultural production.

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Evaluation Of Microbial Contamination Of Seeds Germinated For Food

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Abstract

Germinated seeds are popular for human diet providing health benefits, because they are important source of proteins, vitamins, minerals and fibers. But in some cases seeds are contaminated by high microbial loads, including molds and yeasts. Colonization of seeds with microorganisms may start as seeds mature and continues all through the period of storage and germination. Just after being harvested seeds are usually not abundantly contaminated with microorganisms, however there are enough of propagules of fungi outside and inside on seeds surfaces and they are ready to grow if temperature and humidity are favorable. The aim of this research was to investigate the fungi composition and their total count in germinated barley, beans, corn, peas and wheat seeds samples as the raw material used for food. The total fungi count was calculated in germinated beans, wheat, peas and barley seeds samples. The results demonstrated that in the germinated seeds samples total number of fungi varied between $2{,}2x10^{-3}$ and $19{,}3x10^{-4}$ CFU g^{-1}. 22 species of fungi were detected. According to the research, fungi genera of *Mucor* spp. (31,3 %) *Rhizopus* spp. (11,5 %), *Penicillium* spp. (21,0 %), *Fusarium* spp. (12,9 proc.) and different yeasts (43,7 %) were dominated in the samples. Most attention must be given to widely distributed fungi, known producers of toxins - *Penicillium* spp. and *Fusarium* spp. Abilities of some of these fungi species to produce secondary toxic metabolites are as possible hazard caused to people consuming the contaminated products.

Keywords: Germinated seeds, fungi, contamination, mycotoxins.

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Evaluation Of Oncolytic Efficacy Of Adenovirus Serotype 6 And Its Influence On Glioblastoma U87 Cancer Stem Cells

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Abstract

Glioblastoma is mostly resistant to conventional treatment. Inability to fully treat glioblastoma and prevent relapse or metastasis is likely caused by cancer stem cells (CSCs). Oncolytic viruses represent different class of therapeutics that can kill cancer cells in a variety of ways, different from conventional therapy. Hence, CSCs may be susceptible to oncolytic virus-mediated killing. Adenoviral treatment is of significant interest as these viruses have high oncolytic potential, that was shown on adenovirus serotype 5 (Ad5) therapeutic strains. But because of high hepatotoxicity and seroprevalence of Ad5, alternatives needed to be developed.

We present evaluation of oncolytic efficacy of adenovirus serotype 6 (Ad6) on glioblastoma cells. It is shown that Ad6 has similar cytotoxicity towards U87 and U251 cell lines to Ad5 *in vitro*. In the model of SCID mice with subcutaneous xenograft of U87 cells tumor injection of Ad6 decrease volume of tumor compared to control group with confidence value $p < 0.01$. Patho-morphological analysis of tumor samples shows larger necrosis stage in case of Ad6 compared to Ad5 and control group. Analysis shows that amount of CSCs tend to reduce in groups treated with adenoviruses compared to control group.

As a result, oncolytic efficacy of Ad6 against U87 cells line is similar to Ad5. Besides we demonstrated that Ad6 is capable to lyse CSCs and percentage of CSCs in treated tumors tended to reduce compare to control group. Application of this strain needs further research and modifications that would enhance its oncolytic ability.

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Keywords: oncolytic virus, adenovirus serotype 6, glioblastoma, cancer stem cells.

Evaluation Of Some Markers Of Tumor Tissue Status In Ovarian Cancer Treatment

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Abstract

To evaluate the efficiency of neoadjuvant (preoperative) polychemotherapy (NPHT) of ovarian cancer (OC) and prognosis of this disease progression Ki-67, bcl-2, as well as E- cadherin expression were studied in 25 tumor samples of patients with serous OC of III-IV stage with surgery after NPHT and 27 tumor samples of patients with surgery at the first stage treatment. Imunohistochemical methods were used. It is found that the proliferative activity (Ki-67) in serous adenocarcinomas decreases 4 times with an increase in the number of courses of NPHT to 4-6 and depends on the degree of differentiation of the tumor. At the same time, there is a significant increase in the expression of bcl-2 (an inhibitor of apoptosis) and a decrease in E-cadherin (an intercellular adhesion regulator and an epithelial-mesenchymal transition marker), which is associated with a poor prognosis of the course of ovarian cancer and may be explained by the presence of tumor stem cells (TSC). This requires the development of new methods of treatment aimed at the devitalization of TSC by acting on membrane markers and signaling molecules, interrupting signaling intracellular pathways and altering the microenvironment [2].

Keywords: spaces of tumor, ovarian cancer, neoadjuvant poychemotherapy (NPChT), Ki-67, bcl-2, E-kadgherin

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Extraction Of Lactic Acid Bacteria Secreting Extracellular Proteins From Kazakh National Fermented Products

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Abstract

Due to the diversity of the metabolic potentials of lactic acid bacteria (LAB), it is possible to use the extracellular proteins produced by them to biomedicine. The use of probiotics created on the basis of LAB has a positive effect on the human body, including inducing an immune response, inhibiting inflammation caused by pathogenic microorganisms.

The aim of our research is the study the extracellular proteins that increase probiotic activity from the Kazakh national fermented products (ayran, koumiss, kazy, etc.). For growing cultures of lactobacillis MRS-1 environments produced by HiMediaLaboratoriesPvt. Ltd. (India) were used. The selection and determination of the belonging of the selected isolates to the LAB was performed by Gram staining, the presence of catalase and smear microscopy. Genomic DNA from LAB cultures was isolated by the method of K. Wilson. The concentration of the obtained samples was measured using Thermo Scientific Nano Drop 2000 Spectrophotometer.

As a result 15 isolates of LAB were picked out and their cultural and morphological properties were studied. Biochemical identification was carried out on the basis of the digestion of certain types of sugars and LAB genotyping by analyzing the nucleotide sequence of the 16S rRNA gene, as a result of which it was determined that 11 strains were lactobacilli, 2 - lactococci, 2 - pediococci.

In order to search for extracellular proteins with a probiotic effect, the accumulation of the cell supernatant from the isolated cultures will be carried out by Western blotting.

Keywords: Fermented Products**,** lactic acid bacteria**,** extracellular proteins, probiotic**,** extraction.

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Fractional Composition Of Blood Proteins And Metabolism In Ruminants

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Abstract

Studies have shown that the clinical status of newborn calves and animals 3 and 6 months age, namely, the pulse rate is higher compared to heifers at the age of 12 months and dry cows at optimal body temperature, and morphological parameters of blood. In newborn calves, the state of subcompensated respiratory acidosis was detected in contrast to calves of 3 months of age, and for an animal of 6 and 12 months of age, subcompensated metabolic acidosis, characterized by low levels of blood counts of hydrocarbonates, partial pressure of CO_2, total carbon dioxide and negative values of the indicator shift of buffer bases. It has been established that in blood plasma of cattle of different ages contains 13 fractions of proteins, the molecular weight of which varies from 35 to 900 kDa, and the main proteins are albumins (24.5-40.7%), immunoglobulins A and G (11.5 -30.5%), transferrin (10.2-15.3%), fibrinogen (2.4-3.2%), β-lipoproteins and IgM (1.1-1.8%), ceruloplasmin (1, 2-1.9%) and prealbumin (3.4-4.6%). The fractional composition of blood plasma proteins of newborn calves differs from animals at the age of 3.6 and 12 months. In newborn calves in blood plasma 2.2 times the level of proteins of the fraction of immunoglobulins Ai G, with a molecular weight of 150-170 kDa, 37% of the content of hapthoglobin, 41% - of plasmin, but above 34% concentration of ceruloplasmin, and some fractions of transferrin with a molecular weight of 78 and 72 kDa higher, and 75 kDa - less, whereas other proteins did not differ from animals of 3 months of age. The blood plasma of 12 months old heifers contained more albumin albumin proteins, but fewer pre-albumin levels, which were lower in cows during the dry period. There is no difference in the plasma protein content of β-lipoprotein and IgM fractions, fibrinogen, albumin and prealbumin in newborn calves and animals of 3 and 6 months of age.

Key words: ruminants, blood, proteins, metabolism.

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Growth Properties Of Stenotrophomonas Maltophilia Imv B-7288 – New Selected Destructor Of Hexachlorocyclohexane Pesticide In Comparison With Other Effective Strains

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Abstract

The organochlorine insecticide Lindane is the γ-isomer of hexachlorocyclohexane (HCH) that has been used worldwide in agriculture and public medical programmes. Technical grade Lindane contains a mixture of HCH-isomers which include also α-, β- and δ-HCH that have not insecticidal. However, all four isomers are considered as highly toxic and resistant to destruction. They are dangerous to living organisms, first of all to soil microbial community [1, 2]. Bioremediation of soil using microorganisms is the most environmentally friendly and economically promising method for detoxication of HCH-pollutions.

For this purpose we have been firstly identified the ability to degrade isomers of hexachlorocyclohexane by the heterotrophic non-pathogenic strain *Stenotrophomonas maltophilia* IMB B-7288, that we isolated from contaminated soil [3]. *S. maltophilia* IMB B-7288 is able to decompose HCH-isomers complex at 46.6-77.1% of the initial content. Under co-cultivation conditions of *S. maltophilia* IMV B-7288 with other destructors (*Bacillus megaterium* IMV B-7287 and *Pseudomonas putida* IMV B-7289) on nutrition medium containing 20 mg/L HCH the growth of *S. maltophilia* IMV B-7288 was studied. In comparison with other microorganisms-desrtuctors at HCH-isomers presence we were established that *S. maltophilia* IMB B-7288 is the first starts active growth and first enters into the HCH-isomers destruction process, while other strains remained in the lag phase.

Moreover, the degradation activity of *S. maltophilia* IMV B-7288 during the whole year has been researched and we have found only a little fluctuation the ability to degrade HCH isomers depend on the season. However it was at maximum in the summer time. Eventually, the ability to decompose HCH-isomers complex is stable for a long time for *S. maltophilia* IMV B-7288.

Keywords: microbial destruction, *S. maltophilia,* hexaclorocyclohaxane, chloroorganic pollutants, resistance and degradation.

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Index Of Sexual Dimorphism Of Histochemical Activity Of Phosphatases In Anal Glands Of Brown Rats

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Abstract

For the first time, using histo-enzymological and qualimetrical methods, we established sexual dimorphism of histochemical phosphatases' activities in the specific skin anal glands [1] of brown rats. The activity of acid phosphatase (ACP) in males (+/3 points) was less than in females (++/4 points). The activity of alkaline phosphatase (ALP) showed maximum value in males (+++/5 points) and average value in females (++/4 points). The activity of adenosine triphosphatase (ATPase) was the same (++/4 points) in both males and females. The index of sexual dimorphism [2] with female (F) dominance for ACP was calculated using the formula (F/M) – 1 = (4/3) – 1 = 0.33. The index of sexual dimorphism with male (M) dominance for ALP was converted into the following calculation [2]: − (M/F) + 1 = − (5/4) + 1 = – 0.25. ATPase activity showed no signs of sexual dimorphism. This index can have a certain value in calculations of population changes of this species.

Keywords: brown (Norway) rat *Rattus norvegicus*, males, females, sexual dimorphism, cutaneous glands of the anal region, histochemistry, phosphatases, semi-quantitative analysis.

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Influence Of Nitric Oxide For Protein Fractions In Rat's Serum

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Abstract

Nitric oxide (NO) is a small bioactive gas with a plethora of functions in cell biology. Every year we discover new functions of NO, but it is still needed studying.

The experiment was conducted on 18 white male rats, who weighed 200-230 g. Animals were randomly divided into three groups (n=6). Rats of the control group were injected with 1 ml of 0.9% NaCl solution (I). Suppression and increase synthesis NO caused by a 6- and 12-day intraperitoneal injection of Nω-nitro-L-arginine (L-NNA) at a dose of 40 mg/kg (II and III) and of sodium nitroprusside (SNP) at a dose of 1,5 mg/kg (IV and V) respectively. We determined concentrations of total protein and protein fractions by photometric methods. We used nonparametric Kruskal-Wallis tests for comparative analysis of the studied groups.

Concentrations of total protein reduced significantly with deficiency of NO. Also protein composition changed: concentration of albumin descend by 35% and 45%, level of α1-globulin and β-globulin increased. With an excess of NO in the organism concentrations of total protein didn't change significantly, but correlation of protein fractions fluctuated: level of albumin descended by 19% and 29%, concentrations of α1-globulin, α2-globulin and β-globulin increased. Level of γ-globulin didn't change significantly in both models.

These changes in the ratio of protein fractions may be associated not only with the processes in the liver and kidneys, but also with changes in the immune system.

Influence Of Organic Origin Microelements On Productivity And Quality Factors Of Goat Milk

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Abstract

In Ukraine the issue of procurement of goat milk for industrial processing, the development of technologies for the production of food based on its dairy output have recently become relevant. Goat's milk is widely used throughout the world. Milk of goats has a high nutritional value, which is due to the high content of Calcium, Phosphorus, Cobalt and lipid-soluble and water-soluble vitamins. It contains more dry substance due to the high content of fats, proteins and minerals. Digestibility of goat's milk and of its dairy products is very high, about 94-98%. Goats should get full and balanced for all the elements of nutrition feeding order to make their milk of high quality. Mineral nutrition is an essential component of ration of goats. Therefore, the study of foddering mineral additives of organic origin in ration of the Saanen breed goats to obtain the maximum quantity of high quality milk is an actual problem at present days.

As aresult of the research it was found that milk from goats which were fed with organic mineral complexes according to organoleptic parameters corresponded with the requirements of current Ukrainian quality standards of milk. According to research results it was found that the morning yields of goats, which had in a diet a complex of organic minerals, is 2.54 kg per one goat. The milk density of experimental group of goats was almost at the equal level to the control group, which was 27 and 28°A, respectively. By the fat content, the highest index was observed in group of goats which were fed with a complex of organic mineral substances. This indicator was 2.64% ($P < 0.05$), which is by 0.46% higher than in the control group of goats receiving the usual complex of mineral additives of inorganic origin. By the content of casein, the highest rates were observed in milk of goats, which were fed with a complex of organic minerals (2.52%), it is by 0.31% higher than its amount in the control group of goats. The content of casein in goat's milk ranged from 2.2% to 2.8%.

Key words: goats, milk productivity, mineral nutrition, organic mineral additives, Cobalt, indicators of milk quality.

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Innovative Approach To Biomonitoring Of Toxic Loading On Animals In Native And Artificial Ecosystems

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Abstract

In the last 30-40 years, results of analysis of biomonitoring systems suggest that available indicators used for such purposes may reflect only the limited characteristics for the constituent ecosystems [1, 2]. Our studies allowed clearing the ecological characteristics of populations with different animal groups that necessarily response to impact of environment contamination. Characteristics of population structure, reproduction, fertility and mortality, morphophysiological indexes, and others can serve as adequate ecological markers.

We also identified biochemical parameters of different animal groups in the conditions of ecosystem contamination, especially heavy metal bioaccumulation in animal bodies. It has been found that some molecular indicators can rapidly and adequately react to ecotoxicant ingestion in body. Level of glial fibrillary acidic protein (GFAP) expression and the state of astrocyte cytoskeleton in brain nervous tissue as well as indicators characterizing the level of oxidative stress and regulation of cellular response to damage may be used as such molecular markers of toxic effects [3]. We show relationship between the changes in GFAP expression and toxic effects of aluminum and lead ions. But these adequate indicators are still not used for biomonitoring purposes. Combination of ecological and population indicators with molecular and cytological ones will allow creation an innovative system of biomonitoring for adequate estimation of toxic effects of ecosystems induced by chemical contamination.

Keywords: biomonitoring, climate changes, GFAP expression, ecological and population indicators, Ukraine.

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Members Of The Family Fabaceae In The Flora Of Northern Kazakhstan

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Abstract

The family of Legumes (Fabaseae) is one of the largest families in the flora of the North Kazakhstan region, both in generic and species composition. The family consists of 57 species belonging to 20 genera.

The list of leading genera Fabaceae includes: genus Astragalus - 10 species (17.5 % of the total flora of the family), Vicia – 8 species (14 %), Trifolium – 6 species (10.5 %) and genus Lathyrus – 8 species (14 % of the total flora). Large genus includes 32 species of plants, which is 56 % of the total number of species in this family.

The largest genus is the genus Astragalus, containing 10 species. Rare species of this genus include the following species: A. contortuplicatus M. Bieb., A. sulcatus L., A. stenoceras C. A. Mey., A. adsurgens Pall., A. corniculatus L., A. cicer L.

In the family there are 16 small genera, they include 25 species of plants, which is 44 % of the total number of species in this family. 9 genera are represented by only one plant species, among them: Coronilla varia L., Pisum arvense L., Hedysarum gmelinii Ledeb., Oxytropis pilosa (L.) DC., Trigonella foenum-graecum L., Chamaecytisus ruthenicus Fisch. ex Bess., Sophora alopecuroides L., Thermopsis lanceolata R. Br., Phaseolus vulgaris L.

The spectrum of life forms of Fabaceae showed that the herbaceous plants are 57 species, most of them are perennials – 39 species, annuals are 14 species, biennial are 3 species.

The meteorological analysis of Fabaceae was carried out in accordance with the modern distribution, the species were distributed into 8 geographical groups: Eurasian, Asian-American, boreal, European, Euro-Siberian, Central Asian, Holarctic, Cosmopolitan. Widespread species with the following types of habitats: cosmopolitan group includes 12 species, which is 21.1 % of the total number of species, the Euro-Siberian group has 11 species (19.3 %), the Eurasian group - 10 species (17.5 %), Holarctic 6 species (10.5 %). The Central Asian group is represented by 6 species (10.5 %): Astragalus stenoceras C. A. Mey., Vicia costata Ledeb., C. frutex (L.) C. Koch.), Hedysarum gmelinii Ledeb.), Chamaecytisus ruthenicus Fisch. ex Bess., Onobrychis sibirica Turcz.). The boreal elements of the flora include 3 species (5.3 %): Vicia villosa Roth.), Trigonella foenum-graecum L.), Lathyrus palustris L.).

Molecular Diagnostics Of Pathogens Causing Acute Respiratory Viral Infections In Residents Of Almaty And Karaganda Cities In 2018

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Abstract

Acute respiratory viral infections (ARVI) account for 90% of all infectious diseases affecting the respiratory tract. There are currently six major families causing ARVI in humans: *Orthomyxoviridae* (influenza virus), *Paramyxoviridae* (parainfluenza viruses, types 1-4; respiratory syncytial virus, metapneumovirus), *Picornaviridae* (entorovirus, rhinovirus), *Coronaviridae* (coronavirus, the causative agent of severe acute respiratory syndrome), *Adenoviridae* (adenovirus), *Parvoviridae* (bocavirus). Intensive development of molecular diagnostic techniques makes it possible to identify various viruses that cause respiratory diseases.

To carry out the epidemiological study, 45 nasopharyngeal and oropharyngeal swabs were collected from people aged 1 to 65 years who contacted healthcare institutions in Almaty and Karaganda with a diagnosis of ARVI and influenza.

A molecular genetic study of clinical materials using the AmpliSens ORVI-screen-FL multiplex reagent kit (Moscow, Russia) identified four samples (8.89%) positive for adenovirus DNA, five samples (11.11%) positive for rhinovirus RNA, and one sample (2.22%) positive for each of respiratory syncytial virus RNA, metapneumovirus RNA, and coronavirus RNA.

Therefore, the primary PCR-based screening of clinical samples collected from healthcare institutions in Almaty and Karaganda in 2018 has revealed the prevalence of adeno- and rhinovirus infections.

Keywords: acute respiratory viral infections, molecular diagnostics, adenovirus, rhinovirus

Morphological Characteristics Of Vegetative Mycelium Of Some Rare Mushrooms *In Vitro*

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Abstract

Mushroom cultures are widely used in biotechnology. The correct identification cultures has a great importance due to their biotechnological application. A detailed study of vegetative mycelium structures allows more accurate morphological characterization of taxa introduced in pure culture. Vegetative mycelium microstructures of macromycetes species from the IBK Mushroom Culture Collection were studied using scanning electron microscopy (SEM). We got new data on the fine microstructures *in vitro* for the following fungi species: *Fomitopsis officinalis*, *Hericium erinaceus*, *H. coralloides*, *Sparassis crispa*, *S. nemecii*.

Different microstructures from on the hyphae in culture. Presence and dislocation of clamp connections on hyphae are essential taxonomic characteristics *in vitro*. We registrated clamp connections for all investigated species. Only *Fomitopsis officinalis* has regular unilateral two types clamps: without a slit and seldom medallion-type.

Different structures of asexual reproduction (anamorphs), may serve as taxonomic criterion at species level. We observed chlamydospores and conidial sporulation in dicaryotic *Hericium erinaceus, H. coralloides* cultures. Blastoconidia after prolonged cultivation were discovered in cultures *F. officinalis* as well as incrustation of their hyphae in the form of thin villi. Also the hyphae with regular numerous secretory cells on the surface *S. crispa* and polygonal, hair-like and crystals of other shapes in *H. erinaceus* cultures were described.

Keywords: *IBK* mushroom culture collection, pure culture, micromorphologia, scanning electron microscopy.

Multilayer Polyion Complex Of Superoxide Dismutase 1 Brain Injury Treatment

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The development of well-defined nanomedicines is crucial for their successful clinical decision. A simple procedure for the synthesis and purification of chemically cross-linked polyionic complexes of superoxide dismutase (SOD1) Cu/Zn and catalase with a methoxy-poly (ethylene glycol) block-poly (L-lysine hydrochloride) cationic block copolymer (PEG-pLL50) has been established. Such complexes are called crosslinked nanozymes. Nanosimes retain their catalytic activity very well and have a narrow size distribution. Moreover, their cytotoxicity is reduced compared with unstitched complexes due to the suppression of the release of free block copolymer [1].

These nanozymes are stable due to the electrostatic interaction between the enzyme and polycation and block copolymer and protects the enzymes from the body's proteases [2]. In addition, these nanozymes exhibit a long-term ability to absorb experimentally induced active types of oxygen (ATO) in cultured endothelial cells of brain microvessels and central neurons.

Despite the seeming simplicity of this approach, the efficiency technology can be significantly improved by reducing the size of the resulting foot-layer complexes. Therefore, the synthesis of nanozymes with high enzymatic activity and high yield of protein and retention of SOD1, as well as with certain sizes, remain complex.

To obtain mixed polyion complexes at pH-6.8, initial solutions were prepared in 60 mM HEPES (pH 6.8) and 60 mM phosphate buffer (PBS, pH 6.8) for SOD1 and catalase, respectively. With stirring, a solution of protamine was added dropwise to SOD1 and catalase solutions and left to mix for 30 minutes. Next, a PEG-PG solution was added to the initial mixture and left for 30 minutes at 4°C in a refrigerator, after which a solution of 5% glutaraldehyde-GA was added.

The reaction mixture was left overnight at 4°C, and the next day, 1 mg/ml of sodium borohydride ($NaBH_4$) solution was added to restore the Schiff bases resulting from the reaction of protein amino groups and protamine with GA in solution.

The by-products and unreacted reagents were removed by centrifuging three times using Amicon filter systems (300 kDa, 4°C).

Determination of the size of the samples was carried out on the installation of dynamic laser light scattering - Zetasizer Nano ZS "Malvern Instrument", United Kingdom. An aliquot of the sample solution was diluted about three times and then measured at room temperature.

Thus, it can be said that well-defined, cross-linked nanosymes are essential for their successful application in nanomedicine.

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On Possibility Of Using Nanocrystalline Cerium Dioxide In Cryoprotective Media

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Abstract

The search for new safe cryoprotective substances for improving the existing low-temperature biotechnology techniques remains relevant. The effectiveness of applying the antioxidant compounds (ascorbic acid, α-tocopherol, N-acetyl-L-cysteine) included in the cryoprotective media was confirmed [1]. Nanocompounds (fullerenes, cerium dioxide), being the free radicals acceptors, are known to prevent a cell damage against the oxidative stress [2], also occurring during cryopreservation. We have attempted to use the nanocrystalline cerium dioxide (CeO_2) as the cryopreservation solution component for freezing the *Spirulina platensis* cell culture. Cerium dioxide was used as an auxiliary component in a solution containing traditional cryoprotectant dimethyl sulfoxide (DMSO). DMSO solutions were reported [3] to exhibit toxic properties and cause damage to cells elements during cryopreservation.

Therefore, the research aim was to study the possibility of adding cerium dioxide to the cryoprotective medium to reduce the DMSO concentration while maintaining the maximum number of viable *Spirulina platensis* cells.

Cryoprotective solutions were used in the research: 10% DMSO solution; 5% solution of DMSO; 5% solution of DMSO + 0.075% solution of CeO_2. After exposure in the cryoprotective solution, the cells of *Spirulina platensis* were frozen by direct immersion into liquid nitrogen.

We observed the tendency to preserve the number of viable cells frozen using a 5% DMSO solution and a 0.075% CeO_2 solution at the level of cell preservation in a 10% DMSO solution. However, to understand clearly whether the use of cerium dioxide as the cryoprotective medium component can reduce a toxic cryoprotectant concentration the further studies are needed.

Keywords: cerium dioxide, cryoprotective media.

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Phenotypical Plasticity Of The Thermal Reaction Norms For Development In Insects

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Abstract

Temperature has the greatest effect on the developmental time of ectothermic organisms. The developmental rate (the reciprocal of the developmental time) shows a linear dependence on temperature within the favorable for life temperature conditions. The graph of the linear regression equation of the developmental rate on temperature crosses the abscissa axis at the threshold point. The regression coefficient (or thermal sensitivity coefficient) determines the slope of the regression line to the abscissa axis. The more is its value, the higher is temperature dependence of the developmental rate, i.e. the higher is the thermal sensitivity of development. Abiotic and biotic environmental factors modify the thermal reaction norms for development (TRND), causing the changes of the temperature threshold and thermal sensitivity coefficient. The forms of TRND plasticity are the following. (1) A short day accelerates development at lower temperatures, and a long day - at higher temperatures. (2) A short day accelerates development at all favorable temperatures. (3) A short day accelerates development at high temperatures, and a long day at low temperatures. (4) A short day retards the development, and a long day accelerates it, in optimal temperature range. It means that the influence of abiotic and biotic environmental factors on the developmental time of insects always involves the changes in TRND. The photoperiods do not simply accelerate or retard the development of insects, but modifies the reaction norm to the environment thermal conditions. In the same geographic region the forms of photoperiodic modification of TRND can vary in different species.

Keywords: insects, temperature, photoperiod, development, thermal threshold, thermal sensitivity

Phytophthora Spp. Detected In Raspberry Plants In Montenegro

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Abstract

In last decade growing of raspberry (*Rubus idaeus* L.) has been very important especially in northern parts of Montenegro because of favorable natural conditions and good price at the agricultural market. Among several obstacles recognized in raspberry cultivation, there are several diseases which interfere in its production. Gray mold (*Botrytis cinerea*) and spur blight of raspberry (*Didymella applanata*) appears almost regularly but they are successfully controlled by different fungicides.

In May and June 2018, however, in a raspberry orchard of 1,35 ha near Mojkovac with 35 000 plants planted in the previous year, a severe wilting and dying of some plants have been noticed. Symptoms were mostly expressed in a depressed location of the orchard that retained water where approximately a thousand of plants were affected. Symptoms included reduced vigor of plants with yellow to brown colored leaves and declining canes making plants look like burnt. The diseased plants were dug up and transfer to plant pathology laboratory. After removal of epidermis from plants root and crown, reddish-brown discoloration was noticed. Decayed vascular tissue on cross section was also visible.

Considering the symptoms observed, samples taken between infected and healthy tissue were tested for the presence of *Phytophthora* species with lateral flow device (LFD). Besides the control line, the test line appeared as well within 10 minutes in each of the repeated assays so the positive results were clearly obtained.

Since the disease consequently leads to a significant lower yield in raspberry production and several *Phytophthora* species can be implicated, additional research on the pathogen needs to be performed in the future.

Keywords: Raspberry, *Phytophthora* spp., Montenegro

Acknowledgement: This research was conducted within the program on fruit health protection with monitoring of pesticide residues in 2018, supported by Directorate for Food safety, Veterinary and Phytosanitary Affairs and Centre of Excellence for Research and Innovation of Montenegro.

Polymorphism Of Microsatellite DNA In Ukranian Paddlefish Populations

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Abstract

In this study it was analyzed the genetic polymorphism of Ukrainian paddlefish populations by microsatellite DNA markers Psp12, Psp21, Psp26 and Psp28 using modern molecular genetics methods.

It was investigated three Ukrainian paddlefish populations from such fish farms, as «Dnieper sturgeon fish hatchery» (n=32), «Chernigivrybhosp» (n = 35) and «Mercury» (n = 38).

In general, it was determined that the most polymorphous was the Kherson population, for which the common number of allele was 25, when the Vinnytsia and Chernihiv populations were less polymorphic, for which 22 and 21 alleles were identified, respectively. The highest genetic diversity observed for Psp26 and Psp28 loci, which averaged from 7,7 to 7,3 alleles per locus, respectively. The least genetic diversity in three populations was for Psp21 locus (3,3 alleles per locus).

The specifics of the distribution of allelic variants and their frequencies were established for the investigated paddlefish populations. At locus Psp12 allele 222 bp was with the highest frequency for three Ukrainian populations. At locus Psp21 the most often was detected 150 bp allele for three analyzed populations, when at locus Psp26 with the highest frequency were alleles 144 bp (Kherson population) and 142 bp (Chernihiv and Vinnytsia populations). At locus Psp28 the most often was identified the allele 256 bp for Kherson population and the allele 258 bp for Chernihiv and Vinnytsia populations, respectively.

Thus, the conducted studies allowed to investigate the genetic polymorphism and reveal the differences in the distribution of allelic variants and their frequencies for each of the studied loci in Ukrainian paddlefish populations.

Keywords: paddlefish, *Polyodon spathula*, microsatellite DNA markers, allele, polymorphism.

Preservation Of Agrobiodiversity As Ecological Safety Of The Crop And Livestock Sector, Prospects For Reproduction In Ukraine

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Abstract

The XXI century is characterized by increased attention of the world community to the issue of biodiversity. Preserving the diversity of life on a global scale - it is the problem was raised at the UN summit in Rio de Janeiro in 1992.The International Convention "The Convention on Biological Diversity", which was then adopted, set its objectives for the conservation of biological diversity, the ecologically balanced use of its components, and the joint, equitable and equal sharing of benefits associated with the use of genetic resources [1].The key words of the first phrase of the Convention are "**Conscious**" and "**Agreed**". Unfortunately, for most inhabitants of our planet, they remain only words on paper or on the Internet. [2].

Growth in the intensity of agriculture and livestock caused a rupture of natural bonds, which throughout the evolutionary history of the Earth served as a balance regulator in ecosystems.

Preservation of agrobiodiversity as an independent problem has appeared not now and is gradually becoming more and more important. Humanity in its production, including agricultural, activity after the start of the so-called "green" revolution, especially began to face the need to regulate agroecosystems. The issue of preserving agrobiodiversity has great relevance to society now. It affects both economic and socio-cultural factors as well as environmental factors.

At the 5th Meeting of the Convention on Biological Diversity (Nairobi, May, 2000), at adopted specific program of works in biodiversity that related with agricultural , prepared in cooperation with FAO, agricultural biodiversity or Agrobiodiversity is defined as "the diversity and variability of animals, plants and microorganisms at the genetic, species and ecosystem levels, which are necessary to maintain the most important functions of the agro ecosystem, its structure and processes, which provide development of food and food security" [3].

The most important task of balanced nature management in the agro-sphere is to ensure the dynamic and environmentally safe development of agro-industrial production. However, it can't be solved without the implementation of an integrated system of measures in the field of improving the quality and safety of food products, ensuring the competitiveness of domestic products, harmonization and safety of vital activities, etc. These measures, in turn, are not possible without preservation and reproduction of agrobiodiversity and biodiversity in general [4].

Keywords: biological diversity, the Convention on Biological Diversity, problem of conservation and reproduction of agrobiodiversity, ecological food safety, sustainable development, balanced use of nature in the agro-sphere.

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Problems Of Reducing Soil Fertility In The North Kazakhstan Oblast

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Abstract

Soil is the most important block of ecosystems, acts as a factor of fertility for plants and as the most saturated environment of life.

The main natural resources of the North Kazakhstan region are soils represented by arable land 80% of the black soil.

Within the Northern regions of the region are common gray forest soils. In the zone of the prickly forest-steppe dominated by ordinary black soil. The southern part of the region is characterized by steppe landscapes with ordinary carbonate black soil, southern black soil and dark chestnut soils.

The studies were conducted in administrative districts of North Kazakhstan region. Within the region, the above mentioned soils are spread out.

North Kazakhstan oblast takes the area of 7 million 331,567 thousand hectares, of which agricultural lands occupy an area of 7 million 84,142 thousand ha. In the structure of agricultural land arable land occupies an area of 5 million 381,6 thousand hectares, pastures 406,735 thousand hectares, fallow 71,923 thousand hectares, hayfields 15,913 thousand ha.

Mineral fertilizers play an important role in soil fertility preservation. On the field region in 2016 19507 tons, in 2017 25400 tons in 2018 33690 tons.

With the aim of maintaining and enhancing soil fertility, increasing crop yields, is carried out agrochemical inspection of soils of the region.

Soil fertility decreases due to deflation and water erosion, insufficiency and uneven distribution of soil conservation forest plantations, violations of agrotechnical soil conservation methods of processing, domination of monoculture, soil pollution, mechanical influence of heavy agricultural machinery.

Prospects For The Use Of Laser Radiation In Dentistry

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Abstract

Current trends in the treatment of dental pathology of infectious genesis are based on the sharing of physical and chemical factors. One of the promising areas was the use of low-intensity laser radiation (LILR) against the background of a photosensitizer - ethacridine lactate (EL).

Chemotherapeutic efficacy of this method is to enhance the selective elimination of pathogenic and conditionally pathogenic microorganisms. In determining the effectiveness of EL, it was established that its action in the interval from 30 to 60 s was not accompanied by a pronounced quantitative change in the microbial population. At the same time, an increase in exposure to 1.5-3 minutes was accompanied by a bactericidal effect on microorganisms. The study of the sensitivity of microorganisms to various concentrations of the photosensitizer allows us to conclude that the minimum concentration of EL increases the sensitivity of microorganisms to the action of LILR. In the course of the experiment, it was found a pronounced antimicrobial effect of the combined effect of EL and laser radiation of the blue spectrum, manifested by a decrease in the number of CFU / ml of the total dental flora microflora. On average, the number of CFU decreases sevenfold after irradiation. Comparing the control data (the initial number of grown colonies) and experience (the number of colonies grown after conducting photoactivated disinfection), it was established that the antimicrobial action of photoactivated disinfection is directly dependent on the duration of exposure. So the efficiency of the combined use of a photosensitizer with LILR exceeds the activity of EL (with an exposure of 60 seconds) and twice the antimicrobial effect of the laser radiation of the blue spectrum (with an exposure of 120 seconds).

Conclusions: The obtained results indicate a pronounced antimicrobial effect of the combined use of laser radiation of the blue spectrum and EL, which is confirmed by a decrease in the number of CFU / ml of the total plaque microflora.

Key words: laser radiation, microflora, plaque, antimicrobial action.

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Radiation Effects Of Mining And Processing Of Rare-Earth Raw Materials

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Abstract

There is no real radiation hazard in mining and processing of rare-earth raw materials, but safe production under conditions of small radioactive impurities must be organized. Using the example of Vilnohirsk mining-metallurgical combine in the west of the Dnipropetrovsk region (Central Ukraine), it is shown that the presence of radionuclides in rare-earth raw materials may cause radiological occupational diseases. This large industrial enterprise mines and processes titanium-zirconium sands for production of zirconium and hafnium compounds. Increased capacities of an exposition doze of γ-radiation (15-40 mcR/hours) occurs in most of the combine territory. At the same time, the largest γ-anomalies (up to 200 mcR/hours) are found near the finished product storages (zircon concentrate).

Small impurities of thorium and uranium may be the primary source of radiation hazard in the mining, enrichment and chemical-metallurgical processing of rare-earth raw materials. Radiation-hazardous features of this production are: complex multi-stage processing technologies and low specific radioactivity of large volumes of processed rare-earth raw materials and intermediate concentrates. The main radiation-safe and potentially dangerous material flows in the technological system of the combine have been identified and investigated. The radiological unit of integrated environmental monitoring system of this large mining-smelting enterprise has been created as one of the most important necessary security measures. All structural parts of the enterprise for mining and processing of rare-earth raw materials and all components of the environment in area of its influence are the objects of this monitoring unit.

Keywords: mining-metallurgical combine, radioactive impurities, radiological unit of integrated environmental monitoring system, rare-earth raw materials

Reindeer Hunters in the Late Glacial in Eastern Baltic Region

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Abstract

During the late Glacial in the territory of East Baltic region after retreat of the glaciers, the main hunting object was reindeer (Rangifer tarandus L.). Baltic region specimens would considerably help in the reconstruction of the origin and migration routes of the extant wild reindeer populations in northern Europe.

Proposed migration routes for the subspecies of the wild reindeer from Užnemunė and Kaliningrad district in two directions: northwards and northeastwards crossing the Lithuanian rivers reaches near already existent wades and shoals formed by the Nemunas River scouring out through moraine hills and backward. On both sides of the Nemunas River, at the shoals, most campsites and finding places of the mainly Swiderian cultures occurred.

In 16 localities of the territory of Lithuania and radiocarbon dates from antlers of reindeer between 12 085 and 10 435 yr BP were collected. The majority of radiocarbon dating results show that reindeers colonized the eastern Baltic region quite rapidly and possibly all at once – 13400–12300 yr. BP. An axe of Lyngby type made of the antler of reindeer was recovered in 2014 in the Parupė settlement of Biržai District. It was determined that reindeer hunters made the Parupė axe in the Late Allerød what is confirmed by the radiocarbon dating: 11145 to 11045 cal. BC. This is the first find of this kind uncovered in the territory of Lithuania. The artefacts of Lygby type recovered in Lithuania and in the Baltic area are typologically, technologically and chronologically identical and coeval with the artefacts discovered in South-West Europe.

Keywords: reindeer, radiocarbon dating, migration.

Relationship Between Allergenic Trees Exposure And Allergy Symptoms Among Children

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Abstract

Allergic airway diseases are the most common seasonal respiratory diseases in Lithuania. Children and young people are at greater risk because they are more sensitized than adults. Children lungs and immune system are not fully developed. Furthermore, children and young people spend more time outdoors and breathe a greater amount of pollen and other air pollutants per body weight. Therefore, exposure to allergenic trees, particularly in spring when it is tree pollen peak, is important for children.

The aim of this study was to determine the association between allergenic trees exposure and allergy symptoms for 4-6-year-old children in April and in May. We selected allergenic tree species in Kaunas city that produce the largest amount of high allergenic pollen: birch (Betula), alder (Alnus), hazel (Corylus), oak (Quercus), maple (Acer) and ash (Fraxinus). In the statistical analyses, we used allergenic trees amount cut-off point by terciles (first group was reference) and we assessed the effect of allergenic trees exposure on allergy symptoms among children in April and in May.

The results of the study showed that the occurrence of new allergy symptoms in 4–6 year-old children in April and in May was significantly higher among children who were exposed to the highest exposure to allergenic trees. There was found an association between increased risk of allergy symptoms in children in April and in May and exposure to allergenic trees.

Keywords: children health, allergenic trees, exposure, allergy symptoms.

Roc–Analysis Of Predictors For The Development Of Ovarian Hyperstimulation Syndrome

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Abstract

Ovarian hyperstimulation syndrome (OHSS) - a complication of exogenous gonadotropic therapy, which is used in assisted reproductive technologies to produce a large number of follicles. The main manifestations of OHSS are enlarged ovaries, systemic organ dysfunctions. Also, with OHSS, the risk of a negative result of embryotransfer significantly increases, which determines the relevance of the search for early markers of developing OHSS.

The aim of the study was to identify predictors of developing OHSS using the construction of ROC-curves.

The data of 12 middle-aged women (20-45 years) after hormonal therapy in 2 experimental groups were analyzed: 1) with the risk of developing OHSS; 2) with clinical manifestations of OHSS.

Research methods: clinical (analysis of the number of follicles, in samples of peripheral blood - determination of the content of leukocytes, relative and absolute content of lymphocytes) and statistical - using ROC-analysis.

According to the ROC-analysis, it was revealed that the diagnostic value is an indicator of the number of follicles and is rated as excellent (AUC = 0.907), sensitivity - high (100.00%), which indicates that in 100.00% of cases in women with OHSS this diagnostic test will be positive; test specificity (66.70%) is medium, therefore 66.70% of patients who do not have OHSS, this test will be negative; the critical value of the indicator is >16, which makes it possible immediately after the analysis to form a risk group according to the probability of the development of ovarian hyperstimulation syndrome. The diagnostic value of the indicator of the number of leukocytes is characterized as good (AUC = 0.704), sensitivity - high (100.00%), test specificity (55.60%) - medium; the critical value of the indicator is >9.05, which also allows its use as a diagnostic indicator in the early stages of the diagnosis of OHSS. For relative and absolute lymphocyte counts, the diagnostic value of the indicators is estimated as unsatisfactory (AUC = 0.556) and average (AUC = 0.630), respectively; the sensitivity of the tests is average (66.7%), the specificity of the tests (66.70% and 77.80%) is moderate and sufficient, respectively.

Thus, during the ROC-analysis, it was established that among the studied indicators, informative predictors of developing OHSS are the number of follicles and the content of blood leukocytes.

Indicators of the relative and absolute number of lymphocytes can not be used as early markers of OHSS. However, they can provide additional information of the level of changes in the woman's body, since the immune mechanisms are actively mated in the pathogenesis of the clinical symptoms of OHSS.

Key words: ovarian hyperstimulation syndrome, follicles, blood leukocytes, lymphocytes, ROC-analysis.

Scientific Justification Of The Need For Balanced Development Of Medicinal Plant Cultivation

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Abstract

In the present conditions, medicinal plant growing plays a significant role in the development of the national economy as a component of the processing industry, agriculture and forestry. Its resource base is a valuable natural resource, an indispensable functional part of the biosphere, the basis for maintaining the potential of human health. An important aspect of balanced development is the preservation of medicinal plant resources in the natural conditions of their growth in order to preserve the species composition of commodity products and biological diversity of the ecosystem [1]. Global trend, including Ukrainian, testifies to the rapid increase in the importance of preserving the species diversity of the natural fauna and wild herbs in particular. There are two directions of medicinal plant cultivation: the use of natural plant resources (the collection of wild species) and the cultivation of medicinal plants.

Therefore, the specificity of the development of this industry directly depends on the way of its management for the production of medicinal plant material, about 160 species of wild plants and about 60 species of cultivated medicinal plants are currently used. [2]. That is, over 70% of medicinal plants are wildlife, and they constitute the fund of comprehensive renewable resources of the state that are harvested in Ukraine, ad this, in turn, attaches great importance to this area of harvesting of medicinal plants, since it is predominant.

The current state of medicinal plant growing shows a significant gap in production processes, logistics, environmental management, certification and other financial and organizational aspects. The solution of these issues will promote the development of ecologization of agriculture, development of rural territories, stabilization of the volume of medicinal plant cultivation and regulation of market relations for medicinal plant production [3].

Keywords: medicinal plant growing, balanced development, production, economic potential, natural resources, environmental policy.

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Some Refinements For Dissection Of Small Microlepidoptera

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Abstract

Dissection of genitalia has been established as a method for taxonomy of Microlepidoptera many decades ago. It is indispensable for the species description and in many cases necessary for identification. Most known suggestions for standardization of techniques for Microlepidoptera have been made by G. Robinson in 1976. He stated, inter alia, that a genitalia preparation should be preserved and displayed with as much clarity as possible. It is particularly important for the very small moths. The insufficient quality of preparations, especially of type specimens, can be a serious problem for further investigation.

In order to obtain high quality of preparation and to avoid unwanted scales, dust and debris in genitalia slides we suggest few refinements: a) to clean the scales in glycerol as much as possible, and afterwards boil genitalia in 10% KOH repeatedly; b) to remove phallus and anal tube (if not done in previous procedures, especially in glycerol) from male genitalia capsule while genitalia are in the drop (first; on separate glass microscope slide) of Euparal; c) to transfer abdominal pelt from alcohol to the first drop of Euparal and remove possibly remaining scales, dust and debris; d) to place genitalia capsule, phallus and abdominal pelt to the second (final) drop (on separate glass microscope slide) of Euparal and cover with the coverslip. These procedures can essentially reduce amount of redundant objects and hereby improve the quality of the genitalia slide. It should be done with exceptional accuracy to avoid possible distortion parts of genitalia.

Keywords: Microlepidoptera, genitalia dissection.

Specific Diversity Of Lepidoptera Detachment Of Esilsky District Of The North Kazakhstan Region

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Abstract

Butterflies pests are one of the poorly studied animal world objects in the North Kazakhstan region (North Kazakhstan). At the same time, some of them are pests of agriculture, they are the source of damage for grain and other crops. That's why, the studing of the populations status and their issues in biology is relevant.

In monitoring of the spread and harmfulness now is one of the most numerous and dangerous pests belonging to the order of Lepidoptera in the Esilsky district.

All over the study period was met about 113 species including 43 species of butterflies belonging to 6 families: *Lycaenidae, Satyridae, Nymphalidae, Pieridae, Hesperiidae, Papilionidae*; 47 species of different-size lepidoptera belonging to 8 families: *Sphingidae, Lasiocampidae, Erebidae, Cossidae, Noctuidae, Geometridae, Notodontidae, Nolidae*. Different butterflies belonging to the families: *Yponomeutidae, Depressariidae, Gelechiidae, Plutellidae, Zygaenidae, Tortricidae; Pyralidaes* are represented which belonging to 2 families: *Pterophoridae, Pyralidae*. The richest in species diversity was represented the family of Geometer moths, Leafworm, Pigeons in 13 species (11% from the total number of species of butterflies, which was encountered). The average number of species was recorded for the Noctuidae - 11 species (9.7% of all butterflies encountered), in the Sphingidae, Erebidae families of 7 species (6.2% of all butterflies encountered) for each family. Family of the Pieridae, Skippers, Satires include 6 species (5.3% of all butterflies, which are encountered). The Pterophoridae and Pyralidae family include 4 species (3-5% of all butterflies, which are encountered). The Notodontidae family includes– 3 species (2.6% of all butterflies, which are encountered), also 3 species of butterflies belong to such families as Coconopads, which make up (2.6% of all butterflies, which are encountered), the Nolidae family - 2 species (1.8% of all encountered butterflies). During the research, the representatives of the Cossus cossus family were encountered from 2 species (1.8% of the total number of species of butterflies encountered). The smallest numbers of species are presented: Swallowtail butterflies, Ermine moths, Depressariinae, Plutellidae, Twirler moths, Zygaenidaes 1 species (0.9% of the total number of butterflies species, which are encountered).

Study Of Morphofunctional Indicators Of Students From The City And Village

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Abstract

Due to that the aim of the research is the study of morphofunctional indicators of the students from the city and village. The study of morphological and functional indicators of the organism of fellows and ladies at the age of 17-18 years was conducted. All in all 400 students from North-Kazakhstan State University named after M.Kozybayev (200 fellows and 200 ladies) were examined.

The results of the research showed that there are intergroup and individual differences. Anthropological research of total body size set the whole number of somatic peculiarities, which are defined with the influence of the former residency. Higher indicators of the body weight and the chest circumference the village inhabitants of both genders possess. The higher length of the body possess the city inhabitants in all study groups. The conducted evaluation of weight-height ratio among ladies showed that in all study groups the index was in terms of age-gender norm, however it was lower in the group of city students that certifies about less tight build of ladies of that group in comparison with others.

Pigne index is more among city students that is explained by higher height and less weight. Besides, it corresponded to hypersthenic body among fellows, and to normosthenic one among ladies. Our research showed that ladies from the city possess normosthenic body, and ladies from the city possess the tendency to the hypersthenia.

The estimation of the manual dynamometry of students depending on the place of living showed that fellows and ladies from the village possess higher indicators of the strength of right and left hands. On the value of the carpal index students from the city differed with lower indicators than ones from the village. Comparative analysis of the vital lung capacity of students showed that lower indicators of vital lung capacity had city students. The comparison of average indicators of the dimensional characteristic of the respiratory system allows to state that vital lung capacity of students is mainly lower than age indicators of the norm.

Estimation of middle-group indicators of the systolic pressure among students depending on the place of living showed that city ones had lower indicators, at the same time village ladies had the higher level of systolic pressure. The differences on the systolic pressure indicator among city and village fellows are not revealed. The estimation of the indexes of diastolic and pulse pressure in the study groups testifies about higher rates of these indicators among village students, especially, it is visible among ladies.

Thus, the conducted comparative analysis of average integral point estimations of the express-evaluation of the level of physical health of the 1st year students depending on the place of living showed that students who came to study from the village posses higher level of health than city students.

The differences on the systolic pressure indicator among city and village fellows are not revealed. The estimation of the indexes of diastolic and pulse pressure in the study groups testifies about higher rates of these indicators among village students, especially, it is visible among ladies.

Thus, the conducted comparative analysis of average integral point estimations of the express-evaluation of the level of physical health of the 1st year students depending on the place of living showed that students who came to study from the village posses higher level of health than city students.

Study Of The Detoxifying Properties Of A Biocomposition Based On Humic Acids Of Peats And Microorganisms Of The Genus *Rhodococcus* In The Relation To Oil Products In Aqueous Media

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Abstract

The objects of the study are humic acids of peats from the Tula region: reed fen peat (RFP), black alder fen peat (BFP), sphagnum high-moor peat (SHP) and sphagnum transition peat (STP), identified by the traditional method of water-alkaline extraction; bacteria strains *Rhodococcus erythropolis S67*, *Rhodococcus erythropolis X5*. Model pollutants: hexadecane, diesel fuel from the Rosneft filling station and oil from the refinery of GAZPROMNEFT JSC. Test object is a duckweed. HAs stimulated the growth characteristics of the hydrophyte regardless of their origin: there was an increase in the number of growth of the duckweed blades compared with the control from 24 to 42%. The maximum growth of the duckweed blades was observed in the presence of HAs (BFP) of 42%, the minimum - in HAs (STP) of 24%. It has been established that the presence of humic acids of peats reduces the toxic effect of model pollutants: hexadecane by 3–23%; diesel fuel - 8–40%; oil - 6–16%. Biocompositions based on HAs of peats and microorganisms of the genus *Rhodococcus*, differing in increased detoxifying ability in the relation to petroleum hydrocarbons in aqueous media, were obtained. The highest values of the detoxification coefficient of the biocompositions on the basis of microorganisms Rh. erythropolis S67 and HAs (RFP), or HAs (SHP) 95–79% and 84–68%; Rh. erythropolis X5 and HAs (SHP), or HAs (STP) 82–68% and 71–63%.

Keywords: Humic acids, oil, petroleum hydrocarbons, oil-degrading microorganisms, detoxification, detoxification coefficients.

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Studying Activity Of Some Antioxidant Enzymes In Blood Of Rats Exposed To 460 Mhz Electromagnetic Radiation

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Abstract

Intensive development of radio and electrical communications, various electronic devices leads to a significant "electromagnetic pollution" of the environment. In the modern view, interaction of electromagnetic radiation (EMR) with living tissue is presumably associated with activation of free-radical processes. For the regulation of free-radical processes there is an antioxidant system in organism. In present work, the activity of enzymes catalase (Cat) and superoxide dismutase (SOD), as well as the content of lipid hydroperoxides (LH) were investigated in blood of rats exposed to EMR in decimeter range

The study was carried out on white Wistar rats weighing 250-300 g, contained in normal vivarium conditions. Animals were divided into experimental and control groups. The experimental group of animals was exposed to 460 MHz radiation from the physiotherapy apparatus "Volna -2" (manufactured in Russia). Whole body exposure procedure was carried out daily for 20 min to 4 weeks at direct power flux density of 30 $\mu W/cm^2$.

Concentration of LH significantly increases in blood plasma in rats undergone to exposure with 460 MHz EMR compared to control animals; by the end of the 4th week, the excess is 98%. Activities of Cat and SOD enzymes under the same conditions are significantly reduced in comparison with the control group. Observed significant increase in LH concentration, accompanied by a decrease in activity of key enzymes that regulate free radical processes level indicates apparently an excessive accumulation of primary free radicals (reactive oxygen species) due to exposure to the EMR.

Keywords: electromagnetic radiation, rats, lipid hydroperoxides, catalase, superoxide dismutase

Sustainable Development Of Agricultural Higher Education: Ways To Control

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Abstract

Rational use of professional potential of the country is a guarantee of successful development of all spheres of society's life: social, legal, economic, environmental, scientific, etc. In the system of agrarian university education more attention has been paid to the specialization and quality control of education. [Zhuravska, 2015]. Sustainable development of agriculture for Europe now means: we live today to save lives in the future. The European vision of sustainable development of agrarian education involves an integrated approach: quality, safety, control [Sayenko T., Nagorniuk, 2013]. This applies both to the production of agricultural products and to the educational process, in particular agroecological education and social work in rural areas [Yashchuk, 2016]. The need for social work increases, depending on the complexity of socio-economic conditions [Kubitskiy, 2015]. Therefore, education in favor of ecologically balanced (sustainable) development covers the economic, social and environmental sectors. Pedagogical conditions for the formation of professional competence of future social workers and teachers in the conditions of an agrarian institution of higher education is the creation of positive motivation; a complex of traditional and innovative forms and methods of teaching; ensuring teachers' readiness to form a high ecological culture and youth consciousness.

The analyzed methods, generalized empirical and theoretical positions in the works of domestic and foreign researchers, the results of own research and the proposed discussion are presented.

Comparative analysis of quantitative and qualitative indicators of the levels of formation of the professional competence of future social workers in the conditions of a higher education institution obtained during the formative research and experimental work showed that the general level of formation of professional competence, in comparison with the qualifying stage, in the participants of the control group increased by 1.3%, while in the experimental group - by 11,975.

Keywords: agroecology, sustainable development, ecologically balanced management, higher agricultural education, methodology of teaching agrarian and environmental disciplines, social work in rural areas.

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Technologies Of Organic Seed Production Of Legumes

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Abstract

Because of the reorientation of the export market of Ukraine to the EU market in the country, the number of agricultural producers willing to produce organic products has steadily increased in recent years. The demand for organic farming in the European Union is quite large and has a stable price, which is an attractive factor for many agricultural enterprises in Ukraine. Today, in our country there are more than 600 farms, which switched to the production of organic products or are undergoing a conversion period.

A special niche in organic production is occupied by legume crops. Legumes due to valuable chemical composition of grain have a great industrial and raw material value. From legume crops producecereals, flour, various confectionery, food and feed concentrates. Legumes play an important role in improving soil fertility. Due to this, they are one of the best precursors in crop rotation for cereals and industrial crops.

For the production of organic products (raw materials), seeds and planting material obtained using organic production technologies, namely parent and parent forms of plants grown in accordance with detailed rules for one generation, are used. Organic seeds are produced in environmentally safe conditions in accordance with world standards and are intended for organic production. The production and sale of such seeds is carried out for a limited set of varieties and hybrids.

In the conditions of Right-Bank Forest-Steppe of Ukraine, based on the Skvyrska research station of organic production of the Institute of Agroecology and Environmental Management of NAAS, studies were conducted on the impact of technologies of using the complexes of preparations of natural origin of domestic producers on the seed productivity of soybean and pea, their crop quality and phytosanitary condition. The potential of soybean varieties of domestic and foreign origin according to the main economic features in the conditions of use of organic production technologies is estimated.

The research has established the positive effect of technologies with using of all complexes of biological preparations on the yield of legumes as well as on the seed quality of the studied crops. When selecting soybeans for organic production, the main criterion in the conditions of Right-Bank Forest-Steppe of Ukraine is the period of vegetation. It was found that late ripe soy varieties are at risk zone because of the formation of not high quality of crop yield, both of commercial products and of the sowing material.

Keywords:organic products,legume crops,biological preparations.

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The Dynamics Of The Cultivation Of Lentils In Akmola Region

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Abstract

Culture of lentil (lat. Lens culinaris) interesting, rare legume, which in Kazakhstan recently began to cultivate, and in the Akmola region for the first time, brown lentils Wehowsky varieties were sown in 2015. Work on the zoning of this crop in Akmola region continued in subsequent years, and the yield was 21.6 centners per hectare (S= 351 ha), thereby exceeding the yield of wheat.

This culture is promising in the agronomic aspect, as it is suitable for direct harvesting. The protein content of lentils is second only to soy and 2 times higher than wheat.

It is practically established that when sowing lentils, should be used large and clean seeds, the best soil for growing lentils is black soil, the soil temperature during sowing should not be lower than 6-7C. For row sowing, the distance between rows was 15-20 cm, and between plants 10-12 cm, the seed rate of 70-85 kg / ha, the depth 3-5cm and sowing time from 10 to 25 of May, the air temperature should be in the range of 15-20C. The formation of a equal shoots were observed on day 6-8, full bloom occurred 40-45 days after germination and the growing period lasted for 75-85 days.

The results of high yields in 2015-2016 years 21,6 centners per hectare (S= 351 ha) and 21,7 centners per hectare (S= 5000 ha) due to favorable conditions, the presence in the soil of sufficient moisture, which is not to say about the dry summer of 2017. The reason for the low yield of brown lentils 12.2 centners per hectare (S= 421 ha), was insufficient rainfall before and during flowering plants. The following 2018 year was unfavorable for this culture. Excessive rainfall led to long-term disease (ascochitosis) of the plant, resulting in a yield of 12 centners per hectare (S=1600 ha). Lentils grown on the territory of Akmola region of Zerenda district corresponds to the appearance, color of brown lentils, is inferior only in grain size, as climatic conditions do not allow to fully realize the desired goals.

The Eco-Friendly Method Of Producing Organic Mono-, Di- And Polysulfides Using Microwave Activation Of Hydrogen Sulfide

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Abstract

One of the principles of Green chemistry involves the use of waste of one technology as a raw material for another process. When extracting gas condensate, H_2S is the accompanying component that is burned to elemental sulfur. As a result, emissions from flare units at gas processing plants are quite large. It is more expedient to H_2S utilizate in the synthesis of practically useful organic sulfur derivatives. Recently, microwave synthesis is the most environmentally friendly. Compared to thermal processes, MW irradiation allows for a reduction of energy consumption. The increasing of the reaction rate is achieved more efficiently than during catalytic chemical transformations. We have previously investigated microwave activation of H_2S in reactions with aromatic and alicyclic hydrocarbons [1, 2]. In this work, a three-component synthesis (200 W, 30 min) with di(*n*-butyl)disulfide, which is necessary for obtaining of an asymmetric sulfides, is proposed. The yield of the asymmetric sulfides (6,7-8,1%) was comparable for different alicycles C_5-C_8. Along with sulfides, cycloalkanthiols and the corresponding di- and trisulfides were obtained. The symmetric trisulfides (15,6-19,0%) were the dominant products, the highest yield under these conditions was achieved for C_5. In the case of C_6, the rate of disulfides conversion to trisulfides is the highest, and for C_7 this value is minimal. The changing of the MW power from 200 to 300 W led to an increase of the yield of compounds. The resulting sulfides are part of the drugs for the treatment of multiple sclerosis, autoimmune diseases, inflammatory bowel disease, asthma and arthritis.

Keywords: microwave synthesis, activation, hydrogen sulfide, di(*n*-butyl)disulfide, organic sulfur derivatives

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The Effect Of Small Heat Shock Protein Hsp67Bc On The Fitness Of *Drosophila Melanogaster* Under Stressful Conditions

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Abstract

Heat shock proteins (HSPs) is a class of stress-inducible proteins present in all living organisms, playing a crucial role in the maintenance of cell viability by folding unfolded proteins and preventing their aggregation, breaking down protein aggregates etc. both in normal and stressful conditions. Hsp67Bc is a small HSP found in *Drosophila melanogaster*, which has been shown to be an orthologue of human HSPB8 involved in the regulation of macroautophagy and the prevention of polyQ-protein aggregation [1].

Here, with the use of the imprecise excision of *P*-element, we obtained *hsp67Bc*-null mutant *D. melanogaster*. These flies demonstrate an increased rate of climbing in negative geotaxis assay, decreased fecundity (roughly 3/4 of that of control females, declining more drastically with age), a tendency towards reduced tolerance to oxidative stress (3% peroxide), an increased lifespan at 29 °C and a decreased survival of females after chill coma (12h at 0 °C; 4 day old flies; down to 40.6% of control group survival).

Thus, Hsp67Bc protein is involved into various complicated processes of Drosophila organism, and the absence of *hsp67Bc* gene can increase the fitness of the host under some mild prolonged physiological stresses while being detrimental under acute stress conditions.

Keywords: Drosophila melanogaster, heat shock proteins, Hsp67Bc, stress response.

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The Environmentally Safe Method Of Electrosynthesis Of Bicyclic Hydrocarbons Thio Derivatives With The Participation Of H_2s

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Abstract

Recently, an important role played by modern synthesis processes, characterized by minimizing the negative impact on the environment and environmental technologies used. The main advantage of electrolysis over chemical methods for producing compounds is compliance with the requirements of Green Chemistry. In addition, electrosynthesis makes it relatively easy and simple to control the speed and selective direction of chemical reactions. In electrochemical processes, less energy is consumed and the amount of harmful emissions into the environment is practically reduced to zero. Previously, we considered various (direct and indirect) methods of redox activation of hydrogen sulfide to ion radical forms in reactions with organic compounds [1-3]. In this work, the reactions of indane (indene) with H_2S or at presence of system H_2S-S_8 were studied under mild condition. The interaction was carried out at room temperature due to the activation of H_2S (1.70 V) by single-electron oxidation at the Pt-anode. The generation of the tile radical during electrolysis (CH_2Cl_2, 90 min) allowed the thiolation reaction of the substrates. During the electrochemical transformations the formation of the same primary reaction product (thiol (1.66 V)), was recorded for both substrates. When using system H_2S-S_8 the sulfur-containing polymer product (1.37 V) was obtained. In the case of indene, the yield of the obtained reaction products was significantly higher, which is explained by higher reactivity due to the presence of a multiple bond. The potential biological activity of the synthesized compounds which are effectively used in the treatment of stroke and phobic disorders, was determined (PASS).

Keywords: electrosynthesis, anodic activation, hydrogen sulfide, indane, indene

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The Influence Of Dimethyltin Dichloride And Diphenyltin Dichloride On Russian Sturgeon Fresh And Cryopreserved Sperm Lipoperoxidation Level

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Abstract

Sturgeon sperm cryopreservation is an important procedure to the aquaculture industry. One of the factors affecting the quality of fish sperm in aquaculture may be the toxic effect of pollutants of industrial and agrochemical origin, including organotin compounds which are highly toxic persistent organometallic xenobiotics in the environment. In this work the effect of the dimethyltin dichloride and diphenyltin dichloride on lipoperoxidation level fresh and cryopreserved sperm Russian sturgeon was studied. The present work demonstrated that the studied organotin compounds are the promoters of the lipoperoxidation derived carbonyl by-products accumulation, which react with thiobarbituric acid both in the native sperm and in the frozen sperm, in the presence and absence of the modified cryomedium Stein's. It was shown that diphenyltin dichloride demonstrates the greatest promoting activity for native sperm, and dimethyltin dichloride for frozen sperm. A decrease in the sensitivity of cryopreserved Russian sturgeon sperm to the promotion of lipoperoxidation by organotin compounds, especially diphenyltin dichloride, has been found. It has been established that in the presence of toxicants, the protective effect of cryomedium decreases, which can be explained by the interaction of organotin compounds with cryomedium components, for example, with DMSO. Our results suggest that the accumulation of organotins by fish sperm is another stress factor affecting cells in the process of cryopreservation.

Keywords: organotins, Russian sturgeon sperm, cryopreservation, lipoperoxidation.

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The Influence Of Organotin Complexe Containing An Antioxidant 2,6-Di-Tert-Butylphenol Moiety On The Ability Of The Rat Erythrocytes Hemolysate To Utilize Of Reactive Oxygen Species In Vitro

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Abstract

It is known that one of the functions of erythrocytes is inactivation of reactive oxygen species, which are produced continually in red cells by hemoglobin autooxidation, and this process is accelerated upon exposure to a large number of xenobiotics. *In vitro* experiments, the effect of bis(3,5-di-tert-butyl-4-hydroxyphenyl)tin dichloride (BTD) on the ability of the rat erythrocytes hemolysate to utilize: the superoxide anion radical ($O_2^{\bullet-}$) (in reaction of epinephrine autoxidation in alkaline medium) and hydrogen peroxide (H_2O_2) was studied. The effect of BTD was studied in comparison with $(C_6H_5)_2SnCl$ (DPT). It is shown that DPT induce $O_2^{\bullet-}$ production, reduced the rate of decomposition of H_2O_2, which indicates the ability of DPT to inhibit the antioxidant enzymes: superoxide dismutase and catalase of erythrocytes. Unlike DPT, organotin containing an antioxidant moiety, increased the ability to rat erythrocytes hemolysate to utilize H_2O_2 and only slightly reduced the ability of hemolysate to utilize the $O_2^{\bullet-}$. Thus, it is shown that the substitution in the organotin of phenyl groups for sterical hindrance phenolic groups, has a protective effect on the rat erythrocytes hemolysate antioxidant capacity.

Keywords: organotins, 2,6-di-tert-butylphenol, erythrocytes, reactive oxygen species.

This work was supported by Russian Foundation Basic Research (grant № 17-03-00434).

The Inhibitory Activity Of Organic Di- And Trisulfides

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Abstract

The inhibitory activity of organic di- and trisulfides in the model system of oleic acid peroxide oxidation by oxygen was investigated. The experiments were carried out in air at 65°C for 5 hours, kinetic of the process was characterized by accumulation of hydroperoxides (LOOH) and carbonyl compounds, giving colored complexes with thiobarbituric acid (TBARS). The total content of LOOH and TBARS accumulated upon the oxidation of oleic acid at presence of additives of organic di- and trisulfides was calculated and compared with the control experiment. It was found that in the case of diphenyl di- and trisulfides, the level of LOOH and TBARS accumulation decreased in 1.3 times. At the presence of bis-(4-hydroxy-2,6-di-tert-butylphenyl)disulfide, the level of TBARS and LOOH in oleic acid was 10 % lower from the control experiment At presence of bis-(4-hydroxyphenyl)disulfide after 5 hours of incubation the level of oleic acid oxidation was almost 2 times lower compared to the control experiment. Thus, addition of organic di- and trisulfides led to decrease of the LOOH and TBARS quantities, which confirms the inhibitory activity of the compounds under study. The decrease of LOOH accumulation, which did not lead to the increase of the TBARS content in oleic acid at presence of additives, can be explained by action of different functional groups in present in the compounds.

Keywords: organic di- and trisulfides, hydroperoxides, thiobarbituric acid reactive substances, oleic acid, lipid peroxidation

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The Study Of Microbiological Methods For Cleaning Soil Contaminated With Heptyl

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Abstract

The aim of the study is to determine microorganisms capable of absorbing heptyl from soils of gray-brown desert sandy soil and loamy soil, selected in the positional area of the Baikonur Cosmodrome, and compilation of optimal associations from cultures of microorganisms that have the ability to digest heptyl as the sole carbon source.

In the course of the study of 30 soil samples, including gray-brown desert sandy loam soil and loamy soil contaminated with heptyl and 32 cultures of microorganisms in its cleaning-up, 4 cultures were identified and its biological properties were studied. According to the results of a comparative analysis it was determined that cultures No. 7, No. 15, No. 26, and No. 29 are the most active in terms of biomass accumulation and able to absorb heptyl. Among these selected cultures of microorganisms, 4 different associations were compiled taken in equal proportions (1: 1).

The first one consists of all four cultures of microorganisms - 7 + 15 + 26 + 29, the second of the three 7 + 26 + 15, the third culture 7 + 26 + 29 (1: 1: 1) and the fourth 15 + 26. In addition, the studies have showed that the greatest degradation of heptyl occurred in the soil sample No. 1 and No. 6, in which the association of four strains was included, i.e. - 7 + 15 + 26 + 2.

Keywords: Soil, Heptyl, Microorganisms, Nutrient Medium, Degradation of Heptyl.

The Study Of Molecular-Genetic Characteristics Of Isolates Of Lactic Acid Bacteria In Fish

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Abstract

Modern biotechnology is inextricably linked with the use of new approaches to the selection of natural microorganisms when creating bacterial preparations. Fundamental achievements and practical studies of recent decades in microbiology, genetics and molecular biology made it possible to study the genetic diversity of microorganisms. With the development of genetic taxonomy, a variety of methods used to study the bacterial genome and the accumulation of experimental data, allowed to solve many controversial issues of taxonomy of specific groups of microorganisms. The objects of the study were collection cultures and isolates of lactic acid bacteria (Lactobacillus, Pediococcus) isolated from water, sludge of a pond and fish intestines.

In this regard, the purpose of this work was to study the molecular genetics properties of isolated isolates of lactic acid bacteria in fish. The molecular genetics properties of 23 active isolates were assessed by isolating DNA, obtaining a PCR product, followed by sequencing and analyzing the nucleotide sequences in the GenBank-BLAST program to determine the genus and species identification of microorganisms. The nucleotide sequences were analyzed and combined into a common sequence in the SeqMan software. As a result, molecular genetics identification of 23 isolates of lactic acid bacteria isolated from the intestines of fish inhabiting the Nura reservoir was carried out. Selected 3 active isolates of lactic acid bacteria with high antagonistic and bacteriocinogenic activity were brought to the form: 10 / 9K - Pediococcus pentosaceus, 9C - Lactobacillus paracasei, 24C - Lactobacillus fermentum. A biological preparation was created on the basis of 3 strains (24C, 10 / 9K, 9C): Pediococcus pentosaceus, Lactobacillus paracasei, Lactobacillus fermentum. Conducted research in the laboratory confirmed the effectiveness of a biological product in the experimental group compared with the control group, which is reflected in a decrease in the total mortality of fish.

Keywords: genome, deoxyribonucleic acid, nucleotide, strain.

The Utilization Of Toxic Hydrogen Sulfide For Obtaining Of Thiolation Products Of Bicyclic Hydrocarbons By Its Anodic Activation

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Abstract

The removal of H_2S and its effective use is a big problem for many branches of the oil refining industry at present. This work could potentially be used as an alternative to the Claus process aimed at processing H_2S into elemental sulfur. As an alternative to burning H_2S to S_8, we proposed to use H_2S for the synthesis of practically useful organic sulfur derivatives, which will reduce the level of environmental pollution. Electrosynthesis is a powerful environmental tool that provides less of waste, decrease of reagents consumed and of reaction stages, reduce of energy consumption in contrast to traditional synthetic methods. Previously, we studied the effective reactions of H_2S with (un-)saturated alicyclic hydrocarbons under conditions of anodic initiation [1-3]. In this work an electrochemical method has been developed for involve H_2S in reactions with decaline and 1,2-dihydronaphthalene at 25°C. The mild conditions are provided by anodic activation of H_2S to a radical cation, which fragments with proton elimination and the formation of a thiyl radical. The potential of electrosynthesis is equal to the value of the oxidation potential of H_2S. Due to the different nature of substrates, they enter into different types of reactions with $HS^{\cdot}$. Decaline interacts with activated H_2S to form the product of the replacement of a hydrogen atom by a thio group. In the case of 1,2-dihydronaphthalene, the thiyl radical is attached to the double bond of the alicyclic compound. The potential biological activity of the products of substrate thiolation was evaluated using the PASS program.

Keywords: utilization, electrosynthesis, activation, hydrogen sulfide, decaline, 1,2-dihydronaphthalene

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Three-Year Average Mortality Rate From Different Types Of Diseases In The North Kazakhstan Region

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Abstract

In the period of 2015-2017 years, the North Kazakhstan Region had rapidly developed. The region's industry, agriculture and infrastructure aspects had been improved. Moreover, according to the Regional Department Statistic data, decreasing mortality rates were observed in the region.

To find information on the mortality rate in the region for 2015-2017 years official regional department statistics website was used. To present three-year average mortality rates for 1000 people for the region mathematical operations were performed. Mortality rates by different types of diseases in the North Kazakhstan Region and its administrative centre for 2015-2017 years were analysed.

The results showed that the regional three-year average mortality rate by cardiovascular diseases was 2.61 per 1000. The administrative centre three-year average mortality rate was 3.09 per 1000. We found that the regional three-year average mortality rate for different types of cancer was 1.33 per 1000, whereas for the administrative centre was 1.78 per 1000. The regional three-year average mortality rate by digestive diseases was 1.09 per 1000, while for the administrative centre was 0.74 per 1000.

Three-year average mortality rate by cardiovascular diseases and different types of cancer in the administrative centre was higher than in the region. The administrative centre three-year average mortality rate by digestive diseases was lower than the regional three-year average mortality rate.

Key words: mortality rate, cardiovascular diseases, digestive diseases, cancer.

Transgenic *Nicotiana Benthamiana* Plants Carrying P4h Gene As A Host For Transient Gene Expression And Human Collagen Production

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Abstract

Collagen is the main structural protein in the various connective tissues, and it is an important biomaterial with a lot of medical applications. Collagen production in plants has both advantages (low cost, large scale etc.) and limitations [1] (e.g., lack of human prolyl-4-hydroxylase (P4H), that is essential for structural stabilization [2]). Transient gene expression (TGE) in plants allows fast obtaining of high levels of foreign proteins, while transgenic plants transmit target gene to their offspring. To improve collagen production, we combined two strategies: obtaining transgenic plants and further using them for TGE. Firstly, transgenic *Nicotiana benthamiana* plants carrying the P4H α-subunit (catalytic activity responsibility) were generated by agro-transformation. Transgenic lines were self-pollinated, and seeds were harvested. Seeds were germinated and then were grown under selective pressure of BASTA herbicide. Plants resistant to selection were checked by PCR analysis for the presence of target gene. Plants carrying target gene were transferred in soil and grew in greenhouse conditions. Next step was testing transgenic *Nicotiana* plants as a host for foreign protein production via *Agrobacterium*-mediated TGE. For this task GFP was chosen as a reporter protein. The standard infiltration procedure was performed [3]. After three days bright green fluorescence indicating on high level of GFP production was detected. The brightness varied between the lines and it depended on genetic vector construction, but it was comparable to control non-transgenic plants. Thus, we obtained transgenic plants with stable inheritance of target gene and showed that these plants can effectively produce foreign proteins after TGE.

Keywords: *Nicotiana benthamiana*, prolyl-4-hydroxylase, transient gene expression, GFP, human collagen

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Water Quality In The Ingulets Irrigation System: Current State And Forecast

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Abstract

The Ingulets irrigation system is one of the main water suppliers of the agricultural producers of the South of Ukraine. The source of the water is river Ingulets, which is polluted with industrial wastes and runoffs on the whole length of its main stream. Therefore, continuous monitoring of water quality by agronomic criteria is required to provide safe use of the water for irrigation purposes. In 2010 a new method of the water amelioration was developed and introduced. The study of the Ingulets irrigation system water quality during the last years proved high efficiency of the water amelioration method, which is based on the systematical feed of the system canal with pure water from the Karachuniv reservoir. The results of the study certified a considerable improvement of the water quality. A comparison of the average values of main agronomic criteria between the pre-amelioration (2007-2010) and post-amelioration (2011-2018) periods is as follows: mineralization decreased from 2163.5 to 1531.0 mg/L; sodium adsorption ratio decreased from 6.69 to 5.08 me/L; toxicity expressed in eCl^- decreased from 21.78 to 11.31 me/L; sodium content decreased from 52.98 to 49.87%. The forecast of further dynamics of the water quality in the system by the Holt-Winters exponential smoothing method allowed concluding that the water amelioration method is efficient, and until 2025 it should provide stable improvement of the water quality: mineralization of 1583.6 mg/L; sodium adsorption ratio of 6.01 me/L; toxicity of 12.11 me/L (the forecast is reliable at the probability level of 95%).

Keywords: forecast, irrigation, mineralization, sodium adsorption ratio, toxicity, water quality.

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Wetland Plants Of North-Kazakhstan Region

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Abstract

The *Cyperaceae* family is one of the ten leading families in the flora of the North Kazakhstan region contains 28 species (3.7 %) of the total number of species of North Kazakhstan, which is quite reasonable. On the territory of the region flows the river Esil there is a huge network of lakes in the river floodplain spread various wetland vegetation. And also in the North of the region there are small residual peat bogs, small in size with characteristic swamp vegetation. Therefore, representatives of the family *Cyperaceae* widespread in our region and play a significant role in the addition of vegetation.

Distinctive families in the territory of North Kazakhstan region are the *Ericaceae* family, which includes 11 species of 8 plant genera and *Droseraceae*. These plants are the remains of ancient holocene vegetation and are relics. Almost all these species are included in the Red book of Kazakhstan.

Among the wetland vegetation plants belonging to the families: *Cyperaceae, Juncaginaceae, Juncaceae, Potamogetonaceae Dum., Alismataceae Vent., Butomaceae Rich., Hydrocharitaceae Juss.* and others.

In the family *Cyperaceae* 7 genera: genus *Schoenoplectus Palla*. it has 3 species, genus *Scirpus L.*– 1 species, genus *Bolboschoenus Palla*.– 2 species, genus *Eriophorum L.*– 3 species, genus *Carex L.*– 17 species, genus *Rhynchospora* and *Cyperus* – 1 species.

The largest genus is Carex L. - 10 species: *C.riparia Curtis, C.inflata Huds., C.limosa L, C.lasiocarpa Ehrh., C.secalina Willd, C.fusco-vaginata Kuk., C.rhynchophysa C.A.Mey., C.pseudocyperus L., C.omskiana Meinsh., C.cespitosa L*.

To the genus *Schoenoplectus Palla*. applies 3 species: *Schoenoplectus lacustris (L.) Palla., Schoenoplectus triqueter (L.) Palla., Schoenoplectus tabernaemontani (C.C.Gmel) Palla.*

In the genera *Scirpus L.* 1 species *Scirpus sylvaticus L.,* and *Bolboschoenus Palla.*– 2 species of *B. maritimus (L.) Palla., B. maritimus (L.) Palla.var.compactus Egorova.*

Genus *Eriophorum L.* contains 2 species: *Eriophorum graci1is Koch., Eriophorum vaginatum L.*

The *Juncaginaceae* family is represented by 2 species - *Triglochin maritima L.,Triglochin palustris L.*

There are 7 species in the family *Juncaceae* : *Juncus gerardii Lois., Juncus compressus Jacg., Juncus atratus Krock., Juncus bufonius L., Juncus sphaerocarpus Nees., Juncus articulatus L., Juncus tenuis L.*

By life forms, most of the species considered are herbaceous perennials. And only 1 species of *Juncus bufonius L.,* is an annual plant.

Keywords*:* wetland plants, genus, species, herbs.