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ABSTRACT BOOK

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VYTAUTAS MAGNUS UNIVERSITY Faculty of Natural Sciences

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3-May-2018 VMU Small hall (S. Daukanto g. 28, Kaunas) and VMU Tadas Ivanauskas hall (Ž. E. Žilibero 2)

08:30-12:00 Registration

09:30-09:45 Opening Ceremony. Welcome word from Vice Rector for Research Prof. Dr. Julija Kiršienė.

09:45-10:00 Opening Ceremony. Dean of Nature science faculty of Vytautas Magnus university speech.

10:00-12:30 Session 1 (VMU Small hall (S. Daukanto g. 28, Kaunas). **Chairperson:** Algimantas Paulauskas, Alexander Sirotkin.

10.00 – 10.20 Dmitry Spivak, A. Urazova, A. Zakharchuk, I. Spivak. Dynamics of telomere length and telomerase activity under the influence of music of various types

10.20 – 10.40 Natallia Shtemenko, Alexander Shtemenko. Redox-Activated Nanobased Combinational Therapy with the Use of the Quadruple-Bonding Rhenium Compound.

10.40 – 11.00 Pavel Shlizov, T.I. Dolinina, N.M.Pleskach, S.V. Zherebtsov, M.L. Bulatnikova, V.M. Mikhelson, I.M. Spivak. General and individual differencies of aging markers in the cells of patients with cockaine syndrome.

11.00 – 11.20 Eduardas Cicinskas, Mariya Begun, Valeriia Vikhareva. Immunotropic activity of Sea of Japan algae carrageenans.

11.20 - 11.40 Aleksandra Kalitnik, **Eduardas Cicinskas, Maria Begun, Vladlena Tiasto, Valeriia Mikhaylova, Valeriia Vikhareva**. Biological effects of sulfated polysaccharides isolated from red marine algae

11.40 – 12.00 Algimantas Paulauskas. Climate change impact to expansion of ticks and tick-borne deseases.

12.00 – 12.30 Alexander Sirotkin. Novel hormonal, intracellular and pharmacological regulators of female reproduction

12:45-13:15 Lunch

13:15 1st Bus which will drive to Tadas Ivanauskas hall (participations should wait at 13:10 near S. Daukanto g. 28 central entrance)

13:45 2nd Bus which will drive to Tadas Ivanauskas hall (participations should wait at 13:40 near S. Daukanto g. 28 central entrance)

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13:15-14:30 Poster session 1

14:30-17:00 Session 2 (Young researchers section) (VMU Small hall (S. Daukanto g. 28, Kaunas). **Chairperson:** Saulius Mickevičius, Yuliia Ovchynnykova.

14:30-14:45 Tadas Didvalis, Paulius Ruzgys, Saulius Šatkauskas, Diana Adlienė, Saulius Mickevičius. Assessment of ROS production using DCFH-DA dye in CHO cells after application of ionizing radiation.

14:45-15:00 Viktorija Malouškina, Milda Jakutavičiūtė, Saulius Šatkauskas. Dependence of CHO cell electroporation and electrotransfection efficiency on the cell density and elapsed time since last passage.

15:00-15:15 Maxim Vasilenko, Alena Gajdosova, Mykola Kuchuk, Olha Yaroshko. Transformation of varieties of *Amaranthus caudatus* L. and varieties of hybrids *A. caudatus* x *A. paniculatus* L. by "floral-dip" method.

15:15-15:30 Anatoly Ivankov, A. Velygodska. Ways of Increasing the Carotenoids Synthesis of the Basidiomycetes Strains Laetiporus sulphureus (Bull.) Murrill.

15:30-15:45 Arūnas Struckas, Piotr Vasiljev, Regimantas Bareikis, Sergejus Borodinas. The Overview of Ultrasonic Systems for Oil Extraction from Micro Algae.

15:45-16:00 Izabela Smok, A. Polit. Confocal microscope analysis of human G protein subunits interactions.

16:00-16:15 Julija Fediajevaitė, Sigitas Juzėnas. *L. clavatum* and *L. annotinum* clones: the establishment in Scots Pine dominated forest in relation to disturbances.

16:15-16:30 Mantas Adomaitis, Grita Skujienė. Taxonomic clarification: the invasive pest slug occuring in Lithuania is *Arion vulgaris* Moquin-Tandon, 1855.

16:30-16:45 Elena Tyumina, G. Bazhutin, I. Ivshina, E. Vikhareva. Structural and functional features of rhodococci exposed to NSAID-based pharma pollutants.

16:45-17:00 Dykyy, I.V., Milinevsky, G.P., Savitsky, O.L., Lutsenko, D.G., Khoetsky, P.B., Veselsky, M.F., Smagol, V.M., Dzhulay, A.O., Tsaryk, J.V., Nazaruk, K.M., Zatushevsky, A.T., Simon A.O., Telipska, M.A., Beznoshchenko B.O. New Smart Technology For Antarctic Biology Research.

15:00-17:00 Session 3 (Dedicated to 95th anniversary of Vytautas Magnus University Botanical Garden) (VMU Tadas Ivanauskas hall, Ž. E. Žilibero 2, Kaunas). **Chairperson:** Remigijus Daubaras, Tetiana Andrianova.

15.00 -15.15 Tetiana Andrianova. Mycospherella and its related conidial fungi as pathogens on medicinal plants in Ukraine

15:15-15:30 Tetiana Kyrpa-Nesmiian, Volodumur Rudas, Olga Ovcharenko, Victoria Osipenko, Maxim Kharhota, Mykola Kuchuk. Studies On The Adaptation Of Solanum Tuberosum Plants Expressing The Desa Gene To Osmotic Stress

15:30-15:50 Vida Mildžienė. On the Molecular Mechanisms of Plant Response to Prie-sowing Seed Treatment with Cold Plasma and Electromagnetic Field.

15:50-16:05 Volodumer Radchenko, Svitlana Bilous, Artur Likhanov, Raisa Matashuk. Micropropagation and Secondary Metabolite Activity of *Lysimachia Nummularia* L.

16:05-16:20 Edvina Krokaite, Jolanta Nemaniute-Guziene, Dinara Shakeneva, Lina Jociene, Laisvūnė Duchovskienė, Donatas Zvingila, Jolanta Patamsyte, Violeta Kleizaitė, Regina Vysniauskiene, Vida Ranceliene, Eugenija Kupcinskiene. Is nitrogen in excess among plant species of Nemunas and other Lithuanian river basins?

16:20-16:40 Ona Ragažinskienė, Audrius Sigitas Maruška. Development Research of Medicinal (Aromatic) Plants (MAP‘s) in Vytautas Magnus University in 1924-2018.

16:40-17:00 Remigijus Daubaras, Laima Česonienė. Integrated investigation of prospective Vaccinium species and selection of new cultivars at Kaunas Botanical Garden of VMU.

17:30 Excursion to Vytautas Magnus University Botanical Garden (Bus which will drive to excursion are leaving at 17:05)

4-May-2018 VMU Small hall and 402 aud. (S. Daukanto g. 28, Kaunas)

08:30-12:00 Registration

09:00-10:00 Poster session 2

10:00-12:30 Session 4. The session was dedicated to the project “Integrated impact of climate and environmental changes to the productivity, biodiversity and sustainability of agro-ecosystems” (KLIMAGRO, No. SIT-8/2015) of the National Research Program “Sustainability of Agro-, Forest and Water Ecosystem”.

VMU Small hall (S. Daukanto g. 28, Kaunas).

Chairperson: Viktor Glebov and Jūratė Žaltauskaitė.

10.00-10.15 Romualdas Juknys, Arvydas Kanapickas, Jūratė Žaltauskaitė, Gintarė Sujetovienė, Irena Januškaitienė, Giedrė Kacienė, Austra Dikšaitytė, Rimantas Velička, Aušra Marcinkevičienė, Zita Kriaučiūnienė, Jūratė Aleinikovienė, Ilona Vagusevičienė, Robertas Kosteckas. Integrated

Impact Of Climate And Environmental Changes To The Productivity, Biodiversity And Sustainability Of Agro-Ecosystems.

10:15-10:30 Arvydas Kanapickas, Romualdas Juknys, Gintarė Sujetovienė. Thermal Time Models For Estimating Plant Phenological Development Under Climate Based Relationships.

10:30-10:45 Aušra Marcinkevičienė, Rimantas Velička, Zita Kriaučiūnienė, Marina Keidan, Lina Marija Butkevičienė, Rita Pupalienė, Robertas Kosteckas, Sigitas Čekanauskas. The Efficiency Of Non-Chemical Weed Control In Winter Rapeseed.

10:45-11.00 Giedrė Kacienė, Austra Dikšaitytė, Irena Januškaitienė, Diana Miškelytė, Jūratė Žaltauskaitė, Gintarė Sujetovienė, Sandra Sakalauskienė, Jurga Miliauskienė, Romualdas Juknys. Ozone And Future Climate Effect On Interspecific Competition Between Summer Rapes And Wild Mustard.

11.00-11.15 Monika Toleikienė, Žydrė Kadžiulienė, Aušra Arlauskienė. Environmental Aspects Of Legume Manure Management In Organic Agroecosystem.

11:15-11:30 Oleksandr Mudrak, Yuliia Ovchynnykova, Galyna Mudrak, Oksana Nagorniuk. Eastern Podilia As Structural-Functional System Of European Environmental Network

11:30-11:45 P. Lakyda, Andrii Bilous, V. Myroniuk, R. Vasylyshyn, I. Lakyda, M. Matsal. Remote Sensing-Based Assessment Of Biomass Carbon Stock: A Case Study For Ukrainian Polissya

11:45-12:00 A. Kravchenko, E. Sarina, E. Solov'eva, V. Glebov. Accumulation of Toxicans in Soils of the Lipetsk Region Close to Roads.

12:45-13:15 Lunch

13:15-14:30 Poster session 3

14:30-17:00 Session 5 (VMU Small hall (S. Daukanto g. 28, Kaunas). **Chairperson:** Oleksandr Tashyrev, Andrius Kaselis.

14:30-14:50 Oleksandr Tashyrev, Vira Hovorukha, Nadiezhda Matvieieva, H.O. Tashyreva, V.M. Shevel, O.S. Iungin. Development of novel universal biotechnologies for obtaining valuable products from a wide range of wastes.

14:50-15:10 Nadiezhda Matvieieva, H. Shutava, S. Shysh, K. Drobot, Ya. Ratushnyak, A. Shakhovsky, V. Duplij. Biofortification Of Wormwood Using Agrobacterium Rhizogenes-Mediated Transformation

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15:10-15:25 V.M. Hovorukha, O.B. Tashyrev, N.A. Matvieieva, H.O. Tashyreva, O.A. Havryliuk, O.IU. Bielikova, I.B. Sioma. Integrated approach for development of environmental biotechnologies for treatment of solid organic waste and obtaining of biohydrogen and lignocellulosic substrate

15:25-15:45 Ilya Velegzhaninov, Anna Rybak, Elena Belykh, Yana Pylina, Dmitry Shadrin. Increasing of cell resistance to genotoxic stress by multiplex CRISPR/dCas9-mediated overexpression of genes of DNA damage recognition and repair.

15:45-16:00 Lilit Ovsepyan, I. Kurganova, V. O. Lopez De Gerenyu. Dynamics of microbial and enzymatic activity in post-agrogenic soils of Central Russia.

16:00 – 16:15 Sergey Dromashko, Oleg V. Kvitko, I.I. Koneva, Ya I. Sheiko, Nina A. Balashenko, Svetlana N. Shevtsova, Anastasia S. Sapun. Time-laps microscopy of living cells with video complex "tsitomir": scientific, medical, and ecological possibilities.

16:15-16:30 Nina Voronova, Raman Shulinski, S.S. Levykina, Y.V. Bandarenka, D.G. Zhoro. New mitochondrial genomes of three aphid species: aphis fabae subsp. Mordvilkoi, therioaphis tenera, appendiseta robiniae.

16:30-16:45 Daria Kozlova, Alexander Popov. Interleukin-6, 14-3-3-η, calprotektin and butyrylcholinesterase as the most promising biomarkers for the rheumatoid arthritis diagnosis complex test system development.

16:45-17:00 Andrius Kaselis. Role of extracellular cues on PNS regeneration *in vitro.*

15:00-17:00 Session 6 (402 room, S. Daukanto g. 28, Kaunas, Kaunas). **Chairperson:** Vera Shekh, Eugenija Kupčinskienė

15.00 -15.20 Dmitrii Bogoliubov. Karyosphere: a many-faced structure of the oocyte nucleus.

15:20-15:40 Elena Michailova, Larisa Barabanova. The implementation of genetic assays for investigating the Gulf of Finland biological systems.

15:40-16:00 Olena Danchenko, O.V. Yakoviichuk, A.S. Fedorko, Nikolaeva , T.I. Halko. Ontogenetic features of redox reactions In The Myocardium Geese

16:00-16:20 Tugce Yurtluk, Fikriye Alev Akcay, Ayse Avci. Effects of process conditions on the biosynthesis of silver nanoparticles by Bacillus sp. SBT8.

16:20-16:40 Vera Shekh, Emeka Ofoegbu, Ebunoluwa Adenuga, Anna Dubina, Larisa Shchyrova. High responsiveness of cardiovagal outflow and sympathoinhibition to cold pressor test in young overweight normotensive subjects.

16:20-16:40 Eugenia Perminova, Yulia Vinogradova, Elena Lapteva, Vera Kovaleva. The Specifity Of Microbiological Complex Formation In Post-Agrogenic Soils.

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16:40-16:55 Roman Mamadzhanov, Aleksandr Khaustov, Margarita Redina, Yulia Nigmatzyanova. Environmental Monitoring of the University Campus: the Case Study of RUDN University Campus in Moscow, Russia.

16.55 – 17.10 Yulia Vinogradova, Alla Kuklina, Olga Shelepova, Olena Vergun, Olga Grygorieva, Ján Brindza. Differences between Aronia Medik. taxa on the micromorphological and biochemical characters.

17:10-17:25 Mark Schlueter. Using wild beese for increasing crop production.

5-May-2018 Post conference tour to Trakai castle (particaptions are meeting at 9:50 near the central entrance of S. Daukanto g. 28, Kaunas central entrance)

The organisers are not responsible for the contents of the abstracts published in this book

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ORAL PRESENTATIONS

ACCUMULATION OF TOXICANTS IN SOILS OF THE LIPETSK REGION CLOSE TO ROADS

A. Kravchenko[1], E. Sarina[1], E. Solov'eva[3], V. Glebov[4]

[1]K. S. KONSTANTINOVA YELETS MEDICAL COLLEGE, RUSSIA, [2]I. A. BUNIN YELETS STATE UNIVERSITY, RUSSIA, [3]PEOPLES' FRIENDSHIP UNIVERSITY OF RUSSIA, RUSSIA
VG44@MAIL.RU

Abstract

It is known that heavy metals (HM), having cumulative effect, both in agricultural products and in the human body, cause a negative impact on human health. When growing agricultural products in the vicinity of roads, the influence of gasoline combustion products containing lead additives affects. In this regard, we have conducted a study on the impact of vehicle emissions on agricultural products grown near the highway. Method of research. Determination of HM in forest soils and agricultural crops was carried out by atomic absorption method on spectrometer "Spektr-5", and mobile in acetate-ammonium buffer solution with pH=4.8. HM we determined on a plot of 16 hectares, located in the forest-steppe zone of the Lipetsk region, adjacent to the highway Rostov – on-don-Moscow. In the soil (leached black soil) samples were taken at a distance of 10-30, 30-50, 50-300 and 300-400 m from the road at a depth of 0-10 and 10-20 cm, determined the content in the soil of the gross and mobile forms of metals such as cadmium, lead, Nickel, manganese, copper and zinc. Acquired data. Increased the total contents of lead and cadmium occurs at a distance of 30 to 50 meters and at a depth of 0-20 cm, lead and Nickel are concentrated in the soil at a distance from roads in the range of 30 to 50 meters. The manganese there is an increase of concentration and over longer distances (100 m).

In the analysis of the sanitary condition of pine forest, a strong dependence on anthropogenic influence is established, since about 5% of their area is at the 4th stage of digression from the soil, lost ability to self-restoration, about 20% of the territory to the 3rd, the rest to the 2nd stage of digression. Conclusion. Thus, the high content of toxic metals leads to degradation of nearby pine plantations, because they serve as a major barrier to their uptake from the atmosphere and snow cover, protecting the soil of agricultural land.

Coniferous plantings reduce the content of heavy metals in barley grain below permissible concentration, without causing deterioration of its quality. Thus, forest protection strips, do not allow extending on considerable distances of farmland, accumulating them in forest plantings, and thereby positively influence quality of agricultural production

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ASSESSMENT OF ROS PRODUCTION USING DCFH-DA DYE IN CHO CELLS AFTER APPLICATION OF IONIZING RADIATION.

Tadas Didvalis[1], Paulius Ruzgys[1], Saulius Šatkauskas[1], Diana Adlienė[2], Saulius Mickevičius[1]

[1]VYTAUTAS MAGNUS UNIVERSITY, K. DONELAIČIO 58, LT-44248, KAUNAS, LITHUANIA, [2]KAUNAS UNIVERSITY OF TECHNOLOGY, K. DONELAIČIO 73, LT-44249, KAUNAS, LITHUANIA
TADASDID@GMAIL.COM

Abstract

The research on x-ray effect on cell behavior is important for improving clinical radiotherapy application. Studies show that part of ionizing radiation induced DNA damage is done indirectly by generating reactive oxygen species [1] that interact with cells' DNA and other cellular macromolecular materials that leads to decreased cell proliferation and signaling abilities [2]. ROS also increases the risk of cell transformation into cancer cells ((carcinogenesis))) and impair the functionality and efficiency of enzymes that are needed to repair damaged DNA [4].

In this study Chinese hamster ovary (CHO) cells were irradiated using medical linear accelerator Varian Clinac DMX (X-rays, 6Mev and 3Gy/min) with doses ranging from 0.5 to 10 Gy.50µMconcentration of dichlorodihydrofluorescein diacetate (DCFH-DA) dye was used as a probe to monitor ROS generated inside irradiated cells and in a growth medium. The DCF production dynamics in cells was observed 1, 3, 6, 12 and 24h after cell irradiation. To assess DNA damage and cell viability dependence on irradiated dose COMET and clonogenic assays were performed.

Results show linear delivered dose dependency with DCF fluorescence measured one hour after irradiation. Cells irradiated with 4 and 8 Gy produced higher additional DCF fluorescence 3 and 6 h post irradiation compared to lower doses. Therefore results suggest that 4 Gy dose is a threshold at which ROS production increases significantly after 3 and 6 h. DNA damage and cell viability results support this observation. Cell irradiation at 2, 4, 6, and 8 Gy increased DNA damage to 5.1±0.6, 24.8±2.4, 32.0±3.2, 45.6±3.5% respectively. Cell viability decreased to 82±5% after 2 Gy and to 48±1.8% after 4 Gy irradiation. That is the largest decrease in viability compared with 6, 8 and 10 Gy that led to viability decrease to 24±3.4, 12±0.7 and 9±0.7% respectively.

1. Reisz, J. A. et al. (2014) 'Effects of Ionizing Radiation on Biological Molecules—Mechanisms of Damage and Emerging Methods of Detection', Antioxidants & Redox Signaling, 21(2), pp. 260–292. doi: 10.1089/ars.2013.5489.

2. Pavelescu, L. A. (2015) 'On reactive oxygen species measurement in living systems.', Journal of medicine and life, 8(Spec Issue), pp. 38–42. doi: 10.1186/s13054-014-0678-7.

3. Wallace, S. S. (2014) 'Enzymatic Processing of Radiation-Induced Free Radical Damage in DNA.', Radiation Research, 150(5), pp. 60–79. doi: 10.2307/3579809.

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BIOFORTIFICATION OF WORMWOOD USING AGROBACTERIUM RHIZOGENES-MEDIATED TRANSFORMATION

Matvieieva N.[1], Shutava H.[2], Shysh S.[2], Drobot K.[1], Ratushnyak Ya.[1], Shakhovsky A.[1], Duplij V.[1]

[1]INSTITUTE OF CELL BIOLOGY AND GENETIC ENGINEERING, NATIONAL ACADEMY OF SCIENCES OF UKRAINE, [2]CENTRAL BOTANICAL GARDEN OF THE NATIONAL ACADEMY OF SCIENCES OF BELARUS
JOYNA56@GMAIL.COM

Abstract

Genetic transformation is an effective method for plant engineering aimed to increase the level of natural biologically active compounds (BAC) accumulation and synthesis of recombinant BAC. Agrobacterium rhizogenes A4 as well as bacteria carried human interferon-α2b gene were used to establish "hairy" root culture of *Artemisia tilesii* Ledeb, *A. dracunculus* L., *A. annua* L. and *A. vulgaris* L. These transgenic root cultures carrying interferon-α2b gene or only agrobacterial genes were used to study fructans, phenolics, flavonoids, carbohydrates and artemisinin accumulation; antioxidant, antimicrobal and antiviral acitivities of root extracts. We found that transformation increased fructans (*A. annua* and *A. dracunculus*), artemisinin (*A. vulgaris*), flavonoids (*A. annua* and A. *vulgaris*) content in some "hairy" root lines compared to the control roots. Synthesis of compounds which were not inherent for control roots (such as mannitol (for *A. vulgaris*), and galactose (for *A. dracunculus*)) was also observed. Total phenolic content in "hairy" roots was mostly the same as in the control, but the qualitative composition of phenolics varied. For example the high content of 3-caffeolic acid (1,26 mg/g), 3 isomer of di-caffeoylquinic acid (14,48 mg/g) was observed in some root lines.

Transformation led to the antioxidant activity increase (up to 98% of the DPPH radical inhibition) in 50% of the studied lines. The ability to reduce ABTS+ radical increased in 80% of extracts. Antimicrobial activity of water and ethanol extracts from the control wormwood was not found. At the same time the extracts from "hairy" root lines inhibited the growth of *Staphylococcus aureus*, *Escherichia coli*, *Kocuria carniphila*, *Micrococcus luteus* and *Rhodococcus eritropolis*. Among of the studied species, transgenic roots of *A. dracunculus* demonstrated the greatest antimicrobial activity and the diameter of the zone of inhibition of growth of microorganisms was up to 21 mm. Transgenic roots carrying human ifn-α2b gene possessed antiviral activity with the value up to 1414 and 1212 IU/g for *A. vulgaris* and *A. annua* respectively. Thus, Agrobacterium-mediated genetic transformation can allow to increase the pharmaceutical value of medicinal wormwood plants by increasing the content of BAC. Therefore it can be a useful tool of the plants biofortification aimed at the production of natural and recombinant biologically active compounds.

Key words: wormwood, Agrobacterium rhizogenes, "hairy roots"

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BIOLOGICAL EFFECTS OF SULFATED POLYSACCHARIDES ISOLATED FROM RED MARINE ALGAE

Aleksandra Kalitnik[1], Eduardas Cicinskas[1], Maria Begun[1], Vladlena Tiasto[2], Valeriia Mikhaylova[2], Valeriia Vikhareva[1]

[1]DEPARTMENT OF PHARMACY AND PHARMACOLOGY, SCHOOL OF BIOMEDICINE, FAR EASTERN FEDERAL UNIVERSITY, 8 SUKHANOVA STR, VLADIVOSTOK, PRIMORSKY REGION, 690950, RUSSIAN FEDERATION, [2]CENTRE FOR GENOMIC AND REGENERATIVE MEDICINE, SCHOOL OF BIOMEDICINE, FAR EASTERN FEDERAL UNIVERSITY, 8 SUKHANOVA STR, VLADIVOSTOK, PRIMORSKY REGION, 690950, RUSSIAN FEDERATION
KALITNIK85@GMAIL.COM

Abstract

Sulfated polysaccharides of red algae – carrageenans consisting of D-galactose residues linked by alternating regularly β-(1-4) and α-(1-3) glycosidic bonds refer to soluble dietary fibers and relate in the list of foodstuffs (Food and Drugs, 2008). Also carrageenans are known as nontoxic biopolymers with different biological activity. In particular, carrageenans possess a number of immunotropic effects, exhibit anti-inflammatory properties, also decrease cancer cell proliferation in vitro and demonstrate in vivo antitumor activity on different tumor models. The structural diversity of carrageenans due to the content of 3,6-anhydrogalactose and the location and number of sulfate groups determines the variation of their biological effects, besides biological properties are often determined by the molecular weight (MW) of carrageenan.

We studied a number of in vitro and in vivo biological effects of different chemical types of carrageenan isolated from some species of pacific red algae (Sea of Japan, Far East, Russia) and also their oligosaccharides obtained by mild acid hydrolysis.

We have shown that κ/β-carrageenan from *Tichocarpus crinitus* induces ex vivo cytokine (TNF-α, IL-10) production in human blood immune cells in dose-depend manner, the most activity was in a highest concentration, thus the ability of carrageenan and their oligosaccharides to induce IL-10 was high and equal with activity of LPS independently of MW and concentration. Also we have shown that λ- and κ -carrageenan from *Chondrus armatus* and their oligosaccharides at concentration of 1, 10 and 100 μg/ml induce ex vivo pro-(TNF-a, IL-1beta) and anti-inflammatory (IL-10) cytokine production in human monocytes, in this κ -oligo-carrageenan possesses the highest effect. Furthermore we have found that κ-carrageenan (*C. armatus*) and its oligosaccharides at concentrations of 100 μg/ml and 200 μg/ml exhibit a cytotoxic effect against human esophageal cancer in cell culture.

Earlier we have found that κ-carrageenan (*C. armatus*) administrated orally at a dose of 5 mg/kg exhibit anti-inflammatory and protective effect on the progression of acid-induced colitis in mice. We also have shown that κ/β-carrageenan (*T. crinitus*) under oral administration in mice induces cytokine secretion (IL-12, IL-1beta, IL-4, IL-10) in blood cells, and also stimulates interferon-gamma (INF-gamma) production more significantly than LPS and additionally moderately increases of murine macrophage activity stimulating the adhesion and spreading steps. Furthermore we have demonstrated that κ/β-carrageenan has a protective effect in LPS-induced endotoxemia in mice and reduce the production of TNF-α and IL-1beta while increasing of IL-10 levels.

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CONFOCAL MICROSCOPE ANALYSIS OF HUMAN G PROTEIN SUBUNITS INTERACTIONS

I. Smok[1], A. Polit[1]

[1]DEPARTMENT OF PHYSICAL BIOCHEMISTRY, FACULTY OF BIOCHEMISTRY, BIOPHYSICS AND BIOTECHNOLOGY, JAGIELLONIAN UNIVERSITY, CRACOW, POLAND
SMOK.IZABELA@GMAIL.COM

Abstract

G protein-coupled receptors (GPCRs), also known as seven-transmembrane receptors (7TMRs), compromise of a large group of membrane proteins, associated with signal transduction from a wide range of extracellular stimuli to a cell interior via heterotrimeric G proteins (GTPase). In a response to ligand stimulation, GPCR undergoes agonist-induced conformational change that allows the receptor to interact with one of the G protein subunit (Gα). Thus, G proteins serve as a mediator between extracellular microenvironment and intracellular signaling cascades, modulating a great number of downstream effectors, such as ion channels or enzymes.

Peripheral G proteins are composed of three subunits: Gα subunit able to bind and hydrolyze GTP, as well as Gβ and Gγ subunits forming a functional heterodimer. Gα subunit plays a pivotal role in GPCR-mediated signaling – as a so called molecular switch it is able to bind GTP, therefore dissociating into the independent, GPCR-stimulating Gα subunit and Gβγ complex, both acting as downstream regulators. Gα and Gγ subunits are lipidated, thus being associated with the inner leaflet of a cell membrane.

According to the current knowledge, there are at least 16 genes encoding Gα, 5 encoding Gβ and 12 genes encoding Gγ subunit, however the possible configurations and interactions between the different types of subunits are not yet well understood and defined.

The aim of this study was to visualize in vivo a possible configuration, interaction and co-localization between human G protein β2 subunit coupled with a mCherry fluorescent protein, non-labeled human Gγ2 and: (1) human GαS subunit coupled with fluorescent protein, Citrine, and the second type of Gα: (2) human Gαi2-Citrine. In order to visualize the interaction, human cell line HEK293 was transfected with pcDNA3.1(+) vectors containing appropriately mutated fusion proteins. Complexes-forming subunits were observed with Leica SP5 confocal microscope. Both cases resulted in a proper heterotrimeric G protein formation within the cell membrane, suggesting an accurate subunit choice, possibly existing naturally in vivo.

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DEPENDENCE OF CHO CELL ELECTROPORATION AND ELECTROTRANSFECTION EFFICIENCY ON THE CELL DENSITY AND ELAPSED TIME SINCE LAST PASSAGE

Viktorija Malouškina[1], Milda Jakutavičiūtė[1], Saulius Šatkauskas[1]

[1]VYTAUTAS MAGNUS UNIVERSITY, FACULTY OF NATURAL SCIENCES, LITHUANIA
MILDA.JAKUTAVICIUTE@VDU.LT

Abstract

Various physical and chemical transfection methods can be applied to transport the molecules of interest, including DNA, RNA, proteins, drugs, enzymes or antibodies, to the cells. One of these methods is electroporation, based on application of short, high-voltage electric pulses to transiently permeabilize the cell membrane. This leads to increased transport of drugs, molecular probes and DNA to the cells. As electroporation can be applied to many different cell types and, with appropriate parameters, preserves cell viability, it is one of the most promising techniques for molecular delivery.

For successful electroporation, appropriate parameters of the electric field, such as pulse duration and amplitude, are of utmost importance. However, biological factors, such as cell growth phase and density, that consequently determine cell shape, radius and aging, also play an important role.

As cells move from exponential to stationary phase, changes in their composition, labelled stationary phase aging, occur. Due to cell aging, the membrane microviscosity changes due to the increase in total amount of proteins and cholesterol, potentially hampering the creation of electropores. In addition, cell density increases, leading to cell compression, suppression of reproduction and decrease of the cell radii. That may also lead to decreased electroporation efficiency.

In this study, we tested the efficiency of electroporation on cells passaged 1, 2 and 3 days before electroporation experiment. Cells were treated with 1, 4 or 8 pulses (1400 V/cm, 100 µs) at 1 Hz frequency. Green fluorescent protein coding plasmid (pGFP), 100 µg/ml, was used for electrotransfer. Transfection was measured by flow cytometry.

The results show that highest transfection efficiency, both in percentage of transfected cells and their fluorescence, is gained in cells passaged 1 day before the experiment, independently of number of pulses used. The difference is negligible between cells electroporated on days 2 and 3 after passage. Highest transfection efficiency is obtained with 8 pulses on all days, however, this condition is detrimental to cell viability as only 40-60 percent of cells survive after treatment with 8 pulses. Cell radius decrease is also observed as day count after passage increases.

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DEVELOPMENT OF NOVEL UNIVERSAL BIOTECHNOLOGIES FOR OBTAINING VALUABLE PRODUCTS FROM A WIDE RANGE OF WASTES

O.B. Tashyrev[1], V.M. Hovorukha[1], N.A. Matvieieva[2], H.O. Tashyreva[1], V.M. Shevel[3], O.S. Iungin [1]

[1]ZABOLOTNY INSTITUTE OF MICROBIOLOGY AND VIROLOGY OF THE NAS OF UKRAINE, DEPARTMENT OF EXTREMOPHILIC MICROORGANISMS BIOLOGY, UKRAINE, [2]INSTITUTE OF CELL BIOLOGY AND GENETIC ENGINEERING OF THE NAS OF UKRAINE, LABORATORY OF ADAPTATIONAL BIOTECHNOLOGY, UKRAINE, [3]INSTITUTE FOR NUCLEAR RESEARCH OF THE NAS OF UKRAINE, UKRAINE
TACH2007@UKR.NET

Abstract

Unsolved problems of global importance include:1. Processing of huge volumes of multi component food wastes; 2. Purification of toxic food waste filtrates;3. Purification of industrial wastewater containing wide range of soluble metal compounds;4. Purification of liquid radioactive waste (LRW).

Despite the achievements in development of environmental biotechnologies, the total amount of waste is continuously increasing. Development of novel methodological approach is the only possible effective solution of problems. So, the aim was to develop the base of universal biotechnologies for effective treatment of all four classes of waste and obtain valuable products.

We have developed the concept for efficient fermentation of food waste with obtaining of environmentally friendly energy carrier – molecular hydrogen. The following fermentation parameters were obtained: time detention T=6 days, coefficient of waste destruction Kd=90; hydrogen yield – 120L from 1 kg of waste. Hydrolysis of food waste leads to formation of sewage containing soluble toxic organic compounds (organic acids, alcohols) in high concentrations. The concept of spatial succession of microorganisms allows purifying filtrates effectively, from 10000 to 20 mg/L of total carbon (COD). Purified water is end valuable product of biotechnology.

Effective biotechnology for purification of metal containing wastewater is based on thermodynamic prognosis of microbial interaction with metals. Maximum potential difference between donor (microorganisms) and acceptor (metals-oxidizers) system ensures reduction of metals to insoluble compounds. The concept of stereochemical analogy of macroelements (Ca2+, Mg2+) and toxic metals (Cd2+, Co2+, Ni2+) is the basis for effective non-specific accumulation of metals-substitutors by microorganisms. Integrating these mechanisms high efficiency of wastewater treatment with obtaining of non-ferrous metal concentrate was achieved. High activity at vanishingly low concentration of radionuclides in solutions is the methodological problem of LRW purification. So, the efficiency of radionuclides sorption is substantially limited. We have developed the concept of integral mechanisms of accumulation of radionuclides by microorganisms. Microorganisms purified LRW with high efficiency and several orders reduced its activity within 4-5 days.

Thus, these biotechnologies are promising for their industrial implementation in order to stop pollution of environment and preserve ecosystems.

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DEVELOPMENT RESEARCH OF MEDICINAL (AROMATIC) PLANTS (MAP'S) IN VYTAUTAS MAGNUS UNIVERSITY IN 1924-2018

Ona Ragažinskienė[1], Audrius Maruška[2]

[1]SECTOR OF MEDICINAL AND AROMATIC PLANTS COLLECTION OF BOTANICAL GARDEN AT VYTAUTAS MAGNUS UNIVERSITY Z. E. ZILIBERO 6, LT-46324 KAUNAS, LITHUANIA, [2]INSTRUMENTAL ANALYSIS OPEN ACCESS CENTRE OF NATURAL SCIENCES FACULTY, VYTAUTAS MAGNUS UNIVERSITY, VILEIKOS G. 8, LT-44404 KAUNAS, LITHUANIA
ONA.RAGAZINSKIENE@VDU.LT

Abstract

Medicinal (aromatic) plants are playing important role for the solution of WHO problem *Health for everyone in 21st Century*. In 184 countries there are 1846 botanical gardens. The collections of medicinal plants are created in 480 botanical gardens.

In Lithuania, since 1924 until now, the collections of medicinal plants are being developed in the Sector of Medicinal and Herbaceous Plants in Botanical Garden at Vytautas Magnus University. These collections are unique in Europe as a research center for the introduction of medicinal, spice (aromatic) plants (MAP's), as the object of project - based activities and of the national and international studies and as the object of public education (2).

This presentation will focus on the recent and present research projects carried out in the Sector of Medicinal and Aromatic Plants Collection of Botanical Garden and the cluster Development of Instrumental Analysis Methods and their Application to Molecular Analysis of Biological Objects, Synthetic Products and the Environment in Faculty Natural Sciences at Vytautas Magnus University (1).

The importance of the complex interdisciplinary and multidisciplinary cooperation in finding new and diverse biologically active compounds will be proven on the basis of the results of research projects.

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DIFFERENCES BETWEEN ARONIA MEDIK. TAXA ON THE MICROMORPHOLOGICAL AND BIOCHEMICAL CHARACTERS

Yulia Vinogradova[1], Alla Kuklina[1], Olga Shelepova[2], Olena Vergun[3], Olga Grygorieva[3], Ján Brindza[4]

[1]MAIN BOTANICAL GARDEN RUSSIAN ACADEMY OF SCIENCES, RUSSIA, [2]MAIN BOTANICAL GARDEN RUSSIAN ACADEMY OF SCIENCES, RUSSIA, [3]M. M. GRYSHKO NATIONAL BOTANICAL GARDENS OF UKRAINE NATIONAL ACADEMY OF SCIENCES, UKRAINE, [4]SLOVAK UNIVERSITY OF AGRICULUTRE IN NITRA, FACULTY OF AGROBIOLOGY AND FOOD RESOURCES, INSTITUTE OF BIOLOGICAL CONSERVATION AND BIOSAFETY, SLOVAKIA
GBSAD@MAIL.RU

Abstract

We studied *A. melanocarpa*, *A. arbutifolia* and *A.* × *prunifolia* in the arboretum of the Main Botanical Garden of the Russian Academy of Sciences (Moscow, Russia), which were brought from the USA in the 1980s. Two samples of cultivated *A. mitschurinii* from the Chekhov and Dmitrov districts of the Moscow region and one sample of naturalized *A. mitschurinii* from the the Orekhovo-Zuevsky district of the Moscow region were also included in the analysis. The task of the study is to determine the degree of heritability of macro- and micromorphological characters of North American plants introduced to Europe and their comparison with the analogous parameters of *A. mitschurinii*. The identification of the samples most promising for further broad cultivation by their antioxidant activity and the content of microelements in leaves was also part of the research purpose. The digital microscope KeyenceVHX-1000 and scanning electron microscope LEO 1430 VP were used for examining leaves by the trichome density and stoma's parameters. Measurements were performed using the AxioVision software package. The antioxidant activity of the fruits was determined by the 2,2-difenyl-1-picrylhydrazyl (DPPH) free radical scavenging test. The content of microelements in the plant material was determined by using ICP-MS (Agilent 7700ce, USA). The diagnostic features of the introduced North American Aronia were found to be inherited under culture conditions. The mass of fruits increases in this order: *A. arbutifolia* → naturalized *A. mitschurinii* →*A.* × *prunifolia* → *A. melanocarpa* →both samples of cultivated *A. mitschurinii* from the Moscow region. The total antioxidant activity in dry fruits had for methanol extracts 83% (*A. melanocarpa* and cultivated *A. mitschurinii*)…93 % (naturalized *A. mitschurinii*), for ethanol extracts 78% (cult. *A. mitschurinii*)…93 % (naturalized *A. mitschurinii*), and for water extracts 60% (naturalized *A. mitschurinii*)…88 % (cult. *A. mitschurinii*). Thus, naturalizing plants have a higher antioxidant activity of alcohol extracts than cultivated plants, and, on the contrary, lower antioxidant activity of water extracts. There are following microelements (ppm) in the leaves of Aronia taxa: Fe (98-124), B (19-63), Mn (23-39), Sr (10-24), Zn (4-12), Se (5-8), Cu (2-4), Ni (1-3), Cd (0.1-0.3), Mo (0.1-0.2), V (0.1-0.2), Pb (0.1-0.2), Sn (0.1-0.2), Co (0.0-0.2), Cr (0.1), As (0.0-0.1), Sb (0.0-0.1). Cultivated *A. mitschurinii* have the highest content (among Aronia taxa) of 10 from 17 microelements: Fe, Mn, Sr, Zn, Se, Cu, Mo, Cr, As and Sb; *A.* × *prunifolia* have the highest content of 6 ones: Ni, Co, V, Cd, Pb, Sn; *A. arbutifolia* have the highest content of B. Our observations suggest that naturalizing plants of Aronia are a potential source of useful bioactive compounds.

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DYNAMICS OF MICROBIAL AND ENZYMATIC ACTIVITY IN POST-AGROGENIC SOILS OF CENTRAL RUSSIA

L.A. Ovsepyan[1], I.N. Kurganova[1], V.O. Lopes de Gerenyu[1]

[1]INSTITUTE OF PHYSICOCHEMICAL AND BIOLOGICAL PROBLEMS IN SOIL SCIENCE, RAS, PUSHCHINO, RUSSIA
LILL.OVSEPYAN@GMAIL.COM

Abstract

Enzymatic activity, basal respiration rate and microbial biomass are the most sensitive indicators of post-agrogenic changes in soils due to their quick response to cessation of agricultural use. In this study, we examined the dynamics of microbial and enzymatic activity in post-agrogenic Phaeozems and Chernozems of Central Russia. A chronosequential study was carried out in two bioclimatic regions of European Russia: deciduous forest (Moscow region; Luvic Phaeozems) and dry steppe (Rostov region; Chernozem). Each chronosequence included a current arable soil, abandoned lands of different ages, and natural cenosis. The rate of basal soil respiration (BR), microbial carbon content (Cmic) and activity of hydrolases were determined in the mixed soil samples collected from different depths of former arable layer: 0-5, 5-10, 10-20, and 20-30 cm. The most visible changes in biological parameters were revealed in the uppermost 0-5 cm layer for both chronosequences. We observed a progressive increase in BR values (from 0.6 to 3.4 mg C kg-1 soil h-1) and Cmic content (from 342 to 636 mg C kg-1 soil) in soils during the postagrogenic evolution in the deciduous forest zone. As a rule, the younger abandoned soils were characterized by low activity of hydrolytic enzymes. In older abandoned soils (>35 years old), hydrolase activity was 3-3.5 times higher than in younger ones and was comparable to that in the forest soil. In steppe zone, a similar trend was also revealed in the upper 0-5 cm layer: a progressive increase of the BR values (from 0.7 to 1.1 mg C kg-1 soil h-1) and Cmic content (from 511 to 970 mg C kg-1 soil). There was no obvious trend in activity of enzymes during post-agrogenic restoration. The activity of hydrolases was the highest in abandoned soils of 19 years. In post-agrogenic Phaeozems, the total activity of hydrolytic enzymes of carbon cycle rised progressively. We revealed an increase of portion of enzymes with a narrow substrate specificity from 20% to 44% during the postagrogenic evolution. There were no obvious trends in the post-agrogenic Chernozems due to the immobilization of enzymes in soil matrix. The changes in the Cmic content explained 50 - 70% variability of hydrolytic enzymes activity in post-agrogenic soils.

Concluding, post-agrogenic evolution of former arable soils resulted in an increase in microbial C content, rate of basal respiration, and activity of hydrolytic enzymes due to the input of fresh plant residues.

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DYNAMICS OF TELOMERE LENGTH AND TELOMERASE ACTIVITY UNDER THE INFLUENCE OF MUSIC OF VARIOUS TYPES

Spivak D.[1], Urazova A.S.[1], Zakharchuk A.G.[2], Spivak I.M.[3]

1HALLE UNIVERSITY CLINIC, HALLE-WITTENBERG UNIVERSITY, HALLE (SAALE), GERMANY, 2S.M.KIROV MILITARY MEDICAL ACADEMY, ST.PETERSBURG, RUSSIA ST.PETERSBURG STATE INSTITUTION OF HEALTHCARE HOSPICE NO.1, ST.PETERSBURG, RUSSIA , 3INSTITUTE OF CYTOLOGY, RUSSIAN ACADEMY OF SCIENCES, ST.PETERSBURG, RUSSIA FACULTY OF BIOLOGY, ST.PETERSBURG STATE UNIVERSITY, ST.PETERSBURG, RUSSIA CHAIR OF MEDICAL PHYSICS, ST.PETERSBURG STATE POLYTECHNICAL UNIVERSITY, ST.PETERSBURG, RUSSIA
D.SPIVAK@MAIL.RU

Abstract

Report presents preliminary results of study of a group of 65 normal, young Russian students all of whom passed a two-week course of music of different types. Subgroup 1 listened to light classical (European) music, subgroup 2 – to modern designer (New Age) music, which was sharply different from the former one, both in timbre and key, subgroup 3 (control subgroup) – to natural sounds. Prior to passing the course, and after its end, 5 ml of peripheral blood was taken, which allowed us to assess the dynamics of such mainstream predictors of life expectancy as telomere length, and telomerase activity. Psychological survey, which was conducted simultaneously, comprised six tests, centered upon short-term and long-term neuroticization, levels of activation of basic psychological defense mechanisms (including stress coping strategies), and such psychological reserves as intrinsic religiosity, and short-term alteration of consciousness in the service of the ego. In processing the samples, contemporary hi-tech methodologies were applied, primarily real-time reverse transcription polymerase chain reaction (PCR) by R.Cawthon. Passing a course of classical music was proved to result in an increase in telomere length, which was often, although not necessarily, accompanied by an increase in telomerase activity. Passing a course of non-traditional music was proved to result in sharp increase of telomerase activity, which was definitely not accompanied by an increase in telomere length. Taking into account results of psychological testing, the former type of dynamics was linked to reduction of neuroticization level, the latter one, to an opposite process. As a result, basic patterns of influence of perception of music of different types upon the dynamics of both telomere length, and telomerase activity, and by their means, upon stress reduction and life expectancy, was traced back. The study was supported by Russian Foundation for Basic Research, grant 16-06-00172a.

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EASTERN PODILIA AS STRUCTURAL-FUNCTIONAL SYSTEM OF EUROPEAN ENVIRONMENTAL NETWORK

Oleksandr Mudrak[3], Yuliia Ovchynnykova[1], Galyna Mudrak[2], Oksana Nagorniuk[3]

[1]VASYL' STUS DONETSK NATIONAL UNIVERSITY, UKRAINE, [2]VINNYTSIA NATIONAL AGRARIAN UNIVERSITY, UKRAINE, [3]MUNICIPAL HIGHER EDUCATIONAL INSTITUTION "VINNYTSIA ACADEMY OF CONTINUING EDUCATION

OV_MUDRAK@UKR.NET

Abstract

Biodiversity conservation is one of the most important tasks of the human community to achieve its sustainable development. This task was formulated in 1992 in Rio de Janeiro in the Program of Action "Agenda 21", the UN Convention on Biodiversity, the World Ecological Summits' documents, the Pan-European Strategy for the Conservation of Biological and Landscape Diversity. According to the recommendations of the latter, the Pan-European Ecological Network was developed as the only spatial-functional system of the territories of European countries with a natural or partially altered state of the landscape. Most of the European Union countries have already moved from the strategy of preserving biodiversity centers through their protection to the strategy of creating national ecological networks. In Ukraine, this process is only gaining momentum. This is due to a number of obstacles: the emergence of new forms of ownership and large-scale licensing of land, forest and water use. The national ecological network must meet the requirements of its functioning in the pan-European ecological network and perform the leading functions of biodiversity conservation, balanced development, non-exhaustive use of biological resources in economic activity. Eastern Podilia occupies 4.5% of the state territory, it is located within the most cultivated Right Bank Forest-steppe. Therefore, the problems of preserving and reproducing its biodiversity, stabilizing the ecological balance, increasing the productivity of ecosystems, and ensuring balanced development of society is extremely relevant. Based on scientific approaches, the scheme of the regional ecological network has been developed, which distinguishes the following structural elements: key, connecting, buffer and recovery territories, their geographic confinement, area, status. They have 4 levels: international, national, regional, local. At present, it is formed by 24 key, 16 connecting and 60 renewable areas. The number and area of buffer zones have been cleared up. The total area of the ecological area is 884087,53 hectares, which makes 33,37% of the total area of the region. World experience defines the biological balance of the territories only if at least 60% of the natural ecosystems are present. Therefore, the ecological network of the Eastern Podilia needs to be substantially improved on the basis of detailed research of all its structural elements.

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ECOLOGICAL EFFECTS OF ANTIBIOTICS ON MICROBIAL COMMUNITY – SOIL RESISTOME

Lyudmyla Symochko[1], Ruslan Mariychuk[2], Olena Demyanyuk[3], Vitaliy Symochko[1]

[1]FACULTY OF BIOLOGY, UZHHOROD NATIONAL UNIVERSITY, UKRAINE, [2]FACULTY OF HUMANITIES AND NATURAL SCIENCES, UNIVERSITY OF PRESOV, SLOVAKIA, [3]INSTITUTE OF AGROECOLOGY AND ENVIRONMENTAL MANAGEMENT, KYIV, UKRAINE
LYUDMILASSEM@GMAIL.COM

Abstract

The soil antibiotic resistome bacteria play an increasingly important role in the evolution, development, and spread of antibiotic resistance in humans and animals, there is little known about the natural bacterial resistome in the soil. Environmental contamination by antibiotics is one of the factors that define the health consequences of antibiotic resistance in bacteria. The fluoroquinolones are one of the most used classes of antibiotics. Enrofloxacin belongs to the class of fluoroquinolone antibiotics that have been intensively used for the treatment of bacterial infections in veterinary medicine. In the environment, enrofloxacin can undergo degradations by different processes including photolysis, biodegradation, and oxidation by mineral oxides but it is not sensitive to hydrolysis. Despite these degradation mechanisms, the environmental half lifetime of enrofloxacin is very long. In this study, the effect of enrofloxacin on the function and structure of soil microbial communities was evaluated. Soil samples were spiked with enrofloxacin (10, 100, and 1000 mg•kg−1) and were incubated for 30, 60, 90 days. Untreated controls received only water. In pots with different concentrations of enrofloxacin were planted: Lactuca sativa var. crispa, Anethum graveolens, Thymus serpillum, Mentha piperita, Calendula officinalis. Soil respiratory responses were inhibited at the high enrofloxacin concentrations in the soils and were increased at the lowest concentration (10 mg•kg−1). The maximum level of soil toxicity was 67.21% at a concentration of enrofloxacin 1000 mg kg−1, in the control this parameter was 8.56%. The soil with a high concentration of antibiotic was characterized by a low content of nitrogen-fixing microorganisms and a high number of oligotrophic and spore-forming microbiota. Thirty-seven antibiotic-resistant bacterial isolates were cultured from the soil. All isolates were multi-drug resistant, of which greater than 64% were resistant to 9–12 antibiotics, comprising almost all classes of antibiotic. In Vitro experiment were isolated 5 bacteria absolutely resistant to all tested antibiotics: anaerobic bacteria: Clostridium difficile, Clostridium perfringens and aerobic bacteria: Enterococcus faecalis, Yersinia enterocolitica, Enterobacter cloacae. In natural conditions, from the soil of model ecosystems were isolated mostly bacteria of the genus Bacillus. All of them are antibiotic resistant and are the causative agents of foodborne infections. The antibiotic contamination of the soil, cause negative changes in the microbial community, reduces the respiratory activity of the soil and is one of the important factors in the formation of soil resistome.

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EFFECTS OF PROCESS CONDITIONS ON THE BIOSYNTHESIS OF SILVER NANOPARTICLES BY *BACILLUS SP.* SBT8

Tugce Yurtluk[1], Fikriye Alev Akcay[2], Ayse Avci[2]

[1]SAKARYA UNIVERSITY, TURKEY, [2]SAKARYA UNIVERSITY, TURKEY
AYSEA@SAKARYA.EDU.TR

Abstract

Biological synthesis of silver nanoparticles (AgNPs) attracts great deal of attention owing to their potential applications in medicine and food industry. In the current study, *Bacillus sp*. SBT8 strain that was isolated from soil was used for the biosynthesis of AgNPs. Effects of varying process conditions including AgNO3 concentration (1-10 mM), pH (5-10), temperature (30-40oC) and time (24-120 h) on the formation of nanoparticles were investigated. The bacterium was cultivated in nutrient broth at 35oC for 24h, then the cells were removed by centrifugation and the resulting cell-free supernatant was used for the biosynthesis of AgNPs. AgNO3 solution was added into the supernatant and biosynthesis was carried out on a shaking incubator held at 120 rpm. During the experiments, color change from light yellow to brown was an indication of the formation of AgNPs. UV-VIS spectrophotometer was used for measuring the absorbance intensity created by surface plasmon resonance of AgNPs at 416 nm. The highest absorbance intensities were obtained at 6 mM AgNO3 concentration, pH 10 and 33-37oC in 120 h. Morphologies of nanoparticles synthesized at varying conditions were determined with Field Emission Scanning Microscopy. Biosynthesis conditions affected the size distribution of the nanoparticles formed and diameters of the nanoparticles were between 1 and 60 nm. Sizes increased as pH was increased. Fourier Transform infrared spectroscopy analysis validated that the proteins were serving as capping and stabilizing agents for the nanoparticles.

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ENVIRONMENTAL ASPECTS OF LEGUME MANURE MANAGEMENT IN ORGANIC AGROECOSYSTEM

M. Toleikienė[1], Ž. Kadžiulienė[1], A. Arlauskienė[2]

1LAMMC INSTITUTE OF AGRICULTURE, LITHUANIA, 2LAMMC JONIŠKĖLIS EXPERIMENTAL STATION, LITHUANIA
MONIKA.TOLEIKIENE@GMAIL.COM

Abstract

Organic farming is established to maintain sustainable agroecosystem. Legume management is the tool to use nitrogen efficiently and provide healthy, self-promoting agroecosystem with benefits to crop production in all rotation. Therefore, we assess various legume management tools – a) legume species selection, b) use of legumes in crop rotation and c) organic fertilizers production from legume manure. Qualitative management evaluation was used according to environmental aspects –efficiency of energy use and nutrient recirculation, greenhouse gas emission, agrofitocenosis productivity and optimization of biodiversity. Field experiments were established in 2015 – 2017 years in Institute of Agriculture, Lithuania. Legume species used in experiment – red clovers and pea. Innovative practices for plant-based fertilizers production - mulching, ensiling, fermentation and mixing plant residues with different value were applied. Innovative plant-based fertilizers significantly influenced nutrient flow in agroecosystem. Mulching of red clover grass on the soil surface results in losses of C and N, grass composting with straw - N, and silage - C losses. While composting, 25-60 % of N was released in the form of NH4+, NOx, CH4 gas emissions. The mass of red clovers inserted in the soil in the autumn (C:N = 15) degraded by 65.6% until crop season. Total agrofitocenosis productivity was increased by all used legume manure, but the maximum value was determined using fresh mass of red clover and granulated cattle manure (GCM). The highest grain yield was accumulated (+28.0%) using red clovers mass inserted in autumn. In the spring, GCM and red clover + straw compost increased grain yield by 17.0% and 10.2%, respectively. The lower weed biomass was in the control field, without any fertilizer.

Ecological environment in amended plots was described by different organism's activity increase. Higher earthworm's activity was measured everywhere processed manure were inserted. Insects quantity was lowest where GCM was applied. Biggest amount traced where fermented manures were applied. Functional diversity of microbial communities was greater in soil fertilized with fresh and ensiled red clovers in first vegetation season. Manures with mixed legume and wheat or straw mass - on second year. Overall environmental evaluations suggest mulching of fresh red clovers mass in the autumn as the most effective practice for sustainable organic farming.

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ENVIRONMENTAL MONITORING OF THE UNIVERSITY CAMPUS: THE CASE STUDY OF RUDN UNIVERSITY CAMPUS IN MOSCOW, RUSSIA

Mamadzhanov Roman[1], Khaustov Aleksandr[1], Redina Margarita[1], Nigmatzyanova Yulia[1]

[1]ECOLOGICAL DEPARTMENT, RUDN UNIVERSITY, MOSCOW, RUSSIA, 115093, PODOLSKOYE SHOSSE (PODOLSK HIGHWAY), 8-5 DADDY_ROMA@MAIL.RU

Abstract

The article is devoted to environmental monitoring of the campus of RUDN University in Moscow, particularly to monitoring of carbon monoxide (CO), nitrogen dioxide (NO2), hydrogen sulphide (H2S), soot and benzene (C6H6) spreading in the atmosphere and the topsoil in the campus of RUDN University located near the Leninsky Prospekt highway. The 3D map of the above compounds spreading in the atmosphere and the topsoil has been made, and the diagram indicating the correlation between the distance from the Leninsky Prospekt highway and CO, NO2, H2S, soot and C6H6 concentrations in 33 sampling sites of the campus has been drawn. As a result, the green and polluted areas of the campus have been identified.

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GENERAL AND INDIVIDUAL DIFFERENCIES OF AGING MARKERS IN THE CELLS OF PATIENTS WITH THE COCKAINE SYNDROME

P.A. Slizhov[1,2], T.I. Dolinina[2,5], N.M. Pleskach[2], S.V. Zherebtsov[2], M.L. Bulatnikova[3], V.M. Mikhelson[2], I.M. Spivak[2,4,5]

[1]HERZEN STATE PEDAGOGICAL UNIVERSITY OF RUSSIA, 191186, [2]INSTITUTE OF CYTOLOGY RAS, ST.PETERSURG, 194064, [3]3POKRIVSKYBANK OF STEM CELLS, ST.PETERSBURG, 199106, [4]SAINT-PETERSBURG STATE UNIVERSITY, 199034, [5] PETER THE GREAT ST.PETERSBURG POLYTECHNIC UNIVERSITY, 195251
MAIDEL@BK.RU

Abstract

The Cockayne syndrome is a rare autosomal recessive disease, described in the 1930s by Edward Alfred Cockayne. Patients suffer from cachexia dwarfism (when the weight is lowered compared to the norm even more than the growth), photosensitivity, deafness, various visual impairments: optic atrophy, cataracts, degeneration of the corneal epithelium, retinal injuries, as well as neurodegenerative symptoms, such as partial demyelination of subcortical structures, increase in ventricular size, cerebral atrophy, calcification of basal ganglia. The average life expectancy of patients with the Cockayne syndrome is 12 years. In the cells of patients with the Cockayne syndrome, the process of nucleotide excision repair (NER), its branch transcribed coupled with transcription (transcription coupled repair, TCR, TC-NER) is disrupted. We have established that all the aging markers studied are strongly expressed in the cells of patients with the Cockayne syndrome. Thus, the idea of the Cockayne syndrome as a syndrome with expressed cellular signs of accelerated aging is confirmed. This allows us to consider the Cockayne syndrome as a segmental progeria and use cell lines obtained from patients as model objects for studying the processes of aging and testing geroprotectors.

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HIGH RESPONSIVENESS OF CARDIOVAGAL OUTFLOW AND SYMPATHOINHIBITION TO COLD PRESSOR TEST IN YOUNG OVERWEIGHT NORMOTENSIVE SUBJECTS

Vera Shekh[1], Emeka Ofoegbu[1], Ebunoluwa Adenuga[1], Anna Dubina[1], Larisa Shchyrova[1]

[1]V.N. KARAZIN KHARKIV NATIONAL UNIVERSITY, UKRAINE

Abstract

Overweight and obesity are well-known risk factors for hypertension. Obesity is characterized by autonomic imbalance and sympathetic nervous system overactivity. The cold pressor test (CPT) is commonly used as a sympathoexcitatory maneuver for evaluation of cardiovascular reactivity to stress. HRV is a noninvasive and useful tool for assessment of autonomic nervous system activity. The aim of this study was to compare the cardiovascular and HRV responses to CPT in overweight and normal weight normotensives and prehypertensives.

A cohort of 46 normotensive (SBP=115.41±1.01mmHg) and 25 prehypertensive (SBP=129.10±1.63mm Hg) subjects enrolled from V.N. Karazin Kharkiv National University was subdivided into 36 subjects with normal weight (BMI=22.04±0.41 kg/m2) and 35 overweights (BMI=27.87±0.37 kg/m2). All of them gave written informed consents. The ECG was recorded at rest and cold pressor test for 5 min each. HR, LF and HF power were obtained by CardioLab-2010 (Ukraine), SBP and diastolic blood pressure (DBP) were recorded three times during each stage (Nissei WS-1011, Japan) and average values were used in the analysis. Three-way repeated measures and two-way MANOVA was used to test for effects of prehypertension, overweight, and CPT on cardiovascular and HRV variables. The stepwise multiple linear regression analysis was used to reveal predictors of ΔHR, ΔSBP and ΔDBP. Data are expressed as means±SE. All analyses were conducted using SPSS 22.

The blood pressure responsiveness to CPT was positively associated with overweight (P=0.004 and P=0.008, for ΔSBP and ΔDBP, respectively), indicating sympathetic nervous system overactivity, but not with prehypertension. The ΔSBP and ΔDBP was significantly more in overweights than in subject with normal weight (11.27±1.15 vs. 7.71±1.25 mm Hg, P=0.022, and 11.16±1.05 vs. 7.41±1.15mm Hg, P=0.019, respectively). However, the group of overweights was not homogenous. So that, only in overweight normotensives HR did not increased but both LnLF and LnHF increased statistically significantly during CPT (6.73±0.20 vs. 7.12±0.18 Lnms2, P=0.018, 6.95±0.26 vs. 7.38±0.24 Lnms2, P=0.021, respectively). The increment of LnLF and LnHF power was significantly higher in overweight normotensives than in overweight prehypertensives (0.39±0.16 vs. -0.23±0.19 Lnms2, P=0.015, and 0.43±0.18 vs. -0.29±0.21 Lnms2, P=0.011, respectively) despite comparable increment of blood pressure. That is why HR did not increase in this group: according to our hypothesis described previously LnLF indicates sympathoinhibition and LnHF widely used as index of cardiovagal outflow.

In conclusion, overweight normotensives represent population characterized by high responsiveness of cardiovagal outflow and sympathoinhibition to CPT.

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IMMUNOTROPIC ACTIVITY OF SEA OF JAPAN ALGAE CARRAGEENANS

E. Cicinskas[1], Mariya A. Begun[1], Valeriia V. Vikhareva[1]

[1]FAR EASTERN FEDERAL UNIVERSITY, SCHOOL OF BIOMEDICINE, DEPARTMENT OF PHARMACY AND PHARMACOLOGY, RUSSIAN FEDERATION
CICINSKAS@GMAIL.COM

Abstract

Search for safe, naturally occurring biologically active compounds remains a driving force in pharmacological and biomedical development. In this regard, earth's oceans, being the cradle of life, continue to be the most prominent source for promising molecules. Marine algae, due to their rapid growth, development and considerable reserve of biologically active substances are very convenient for this purpose. Our study is focused on carrageenans - polysaccharides which are isolated from numerous species of red algae. Carragenans are sulfated galactans, composed of linear chain of regularly alternating 1,3-linked β-d-galactose and 1,4-linked α-d-galactose. Their classification is based on the presence and localization of sulfate esters, and on the presence of the 3,6-anhydro-d-galactose. Carragenans are widely used as food additives and are known to be safe for human consumption, i.e. an excellent candidate for a potential pharmacological agent. We studied immunotropic activity of λ- and κ-carrageenans extracted from Sea of Japan (Far East waters) algae Chondrus armatus, and their oligosaccharide derivatives. We used monocytes obtained from healthy human donor blood to evaluate their in vitro pro- (TNFa, IL1b) and anti-inflammatory (IL10) cytokine production in response to polysaccharide presence in the cultivation medium (at 1, 10 and 100mg/ml). We found that all of the studied polysaccharides induce IL1b and TNFa secretion by the monocytes at 1mg/ml, κ-oligo-carrageenan being the most effective. Furthermore, κ-oligo-carrageenan was the most active at inducing IL10 secretion, increasing its concentration at 1mg/ml. κ- and λ- carrageenans led to an increase of IL10 concentration only at 10mg/ml, whilst λ-oligo-carrageenan had no effect even at 100mg/ml. Compared to bacterial LPS at concentration of 0.1mg/ml, tested carrageenan's were equally effective at inducing cytokine production by monocytes, i.e. there were no significant differences between interleukin concentrations. However, this is most likely a result of insufficient sampling size. Since culturing medium included autologous serum, IL4 was also measured, but, as expected, no changes in its concentration were ever observed.

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INCREASING OF CELL RESISTANCE TO GENOTOXIC STRESS BY MULTIPLEX CRISPR/DCAS9-MEDIATED OVEREXPRESSION OF GENES OF DNA DAMAGE RECOGNITION AND REPAIR

I. O. Velegzhaninov[1], A. V. Rybak[1], E. S. Belykh[1], Y. I. Pylina[2], D. M. Shadrin[2]

[1]INSTITUTE OF BIOLOGY OF KOMI SCIENTIFIC CENTRE OF THE URB RAS, RADIOECOLOGY DEPARTMENT, RUSSIA, [2]INSTITUTE OF BIOLOGY OF KOMI SCIENTIFIC CENTRE OF THE URB RAS, CCU "MOLECULAR BIOLOGY", RUSSIA
VELLIO@YANDEX.RU

Abstract

The massive amount of data accumulated at this point on the genes functions and the mechanisms in which they are involved made possible selecting targets for the regulation of the properties of cells and organisms. In particular, it enabled us to control cell resistance to ionizing radiation and other genotoxic agents. Approaches utilizing CRISPR/dCas9 system allowed us to regulate several genes simultaneously in their natural chromosomal context.

In present work we overexpressed XPC and HR23B genes, products of which are functionally interdependent and act as DNA-damage recognition complex, using VP64-p65-Rta (VPR) activator fused to nuclease-null Cas9. We also overexpressed RPA1, which is involved in DNA replication and repair. Using the fluorometric microculture cytotoxicity assay we showed for the first time that HEK293T cells with the overexpression of both XPC and HR23B genes were more than 20% more resistant to radiation in doses of 1, 2, 3, 4 and 6 Gy than control cells, transfected with gRNAs plasmids without the activator. Same results were obtained when cells were treated with 100 μM paraquat. At the same time, the overexpression of HR23B alone did not lead to changes in the stress-resistance of the cells. Moreover, the resistance to ionizing radiation was reduced by the overexpression of the XPC gene alone. Cells with overexpression of RPA1 are more resistant to irradiation, but not to paraquat. Simultaneous overexpression of all three genes leads to increased cell resistance to both tested stress.

We assumed that the simultaneous overexpression of some functionally interdependent stress-response genes (for example, coding subunits of a single complex or units of a single cascade) that did not disrupt the control of the cell cycle, or apoptosis, or other malignancy protection systems, could present a promising approach for increasing stress resistance of cells, tissues and organisms.

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INTEGRATED APPROACH FOR DEVELOPMENT OF ENVIRONMENTAL BIOTECHNOLOGIES FOR TREATMENT OF SOLID ORGANIC WASTE AND OBTAINING OF BIOHYDROGEN AND LIGNOCELLULOSIC SUBSTRATE

V.M. Hovorukha[1], O.B. Tashyrev[1], N.A. Matvieieva[2], H.O. Tashyreva[1], O.A. Havryliuk[1], O.Iu. Bielikova[1], I.B. Sioma[1]

[1]ZABOLOTNY INSTITUTE OF MICROBIOLOGY AND VIROLOGY OF THE NAS OF UKRAINE, DEPARTMENT OF EXTREMOPHILIC MICROORGANISMS BIOLOGY, UKRAINE, [2]INSTITUTE OF CELL BIOLOGY AND GENETIC ENGINEERING OF THE NAS OF UKRAINE, LABORATORY OF ADAPTATIONAL BIOTECHNOLOGY, UKRAINE
VIRA-GOVORUKHA@UKR.NET

Abstract

Solid food waste is a significant threat to the environment. On the one hand, food waste is produced every day in huge quantities in the agriculture, at enterprises of food and culinary industry, and pollute environment with toxic products. On the other hand, high concentration of carbohydrates in waste makes them promising raw material for biogas production – molecular hydrogen or methane. Our previous studies also show that unfermented lignocellulosic residues of solid food waste enriched with microbial communities may act as biofertilizer with plant probiotic properties.

Thermodynamic calculations allow determining theoretically possible metabolic pathways for degradation of organic compounds by microorganisms, and also to select the optimal one to increase efficiency of food waste recycling. In this regard, the purpose of our work was application of thermodynamic calculations to find out suitable fermentation parameters and compounds for regulation of microbial metabolism to ensure high rate of waste decomposition and formation of valuable products.

Fermentation of multicomponent kitchen food waste under theoretically calculated optimal parameters pH = 7.0 and Eh = –250...–350 mV provided extremely high metabolic activity of hydrogen-producing microbial community which resulted in decrease in duration of batch fermentation from 17-20 to 5-7 days, increase in hydrogen yield from 30-40 to 80-120 L/kg of dry waste. The coefficient of waste destruction (Kd) that is ratio of initial and final weight of waste reached 85-95.

Furthermore, addition of unfermented lignocellulosic substrate in concentration of 33 g/1 m2 of sand revealed positive effect on root formation, provided 100% survival of radish plants under two-day drought stress and also significantly increased the amount of ammonifying and free-living heterotrophic diazotrophic bacteria that may act as plant probiotics and supply mineral nitrogen for plant nutrition in arid condition. Thus, high efficiency of application of thermodynamic prognosis method of microbial interaction with organic compounds was shown to become the base for biotechnology of destruction of environmentally hazardous solid food waste with simultaneous obtaining of valuable products: environmentally friendly energy carrier – molecular hydrogen, as well as lignocellulosic substrate to increase crop yields.

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INTEGRATED IMPACT OF CLIMATE AND ENVIRONMENTAL CHANGES TO THE PRODUCTIVITY, BIODIVERSITY AND SUSTAINABILITY OF AGRO-ECOSYSTEMS

Romualdas Juknys[1], Arvydas Kanapickas[1], Jūratė Žaltauskaitė[1], Gintarė Sujetovienė[1], Irena Januškaitienė[1], Giedrė Kacienė[1], Austra Dikšaitytė[1], Rimantas Velička[2], Aušra Marcinkevičienė[2], Zita Kriaučiūnienė[2], Jūratė Aleinikovienė[2], Ilona Vagusevičienė[2], Robertas Kosteckas[2]

[1]VYTAUTAS MAGNUS UNIVERSITY, KAUNAS, LITHUANIA , [2]ALEKSANDRAS STULGINSKIS UNIVERSITY, STUDENTU STR. 11, KAUNAS, LITHUANIA
ROMUALDAS.JUKNYS@GMAIL.COM

Abstract

Agro-ecosystems along with elevated concentration of green-house gases and ongoing global warming are also affected by other climate change related factors such as droughts, heat and cold waves. Simultaneously they experience impact of different environmental stressors – ground level ozone, eutrophication and others. To investigate interaction of these factors and their integrated impact is one of the most actual and complicated tasks for environmental and agricultural science. It is very important that integrated impact of these factors already started to pose threat not only to separate compounds of agro-ecosystems but to their sustainability in general.

According to the project not only impact of climatic and environmental changes to different species are investigated but also their biological interaction – crop-weed competition, symbiotic and allelopathic relations. Changes in efficiency of fertilizers and chemical and non-chemical weed control measures under warming climate as well as changes in the rate of soil mineralization, humification and carbon sequestration are also investigated. To acquire new knowledge on long-term consequences of climate change impact to agro-ecosystems, the main regularities and mechanisms of their response is an important aim of this project. On the basis of obtained knowledge it is foreseen to present long term projections of productivity of agro-ecosystems and recommendations for the optimization of measures for their long lasting sustainability. Financial Support: This research was funded by a grant (No. SIT-8/2015) from the Research Council of Lithuania.

Key words: winter rapeseed, non-chemical weed control, biological preparations, weeds, seed yield.

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INTEGRATED INVESTIGATION OF PROSPECTIVE VACCINIUM SPECIES AND SELECTION OF NEW CULTIVARS AT KAUNAS BOTANICAL GARDEN OF VMU

Remigijus Daubaras[1], Laima Česonienė[1]

[1]VMU. KAUNAS BOTANICAL GARDEN, LITHUANIA
REMIGIJUSD@HOTMAIL.COM

Abstract

The collections of introduced species, cultivars and clones, the same as the landraces, and wild local samples of blueberry and cranberry were established at Kaunas Botanical Garden. Berries of blueberries and cranberries are very valued in the World markets. They are valuable products of good taste and insignificant caloric content. Half-highbush blueberries are very prospective in Lithuania because of their winter hardiness and resistance to diseases and early spring frosts. Growing of half-high bush blueberry has been limited in Lithuania till the present time. One of the main reasons for such situation was an absence of local cultivars. The collection of half-highbush blueberry germplasm was established and respective breeding programme was started at Kaunas Botanical Garden of VMU in 1995. The aim of these investigations was to ascertain fruiting characters and productivity of seedlings of half-high bush blueberries and to assess the most perspective for growing in industrial plantations. Two clones of half-high bush blueberries were selected and approved as new Lithuanians cultivars by names 'Freda' and 'Danutė'.

European cranberry (*Vaccinium oxycoccos L.*) was widely spread in Lithuania till the sixth decade of the last century. Land melioration as well as peat harvesting have caused a critical lost of the natural resources of this species. The unique collection of European cranberry genetic resources was established at Kaunas Botanical Garden of VMU. Cranberry clones with different size, shape and coloration of a berry were gathered up in the swamps and propagated and planted in the collection ex situ. The comprehensive evaluations of phenotypic and genetic diversity were conducted since 1997. Detailed descriptions allowed employing even more properties for identification of clones: uprightness of flowering shoots; waxy covering of berries; size of calyx; colour of flower and leaf size. The average weight of a berry and the yield are the most important peculiarities in the breeding the rather that recent DNA studies have revealed a high level of genetic diversity of European cranberry. Five clones of European cranberry were selected and approved as new Lithuanian cultivars by names 'Reda', 'Vita', 'Amalva', 'Žuvinta', and 'Vaiva'.

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INTERLEUKIN-6, 14-3-3-H, CALPROTEKTIN AND BUTYRYLCHOLINESTERASE AS THE MOST PROMISING BIOMARKERS FOR THE RHEUMATOID ARTHRITIS DIAGNOSIS COMPLEX TEST SYSTEM DEVELOPMENT

D. Kozlova[1], A. Popov [2]

[1]LTD. "SCIENTIFIC AND PRODUCTION FIRM" ABRIS + ", SCIENTIFIC LABORATORY, RUSSIAN FEDERATION; SECHENOV INSTITUTE OF EVOLUTIONARY PHYSIOLOGY AND BIOCHEMISTRY RUSSIAN ACADEMY OF SCIENCES (IEPB RAS), RUSSIAN FEDERATION, [2]LTD. "SCIENTIFIC AND PRODUCTION FIRM" ABRIS + ", SCIENTIFIC LABORATORY, RUSSIAN FEDERATION; ST. PETERSBURG STATE TECHNOLOGICAL INSTITUTE (TECHNICAL UNIVERSITY), RUSSIAN FEDERATION
DARUSHKA87@GMAIL.COM

Abstract

The most promising biomarkers for early diagnosis of the rheumatoid arthritis (RA) are interleukin-6 (IL-6), calprotectin (Calpro) and 14-3-3η. In addition, we demonstrated that the activity of butyrylcholinesterase (BuChE) forms in blood plasma of patients with RA also can be of great diagnostic value. The aim of this study is to investigate the content of IL-6, Calpro, 14-3-3η, and the activity of the blood plasma BuChE forms in RA for creation of an effective screening test system.

Tree groups of patients participated in the study: control group (CG; n = 17); RA for more than 5 years (n = 15); and osteoarthritis (OA, n = 10). Patients or their representatives gave informed consent to participate in the study. To isolate the plasma, blood samples collected in vacuum tubes and centrifuged at 20,000 g for 15 minutes at 20 ° C. Plasma was used to determine the content of IL-6, Calpro, 14-3-3η by the ELISA. In parallel, in all blood plasma samples, the activity of the BuCh forms was determined by the Ellman method in combination with inhibitory analysis.

Obtained data showed that the typical form of BuChE (610 ± 19 pmoles of substrate/mg/min) is most active in diagnosed RA, while its minor forms (312 ± 11) are most active in early stages of RA, whereas in OA this parameter practically does not differ from CG, where it was 455 ± 41 and 222 ± 8 for atypical and minor forms, respectively. Preliminary results of the study revealed that in blood plasma of RA patients the content of calprotectin increases to 1.9 ± 0.8 μg/ml in comparison with CG (0.6 ± 0.2 μg/ml), protein 14-3-3η (≥ 56) and interleukin-6 to approximately 66.3 g/ml, compared with CG (about 12.1 ng/ml), whereas in OA their content did not differ significantly from CG.

Revealed changes of all studied biomarkers allows to diagnose the rheumatoid arthritis most accurate, and obtained data can be used as a basis for developing a highly effective test system for rheumatoid arthritis early and accurate diagnose.

Key words: interleukin-6, 14-3-3-η, calprotektin, butyrylcholinesterase, monocytes, activity, expression, rheumatoid arthritis, biomarkers

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IS NITROGEN IN EXCESS AMONG PLANT SPECIES OF NEMUNAS AND OTHER LITHUANIAN RIVER BASINS?

Edvina Krokaite[1], Jolanta Nemaniute-Guziene[1], Dinara Shakeneva[1], Lina Jociene[1], Laisvūnė Duchovskienė[1], Donatas Zvingila[2], Jolanta Patamsyte[2], Violeta Kleizaitė[2], Regina Vysniauskiene[3], Vida Ranceliene[3], Eugenija Kupcinskiene[1]

[1]VYTAUTAS MAGNUS UNIVERSITY, VILEIKOS 8, LT-44404, KAUNAS, LITHUANIA, [2]VILNIUS UNIVERSITY, SAULĖTEKIO AL. 7, LT-10257, VILNIUS, LITHUANIA; [3]NATURE RESEARCH CENTRE ZALIUJU EZERU 49, LT-08412, VILNIUS, LITHUANIA
E.KUPCINSKIENE@GMAIL.COM

Abstract

Nitrogen deposition data together with inland water parameters provide indirect message that nitrogen load might have effects on vegetation of Baltic States. There is much concern about eutrophication of the rivers, although information about riparian plant species, their physiology and genetic parameters is still poor. Reacting to elevated nitrogen in the environment, various macrophyte strategies (abundance-, architecture-related) might be developed. Plant productivity finally depends on processes ongoing in the leaves. Data about plant leaf saturation with nitrogen remains poor. Usually studies refer on Ellenberg indicatory values or other indirect parametrs. Present study is aimed at comparison of nitrogen concentration among populations of some riparian and river plant species of Lithuania (project sponsored by Lithuania Research Council; SIT-02/2015). Around 250 populations of riparian and water macrophytes were sampled along main river basins in Lithuania: Nemunas, Venta, Lielupė, Seafront. Very high levels of nitrogen were determined for the most spread riparian plants of Lithuania. Among the tested species the highest concentration was characteristic for Echinocystis lobata. Comparing populations within each species, in most cases the highest concentrations of nitrogen were documented for sites neighbouring Curonian Spit. Relations between population nitrogen data and genetic diversity also some environmental factos such as river regulation is discussed. Species nitrogen concentrations were related to land cover types of neighbouring areas, empoying 2-level hierarchcial Corine classification system. Based on plant nitrogen concentrations it could be assumed that present quantities of this element, entering riparian ecosystems are big enough to cause the spread of native and invasive nitrophilous species.

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KARYOSPHERE: A MANY-FACED STRUCTURE OF THE OOCYTE NUCLEUS

D. Bogoliubov[1]

[1]*INSTITUTE OF CYTOLOGY RAS, LAB. OF CELL MORPHOLOGY, ST. PETERSBURG, 194064 RUSSIA*
DBOGOL@MAIL.RU

Abstrac

In many invertebrate and vertebrate organisms, the karyosphere, also known as the karyosome, is a meiosis-specific peculiar structure of the oocyte nucleus. The karyosphere forms by condensed oocyte chromosomes assembled together in a limited volume of the large nucleus at the diplotene stage of meiotic prophase. Karyosphere formation is a wide-spread, from hydra to human, but not mandatory phenomenon in oogenesis. Despite the fact that the karyosphere was initially described as early as in the early last century, its biological significance remains largely enigmatic. Typically, karyosphere formation represents a rather deep form of chromatin condensation/compaction and coincides with the cease of chromosome transcriptional activity towards the end of oocyte growth, but a residual transcription maintains in some instances. Special attention is paid here to the structure and molecular composition of the so-called karyosphere capsule, a fibrous multilayer element of the oocyte nucleoskeleton. In particular, this structure is indeed enriched in structural proteins such as F-actin and lamins. However, some data suggest the capsule may be more specialized nuclear compartment rather then just a rigid support for inactivated chromosomes joined into a karyosphere, accumulating some essential factors of gene expression. For example, the karyosphere capsule was found to accumulate some poly(A) RNA, small nuclear ribonucleoproteins (snRNPs), and also Y14 protein, a core component of the exon-exon junction complex. At the same time, the capsule does not contain the essential non-snRNP splicing factor SC35/SRSF2, excluding a possibility for splicing there. The morphological variety of karyosphere itself and the heterogeneity/complexity of karyosphere-associated extrachromosomal formations, including the karyosphere capsule, are impressive in different organisms even with similar types of oogenesis. Here, we propose a new terminological nomenclature for different karyosphere structures to distinguish: (i) the karyosphere with the capsule that restricts the condensed ‘knot’ of chromosomes from the rest of the nucleoplasm, (ii) the karyosome as a compact chromatin mass without capsule, and (iii) different types of the inverted karyosphere. In the last case, the chromosomes aggregate around an extrachromosomal body (the central body) that is quite different in their nature in different organisms, e.g., the marsh frog, birds, or human.

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L. CLAVATUM AND *L. ANNOTINUM* CLONES: THE ESTABLISHMENT IN SCOTS PINE DOMINATED FOREST IN RELATION TO DISTURBANCES

J.Fediajevaitė[1], S.Juzėnas[1]

[1]VILNIUS UNIVERSITY, LIFE SCIENCES CENTER, INSTITUTE OF BIOSCIENCES, LITHUANIA
JULIJAFEDIAJEVAITE@GMAIL.COM

Abstract

The aim of this research was to analyze the horizontal structure of *L. clavatum* and *L. annotinum* clones and to determine how their initiation was related to disturbances. The research was carried out in Nemenčinės and Aukštagirio scots pine stands of dry sites (Vaccinio-myrtillosa type), in 2017 august-September. The ecological conditions, such as canopy closure and type of habitats, for all clones of both species were similar (coefficient of variation 13%). The age of tree stands varied between 67-127 years. Fifty-two clones of *L. clavatum* and *L. annotinum* were studied, however 26 were selected after two procedures: firstly, the verification of the tree stand age was carried out using 1944-1950 ortophotos and topografic maps, and secondly, the circularity of the clones was estimated. Clone was considered as circular, if its lenght/width ratio was less than 1.5. The selected clones were considered as primary, i.e. developed after the sexual reproduction. 53.8 % of selected clones were located on the tracks and paths or were not further than 2 m from them.

Assuming, that there is a linear relationship between the size of the clone and the time after the disturbance, we examined, whether the size of the clone is related to the age of the tree stand. However, no significant correlation was found (rs, $p>0.05$). This suggests that the settlement of selected clones was not related with the establishment of pine stands. Next, we determined the probable age of clones. The spread of potential ages was 45 years for *L. annotinum* and 40 years for *L. clavatum*. Hence, the studied clones formed asynchronously in the pine stands.

Following the presumption of club moss biology, we suppose that the studied clones of both species developed from spores when the age of the pine stands reached the pole phase and the settlement continued as the stands were reaching mature phase. The distribution of the frequency of the hypothetical time of establishment was invariable among the tree stands age classes, though *L. annotinum* showed greater preference (38.9 % of studied clones) to emerge when the age of tree stands were 61-70 years. Besides, the establishment of studied clones did not coincide with the stands initiation phase. A time lag of more than 27 years was determined in this research.

Consequently, the emergence of studied clones could be explained by small-scale disturbances rather than the large-scale event, i.e. reforestation. Forestry activities such as thinning of pole sized stands and arise of paths and tracks could be favorable factors for studied clones to appear in plant communities. Finally, the emergence of studied sporophyte clones from gametophytes was a steady process, which occurred during the development of pine stands.

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MICROPROPAGATION AND SECONDARY METABOLITE ACTIVITY OF LYSIMACHIA NUMMULARIA L.

Volodumer Radchenko[1], Svitlana Bilous[2], Artur Likhanov[3], Raisa Matashuk[3]

[1]INSTITUTE OF EVOLUTION ECOLOGY NAS OF UKRAINE, UKRAINE, KYIV, [2]NATIONAL UNIVERSITY OF LIFE AND ENVIRONMENTAL SCIENCES OF UKRAINE, DEPARTMENT OF DENDROLOGY AND FOREST TREE BREEDING, UKRAINE, KYIV, [3]INSTITUTE OF EVOLUTION ECOLOGY NAS OF UKRAINE, DEPARTMENT OF DENDROLOGY AND PARK SCIENCE. UKRAINE, KYIV
FOREST_BIOTECH@UKR.NET

Abstract

Lysimachia nummularia L. is a medicinal plant in the family Primulaceae. It is using like the most suitable grass species in pharmacology in Ukraine and Europe, which have remarkable antibacterial and antioxidant ability of metabolites. In the present work, we took efforts to use in vitro methods for rapid propagation, of *L. nummularia* by direct morphogenesis, their adaptation, evaluated antibacterial and antioxidant activity of metabolic extract of *L. nummularia* stems and flowers and total phenolic and flavonoid contents in the extract. For antibacterial activity analysis were used Gram-negative (Escherichia coli) and Gram-positive bacteria (Micrococcus luteus, Brevibacterium, Staphilococcus aureus, Bacillus subtilis). Shoot tips and nodal explants of *L. nummularia* were surface-sterilized with 25% H2O2 and cultured on MS and DKW (with addition of Fe-EDDHA 4,8 %.) medium supplemented with 0.5 mg/l BA, 0.25 mg/l Kin, and 0,5 mg/l TDZ. Multiple shoot regeneration without callus induction recorded on both of MS and DKW but with different morpho-regeneration activity. Maximum shoot regeneration frequency from all explants of *L. nummularia* on MS culture mediums fortified with 0.5 mg/L TDZ, on DKW – 1.0 mg/l BA, 0.003 mg/l IBA, 0.1 mg/l GA. In vitro plants were rooted of 100% on MS medium without hormones and with addition 0.5 mg/L BA and 0.25 mg/L NAA. In vitro rooted plants have successfully acclimatized in greenhouse with a survival rate of 98%.

Phenolic content was 46.2±3.31 μg GAE/mg of extract while Flavonoid content was 10.8±0.64 μg QE/mg.Antioxidants assay showed high radical scavenging activity of 24.0±1.50 mg dry material by aqueous methanol extracts of in vitro raised 3-months-old plants in compare to the wild plants.

In leaves and flowers of *L. nummularia* accumulated a significant amount of flavan-3-ol, mericitrin (myrithin-3-O-rhamnosid) and routine (quercetin-3-O-rutinoside), as well as peristals, which have high antioxidant activity. For assessment of bactericidal action of leaf and flower extracts were conducted a series of experiments. As a result, it was determined that methanolic extracts of *L. nummularia* flowers can inhibit the growth of microorganisms (Micrococcus luteus, Staphilococcus aureus, Escherichia coli) and fungi (*Candida albicans, Saccharomyces cerevisiae*). Extracts of flowers concerning to microorganisms and fungi were much more active than leaves.

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MYCOSPHERELLA AND ITS RELATED CONIDIAL FUNGI AS PATHOGENS ON MEDICINAL PLANTS IN UKRAINE

Tetiana V. Andrianova[1]

[1]*M.G. KHOLODNY INSTITUTE OF BOTANY NAS UKRAINE, DEPARTMENT OF MYCOLOGY, UKRAINE*
TAND@DARWIN.RELC.COM

Abstract

Knowledge of pathogenic fungi on medicinal plants is rather important: it is essential for quality monitoring of raw host-plant material before processing; estimation of potential threats and prognosis of epiphytoty development on certain territories; search for new producers of pharmaceutical compounds amongst fungi; development of strategies for biocontrol and plant disease management. Climate change, in addition, has impact on diversity and distribution of plant pathogens during last decades, severity of such plant diseases. It was conducted study of the conidial fungi classified in Mycosphaerellaceae (Ascomycota) on medicinal plants in Ukraine. It is known totally 2223 species of medicinal plants used in the State Pharmacopeia of Ukraine and traditional folk medicine (Minarchenko, 2016). The basis of reported investigations were own fungal collections dated from 1990 till 2016, dry reference collections of KW, LW, CHU, and materials of ERE. Fungi of the genus Mycospherella Johanson and related anamorphic fungi were registered on 329 species of 72 families of medicinal plants. Studied fungi were represented by 292 species and caused leaf and stem lesions, spots, drying and withering. Fraction of associated with medicinal plants fungi from Mycospherella genus and related ones constituded about 62 % of 472 fungi of that group known for Ukraine. Host-plants of such families as Asteraceae, Lamiaceae, Rosaceae, Apiaceae and Fabaceae were most invaded by fungal pathogens. Pathogens were common on the medicinal plants from the ecological groups of heliophytes and scioheliophytes. More than one species of fungi from studied group with hyphomycetous and coelomycetous fructifications had been found for 17 % of observed plants. The representatives of Septoria Sacc. (198), Ramularia Unger (62) and Cercospora Fresen. (21) genera were most abundant. Rare and common species are discussed. Presence of plant metabolites as alkaloids, cumarin, essential oils, flavonoids, saponins, terpenoids did not prevent development of these microfungi and may determine the possibility of their use in medicine. Study of morphologic structures of those fungi was provided under compound microscopes and scanning electron microscope (Jeol JSM-6060 LA). The type materials of fungi were examined and compared with the same species collected in various seasons and from various regions for improving diagnostic criteria of their identification. Description of summarized micromorphologic characters of Cercosporella Sacc., Neoovularia U. Braun, Phacellium Bonord., Pseudocercospora Speg., Pseudocercosporella Deighton, Tretovularia Deighton were done. Proposed new additional structural criteria of named genera will allow easier and more precise their identification for further study.

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NEW MITOCHONDRIAL GENOMES OF THREE APHID SPECIES: APHIS FABAE SUBSP. MORDVILKOI, THERIOAPHIS TENERA, APPENDISETA ROBINIAE

N.V. Voronova[1], R.S. Shulinski[1], S.S. Levykina[1], Y.V. Bandarenka[1], D.G. Zhorov[1]

[1]BELARUSIAN STATE UNIVERSITY, ZOOLOGY DEPARTMENT, BELARUS
VORONOFF@LIST.RU

Abstract

Mitochondrial genomes can be used as a multi-genes marker for the high-quality phylogeny constructing in many animal taxa. There are many groups of insects, which phylogenetical relationships have not been solved yet because of the lack of phylogenetic signal in commonly used phylogenetical markers. Using the whole mitochondrial genomes can be a useful tool for the building of phylogenetic trees and studying the evolutionary patterns on the genome level.

There are only 18 aphid mitochondrial genomes that have been assembled so far. 11 from them were obtained from aphids belonged to *Aphididae* Family but none of them belongs to *Calaphidinae*. In our research we sequenced and assembled 3 new mitochondrial genomes of aphids including 1 genome from *Aphididae* (*Aphis fabae subsp*. mordvilkoi Borner & Janisch, 1922) and 2 ones from *Calaphidinae* (*Therioaphis tenera* (Aizenberg, 1956) and *Appendiseta robiniae* (Gillette, 1907)). All species are common in fauna of Belarus where they were collected. The whole genome sequencing was conducted in DNA Sequencing Core, University of Utah, Salt Lake City, USA. Mitochondrial genome assembling was carried out due to successive alignment the whole genome reads to the reference aphid genome *A. glycines* and mitochondrial genome *A. craccivora* [KX447141.1]. The reads that were mapped to A. craccivora mtDNA were used for de-novo assembling around the high-conservative regions of mtDNA (COI [FJ965710.1] and cyt b [GU205347.1] genes) with MITObim 1.9.

Mitochondrial genome of *A. fabae* mordvilkoi is 15346 bp. in length and include 37 genes, 197 bp. repetitive region and 661 bp. D-loop, which is rather long. *A. robiniae* has mitochondrial genome, which is middle size – 15045 bp., consists of 37 genes, 172 bp. repetitive region and much shorter D-loop (203 bp.) than it was shown in *A. fabae* mordvilkoi's mtDNA. Mitochondrial genome of *T. tenera* has several traits that differ it from other aphid mtDNA. It includes 36 genes and enormously long repetitive region (3097 bp.) and D-loop (1451 bp.). The whole mitochondrial genome of *T. tenera* is the largest of all known aphids mitogenomes and consists of 19199 bp.

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NEW SMART TECHNOLOGY FOR ANTARCTIC BIOLOGY RESEARCH

Dykyy, I.V.[1], Milinevsky, G.P.[2], Savitsky, O.L.[3], Lutsenko, D.G.[4], Khoetsky, P.B.[5], Veselsky, M.F.[6], Smagol, V.M.[7], Dzhulay, A.O.[8], Tsaryk, J.V.[9], Nazaruk, K.M.[9], Zatushevsky, A.T.[10], Simon A.O.[2], Telipska, M.A.[11], Beznoshchenko B.O.[11]

[1]IVAN FRANKO NATIONAL UNIVERSITY, LVIV, UKRAINE, [2]TARAS SHEVCHENKO NATIONAL UNIVERSITY, KYIV, UKRAINE, [3]5INSTITUTE OF HYDROBIOLOGY, NATIONAL ACADEMY OF SCIENCES OF UKRAINE, KYIV, UKRAINE, [4]6INSTITUTE FOR PROBLEMS OF CRYOBIOLOGY AND CRYOMEDICINE OF THE NATIONAL ACADEMY OF SCIENCES OF UKRAINE, KHARKIV, UKRAINE, [5]UKRAINIAN NATIONAL FORESTRY UNIVERSITY, LVIV, UKRAINE, [6]ZHITOMYR REGIONAL MUSEUM OF LOCAL LORE, ZHYTOMYR, UKRAINE, [7]9SCHMALHAUSEN INSTITUTE OF ZOOLOGY OF NATIONAL ACADEMY OF SCIENCES OF UKRAINE, KYIV, UKRAINE, [8]NATIONAL ANTARCTIC SCIENTIFIC CENTER, MINISTRY OF EDUCATION AND SCIENCE OF UKRAINE, KYIV, UKRAINE, [9]IVAN FRANKO NATIONAL UNIVERSITY, LVIV, UKRAINE , [10]ZOOLOGICAL MUSEUM OF IVAN FRANKO NATIONAL UNIVERSITY, LVIV, UKRAINE, [11]UKRAINIAN HYDROMETEOROLOGICAL INSTITUTE, KYIV, UKRAINE
A_SAVITSKY@UKR.NET

Abstract

The scientific Antarctic data allow successfully solving the problem of the humans and animals survival in extreme conditions, and study the mechanisms of biological adaptation to low temperatures. Knowledge of species biodiversity and the adaptation of the Antarctic biota to climate change can also help in building new approaches and strategy for human development and adaptation to climate change. Analysis of the penguins' colonies state and dynamics in the CCAMLR 48.1 Subarea is important for assessment of the status of populations and habitats of the major krill consumers in Antarctica and for identification of the potential overlapping of penguin forage ground with important areas of krill commercial fishery. During the latest three expeditions to the "Akademik Vernadsky" station in 2015-2018 a large international project was carried out for the first time, which is aimed in supporting and development of research the state of the penguin breeding colonies – the key indicator of the krill population stock, using the network of automated CEMP cameras installed by Ukrainian scientists in the Wilhelm Archipelago, at Wilhelm Archipelago Western Antarctic Peninsula (WAP) within the framework of the international CEMP project "Establishing a CEMP Camera Network in Subarea 48.1". The automatic CEMP camera network was installed by the Ukrainian Antarctic expeditions for permanent all-year-round monitoring the two penguin species Gentoo and Adelie (Pygoscelis papua and P. adeliae) nesting despite extreme weather conditions. We also participated in the CCAMLR project for the tracking the overwinter habitat use of krill dependent predators. According to the analysis of CEMP cameras data and visual monitoring, the evidences of the domination of Gentoo penguin in the area, as well as the expansion of Adelie and Gentoo penguins' breeding areas has been confirmed.

Conclusions

We observed the change of habitat areas of penguins as indicator species in the Argentine Islands and surrounding territories. The ultimate goal of the research will be the development of the model for the animal population distribution and change, and calculation of ecological risks for possible ecosystem damage.

Acknowledgements

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NOVEL HORMONAL, INTRACELLULAR AND PHARMACOLOGICAL REGULATORS OF FEMALE REPRODUCTION

Alexander V. Sirotkin[1]

[1]*CONSTANTINE THE PHILOSOPHER UNIVERSITY*
ASIROTKIN@UKF.SK

Abstract

This is the review of original data concerning the role of some metabolic hormones (GH, leptin, ghrelin, obestatin), growth factors (IGF-I, IGFBPs, EGF, thrombopoietin), intracellular mediators of their action (cyclic nucleotides, protein kinases, transcription factors and related cDNA, siRNA and miRNA gene constructs) on basic ovarian functions (cell proliferation, apoptosis, secretion, oogenesis, ovulation, production and viability of pups) in different species (pig, rabbit, humans and chicken). These hormonal and intracellular regulators are able to control apoptosis, proliferation and secretory activity in human, porcine, rabbit and chicken ovarian cells and maturation of porcine oocytes and cumulus oophorus. Immuno-blockade of these hormones prevented their effects. Effects of hormones were associated with changes in protein kinases and transcription factors in ovarian cells, whilst blockers of these kinases mimicked, prevented or promoted hormones action. Transfection of granulosa cells with gene constructs for these transcription factors affected ovarian cell functions and prevented or reversed hormones action. Down-regulation of approx. 1./3 known protein kinases by specific siRNA constructs resulted not only decrease in accumulation of these kinases within human ovarian granulosa cells, but also changes in expression of kinase-dependent transcription factors, markers of cell proliferation, apoptosis and hormones release. Transfection of human granulose cells with constructs up and down regulating expression of some miRNAs are able to increase or decrease ovarian cell proliferation, occurrence of apoptosis, as well as the release of steroid hormones and IGF-I. In-vivo experiments demonstrated that leptin, IGF-I, steroid hormones and some pharmacological regulators of protein kinases could be used to predict and to control reproductive efficiency. These observations suggest, that metabolic hormones, growth factors and intracellular regulators and mediators of their action (protein kinases, transcription factors, siRNAs, miRNAs) can be used for characterization of state of ovarian cells, for identification signaling pathways (hormones-growth factors-protein kinases-transcription factors-genes regulating proliferation, apoptosis and secretory activity) controlling reproductive processes, as well as for prediction and control of basic human and animal ovarian cell functions and fecundity.

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ON THE MOLECULAR MECHANISMS OF PLANT RESPONSE TO PRIE-SOWING SEED TREATMENT WITH COLD PLASMA AND ELECTROMAGNETIC FIELD

V. Mildaziene[1]

[1]*VYTAUTAS MAGNUS UNIVERSITY, FACULTY OF NATURAL SCIENCES, DEPARTMENT OF BIOCHEMISTRY*
VIDA.MILDAZIENE@VDU.LT

Abstract

New emerging interdisciplinary field of research on cold plasma (CP) and electromagnetic field (EF) applications for agriculture is directed towards exploiting of the potential of plant functional plasticity. Numerous studies reported that seed stress induced by treatment with CP and EF leads to improved seed germination, faster seedling growth and other beneficial effects. However, until now the weakest point in this area is lack of detailed information on the molecular processes involved in plant response to seed treatments. Our recent studies were focused on considering the observed plant responses in the context of basic principles of seed physiology and development. The experiments were performed on perennial woody species (black mulberry, *Morus nigra L.*; Smirnov's rhododendron, *Rhododendron smirnowii* Trautv.; Norway spruce, *Picea abies*), perennial medicinal plants (purple coneflower, *Echinacea purpurea* (L.) Moench; red clover, *Trifolium pratense* L.) and annual plant species (sunflower, *Helianthus annuus*; thale cress, *Arabidopsis thaliana*; radish *Raphanus sativus*; common buckwheat, *Fagopyrum esculentum*). We report novel findings important for understanding of CP and EF effects in the context of seed physiology and molecular processes: (1) 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, ABA and gibberrelins, GA) and we showed that seed treatment with CP and EF induce rapid decrease in ABA/GA ratio indicating that CP and EF are extremely powerful dormancy breaking agents; (2) seed treatments with CP and EF modulate H2O2 production in germinating seeds of P. abies, so that CP treatments inhibiting germination decrease ROS generation while EF treatments stimulating germination result in increased ROS generation; (3) seed treatments with CP and EF induce substantial changes in the amount of secondary metabolites (SM) and antioxidative activity in leaves growing seedlings of *E. purpurea, T. pratense* and *F. esculentum*. That is an important part of plant stress response leading to increased seedling establishment and defense potential (SM function as antioxidants, antimicrobial compounds or means for plant communication); (4) results of differential proteomic analysis performed on control, CP and EF treated H. annuus seeds (4 days after treatment) and leaves of seedlings (3 weeks after sowing) have revealed significant changes in expression of more than 30 proteoforms in seeds and more that 100 proteoforms (30% of identified proteoforms 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 that develop in time.

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ONTOGENETIC FEATURES OF REDOX REACTIONS IN THE MYOCARDIUM GEESE

Olena Danchenko.[1], O.V. Yakoviichuk[1], A.S. Fedorko[1], Nikolaeva, T.I. Halko[1]

[1]MELITOPOL STATE PEDAGOGICAL UNIVERSITY; UKRAINE
NNDEA@UKR.NET

Abstract

The physiological functioning of any organism is possible only under condition of maintaining a certain balance between the redox processes of radical and ionic nature. However, this balance in the occurrence of physiologically stressed states of different etiology presupposes its displacement and provokes metabolic rearrangements of the cell, aimed at compensating the influencing factor. The mechanism of implementation of the support in tissues is determined by the intensity of metabolism, energy needs and level of oxygen consumption. Each physiologically intense period is accompanied by an intensification of peroxide oxidation of lipids and the transition from embryonic hypoxia to hyperoxia of postnatal development in the ontogenesis of birds is an example of such a state. The high content of polyunsaturated fatty acids and their use as one of the main energy substrates of the myocardium, should provoke the attraction of all systems of this tissue to adaptive restructuring. The aim of the work is to study the peculiarities of oxidation-reduction reactions, the content of fatty acids and accumulation of lipid peroxidation products in the myocardium of geese in the embryonic and early postnatal period of ontogeny. Investigation of biological oxidation and antioxidant protection processes in the myocardium of geese was conducted during the second half of embryogenesis and the postnatal adaptation (1-14 days). In this tissue the following indicators were determined: the activity of dehydrogenases of the Krebs cycle (succinate dehydrogenase and α-ketoglutarate dehydrogenase), antioxidant enzymes (superoxide dismutase, catalase, glutathione peroxidase). The intensity of peroxide processes was evaluated by the content of their end products in homogenate and with the initiation of lipid peroxidation Fe2+. As an integral indicator of the state of antioxidant protection system coefficient of antioxidant activity KAOA was used. The content of fatty acids was determined by gas-liquid chromatography. To determine the availability and character of the integrated structure of all the investigated parameters, correlation and cluster analyses were conducted. The clustering of these indicators on the basis of the density of correlation links between them at the significance level $\gamma \leq 0.10$ helped to discover two clusters. However, at the level of the statistical tendency to correlations ($\gamma \leq 0.20$), was established the weak tendencies to correlation links between the indicators included in different clusters. It is these weak interactions that combine all the investigated indicators into a single system. Thus, under the physiological functioning, even in the tense periods of ontogenesis, the redox system of the myocardium is a coordinated dynamic system.

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OZONE AND FUTURE CLIMATE EFFECT ON INTERSPECIFIC COMPETITION BETWEEN SUMMER RAPES AND WILD MUSTARD

Giedrė Kacienė[1], Austra Dikšaitytė[1], Irena Januškaitienė[1], Diana Miškelytė[1], Jūratė Žaltauskaitė[1], Gintarė Sujetovienė[1], Sandra Sakalauskienė[1], Jurga Miliauskienė[1], Romualdas Juknys[1]

[1]VYTAUTAS MAGNUS UNIVERSITY, KAUNAS, LITHUANIA
GIEDRE.KACIENE@VDU.LT

Abstract

Weeds are accepted to be the most important pests in agriculture. Increased spread or aggressiveness of invasive and native weeds due to climate change and other anthropogenic activities have been evidenced in many scientific researches. Therefore the aim of this study was to evaluate an effect of climate change (elevated air CO2 concentration and temperature) and O3 treatment on mono- and mixed-culture summer rape and wild mustard. A pot experiment was carried out in phytotron chambers. Summer rape (*Brassica napus* L.) and wild mustard (*Sinapis arvensis*) were grown in mono- and mixed-cultures under current climate (CC) (400 µmol mol−1 of CO2, 21/14 °C day/night temperature) or future climate (FC) conditions (800 µmol mol−1 of CO2, 25/18 °C day/night temperature) with and without O3 treatment (180 µg m-3). Competition with wild mustard had relatively low effect on rape's growth at current climate, both with and without ozone treatment. Climate change positively affected crop's growth; however, weed competitive effect increased at FC conditions. The most drastic changes was detected under combined impact of ozone and future climate (FC+O3). Rape competitive effect on wild mustard also significantly increased under FC+O3 treatment. In must be emphasized, that stronger competition-induced reduction in dry biomass was detected for wild mustard (up to 80 %) than for summer rape (up to 40%), indicating increased rape's competitiveness under FC+O3 conditions. Better antioxidative protection was found to be the main reason for improved rapes growth at FC. Whereas stronger oxidative damage and lower pool of soluble sugars in wild mustard determined its sharply reduced competitiveness under FC+O3 conditions. However, in spite of improved competitiveness of rape, competition with weeds strongly interfered with crops growth, indicating increased yield losses due to the climate change, especially with concomitant intensification of O3 pollution. One of the reasons of growth inhibition of mixed-culture rape and wild mustard could be allelopathic interaction via severely increased concentration of flavonoids under FC+O3 conditions.

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REDOX-ACTIVATED NANOBASED COMBINATIONAL THERAPY WITH THE USE OF THE QUADRUPLE-BONDING RHENIUM COMPOUNDS

Nataliia Shtemenko[1], Alexander Shtemenko[1]

[1]DEPARTMENT OF INORGANIC CHEMISTRY, UKRAINIAN STATE UNIVERSITY OF CHEMICAL TECHNOLOGY, GAGARIN AV.8, DNIPRO 49005, UKRAINE
N.SHTEMENKO@I.UA

Abstract

Dirhenium(III) compounds (Re) contain quadruple Re≡Re bond that supports the lower valence state of the metal that is important in "prodrug strategy". Re have their own anticancer activity that is mainly conditioned by dirhenium cluster fragment but depends on the nature of the ligands, bind to different targets in cancer cells exploiting both the redox regulation potential of the cluster fragment and its coordination ability as well. Especially good results were shown by using the combinations of drugs with cisplatin (Re-Pt system). The synergistic effect in application of cisplatin and Re showed eliminated tumor growth and provoke cancer cells death with high efficiency. Encapsulation of Re to lipid coating (nanoliposomes, solid nanoparticles) together with cisplatin (so called "nanobins") was shown to have not only protective but activation significance for the quadruple bond. Our recent research in experiments with plasmids and spectral investigations showed that DNA - Re interactions were redox – activated. We consider the redox-activating properties and the proposed nanobased approach were both the reasons of the efficacy of Re-Pt antitumor system that allows simultaneously to reduce tumors growth and to support crucial living functions in experimental animals. Quadruple bond with δ-component is able to scavenge an unpaired electron and to diminish oxidative stress that presents a new type of antioxidants - δ – antioxidants. The antihemolytic, hepato- and and nephroprotective abilities of Re was established, the ability of Re to protect tumor-bearing animals against cisplatin-induced toxicities was documented. This effect may be associated with support (repair) of proximal tubular apparatus, where erythropoietin is synthesized, as some antioxidants made. Some recent experiments with human cancer cells showed proapoptotic activity of Re. Several aspects of the mechanism of Re action are discussing: maintenance of the drug ratios and possibility to use not the highest doses of both cytostatics with the same efficacy; regulation of the redox-state of tissues; red blood and bone marrow system defense; lowering of the cisplatin toxicity; nephro- and hepato-protection; overcome of the cisplatin-induced resistance, etc.

Key words: Dirhenium (III) compounds, redox-activation, nanoliposomes, solid lipid nanoparticles, cisplatin, combinational anticancer therapy.

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REMOTE SENSING-BASED ASSESSMENT OF BIOMASS CARBON STOCK: A CASE STUDY FOR UKRAINIAN POLISSYA

P. Lakyda[1], A. Bilous[1], V. Myroniuk[1], R. Vasylyshyn[1], I. Lakyda[1], M. Matsala[1]

[1]NATIONAL UNIVERSITY OF LIFE AND ENVIRONMENTAL SCIENCES OF UKRAINE, EDUCATION AND RESEARCH INSTITUTE OF FORESTRY AND PARK GARDENING, UKRAINE
BILOUS@NUBIP.EDU.UA

Abstract

Forest ecosystems are substantial natural regulators of carbon balance in the atmosphere that may positively influence on global climate change situation. Inventory and assessment of forest carbon pools and flows are an important issue of multipurpose assessment of forest resources and bioproductivity. Remote sensing as technical background of modern forest inventory methods is also an efficient tool for carbon balance estimation in ecosystems. Nowadays, the advances in non-parametric methods for processing remote data, especially k-Nearest Neighbors (k-NN) and Random Forest (RF), have proven to be effective for mapping forest ecosystems.

For assessment of carbon-sequestering potential of forests by means of remote sensing methods the study area of 45 km2 was established in Chernihiv region of Ukraine. About 41.8 % of the study area is covered by forest vegetation. According to tree species distribution, the area is mainly covered by Scots pine (44.7 %), Silver birch (39.8 %) and Black alder (13.1 %) stands. Forest biomass data was collected during the ground-based survey and harmonized with forest inventory data. In order to estimate carbon stock in live biomass, fixed-radius sample plots were established, where detailed measurement of model trees was performed with the aim of wood density parameters estimation. Dead organic matter was studied in the context of such components as stems, logs, litter of coarse branches (d > 1 cm), and fine litter. Appropriate models for forest biomass estimation have been used.

Geospatial dataset included a five-band RapidEye image (acquired in 2011) and DEM with spatial resolution of 5 m. Forest mask was created using RF classification model which classified the land cover as follows: forested lands, agricultural areas, meadows, swamps and water bodies. We used two different datasets as a reference for development of the classification model and for accuracy assessment of the thematic map. Finally, the map was reclassified taking 1 for forested areas and 0 – for others.

Live biomass carbon stock was predicted using non-parametric k-NN method as implemented in yaImpute package for R. We have tested different methods of nearest neighbors search and selected random forest as the most accurate followed by most similar neighbor (MSN). According to forest inventory data, the total carbon sink of the study area is 14 % lower than simulated by the applied k-NN method. Mean carbon stock according to inventory data is 64.0 Mg C/ha, while predicted by the k-NN method is 63.7 Mg C/ha; i.e., mean carbon stock deviation is within 1 % range. However, mean carbon stocks of dead organic matter differ by more than 10 %, based on the methods mentioned above.

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ROLE OF EXTRACELLULAR CUES ON PNS REGENERATION IN VITRO

Andrius Kaselis[1]

[1] *LABORAMA JSC, PROJECT MANAGER*
ANDRIUS.KASELIS@LABORAMA.LT

Abstract

Neurons in the peripheral nervous system have capability to regenerate their neurites (axons and dendrites) to periphery and in some instances to the central nervous system (PNS and CNS). During initiation and growth of neurites for prolonged distances in both CNS and PNS regenerative process is guided by extracellular cues. For the successful regeneration axons navigate using signaling molecules promoting growth to the right direction either inhibiting growth in case of displacement of neurite as well as extracellular matrix molecules for the adhesion of the neurite. Dorsal root ganglion (DRG) – sensory neuron cluster on the dorsal side of the spinal cord growth and regeneration are mostly guided by semaphoring class molecules, of which semaphorin 3A (Sema3A) is one of the most important. Sema3A inhibits CNS and PNS neurite growth and regeneration preserving NS from incorrect regeneration to the target location. Nerve growth factor (NGF) in turn is the main sensory neuron neurite growth factor, that is highly secreted during development of the NS. Interaction between two of these factors along with other extracellular cues has great potential in therapeutic approach for regenerating infringed nervous system.

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STRUCTURAL AND FUNCTIONAL FEATURES OF RHODOCOCCI EXPOSED TO NSAID-BASED PHARMA POLLUTANTS

E. Tyumina[1], G. Bazhutin[1], I. Ivshina[2], E. Vikhareva[3]

[1]PERM STATE HUMANITARIAN PEDAGOGICAL UNIVERSITY, FACULTY OF NATURAL SCIENCES, RUSSIA, [2]PERM STATE UNIVERSITY, DEPARTMENT OF MICROBIOLOGY AND IMMUNOLOGY; INSTITUTE OF ECOLOGY AND GENETICS OF MICROORGANISMS, LABORATORY OF ALKANOTROPHIC MICROORGANISMS, RUSSIA, [3]PERM STATE PHARMACEUTICAL ACADEMY, DEPARTMENT OF ANALYTICAL CHEMISTRY, RUSSIA
ELENATYUMINA@MAIL.RU

Abstract

The work was performed using strains R. ruber IEGM 231, IEGM 346, *R. erythropolis* IEGM 501and *R. cercidiphylli* IEGM 1184 from the Regional Specialised Collection of Alkanotrophic Microorganisms (WDCM # 768, www.iegmcol.ru). The pharmaceutical substances of sodium diclofenac (50 mg/l), ibuprofen (100 mg/l), most frequently detected in the environment non-steroidal anti-inflammatory drugs (NSAIDs), were used. The combined atomic-force and confocal laser scanning system including MFP-3D-BIO™ atomic force microscope (Asylum Research Inc., USA) and Olympus Fluo View 1000 confocal laser microscope (Olympus, Japan) was applied. The most typical reaction of rhodococci to NSAIDs exposure is the formation of isolated multicellular aggregates in a liquid medium. The effect of diclofenac is accompanied by an increase in the root-mean-square roughness of the bacterial surface (from 154.10 ± 8.30 to 221.51 ± 18.61 nm), a change in the zeta potential (from -35.27 ± 2.33 to -47.81 ± 2.50 mV), an improved cell wall hydrophobicity, and an increase in the content of total cellular lipids (from 43.40 ± 1.72 to 70.83 ± 4.46 % of the dry weight). The data obtained can be interpreted as mechanisms of bacterial cell adaptations that consequently increase their resistance to the toxic effects of pharma pollutants. The study was supported by the Russian Foundation for Basic Research (grant № 17-44-590567) and the Federal Agency for Scientific Organizations program for support the bioresource collections (2018).

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STUDIES ON THE ADAPTATION OF SOLANUM TUBEROSUM PLANTS EXPRESSING THE DESA GENE TO OSMOTIC STRESS.

Tetiana Kyrpa-Nesmiian[1], Volodumur Rudas[1], Olga Ovcharenko[1], Victoria Osipenko[1], Maxim Kharhota[2], Mykola Kuchuk[1]

[1]INSTITUTE OF CELL BIOLOGY AND GENETIC ENGINEERING OF NAS OF UKRAINE, UKRAINE, [2]DANYLO ZABOLOTNY INSTITUTE OF MICROBIOLOGY AND VIROLOGY NAS OF UKRAINE, UKRAINE
T-KIRPA@UKR.NET

Abstract

At the present time, the study of growing plants under conditions of high salinity soils is very relevant. Desaturases are enzymes that contribute to the formation of double bonds in fatty acids and thus convert them from saturated to unsaturated. This increases the viscosity of membranes and increases the resistance of plants to abiotic stresses. The plants *Solanum tuberosum* containing its genome and expressed the gene desA of cyanobacteria *Synechocystis sp*. PCC 6803 and control non-transgenic plants *Solanum tuberosum* used. All potato plants were cultivated on MS medium with mannitol added at concentrations of 100mM and 200mM. It was found that in potatoes with the desA genome, the best adaptive indices compared to control non-transgenic plants.

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TAXONOMIC CLARIFICATION: THE INVASIVE PEST SLUG OCCURING IN LITHUANIA IS ARION VULGARIS MOQUIN-TANDON, 1855

M. Adomaitis[1], G. Skujienė[1]

[1]VILNIUS UNIVERSITY, LIFE SCIENCES CENTER, INSTITUTE OF BIOSCIENCES, LITHUANIA
MANTAS.ADOMAI@GMAIL.COM

Abstract

The invasive pest slug was detected in Lithuania in 2008 under the name of *Arion lusitanicus*, when scientific discussions took place in Europe. Castillejo (1997, 1998) has shown that *A. lusitanicus* as described by Mabille (1868) is endemic to Portugal, and these findings were confirmed by genetic studies (Quinteiro et al., 2005; Pfenninger et al. 2014). The species is currently correctly referred to as *A. lusitanicus auct.* Non-Mabille or as *Arion vulgaris* Moquin-Tandon, 1855. This created some nomenclatural confusion in the slugs key literature, as the earlier studies of the ligula (a part of the distal genitalia), which promised rapid and reliable differentiation to the specific level, provide insufficient characteristics to distinguish between members of the closely related *A.lusitanicus* aggregate. This study compares the specific identification characteristics of the Portuguese *A.lusitanicus* presented by Castillejo (1998) and the same characteristics of the Lithuanian invasive slugs. Furthermore, we made comparison of spermatophores between literature data and our data, as many authors have suggested that there are effective reproductive barriers in closely related Arion species due to differences in the spermatophores (Boettger, 1949; Quick, 1964; Davies, 1977; Backeljau and van Beek, 1986). Our results of anatomical-morphological description confirm that the characteristics used to separate these species are inadequate.

Cytochrome c oxidase subunit I and NADH dehydrogenase subunit 1 mitochondrial DNA sequences provide genetic confirmation of the presence of the invasive slug *Arion vulgaris* in Lithuania (Vilnius, N = 3), where it has previously been identified as *Arion lusitanicus*. The lowest values of allelic richness (=2.68), observed (=0.4) and expected (=0.44) heterozygosity were estimated for this population between 32 locations across Europe (Zemanova et al., 2016).

As the invasive slugs in Lithuania do not differentiate morphologically, biologically or ecologically within the country and from other countries and fall into a region of low genetic diversity, we propose that we can identify the invasive species as *A. vulgaris*, even if only three individuals were genetically examined. In the future to extend the study, a more statistically reliable sample should be investigated. In addition, we present data on the distribution of this species in Lithuania (biotope, population density and life cycle).

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THE EFFICIENCY OF NON-CHEMICAL WEED CONTROL IN WINTER RAPESEED

Aušra Marcinkevičienė[1], Rimantas Velička[1], Zita Kriaučiūnienė[1], Marina Keidan[1], Lina Marija Butkevičienė[1], Rita Pupalienė[1], Robertas Kosteckas[1], Sigitas Čekanauskas[1]

[1]ALEKSANDRAS STULGINSKIS UNIVERSITY, STUDENTU STR. 11, LT-53361 AKADEMIJA, KAUNAS DISTR., LITHUANIA
ZITA.KRIAUCIUNIENE@ASU.LT

Abstract

There are favourable conditions for spread of weeds, pests and diseases in rapeseed crop grown in organic farming, and this is results in low rapeseed productivity. The aim of the research was to determine the efficiency of non-chemical weed control methods (thermal, mechanical and smothering) in winter rapeseed crop.

Field experiment was carried out in 2014–2017 at the Experimental Station of Aleksandras Stulginskis University (54°53′ N, 23°50′ E). Soil – *Calc(ar)i-Endohypogleyic Luvisol*. Winter rapeseed (*Brassica napus* L. spp. *oleifera biennis* Metzg.), variety 'Cult' (3 kg ha-1) was grown in soil with a regular (23–25 cm) (Experiment I) and thickened (45–50 cm) (Experiment II) humus layers. Experimental treatments: Factor A: non-chemical weed control: 1) thermal (water steam); 2) mechanical (inter-row loosening); 3) smothering (self-regulation with narrow spacing); Factor B: use of bio-preparations: 1) no application, 2) with application (bio-organic fertilisers used: 'Nagro' applied for rapeseeds before sowing, 'Terra Sorb Foliar' was sprayed in autumn (2 l ha-1), and in spring – 'Terra Sorb Foliar' (1 l ha-1) and 0.3 % Conflic).

In the winter rapeseed crop, annual weed species dominated: *Chenopodium album* L., *Tripleurospermum perforatum* (Merat) M. Lainz, *Stellaria media* (L.) Vill., *Veronica arvensis* L., *Capsella bursa-pastoris* (L.) Medik., and *Poa annua* L. During vegetation period of organic winter rapeseed crop, mechanical weed control was the most effective method both in autumn (efficiency was 26.8–71.5% in the soil with regular and 40.6–76.0% with thickened humus layers) and in spring (efficiency was accordingly 36.9–76, 5% and 46.4–73.3%). The effectiveness of thermal weed control compared to mechanical was lower. Bio-preparations increased the effectiveness of thermal and mechanical weed control methods only in autumn of 2014 and spring of 2015. Before harvesting the lowest weed dry matter was determined in plots with mechanical weed control compared to other non-chemical weed control methods. The effect of thermal weed control on the weed dry matter increased with the use of bio-preparations.

Winter rapeseed yield depended on meteorological conditions, crop density formed and efficiency of weed control. Significant increase in winter rapeseed yields estimated in 2015 and 2017 in treatment with mechanical weed control, while in wet 2016 – using a bio-preparations and smothering. Bio-preparations in the dry 2015 significantly increased the yield of rapeseed in the plots with thermal and mechanical weed control by 43.4 and 25.1 also 34.4 and 20.7% respectively and in 2016 – in the plots with smothering by 51.5 and 33.3% respectively.

Financial Support: This research was funded by a grant (No. SIT-8/2015) from the Research Council of Lithuania.

Key words: winter rapeseed, non-chemical weed control, biological preparations, weeds, seed yield.

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THE IMPLEMENTATION OF GENETIC ASSAYS FOR INVESTIGATING THE GULF OF FINLAND BIOLOGICAL SYSTEMS.

Elena I. Michailova[1], Larisa V. Barabanova[1]

[1]SAINT-PETERSBURG STATE UNIVERSITY, DEPARTMENT OF GENETICS AND BIOTECHNOLOGY, RUSSIA
EMIKHAILOVA2010@GMAIL.COM

Abstract

It is not a novelty, that anthropogenic pressure has a profound impact on the biological system of the Gulf of Finland. In the first instance it is due to development of ship industry. Secondly, high number of major built-up areas, cities including, are located along the coastal areas belonging to different states. Industrial and economic activities carried out to maintain sustainability of those areas are having certain impact on the aquatic state of the littoral zone. The dam of St. Petersburg could be given as an example of such an influence. Complex monitoring of ecological situation is needed, but so far hydrological state has being assessed as well as hydrochemical analyses and biological monitoring have been carried out. Biosystem dynamics of the Gulf of Finland has been studied by means of traditional hydrobiological methods using biodiversity criteria in particular. This type of assessment allows for estimation of the current state of investigated biosystem but does not allow giving a long-term forecast of possible changes. Various genetic approaches are indispensable for complex assessment of water system state including investigations on water organisms. On one hand, genetic methods give possibility to estimate genotoxic effects of water pollution, on the other hand, allow giving a forecast of the possible structural changes of biosystem under analysis. Abiotic contamination of the environment is insecure not only for the present day life. It is unsafe for future generations as well. This can be explained by the fact that numerous pollution components are mutagens or genetically active agents. Therefore, genetic toxicology takes on a value and due to its methodology and vast arsenal of research methods allows extending the potential of biological indication and monitoring of the environment. In the first instance, this has to do with early recognition of various types of genetic disturbances caused by environmental factors, including those of anthropogenic origin. This type of monitoring is based on genetic test-systems, which include indicator species and criteria for measuring deleterious effect on genetic material. The results of genetic monitoring and assessment of the aquatic system of the Gulf of Finland will be presented and discussed. The research was supported by the grants, RFBR 15-29-02526 and NSH 9513.2016.4, and performed at the Research park of St.-Petersburg State University Centers for Molecular and Cell Technologies and “Chromas”.

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THE OVERVIEW OF ULTRASONIC SYSTEMS FOR OIL EXTRACTION FROM MICRO ALGAE

A. Struckas[1], P. Vasiljev[1], R. Bareikis[1], S. Borodinas[1]

[1]LIHUANIAN UNIVERSITY OF EDUCATIONAL SCIENCES, THE INSTITUTE FOR SCIENTIFIC RESEARCH, LITHUANIA
ARUNAS.STRUCKAS@LEU.LT

Abstract

Nowadays one of the biggest challenges in the world is to find clean energy source. This is a very important question because we would not think about economy growth or whatever like that if we just make our planes inappropriate for living. As to explain more accurately what this study is about lets go to some common examples – how much oil equivalent energy is needed to get one barrel of oil. Obviously it should be less than one otherwise it is not worth it. So in this research micro alga represents the oil, as it can be used as a clean energy source by producing bio fuel. As the second part of the issue is how much energy is needed to growth algae, collect it and process, before it turns into usable form of fuel. So here in this research you can find series of ultrasonic systems created and tested in our lab. By this moment the commercially available ultrasonic systems, which are used for micro algae processing in oil extraction are longitudinal transducers, so our goal was to create advanced ultrasonic systems that would be energetically more efficient. The study lasted for about 3 years, during this time we designed and tested about 12 ultrasonic systems. At first we tried to use various micro algae types while later on stayed only for two: single cell *Monoraphidium griffithii* and colonial *Scenedesmus acutus Meyen*. The experimental setup also has been changing during time like keeping constant volume of the algae liquid mixture for standard system and prototype when it was possible. The time of affection was the most constant thing, because of the temperature rise making sure that micro algae cell walls destroyed by means of cavitation instead of just being overheated. Subsequently we did calculations of how many micro algae cells managed to survive during each experiment and how much power was used by the system to do the job. The presented results represent only those systems which showed better results comparing with the standard (commercially available) system. The majority of created systems can handle algae processing with a greater affection area, have a better micro algae destruction rate and lower power consumption. The destruction rate depending on used power varies from 25% to 500% in comparison with the results showed by the standard system. Any of the proposed systems can be implemented in commercial facilities.

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THE SPECIFITY OF MICROBIOLOGICAL COMPLEX FORMATION IN POST-AGROGENIC SOILS

E. M.Perminova, Y. A. Vinogradova[1], E. M. Lapteva[1], V. A. Kovaleva[1]

[1]INSTITUTE OF BIOLOGY KOMI SC URD RAS, RUSSIA
PERMINOVA@IB.KOMISC.RU

Abstract

In Russia, from 30 to 40 million hectares of arable land has been abandoned from agricultural production. These arable land sites represent the various stages of vegetation successions depending on the bioclimatic zone. The complex of quality indicators of once-abandoned lands is important in the economic assessment of the possibility of their further use. One such indicator is a pool of soil microorganisms. The total and correlation of microorganisms are able to reflect the state and features of the soil functioning, since the soil microorganisms are the most dynamic component of soils.

The aim of the study was to evaluate the patterns of changes in the abundance and biomass of soil microorganisms in the soils of arable lands of various stages of postagrogenic succession.

Studies were conducted in the subzone of the middle taiga (the Russian European Norteast, the Komi Republic). The composition and abundance of microorganisms in the soils of the native spruce forest and former arable land - the meadow area, which is currently undergoing periodic haymaking, and the young birch-aspen forest, formed on the deposits, were studied. Total amount of microorganisms was assessed by the luminescent microscopy method.

The number of bacteria in the forest litter horizon under the spruce forest was 1.25 ± 0.5 billion g-1 soil, in the upper horizon of the meadow soil (0-5 cm) - 13.20 ± 2.15 billion g-1 soil, in the forest litter of the young birch-aspen forest - 0.25 ± 0.06 billion g-1 soil. The maximum length of the fungal mycelium is found in the litter of the spruce forest soil. On average, it was 3413.4 m g-1 soil. In the soil of the young deciduous-coniferous community, it is an order of magnitude lower, and in the soil of the meadow - by two orders of magnitude. The maximum value of microbial biomass is 10030.7 mg•g-1 soil - also noted in the soil of the spruce forest. In the soil of the aspen-birch forest it is characterized by a value of 2250.1 mg•g-1 soil, in the soil of the meadow - 827.5 mg•g-1 soil. The main contribution to the overall biomass of microorganisms is contributed by eukaryotes. The proportion of prokaryotic cells varies from 0.1% in the mineral part of the soil to 31.9% in the upper sod horizon of the meadow community, in forest litter this figure is 0.2%. In the soils of forest communities in the morphological structure of microscopic fungi, the main role is played by fungal mycelium (86.2-95.3%). In the organogenic horizon of the meadow soil, the contribution of fungal spores increases (56.9%). The results obtained indicate a redistribution of the content of various groups of microorganisms in soils in the process of post-agrogenic development of plant communities.

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THERMAL TIME MODELS FOR ESTIMATING PLANT PHENOLOGICAL DEVELOPMENT UNDER CLIMATE BASED RELATIONSHIPS

A.Kanapickas[1], R.Juknys[1], G.Sujetovienė[1]

[1]VYTAUTAS MAGNUS UNIVERSITY, FACULTY OF NATURAL SCIENCES
ARVYDAS.KANAPICKAS@VDU.LT

Abstract

Accurate prediction of plant phenology is a key requirement for plant development models. The prediction of crop yield and quality from meteorological data can be improved by quantifying heat and moisture conditions during specified phenological phases. The analysis of long-term time series of spring phenology for different deciduous trees species supplies with the important information how the timing of leaf unfolding is related to spring temperatures and crop phenological development. The objective of this study was to investigate the timing of phenological phases of deciduous trees (silver birch, small-leaved lime, Norway maple and common oak) using thermal time as a key parameter and compare observed as well projected data with the phenological changes of winter wheat and spring barley under ongoing and future climate change conditions. Thermal time (growing degree days) was evaluated used more precise degree days approach. The projection of climatic parameters was conducted using the data of three Global Circulation Models under the optimistic scenario (RCP 2.6) and the pessimistic scenario (RCP 8.5). It was shown that plants react to climate changes in a similar way. High correlation between the dates of winter wheat regrowth after dormancy and birch leaf unfolding was detected. The advancement of these spring phenological phases along with climate warming is also very similar and equals approximately 12 days over the last six decades. The regrowth phase of winter wheat occurs almost 20 days earlier than leaf unfolding of this early season tree, indicating significantly lower thermal accumulation requirement in order to start the spring vegetation of winter wheat.

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TIME-LAPS MICROSCOPY OF LIVING CELLS WITH VIDEO COMPLEX "TSITOMIR": SCIENTIFIC, MEDICAL, AND ECOLOGICAL POSSIBILITIES

Sergey E. Dromashko[1], Oleg V. Kvitko[1], I.I. Koneva[1], Ya I. Sheiko[1], Nina A. Balashenko[1], Svetlana N. Shevtsova[1], Anastasia S. Sapun[1]

[1]STATE SCIENTIFIC INSTITUTION "INSTITUTE OF GENETICS AND CYTOLOGY OF THE NATIONAL ACADEMY OF SCIENCES OF BELARUS", AKADEMICHESKAYA ST. 27, MINSK 22072, THE REPUBLIC OF BELARUS
S.DROMASHKO@IGC.BY

Abstract

Reliable testing of effects of various natural and synthetic substances on cells is critical in searching for effective inhibitory or stimulating agents. Such work is essential in discovery of anticancer drugs and testing of newly synthesized compounds' toxicity. On the other hand, findings of stimulating formulas are helpful in (developing of pharmaceuticals that can restore or improve cell health of the organism's tissues. In this context, finding the means of retardation and reversion of age-related cell deterioration (cell ageing) is of a special interest. Besides, in frames of the emerging field of stem cell research, there is a problem of accelerated ageing of stem cells in vitro and this does not allow to expand stem cells in quantities that are sufficient for medical transplantations. In cooperation with the Scientific Production Association "Planar", we have developed the computer video complex "Tsitomir". This complex is destined for time-laps video microscopy of living cell cultures. It consists of three main devices: an inverted microscope, a video camera and a computer. In a microscope chamber, conditions are created for normal cell vital activity. Thus, long-term cultivation of cell cultures with their parallel computer video recording is provided. We have elaborated a method for counting of cells in low-density living cell cultures during extended periods of cultivation with use of "Tsitomir". This allows to calculate the number of cells n the same growth substrate areas during different periods of cultivation. It is possible to test up to 96 various cell cultures in one medium, or one culture in 96 various media. The method allows to obtain cell numbers in dynamics and it makes it possible to get statistically valid quantitative data by using a minimal number of culture flasks (in cases of pronounced toxic or stimulating effects in some experiments only two parallel flasks per experimental variant may be enough). This approach can be exploited for testing of antiproliferative and apoptosis-inducing effects, as well as action of various substances and their combinations. With use of the video complex "Tsitomir", we have also developed a non-invasive technology for receiving and analyzing of cells from human hair follicle and urine. It was shown that the cells obtained were aging after the two-week cultivation, and therefore not prone to immortalization, i.e. suitable for use in research for regenerative medicine.

Keywords: time-laps microscopy, video complex "Tsitomir", cell cultures, regenerative medicine, natural and chemical substances' testing

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TRANSFORMATION OF VARIETIES OF AMARANTHUS CAUDATUS L. AND VARIETIES OF HYBRIDS A. CAUDATUS X A. PANICULATUS L. BY "FLORAL-DIP" METHOD

Maxim Vasilenko[1], Alena Gajdosova[2], Mykola Kuchuk[1]

[1]INSTITUTE OF CELL BIOLOGY AND GENETIC ENGINEERING NAS, UKRAINE, [2]INSTITUTE OF PLANT GENETICS AND BIOTECHNOLOGY PSBC SAS, SLOVAK REPUBLIC
90TIGERYAROSHKO90@GMAIL.COM

Abstract

At present, amaranth becomes well known and requested due to its rich biochemical composition and unique medicinal properties. In connection with this, it is promising to improve its properties with the help of biotechnological methods.

The objects of investigation were varieties of amaranth species *Amaranthus caudatus* L.: *Karmin, Kremovyi rannii*, *Helios*, and hybrids *A. caudatus x, A. paniculatus L. – Sterkh, A. caudatus x Sterkh - Zhaivir*. The above-mentioned varieties were transformed by method "floral-dip".

Three months after floral-dip" transformation with *Agrobacterium rhizogenes* strain A4, with plasmid pCBv19, transgenic seeds were obtained. Plasmid pCBv19 contained bar and gus as selection and reporter genes, respectively.

The incorporation of plasmid into amaranth cells was confirmed with herbicide selection (herbicide PPT - phosphinotricin). The presence and activity of GUS gene was tested by histochemical assay. Positive results for 2 varieties of *A. caudatus: Karmin* and *Kremovyi rannii* were obtained. The percentage of GUS positive samples for cv. *Karmin* was 1% and for cv. *Kremovyi rannii* – 1.1% from the total initial quantity of plants that were subjected to selection with the herbicide.

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WAYS OF INCREASING THE CAROTENOIDS SYNTHESIS OF THE BASIDIOMYCETES STRAINS LAETIPORUS SULPHUREUS (BULL.) MURRILL.

Ivankov A.[1], Velygodska A. K.[1]

[1]VASYL' STUS DONETSK NATIONAL UNIVERSITY, FACULTY OF BIOLOGY, UKRAINE
ANATOLYIVANKOV@GMAIL.COM

Abstract

The search for new biologically active substances producers with the purpose of developing and improving methods for their cultivation and obtaining target metabolites takes an important place in modern biotechnology. A promising object of such studies is Basidiomycetes, which produce a number of physiologically active substances with a wide spectrum of therapeutic actions.

The aim of the research is to investigate ways to increase the biosynthetic activity of carotenoids of basidiomycetes *Laetiporus sulphureus* by changing the conditions of its cultivation and exposure to various sources of light irradiation.

The investigation of the influence of different light spectra on the accumulation of the biomass and the biosynthesis of carotenoids *L. sulphureus* was carried out by using three powerful 100 mW lasers with different wavelengths of light - 405 nm, 532 nm and 650 nm. A fluorescent lamp with a power of 16 W and a wavelength of 640 nm was used for the irradiation the mycelium with daylight spectra. The level of the absolutely dry biomass (ADB) accumulation was measured using standard mycological methods. The total carotenoid content was set in acetone extracts of mycological material spectrophotometrically and calculated using the Vetshteyn formula.

Screening of the biomass accumulation and dynamics of the total carotenoid content in 7 strains of Basidiomycetes was carried out. Strains *L. sulphureus* Ls-09 and Ls-08 and F. hepatica Fh-18 were distinguished by a high level of carotenoid biosynthesis. The maximum values of these indicators were fixed on the 12th day of the cultivation. To increase the biosynthesis of carotenoids, a strain of Basidiomycetes *L. sulphureus* Ls-08 was selected. Thus, the highest carotenoid content is observed at pH 3.5. In addition, a temperature optimum for the strain at 27.5 º C was established.

According to the results of the study, daylight irradiation for 4, 8 and 12 hours negatively affected the biosynthesis of carotenoids of *L. sulphureus* Ls-08 strain and showed no significant results relative to control. In this respect, only the growth of ADB by 12.4% with 4 hours of irradiation per day was identified. The irradiation of mycelium *L. sulphureus* Ls-08 with blue, red, green and blue and red lasers simultaneously, increased both the biomass gain and the content of carotenoids in comparison with the control. The maximum values were achieved by the irradiation in the green spectrum, they exceed the control by 47.7% and 29.2%, respectively.

The obtained conclusions have shown that due to the influence on culture or by means of the influence of different spectra of laser irradiation, the growth of the biomass and the biosynthetic activity of the cultural strain can be significantly improved, as compared to the control.

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POSTER PRESENTATIONS

A STUDY ON ANTIMICROBIAL PROPERTIES OF A THERMOPHILE MICROALGA

Nur Kocberber Kilic[1], Gönül Dönmez[1]

[1]ANKARA UNIVERSITY, FACULTY OF SCIENCE, DEPARTMENT OF BIOLOGY, BEŞEVLER, ANKARA, TURKEY
NRKILIC@ANKARA.EDU.TR

Abstract

With an increase in microbial resistance against antibiotics causes the decrease in effectiveness of them. As a result, studies are focused to find new compounds to help health sector. Several studies are performed to investigate bioactive compounds by microalgae. These compounds can have antimicrobial, antioxidant, antiviral and antitumor properties. Compounds in thermophile microalgae are very promising ones related to the usage potential in biotechnological applications.

In this study, one thermophile microalga (Strain E) was obtained from Ankara University, Faculty of Science Laboratories' current culture collection. Strain E was investigated in order to determine its antimicrobial properties under different conditions like media with different nitrogen concentrations and temperatures. To find the most effective bioactive compound, Strain E was cultivated in BG 11 media under continuous light intensity as 2400 lx at a growth chamber for 14 days (30 ºC). At the end of the incubation period, algal biomass was obtained by centrifugation. Freeze-dried biomasses were exposed to ethanol solvent and algal extracts were attained. Antimicrobial activity was done with paper disc diffusion method using standard bacterial strains.

According to the results obtained from the trials that Strain E produced the most effective bioactive compound when microalga was cultivated in media with 1 g/L nitrogen. It was also determined that with an increase in temperature, microalga produced more effective bioactive compounds, thus, antimicrobial activity against bacteria increased, as well.

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A STUDY ON BIOETHANOL PRODUCTION FROM LIGNOCELLULOSIC WASTES

Ekin Demiray[1], Sevgi Ertuğrul Karatay[1], Gönül Dönmez[1]

[1]ANKARA UNIVERSITY, BIOLOGY DEPARTMENT, TURKEY
SERTUGRUL@ANKARA.EDU.TR

Abstract

Rapid depletion of fossil fuels forces researchers to explore new energy sources. Bioethanol, as a clean and renewable energy source, is gaining much attention because of its major environmental properties. Bioethanol can be produced from different types of renewable raw materials such as, corn, wheat, sugar cane (first generation), lignocellulosic feedstocks (second generation) and microalgae or photosynthetic cyanobacteria (third generation). Lignocellulosic materials constitute a substantial renewable substrate for bioethanol production which do not compete with food production and animal feed. These lignocellulosic materials also support environmental sustainability. By this context in this study we examined the feasibility of bioethanol production from apple and carrot pomaces. In experiments *Kluyveromyces* sp. was used and some important parameters were optimized.

Apple and carrot pomaces were supplied from local markets in Ankara/Turkey. These pomaces were hydrolysed in 1% H2SO4 (v/v). Microbial growth, sugar consumption and bioethanol amounts were monitored periodically. Bioethanol concentration was determined with gas chromotography.

Kluyveromyces sp. produced at pH 4 at the end of 12 hours fermentation time 7.73 and 9.17 g/L bioethanol in the media containing apple and carrot pomace, respectively. There was no significant difference for the microbial growths between apple and carrot pomace containing media. The values measured at OD600 were 6.90 and 6.27, respectively.

The data obtained from the current study depict that apple and carrot pomaces were supported the growth and ethanol production of *Kluyveromyces* sp. In this context apple and carrot pomaces can be suitable feedstock for bioethanol production.

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AFRICAN SWINE FEVER SITUATION AND DETECTION METHODS IN LITHUANIA

S. Pilevičienė[1,2], V. Jurgelevičius[1,2], A. Paulauskas[1], Ž. Janeliūnas[1,2], G. Pridotkas[2]

[1]VYTAUTAS MAGNUS UNIVERSITY, FACULTY OF NATURAL SCIENCE, LITHUANIA, [2]NFVRAI, LITHUANIA
SIMONA.PILEVICIENE@VDU.LT

Abstract

African swine fever is one of the most important and serious diseases of wild boar and domestic pigs. Its highly contagious nature and ability to spread over long distances make it one of the most feared diseases, since its devastating effects on pig production have been experienced not only in most of sub-Saharan Africa but also in Western Europe, the Caribbean, Brazil and, most recently, the Caucasus. On 24 th January 2014 Lithuania notified two primary cases of African swine fever (ASF) in wild boar. The animals were tested positive for ASF virus (ASFV) genome by real time PCR at the National Reference Laboratory for ASF in Lithuania (NRL), results were confirmed by the EURL CISA-INIA. Intensive wild and domestic animal monitoring program was started. During period 2014-2017 ASF were confirmed in two large commercial pig holding with the highest biosecurity. Pigs were killed and destroyed. Since 2014 ASF outbreak territory from east and south has expanded to the middle of Lithuania. As there is still no vaccine or treatment available, monitoring and controling of the disease is the only way to control the disease. Diagnosis by PCR is one of the highly recommended diagnostic methods by OIE for diagnosis of ASF. This studies was to combine singleplex real-time PCR assays to a duplex assay allowing the identification of ASF and internal control in a single PCR tube and to compare primers target the p72 gene (ASF 250 bp and ASF 75 bp) efectivity. Multiplex real-time PCR assays offer the possibility to save analysis time and costs and have therefore a high potential to be applied in routine analysis. For experiments were used reference sample (INIA, Spain), and positive samples from affected places in Lithuania. Results show 100% sensitivity and specificity.

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ANAPLASMA PHAGOCYTOPHILUM INFECTION IN RED DEER (*CERVUS ELAPHUS*)

A. Bikulciute[1], I.Ražanske[1], , O.Rosef[2], J.Radzijevskaja[1], M.Bratchikov[1], A.Paulauskas[1]

[1]VYTAUTAS MAGNUS UNIVERSITY, FACULTY OF NATURAL SCIENCES, DEPARTMENT OF BIOLOGY, VILEIKOS G.8, LT-44404 KAUNAS, LITHUANIA, [2]ROSEF FIELD RESEARCH STATION, FROLANDSVEIEN 2667, 4828 MJÅVATN, NORWAY; AGNE.BIKULCIUTE1@STUD.VDU.LT

Abstract

Anaplasma phagocytophilum is a small zoonotic intragranulocytic alpha-proteobacterium, reported to cause human granulocytic anaplasmosis (HGA), tick-borne fever (TBF) in ruminants and granulocytic anaplasmosis in horses and dogs. These days tick-borne fever and anaplasmosis are one of the widest spread vector-borne diseases in Europe. There are case reports of *A. phagocytophilum*-associated mortality in roe deer (*Capreolus capreolus*) fawns and a moose calf (*Alces alces*) from Norway. Abortion in ewes and reduced fertility in rams have also been reported. In addition, reduced weight gain in *A. phagocytophilum* infected bullocks and lambs have been observed. *Ixodes ricinus* are the primary vectors of this pathogen in Europe and red deer (*Cervus elaphus*) is considering to be one of the main large hosts of these ticks. In addition, red deer (*Cervus elaphus*) have been suspected to be one of the major *A. phagocytophilum* reservoir host. In this study, spleen samples from 133 red deer (*Cervus elaphus*), collected from 11 different farms in Norway, were analysed for presence of *A. phagocytophilum* DNA by real-time and nested PCR, using *msp2* and *16S rRNA* gene. The overall prevalence of *A. phagocytophilum* DNA by using real-time PCR was 75% and nested PCR - 36%. The present work indicates that red deer (*Cervus elaphus*) is exposed to *A. phagocytophilum* in Norway.

Keywords: *Cervus elaphus*, red deer, *Anaplasma phagocytophilum*, real-time PCR, nested PCR, *msp2*, *16S rRNA*.

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ANTIFUNGAL EFFECTS OF NEW POTENTIAL INHIBITORS OF FARNESYL AND N-MYRISTOYL TRANSFERASES

Nataliia Voloshchuk[1], Olena Bashta[1], Oleksandr Vasylchenko[2], Oleksandr Sorokin[2], Tetyana Shyrina[2], Maksim Platonov[2], Larysa Palchykovska[2]

[1]NATIONAL UNIVERSITY OF LIFE AND ENVIRONMENTAL SCIENCES OF UKRAINE, UKRAINE, [2]2INSTITUTE OF MOLECULAR BIOLOGY AND GENETICS, NAS OF UKRAINE, UKRAINE
VOLOSHCHUK_M_NATALIIA@UKR.NET

Abstract

Development of new biologically active compounds with antifungal properties is due to several reasons: the emergence of the resistance of pathogens to existing therapeutics, new strains of pathogens and the lack of new efficient drugs. The modern approach to antifungal drugs development is based on design and synthesis of target-oriented compounds. It is known that enzyme farnesyltransferase (FTase) is critical for fungal growth, virulence and cell-membrane formation. Structural characteristics are key features that distinguish fungal FTases from human (hFTase). Such differences result in opportunities for developing selective antifungal drugs. N-myristyl transferase (NMTase) is responsible for the growth of various organisms and determines cellular proliferation and has been considered as potential target for antifungal drugs. Development of inhibitors of these enzymes will expand the spectrum of biologically active compounds with antifungal action.

The main aim of our study was in prognosis and selection of potential inhibitors of proteins FTase and NMTase of filament fungi and yeasts by molecular docking method. Antifungal activity screening of new synthesized compounds toward to Fusarium and Candida strains was determined by the generally accepted agar diffusion method. All the synthesized compounds (forty four FTases and forty three NMTase potential inhibitors) were screened for in vitro antifungal activity using fluconazole and tebuconazole as the standard drugs. It was found 9 compounds that were active toward to test cultures in concentration 2 mg/ml, diameter of the fungal growth inhibition zones were between 15 and 50 mm. From tested chemical agents the compound 6C3 exhibited the highest antifungal effect against Fusarium culmorum 3260/4, F. verticillioides and *F. sporotrichioides* with zones of growth inhibition 27, 20 and 15 mm accordingly. These strains were sensitive to NMTase inhibitors 7A2 and 7A4 that demonstrated diameter of the zones of inhibition 17, 22 and 26 mm and 50 and 20 mm accordingly. Only one compound 7A4 showed activity against yeast strains Candida glabrata M and C. tropicalis M, zone of clearance was 21 mm for both species. Some of the new FTase and NMTase inhibitors exhibited the same or better antifungal activities in comparison to the reference drug fluconazole and tebuconazole against the tested strains.

Keywords: Filamental fungi, yeasts, antifungal agents, potential inhibitors of Farnesyl and N-myristoyl transferases

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ANTIOXIDANTS EFFECT ON MX-1 CELLS RESISTANCE

E.Radzevčiūtė[1], I.Januškevičienė[2], R.Daugelavičius[1]

[1]DEPARTMENT OF BIOCHEMISTRY, FACULTY OF NATURAL SCIENCE, VYTAUTAS MAGNUS UNIVERSITY, [2]DEPARTMENT OF DRUG CHEMISTRY, FACULTY OF PHARMACY, LITHUANIAN UNIVERSITY OF HEALTH SCIENCES
EIVINA.RADZEVICIUTE@GMAIL.COM

Abstract

Background. Multidrug resistance (MDR) is simultaneous resistance of cancer cells to many drugs used for chemotherapy. The main mechanism of MDR is multidrug resistance efflux pumps. It is a large superfamily of proteins called the ATP-binding cassette (ABC) transporters. The main efflux pumps responsible for MDR are P-glycoprotein (P-gp), multidrug-resistance protein (MRP) and breast cancer resistance protein (BCRP) (1). In this study we explored antioxidants inhibition activity to efflux pump.

The aim: to investigate the effects of antioxidants on breast cancer cell line.

Methods. The levels of MX-1 cell resistance to rutin (R), quercetin (Q) and epigallocatechin gallate (EGCG) were estimated using MTT viability test. The MDR pump functional activity was determined by fluorometric measurements.

Results. In this study was derived a new MX-1 cells sublines resistance to rutin, quercetin and epigallocatechin gallate. These cells sublines showed different functional activity of the MDR pumps.

Conclusion. All antioxidants on MX-1 cells affected differently. Quercetin increased the functional activity of the pumps, while epigallocatechin gallate suppressed.

Keywords: cancer, multidrug resistance, rutin, quercetin, epigallocatechin gallate.

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ASSESSMENT OF MOLECULAR DIVERSITY IN LITHUANIAN IMPATIENS PARVIFLORA DC. ACCORDING TO AMPLIFIED FRAGMENT LENGTH POLYMORPHISM MARKERS

Kristė Stravinskaitė[1], Giedrė Rajackaitė[1], Rasa Janulionienė[1], Lina Jocienė[1], Eugenija Kupčinskienė[1]

[1]DEPARTMENT OF BIOLOGY, VYTAUTAS MAGNUS UNIVERSITY, VILEIKOS STR. 8, LT-44404 KAUNAS, LITHUANIA
E.KUPCINSKIENE@GMAIL.COM

Abstract

Chitin is a biopolymer found in crustaceans, also from aquatic environment. The aim of the study was to determine the chitin content and physicochemical properties of this biopolymer extracted from alien gammarid Dikerogammarus haemobaphes (Eichwald, 1841). This species of Ponto-Caspian origin is now widely distributed in many European fresh and brackish waters.

The dry weight chitin content of this species was determined. Fourier transform infrared spectroscopy (FT-IR) and thermogravimetric analysis (TGA) were used to characterize physicochemical properties of obtained chitin.

As expected, FT-IR results showed that the isolated chitin was in a form. According to our results the extracted chitin was thermally stable and potentially can have application in many industrial processes.

As biological invasions are one of the major problems worldwide, our study show potential solution to use of invaders in human industry.

Keywords: chitin, invasive crustacean, FT-IR, TGA

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ATP EXTRACTION FROM CHO CELLS AFTER ELECTROPORATION

M. Sereika[1], B. Jakštys[1], S. Šatkauskas[1]

[1]VYTAUTAS MAGNUS UNIVERSITY, FACULTY OF NATURAL SCIENCES, LITHUANIA
M.SEREIKA@GMAIL.COM

Abstract

The cell membrane is a barrier which separates cell internal structures from the outside of the cell. Barrier function of the cell membrane can be modified by electroporation (EP). During EP high-voltage short electric pulses cause the permeabilization of the plasma membrane for various molecules (anticancer drugs, DNA, RNA, biomarkers) due formation of hydrophilic pores. These pores can exist from few seconds to few minutes where ATP extraction might take place. ATP is the energy component of all living cells and its loss causes immunogenic apoptosis and has a significant effect on cell viability and is necessary to be investigated in order to better understand EP effects on cell viability. For experiments we used the CHO cell line. Cells were placed in an electroporation medium (0.1 S / m, 270 mOsmol, 7.2 pH sucrose basis) and electroporated using the following parameters: 1, 5 and 9 high voltage (HV) pulses, pulse strength from 600 V/cm to 4200 V/cm, pulse duration was 100 μs, pulse repetition frequency was 1 Hz. PI and flow cytometry assays were used to evaluate the amount of irreversibly permeabilised CHO cells. Colony formation assay (CFA) was used to evaluate the final viable cell ratio. To detect ATP extraction, we used the Luciferase-luciferine ATP determination kit. Results revealed that 10 min after EP using 1, 5 and 9 HV pulses increasing the pulse strength from 600 V/cm to 4200 V/cm ATP extraction and amount of PI permeable cells were increasing accordingly. For example, ATP extraction at 1800 V/cm using 9 HV was 2,43 ± 0,56 times higher compared to control. 10 min after EP at 1800 V/cm using 9 HV amount of PI permeable cells was 58,4 ± 3,22 %. However, 30 min after EP it was reduced to 38,2 ± 3,66 % indicating time dependent alterations in plasma membrane permeability after EP. CFA results have shown that the final cell viability after 6 days at 1800 V/cm using 9 HV was 14,8 ± 0,84 %. In summary, we demonstrated that: 1) ATP Extraction from CHO cells grows with increase of intensity of electric pulses; 2) cells exposed to weak EP conditions restored the membrane within 10 min, 3) CHO cells affected with heavy EP conditions began to die both necrotic death and death caused by secondary processes that began in cells after EP.

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BINDING METAL IONS BY FLAVOLIGNANS

Hanna Chubarova[1], Maxim Kapustin[1], Vladimir Kurchenko[1]

[1]BELARUSIAN STATE UNIVERSITY, BIOLOGY DEPARTMENT, BELARUS
CHUBAROVA.HANNA@GMAIL.COM

Abstract

Environment pollution by various pollutants leads to their presence in food products. These substances can be accumulated in the internal environment of the body. Often these pollutants are ions of different metals.

The milk thistle fruits are rich in flavolignans – phenylpropanoid compounds, the composure of which is called silymarin. The predominant flavolignanes contained in silymarin are: silybinin, silycristin and silydianin. In vitro and in vivo studies, it has been established that silymarin and its constituent flavolignans exhibit a number of important biological activities.

The processes of complex formation major flavolignans with ions of copper (II), aluminum (III), zinc (II), iron (II), iron (III), magnesium (II), cobalt (II) and lead (II) in methanol were studied.

Based on the data obtained, it can be concluded that in methanol silybinin, silycrystin and silydianin form complex compounds with copper (II), zinc (II), iron (II), magnesium (II), cobalt (II) and lead (II) ions, in the ratio 3:2. It should be noted that the absence of a double bond in the C ring in silybinin leads to the formation of complexes with higher stoichiometry.

Complexation is accompanied by changes in the absorption spectra of the original flavolignans in the absorption band I, where a new maximum absorption occurs in flavolignans. The similar in their spectral changes suggests that the main role in this process is played by the hydroxyl group at the 3 position and the oxo group at the 4 position in the C ring. The catecholastic part of the B ring plays a secondary role. In the literature there is evidence that quercetin forms complexes with a 1:1 stoichiometry in the acid medium and 3-hydroxy and 4-oxo groups of the C ring participate in it, and in the alkaline medium, due to the additional participation of the catechol group, complexes with high stoichiometry – Me:Ligand 1:2. Flavolignans do not have a double bond in the C ring and the catechol group in the B ring, which leads to other spectral changes in band I during the chelation of metal ions. The structural features of these molecules are the result of the formation of complexes with high stoichiometry: Me:Ligand – 2:3.

Analysis of the formation constants values of complexes for the investigated flavolignans showed that, due to the presence of a double bond in the C ring, quercetin and morin form stronger complexes in methanol than taxifolin and flavolignans. It should be noted that stronger complexes have higher molar extinction coefficients.

The results of the study can be used during development and production functional food products. Adding flavolignans to daily food, for instance butter, can increase its shelf-life and will reduce the load on the body of various pollutants.

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BIOACTIVE COMPOUND PRODUCTION BY DUNALIELLA SP. UNDER DIFFERENT CONDITIONS AND ITS ANTIMICROBIAL ACTIVITY AGAINST STAPHYLOCOCCUS AUREUS SUBSP. AUREUS (ATCC® BAA¬976TM)

Nur Kocberber Kilic[1], Gönül Dönmez[1]

[1]ANKARA UNIVERSITY, FACULTY OF SCIENCE, DEPARTMENT OF BIOLOGY, BEŞEVLER, ANKARA, TURKEY
NRKILIC@ANKARA.EDU.TR

Abstract

Bioactive compounds sourced from microalgae are of special interest in having different properties such as antimicrobial, antioxidant, antiviral and antitumor. Extremophile microorganisms have survival capability under extreme conditions like high salt concentration and high temperatures. Therefore, they are good alternatives in biotechnological applications and productions. Halophile microalgae Dunaliella sp. is also very interesting related to the compounds produced under extreme conditions.

In this study, Dunaliella sp. was obtained from Ankara University, Faculty of Science Laboratories' current culture collection. Dunaliella sp. was investigated in order to determine its antimicrobial properties under different conditions like media with different nitrogen, NaCI concentrations and light intensities. To find the most effective bioactive compound, microalga was cultivated in Johnson's media under continuous light intensity as 2400 lx at a growth chamber for 14 days (30 ºC). At the end of the incubation period, algal biomass was obtained by centrifugation. Freeze-dried biomasses were exposed to ethanol solvent and algal extracts were attained. Antimicrobial activity was done with paper disc diffusion method with using S. aureus subsp. aureus (ATCC® BAA976TM).

Results showed that Dunaliella sp. had effective bioactive compound when microalgae was cultivated in media with 1 g/L nitrogen. With an increase in NaCI concentration and light intensity, antimicrobial activity of extracts from microalgal biomass obtained under these conditions was also increased.

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Nur Kocberber Kilic[1], Gönül Dönmez[1]

[1]ANKARA UNIVERSITY, FACULTY OF SCIENCE, DEPARTMENT OF BIOLOGY, BEŞEVLER, ANKARA, TURKEY
NRKILIC@ANKARA.EDU.TR

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BIOACTIVE COMPOUND PRODUCTION BY *DUNALIELLA SP.* UNDER DIFFERENT CONDITIONS AND ITS ANTIMICROBIAL ACTIVITY AGAINST *STAPHYLOCOCCUS AUREUS* SUBSP. AUREUS (ATCC® BAA976TM)

Nur Kocberber Kilic[1], Gönül Dönmez[1]

[1]ANKARA UNIVERSITY, FACULTY OF SCIENCE, DEPARTMENT OF BIOLOGY, BEŞEVLER, ANKARA, TURKEY
NRKILIC@ANKARA.EDU.TR

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Bioactive compounds sourced from microalgae are of special interest in having different properties such as antimicrobial, antioxidant, antiviral and antitumor. Extremophile microorganisms have survival capability under extreme conditions like high salt concentration and high temperatures. Therefore, they are good alternatives in biotechnological applications and productions. Halophile microalgae *Dunaliella sp*. is also very interesting related to the compounds produced under extreme conditions.

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BIODIVERSITY OF FAMILY LIMONIIDAE (DIPTERA: NEMATOCERA) IN LITHUANIA AND GENUS ANTOCHA

R. Markevičiūtė[1]

[1]NATURE RESEARCH CENTRE, AKADEMIJOS STR. 2, LT–08412 VILNIUS, LITHUANIA
RADVILE.MARK@GMAIL.COM

Abstract

The main objective of this research is to estimate the biodiversity of family Limoniidae (Diptera: Nematocera) in Žalioji giria forest (Panevėžys district) and in Dainavos giria forest (Varėna district). During the research 1 425 individuals were caught by an entomological net and a light trap. 60 species were found and 1 of them is new to Lithuanian fauna. This paper provides new data on dominant species, biodiversity and seasonal aspects of insect's flight.

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BIODIVERSITY OF FLIES (NEMATOCERA, DIPTERA) IN DEAD WOOD

I. Gorban[1], V. Podėnienė[1]

[1]VILNIUS UNIVERSITY, LITHUANIA
INAGORBAN@GMAIL.COM

Abstract

The aim of this study was to investigate biodiversity of flies (*Diptera, Nematocera*) developing in dead wood. Wood is habitat for a vast amount of insect species, however no efforts at all were made to study saproxylic dipterans in Lithuania. During this investigation emergence traps were set up on five dead trees (four ash and one aspen tree) from May till November in Būda botanical-zoological reserve in Kaišiadorys district in 2016. During this period 1709 individuals emerged from dead wood which belonged to 13 different nematoceran families. The most abundant was family of Sciaridae with 373 individuals and 17 species,16 of them are new to Lithuania.

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BIOETHANOL PRODUCTION FROM FIVE CARBON SUGARS

Ekin Demiray[1], Sevgi Ertuğrul Karatay[1], Gönül Dönmez[1]

[1]ANKARA UNIVERSITY, BIOLOGY DEPARTMENT, TURKEY
SERTUGRUL@ANKARA.EDU.TR

Abstract

Global energy demand of the world is met by non-renewable energy sources such as not renewable fossil fuel. On the other hand it is necessary to explore alternative energy sources such as biodiesel, bioethanol, hydrogen etc. Because of it is obtained from renewable agricultural products or agricultural wastes and less toxic than fossil fuels, bioethanol is one of the most important alternative to fossil fuels. Bioethanol can be produced from different feedstocks. Althought it is easier to produce bioethanol from edible crops; cost of raw material, some ethical and environmental concerns are the major drawbacks for first generation bioethanol production. Lignocellulosic materials have considerable amount of hemicellulose. Hemicellulose is a source of pentose sugars such as xylose. *P. stipitis* is well-known pentose fermenter and there are numerous studies about bioethanol production of *P. stipitis*. Therefore many researchs have been focused on bioethanol production from lignocellulosic biomass. Lignocellulose represents the most underutilized and cheap resource on the Earth. It also has low price, rich carbonhydrate content and does not compete with edible crops. Therefore in this study we have investigated the bioethanol production capacity of important lignocellulosic feedstocks such as carrot pomaces and sugar beet molasses using by *P. stipitis*. Important parameters for fermentation such as pH and initial biomass loading were also investigated.

Pichia stipitis were obtained from NRRL Culture Collection. Before the fermentation yeasts were incubated at YPD medium. For fermentation experiments pH values of the molasses and carrot pomaces media were adjusted to pH 5, pH 6, pH 7 respectively. To determine the optimal initial biomass loading increasing molasses and carrot pomace concentrations were prepared.

According to our results, *P. stipitis* produced 2.13 and 1.49 g/L bioethanol in the presence of 60 g/L initial molasses and 120 g/L carrot pomaces loading, respectively. Maximum ethanol concentrations were observed at 24 hours.

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BIOLOGICAL AGE OF TEMPORARILY RELOCATED STUDENTS IN UKRAINE

Zoryna Boiarska[1], Oksana Radzikhovska[1]

[1]VASYL' STUS DONETSK NATIONAL UNIVERSITY, UKRAINE
Z.BOIARSKA@GMAIL.COM

Abstract

The whole world know about the tragedy in Eastern Ukraine. Military actions have affected all residents of the country, especially the residents of Donetsk and Luhansk regions. Many citizens had to be evacuated, including young people and students. The lifestyle of modern students has a number of characteristics. The motor activity of students has decreased while the informational load is increasing. In Ukraine, the socio-economic situation sharply has got worse, this affected the living conditions and nutrition of students. These features affect the body defence and lead to the of chronic diseases development. The indicator of "wear" of physiological systems is the biological age of a person. Biological age is an integral indicator of the aging organs and human biological systems. When the biological age is the same as the chronologic age, it is perfect. However, in Ukraine the average biological age of the population is higher. Ukraine in the rating of life expectancy gets 103 place out of 168 countries. The average life expectancy is 68.6 years. Therefore, the attention of science should be directed to studying the leading factors of aging in modern conditions among young people. Our goal is to study the changes in physiological systems of the students-migrants in 2-4 years after the evacuation. We have surveyed 106 students of Donetsk National Vasyl Stus University (the University was moved to the city of Vinnytsia in 2014, because of the occupation of Donetsk city). We have got 95% of the complaints on the health conditions (on the scale of self-assessment of health). In a separate group we studied the biological age of male-students, immigrants from Donetsk and Lugansk regions. It is established that their biological age on the average is 41.3 years (the passport age is 21.8 years), which is 89.4% more than the chronologic age. When examining young male-students of the same chronologic age, the biological age is 37.6 years (the passport age is 20.5), which is 83.4% higher than the calendar age. It is worth noting that an interesting pattern was found while determining the biological age of girls in the control and study group. The biological age of the migrant girls increased to 29% comparing to the passport age, and 46% of the girls permanently alocated in the Vinnytsia region. Thus, the male-migrants have an increased rate of aging. At the same time, students who did not withstand the evacuation after-effects have an increased rate of aging. It is necessary to find out the cause of this phenomenon. The aging rate of girls does not progress so much, but a correction of the psychoemotional state is required in relation to a sufficiently high index self-esteem of health.

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BIOLOGICAL TREATMENT OF CR(VI) FROM WASTEWATERS WITH USING THERMOPHILE MICROALGAL CELLS

Elif Safran[1], Nur Kocberber Kilic[1], Gönül Dönmez[1]

[1]ANKARA UNIVERSITY, FACULTY OF SCIENCE, DEPARTMENT OF BIOLOGY, BEŞEVLER, ANKARA, TURKEY
NRKILIC@ANKARA.EDU.TR

Abstract

Heavy metals are the most widespread pollutants in the environment. Within all the heavy metals, especially Cr(VI) has high toxic effect and caused serious health problems for humans. For this reason, Cr(VI)-contaminated wastewaters have to be treated. Biological treatment methods are preferable related to their cost-effective, safety and efficiency. Usage of thermophile microalgae as a biosorbent to remove heavy metals is a promising and alternative biological method.

In this study, thermophile microalga was used to remove Cr(VI). To determine the effect of pH onto bioremoval process, experiments were done under different pH levels as 6.5, 7.5, and 9.5 in BG11 medium. Trials were also performed with increasing pollutant concentrations (5, 10, 15, and 40 mg/L) under 2400 lx light intensity for an incubation for 5 days at 30 ºC. The concentration of Cr(VI) in the supernatant was determined spectrophotometrically (540 nm).

Chromium (VI) bioremoval by microalga was its highest yield as 33.1% at pH 9.5. When pollutant concentration increased, microalga was affected negatively and bioremoval efficiency decreased.

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AGING MARKERS IN THE CELLS OF PATIENTS WITH COCKAINE SYNDROME. GENERAL AND INDIVIDUAL DIFFERENCIES

P.A. Slizhov [1]

[1]*HERZEN STATE PEDAGOGICAL UNIVERSITY OF RUSSIA, DEPARTMENT OF BIOLOGY, RUSSIAN FEDERATION*
MAIDEL@BK.RU

Abstract

The Cockayne syndrome is a rare autosomal recessive disease, described in the 1930s by Edward Alfred Cockayne. Patients suffer from cachexia dwarfism (when the weight is lowered compared to the norm even more than the growth), photosensitivity, deafness, various visual impairments: optic atrophy, cataracts, degeneration of the corneal epithelium, retinal injuries, as well as neurodegenerative symptoms, such as partial demyelination of subcortical structures, increase in ventricular size, cerebral atrophy, calcification of basal ganglia. The average life expectancy of patients with the Cockayne syndrome is 12 years. In the cells of patients with the Cockayne syndrome, the process of nucleotide excision repair (NER), its branch transcribed coupled with transcription (transcription coupled repair, TCR, TC-NER) is disrupted. We have established that all the aging markers studied are strongly expressed in the cells of patients with the Cockayne syndrome. Thus, the idea of the Cockayne syndrome as a syndrome with expressed cellular signs of accelerated aging is confirmed This allows us to consider the Cockayne syndrome as a segmental progeria and use cell lines obtained from patients as model objects for studying the processes of aging and testing geroprotectors.

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APPLICATION OF LIOPHILIZED CORD BLOOD FOR TREATMENT OF GENITAL HERPES (EXPERIMENTAL STUDY)

Viktoria Stetsyshyn[1], Ludmila Ostankova[1], Nikolay Bondarovich[1], Olena Lutsenko[1], Igor Grisha[1]

[1]INSTITUTE FOR PROBLEMS OF CRYOBIOLOGY AND CRYOMEDICINE OF THE NATIONAL ACADEMY OF SCIENCES OF UKRAINE, DEPARTMENT OF CRYOPATHOLOGY AND IMMUNOLOGY, UKRAINE
STETSYSHYNV.G@EMAIL.UA

Abstract

Nowadays certain results have been achieved in the study of genital herpes (GH) etiopathogenesis, which is defined as immuno-mediated dermatosis. The main task of optimized approaches to its treatment is the suppression of reproduction of herpes simplex virus of type 1 (HSV-1) and formation of an adequate immune response. In this study, a lyophilized leucoconcentrate of human cord blood (lLHCB) was used as an immunocorrector. The research aim was to evaluate the effectiveness of lLHCB as an immunocorrector during treatment of genital herpes in rats. Materials and methods. Experiments were carried out in 6-month-old Wistar female rats, weighing 180-200g. Genital herpes was simulated by intraperitoneal injection of 1 ml of HSV-1 (1:20,000). LHCB was lyophilized as reported by Goltsev A.N., et al. (2016). Pre-diluted with distilled water lLHCB was injected intraperitoneally by 0.5 ml at a concentration of 5*106 cells by day 5 after induction of GH. Acyclovir (ACV) was administered at a dose of 50 mg/kg of rat weight daily for 5 days. The rats were divided into the groups: 1 – intact (control); 2 – GH; 3 – GH+ACV; 4 – GH+ lLHCB; 5 – GH+lLHCB+ACV. Evaluation of indices of cellular (CCIS) and humoral (HCIS) components of immune system, endometrial structure in rats was performed by the 3rd, 7th and 14th days after induction of GH and its treatment. Results and discussion. The obtained data testify to the expressed immunomodulating effect of lLHCB on the state of immune homeostasis of animals with GH. Application of lLHCB with ACV more than the one of ACV, provided recovery of IS indices. The performed therapy promoted the normalization of CD3+, CD4+, CD8+ and CD4+ CD25+ (T-reg) cells. There was established a certain correlation between the changes in the content of immune competent cells in spleen, the indices of circulating immune complex and C-reactive protein, the profile of inflammatory and anti-inflammatory cytokines, and the structure of endometrium. Conclusions. The effectiveness of complex treatment of GH by the administration of lLHCB with ACV has been experimentally proven. The amplifying immunocorrecting effect of lLHCB was shown under conditions of pathology modified IS of animal.

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BLUE FLORESCENCE PROTEIN (BFP) TRANSFER IN TO ARABIDOPSIS THALIANA GENOME

Algirdas Kazlauskas[1]

[1]*VMU , APPLIED BIOTECHNOLOGY, (TAIKOMOJI BIOTECHNOLOGIJA) MASTER'S SECOND YEAR STUDENT , LITHUANIA*
ALGIRDO@YAHOO.COM

Abstract

A Golden Braid is a golden gate based DNA constructing method. BFP was used for easy markers for future gene editing in order to try this method.

Plant Arabidopsis thaliana was used for convenience, because *Arabidopsis thaliana* DNA is fully known and has good transformation documentation.

DNA was selected (CaMV 35S , The CaMV 35S promoter, CaMV 35S terminator and pDGB3_alpha1) to construct a vector to transfer BFP using Golden Braid library. *E.coli*, containing needed DNA parts, was grown and selected using blue–white screen, grown and plasmids harvested.

One single target plasmid was created from plasmids containing DNA parts ,using golden gate cloning technics and transfered to *E.coli*, grown, and selected using blue–white screen, then grown and plasmids harvested , plasmids transferred to Agrobacterium, in order to use in *Arabidopsis thaliana* transformation.

Arabidopsis thaliana was transformed using floral dip method. Seeds were grown in antibiotic medium to find transformants alive and well seedling was separated, grown, under UV lamp some plants glowed blue.

By confirming that the Golden Braid method works, new construct containing CRISPR/Cas9 will be tested to make more specific transformations.

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CONTENT OF RADIONUCLIDES IN FOREST CULTURES IN VINNYTSK REGION HOUSEHOLDS IN THE DEPENDENCE FROM THE POLLUTION ZONE

Valentyna Panko[1]

[1]*VASYL' STUS DONETSK NATIONAL UNIVERSITY, VINNYTSIA UKRAINE*
PANKO.VALENTYNA@MAIL.RU

Abstract

Based on the data obtained during the scientific and economic experiment, it has been proved that contamination of radioactive substances of agricultural feeds in the Vinnytsia region indicates a decrease in pollution levels in 2015 compared with 2010. In crop production there is a slight reduction of radioactive material (grain, potatoes, vegetables, silage), a sharp decrease in radionuclide observed in green mass and hay and straw only a slight increase. As a result, agricultural research exceeded permissible levels of radionuclides in comparison with State sanitary standards "for permissible levels of radionuclides 137Cs and 90Sr in food and drinking water" is not found.

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COPPER BIOACCUMULATION STATUS AND PHYTOREMEDIATION POTENTIAL OF SOME AGRICULTURAL PLANT SPECIES GROWING IN POLLUTED AGRICULTURAL LANDS OF ARMENIA

Ghazaryan Karen[1], Ruzan Avetisyan[1], Hrant Zhamharyan[1]

[1]CHAIR OF ECOLOGY AND NATURE PROTECTION, FACULTY OF BIOLOGY, YEREVAN STATE UNIVERSITY, ALEX MANOOGIAN ST. 1, 0025 YEREVAN, REPUBLIC OF ARMENIA
KGHAZARYAN@YSU.AM

Abstract

Continuous environmental contamination is a global problem and hence the pollution of agricultural lands by heavy metals, which is directly connected to human health and ecological safety, is a critical challenge for the scientists. Currently the heavy metals pollution of agricultural lands through mining industry is one of the most severe ecological problems in Armenia.

The aims of our studies were the investigation of topsoil physicochemical properties, Cu concentration in agricultural plants growing on these soils as well as the estimation of the risk level of studied agricultural plants for human health and the detection of their phytoremediation potential. In fresh shoot mass the highest concentrations of copper were observed in garlic (13.7 mg/kg) and coriander (12.2 mg/kg), whereas in dry shoot mass the highest contents were registered in onion (59 mg/kg), garlic (52 mg/kg) and spinach (51 mg/kg). Actually in dry and fresh mass the highest contents of copper were observed in different plants and this fact is conditioned by different content of water in these crops. In fresh and dry root masses the greatest contents of copper were found in maize (36.4 and 85 mg/kg, respectively) and lettuce (32.5 and 92.6 mg/kg, respectively). The highest contents of copper in fresh and dry masses of edible parts of agricultural plants were observed in leaves of horseradish, used as pickles (16.2 mg/kg and 45.9 mg/kg, respectively). Maximum permissible concentration (MPC) of copper in fresh mass of agricultural products is 10 mg/kg. Study results show that from agricultural plants used as foodstuff the exceeding of MPC was observed in coriander, in garlic and in leaves of horseradish.

The assessment of phytoremediation potential of agricultural plants was performed using bioconcentration factor of root (BCFroot) and translocation factor (TF). Allowing for the fact that BCFroot value of maize is rather high (25.91) and it forms a strong rootage as well as the circumstance that meanwhile the TF value is low (0.51), this plant species is advisable to use for phytoremediation purposes. Specifically its aerial parts may be used in agricultural purposes (copper contents do not exceed maximum permissible concentrations there) while the underground parts should be removed from the site. High BCFroot value is also observed in lettuce but its rootage is not such strong and this circumstance decreases its phytoremediation potential.

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DETERMINISTIC APPROXIMATION OF STOCHASTIC SPATIALLY EXPLICIT MODEL OF ACTIN-MYOSIN INTERACTION IN DISCRETE FILAMENT LATTICE: FORMULATION AND APPLICATION TO MODELING OF THE TRANSIENT OSCILLATORY RESPONSE OF MUSCLE

A.Mishchenko[1], G. Taradina[1]

[1]"VASYL' STUS" DONETSK NATIONAL UNIVERSITY, BIOPHYSICAL DEPARTMENT, UKRAINE
A.MISHCHENKO@DONNU.EDU.UA

Abstract

One of commonly used approaches of biophysical modeling of muscle contractile apparatus is spatially explicit discrete lattice models in Monte-Carlo simulation. Such models allow to reproduce structural features and actin-myosin interaction in the muscle contractile system more accurately. Limitation of such models is their low computational efficiency and stochasticity under certain circumstances.

An innovative method for deterministic ODE approximation of stochastic spatially explicit model of single pair of rigid thick and thin filaments is introduced in this study. Approximation background is discreetness of spacing between cross-bridges and binding sites. Due to this property cross-bridges can be divided into discrete groups with the same strain and considered statistically using the set of ODE. Application of such ODE model allows to avoid extensive calculations associated with the use of Monte Carlo simulation of the spatially explicit model. ODE model retains information about constraints imposed on actin-myosin interactions caused by their arrangement in discrete filament lattice, it operates with average values. The proposed approach can also be applied to approximation of continuous Huxley-based PDE models solutions. Advantage over existing numerical methods is their greater numerical stability. Within suggested approach, simulation of isotonic transient response to a force step was considered. Experimental studies have shown that transient responses at the level of muscle fibers, single sarcomeres and single pair of contractile filaments may have oscillatory (stepwise) character. It is submitted, that this phenomenon can be related with structural restrictions imposed by filament lattice on myosin and actin interaction. Indirectly, this is indicated by quantitative relations between the parameters of oscillatory dynamics and geometrical parameters of the lattice. However, the mechanism of stepwise motion under isotonic response remains unclear. In some previous theoretical models this phenomenon has been interpreted as collective behavior of cross-bridges which in turn is closely related with sarcomere structure, and namely with discreetness of filaments lattice. However, in those models no quantitative agreement with oscillation parameters of experimental isotonic responses was reached. In our work, based on the principles which underlie the approximation as well as simulation results, we conclude, that such disagreement has principal character and it is unlikely to explain the experimentally observed length oscillations only on the ground of cooperative effects in myosin cross-bridges related to restrictions imposed by discrete filament lattice on myosin and actin interaction.

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ECOLOGICAL ASPECTS OF DEVELOPMENT OF FUNERAL BUSINESS IN MEGAPOLIS

Volkova Nadezhda[1], Golovachova Irina[1]

[1]RUDN, ECOLOGICAL FACULTY, RUSSIA
NADEZHDA-VOLKVA-1997@MAIL.RU

Abstract

The process utilized of dead body, whatever it is, goes hand with of human development that is what differs as from animals: only humans bid farewell to the deceased and escort to the final resting. Place with further bodies utilized. There are some special places for deceased: cemeteries, towers of silent, columbarium and etc. Kinds of body's utilization are permanent during all humans' existence with technical improvement.

In temperate latitudes it is a traditional to bury into the ground or cremate bodies because of environmental conditions. Nowadays we don't pay enough attention to ecological consequences of body's utilization in metropolis. There are few scientific researches that study influence of cemeteries to environment and to human Meanwhile, concentration citizens is increasing every year city's boundaries are expending and earlier country cemeteries are being changed and people changed the natural around them so much that we have to review long-standing traditional of body's utilization.

In our project we represent different trends of development of funeral business on megapolic and there are analysis from environmental point of view. During the first part of our research it is necessary to understand historical cultural of burial and its geological expansion in town. During the second part of research we review anthropogenic congestion of town, because of load on ecosystem (the soil, underground water, air-circulation). It can change ecosystem of cemetery, which could satisfy sanitation and hygiene rules before. We should say that old burial places are save if 50 years past since last burial. During the third part of our research we will review theoretic ways of development of funeral business based on combination of sociocultural, natural and anthropogenic facts.

For support conservative way of development, it is traditional of burial is necessary consider whatever the self-cleaning ability this soil have. The cemetery is geochemical anomaly and? If you know feature of place, to it is necessary to foresee interaction of soil with underground water and with fauna without allowing of disturbance of sanitation and hygiene aspects, it is easy make, is selected correct depth of burial. For new burials are selecting places, which don't flood (an any season), but not on the height, and on opposite slope from settlement; the soil shouldn't contain of many clays or sand in order to avoid of saponification and mummification. For safe cremation it is necessary to use of filters and system of a burn up.

There are alternative ways of development of funeral business(with use of new technologies): resomation, promessa and different kind of ecological burial, and memorial brilliants and space burial.

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COPPER PHYTOREMEDIATION POTENTIAL OF NATIVE PLANT SPECIES GROWING IN THE MINE POLLUTED AREAS OF SOUTH ARMENIA

K. Ghazaryan[1], S. Antonyan[1], H. Movsesyan[1]

[1]CHAIR OF ECOLOGY AND NATURE PROTECTION, FACULTY OF BIOLOGY, YEREVAN STATE UNIVERSITY, ALEX MANOOGIAN ST. 1, 0025 YEREVAN, REPUBLIC OF ARMENIA
KGHAZARYAN@YSU.AM

Abstract

Nowadays the pollution by heavy metals from mining industry is one of the biggest threats to ecosystems and human health. Objectives of present study were the identification of Cu phytoremediation potential of native wild plant species growing in contaminated soils of mining region and the determination of soil main characteristics affecting Cu accumulation capability of plants. In this study sixteen native wild plant species growing in Cu contaminated soils of mining region in Armenia were investigated to reveal their phytoremediation potential. In roots (dry weight) of dominant plant species growing in Cu contaminated areas the content of copper varied between 55 mg/kg (*Hypericum perforatum*) and 775 mg/kg (*Thymus kotschyanus*), and in shoots of plants - in the range from 33 mg/kg (*Teucrium orientale*) to 243 mg/kg (*Phleum pratense*). Since the Cu accumulation capability of plants depends both on physiological peculiarities of plants and on the content of Cubioavailable in the soil, the studies were carried out in this direction and it was found that the high contents of humus and clay in the soil facilitated the decrease of the ratio Cubioavailable/Cutotal and as a result - the decrease of Cu accumulation capability of plants. Bioconcentration factor of root (BCFroot) and translocation factor (TF) are the important indices for revelation of phytoremediation potential. High BCFroot is a significant characteristic of plant species for phytostabilization suitability. The highest BCFroot values were registered in *Thymus kotschyanus* (BCFroot=4.84), *Phleum pratense* (BCFroot=4.64) and *Achillea millefolium* (BCFroot=3.94). High TF is a significant characteristic of plant species for phytoextraction suitability, but for phytostabilization suitability a low translocation factor is required. The highest TF values (>1) were observed in *Hypericum perforatum* (TF=1.27) and in *Astrodaucus orientalis* (TF=1.19). This fact indicates that mentioned plants by active mechanisms transfer the copper to their aboveground parts and it can be removed from the soil through harvesting. *Thymus kotschyanus*, *Phleum pratense* and *Achillea millefolium* had the highest phytostabilization potential from all studied plant species due to high BCFroot and low TF values registered in these plants, and further field and laboratory experiments are planned to confirm this useful ability for remediation of copper contaminated soils.

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CARBON OF DEAD BIOMASS OF BLACK ALDER FORESTS IN UKRAINIAN POLISSYA

A. Bilous, U. Kotlyarevska[1]

[1]NATIONAL UNIVERSITY OF LIFE AND ENVIRONMENTAL SCIENCES OF UKRAINE, EDUCATION AND RESEARCH INSTITUTE OF FORESTRY AND PARK GARDENING, UKRAINE
BILOUS@NUBIP.EDU.UA

Abstract

For estimation of biometric characteristics of black alder forests, were using the database of the Ukrderzhlisproekt Production Association of the Ukrainian Polissya which is represented by more than 116 thousand forests plots. In results, the main section within the research region indicate that 95.9 % of medium and high-level relative stocking of forests, most of the alder forests have sprout reforestation (84.4 %), the most middle-aged (49.6 %) and mature (21,5 %) forests, net by the composition of the stands are 30.4 %. The most common type of forest vegetable conditions for black alder is edotop C4 – 76 % of alder forest grow under these conditions. High-yielding stands represent 74 % of the area occupied by alder forests.

In order to determine the snags and logs of alder forests of Ukrainian Polissya, forest management data on the snags and logs was used for 3,5 thousand forests inventory plots of forest enterprises. In the alder forests on an area of more than 13 thousand hectares 145 thousand m3 of snags are estimated, as well as on 4 thousand hectares – almost 41 thousand m3 of logs. In the alder forests, where snags and logs are recorded, the average snags stock is 11,0 m3·ha-1, and the logs is 10,2 m3·ha-1. It is established that the total carbon content of dead biomass is 39.9 GgC.

In general, there were used the data of 40 temporary research plots (TRP) for forest dead biomass research in the modal alder forests, including 40 TRP with snags assessment and 17 TRP – the logs, and 15 TRP – the woody debris of branches and fine litter. There were selected 240 stem samples of snags dead biomass, 255 samples of logs of the 4th destruction classes, 225 samples of branches woody debris and 135 samples of fine litter on 17 TRP, according to the results of research.

For the patterns determination of dead biomass components dynamics, the modeling of its components and general alder forests dead biomass is carried out on the basis of experimental data for the application of various combinations of influence factors (average diameter, average height and relative stocking of the stands). According to the results of this simulation, models for determining the amount of snags, logs, woody debris of branches, fine litter and general alder forests dead biomass of the Ukrainian Polissya have been developed.

Based on the developed models for the establishment of a common dead biomass of alder forests and a section database of the forest fund of Ukraine, there was estimated that in the total alder forests dead biomass of the Ukrainian Polissya 3.39 Tg C had been accumulated. There was estimated that the dead biomass carbon stock of alder forests according to forest inventory data is 85 times lower than the data obtained from research results.

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THE INFLUENCE OF THE FEEDING ON DIFFERENT HOST PLANTS ON THE CYTOCHROME P450S ACTIVITY IN THE DAUGHTER STRAINS OF *MYZUS PERSICAE*

R.S. Shulinski[1], N.V. Voronova[1], V.A. Astramovich[1]

[1]BSU, ZOOLOGY DEPARTMENT, BELARUS
SHULINSKY@MAIL.RU

Abstract

Aphids are regarded as one of the major pests of crops and cause high economic damage worldwide both through direct feeding on phloem sap and as powerful vectors of plant viral pathogens. Since plants have developed a system of protection against phytophagous, the main component of which is the production of secondary metabolites with insecticidal and/or repellent activity, phytophagous insects had to withstand the toxic effects of substances ingested in their bodies in the process of feeding and capable of rendering lethal or depressing effect on insect vital systems. Aphids have formed a strong protective system against insecticide treatment, because many current insecticides are analogues of plant alkaloids. Several detoxification systems have been associated with allelochemical metabolism, the most important is being the cytochrome P450 monooxygenases (P450s). We estimate P450s activity in the daughter strains of green peach aphid, *Myzus persicae*, associated with different host plants producing different levels of allelochemicals.

The experiment used genetically identical daughter strains of aphid M. persicae, feeding on the following host plants: *Capsicum annuum* L., *Beta vulgaris* L., *Daucus carota* L., and *Raphanus sativus* L. P450s activity was determined by the fluorescence method. Fluorescence was measured with an excitation wavelength of 390 nm and an emission wavelength of 460 nm. To calculate the significance between the mean samples, a nonparametric method of multiple comparison of the mean and one-way ANOVA were used.

The data were presented as a difference between the obtained data and the background fluorescence intensity of the substrate (fluorescence in control wells) in terms of 1 mg of tissue homogenate (fluorescence units/mg). The total number of samples was 390 imagines for each daughter strain of aphids.

The highest fluorescence activity in the tissue homogenate was observed in samples from aphids fed on D. carota (the average was 25.068 f.u./mg), less activity was measured in samples from *C. annuum* (the average was 17.087 f.u./mg), more less fluorescence activity was in the tissue homogenate of aphids fed on B. vulgaris (the average was 10.643 f.u./mg) and the lowest fluorescence activity was observed in the tissue homogenate of aphids fed on *R. sativus* (the average was 5.833 f.u./mg). As a result of statistical data processing, it was found out that the differences in the activity of P450s between all four groups were statistically significant ($p < 0.0001$). Thus, it is possible to conclude that the feeding of the daughter strains of *M. persicae* on different host plants is leading to a change in the activity of detoxification enzymes that is the most important in the view of the potential insecticide resistance.

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NOVEL APPROACH FOR NUMERIC CELL MORPHOLOGY DESCRIPTION AND CLASSIFICATION

Yura A. Karetin[1], Eduardas Cicinskas[2]

[1]NATIONAL SCIENTIFIC CENTER OF MARINE BIOLOGY, LABORATORY OF EMBRYOLOGY, RUSSIAN FEDERATION, [2]FAR EASTERN FEDERAL UNIVERSITY, SCHOOL OF BIOMEDICINE, DEPARTMENT OF PHARMACY AND PHARMACOLOGY, RUSSIAN FEDERATION
CICINSKAS@GMAIL.COM

Abstract

Describing cell morphology is a complicated matter. Cells are complex, non-Euclidean objects. As such, they are highly prone to misrepresentation due to subjective nature of human observer and his limited vocabulary. This determines wide spread use of statistically unverifiable language describing cell morphology. This limits the use of cell morphology, a highly cell-state-dependent parameter, for describing various molecular intricacies.

Nevertheless, there are ways to increase objectivity when describing cell morphology. Replacing human observer with a computer is one of them. While computer is not as flexible as human's mind, it will however, impartially, accurately and quickly describe anything, as long as it is provided with a proper set of instructions. As two-dimensional objects, cells closely resemble fractals. Mathematical apparatus for describing the latter is well developed.

In our study we used a combination of linear and non-linear descriptors (various cell dimensional characteristics, symmetry and roundness, fractal dimension and lacunarities, peculiarities of cell-encircling) to describe visually distinguishable, but verbally indescribable digitized cell images of highly polymorphic marine invertebrate immune cells (starfishes' *Aphelasterias japonica* and *Patiria pectinifera* (Echinodermata: Asteroidea) coelomocytes, and bivalve's *Callista brevisiphonata* (Mollusca: Bivalvia) hemocytes) to generate their "numeric code" – a unique set of cell-describing parameters. With it, we could reliably group cells belonging to different species. Furthermore, among cells belonging to animals of the same species, we could allocate subgroups, which we believe represents cells at different biochemical and functional cell-states. We argue that using this morphometric methodology for compiling "cell state – numeric code" library has a lot of practical applicability, e.g. for creating express ecological state evaluating system.

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PROGNOSIS OF MASS DISTRIBUTION OF STEM PESTS IN THE UKRAINIAN POLISSYA ZONE AND ITS RELEVANCE

Svitlana Loginova[1], Eduard Kavun[1], Grigoriy Khaetskiy[2]

[1]VASIL' STUS DONETSK NATIONAL UNIVERSITY, UKRAINE, CANDIDATE OF BIOLOGICAL SCIENCES AND ASSOCIATE-PROFESSOR OF BIOLOGICAL DEPARTMENT , [2]VINNITSIA NATIONAL AGRARIAN UNIVERSITY, UKRAINE, CANDIDATE OF GEOGRAFICAL SCIENCES AND ASSOCIATE-PROFESSOR OF AGRONOMY DEPARTMENT SVETAMAGNOLIA@GMAIL.COM

Abstract

One of the first steps in solving the problem of conservation and rational use of natural resources, and especially biological diversity in artificial ecosystems such as forests, is the inventory of harmful and useful fauna, the identification of spatial distribution of organisms and the introduction of mechanisms for regulating their numbers. At present, the data obtained are an important component of the monitoring of the population of forest stands with bark beetles. In addition to the account and supervision, the prognosis of the massive proliferation of stem pests in coniferous forests is of particular importance. It allows you to prematurely prepare for this type of pathology in the woods, strengthen surveillance of pests (Wermelinger, 2004), carry out preventive measures and develop appropriate methods of combating them. In Ukrainian Polissya, since 2012 and to date, there is a looming increase in the number of stem pests. For the spruce (*Picea abies*) predominant species is bark beetle typographer (*Ips typographus*). For pine (*Pinus silvestris*) , topical bark beetle (*Ips acuminatus*), hexahedral bark beetle (*Ips sexdentatus*) and small pineal loboid (*Blastophagus minor*) come to the forefront. The analysis of meteorological data (Galik, 2014), from 2007, convincingly suggests that underlying arid phenomena and their forest pathologies are the lack of precipitation and the increase in the sum of active temperatures. Taking into account the above - starting in 2016 and till now, the forest-pathological situation in coniferous forests of Ukraine on the example of Zhytomyr region remains complicated. The area of the forested areas affected by stem pests and, accordingly, the area of continuous sanitary felling significantly and rapidly increases. Therefore, pine plantations with a view to timely detection of cells (Mozolevskaiia, 1984) and the planning of appropriate sanitary-and-health measures for forest protection should be maintained under intensified reconnaissance surveillance.

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ENVIRONMENTAL RISK ASSESSMENT OF SOIL CONTAMINATION BY TRACE ELEMENTS AROUND OPEN MINE AND TAILING DUMP OF THE AKHTALA ORE PROCESSING COMBINE

K. Ghazaryan[1], H. Khachatryan[2]

[1]CHAIR OF ECOLOGY AND NATURE PROTECTION, FACULTY OF BIOLOGY, YEREVAN STATE UNIVERSITY, ALEX MANOOGIAN ST. 1, 0025 YEREVAN, REPUBLIC OF ARMENIA, [2]MINISTRY OF EDUCATION AND SCIENCE OF RA, ARMENIAN NATIONAL AGRARIAN UNIVERSITY, TERYAN ST. 74, 0009 YEREVAN, REPUBLIC OF ARMENIA
KGHAZARYAN@YSU.AM

Abstrac

One of the most considerable problems is the pollution of environment with heavy metals. Metal mining is an essential human activity to provide rough materials for our society. The development of mining technology enabled the progressive substitution in the 1950s of the old methods based on underground exploitation by modern and profitable surface extraction technologies. That is the reason that the volumes of metal extracted were increased. A similar process has occurred also in our studied area and the closed mine working not far from a city Shamlugh about 15-20 years ago was replaced by a more profitable surface extraction technologies. The main objective of this study is the assessment of the soils pollution level of the open mine and tailing dump of the surrounding territories of Akhtala ore processing combine by heavy metals.

The soils of two riskiest sites of this region were studied: surroundings of open mine near the Shamlugh town and surroundings of the Chochkan active tailing dam. The mountain cambisol was the main soil type in the study sites. To classify soil pollution level contamination indices like Contamination factors (Cf), Degree of contamination (Cd), Pollution load index (PLI) and Geo-accumulation index (I-geo) are calculated. The distribution pattern of trace metals in the soil profile dueto I geo, Cf and Cd values shows that the soil is very polluted. The PLI values for the 19 sites were >1, which indicates deterioration of site quality. The significant correlation between some of the heavy metals showed that the pollution of soils by heavy metals in the studied territory was directly due to human activities, particularly mining and smelting industry. The variation of high pollution with Cu and some heavy metals near the open mine and the surroundings of Chochkan active tailing dam was due to the character of industrial activities, the moving direction of airstreams as well as the physicochemical peculiarities of soils. It is actual case as the some parts of these highly polluted regions are inhabited by population, and also the agriculture is highly developed there. Taking into consideration that heavy metals can enter human body through soil-plant-human or soil-plant-animal-human chain causing various diseases, this is more urgent theme for investigation. Consequently it is highly important to study the concentrations and health implications of these heavy metals in residents of the Shamlugh town and the Chochkan village.

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REPORTED AND POTENTIAL BIOLUMINESCENT SPECIES IN LITHUANIA

Asta Malakauskienė[1]

[1]*KAUNAS BOTANICAL GARDEN OF VYTAUTAS MAGNUS UNIVERSITY, LITHUANIA*
ASTA.MALAKAUSKIENE@VDU.LT

Abstract

Bioluminescent species are those producing and emitting light by chemical reactions and using it for a wide range of functions important for survival, hunting, hiding, mating, recognizing, communicating and so on. Studies on Lithuanian bioluminescent species biodiversity are scarce. The aim of this study was to review available information about reported and potential (found near the border of the surrounding countries and having potential of migrating to Lithuania) bioluminescent species of fireflies, fungi, centipedes and mosses in Lithuania.

Two species of fireflies have long been known in Lithuania: *Lampyris nocticula* and *Phosphaenus hemipterus*. Female individuals of both species are glowing but do not fly, males fly but do not glow. Verbal confirmation of at least 6 different unrelated persons that glowing flying fireflies have been already spotted in western and southern regions indicate that probably the third species of fireflies is already migrating to Lithuania from Poland and Belorussia: *Phausis splendidula* is found in those countries and male individuals of the species fly and glow in the dark (females are glow but not fly). Glowing centipedes (*Geophilus sp*.) were reported to be found in Vilnius Antakalnis district in 2012, but exact species was not identified.

Several fungi species, which are found in Lithuania, have been mentioned as bioluminescent by different sources: *Armillaria mellea*, *Collybia tuberosa*, *Collybia radicata*, *Chlorociboria aeruginascens*, *Tricholoma sciodes* (glowing mycelium), some species of genus Mycena (glowing fruiting bodies). Some species were mentioned in folklore as glowing (which were called „nakcižibiai“, “žibanakčiai”, “naktižieda” meaning “shining ant night”): *Suillus bovinus*, *Clavaria botrytis* or *Ramaria botrytis*, according to the meaning the fruiting bodies should glow, but there are no written or photographed evidence, moreover, these species are not included in the global list of bioluminescent fungi species (bioluminescence of these species must be proved). Some bioluminescent fungi species, that have been reported in other countries (mostly in north eastern America and some European countries), are also found in Lithuania: *Xylaria hypoxylon* (until present no evidence of glowing in Lithuania have been reported), *Panellus stipticus* (not glowing in Lithuania). Speciments of *Chlorociboria aeruginascens* and *Xylaria hypoxylon* found in Kaunas Botanical Garden (Kaunas district) did not glow.

Rare bioluminescent moss species *Schistostega pennata* has been reported to be found in Lithuania in Biržai in 1998 (it was found on spruce tree windfall roots in a dense fir grove). It was included in the Red Book of Lithuania in 2000.

Keywords: bioluminescent, firefly, centipede, moss, fungus.

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SAND LIZARD (LACERTA AGILIS) MONITORING IN LATVIA

Andris Ceirans[1], Mihails Pupins[1]

[1]DAUGAVPILS UNIVERSITY, INSTITUTE OF LIFE SCIENCES AND TECHNOLOGIES, DEPARTMENT OF ECOLOGY, LATVIA
MIHAILS.PUPINS@GMAIL.COM

Abstract

Sand lizard monitoring was carried out in 2016-2017 as a part of State Amphibian and Reptile Monitoring Programme. Lizards were counted on transects located in three 5x5 km plots, one in Central Latvia (NE from Riga), one - in SE.Latvia (N from Daugavpils), and one – in N.Latvia (S from Valka). A total length of transects was 56.135 km. For each observation, distance at straight angle from observer's movement direction was measured to evaluate effective transect width for population density estimations. Main lizard habitats were ecotops of dry pine forests, ruderal habitats, dry meadows. Highest relative (observed) densities were in linear ruderal habitats of SE.Latvia (7-147 indiv/ha). In dry meadow habitat average lizard density was 6 indiv/ha. Among forest types used for forestry purpose in Latvia, highest densities were found in ecotops of dry pine forest type on poor sandy soils of Vacciniosa type (Latv:Mētrājs, see Bušs 1997) of SE.Latvia - 13 indiv/ha. On other plots, lizard densities in this forest type were lover: 6 indiv/ha – in C.Latvia, 4 indiv/ha – in N.Latvia. However, total lizard population on plots of SE and C Latvia was similar due to larger areas of of suitable ecotops (forest clearings, young sparse stands) on latter. Estimated total population densities on whole plots, taking into account lizards detection probabilities, were 254-444 indiv/km² in C.Latvia, 237-412 indiv/km²– in SE.Latvia, and 40-107 indiv/km² - in N.Latvia.

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THE HEAVY METAL UPTAKE POTENTIAL OF FRAXINUS EXCELSIOR INVOLVED IN GREEN INFRASTRUCTURE OF YEREVAN (ARMENIA)

Lilit Khachatryan[1], Hasmik Hovhannisyan[1]

[1]CENTER FOR ECOLOGICAL-NOOSPHERE STUDIES OF NATIONAL ACADEMY OF SCIENCES OF ARMENIA
LILIT.KHACHATRYAN.CENS@GMAIL.COM

Abstrac

This paper provides both the results from a decade-long (2007 through 2016) monitoring of the heavy metal uptake potential of Fraxinus excelsior L. (European ash-tree)-one of most widespread native tree species involved in the green infrastructure of Yerevan – Armenia's capital city, and the studied tree species condition assessment data. Ash-tree leaves were gathered throughout the city and then underwent lab pretreatment at the Center for Ecological-Noosphere Studies NAS RA. Measurements of contents of ten heavy metals: Pb, Hg, Ni, Mo, Cu, Zn, Mn, Cr, Sn, Ag in the leaf samples were done by the accepted atomic absorption method. One of major results generated from this research is that F. excelsior best takes up Pb, Ni, Mo, Hg and that over the studied period Ni and Mo remained persistently in the list of priority pollutants of urban ash-trees. Besides, the research allowed establishing a regularity of dynamic changes in Pb and Hg uptake by ash tree leaves. According to assessment data, condition of ash tree specimens involved in the green infrastructure of Yerevan is assessed as good. Collating between long-term data on heavy metal uptake by ash tree leaves and those on the studied tree species condition assessment has indicated that under the impact of diverse environmental factors F. excelsior is best tolerant to Yerevan's conditions and has a high heavy metal uptake potential. The obtained research results are intended for organizations involved in urban forestry and urban planning, etc. in Yerevan and other urban settlements enjoying similar environmental conditions.

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INFLUENCE OF ENVIRONMENTAL FACTORS ON ADAPTATION PROCESSES OF FOREIGN STUDENTS IN RUSSIA

Viktor Glebov[1], Elizabeth Anikina[1], Ksenia Mikhailichenko[1]

[1]PEOPLES' FRIENDSHIP UNIVERSITY OF RUSSIA (RUDN UNIVERSITY), RUSSIAN FEDERATION
VG44@MAIL.RU

Abstract

It is known that human health and performance depend on the functionality of the cardiovascular system (CCS), earlier and stronger than other media reacting to changes in climatic and geographical conditions (Aghajanian, 2006; Glebov, 2017). To assess the level of adaptation of foreign students in Russia, we conducted a study on a sample of African students (n=90). The study was conducted 2 times during the academic year (early September and late June) on three groups of subjects: first group - 30 students of the preparatory faculty (at the time of the study their stay in Russia did not exceed two weeks); second group - 30 students of secondary courses (2 - 3 course), who lived in Moscow for at least 2-3 years; third group - 30 students of final (4 - 5 course) courses. The influence of the complex of environmental factors on the level of sensorimotor reactions and the work of the CCS of African students was assessed. The study showed that by the end of the school year African students of the first group had a stress in the psycho-emotional state. The increase in the level of sensorimotor reactions in students of second and third groups indicates adaptation of the Central nervous system, increased efficiency and positive dynamics of adaptation processes and resistance to a complex of environmental factors. Assessment that the adaptation of the CCS to environmental conditions is a long-term process and occurs gradually: students of the first group by the end of the year are close to the failure of adaptation; in the future, students of the second group and third group, the stress of adaptation processes decreases, but does not reach the level of satisfactory adaptation, which is associated with a decrease in functional reserves of the body. Thus, the dynamics of psychophysiological processes shows that at different stages of training African students have different levels of adaptation. So at the initial stage of training (preparatory faculty) there is tension of psycho-functional systems of organism of trained African students. In the middle of the educational process (middle, 2-3 course) psycho-functional indicators stabilize at the physiological optimum functioning of the body. The students once more on the rise of intensity of work psych functional systems.

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INHIBITION OF NOS ACTIVITY AS AN EFFECTIVE ANTICANCER THERAPY AGAINST 7,12-DMBA RAT MODEL OF BREAST CANCER

Mamikonyan A.[1], Avtandilyan N.[2], Javrushyan H.[3], Trchounian A.[2]

[1]DEPARTMENT OF BIOCHEMISTRY, MICROBIOLOGY AND BIOTECHNOLOGY, YEREVAN STATE UNIVERSITY, ARMENIA., [2]DEPARTMENT OF BIOCHEMISTRY, MICROBIOLOGY AND BIOTECHNOLOGY, YEREVAN STATE UNIVERSITY, ARMENIA. RESEARCH INSTITUTE OF BIOLOGY, YEREVAN STATE UNIVERSITY, YEREVAN, ARMENIA., [3]RESEARCH INSTITUTE OF BIOLOGY, YEREVAN STATE UNIVERSITY, YEREVAN, ARMENIA.
ANAHIT.MAMIKONYAN@YSU.AM

Abstract

Increased NO generation in cancer cells may contribute to tumor angiogenesis by up-regulating vascular endothelial growth factor. The main question was addressed in this work, would treating the rats with NO-synthase (NOS) inhibitor NG-nitro-L-arginine methyl ester (L-NAME) affect the breast cancer developing and progression? A total of 35 adult female Wistar rats weighing 90-120 g were used. All conditions were in accordance with the rules of the Ethical Committee. Rats were divided into five groups (control, saline control, control L-NAME, DMBA control and DMBA+L-NAME, 7 rats per group). Rats in "DMBA control" and "DMBA+L-NAME" groups were administrated intragastrical by gavage each with a single dose of 20 mg/ml DMBA dissolved in 0.5ml olive oil and 0.5ml saline. Rats in "control L-NAME" and "DMBA+L-NAME" groups were injected by L-NAME intraperitoneally for 5 weeks (after 10 days of DMBA administration, every 3th day) in dose of 30 mg/kg body-weight in 0.25ml saline. Blood total nitrite anions was measured by the Griess assay (μg/ml blood). At the end of 20th week, rats in all groups were sacrificed by cervical decapitation under anesthesia. Histopathological examination in "DMBA control" group (2-4 tumors, 0.3-0.8cm) in 20th weeks has revealed the invasive ductal and lobular carcinoma, and in "DMBA+L-NAME" group (0-2 tumors, 0.1-0.4cm) only noninvasive ductal carcinoma. There was a significant difference in the timings of the deaths in "DMBA control" (1 in 12th week) and "DMBA+L-NAME" group (1 in 17th week). In DMBA control group significantly increased blood NO2- levels in 13th (78.2%), 16th (69.1%) and 20th (63.5%) week comparing to the control groups. Subsequent co-treatment with L-NAME blocked these increases in "DMBA+L-NAME" group, resulting in mean values lower those of the control groups (decreased 11.1% in 20th week). We conclude that NO deprivation by downregulation of NOS attenuated tumor growth and numbers, pathological progression and death rate.

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CHARACTERIZATION OF IMPREGNATED ACTIVATED CARBONS AND WATER TREATMENT RESIDUALS FOR COPPER(II) REMOVAL FROM AQUEOUS SOLUTIONS

Edita Zubrytė[1], Audronė Gefenienė[2], Danutė Kaušpėdienė[1]

[1]FTMC CHEMICAL TECHNOLOGY DEPARTMENT, LITHUANIA, [2]FTMC CHEMICAL TECHNOLOGY DEPARTMENT, LEU, LITHUANIA
EDITAZUBRYTE@GMAIL.COM

Abstract

The problem of environmental pollution by heavy metals is becoming more and more serious. Therefore, studies are needed to develop new cost effective and environmentally friendly methods. In this work, the adsorption of copper(II) ions from aqueous solutions was investigated using two different adsorbents: water treatment residuals obtained from Antaviliai drinking water supply station (Lithuania) and modified commercial activated carbon NORIT PK 1-3.

To enhance the adsorption capacity of activated carbon NORIT PK 1-3 towards copper(II) ions, it was impregnated with various environmentally friendly compounds by soaking in the solutions of different concentration of potassium hydrogen citrate, potassium sodium tartrate, tannin and oxalic acid. Potassium iodide, potassium permanganate, and silver nitrate solutions were also used for impregnation. Besides of these chemical reagents, activated carbon was treated with the iron(III) hydroxide sol, sol of soil particles and extract of wood ashes. For comparison, the removal efficiency for non - modified activated carbon was also determined. It was found that the efficiency of activated carbon NORIT PK 1-3 as copper(II) ion adsorbent depends on the chemical nature and the concentration of impregnant, as well as the duration of impregnation. The experimental data of equilibrium adsorption of copper(II) have showed that the most significant improvement of sorptive properties of activated carbon NORIT PK 1-3 was achieved by impregnation with aqueous 1 M potassium hydrogen citrate and 0.5 M potassium iodide solutions.

Deironing and demanganization of underground water without the addition of chemical reagents leads to the formation of eco-friendly waste. The sorption capacity of water treatment residuals as alternative sorbent to expensive activated carbon was tested. The comparison of experimental results of copper(II) adsorption in batch mode revealed that both the adsorbents water treatment residuals and potassium iodide or potassium hydrogen citrate-modified activated carbon demonstrate the high copper(II) removal efficiency. When the initial concentration of copper (II) is less than 2 mmol/L, the solution is purified by almost 100%. The adsorption mechanism of copper(II) was studied using Freundlich and Langmuir isotherms. Considering the good adsorption performances and environmentally benign nature, the water treatment residuals as well as impregnated carbons could be used for the removal of copper(II) ions fro

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BIOREMEDIATION OF NI(II) AND CU(II) BY MICROALGAL BIOMASS

Nur Koçberber Kiliç[1], Gönül Dönmez[1]

[1]ANKARA UNIVERSITY, BIOLOGY DEPARTMENT, TURKEY
GDONMEZ@ANKARA.EDU.TR

Abstract

As industrializations and urbanization increased, excess of pollutant were produced. These pollutants could contaminate water sources. Contaminants might be organic and inorganic chemicals. Of these, inorganic pollutants like heavy metals are known as the most toxic ones used in industrial applications such as electroplating, anticorrosive products, and metal alloy. Heavy metals like Ni(II) and Cu(II) can be used in several industrial applications. Thus, wastewaters including such heavy metals have to be treated. Biological treatment methods used in the treatment of such wastewaters are economical and environmental friendly. However, microalgae are recently good candidates in treating such wastewaters by safe, eco-friendly and not causing secondary pollution wastes.

In this study, Gonium sp. was obtained from Ankara University, Faculty of Science Laborato-ries' current culture collection. Experiments were done in media with increasing heavy metal concentrations as 5 mg/L, 10 mg/L, and 20 mg/L at pH 7 in BG11 media (including 2 g/L Go-nium sp. biomass) at an incubation period for 240 min. During the incubation period, 3-mL of samples were taken after 5 min, 120 min, and 240 min. Ni(II) and Cu(II) concentrations were determined spectrophotometrically by measuring the absorbance at 340 nm and 460 nm with using sodium diethyldithiocarbamate reagent as the complexing agent, respectively.

Bioremoval efficiency of Gonium sp. was found 48.5% in media with 5.4 mg/L Ni(II) after incu-bation for 5 minutes. On the other hand, the bioremediation yield was 49.8% in media with 4.9 mg/L Cu(II) after incubation for 120 min. It was concluded that Gonium sp. could be used as a biosorbent in Ni(II) and Cu(II)-polluted wastewaters.

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INFLUENCE OF METALS AND HALKOGENS NANOPARTICLES ON MESENCHIMAL STROMAL CELLS

Kuzmenko V.[1], Vasilenko I.A.[1], Stanishevskaya I.E.[1], Stanishevsky I.M.[1]

[1]PEOPLES' FRIENDSHIP UNIVERSITY OF RUSSIA (RUDN UNIVERSITY), RUSSIAN FEDERATION
KUZMENKO.VALERIA@GMAIL.COM

Abstract

Drugs consisting of silver are used in the prevention and treatment of bacterial and viral diseases. Selenium is used as antioxidant and antitumor preparations in pharmaceutics. The dose and form of these elements are important factors that determine biological activity and toxicity; it proved that the reduction of the particle size increases efficiency. Nanoparticles were obtained by chemical methods. The suspensions were analyzed using the cross-correlation method of photons. It was proved that the increase of concentration of silver nanoparticles 20-45 nm are observed of morphological changes and apoptosis of cells in the cell culture. Selenium particles with a minimum size of 500 nm and a minimum dose of 0.005 mg / ml cause a toxic effect: a decrease in survival rate, single morphology changes.

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BIOREMOVAL OF CU(II) FROM WASTEWATERS BY HALOPHILE MICROALGAL STRAINS

Kübra Erdem[1], Nur Kocberber Kilic[1], Gönül Dönmez[1]

[1]ANKARA UNIVERSITY, FACULTY OF SCIENCE, DEPARTMENT OF BIOLOGY, BEŞEVLER, ANKARA, TURKEY
NUR.KOCBERBER@GMAIL.COM

Abstract

Along with the increment of textile industry, the amount of wastewater that causes environmental pollution increases. Due to its toxic properties, wastewaters having high content of heavy metals cause serious damage to humans, the environment, aquatic ecosystems and living organisms. Halophile microalgae are an attractive alternative for their ability in high metal ion uptake compared to other microbial species.

In this study, four different Dunaliella strains (Dunaliella sp. 1, Dunaliella sp. 2, Dunaliella sp. 3, and Dunaliella sp. 4) were obtained from Ankara University, Faculty of Science Laboratories' culture collection. The strains were cultivated on Johnson medium at 30 º C for 14 days under continuous illumination (2400 lx). Dunaliella strains were tested with regard to their growth, bioremoval capacities and Cu(II) bioremoval in different pH levels (7, 8, and 9).

According to the data obtained, the highest Cu(II) removal was found for Dunaliella sp. 4 (72%) after incubation for 7 days. Therefore, further experiments were done with Dunaliella sp. 4. Microalga had the highest Cu(II) bioremoval capacity at pH 8.

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CARDIOPROTECTIVE PROPERTIES OF AMINOACIDS IN EXPERIMENT

V. Kardash[1], A. Korda [1]

[1]INSITUTE OF BIOCHENISTRY, BELARUS
MUCHADO@BK.RU

Abstract

Over the past decades we have evidence that the amino acids are not only the structural components of proteins, but they themselves can play the role of signaling molecules, thus being an important step in the major protective mechanism.

The aim of our study was to assess cardioprotective effects of the amino acids during heart ischemia.

Methods. We used methods of histological examination and quantification of antioxidant activity of cardiomyocytes after preservation of hearts from 88 adult male Wistar rats (weighing 250-300 g) for 3 hours in the following solutions: Krebs-Henseleit (control), Custodiol, which comprises histidine, 27.93 g (180 mM) and tryptophan 0.408 g (2 mM), and the Krebs-Henseleit with the inclusion of compositions of L-amino acids. Antioxidant activity of cardiomyocytes was determined by the ability of the isolated cells to inhibit the radical 2,2′-azinobis-(3-ethylbenzothiazoline-6-sulfonic acid) (ABTS•+) at the 10th minute of incubation (OksiStat, Belarus). Histological studies of the myocardium were performed by standard methods using hematoxylin-eosin staining.

Results. The most pronounced antioxidant activity of the myocardium were revealed in groups of rat hearts were incubated in Krebs-Henseleit solution with the inclusion of amino acids tryptophan - arginine, tryptophan - asparagine and tryptophan - glutamine. Their antioxidant activities were more pronounced compared with the rat heart were incubated in Custodiol solution.

Accordingly to histological studies preservation of rat hearts in the Krebs-Henseleit solution with the inclusion of compositions of amino acids (tryptophan-arginine, tryptophan- asparagine and tryptophan - glutamine) significantly reduced ischemic damage of the myocardium.

Conclusion. The inclusion of amino acids (tryptophan - arginine, tryptophan - asparagine and tryptophan - glutamine) into the preservation solution diminishes ischemic changes in the hypoxic myocardium.

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CHANGES OF INTRODUCED TO LITHUANIA SPECIES *JUGLANS CINEREA* AND *JUGLANS REGIA* PHENOLOGY IN 1980–2016

A. Malakauskienė[1]

[1]*VYTAUTAS MAGNUS UNIVERSITY, KAUNAS BOTANICAL GARDEN, LITHUANIA*
ASTA.MALAKAUSKIENE@VDU.LT

Abstract

Introduced to Lithuania butternut (*Juglans cinerea L.*) and Persian walnut (*Juglans regia L.*) are valuable species from the nutritional, medicinal and decorative point of view, thus it is important to evaluate how they act and adapt to the environment in the context of changing climatic conditions. Bud breaking date of walnuts is one of the most important features for growing them for commercial purposes, as these trees are most vulnerable to spring frosts. The aim of this study was to estimate the response of butternut and Persian walnut phenology (the beginning of bud swelling, bud breaking, leave unfolding, flowering, fruit maturation and leave fall, end of shoot matureness, flowering, fruit maturation and leave fall) to changing climate in 1980–2016. Long-term observation of introduced walnut species phenology were carried out by dendrologists of Kaunas botanical Garden of Vytautas Magnus University. Data of butternut and Persian walnut phenology in 1980–2016 were analyzed. Possible error of observed phenological events was ±5 days. Data sequences of phenological stages dates were transformed into sequences of number of days since the beginning of the year. Data of mean monthly air temperature (oC) and precipitation amount (mm) were obtained from Kaunas meteorology station archives. The change of mean annual air temperature in 1918–2016 was equal +1.66 ºC ($p < 0.05$), and the change of annual precipitation amount – +7.25 (mm) ($p > 0.05$). In 1980–2016 mean annual temperature in the environment of sample walnuts rose by 0.05 ºC per year. Majority of analyzed phenological stages advanced for both walnut species except the end of shoot matureness, which delayed (on average by 15.69 days for butternut and 10.66 for Persian walnut) for both species, the end of flowering and the end of leave fall, which delayed (on average by 1.60 and 7.97 days, respectively) for butternut walnut, in 1980–2016. The beginning of fruit maturation (on average by 33.07 days for *J. cinerea* and 23.36 days for *J. regia*), the end of fruit maturation (respectively by 33.55 and 20.10 days), the beginning of leave fall (respectively by 26.35 and 15.79 days) and the beginning of bud swelling (respectively by 18.61 and 18.67 days) advanced most for both walnut species. The beginning of phenological spring events on average shifted from the 21st till the 2nd of April for *J. cinerea* and from the 23rd of April till the 25th of March for *J. regia*. As the last spring frosts in Lithuania come in the first part of May, the advance of both introduced walnut species spring phenology increases the risk of shoot and bud freezing, which may have later negative effect on fruit formation and nut crop.

Keywords: *Juglans cinerea, Juglans regia*, phenological stage, climate change.

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CHANGES ON CANCER AND NORMAL CELLS VIABILITY AND ABILITY TO PROLIFERATE IN RESPONSE TO HYPERTHERMIA

L. Degutytė-Fomins[1], G. Šilkūnienė[1], B. Jakštys[2], Z. Naučienė[1], R. Žūkienė[1], V. Mildažienė[1]

[1]VYTAUTAS MAGNUS UNIVERSITY, DEPARTMENT OF BIOCHEMISTRY, LITHUANIA, [2]VYTAUTAS MAGNUS UNIVERSITY, DEPARTMENT OF BIOLOGY, LITHUANIA
GIEDRE.SILKUNIENE@VDU.LT

Abstract

Hyperthermic treatment alone or in combination with chemotherapy or radiotherapy is widely used for cancer therapy. However, treatment efficiency varies in different types of cancer cells and more detailed knowledge on response of different cells to hyperthermia is needed. Tests used for cell viability usually are based on estimation of certain cellular function (metabolism based on one substance, plasma membrane permeability, etc.). It is often not clear, whether these viability tests reveal survival of the cells or loss of some metabolic functions recover with the time passed without an impact on survival of treated cells. The aim of our work was to determine changes on cancer and normal cells viability and ability to proliferate in response to hyperthermia using different methods and to estimate correlation of results obtained by various viability tests with actual cell survival. Hyperthermia (HT) (42 ºC) was applied on cancer (WEHI-164, L929, MH22a, B16-F12, PANC1, BXPC3) and normal (BHK-21, CHO, McCoy) cell lines for 30 min. Immediately after the HT treatment, viability of cells was estimated by calcein-AM or propidium iodide methods. For cell survival colony formation assay was used. Diversity in response among the analysed cell lines to hyperthermia estimated by viability tests was observed. Cell staining with calcein-AM showed that 42 ºC HT inactivated esterases by 40% in 2 (out of 3) normal and 3 (out of 6) cancer cell lines. Meanwhile, plasma membrane permeability evaluation by cell staining with propidium iodide indicated negligible viability changes (up to 15%) nearly in all cell lines. Furthermore, the assay of colony formation revealed that MH22a cells had only 30% survival ratio, although these cells appeared resistant to HT when evaluated by calcein-AM and propidium iodide methods. In contrast, cells B16 which seemed to be very sensitive to HT treatment when stained with calcein-AM and propidium iodide, had 80% survival ratio by colony formation. Thus, the obtained results indicate that immediate viability tests do not represent cell ability to survive on longer time scales and are less informative in comparison to the colony formation assay.

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CHANGES ON CANCER AND NORMAL CELLS VIABILITY AND ABILITY TO PROLIFERATE IN RESPONSE TO HYPERTHERMIA

Eglė Galdikaitė-Brazienė[1], Algimantas Paulauskas[1], Jana Radzijevskaja[1]

[1]VMU, BIOLOGY DEPARTMENT, KAUNAS, LITHUANIA
EGLE.GALDIKAITE-BRAZIENE@VDU.LT

Abstract

Ticks of Ixodidea family are wide spread parasitic arthropods that are involved in transmition of number of tick-borne pathogens. *Ixodes inopinatus* (Estrada-Pena, Nava and Petney, 2014) is recently described species of this family that originates in dry areas of the Mediterranean region in Spain, Portugal, Morocco, Algeria and Tunisia. It has also been collected in the areas of western Germany in sympatry with *I. ricinus* as well as in Baltic countries. *I. inopinatus* is a mammal and lizard parasite, and so far was collected from lizards, foxes and vegetation. The morphological differences of *I. inopinatus* and *I. ricinus* are minimal, so *16S rRNA* gene sequences were used to identify *I. inopinatus* ticks. In this study mitochondrial control region, *cytb* and *COI* genes were sequenced and compared to sequences available from GenBank of 13 individuals previously identified as *I.inopinatus*. Little to no separation is shown between *I. ricinus* and *I. inopinatus* ticks using these genes.

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CONSERVATION AND REPRODUCTION IN VITRO OF ENDANGERED SPECIES OF THE GENUS SALIX L.

Oksana Chornobrov[1], Maria Manko[1], Oleksandr Chornobrov[2]

[1]PLANT BIOTECHNOLOGY RESEARCH LABORATORY, BOYARKA FORESTRY RESEARCH STATION, NATIONAL UNIVERSITY OF LIFE AND ENVIRONMENTAL SCIENCES OF UKRAINE, UKRAINE, [2]HOLOSIIVSKYI NATIONAL NATURE PARK, UKRAINE
OKSANA_CHORNOBROV@UKR.NET

Abstract

Conservation and reproduction of rare genotypes of Salix L. species, natural richness and sources of a unique gene pool, is one of the urgent tasks of the present. Such plants include the Blunt-leaved Willow (Salix retusa L.) and Jacquin's Willow (Salix alpine Scop.) – alpine species that are listed in the Red Data Book of Ukraine in the status of rare and endangered species. One of the approaches to solving the problem is to preserve plants in vitro. The method of culture of isolated tissues and organs in vitro allows obtaining healthy, genetically homogeneous plants throughout a year from a minimum amount of donor material. Therefore, the aim of our research was to develop a method of introduction S. retusa and S. alpina into the in vitro culture for their mass reproduction and conservation.

For the research, parts of 5–10 cm long shoots selected from 3–4-year-old donor plants of S. retusa and S. alpina in September of 2017 were used. As explants, shoots fragments with one lateral bud 10–15 mm in length were used. Sterilization of plant material consisted of soaking in soapy and then in running tap water (for 15–20 min in each), rinsing with distilled water (for 1−2 min), treatment with 70 % ethyl alcohol (for 30–60 sec),use of a number of sterilizing substances (0.1 % HgCl2 (for 5−20 min), 1.0 % AgNO3 (for 5−20 min), 2.5 % NaClO (for 5−20 min) and 4-fold washing in sterile distilled water (for 4–5 min). The plant material was cultivated on a nutrient medium prescribed by T. Murashige & F. Skoog (MS) with the addition of growth regulators according to the conventional method.

Effective sterilization (over 80 %) of S. retusa and S. alpina explants was achieved by applying a stepwise method, which consisted of consistently maintaining in a number of solutions for 5–6 minutes in each: 0.1 % HgCl2, 1.0 % AgNO3 and 2.5 % NaClO. A significant percentage of aseptic (over 70 %) microshoot fragments was obtained by the use of 0.1 % HgCl2 within 15–16 minutes. The results of experiments on the study of the regenerative capacity of plant explants showed the expediency of using the MS nutrient medium as a base (regeneration frequency over 80 %). The significant results on the regeneration of explants by activating the growth of available meristems in vitro were fixed on MS with the addition of 0.25–0.5 mg•L-1 6-(Furfurylamino) purine (kinetin) and 2 g•L-1 activated carbon. Under such condition, actively growing plant microshoots 1.5–2.9 cm in length with characteristic pigmentation were obtained on 25th–30th day of cultivation; the presence of the root system in the microshoots were not fixed. Our further research is aimed at developing biotechnology for microclonal propagation of S. retusa and S. alpina for their conservation and reproduction in vitro.

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CHARACTERISATION OF PELAGIC AND BENTHIC DIVERSITY IN THE SPECIFIC CONDITIONS OF THE SHALLOW WATERS OF THE ROMANIAN BLACK SEA COAST

Daciana Sava Manuela Diana Samargiu[1], Liviu Daniel Galatchi[1]

[1]FACULTY OF NATURAL AND AGRICULTURAL SCIENCES, "OVIDIUS" UNIVERSITY, CONSTANTA, ROMANIA
DACIANA.SAVA@GMAIL.COM

Abstract

The Black Sea is well known for its unique ecosystem, beeing a semi-enclosed sea with special features which provides researchers many subjects of study in terms of physicochemical and biological characteristics. But the Black Sea ecosystem, and the Romanian coastal area as an important part of it, has changed over the years as a result of multiple natural factors and anthropogenic pressures. Consequently, there was a reduction of biodiversity, both for plant and animal species.

Phytoplanktonic and benthic vegetation, participate in the synthesis of organic matter from the chemical elements dissolved in water, forming thus the first step of the aquatic trophic pyramid, and in this way, determine the development of the other links in the trophic chain, for example fauna associated with macrophytes.

The present paper provides data obtained after long term observationa of the phytoplankton, macrophytobenthos and its associatede fauna from the Romanian littoral.

Studies developed about Black Sea biodiversity show that the ecological state of the Black Sea ecosystem has been affected, with a significant reduction of the biodiversity, and appropriate ways of conservation would be the improvement of physicochemical conditions of coastal waters and maintenance of the underwater marine reserve "Vama –Veche" in the south part of our coast.

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CHARACTERIZATION OF CHITIN FROM SHELLS OF SNAILS (GASTROPODA: HELIX POMATIA, SUCCINEA PUTRIS, CEPAEA HORTENSIS, VIVIPARUS CONTECTUS, V. VIVIPARUS)

J. Rutkauskaitė-Sucilienė[1], I. Šatkauskienė[1], R. Skvorcinskiene[2], S. Tučkutė[2]

[1]VYTAUTAS MAGNUS UNIVERSITY, FACULTY OF NATURAL SCIENCES, DEPARTMENT OF BIOLOGY, LITHUANIA, [2]LITHUANIAN ENERGY INSTITUTE, BRESLAUJOS STR. 3, KAUNAS
JURGITASUCILIENE@GMAIL.COM

Abstract

Gastropods widespread occurrence is clear evidence of their successful adaptation to different environments. Though the main component of terrestrial snail shell is calcium carbonate, it can contain an array of other compounds. Jeniaux (1965) and Peters (1972) estimated chitin in shell organics of some species molluscs. However, there is no clear evidence of presence of chitin in all mollusc shells (Furuhashi et al., 2009).

Chitin polymorphism (α- versus β-chitin) is another important issue. Many researchers believe that all mollusc shells contain β-chitin (Levi-Kalismann et al., 2001; Addadi et al., 2006) and there is still a possibility that some mollusc shells have α-chitin (Evans, Macey & Webb, 1990).

In present study chitin from periostracum of *Helix pomatia* was extracted and characterized by identifying α- and β-chitin.

Specimens of snails *Helix pomatia* were collected by hand – picking in Kaunas city and district (Lithuania) on August and September in 2015 -2016. For chitin extraction demineralization in a 1 M HCl, deproteinization 1 M NaOH and decolorization in 3% NaClO solution were performed. The IR spectra of chitins extracted from *Helix pomatia* periostracum were evaluated using a Perkin Elmer FTIR spectrometer over the frequency range of 4000–625 cm-1. The surface morphologies of the chitins isolated from *H. pomatia* periostracum were analyzed by SEM.

Results of this study confirmed the presence of chitin in periostracum of *H. pomatia*, *Succinea putris*, *Cepaea hortensis*, *Viviparus contectus*, *V. viviparus* and provided new and additional data in characteristic of chitin.

Keywords: Chitin, mollusc, Helix pomatia, Succinea putris, Cepaea hortensis, Viviparus contectus, V. viviparus

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CHITIN CHARACTERIZATION OF THE ALIEN SPECIES *DIKEROGAMMARUS HAEMOBAPHES* (CRUSTACEA: AMPHIPODA) FROM THE BALTIC SEA

Vykintas baublys[1], Vaida Tubelytė[1], Raminta Skvorčinskienė[2], Ignas Sabeckis[1], Deimantė Noreikaitė[1]., Aldona Dobrzycka-Krahel[3]

[1]VYTAUTAS MAGNUS UNIVERSITY, DEPARTMENT OF BIOLOGY, VILEIKOS 8, LT-44248, KAUNAS, LITHUANIA, [2]LABORATORY OF COMBUSTION PROCESSES, LITHUANIAN ENERGY INSTITUTE, BRESLAUJOS STR. 3, LT-44403 KAUNAS, LITHUANIA, [3]UNIVERSITY OF GDANSK, FACULTY OF OCEANOGRAPHY AND GEOGRAPHY, INSTITUTE OF OCEANOGRAPHY, DEPARTMENT OF EXPERIMENTAL ECOLOGY OF MARINE ORGANISMS, AL. MARSZAŁKA PIŁSUDSKIEGO 46, 81-378 GDYNIA, POLAND VYKINTAS.BAUBLYS@VDU.LT

Abstract

Chitin is a biopolymer found in crustaceans, also from aquatic environment. The aim of the study was to determine the chitin content and physicochemical properties of this biopolymer extracted from alien gammarid Dikerogammarus haemobaphes (Eichwald, 1841). This species of Ponto-Caspian origin is now widely distributed in many European fresh and brackish waters.

The dry weight chitin content of this species was determined. Fourier transform infrared spectroscopy (FT-IR) and thermogravimetric analysis (TGA) were used to characterize physicochemical properties of obtained chitin.

As expected, FT-IR results showed that the isolated chitin was in a form. According to our results the extracted chitin was thermally stable and potentially can have application in many industrial processes.

As biological invasions are one of the major problems worldwide, our study show potential solution to use of invaders in human industry.

Keywords: chitin, invasive crustacean, FT-IR, TGA

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CHITOSAN EXERTS CYTOTOXIC ACTIVITY IN VITRO BY INDUCING APOPTOSIS AND NECROSIS IN MOUSE HEPATOMA AND CHINESE HAMSTER OVARY CELLS

A. Oberemko[1], R. Saule[1], V. Baublys[1], G. Saulis[1], V. Tubelytė[1], P. Mulerčikas[2]

[1]VYTAUTAS MAGNUS UNIVERSITY, DEPARTMENT OF BIOLOGY, LITHUANIA, [2]INSTITUTE OF BIOLOGY AND PLANT BIOTECHNOLOGY, ALEKSANDRAS STULGINSKIS UNIVERSITY, STUDENTŲ G. 11, LT–53067, AKADEMIJA, KAUNO RAJ., LITHUANIA,
A.O.VERED@GMAIL.COM

Abstract

The mechanisms responsible for the cytotoxic effects of chitosan on cancer cells are still unclear. The goal of this study was to evaluate the cytotoxic properties of chitosan films and solutions in vitro on mouse hepatoma MH-22A (tumor cells) and Chinese hamster ovary (CHO, non-cancerous) cells cultivated on films with different chitosan concentrations and cultivated on Petri dishes after preincubation with chitosan solutions.

To measure plating efficiency (cloning efficiency), cells were plated at low densities (~300 cells per dish) on chitosan films and allowed to grow for 9 days. To see the colonies clearly, they were stained with crystal violet. To investigate cytotoxic activity of chitosan in cell suspensions, 10μl of the chitosan solution (10, 1, 0.1 and 0.01 gL-1)/acetic acid was added to 90μl of warm, fresh serum-free media such that there were duplicate tubes per dose including the untreated control. The cells were mixed gently by pipetting every 10 min during 20 min and 1h and then plated and allowed to grow at 37 oC and 5 % CO2 for 5–6 (CHO cells) or 9 days (MH-22A cells). To reveal the rupture of cell membrane (morphologic expression of necrosis) cells were stained with Trypan Blue solution after 40 and 100 min of chitosan treatment.

Cells fully or partly did not attach to the surfaces of Petri dishes, coated with chitosan solutions with concentrations ranging between 10 and 2 gL-1 ($p<0.05$). In these dishes on the next day after seeding cell debris was observed on the top of culture media, that is chitosan films not always have surfaces with adhesive for mammalian cells properties. At lower concentrations (between 0.2 and 1 gL-1), cells formed both normal and sparse colonies. With chitosan concentrations ranging between 1 and 0.01 gL-1 cells had surviving fraction more than 70%. After the incubation of cells with chitosan solutions, morphologic features of necrosis and apoptosis were observed. This study clearly revealed that cytotoxic effect of chitosan solutions is concentration-depended. It should be noted that low concentrations of chitosan in chitosan films do not induce neither apoptosis nor necrosis and act like a cause of sparse colonies of cultivated cells, maybe because of the positive surface charge of chitosan films. Lower number of cancerous cell colonies on chitosan films can be explained by the lower initial cell number than for non-cancerous cells. Chitosan solutions can act cytotoxically on both tumor and normal cells.

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COLD PLASMA TREATMENT AS SEED DORMANCY BREAKING AGENT

Laima Degutytė-Fomins[1], Rasa Žukienė[1], Giedrė Paužaitė[1], Olegas Pančenka[1], Ainis Jarušaitis[1], Vida Mildažienė[1], Zita Naučienė[1], Kazunori Koga[2], Masaharu Shiratani[2]

[1]VDU, KAUNAS, LITHUANIA, [2]KYUSHU UNIVERSITY, FUKUOKA, JAPAN
LAIMA.DEGUTYTE-FOMINS@VDU.LT

Abstract

The aim of this study was to evaluate the dependence of atmospheric cold plasma (CP) irradiation effects on the duration of treatment and time interval passed between treatment and sowing. We estimated changes induced in radish (*Raphanus sativus*) germination and content of the main phytohormones controlling germination – abscisic acid (ABA) and gibberelins (GA7 and GA3) in dry seeds.

Radish seeds were treated for different durations (1, 3, 5, 7 and 10 min) with a scalable dielectric barrier discharge (DBD) device. The discharge voltage, current and power density were 7.0 kV, 0.2 A and 3.1 W/cm2, respectively. Germination tests in vitro were performed 0, 1, 4, 8 days (CP 5 min) and 14 days (CP 1, 2, 3, 5, 7, 10 min) after treatment, and at the same time methanol extracts of dry seed homogenates were prepared for phytohormone HPLC analysis. Indices of germination dynamics – the final germination percentage Vi (%) and the median germination time Me (h), were determined using Richards plots. Morphometric seedling analysis was performed 4 days after sowing.

CP treatment strongly stimulated germination: Vi increased from 18 to 30%; Me decreased from 15 to 29% in all CP treated seed groups in comparison to control. Increase of irradiation time above 5 min did not lead to stronger positive effects on germination as it was achieved by 5 min irradiation. Both effects on germination and morphometric parameters of seedlings were stronger when time interval between seed treatment and sowing was increased from 0 or 1 day to 4 days.

In all groups of CP-treated seeds ABA content was strongly reduced while GA7 content was increased. Strong negative correlation (R2=0,934) was obtained between Vi and ABA content, and between Vi and ABA/(GA7+GA3) (R2=0,936). Positive polynomial correlation between Me and GA7+GA3 was characterized by R2=0,843. ABA and GA amount changes are observed immediately after seed irradiation, however ABA/GA changes progressively developed with time so that maximal changes were observed 4 days after CP treatment.

The obtained results demonstrate that optimal conditions for radish seed CP irradiation was 5 min with 4 d time interval between treatment and sowing. In addition, stimulation of germination by CP treatment on the molecular level can be explained by the induced changes in the ratio of the main phytohormones (ABA and GAs) involved in the control of seed dormancy and germination, i.e., CP treatment works in the similar way as other seed dormancy breaking treatments.

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COMBINED EFFECT OF CADMIUM IONS AND MILLIMETER RANGE ELECTROMAGNETIC WAVES ON GROWTH AND ANTIOXIDANT ENZYMES ACTIVITY OF WHEAT SEEDLINGS

Gayane Poghosyan[1], Zhanna Mukhaelyan[1], Pogos Vardevanyan[1]

[1]DEPARTMENT OF BIOPHYSICS, FACULTY OF BIOLOGY, YEREVAN STATE UNIVERSITY, 1 ALEX MANOOGIAN ST., YEREVAN, 0025, ARMENIA
G.POGHOSYAN@YSU.AM

Abstract

It has been shown, that millimeter waves or extremely high frequencies (EHF) electromagnetic irradiation (EMI) (a range 30 GHz-300 GHz) are capable to modify biological systems response to the action of chemical substances and physical factors [1]. Nowadays heavy metals are considered the major pollutants of the environment. Among them cadmium (Cd), a non-essential and toxic metal, is well known for its phytotoxicity, which is associated with number of morphological, physiological and biochemical events [2]. An experiment was conducted to examine the effect of isolated and combined action of different concentrations of CdCl2 (50mM, 100mM) and EHF EMI on the growth, malondialdehyde (MDA) rate, and activities of antioxidant enzymes such as guaiacol peroxidase (GPX; EC 1.11.1.7) and catalase (CAT; EC. 1.11.1.6) of wheat seedlings.

Surface sterilized seeds of Triticum aestivum L. of "Bezostaya" cultivar were moistened during 12 hours and then germinated on wet filter paper in Petry dishes at 250 C in the dark for 7 days. Germinated control plants were divided into six groups according to applied treatments as follows:

I group [- Cd /- EMI] , control] no Cd-toxicity, no EMI treatment.

II group [- Cd / + EMI], no Cd-toxicity, with EMI treatment.

III group [+ Cd / - EMI], with Cd-toxicity (50 mM), no EMI treatment.

IV group [+ Cd / - EMI], with Cd-toxicity (100 mM), no EMI treatment.

V group [+ Cd / + EMI], with Cd-toxicity (50 mM), with EMI treatment.

VI group [+ Cd / + EMI], with Cd-toxicity (100 mM), with EMI treatment.

From the first day of germination wheat seedlings were exposure to the EMI EHF (50,3 GHz frequency, energy-flux density - 64mWt /cm2) for 1 hr/day 7 days, day after day, using a EMI generator G4-141 type (State Scientific-Production Enterprise "Istok", Russia).

A slight increase was recorded in the leaf /root (leaf > root) length and plant fresh weight in EMI- exposed groups (II group) compared to the matched control, while the levels of MDA and catalase activity in leaf were not changed significantly. High Cd concentration (100 mM) inhibited the seedlings growth ($P< 0,001$), (IV group), and significant decline in leaf / root (root>leaf) length and fresh weight was observed. However, Cd-induced oxidative stress was indicated by the markedly increase of MDA content, catalase activity and by decrease of peroxidase activity both in leaves and roots, compared with the respective control. Research findings also showed that treatment.

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COMPARING MITOCHONDRIAL CONTROL REGION, CYTB AND COI GENES IN IXODES INOPINATUS AND I. RICINUS TICKS IN BALTIC COUNTRIES

Eglė Galdikaitė-Brazienė[1], Algimantas Paulauskas[1], Jana Radzijevskaja[1]

[1]VMU, BIOLOGY DEPARTMENT, KAUNAS, LITHUANIA
EGLE.GALDIKAITE-BRAZIENE@VDU.LT

Abstract

Ticks of Ixodidea family are wide spread parasitic arthropods that are involved in transmition of number of tick-borne pathogens. Ixodes inopinatus (Estrada-Pena, Nava and Petney, 2014) is recently described species of this family that originates in dry areas of the Mediterranean region in Spain, Portugal, Morocco, Algeria and Tunisia. It has also been collected in the areas of western Germany in sympatry with I. ricinus as well as in Baltic countries. I. inopinatus is a mammal and lizard parasite, and so far was collected from lizards, foxes and vegetation. The morphological differences of I. inopinatus and I. ricinus are minimal, so 16S rRNA gene sequences were used to identify I. inopinatus ticks. In this study mitochondrial control region, cytb and COI genes were sequenced and compared to sequences available from GenBank of 13 individuals previously identified as I.inopinatus. Little to no separation is shown between I. ricinus and I. inopinatus ticks using these genes.

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COMPARISON OF X-RAY ATTENUATION PROPERTIES IN SOLUTIONS CONTAINING SODIUM TUNGSTATE DIHYDRATE AND SILICOTUNGSTIC ACID

L. Gilys[1], E. Griškonis[2], D. Adlienė[1]

[1]KAUNAS UNIVERSITY OF TECHNOLOGY, PHYSICS DEPARTMENT, LITHUANIA, [2]KAUNAS UNIVERSITY OF TECHNOLOGY, FACULTY OF CHEMICAL TECHNOLOGY, LITHUANIA
LAURYNAS.GILYS@KTU.EDU

Abstract

Lead is the most common material used for radiation protection purposes. However lead is toxic and in some cases can cause serious health problems, if used for radiation protection of individuals, due to radiation induced production of secondary electrons in radiation protection equipment. Also recycling of lead containing materials is relative complicated. The purpose of this work was to investigate and compare X-ray attenuating properties of newly developed lead free solutions.

Materials and methods. Two types of lead free aqueous solutions have been developed: solution containing sodium tungstate dihydrate (Na2WO4 · 2H2O) and solution containing silicotungstic acid (H4SiW12O40 · xH2O). Solutions samples were fabricated using different salt concentrations and poured into standard cuvettes. Prepared samples were exposed to 120 keV X-rays in X-ray unit AXIOM MULTIX MP and sample entrance and exit doses were measured using multifunctional system Barracuda with integrated R100B detector (RTI Electronics, Sweden). Lead equivalent of solutions was evaluated using measurement's data and following standard evaluation procedure.

The results of the performed investigation have shown that increased concentration of the applied salts was responsible for the increased lead equivalent of the investigated solution. It was found that concentration of 30% of sodium tungstate solution and concentration of 45% of silicotungstic acid solution was sufficient enough to secure X-ray attenuation in sample which correspond to the lead equivalent of 0.25 mmPb. At low concentrations sodium tungstate aqueous solutions were more effective in X-ray attenuation but aqueous solutions of silicotungstic acid can reach higher concentrations which gives higher lead equivalent.

Conclusion. Lead equivalent ≥ 0.25 mmPb for 10 mm thick samples containing 30% concentrated aqueous solutions of sodium tungstate dihydrate and 45% silicotungstic acid was estimated indicating compliance of these lead free solutions with the requirements for the materials used in medical radiation protection equipment. The results of investigation and comparison of X-ray attenuating properties of both types of solutions are discussed in the presented paper.

Keywords: X-rays, radiation protection, lead free X-ray shielding materials.

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CONCENTRATION OF TESTOSTERONE IN BLOOD PLASMA AND QUALITY OF BULLS' EJACULATES DUE TO THE ACTION OF L-CARNITINE

Viktoriia Koberska[1], Svitlana Tsehmistrenko[2], Oleg Yermishev[1]

[1]VASYL' STUS DONETSK NATIONAL UNIVERSITY, UKRAINE, [2]BILA TSERKVA NATIONAL AGRARIAN UNIVERSITY, UKRAINE
TERRA2307@UKR.NET

Abstract

For a complex rating assessment of sperm quality, it is important to identify markers of quantitative and qualitative characteristics of ejaculates, one of which is the concentration of testosterone in the blood plasma. This androgen provides the maturation of sperm, causes the development of additional gonads and their function [Bakl Dg., 1986]. Survival and resistance of germ cells are provided by natural energy substrates and compounds with antioxidant properties that are present in semen (Ostashko, 1995). Therefore, in order to improve sperm quality, it is advisable to use energotrophic substances, one of which is the vitamin-like aminoacid L-carnitine, detected in high concentrations in the testicle's epididymis [Jeulin C., 1996], where it plays an important role in maturation of sperm, affects their mobility and acts as an antioxidant [Arrigoni-Martelli E., 2001]. Inasmuch as there is a positive correlation between the content of androgen in the testes and their content in blood plasma, our purpose of the research was to study the effect of carnitine on the concentration of testosterone in the blood plasma and the physiological quality of ejaculates and the identification of bonds between them.

The study was conducted on the basis of Genetic Ukrainian Company and the Institute of Animal Biology at the NAAS, Ukraine. The material for research was bulls' semen and blood plasma. According to the analogy principle, there were formed three groups of bulls with 4 heads each. Bulls of the 1st group received standard feed and served as a control, and the 2nd and 3rd groups were fed for 75 days in addition to the basic diet with L-carnitine (commercial name "Karnipas", produced by Loman animal health, Germany) in the amount of 20 and 40 g per head accordingly. We received blood from a jugular vein, and ejaculate using an artificial vagina. Concentration of testosterone was determined by enzyme immunodetection using reagents «Testosterone ELISA». Physiological parameters were determined in ejaculates: volume (ml), sperm activity (scores), sperm concentration (109 cells/ml), survival (h). Survival of sperm was determined at the temperature of 2-4º C until they ceased straightforward translational movement (Vlizlo et al., 2012).

The results of our work showed an increase in blood testosterone concentrations and an improvement in the physiological quality of ejaculate with feeding L-carnitine. In studying the liaison between the concentration of testosterone and ejaculate volumes, we found a positive correlation, and the curvilinear dependence was established between the concentration of testosterone and the number of sperm in the ejaculate and their activity. To conclude, L-carnitine stimulates the synthesis of testosterone and plays a key role

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CONTROL OF *HERACLEUM SOSNOWSKYI*

Darija Jodaugiene[1], Aušra Marcinkevičienė[1], Aušra Sinkevičienė[1]

[1]ALEKSANDRAS STULGINSKIS UNIVERSITY, STUDENTU STR. 11, LT-53361 AKADEMIJA, KAUNAS DISTR., LITHUANIA
DARIJA.JODAUGIENE@ASU.LT

Abstract

Sosnovsky's hogweed (*Heracleum sosnowskyi*) is a dangerous perennial, invasive alien plant in Lithuania. Control of this plant is complicated due to well-developed biological properties. To achieve efficient control of the species, it is crucial to choose highly efficient herbicides and their combinations. Field experiments, designed to compare the efficacy of different herbicides and their mixtures used to control *Heracleum sosnowskyi*, were conducted in 2016 and 2017 in Lithuania, Varnupiai (54º 29' 19.54", 23º 30' 45.9"), Marijampolė distr. The efficacy of the herbicides and their mixtures applied for Sosnovsky's hogweed control was different. The use of both lower and higher rates of glyphosate did not have the expected result, as 4-6 weeks after application new plants started to emerge. A mixture of glyphosate with triasulfuron showed better effect. The efficacy of dicamba and its mixtures with fluroxypyr and triasulfuron, fluroxypyr, triasulfuron and their mixture, fluroxypyr + clopyralid + MCPA mixture depended on the experimental years' meteorological conditions. In 2017, the effect of the above mentioned herbicides and their mixtures on Sosnovsky's hogweed stood out 4-6 weeks after application. Both the smaller and higher rates of tribenuron-methyl + metsulfuron-methyl mixture gave effective control of Sosnovsky's hogweed. The effect of fluroxypyr + metsulfuron-methyl mixture was more rapid, and 6 weeks after application only single plants remained in the plots.

Keywords: *Heracleum sosnowskyi*, control, herbicides, efficacy

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CONTROL OF *HERACLEUM SOSNOWSKYI*

Darija Jodaugienė[1], Aušra Marcinkevičienė[1], Aušra Sinkevičienė[1]

[1]ALEKSANDRAS STULGINSKIS UNIVERSITY, STUDENTU STR. 11, LT-53361 AKADEMIJA, KAUNAS DISTR., LITHUANIA
DARIJA.JODAUGIENE@ASU.LT

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COPPER (II) BIOREMOVAL BY ACTIVELY GROWING FUNGI

Gülşah Büşra Yalçinkaya[1], Sevgi Ertuğrul Karatay[1], Gönül Dönmez[1]

[1]ANKARA UNIVERSITY, BIOLOGY DEPARTMENT, TURKEY
SERTUGRUL@ANKARA.EDU.TR

Abstract

Although at low concentrations copper is an essential element to virtually all plants and animals, including humans, it is highly toxic at the high levels for organisms. The elimination of this pollutant is among the current wastewater treatment goal. However the removal technologies are expensive and energy-intensive. Therefore scientist search for cheaper alternatives in both developing and developed countries. In recent years, efforts have been made for the development of heavy metal uptake process using microorganisms. There is a wide variety of microorganisms that are capable of uptake of heavy metals. Among them fungi are promising bioaccumulating materials for the removal of heavy metal ions. The present study reports on potential of Cu (II) bioremoval by newly isolated fungal strain.

The fungal mycelia were transferred into 250 ml Erlenmeyer flasks containing nearly 10 mg/L Cu (II) concentrations in 100 ml of liquid molasses medium. The flasks were incubated at 30 ± 1 ºC on a rotary shaker at 100 rpm for 3 days. During the incubation period, a 3-mL sample was taken daily from each flask. The concentration of Cu (II) in the supernatant was determined spectrophotometrically at 460 nm, by using sodium diethyl dithiocarbamate as the complexing agent

In the present work eighteen fungi isolated from contaminated soils. The bioaccumulation of Cu (II) has been investigated by newly isolated fungal cells in the media containing 8% molasses supplemented with 1.0 g/L (NH4)2SO4 and 0.5 g/L KH2PO4 at pH 5. The Cu (II) bioremoval yields were between 7.7% and 64.9% in the presence of nearly 10 mg/L Cu (II) at the end of third day incubation time.

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[1]ANKARA UNIVERSITY, BIOLOGY DEPARTMENT, TURKEY
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DEGRADATIVE IMPACT OF *TALAROMYCES PINOPHILUS* ON NEWLY SYNTHESIZED POLYMERIC COMPOSITES FILLED WITH INDUSTRIAL WASTE MATERIALS AND ITS DEPENDENCE ON ENVIRONMENTAL FACTORS

Eglė Malachovskienė[1], Danguolė Bridžiuvienė[1], Jolita Ostrauskaitė[2], Justina Vaičekauskaitė[2]

[1]NATURE RESEARCH CENTRE, BIODETERIORATION REASEARCH LABORATORY, LITHUANIA, [2]KAUNAS UNIVERSITY OF TECHNOLOGY, DEPARTMENT OF POLYMER CHEMISTRY AND TECHNOLOGY, LITHUANIA
EGLE.GUDELIUNAITE@GMAIL.COM

Abstract

Introduction: Depleting oil reserves, accumulation of non-degradable polymers and continuous rise of consumer needs for plastics encouraged the development of polymeric materials derived from renewable resources. Polymeric composites filled with industrial waste materials could be applied as mulching films in agriculture and forestry. Thus, the biodegradability of such polymeric materials and its dependence on environmental factors as well as identification of microorganisms with degradative potential is essential for their application.

Aim: To evaluate the degradative impact of *Talaromyces pinophilus* on newly synthesized polymeric composites and its dependence on environmental factors. Materials and methods: The polymeric composites of epoxidized linseed oil, 1-hydroxyethane-1, 1-diphosphonic acid and different types of industrial waste materials as fillers (5 %): pine needles (1), pine bark (2), grain mill waste (3), rapeseed cake (4) and specimen without filler (0) were obtained from Department of Polymer Chemistry and Technology, Kaunas University of Technology. The resistance of polymeric composites to *T. pinophilus* under different pH and temperature conditions was evaluated according to the standard LST EN ISO 846: 1999. Molecular identification of *T. pinophilus* was supplemented by macroscopic and microscopic analysis. Extracelullar enzyme assays were estimated by qualitative methods.

Results: After 4 weeks of incubation, polymeric composites inoculated with *T. pinophilus* changed their colour and weight compared to the similarly treated but noninoculated specimens (control). The highest weight loss of polymeric composites was observed when *T. pinophilus* was grown at 26 ºC and 37 ºC and it varied between 24.2−43.8 % and 33.2−44.3 % respectively. Polymeric composite with grain mill waste as filler (3) showed the greatest weight loss at 26 ºC and 37 ºC which was 1.95 and 2.24 times greater than control. The lowest weight loss at 26 ºC and 37 ºC was observed for the sample of polymeric composite 2 and 1 respectively. Weight loss of polymeric composites was quite similar under pH 4−8. Specimen without filler (0) showed the highest weight loss at all pH levels except pH 7 and it varied between 39.2−41.9 %. The lowest weight loss at all pH levels except pH 7 was observed for the sample of polymeric composite 4 and it varied between 34.3−35.2 %.

Conclusions: During this investigation we assessed that the degradative impact of *T. pinophilus* on polymeric composites depends on their chemical structure as well as temperature. However, the resistance of polymeric composites to *T. pinophilus* under different pH was quite similar and no significant differences were observed.

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DETECTION OF ANAPLASMA PHAGOCYTOPHILUM IN GOLDCREST (REGULUS REGULUS) TISSUES

Vesta Matulaitytė[1], Asta Karalavičiūtė[1], Algimantas Paulauskas[1], Algimantas Petraitis[2], Maksim Bratčikov[1], Jana Radzijevskaja[1]

[1]FACULTY OF NATURAL SCIENCES, VYTAUTAS MAGNUS UNIVERSITY, LITHUANIA, 2KLAIPEDOS UNIVERSITY, LITHUANIA
ASTA.KARALAVICIUTE@STUD.VDU.LT

Abstract

Birds specifity as reservoir and posibility to transmit tick-borne pathogens are still unclear. During the autumn migrations of 2016, 72 dead goldcrests were collected at Klaipėda district in Lithuania. Total 67 hearts and 72 livers samples from dead birds were screened for the presence of epidemiologically important pathogens such as Borrelia spp., Anaplasma phagocytophilum and Babesia spp. Multiplex real-time PCR analysis was performed using msp2 gene for Anaplasma spp, 23S rRNA gene for Borrelia spp and 18S rRNA genes for Babesia spp. Anaplasma spp. were detected in 41,7 % (30/72) of screened birds. Among infected birds, anaplasmosis was detected in 20,9 % (14/67) of hearts and in 25 % (18/72) of livers samples. PCR products which was positive for Anaplasma spp. were sequenced and analyzed using the Mega software. Sequence analysis for msp2 gene showed that goldcrest was infected by A. phagocytophilum. None of examined samples were infected by Borrelia spp. and Babesia spp. These studies shown that goldcrest might be important for the dispersal of A. phagocytophilum in Lithuania territory.

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DETECTION OF ANAPLASMA PHAGOCYTOPHILUM IN LIPOPTENA FORTISETOSA DEER KEDS FROM MOOSE AND ROE DEER IN LITHUANIA

Kamilė Klepeckienė[1], Jana Radzijevskaja[1], Algimantas Paulauskas[1]

[1]VYTAUTAS MAGNUS UNIVERSITY, LITHUANIA
VAIVAJU@GMAIL.COM

Abstract

Deer keds are a blood-sucking ectoparasites of the family Hippoboscidae. One of the species – Lipoptena fortisetosa were analyzed by a nested DNA polymerase chain reaction (PCR) technique from moose (*Alces alces*) and roe deer (*Capreolus capreolus*). *L. fortisetosa* identification has been done using four primers CI-J-1632, CI-N-2329, CI-J-1718, CI-N-2191. The present study is the first molecular identification of L. fortisetosa in Lithuania. The 16S rRNA sequences of *L. fortisetosa* in this study were 97 – 99% identical to those in GenBank. *L. fortisetosa* individuals were examined for gram-negative bacteria *Anaplasma phagocytophilum* using four primers MAP4AP5, MSP4AP3, msp4f, msp4r. *A. Phagocytophilum* pathogen was not detected in these specimens. Studies prove that *L. Cervi* transmit *A. Phagocytophilum* (Buss et al., 2016, de Bruin et al., 2015). This strong genetic relationship among *L. fortisetosa* and *L. Cervi* sequences suggest potential transmission among mammalian hosts by *L. fortisetosa* too. Although further studies are required to positively confirm *L. fortisetosa* as a biological vector of *A. Phagocytophilum* pathogen.

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DETECTION OF BARTONELLA SPP. IN LITHUANIAN RED DEER (CERVUS ELAPHUS) POPULATION

S.Kalibataite K. Klepeckiene[1], I.Razanske[1], J.Radzijevskaja[1], A.Paulauskas[1]

[1]VYTAUTAS MAGNUS UNIVERSITY, FACULTY OF NATURAL SCIENCES, DEPARTMENT OF BIOLOGY, VILEIKOS G. 8, LT-44404 KAUNAS, LITHUANIA
SIMONA.KALIBATAITE@STUD.VDU.LT

Abstract

The bacteria belonging to the genus Bartonella are parasites of the red blood cells of wild and domestic mammals and also humans. The bacteria are mainly transmitted by haematophagous arthropods, such as fleas, lice, mites, or flies. Up to now, little notice has been given to prevalence of Bartonella spp. among the wild animals in Lithuania. It is known that bacteria Bartonella might not cause any symptoms and only influence minor organism changes. However, some species of pathogens might cause fatal consequences to infected mammals.

Spleen and blood samples were collected from 75 red deer (Cervus elaphus) hunted in 2015 - 2017 in Lithuania and screened for Bartonella DNA. Bartonella DNA was detected by using primers complementary to the intergenic spacer (ITS) between the 16S and 23S rRNA genes, which is used for identification of different species of this genus. PCR product were loaded into a 1.5% agarose gel containing ethidium bromide and then visualized on a UV transilluminator. The PCR amplicons were purified and sequenced. The sequences of red deer isolates were edited and aligned with the ITS sequences from GenBank of other Bartonella species using program MEGA6.

The multiple alignment was used to generate a phylogenetic tree. It indicated that the most red deer sequences were similar to Bartonella schoenbuchensis (6 out of 12). Other sequences were similar to B. capreoli, B. bovis. Our data confirm that Bartonella spp. can be found in red deer in Lithuania, and the prevalence of this pathogen is very high.

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DETECTION OF BARTONELLA SPP. IN PARASITIC BUGS OECIACUS HIRUNDINIS

Indrė Lipatova[1], Ernesta Šukauskaitė[1], Irma Ražanskė[1], Algimantas Paulauskas[1]

[1]VYTAUTAS MAGNUS UNIVERSITY, DEPARTMENT OF BIOLOGY, LT-44404, KAUNAS, LITHUANIA
INDRE.LIPATOVA@VDU.LT

Abstract

Cimicidae are a family of blood-sucking ectoparasites. Parasitic bugs of *Cimicidae* family are widespread in the world but their effects on the spread of pathogens have been poorly investigated. *Oeciacus hirundinis L.* are blood-sucking ectoparasites of swallows and martins (*Hirundinidae*). Every year when the birds return to the same nest, they increases the probability of survival of the parasite population and abundance. Ectoparasites actively proliferate, or on the host's death lack of food, are looking for new hosts. Nests in people's living environment is a threat because the parasites can enter the premises and parasiteze pets. The aim of this study was to identify infection of Bartonella species in parasitic bugs *O. hirundinis* using molecular tools. Bartonella DNA in samples was detected using a nested-PCR of the 16S-23S rRNA ITS region. A total 204 pools of *O. hirundinis* were tested. Bartonella DNA was detected in 19.6% pools. Sequence analysis of 16S-23S rRNA ITS region showed that sequences were identical or similar to *B. schoenbuchensis*. This study is the first detection of Bartonella species in swallow bugs *O. hirundinis* in Lithuania.

Keywords: Oeciacus hirundinis, parasite, Bartonella, swallows.

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DETECTION OF *RICKETTSIA* SPECIES IN ECTOPARASITES OF WILD MAMMALS

A. Stankutė[1], I. Lipatova[1], J. Radzijevskaja[1], A. Paulauskas[1]

[1]VYTAUTAS MAGNUS UNIVERSITY, LITHUANIA
INDRE.LIPATOVA@VDU.LT

Abstract

Rickettsia are small, intercellular, gram-negative bacteria, which cause infectious diseases – rickettsioses in many countries around the world. These patogens are transmitted to vertebrates, including humans by a variety of arthropod vectors such as ticks, fleas and mites. The aim of this study was to identify *Rickettsia* spp. infection in ectoparasites of wild mammals. In total 118 ectoparasites were collected (110 ticks and 8 fleas) from wild mammals (European hare, raccoon dog, European polecat, European badger and red fox). Rickettsia DNA was found in 14.4% (17/118) of ectoparasites. Ectoparasites collected from European polecat were not infected with *Rickettsia* spp. Rickettsia DNA were found in 23.1% (3/13) *Dermocentor reticulatus* ticks and 13.4% (13/97) *Ixodes ricinus* ticks, as well in 12.5% (1/8) fleas of *Chaetopsylla globiceps* species. Sequence analysis of the *17 kDa* protein coding gene fragment sequences showed that sequences are similar to *R. helvetica* and *R. raoultii* species.

Keywords: *Rickettsia*, *17 kDa gene*, ticks, fleas, Lithuania.

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DETERMINATION OF BARTONELLA SPECIES IN ECTOPARASITES OF WILD MAMMALS

R. Biguzienė[1], I. Lipatova[1], J. Radzijevskaja[1], A. Paulauskas[1]

[1]VYTAUTAS MAGNUS UNIVERSITY, LITHUANIA
INDRE.LIPATOVA@VDU.LT

Abstract

Bartonella is a small, pleomorphic, gram-negative bacteria. This bacteria species is known to cause a disease called bartonellosis. The disease may be transmitted by parasites such as ticks or fleas or by direct contact with the infected blood. The aim of this study was to determinate *Bartonella spp*. infection in ectoparasites of wild mammals. A total 118 ectoparasites were collected (8 fleas and 110 ticks) from 5 different species of wild animals. Bartonella DNA in samples was detected using a nested-PCR of the 16S-23S rRNA ITS region and two primer sets WIT-F/WIT-R (external primers) and Bh311-32F/LongITS-R (internal primers). A total 3.39 % (4/118) tested ectoparasites were infected with the Bartonella pathogen. All Bartonella positive samples were sequenced. Sequence analysis of the 16S-23S rRNR ITS region fragment sequinces showed that fleas were infected with *B.hensellae* and ticks with *B.schoenbuchensis* species.

Keywords: Bartonella, ectoparasites, mammals, Lithuania.

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DETERMINATION OF THE ACCEPTABLE TEMPERATURE OF THE BIOCHEMICAL LEACHING PROCESS

Kanayev A.T., Baimyrzayev K.M., Kanayeva Z.K.[1]

[1]ZHETYSU STATE UNIVERSITY NAMED AFTER I. ZHANSUGUROV, KAZAKHSTAN
KANAYEV1959@GMAIL.COM

Abstract

For definition of biochemical gold leaching optimum temperature the Bolshevik deposit ore has been used. Ore was crushed till the size of grains of 0.074 mm. At the first stage ore was exposed to bioleaching, on the second gold extraction was made actually. The temperature regime was provided with cultivation and leaching both the first, and the second stage in thermostatic shaker (figure 15). Investigated temperature regimes were 20, 30 and 40 ºC, ratio S: L = 1:1.5. Other conditions of experiments carrying out were similar the aforesaid.

Dates to a considerable intensification of thiosulfate leaching process with rise in temperature. However temperature influence on the preprocessed by bacteria samples and not, is different. In the first case it is so strong that there are negative phenomena expressed in kinetic complications strengthening, leading to thiosulfate complexes destruction and to metal resedimentation about what speaks sharp decrease in gold extraction at 40ºC. Productive process basically goes at the first 24 hours. In this case it is necessary to reduce thiosulfate leaching duration to 8 - 12 hours. Process with bacterial preprocessing by association 2 is steadier against temperature differences. In control variants process goes in the classical way, i.e., rise in temperature leads to increase of gold extraction degree.

The increase in temperature to 40ºC radically changes all picture: gold concentration by the end of 24 hour sharply falls at bioleaching whereas it essentially increases in control. Considering processes from the point of profitability view, power expenses for temperature 40ºC retain are higher, than 30ºC therefore biochemical process is more economic.

Thus, rise in temperature considerably intensifies both biochemical and chemical processes of gold extraction of Bolshevik deposit ore. Optimum for biochemical thiosulfate leaching it is necessary to consider 20-30ºC. Thus duration of process can be reduced till 8-12 hours.

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DEVELOPMENT OF DIAGNOSTIC TEST SYSTEMS USING NANOPARTICLES FOR DETERMINATIONS OF MARKERS OF AUTOIMENOUS DISEASES

Stoinova Anastasia[1], Stanishevskiy Yaroslav[1], Popcova Anna[3]

[1]PEOPLE'S FRIENDSHIP UNIVERSITY OF RUSSIA, INSTITUTE OF BIOCHEMICAL TECHNOLOGY AND NANOTECNOLOGY, RUSSIA, [2]PEOPLE'S FRIENDSHIP UNIVERSITY OF RUSSIA, DEPARTMENT OF ECOLOGY, RUSSIA
STOINOVA17@MAIL.RU

Abstract

In modern medicine, the issue of diagnosing diseases is very relevant. The necessary prevention and drug therapy on the early stages of the disease can be very effective in fighting for the life and health of the patient.

Viral and infectious diseases, diseases of the thyroid gland, as well as many other diseases in himan medicine and veterinary medicine, are already diagnosing. Currently widely used such immunodiagnostic methods as indirect hemagglutination (RNGA), enzyme immunoassay (ELISA), radial immunodiffusion (RID), neutralization reaction on cell culture (PH), etc. However, these methods are limited, namely, the lack of rapidity and simplicity in the formulation of the reaction, stability in the design and storage of drugs, long-term suitability, the necessary sensitivity and specificity, reproducibility from batch to batch, etc.In the modeling of various diagnostic systems are used some conjugates which consist of a polymer particle that contains on its surface specific bio-ligands capable of affinity binding to a detectable component (antigen, antibody). Its immobilization with the carrier will have a random character, which will significantly affect the immune activity of the biomolecule. Therefore, it was proposed to immobilize gold nanoparticles on the antibody surface in various concentrations to select the optimal conditions for conjugate creation. It is assumed that, due to their small size, they will not block the active centers of proteins. The objectives of this stage of work on diagnostic test systems were: 1. Preparation of gold nanoparticles with a narrow size distribution. 2. Creation of the "nanoparticle-AT1" conjugate (AT1 - antibody to the human thyroid gland thyroglobulin protein).

Materials and methods. Gold nanoparticles were obtained by reduction with tannin from a gold salt (details in article). The size of the gold nanoparticles was determined using an innovative analyzer based on the cross-correlation spectroscopy method - NANOPHOX Sympatec GmbH. The nanoparticle size was about 30 nm. To obtain the conjugate, gold nanoparticles were mixed with antibodies to thyroglobulin at various concentrations. These conjugates were studied using the Transmitting Electron Microscope (TEM) JEOL JEM-2100. The photo shows the formation of conjugates by immobilizing the nanoparticle onto the surface of the protein. It is planned to continue work on diagnostic test systems in the future.

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DIFFERENT NANOPARTICLES AFFECT MIRNA ACTIVITY IN RUCOLA (ERUCA SATIVA MILL.) PLANTS

Inese Kokina[1], Ilona Mickeviča[1], Linda Bankovska[1], Inese Gavarāne[1], Marija Jermaļonoka[1], Eriks Sladevskis[2], Andrejs Ogurcovs[2], Vjačeslavs Gerbreders[2]

[1]DAUGAVPILS UNIVERSITY, INSTITUTE OF LIFE SCIENCES AND TECHNOLOGY, DEPARTMENT OF BIOTECHNOLOGY, LABORATORY OF GENOMICS AND BIOTECHNOLOGY, PARADES STREET 1A, DAUGAVPILS, LATVIA, LV 5401, [2]DAUGAVPILS UNIVERSITY, INSTITUTE OF LIFE SCIENCES AND TECHNOLOGY, DEPARTMENT OF TECHNOLOGY, G.LIBERTS' CENTER OF INNOVATIVE MICROSCOPY, PARADES STREET 1A, DAUGAVPILS, LATVIA, LV 5401
LINDA.BANKOVSKA@DU.LV

Abstract

Currently, nanomaterials and nanotechnology have been extensively applied worldwide due to their physico-chemical properties. Engineered nanomaterials are under interest for their positive impact in improving many final products, including consumer products, pharmaceutics, cosmetics, transportation, energy and agriculture etc. Nanoparticles (NPs) are also actively utilized for a wide range of applications within plant investigations. As a result, nanomaterials have received a particular attention in the topic concerning nanomaterial safeness to the environment. Plants are significant integral part of ecological system and it is important to understand the influence of different NPs and their interaction with plant organisms. A large number of various experiments related to the effects of different NPs on plant growth and development are described. Also, possible mechanisms of plant response to NPs are presented, however, still is a need for more experiments and knowledge for better understanding of changes in plant cell mechanisms. In the present study, plant tissues of rucola (*Eruca sativa* Mill.) grown on hydroponics with different concentrations of NPs were utilized for miRNA quantification using qPCR. The results showed changes in miRNA activity in rucola under NP stress influence. Obtained new and more accurate knowledge can lead to developing of methods for plant species-specific resistance regulation against particular pathogens. This work was supported by DU internal grant No 14-95/13

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DISTRIBUTION AND DIVERSITY OF ROTIFERS (ROTIFERA) IN SOME FRESHWATER BODIES IN KAUNAS CITY

I. Šatkauskienė[1], G. Lesivaitė[1], R. Tamėnaitė[1]

[1]VYTAUTAS MAGNUS UNIVERSITY, BIOLOGY DEPARTAMENT, LITHUANIA
RUGILE.TAMENAITE@VDU.LT

Abstract

Rotifers (Rotifera) are freshwater microscopic multicellular organisms, abundant in various water bodies. Rotifers are an important part of the freshwater zooplankton; they can be used as indicators of water quality. Due to their fast and easy growth, they are perfect model organisms in various researches. There are around 1350 rotifer species in Europe, 300 of them are found in Lithuania. During this study, distribution and diversity of rotifers were investigated in three different water bodies of Kaunas, with respect to water chemical composition, seasonality and microfauna. Epiphytic and planktonic rotifers were collected, with total number of 694 specimens. Collected samples revealed 13 species of rotifers, which belong to 17 genera and 9 families: Asplanchidae, Bdelloidea, Branchionidae, Collochetidae, Dicranophiae, Lecanidae, Lepadellidae, Synchaetidae and Trichocertidae. The largest diversity (11 genera) of rotifers has been observed in standing water pond (Kaunas Botanical garden). *Philodina* sp. rotifers (Bdelloidea) were the most common genus in ponds and Neris river. Stagnant water and temperature of the water were the main factors that determined the variety of rotifers.

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DIVERSITY AND DISTRIBUTION OF MYRIAPODS (MYRIAPODA: DIPLOPODA, CHILOPODA, SYMPHYLA) AND PSEUDOSCORPIONES (ARACHNIDA: PSEUDOSCORPIONES) IN SOME REGIONS OF LITHUANIA.

Tautvydas Rušas[1], Aistis Petruškevičius[1], Ingrida Šatkauskienė[1]

[1]VYTAUTAS MAGNUS UNIVERSITY, LITHUANIA
TAUTRUSAS@GMAIL.COM

Abstract

The myriapods and pseudoscorpiones, contain approximately 16,000 and 3000 described species respectively. Although these arthropods play an important ecological role in most terrestrial ecosystems, little is known about their diversity and biology compared with other arthropod groups. Most pseudoscorpiones are small and have cryptic habits, therefore they are rarely detected and often overlooked. In contrast to larger arthropod orders, there are few specialists dedicated to their research, thus they are many insufficiently known areas in Europe. Lithuania being one of them. Up till now only one species of pseudoscorpion, *Neobisium carcinoides* is recorded living in Lithuania (Tamutis 2011).

The aim of this study to supplement the data about diversity and distribution of myriapods and pseudoscorpiones in some regions of Lithuania. These arthropods were collected on 2016 – 2017 in Kaunas, Jonava and Šilutė regions, by hand and/or sampling soil/litter from 30 cm2 quadrats fields in study sites. The material collected was identified and stored in 70% ethanol.

10 diplopods, 5 centipedes and 1 species of genus Symphyla together with three pseudoscorpiones species: *Chtonius tetrachelatus* (fam. *Chtoniidae*), *Microbisium brevifemoratum* (fam. *Chernitidae*), and *Dinocheirus panzer* (?) and (fam. *Neobisidae*). were identified.

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DIVERSITY OF POWDERY MILDEW FUNGI IN LITHUANIAN GREENERIES

A. Stankevičienė[1]

[1]KAUNAS BOTANICAL GARDEN OF VYTAUTAS MAGNUS UNIVERSITY
ANTANINA.STANKEVICIENE@VDU.LT

Abstract

The monitoring of Erysiphaceae pathogens was carried out during the year of 2009–2017 at city greeneries in Lithuania. Ornamental plants of 35 genus, 48 species, and 11 varieties were examined. Street greeneries were identified to have powdery mildew fungi, the agent of leaf diseases of 3 genera, 5 species; recreational plantations – fungi of 3 genera and 9 species. Pathogens most harmful are on plants of *Acer L*., *Berberis L*., *Caragana L*., *Quercus L*. The agent of *Erysiphe R. Hedw*. ex DC genus powdery mildew was mostly violent as follows: on *Euonymus europaea L*.– Erysiphe euonymi DC, on *Aesculus hippocastanum L*. – *Erysiphe flexuosa* (Peck) U. Braun & S. Takam., on *Spireae arguta Zabel* and S. latifolia (Aiton) Borkh. – *Erysiphe penicillata* (Wallr.) Link, on *Caragana arborescens Lam*.– *Erysiphe palczewskii* (Jacz.) U. Braun & S. Takam., on *Syringa vulgaris* – *Erysiphe syringae*. Plants growing at recreational greeneries that suffered the strongest injuries were as follows: *Erysiphe alphitoides* (Griffon & Maubl.) U. Braun & S. Takam. (average damage grade – from 1.4 till 4 on *Quercus robur L*.; *Sawadaea bicornis* (Wallr.) Homma (3.33 grades), has injured *Acer ginnala Maxim*.; *Sawadaea tulasnei* (Fuckel) Homma (grade 1–3.3) – on *Acer platanoides L*.; *Podosphaera pannosa* (Wallr.) de Bary (1.27–1.54) injured Rosa spp. The rare species in Lithuania of *Phyllactinia fraxini* (DC.) Fuss were detected on *Fraxinus excelsior L*. (1.17–1.5 grades). *Erysiphaceae* agents of 3 genus, 5 species were detected on plants of 5 genus, 6 species and 1 variety grown at protected green plantations; fungi of 3 genera, 9 species were detected on plants of 8 genera, 13 species grown at recreational plantations.

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DIVERSITY OF VECTOR-BORNE PATHOGENS IN SMALL RODENTS FROM LITHUANIA

Dalytė Mardosaitė-Busaitienė[1], Jana Radzijevskaja[1], Paulina Amšiejūtė[1], Algimantas Paulauskas[1]

[1]VYTAUTAS MAGNUS UNIVERSITY, LITHUANIA
DALYTEMARDOSAITE@GMAIL.COM

Abstract

Small rodents are important hosts for various species of ectoparasites and are considered reservoir hosts for several vector-borne pathogens. The prevalence of vector-borne bacterial pathogens *Borrelia* spp., *Rickettsia* spp., *Anaplasma phagocitophilum, Bartonella* spp. and protozoan parasites *Babesia* spp. in different species of small rodents were investigated during 2006–2016. Small rodents of 9 species (*Apodemus flavicollis, A. agrarius, Mus musculus, Micromys minutus, Myodes glareolus, Microtus oeconomus, M. agrestis* and *M. arvalis*) were captured in different locations of Lithuania. DNR was extracted from the ear, spleen and urine bladder samples of small rodents. Different genome regions of pathogens were amplified with subsequent sequencing of fragments obtained during PCR amplification. The overall prevalence of *Borrelia* spp. in rodent was 25%, *Rickettsia* spp. - 34.5 %, *Bartonella* spp. - 23.7% and *Babesia* spp. - 6%. Sequence analysis of DNA from positive samples indicated the presence of two *Borrelia* species *Borrelia afzelii* from the *Borrelia burgdorferi* s. l. complex and *Borrelia miyamotoi* belonging to the relapsing fever group, *Rickettsia helvetica, Bartonella grahamii, B. taylorii, Bartonella* sp. belonging to the *Bartonella rochalimae* group, and *Babesia microti*. The findings of our study demonstrated the importance of small rodents as potential reservoirs of these zoonotic pathogens in Lithuania.

This research was partly supported by the European Social Fund under the No. 09.3.3-LMT-K-712-03-0027 "Development of Competences of Scientists, other Researchers and Students through Practical Research Activities" measure.

Keywords: *Borrelia, Bartonella, Rickettsia, Babesia*, rodents

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DOES *LEPTIDEA JUVERNICA* (*LEPIDOPTERA*: *PIERIDAE*) IS RARE SPECIES IN LITHUANIA?

Agnė Rocienė[1], Virginijus Sruoga[1]

[1]DEPARTMENT OF BIOLOGY AND CHEMISTRY, LITHUANIAN UNIVERSITY OF EDUCATIONAL SCIENCES
AGNE.ROCIENE@LEU.LT

Abstract

Two sibling species, *Leptidea sinapis* and *L. juvernica*, occur sympatrically in Lithuania. Only a few papers dealing with *Leptidea* species distribution in Lithuania have been published during the past 15 years. The purpose of our research is to examine intra- and interspecific genital measurement variations in *L. sinapis* and *L. juvernica* and to report new distributional records for *L. juvernica* from Lithuania. The butterflies were collected at 13 localities in 10 administrative districts of Lithuania from 2005 to 2010. Our study has shown that morphological approach based on measurements of length of phallus and saccus in the male genitalia, and length of ductus bursae in the female genitalia can be used for separating the specimens of *Leptidea* collected in Lithuania. Since 2004, *L. juvernica* was considered as rare species in Lithuania, but our findings suggest that *L. juvernica* can be widespread in the country. The examined material yielded new distributional records of *L. juvernica* at 9 new localities in 7 administrative districts of Lithuania. We expect the species to occupy far more sites than have been recorded until now.

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ECOLOGICAL SCALES OF PHYTODIVERSITY IN DIFFERENT AGROHABITATS

Ligita Baležentienė[1]

[1]*ALEKSANDRAS STULGINSKIS UNIVERSITY, INSTITUTE OF ENVIRONMENT AND ECOLOGY, LITHUANIA*
LIGITA.BALEZENTIENE@ASU.LT

Abstract

Recently ca. 40 % of the European Union (EU) area is agricultural land and thus mainly used for production of food and raw materials. Moreover, increasing agricultural land use intensity caused the deterioration of the environmental conditions of agro habitats.

This study was aimed of to evaluate species indicator values response to spatial gradient of environmental (light, L; moisture, F; nitrogen, N, and temperature, T) indices in different agrohabitats (in crop fields and their boundaries of conventional, IF and organic farming, OF) by applying Ellenberg scale (1974) of species indicator values available for Central Europe. The analysis was performed in previously enumerated habitats located the Training Farm of Aleksandras Stulginskis University, Central Lithuania. In addition, established species were grouped into 6 groups accordingly to plant life form. In a spatial approach, Multiple Correspondence Analysis (MCA) was applied to analyze the pattern of relationships between species indicator values and environmental conditions in six different agrohabitats. Variation of N-values (ranging between 2-9 and x point) observed the highest between ecological gradients, thus indicated the widest spatial dispersion of soil N deposition in habitats. In this approach, the N-gradient was followed by F-gradient. The presence of species peculiar with medium indicator values (L 5-L6, F4-F5, N5-N6, T4-T5) suggests the IF crop habitats being more friendly for mezophytes establishment. Hence, crop and margin habitats in organic farm possess wider environmental gradient ensuring higher phytodiversity here.

Keywords: indicator value, habitats, MCA

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EFFECT OF 50-YEAR TERM CROP ROTATIONS ON SOIL ORGANIC CARBON

Lina Skinuliene[1], Lina Marija Butkeviciene[1], Vaclovas Boguzas[1]

[1]ASU, INSTITUTE OF AGROECOSYSTEMS AND SOIL SCIENCE, LITHUANIA
LINA.SKINULIENE@ASU.LT

Abstract

Identification and implementation of land use and soil management practices which create a positive agricultural soil/ecosystem carbon budged and restore soil quality is specific challenge worldwide. Moreover, soil carbon sequestration is almost only negative emission technologies which are readily available at a low cost and crop rotation is one of those. The objective of this investigations was to compare the effect of different crop rotations and Rye monocultures as well as fallow on soil organic carbon.

Long - term field experiment was established in 1966 at the Experimental Station of Aleksandras Stulginskis University. 9 different crop rotations were arranged in time and space. In addition, Corn and Rye monocultures as well as Continuous bare fallow were included as control treatment. Soil - Calc(ar)i- Endohypogleyic Luvisol. Investigation were carried out in 2015. Soil samples were taken in different crop rotations in 0-20 cm depth and soil organic carbon was determined spectrophotometric method.

Winter wheat is grown in Cereal, Field with raw crops and Norfolk crop rotations. The highest organic carbon content was found in winter wheat crop in Norfolk crop rotation. Cereal crop rotation has an organic carbon content of less than 1.1 to 1.2 times compared to other crop rotations. Winter rye crops are grown in Intensive , Field with raw crops, For green manure and Three course crop rotations, as well as Winter rye monoculture. In winter rye crops, the highest amount of organic carbon was observed in Intensive and Field with raw crops crop rotations. The lowest in For green manure and Three course crop rotations. Barley crops are grown in Intensive, Cereal, Field with raw crops, For green manure, Norfolk and Fodder crop rotations. The highest organic carbon content was found in Norfolk and Fodder crop rotations compared to other crop rotations. The least organic carbon content was found in Intensive crop rotation. Similar amounts of organic carbon was also found in Cereal and For green manure crop rotations.Soil organic carbon in Continiuos bare fallow obtained two times less comparing with oher investigated crop rotations. Bare fallow without farmyard manure application mostly decreased soil productivity.Crop rotation design in modern agriculture persist as one of major instruments for soil organic carbon managements and sustainable intensification.

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EFFECT OF NANOPARTICLES ON MIRNA QUANTITY IN CALLUSES

Inese Kokina[1], Ilona Mickeviča[1], Linda Bankovska[1], Inese Gavarāne[1], Marija Jermaļonoka[1], Eriks Sledevskis[2], Andrejs Ogurcovs[2], Vjačeslavs Gerbreders[2]

[1]DAUGAVPILS UNIVERSITY, INSTITUTE OF LIFE SCIENCES AND TECHNOLOGY, DEPARTMENT OF BIOTECHNOLOGY, LABORATORY OF GENOMICS AND BIOTECHNOLOGY, PARADES STREET 1A, DAUGAVPILS, LATVIA, LV 5401, [2]DAUGAVPILS UNIVERSITY, INSTITUTE OF LIFE SCIENCES AND TECHNOLOGY, DEPARTMENT OF TECHNOLOGY, G.LIBERTS' CENTER OF INNOVATIVE MICROSCOPY, PARADES STREET 1A, DAUGAVPILS, LATVIA, LV 5401
LINDA.BANKOVSKA@DU.LV

Abstract

MicroRNAs (miRNAs) are small, highly conserved and non-coding RNAs that are involved in regulating gene expression at the post-transcriptional level. miRNA modify messenger RNA by inhibition of translation process, target degradation and gene silencing. Several classes of miRNAs with specific functions are involved in a various molecular pathways in plant cells. Small RNAs are important components in growth, development and maintenance of genome integrity as well as in plant stress responses. Plants can respond to environmental stress by modifying their gene expression through the activity of miRNA. In this study, flax callus cultures were obtained under in vitro conditions and different concentrations of nanoparticles were used as abiotic stress factor for specific miRNA variability. Real-time quantification method was utilized for quantitative evaluation of specific flax miRNA based on the stem-loop RT primer approach using a miRNA-specific primer. Results showed significant changes in specific miRNA quantity between control and experimental flax callus cultures.
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EFFECT OF WHOLE BODY EXTREMELY HIGH FREQUENCY ELECTROMAGNETIC IRRADIATION EXPOSURE ON ANTIOXIDANT ENZYMES ACTIVITY IN RATS

Gayene H. Poghosyan[1], Poghos H. Vardevanyan[1], Marieta S. Mikaelyan[1], Anahit V. Nerkararyan[1], Poghos H. Vardevanyan[1]

[1]DEPARTMENT OF BIOPHYSICS, FACULTY OF BIOLOGY, YEREVAN STATE UNIVERSITY, 1 ALEX MANOOGIAN ST., YEREVAN, 0025, ARMENIA
G.POGHOSYAN@YSU.AM

Abstract

Low intensity electromagnetic field (EMF) of extremely high frequencies (EHF) is a widespread environmental factor. Nowadays exposure to EHF EMF is markedly increased due to modernization and development of new electronic devices. It is known, that EHF EMFs affect living organisms of a different levels of organization. It has been suggested that initial cellular event affected by exposure to EMI might be the increase of free radicals level, which leads to the perturbation of antioxidant enzymes activity [1]. We reported earlier [2] that all applied treatments of rats with 42,2 GHz and 50,3 GHz frequencies EMI not only induced increase in amount of final product of lipid peroxidation- malondialdehyde (MDA) in brain and liver of EMI-exposed animals, but also changed catalase activity. So, present research is aiming to investigate the impact of the repeated (20 min/day 5 days, day after day) exposure to EMI EHF of 42,2 GHz and 50,3 GHz frequencies (power density 64mWt/cm2) on antioxidant enzymes activity in brain, liver, heart and skeletal muscle of rats. Adult Wistar male rats with 100-120 g body weight were used for this study. As a source of monochromatic EMI EHF generator G4-141 type (State Scientific-Production Enterprise “Istok”, Russia) was used. Exposure took place in a ventilated plexiglas cage, where rats could move inside given space. 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 treatment with EMI induced an oxidative stress in different organs of the rats, which was indicated by the changes of SOD, GPX and CAT activities depending on the EMI frequency used and exposure duration. Data show a significant decrease of SOD and GPX activities in experimental rats brain ($P< 0,001$) and liver ($P< 0,05$), whereas CAT activity significantly increased in the same organs compared to control. The slightly elevated levels of SOD and CAT activities in skeletal muscle were observed among rats in 50,3 GHz frequency EMI- exposed group, while 42,2 GHz EMI-exposure did not affect studied indexes. Results concerning the cardiac tissue among control and experimental groups did not differ significantly for all used EMI frequencies.

Keywords: millimeter range electromagnetic waves, antioxidant enzymes, rats.

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EFFECTS OF COLD PLASMA OR ELECTROMAGNETIC FIELD TREATMENT ON GROWTH OF BIOLUMINESCENT FUNGUS PANELLUS STIPTICUS

Asta Malakauskienė[1], Odeta Buzaite[1], Vida Mildažienė[1], Vitalj Novickij[2], Kazunori Koga[3], Masaharu Shiratani[3]

[1]VYTAUTAS MAGNUS UNIVERSITY, LITHUANIA, [2]VILNIUS GEDIMINAS TECHNICAL UNIVERSITY, LITHUANIA, [3]KYUSHU UNIVERSITY, FUKUOKA, JAPAN
ASTA.MALAKAUSKIENE@VDU.LT

Abstract

Numerous studies on cold plasma (CP) effects on germination of fungal spores, viability and further colonies formation report detoxifying effects and reduction of mycotoxins, degrading and dying spores, inhibited mycelium growth. Low frequency electromagnetic field (EMF) was also assessed as agent degrading fungi, though there were species dependent exceptions, when exposure had positive impact. Wood decaying fungi deserve greater attention because after exposure to different treatments some species produce secondary metabolites having potential for wide application in future technologies (e.g. luciferin produced by bioluminescent species).

The aim of this study was to evaluate effects of air CP irradiation and strong EMF on early growth of wood decaying bioluminescent fungus *Panellus stipticus* (colony diameter across the axis crossing the center of the sowing spot and colony surface area), and bioluminescence of mycelium.

Spores of *P. stipticus* were injected on glass microscope slide and were treated for different durations (0.5, 1 or 3 min.) with a scalable dielectric barrier discharge (DBD) device having a plasma irradiation area of 4 x 4.38 cm2 (discharge voltage: 9.2 kV, 10 kHz; discharge current: 0.2 A, 2.17 W; power density: 3.1 W/cm2). For EML treatment spores were injected into a mini centrifugal plastic test-tube which was placed in the center of the induction coil, and treatment by electromagnetic field alternator (frequency, 100 kHz; electromagnetic field strength, 10 mT) was performed for 1 or 3 min. Spores were sown on Petri dishes filled with malt agar medium immediately after treatments and grown in a dark room at the air temperature around +13 oC for 3 weeks, periodically measuring the diameter and surface area of the colonies. CP treatments for 1 and 3 min. showed a tendency of decreasing P. stipticus colony growth on malt agar medium (on the 23rd day after sowing surface area decreased on average by 774 and 189 mm2 and colony diameter by 1.3 and 0.2 cm, respectively), though 0.5 min. exposure had modest positive effect (increased surface area on average by 470 mm2 and colony diameter by 0.07 cm). EMF treatments for 1 and 3 min had negligible effect on wood decaying fungus species mycelium growth: mean colony surface area (on the 17th day after sowing mean surface area in control was equal 2234.0 ± 90.07 mm2) and diameter (5.7 ± 0.06 cm) were almost equal in control and treated groups. CP and EMF treatments did not stimulate the bioluminescence of *P. stipticus* mycelium (glowing was not detected).

Keywords: *Panellus stipticus*, cold plasma, electromagnetic field, growth, bioluminescence.

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EFFECTS OF DIETARY SELENIUM INCLUDING PROBIOTICS MIXTURE ON GROWTH PERFORMANCE, SERUM BIOCHEMICAL PARAMETERS OF PHARAON QUAILS

Volodymyr Bityutsky[1], Oksana Tsekhmistrenko[1], Svitlana Tsekhmistrenko[1], Viktor Kharchyshyn[1], Yuliia Melnychenko[1]

[1]BILA TSERKVA NATIONAL AGRARIAN UNIVERSITY, BILA TSERKVA, SVETLANA.TSEHMISTRENKO@GMAIL.COM

Abstract

Adding probiotic supplements to feed increases the bioavailability of nutrients, health status, immunity, productivity and bird conservation. Selenium supplements what are using inorganic and organic forms are used to increase the growth rate and the antioxidant protection of the organism. However, these forms have limitations such as narrow safety interval, non-specific binding to tissue proteins. The selenium nanoparticles (SeNPs), which have better bioavailability, relatively high safety margins and low toxicity, can serve as alternatives. The purpose of this research was studying of the effects of the feed probiotic additive, selenium nanoparticles, in comparison with the inorganic form of selenium and their complex on growth, conversion of feed, biochemical parameters of blood and preservation of quail. According to the scheme, a number of 600 one day old quails was used, of which, according to the analogues principle, 6 groups were formed (in four subgroups each): control and five experimental ones. The experiment lasted 35 days. Birds of group 1 (control) were fed with Standard diet, experimental quails of 2nd group - Standard diet + 0.3mg of sodium selenite / kg feed, 3rd group. - Standard diet + 0.3mg (SeNPs) / kg feed, 4th group - Standard diet + Probifilact, 5th group - Standard diet + 0.3mg sodium selenite / kg feed + Probifilact, 6th group. - Standard diet + 0.3mg (SeNPs) / kg feed + Probifilact. The conditions for birds keeping in all groups were the same.

It was established that quails of experimental groups over live weight prevailing control analogues. Concentrations of cholesterol, triacylglycerols in serum decreased, and protein content increased with respect to control in the 2nd, 3rd and 6th quail groups ($p < 0.05$). An increase in calcium content in the 3rd, 4th and 6th bird groups was detected ($p < 0.05$). At the same time, in experimental groups there is a tendency to decrease the activity of marker enzymes (AlAT, AsAT), decrease of content of total lipids, uric acid, creatinine. Thus, the addition of inorganic selenium, probiotics, NPSe and their complexes have a positive effect on biochemical parameters, increment, conversion rate of feed and conservation of quails with respect to control. Nanoselen separately, and in combination with a probiotic, has more effective effect compared to sodium selenite

Key words: sodium selenite, selenium nano-particles, quails, Bifidobacterium, Lactobacillus, enzymes

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STATUS AND DISTRIBUTION OF OSMODERMA BARNABITA MOTSCHULSKY, 1845 (COLEOPTERA) IN LITHUANIA

Ivinskis P. [1], **Davenis S. A.** [1], **Rimšaitė J.**[1]

[1]*NATURE RESEARCH CENTER, AKADEMIJOS STR. 2, LT- 08412 VILNIUS, LITHUANIA, ENTLAB@GMAIL.COM; JOLANTA@EKOI.LT*

Abstract

Hermit beetle *Osmoderma barnabita* Motschulsky, 1845 associated with deciduous trees in Lithuania are included in the Lithuanian Red Data Book, Bern Convention (Annex II) and Habitat Directive (Annex II). Hermit beetle (*Osmoderma barnabita* Motschulsky, 1845) (*Cetoniidae*) are among the endangered species. Due to intensive forest cutting and farming, the populations of these species have markedly declined in the majority of European countries over the recent decades, whereas in some countries the status of these populations is critical.

This species is trophically linked with declining habitats – old hollow trees (Ranius, Nilsson, 1997). Hermit beetle is the relict of primeval broad-leaved forests with old hollow trees. It likes old or dead standing and living trees and was also reported to have been found on fallen trees (Oleksa et al., 2003, Ivinskis 2006, 2015). Nevertheless, the fallen trees make up only separate fragments in the distribution range of this species. A tree serves as the habitat for a long time, until the whole inner part of the trunk gets rotten. Extensively decayed tree trunks are not used as habitats.

Hermit beetle in Lithuania was recorded in about 100 localities, but half of this records is old or uncertain and the real populations were established in about 30 localities in the Alytus, Biržai, Joniškis, Jurbarkas, Kaišiadorys, Kaunas, Lazdijai, Molėtai, Panevežys, Prienai, Švenčionys, Trakai, Vilnius, Zarasai district. The main habitats are located in the surroundings of Kaunas and Vilnius cities. The main populations of the species are found in Kaunas Ąžuolynas (Oak Park) and small oak groves in the Kaunas area, in Dūkštos oak forest (Vilnius district). The species in Lithuania is found on *Quercus robur* L. (the majority of cases), *Acer* sp. and *Populus sp*., *Tilia sp*. (several cases). The best suitable habitat for the species is Kaunas Oak Park with a large number of microhabitat – trees with holes in suitable condition, sufficient solar lighting. The main problem of the protection of this species in Lithuania is the destruction of old hollow trees and undergrowth.

For the protection of *Osmoderma barnabita* it is necessary to carry out the inventory of trees inhabited by these species and to ensure their protection. It is important to observe the status of living and dead hollow trees in the habitats of these species. The cutting of old and dead oak trees should be abolished under any circumstances. Tree hollows should be retained, but not filled with cement. As hermit beetle is a warmth-loving species, the undergrowth should be removed.

Key words: Osmoderma barnabita, Coleoptera, habitat protection

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EFFECTS OF PREINCUBATION WITH NON-FERMENTABLE CARBON SOURCES ON THE DESICCATION TOLERANCE OF SACCHAROMYCES CEREVISIAE CELLS

D. Galalytė[1], N. Kuliešienė[1], R. Daugelavičius[1]

[1]DEPARTMENT OF BIOCHEMISTRY, VYTAUTAS MAGNUS UNIVERSITY, KAUNAS, LITHUANIA
DEIMANTE.GALALYTE@GMAIL.COM

Abstract

Introduction: Saccharomyces cerevisiae is a unicellular eukaryotic organism that often undergoes transition into state of anhydrobiosis. During desiccation these cells lose intracellular water, but still protect their structures from damages for successful recovery during the rehydration.

Aim: This study was performed to explore effects of cell preincubation in concentrated solutions of non-metabolizable carbon sources on the resistance of S. cerevisiae to dehydration.

Materials and methods: Two S. cerevisiae strains were studied: #14 – semi-resistant, and #77 – very resistant to dehydration. The cells were incubated in 1 M solutions of xylitol, lactose or glycerol for 3 h and desiccated at 30 ⁰ C for 21 h. During rehydration the metabolic activity of cells was assayed by oxygen consumption test, following intracellular accumulation of K+ and synthetic lipophilic anion phenyldicarbaundecaborane (PCB-), also by fluorescence microscopy.

Results: This study revealed that incubation in various solutions differently affected the cells. Respiration of #14 strain cells preincubated with glycerol and lactose was more intensive (consuming 90% and 70% of medium dissolved oxygen, respectively) than of #77 strain cells whose oxygen consumption was 2 fold slower. Meanwhile, xylitol pretreated cells of both strains consumed the same amount of oxygen (45%). The PCB- test showed that when preincubated in glycerol or lactose, plasma membrane of #14 cells was more permeable than of #77. Another difference was that lactose-preincubated #14 cells recovered membrane barrier more slowly than the same cells preincubated with glycerol. When cells were preincubated with xylitol, membrane permeability of both strains was very similar. Results on the role of preincubation on accumulation of intracellular K+ will also be presented at the conference.

Conclusion: Our results indicate that preincubation of the yeast cells in hypertonic solutions of glycerol, lactose or xylitol highly increase their resistance to desiccation. The most intriguing result of this study is that after preincubation in concentrated solutions of lactose and glycerol the cells "switched" their phenotypes: #14 strain showed higher metabolic activity than #77 one. On the other hand, there were no differences on metabolic activity in both strains after preincubation in 1 M xylitol. This effect should not be metabolism-driven, because in S. cerevisiae cells all three carbon sources are non-fermentable.

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EFFECTS OF SEED TREATMENT WITH COLD PLASMA AND ELECTROMAGNETIC FIELD ON BUCKWHEAT (FAGOPYRUM ESCULENTUM) SEEDS GERMINATION, SEEDLINGS GROWTH AND ANTIOXIDANT CAPACITY

Laura Sarapinaitė[1], Zita Naučienė[2], Laima Degutytė-Fomins[2], Rasa Žukienė[2], Greta Kvietkutė[2], Ainis Jarušaitis[2], Giedrė Paužaitė[3], Asta Malakauskienė[3], Irina Filatova[4], Veronika Lyuskevich[4], Vida Mildažienė[2]

[1]VYTAUTAS MAGNUS UNIVERSITY, FACULTY OF NATURAL SCIENCES, LITHUANIA , [2]VYTAUTAS MAGNUS UNIVERSITY, FACULTY OF NATURAL SCIENCES, LITHUANIA, [3]VYTAUTAS MAGNUS UNIVERSITY, FACULTY OF NATURAL SCIENCES, LITHUANIA; VYTAUTAS MAGNUS UNIVERSITY, KAUNAS BOTANICAL GARDEN, LITHUANIA, [4]NATIONAL ACADEMY OF SCIENCES OF BELARUS, B. I. STEPANOV INSTITUTE OF PHYSICS, BELARUS
ZITA.NAUCIENE@VDU.LT

Abstract

Buckwheat (*Fagopyrum esculentum*) is a popular food component in Lithuania characterized by high nutritional value due to the presence of potential antioxidants, such as rutin, other phenolic substances, and tocopherols.

We studied the effects of pre-sowing seed treatment with radio-frequency electromagnetic field (EMF, 5-15 min) and cold plasma (CP, 2-7 min), on germination (in vitro and in substrate), seedling growth and radical scavenging activity of two buckwheat cultivars – 'Nojai' and 'Vokiai' (seeds were kindly provided by dr. D. Romanovska from Voke branch of Lithuanian Research centre for Agriculture and Forestry). Final germination percentage indicating seed viability in control and all treated groups in vitro and in substrate was about 100%. Germination tests in vitro revealed that CP treatments slightly increased germination rate only in "Nojai", (T50 decreased by 7% in CP 7 min group), EMF treatments had no effect on germination rate in vitro. CP and EMF effects on germination in substrate were different from their effects in vitro: both CP and EMF decreased germination rate of 'Nojai' (by 14 and 15% CP 2 min and EMF 15 min, respectively) while germination of 'Vokiai' was not affected. Despite suppressing effects on germination rates in substrate, CP and EMF treatments induced positive changes in morphometric parameters of seedlings grown for 6 weeks in the climatic chamber under controlled conditions. For both cultivars height and wet weight of seedlings, the average number of leaves per plant and the number of flowering plants in experimental groups grown from treated seeds was larger (up to 15, 33, 33 and 34%, respectively) in comparison to the corresponding control, while roots were longer only in 'Vokiai' cultivar plants from treated seeds groups (up to 14 %) compared to control. Radical scavenging activity in the extracts of leaves of young plants grown from seeds treated with EMF (but not CP) was substantially increased – by 43% in EMF 15 min treated 'Vokiai' group and by 50% in EMF 5 min treated 'Nojai' group.

Thus, the obtained results indicate that short time pre-sowing treatment of buckwheat seeds with CP and EMF had only minor effect on seed germination rate, however both CP and EMF treatments increased early seedling growth, accelerated flowering, but only EMF treatments increased radical scavenging activity in leaf extracts.

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EFFLUX PUMPS INHIBITION OF LISTERIA MONOCYTOGENES CELLS

Kamilė Šepetytė[1], Sandra Sakalauskaitė[1], Rimantas Daugelavičius[1]

[1]VYTAUTAS MAGNUS UNIVERSITY, DEPARTMENT OF BIOCHEMISTRY, KAUNAS, LITHUANIA
KAMILESEPETYTE@GMAIL.COM

Abstract

Introduction: Listeria monocytogenes is an opportunistic foodborne Gram-positive pathogen causing serious human infections. These bacteria are widely distributed in the environment and are the third most common cause of death from food poisoning. Because of efflux pumps *L. monocytogenes* is a multidrug resistant pathogen, not sensitive to many antimicrobial compounds, including tetracycline, amoxicillin, benzalkonium chloride. Efflux pumps are membrane transporters which can extrude out of the cells various toxic compounds. Knowledge about the regulation of activity of these pumps could enhance the efficiency of treatment. One of ideas how to control the efflux is to use the pump inhibitors.

Aim: To assessthe influence of potential inhibitors on the interaction of *L. monocytogenes* cells with efflux indicator Tetraphenylphosphonium (TPP+) ions and compare these results with the results of fluorimetric analysis.

Materials and methods: TPP+ is universal efflux pump substrate in prokaryotic and eukaryotic cells. Electrochemical analysis was used to follow the distribution of TPP+ ions between the cells and the incubation medium. We used well-known inhibitors of Gram-positive cell transporters, such as Chlorpromazine, Reserpine and Verapamil, to analyze the efflux activity in *L. monocytogenes*. In addition, we explored effects of Phe-Arg-β-naphthylamide (PAβN), which is known as an inhibitor of RND family pumpsin Gram-negative bacteria. Fluorescence measurements were made with other efflux pumps substrate Ethidium to assay the intensity of their activity.

Results: Accumulation of TPP+ ions was analyzed at different incubation conditions. The cells, incubated in 100 mM phosphate medium, were sensitive to all mentioned inhibitors and temporally accumulated the increased amounts of TPP+. In arsenate-containing medium the period of temporal additional accumulation of TPP+ was registered. This stage of interaction between *L. monocytogenes* and TPP+ was not observed in phosphate medium.

Conclusions: All used Efflux pump inhibitors increased the accumulation of TPP+ ions in *L. monocytogenes* cells. PAβN demonstrated the efflux inhibiting effect not only on Gram-negative, but also on L. monocytogenes cells.

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ELECTROMAGNETIC FIELD INFLUENCE ON PECULIARITIES OF *RANA TEMPORARIA* LINNAEUS, 1758 (*ANURA*, *RANIDAE*) ONTOGENY

Oleksii Marushchak[1], Oksana Nekrasova[1], Vitalina Voitenko[3], Oleksandra Oskyrko[3], Dmitry Zhytnyk[5]

[1]I.I. SCHMALHAUSEN INSTITUTE OF ZOOLOGY OF NATIONAL ACADEMY OF SCIENCES OF UKRAINE, DEPARTMENT OF ANIMAL MONITORING AND CONSERVATION, UKRAINE, [2]TARAS SHEVCHENKO NATIONAL UNIVERSITY OF KYIV, EDUCATION AND SCIENTIFIC CENTER "INSTITUTE OF BIOLOGY AND MEDICINE", DEPARTMENT OF ECOLOGY AND ZOOLOGY, UKRAINE, [3]TARAS SHEVCHENKO NATIONAL UNIVERSITY OF KYIV, FACULTY OF RADIO PHYSICS, ELECTRONICS AND COMPUTER SYSTEMS, UKRAINE
VSE_OKEI@BIGMIR.NET

Abstract

The study of the environmental factors' effects on the progress of embryonic and post-embryonic ontogenesis is an important trend in modern investigations. Amphibians are often used for this purpose as model objects. Various factors can affect amphibians' ontogeny: temperature, nutrition, population's density, pollutants, etc. Experiments with high frequency irradiation (900 MHz) yielded interesting effects of electromagnetic radiation on bird and fish ontogeny [Romanyuk, 2011; Tsybulin, 2016; Jyoti, 2014]. However, we didn't find such experiments done with Amphibia class. Our experiment was conducted from the end of March to the middle of August. Grass frog spawn was collected from NNP "Holosiivskyi" during spawning. The material was placed in 10 boxes: A, B, C, D (series 1); K1, K2 (control); A (ob), B (ob), C (ob), D (ob) (series 2) with the same water temperature of 12 ºC. After mixing, eggs were transferred to a plastic container (25 cm3) in portions of 22 pieces (n = 264). We used a device for 22 MHz frequency irradiation [Zhytnyk, 2014]. Irradiation time of eggs in each box: A - 0.5 min, B - 5 min, C - 10 min, D - 20 min. Boxes A (ob)-D (ob) were irradiated twice, repeating the previously mentioned times the day after the first session. Control boxes were not exposed to electromagnetic influences. Tadpoles' total length was used as parameter for studying the effects of exposure. Samples for measuring were taken every 4-5 days. Length measuring and stages' determination was made on fixed material (70% ethanol), photos were taken from Leica 2.0 microscope, data processing was done in Adobe Photoshop and Statistica 10.0. The analysis of variance of tadpoles' body lengths claimed that average tadpoles' sizes differ significantly between boxes sets of series (1) and (2). The difference was reliable (95%, $p < 0.036$). This value was established after throwing out artifacts that appeared probably due to the difficulty in processing fixed material (with artifacts, the difference is 99% ($p < 0.0017$). The average body size of the individuals from the series (2) was 6.120 mm, while in series (1) - 5.665 mm. Control series had the lowest body length - 5,158 mm. At this stage of the experiment, we observed a significant positive effect on the development of *R. temporaria* tadpoles under the influence of an electromagnetic field of 22 MHz, but the results' preliminary requires further studies in extended experiment version.

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ENHANCEMENT OF RADIOSENSITIVITY OF MAGIC POLYMER GELS BY INTRODUCING SILVER NANOPARTICLES

Povilas Gabralevičius[1], Diana Adlienė[1], Jurgita Laurikaitienė[1], Judita Puišo[1]

[1]KAUNAS UNIVERSITY OF TECHNOLOGY, KAUNAS, LITHUANIA
POVILAS.GAB@GMAIL.COM

Abstract

Due to their ability of polymerization upon the exposure to ionizing radiation dose gels are widely used in radiotherapy for the recording of irradiated volume and assessment of 3D dose distribution in it. Being almost tissue equivalent dose gels, doped with nanoparticles, can be used for radiation sensitivity studies of organs in targeted nanoparticle radiotherapy, which will contribute to the reduction of treatment doses to patient thus sparing organs at risk from unnecessary exposure during radiotherapy procedure.

The aim of this work was to analyse radiosensitivity changes of polymer gels containing silver nanoparticles and quantify dose enhancement effect in irradiated composites. Instruments and methods. Polymeric dose gel MAGIC of a standard composition (84% distilled water, 8% methacrylic acid, 8% gelatin, 0.037% ascorbic acid, 0.002% copper sulfate) was used as a matrix for embedding of silver nanoparticles. Silver nanoparticles were produced via radiolysis introduced during irradiation of polymer gel with admixed certain amount of AgNO3 in Linear accelerator (Clinac DMX Varian). 6 MV photon beam was used for the irradiation and different doses were delivered to the gel samples. Analysis of irradiated MAGIC gels without nanoparticles and with embedded nanoparticles was performed using UV-VIS spectroscopy (Ocean Optics with USB4000) and Monte Carlo simulations. Results. Performed analysis of UV-VIS spectra revealed the appearance of the well-pronounced absorption peak in the wavelength interval of 400 – 500 nm in irradiated gels with admixed certain amount of AgNO3 indicating formation of Ag nanoparticles in irradiated composites. The intensity and position of the absorbance peak was dose dependent. There was no evidence of any extremity in UV-VIS absorbance spectra for irradiated to the same doses silver free MAGIC dose gels, but the intensity changes due to gel exposure to different doses was estimated as statistically significant. Based on the results of investigation, silver salt concentration dependent dose enhancement factor (DEF) was calculated for MAGIC gels containing admixed certain amount of AgNO3.

Conclusion. Performed investigation indicated the possibility of the direct Ag nanoparticle radiosynthesis in X-ray irradiated MAGIC gels containing certain amount of AgNO3. It was shown that the dose enhancement factor of up to 10% can be achieved when using Ag nanoparticle enriched MAGIC gels for the dose verification in the range of 0.5- 5 Gy.

Keywords: polymer gel, radiotherapy, nanoparticles, dose enhancement

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EPIGENETIC VARIABILITY IN FEN ORCHID (*LIPARIS LOESELII* L.) POPULATIONS IN LATVIA

Nataļja Škute[1], Nadežda Harlamova[1], Marina Savicka[1], Daina Roze[2]

[1]DAUGAVPILS UNIVERSITY, INSTITUTE OF LIFE SCIENCES AND TECHNOLOGIES MOLECULAR BIOLOGY AND GENETICS LABORATORY, LATVIA,
[2]NATIONAL BOTANIC GARDEN OF LATVIA
NATALJA.SKUTE@DU.LV

Abstract

The orchid family is one of the most threatened families in Latvia. One of the rarest and especially protected species in Latvia is the fen orchid (Liparis loeselii L.), whose area covers the entire territory of Latvia. Environmental and climate changes as well as anthropogenic factors have dramatically influenced on fen orchid growing habitat, which has led to decrease the species occurrence. For the understanding of species vitality in changes climate it is necessary to know not only genetic bet also epigenetic processes in population of orchid. These epigenetic changes can be caused as adaptive response to environmental factors. Epigenetic mechanisms regulate gene expression without changes to the underlying DNA sequence. DNA methylation is the best known epigenetic modification. The total DNA methylation level depend on the type of environmental factors.

DNA was isolated from orchid leaves, using the DNeasy Plant kit (Qiagen). The Luminometric Methylation Assay (LUMA method) was used for total DNA methylation analysis of orchid populations. The LUMA is permissive for genomic DNA methylation studies of any genome as it relies on the use of methyl-sensitive and –insensitive restriction enzymes followed by polymerase extension via Pyrosequencing technology.

It was shown, that relative methylation levels in fen orchid varies from 0.27 to 0.46 in different Latvian regions. Relative DNA methylation level in Engure Lake is the highest (0.46). Increased level of total DNA methylation in the fen orchid in this region could be a response to inappropriate environmental factors such as humidity and lighting.

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ESTIMATION OF RRNA GENE CLUSTER COPY NUMBERS IN GENOMES OF SEVERAL REPRESENTATIVES OF THE SAUROPSIDA GROUP

A. Dyomin[1], A. Saifitdinova[2], S. Galkina[3], E. Gaginskaya[4], A. Sokolovskaya[4]

[1]SARATOV STATE MEDICAL UNIVERSITY, INSTITUTE OF EXPERIMENTAL URINEPHROLOGY, RUSSIAN FEDERATION, [2]SAINT-PETERSBURG STATE UNIVERSITY, RESEARCH RECOURSE CENTER CHROMAS CORE FACILITY, RUSSIAN FEDERATION, [3]SAINT-PETERSBURG STATE UNIVERSITY, DEPARTMENT OF GENETICS AND BIOTECHNOLOGY, RUSSIAN FEDERATION, [4]SAINT-PETERSBURG STATE UNIVERSITY, DEPARTMENT OF CYTOLOGY AND HISTOLOGY, RUSSIAN FEDERATION
IN.YAN.2010@YANDEX.RU

Abstract

It is generally known that there are 4 genes coding ribosomal RNAs. Three of them for 18S, 5.8S, and 28S rRNA exist as a cluster and are multi-copied, forming particular chromosomal sites called nucleolus organizer regions (NORs). The number of rRNA gene cluster copies varies in different species and between individuals to some extent. In each cluster 18S rRNA, 5.8S rRNA, and 28S rRNA genes are separated by internal transcribed spacers ITS1 and ITS2. External transcribed spacers 5'ETS and 3'ETS are situated downstream of 18S rRNA gene and upstream of 28S rRNA gene, respectively. rRNA gene clusters are separated by intergenic spacers (IGS). Due to its highly repetitive nature, the exact sequences of NORs are not included in the genome sequence assemblies and therefore have to be investigated in a focused manner. Here we use the information on chicken, Japanese quail and red-eared slider raw genomic sequence data to estimate rRNA gene cluster copy numbers. Using BLAST we analyzed 125 and 126 bp sequences of 18S, 5.8S rRNA genes and 4 reference single-copy genes (with GC content ~50%) in raw FASTA whole-genome DNA Illumina sequence reads retrieved from NCBI Sequence Read Archive (SRA). All founded reads were mapped against the sequence of interest to estimate read depth. Cluster copy numbers were calculated accordingly to: Copy number = mean coverage for 18S (5.8S) rRNA gene / mean coverage for reference gene. Ribosomal gene cluster copy number per diploid genome averaged 85 copies for the green junglefowl (*Gallus varius*), 59 copies for the red junglefowl (*G. gallus*), 74 copies for Indonesian native chickens Kedu Hitam (*G. g. domesticus*), 101 copies for American chickens Black Java (*G. g. domesticus*), 209 copies for the Japanese quail inbred line Cons DD (*Coturnix c. japonica*) and 153 copies for the red-eared slider (*Trachemys scripta*). The calculations for both 18S and 5.8S rRNA genes coincided, which suggests that our approach can be used for the in silico analysis of rRNA cluster copy number in the raw genomic sequence data of animals. Technical and financial support: "Chromas" and "Molecular and Cell Technologies" Research Resource Centers of the Scientific Park of Saint-Petersburg State University; RFBR grant # 18-04-01276.

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EVALUATION OF COMPOSITION OF HERBACEOUS PLANT SPECIES IN THE SITES WITH *IMPATIENS PARVIFLORA* DC

Giedrė Rajackaitė[1], Rasa Janulionienė[1], Vitas Marozas[2], Eugenija Kupčinskienė[1]

[1]DEPARTMENT OF BIOLOGY, VYTAUTAS MAGNUS UNIVERSITY, VILEIKOS STR. 8, LT-44404 KAUNAS, LITHUANIA,2INSTITUTE OF ENVIRONMENT AND ECOLOGY, ALEKSANDRAS STULGINSKIS UNIVERSITY, STUDENTŲ ST. 11, LT-5336, AKADEMIJA, KAUNAS REGION, LITHUANIA
EUGENIJA.KUPCINSKIENE@GMAIL.COM

Abstract

Nowadays invasion of alien species may threaten the most remote habitats altering unique composition of native species. Invasive plants have a tendency to adapt swiftly to different conditions of environment and settle in versatile habitats. Small balsam (Impatiens parviflora DC.) is a widespread invasive plant which managed to pervade the majority of European countries through the last century. The aim of this study was to evaluate the structure of various Lithuanian sites with small balsam populations using set of phytocenological parameters. Scattered across Lithuania 21 population of small balsam were selected for our research. At each site composition and coverage by herbaceous plant species was assessed in 100 m2 plots. Abiotic environment (light, temperature, continentality, soil moisture, pH and nitrogen) was evaluated using weighed Ellenbergind icatory values. In our study sites depending on habitat type coverage by small balsam ranged from 5% (Žagarė) to 70% (Kaunas-Aukštieji Šančiai, Juodkrantė), mean being 35%. By two-way cluster analysis all herbaceous plant species and populations were grouped into several clusters. The most distinct was plant community in Žagarė (32 herbaceous plant species) with the lowest small balsam coverage (5 %). Urtica dioica L.was the only species found in all study sites. Principal coordinate analysis, based on Ellenberg weighed indicatory values, has grouped small balsam populations into four clusters. Žagarė population formed a separate cluster because of unique geographical and habitat features. The next level clusters (from the second down to the 4th degree cluster) have encompassed populations with increasing coverage by small balsam whereas decreasing values of Ellenberg light and moisture estimates. It might be concluded, that for growth of small balsam preferable sites are shaded areas with moderate soil moisture.

Keywords: small balsam, invasive plants, phytocenology

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EXTRACTION OF BETA GLUCANS FROM MUSHROOMS

I. Sabeckis[1], D. Noreikaitė[1], J. Labidi[2], V. Baublys[1], V. Tubelytė[1], N. Striūgas

[1]VYTAUTAS MAGNUS UNIVERSITY, DEPARTMENT OF BIOLOGY, LITHUANIA, [2]UNIVERSITY OF BASQUE COUNTRY, DEPARTMENT OF CHEMICAL AND ENVIRONMENTAL ENGINEERING, SPAIN, [3]LITHUANIAN ENERGY INSTITUTE, BRESLAUJOS STR. 3, KAUNAS IGNAS.SABECKIS@GMAIL.COM

Abstract

Over the last few years, interest has grown in the production of edible films and coatings made from various carbohydrates. These coatings and films have various functions: inhibit the migration and accession of moisture, oxygen, carbon dioxide, aromas, lipids and other substances to food products, also they can extend the shelf life of food products and improve their quality and mechanical properties. Mushrooms have long been used in cuisine and medicine. They are known as a source of vitamins and minerals. Mushrooms are rich in micronutrients (potassium, zinc, etc.), D, PP and B vitamins, amino acids. They also contain glucan molecules that provide well immune function. Glucans are polysaccharides made up of glucose monomers linked by glycosidic bonds. Glucans are found in the walls of plants, bacteria, fungi and protozoa cells. Glucan is present in many different forms, each of which is different in its biological activity. The most commonly found type of glucans is beta glucans, a heterogeneous group of natural polysaccharides, mainly investigated for their immune response. The positive effect of beta glucans on immunity was observed in humans, invertebrates and rodents. Studies have shown that beta glucans have anti-diabetic, antioxidant, hepatoprotective, antitumor, cholesterol and body weight loss effects. In this study, glucans were extracted from low-cost non-toxic cosmopolitan mushrooms species using three different methods. The extraction methods have been compared and the quantity of glucans was calculated.

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FIRST DATA OF GREEN FROG PELOPHYLAX ESCULENTUS COMPLEX (ANURA: RANIDAE) TADPOLES PARASITES IN LATVIA

Muza Kirjusina[1], Evita Gravele[1], Ligita Mezaraupe[1], Mihails Pupins[2]

[1]DAUGAVPILS UNIVERSITY, INSTITUTE OF LIFE SCIENCES AND TECHNOLOGY, DEPARTMENT OF ECOLOGY, PARADES STREET 1A, DAUGAVPILS, LV-5401, LATVIA , [2]DAUGAVPILS UNIVERSITY, INSTITUTE OF LIFE SCIENCES AND TECHNOLOGY, DEPARTMENT OF ECOLOGY, PARADES STREET 1A, DAUGAVPILS, LV-5401, LATVIA
EVITA_22@INBOX.LV

Abstract

The European water green frog *Pelophylax esculentus* complex is widely distributed in freshwater basins in Latvia. Its tadpoles play a significant role in the food chains of small waterbodies ecosystems and can be important hosts for their parasitofauna. Study of the parazitofauna of tadpoles in preserved territories can be useful for conservation of amphibians and for better understanding of co-evolution of amphibians and their parasites in ponds ecosystems. Research was conducted in accordance with Nature conservation agency agreement. The tadpoles were collected from shallow natural pond located in Nature reserve "Ilgas", Nature park "Silene" (Natura 2000), 55.692968º; 26.787382º, South-East part of Latvia.

Hosts examination for endoparasites was carried out within 24-48 hr after capture. In Augusts 2017 total of 55 specimens were collected for parasitological examination. The tadpoles were over anaesthetized in ether-filled containers. The eyes, heart, lungs, liver, gall bladder, alimentary tract and urinary bladder were separated and examined under stereomicroscope. Musculatures, mouth cavity and body cavity have been carefully studied. Three ciliates species from intestine were detected – *Balantidium duodeni*, *Nyctotherus cordiformis* and *Haptophrya gagantea*. However, most ciliates are commensals and pathogen effect is`t known. Three Trematoda species parazite in larvae stage in different organs – *Alaria alata*, *Diplostomum sp*. and *Opisthioglyophe ranae*. Last species and Diplodiscus subclavatus in adult stage were detected in intestine of tadpoles. One Nematoda Thelandros tba common parasite of frog tadpoles was observed in intestine. 2 trematodes species still are under detection. All parasites are collected for future detection and investigation.

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FISHPONDS AND SEWAGE WATER BODIES AS TERRITORIES WITH HIGHER LEVEL OF BIRD DIVERSITY IN UKRAINE

Serebryakov V.[1], Davydenko I.V.[2], Kazannyk V.V.[1]

[1]TARAS SHEVCHENKO NATIONAL UNIVERSITY IN KYIV, UKRAINE, [2]NATIONAL UNIVERSITY OF LIFE AND ENVIRONMENTAL SCIENCE, KYIV, UKRAINE
BCSSU2@GMAIL.COM

Abstract

Nowadays the fresh artificial water bodies according to their area and meaning in nature and to human activities significantly exceed the natural ones. In terms to maintain living activities of wetland and other birds (among which there are many rare species) the fishponds and sewage water bodies are very valuable. In summer, when fishponds with artificial water level regulation are full of water the great number of bird species are breeding here (ducks, geese, swans, gulls, terns, crakes and some species of passerines. This area is good for moulting waterfowls. During the seasonal decreasing of water level for cold period the open bottoms of ponds are good sites for feeding and rest for many local species and migrants in spring and autumn (waders, gulls, cormorants, herons, ducks, gees, birds of prey etc.). The waste water ponds are good feeding base for birds due to a lot organic matter in water. The great variety of such ponds and presence of different sites supply them with good protective characteristics. Different species of waders, terns, ducks and passerines are breeding here. During seasonal migrations these water bodies are good sites for stopover and feeding of many wetland species and others. Thanks to whole-year discharge of warm waters some species of waterfowls, passerines and wetland birds can stay here for wintering.

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FLUORESCENCE MICROSCOPY STUDIES OF DNA AND DNA RESTRICTION ENZYMES INTERACTIONS AT THE SINGLE MOLECULE LEVEL

Giedrė Karzaitė[1], Marijonas Tutkus[1], Giedrė Karzaitė[1], Šarūnė Ivanovaitė[1], Danielis Rutkauskas[1], Mindaugas Zaremba[2]

[1]VILNIUS UNIVERSITY, INSTITUTE OF BIOTECHNOLOGY, SAULĖTEKIO AVENUE 7, LT-10257 VILNIUS, [2] CENTER FOR PHYSICAL SCIENCES AND TECHNOLOGY, SAVANORIŲ PR. 231, LT-02300 VILNIUS
GIEDRE.KARZAITE@GMAIL.COM

Abstract

Restriction endonucleases (REases) recognize specific nucleotide sequences in a double stranded DNA and cleave both strands of the duplex. In vivo REases protect their host bacteria from viral attacks by cleaving foreign DNA. In vitro, they are widely used as a molecular tool for various DNA manipulations [1]. Restrictase BfiI belongs to the phospholipase D (PLD) superfamily and does not require metal ions for DNA cleavage. It recognizes an asymmetric DNA sequence, 5'-ACTGGG-3', and cuts top and bottom strands at fixed positions downstream of this sequence [2].

Here we are studying several versions of BfiI REase: WT BfiI, BfiI-SS, BfiI-K107A, BfiI-K107A-SS. The wild-type BfiI is a native protein. In BfiI-SS protein SS bridge is linking the dimer interface [3]. In BfiI-K107A protein mutation was introduced in the active center at residue 107 - Lysine was changed to Alanine. BfiI-K107A-SS protein contains both mentioned mutations.

In this research we have studied interaction between DNA and BfiI restriction enzymes using single – molecule Forster Resonance Energy Transfer (smFRET) total internal reflection (TIR) microscopy. Biotinylated DNA molecules bearing two targets for BfiI and FRET pair dyes close to these targets were immobilized on a silanized and PEGylated (metoxy-PEG and biotin PEG mixture) glass surface via neutravidin. The protein induces formation of DNA loop: one BfiI site binds one target and second another, and therefore brings the FRET pair in close proximity.

Our acquired smFRET signals have shown multiple FRET level lasting for several seconds. We observed that FRET efficiency and duration was affected by BfiI mutation, Cross-linking and Mg2+ ions/ ion strength.

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FUNGAL BIOSORPTION OF THE REMAZOL BRILLIANT BLUE R AND OPTIMIZATION OF SOME PARAMETERS

Ipek Özeren[1], Sevgi Ertuğrul Karatay[1], Gönül Dönmez[1]

[1]ANKARA UNIVERSITY, BIOLOGY DEPARTMENT, TURKEY
SERTUGRUL@ANKARA.EDU.TR

Abstract

The effluents of synthetic dyes and dye solvents used for textile, pharmaceutical, cosmetics and food industries create serious problems to the environment. Because they have toxic, mutagenic and carcinogenic effects. Furthermore these colorful effluents has adverse effects for photosynthetic activity in aqueous sysytems. To overcome the negative effects of these dyes on environment, several methods such as physical, chemical and biological has been developed. Among them biological methods are often considered as the most economical, ecofriendly and effective alternative process when compared with the others. Some specific microorganisms such as microalgae, fungi, yeast and bacteria can be utilized as bioagents for decolorization of textile dyes in wastewaters.

Remazol Brilliant Blue biosorption capacity of six fungi were investigated in the current study. The fungi were grown at 25 ºC in a molasses liquid medium. For the biosorption studies 1 g/L heat-treated fungal biomass was used. Six fungal isolates were used and the bioremoval yields were between 1%-30% at the end of 24 hours in the presence of about 30 mg/L dye. The highest biosorption yield was observed as 26% at 60 minutes for the first fungal isolate.

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FUSARIUM CIRCINATUM RESEARCH ON PINUS SYLVESTRIS OF DIFFERENT PROVENANCES AND INTERACTION WITH OTHER PINE-INHABITING FUNGI

Kristina Raitelaitytė[1,2], Tomasz Oszako[3], Svetlana Markovskaja[2], Jana Radzijevskaja[1], Algimantas Paulauskas[1]

[1]FACULTY OF NATURAL SCIENCES, VYTAUTAS MAGNUS UNIVERSITY, VILEIKOS ST. 8, LT- 44404 KAUNAS, LITHUANIA, [2]INSTITUTE OF BOTANY, NATURE RESEARCH CENTRE, ŽALIŲJŲ EŽERŲ ST. 49, LT- 08406 VILNIUS, LITHUANIA, [3]FOREST RESEARCH INSTITUTE (IBL), SĘKOCIN STARY, UL. BRACI LEŚNEJ 3, 05-090 RASZYN, POLAND
KRISTINA.RAITELAITYTE@GMAIL.COM

Abstract

Fusarium circinatum Nirenberg & O'Donnell (anamorph of *Gibberella circinata*) is a pathogenic fungus causing pitch canker of Pinus spp. and Douglas fir (*Pseudotsuga menziesii*). It can damage seedlings in nurseries and adult trees in forests. Symptoms for seedlings are damping-off and wilting, and for adult trees are bleeding resinous cankers on stems or thick branches and branch die-back. In Europe *F. circinatum* is known from Spain, Portugal, France and Italy and is treated as serious potential invasive forest pathogen in Europe which spreads via contaminated seeds, seedlings, wood material, soil, wind, insect vectors and human activities. In the future, fungus is more likely to spread to the pine forests of southern Europe, but there is also possibility of spread in Central and Northern Europe. In Lithuania there are no records of *F. circinatum* so far. In 2018 we tested susceptibility of three different Lithuania native *Pinus sylvestris* provenances to this pathogen. To represent each provenance we used 38 pines from every. We inoculated soil with *F. circinatum* suspension and after four weeks following soil inoculation extracted DNA from few plants that looked unhealthy. The RT-PCR method did not detect *F. circinatum* in our samples. The reason, however, might lay in too low proportion of fungal biomass comparing to the host biomass. We also checked interaction between Fusarium circinatum and several pine-inhabiting fungi known in Lithuania: *Dothistroma septosporum, Fusarium oxysporum, Lecanosticta acicola*. We found that F. oxysporum grew somewhat faster than *F. circinatum* and suppressed *F. circinatum* growth rate. Dothistroma septosporum produced dothistromin which seemed to slow down *F. circinatum* culture growth as well. Meanwhile *L. acicola* was outgrown by *F. circinatum*.

Keywords: pathogen, canker, pine.

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GENETIC DIVERSITY ANALYSIS OF LITHUANIAN HOUNDS

Ugnė Kaminskaitė[1], Vaida Tubelytė[1], Vykintas Baublys[1], Algimantas Paulauskas[1]

[1]DEPARTMENT OF BIOLOGY, VYTAUTAS MAGNUS UNIVERSITY, KAUNAS, LITHUANIA
UGNE.KAMINSKAITE@STUD.VDU.LT

Abstract

Lithuanian hound is the oldest national dogs breed in Lithuania from Vytautas Magnus times in XIII century. It was almost extinct when Lithuanian cynologist Z. Goštautas recreated this breed with the rest 5 dogs in 1957-1958. Today we have about 600 Lithuanian hounds, but they aren't accepted by FCI (Federation Cynologique Internationale), as it needs at least 1000. Moreover, some of them do not match breed standard. The most important issue is high inbreeding coefficient inside breed (2,09 %), detected in 2008. Analysis of individual genealogy of registered dogs shows high relatedness across individuals and lack of genetic variability inside breed. High relatedness is the consequence of progenies deaths, large receptivity of pathogenic microbes and mammary gland tumors diagnoses. In order to save Lithuanian hound gene pool genetic analysis must be done instead of pairing dogs by exterior. The aim of this study was to investigate genetic structure of Lithuanian hounds. Buccal swab samples were collected from 63 dogs, during National Lithuanian hound exhibition in 2017. DNA was extracted by using silica spin columns and was used for short tandem repeat (STR) analysis. Data obtained during this study correlates with genealogical analysis data and shows lack of genetic variability inside Lithuanian hound breed.

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GENETIC DIVERSITY OF RED SQUIRREL (SCIURUS VULGARIS) IN LITHUANIA

L. Budginas[1], I.Razanske[1], A.Paulauskas[1]

[1]VYTAUTAS MAGNUS UNIVERSITY, FACULTY OF NATURAL SCIENCES, DEPARTMENT OF BIOLOGY, VILEIKOS G.8, LT-44404 KAUNAS, LITHUANIA
LUKAS.BUDGINAS@STUD.VDU.LT

Abstract

Red squirrel (*Sciurus vulgaris*) is well known and widely spread animal trough Eurasian forests. To maintain healthy levels of genetic diversity, animal populations need to remain sufficiently large. Fragmentation of habitats is followed by the fragmentation of resident populations, as a result of which genetic variation may be lost. In this study, genetic diversity of Lithuanian red squirrels was analyzed using microsatellites and mitochondrial DNA (mtDNA). For microsatellite analysis we used seven different primers (Scv1, Scv3, Scv23, Scv31, Rsμ3, Rsμ4, Rsμ5) that were used in Great Britain to obtain genetic diversity of Red squirrels. For mitochondrial DNA analysis we used Lpro-SQL and SQR-SQR primers. The results that were obtained were compared to other researches done in different European countries. Results revealed high-level genetic diversity of Red squirrel in Lithuania. Microsatellite analysis showed that whole population is not divided in certain groups. Mitochondrial analysis showed that the population of squirrels in Lithuania were not isolated by geographic region from other populations.

Keywords: Sciurus vulgaris, red squirrel, genetic diversity, microsatellites, mitochondrial DNA.

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GENETIC DIVERSITY OF RED SQUIRREL (*SCIURUS VULGARIS*) IN LITHUANIA

L. budginas[1], I.Ražanske[1], I. Lipatova[1], A.Paulauskas[1]

[1]VYTAUTAS MAGNUS UNIVERSITY, FACULTY OF NATURAL SCIENCES, DEPARTMENT OF BIOLOGY, VILEIKOS G.8, LT-44404 KAUNAS, LITHUANIA
LUKAS.BUDGINAS@STUD.VDU.LT

Abstract

Red squirrel (*Sciurus vulgaris*) is well known and widely spread animal trough Eurasian forests. To maintain healthy levels of genetic diversity, animal populations need to remain sufficiently large. Fragmentation of habitats is followed by the fragmentation of resident populations, as a result of which genetic variation may be lost. In this study, genetic diversity of Lithuanian red squirrels was analysed using microsatellites and mitochondrial DNA (mtDNA). For microsatellite analysis we used seven different primers (Scv1, Scv3, Scv23, Scv31, Rsμ3, Rsμ4, Rsμ5) that were used in Great Britain to obtain genetic diversity of Red squirrels. For mitochondrial DNA analysis we used Lpro-SQL and SQR-SQR primers. The results that were obtained were compared to other researches done in different European countries. Results revealed high-level genetic diversity of Red squirrel in Lithuania. Microsatellite analysis showed that whole population is not divided in certain groups. Mitochondrial analysis showed that the population of squirrels in Lithuania were not isolated by geographic region from other populations.

Keywords: *Sciurus vulgaris*, red squirrel, genetic diversity, microsatellites, mitochondrial DNA.

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GENETIC VARIATION OF THE LITHUANIAN BISON (BISON BONASUS L.) POPULATION BASED ON MITOCHONDRIAL DNA D-LOOP SEQUENCES

L.Griciuvienė[1], A.Paulauskas[1], I.Ražanskė[1], E.Blažaitytė[1], R.Papšys[2], A.Lūža[3]

[1]DEPARTMENT OF BIOLOGY, FACULTY OF NATURAL SCIENCES, VYTAUTAS MAGNUS UNIVERSITY, KAUNAS, LITHUANIA, [2]STATE SERVICE FOR PROTECTED AREAS UNDER THE MINISTRY OF ENVIRONMENT, VILNIUS, LITHUANIA, [3]PANEVĖŽYS STATE FOREST ENTERPRISE, PANEVĖŽYS, LITHUANIA
EGLE.BLAZAITYTE@STUD.VDU.LT

Abstract

The European bison (Bison bonasus Linnaeus, 1758) is the largest herbivore in Europe, survived to our days. The species is listed as endangered (EN A2ce, C2a) in the IUCN Red List of Threatened Species. In 1969-1972, 10 bison reproductors were released in Lithuania from Serpuchov Breeding Center, Moscow Region. It is little known about genetic structure of the Lithuania bison population. The aim of our investigation was to estimate genetic diversity in the European bison using mitochondrial DNA (mtDNA) D-loop sequences. We conducted the analysis of 30 individuals of the European bisons from Lithuania. Variable sites, nucleotide (π) and haplotype diversity (Hd) values were estimated in the studied B.bonasus population in Lithuania and compared results with other studies. Our data revealed low levels of molecular genetic variation in B.bonasus from Lithuania.

Key words: Bison bonasus, mitochondrial region, genetic variation, Lithuania

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GENETICAL VARIABILITY OF PONTOGAMMARUS ROBUSTOIDES G. O. SARS, 1894 IN THE LATVIAN RESERVOIRS

Aija Brakovska[1], Jana Paidere[1]

[1]INSTITUTE OF LIFE SCIENCES AND TECHNOLOGY, LABORATORY OF HYDROECOLOGY, DAUGAVPILS UNIVERSITY, LATVIA
AIJA.BRAKOVSKA@INBOX.LV

Abstract

Pontogammarus robustoides made the largest part of fish food, therefore, in order to improve the fish feed base this species was introduced in Latvian reservoirs from the Kaunas Reservoir. Abundance of Pontogammarus robustoides in the Latvian reservoirs was increasing, including the upper stretches of the reservoirs with different vegetation habitats and seasons. At the same time, *Pontogammarus robustoides* successfully exceed or replace native amphipod species. Therefore, studying population genetical variability of invasive and indigenous species might be important for identifying the impact of the invasive species on the native species community. For the first time, the genetic variability of Ponto-Caspian gammarid *Pontogammarus robustoides* population of the Latvian reservoirs was analyzed using iPBS technique. So as mobile elements are frequently found in eukaryotic genomes, that is why retrotransposon-based markers are useful systems for analyses of genetic diversity of many organisms. iPBS technique is based on long terminal repeat (LTR) retrotransposon possibility to integrate it self-copies into different places into genome. In our study we used six retrotransposon-based markers, but three markers with good representativity were selected for the analysis which produce 94 interpretable bands. The biggest number of amplified band was in Pļaviņas population - 78 and Ogresgals population - 75, but the lowest number were in Riga and Tome population - 62. The biggest number of polymorphic loci also were in Pļaviņas population i.e. 82 % and in Ogresgals population (80 %), but the lowest number of polymorphic loci were in Riga (65 %) and Tome population (66 %). The smallest genetic distance (D) (Nei, 1978) in the *Pontogammarus robustoides* populations under research was observed between populations Ķegums and Veczeļķi (0.02) and between Veczeļķi and Riga (0.04), as well as Ogresgals and Tome (0.04), while the greatest genetic distance was found between populations Pļaviņas and Tome (0.11) and between populations Ķegums and Ogresgals (0.11).

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GERMINATION RESPONSE TO PHYTOTOXICITY OF *IMPATIENS PARVIFLORA*

Ligita Baležentienė[1]

[1]*ALEKSANDRAS STULGINSKIS UNIVERSITY, INSTITUTE OF ENVIRONMENT AND ECOLOGY, LITHUANIA*
LIGITA.BALEZENTIENE@ASU.LT

Abstract

The biochemical interactions in ecosystems emphasised the ecological significance of secondary metabolites. Biochemical interaction underlies the novel weapon hypothesis thus presenting one of numerous explanations for spread of invasive species. The knowledge how invasive species spread in new environment might be important for their management control.

This study was aimed to determine the total phenolics content in *Impatiens parviflora* and evaluate germination response of monocot and dicot species to phytotoxicity. Wheat and rapeseed germination responce to allelopathic activity of worldwide invasive *Impatiens* species (*Balsaminaceae*), namely *I. parviflora* (native to C. Asia) was assessed ex situ at Aleksandras Stulginskis University in 2016.

Phenolics content ranged between 0.32 and 5.53 mg g-1 in aqueous extracts of donor Impatiens. These allelopathic compounds are phytotoxic and usually reduce the growth of neighbouring plants. The data revealed their inhibition of germination and seedlings growth of both recipient species. However, germination response was different for each recipient species due to different morphology of seed coat. Inhibition of *Impatiens* extracts was recorded stronger for rapeseed germination (mean 51.3%) than that for wheat germination (mean 23.8%) possibly due to different seed coat anatomy and thus, its permeability. Therefore the strongest inhibition (93.5%) was recorded for rapeseed germination (4.5%) in 0.2% flower and fruit+seed extract of *I. parviflora*. Wheat seedlings parameters also exhibited weaker response to donor extract than that of rapeseed. The data revealed, that *Impatiens parviflora* might negatively affect regeneration of neighbouring native species in invaded habitats.

Keywords: Allelopathy, germination, seedling, phenolics, *Impatiens parviflora*.

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IMPACT OF HEAT WAVES AND DROUGHT STRESS ON BIOMASS OF PISUM SATIVUM AND HORDEUM VULGARE

G. Juozapaitienė, A. Dikšaitytė[1]

[1]DEPARTMENT OF ENVIRONMENTAL SCIENCES, FACULTY OF NATURAL SCIENCES, VYTAUTAS MAGNUS UNIVERSITY
GINTARE.JUOZAPAITIENE@VDU.LT

Abstract

Future climate warming is expected to enhance plant growth but severe heat waves and droughts may become more frequent in a changing climate. Our objective is to investigate the response of pea and spring barley to heat waves and drought stress including biomass of leaves, stems and roots. For this purpose, plants were grown in a closed growth chambers under ambient climate conditions of 21ºC/400 ppm. A 7-day long heat wave (33ºC/400 ppm) and heat wave with elevated CO2 (33ºC/800 ppm) were applied – single and in combination with drought (i.e. fully and not watered during the heat wave period). After the treatment of heat waves and drought stress plants were left to recover for a 7-day period. Results showed that single 33ºC/400 ppm and 33ºC/800 ppm heat waves had no significant effect on biomass of leaves, stems and roots of spring barley and pea. Combination of 33ºC/400 ppm heat wave and drought stress significantly decreased leaves and stems biomass of spring barley and pea compared to ambient climate and drought conditions. Under heat wave and drought stress with elevated CO2 (33ºC/800 ppm) conditions biomass of different plant parts of pea and spring barley were less negatively affected compared to heat wave and drought stress with ambient CO2 (33ºC/400 ppm). As well as after the 7-day recovery period it was easier to recover biomass for plants who were grown under elevated CO2. This indicates that elevated CO2 mitigated the impact of combined heat wave and drought stress on plants biomass.

Keywords: biomass, drought, heat, stress, elevated CO2

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IMPACT OF PROBIOTIC ON WINTER WHEAT GROWTH AND PRODUCTIVITY

Lina Pakalniškytė[1]

[1]*NATURE RESEARCH CENTRE*
LINAPAKALNISKYTE@GMAIL.COM

Abstract

Probiotics consist of a mixture of live cultures of microorganisms, isolated from naturally fertile soils that are useful during crop production. The principal activity of probiotics appears to be to increase the bio-diversity of soil microflora, thereby increasing crop yields. The purpose of our study was to investigate and compare the tested probiotics and, for comparison, together with organic C and NPP the effects on plant growth and productivity formation as well as seed yield under natural conditions. Commercial probiotic Probio Humus, "Baltic Probiotics", Latvia was used. The microbiological content of this composition is: Lactobacillus spp., Bifidobacterium spp., Rhodopseudomonas spp., Bacillus subtilis, Lactococcus lactis. The small-plot trials were performed at the Field Experimental Station of the Institute of Botany of Nature Research Centre. The studied variety was winter wheat 'Zentos'. Probiotics in soil were applied as aqueous solution at the optimal concentration rate 300 ml/ha. Plants were evaluated morphometrically. The data were analysed applying Statistika 5.5. In natural field experiments, the tested probiotics produced stimulating effect on wheat plant growth in autumn and on formation of productivity elements. Under the impact of Probiotics + Organic C, Probiotics + Organic C + NPP, the growth of plants, compared to control, increased by 8, 12 and 15%, respectively. At full maturity stage, it was revealed that Probiotics + Organic C, Probiotics + Organic C + NPP increased the number of productive stems and grain number per ear as well as grain weight per plant. 1000 seed weight differed among the test variants and was significantly higher after the treatment with Probiotics + Organic C and Probiotic + Organic C + NPP. In conclusion, we can state that probiotics more actively regulated winter wheat growth and productivity elements.

Key words: NPP (nitrogen, phosphorus, potassium), organic C, probiotic Probio Humus, winter wheat

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IMPROVING SECOND GENERATION BIOETHANOL PRODUCTION VIA ENZYMATIC HYDROLYSIS

Ekin Demiray[1], Sevgi Ertuğrul Karatay[1], Gönül Dönmez[1]

[1]ANKARA UNIVERSITY, BIOLOGY DEPARTMENT, TURKEY
GDONMEZ@ANKARA.EDU.TR

Abstract

Global energy demand is supplied by non-renewable energy sources such as fossil fuels. As a result of growing population, increasing industrialization, greenhouse gas emissions and climate change, there is an urgent need to explore and develop alternative energy sources such as biodiesel, bioethanol, hydrogen etc. Because of it is obtained from agricultural wastes and less toxic than fossil fuels, bioethanol is one of the most important alternative to fossil fuels. Pretreatment with dilute acid is generally considered as one of the most effective method. In dilute acid pretreatment, majority of the hemicellulose is degraded and the cell wall matrix is loosens. By this reason accessibility to cellulosic structure by cellulase enzymes increases and this cellulose can hydrolysed by the cellulase enzymes. Enzymatic hydrolysis of lignocellulose after the dilute acid pretreatment is common and effective way to obtaining for fermentable sugars and it also have major advantages such as high productivity rates of sugars and hydrolysis happens in temperate conditions. Therefore in this study we investigated the enzymatic hydrolysis of apple and carrot pomaces. For fermentation experiments Kluyveromyces sp. was used. Some important parameters such as enzyme (cellulase) loading and pH were optimized.

Apple and carrot pomaces were hydrolysed in 1% H_2SO_4 (v/v) before enzymatic hydrolysis. Microbial growth, sugar consumption and bioethanol amounts were monitored periodically. Bioethanol concentration was determined with gas chromotography. Reducing sugar were measured with DNS method.

In the presence of 1.5% cellulase loading (v/w) Kluyveromyces sp. produced 14.34 g/L and 10.00 g/L bioethanol at apple and carrot pomace medium respectively. The highest ethanol amounts were detected at pH 5.

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IN VITRO ANALYSIS OF DNA DAMAGE AFTER CELL ELECTROPORATION IN THE PRESENCE OF BLEOMYCIN

A. Rimgailaitė[1], P. Ruzgys[1], S. Mickevičius[1], S. Šatkauskas[1]

[1]FACULTY OF NATURAL SCIENCES, VYTAUTAS MAGNUS UNIVERSITY, KAUNAS, LITHUANIA
AISTE.RIMG@GMAIL.COM

Abstract

Electroporation is based on the formation of pores in cell membrane when exposed to electric fields. Creation of pores leads to ion leakage, escape of metabolites, and increased uptake of various small hydrophilic molecules, including anticancer drugs. Currently electroporation is applied for local anticancer drug delivery in clinics for antitumor electrochemotherapy. During electrochemotherapy usually anticancer drug bleomycin (BLM) is used. This drug act as endonuclease inducing DNA breaks, and ultimately causing cell death. However, to our knowledge there is no studies published, that indicate the quantification of DNA damage induced by BLM electrotransfer. Here we performed in vitro analysis of DNA damage of BLM electrotransfered cells using Comet assay.

Chinese Hamster Ovary (CHO) cell culture was used for bleomycin electrotransfer. Used BLM concentration was from 20 to 2000 µg/ml. Cell were suspended in electroporation medium (conductivity 0.1 S/m, osmolarity 270 mOsm, pH 7.1,) for the delivery of electric pulses. Electroporation was performed with 1 pulse at 1400 V/cm for the duration of 100 µs. Comet assay was performed to evaluate DNA damage. Clonogenic assay was performed to evaluate cell viability.

Results indicate a significant cells DNA damage increase when higher BLM concentrations of were used. After bleomycin electrotransfer DNA breaks varied from 10 % at 20 ng/ml to 80 % at 2 mg/ml. No DNA damage was observed when cells were incubated with the same concentrations of BLM without performance of electroporation. Cell viability decrease was observed only when electroporation was performed in the presence of BLM and started to be significant at concentrations ranging between 0.2 to 2 ng/ml. At higher concentrations cell viability decreased to was about 5 %.

Keywords: Electroporation, Bleomycin, Comet Assay, DNA damage, Cancer.

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INDICATORS OF FREE RADICAL OXIDATION OF LIPIDS, PROTEINS AND ENDOGENOUS INTOXICATION IN THE ORGANISM OF DIFFERENT BREEDS BOAR FERTILIZERS

Svitlana A. Polishchuk[1], Svitlana I. Tsekhmistrenko[1], Vitalii M. Polishchuk[1], Oksana S. Tsekhmistrenko[1], Nataliia V. Ponomarenko[1], Olexandra O. Seleznyova[1]

[1]DEPARTMENT OF CHEMISTRY, BILA TSERKVA NATIONAL AGRARIAN UNIVERSITY, BILA TSERKVA, 8/1 SOBORNA PL., 09117, UKRAINE
SVETLANA.TSEHMISTRENKO@GMAIL.COM

Abstract

The study of the intensity of the course of free radical oxidation of lipids and proteins, the functioning of the antioxidant system of organism protection is of great importance for the evaluation of the etiology of fertility infertility. The purpose of the work is studying the activity of enzymes of antioxidant defense, indicators of free radical oxidation of lipids, proteins and endogenous intoxication in semen of pure-breeding and hybrid breeding boars. The research was conducted at the Bila Tserkva National Agrarian University, Ukraine. two groups of big white breeds and synthetic line SS23 were formed for 8 heads in each for the experiment. The material used for the study was ejaculates, which were obtained manually. The antioxidant system enzymes activity (superoxide dismutase, catalase), lipid peroxidation of lipids (hydroperoxides, diene conjugates, TBA-active compounds), oxidative modification of proteins, endogenous intoxication (medium mass molecules) were investigated in the plasma of sperm and sperm of boars. Sperm plasma of pure-breeding boars of large white breed is characterized by low activity of superoxide dismutase. Instead, the activity of this enzyme in spermatozoa was the highest and exceeded the similar index in animals of synthetic line SS23 by 16.1% ($P < 0.05$). The activity of catalase in the sperm plasma of the synthetic lineage SS23 is significantly lower (by 45%, $P < 0.001$) compared to the indexes of pure-breeding boars. The concentration of primary lipoperoxidation products, namely diene conjugates and lipid hydroperoxide in the genital germ cells, was significantly higher compared to similar sperm plasma values. The content of products of oxidative modification of proteins in semen plasma of purebred and synthetic animals is higher than that of sperm cytoplasm. The intensity of the lipids peroxide oxidation processes in the germ cells is much higher than in the extracellular space. Reactions of free radical peroxide oxidation of proteins and lipids in healthy boars sperm are characterized by a stable level of activity that is necessary for the normal course of processes associated with the implementation of reproductive function. All components of the antioxidant system under physiological conditions are in mutual compensatory ratios.

Keywords: boars fertilizers, semen, sperm, peroxide oxidation of lipids, enzymes of antioxidant system, oxidation modification of proteins, medium mass molecules

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INDICATORS OF THE ANTIOXIDANT PROTECTION SYSTEM IN THE ORGANISM OF NEW ZEALAND BREED RABBITS

Nataliia V. Rol[1], Maksym M. Fedorchenko[1], Svitlana I. Tsekhmistrenko[1]

[1]DEPARTMENT OF CHEMISTRY, BILA TSERKVA NATIONAL AGRARIAN UNIVERSITY, UKRAINE
NATALKA290991@GMAIL.COM

Abstract

The processes of peroxidation play an important role in the life of the organism. In contrast to free radical processes in the organism, there is an antioxidant system, which is a set of protective cells mechanisms, tissues and systems aimed at preserving and maintaining homeostasis in the organism.

The purpose of the experiment was to study the functioning of AOS in organs and tissues of New Zealand rabbits in the age-old dynamics. Materials for research were blood plasma, brain, heart, liver and longest back muscle, which were taken after slaughter of animals from birth to 90-day age at intervals of 15 days. The activity of superoxide dismutase (SOD) and catalase activity was determined.

The increase in activity of SOD was recorded in blood plasma on the 15th day of rabbits life and this indicator was significantly higher by 53,8 % compared with the daily allowance. Increasing the activity of SOD was observed in rabbits up to age of 60 days and amounted to 98,36 ± 5,10 UD / cm3 during this period, which was believed to be 1,5 times higher than the previous age (45 days) and 3,9 times - in comparison with the animals of the day-old age. Rabbits of the 30-day-old rabbits showed an increase in SOD activity, and in animals at the age of 45 days this figure was higher in 3,4 times compared with day-old animals. The activity of catalase in rabbits blood in the 30th and 45th days has a significant difference and were higher in comparison with previous and day-old animals such figures were 23,2% and respectively 89,6%. In the brain tissues of experimental animals on the 30-th day, the activity of SOD was reduced almost threefold, compared to one-day. At the same time, the activity of catalase in the brain was at a high level – 87,6 % compared to the one-day rabbits. It was found that in the heart, the highest activity of SOD was in one-day rabbits. However, on the 15th day, this figure was lower than 2,2 times compared to the start of the experiment, and the lowest activity of the SOD was observed on the 45-th day of life of rabbits. The activity of catalase in the heart tended to be slight fluctuations. In the longest muscle, there is no significant difference between SOD activity indices. The highest activity rate was observed in rabbits 60-day-old age, and by the 90-th day the activity of SOD decreased by 10,8 %. The activity of catalase has increased from birth to 30-day age by 8,5 %.

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INFLUENCE OF HYPOXIA ON ALTERNATIVE APP AND TAU SPLICING

Eglė Jakubauskienė[1], Arvydas Kanopka[1]

[1]VILNIUS UNIVERSITY, LIFE SCIENCES CENTER, INSTITUTE OF BIOTECHNOLOGY, SAULĖTEKIO AV. 7, VILNIUS 10257, LITHUANIA
EGLE.JAKUBAUSKIENE@BTI.VU.LT

Abstract

One of the most wide-spread neurological disorders – Alzheimer's disease, that occurs in the older age and is characterized by an increasing reduction of brain cognitive function. There are several identified causes of Alzheimer's disease: 1) accumulation of beta amyloid (Aβ) peptides, which are produced of amyloid precursor protein (APP); 2) accumulation of microtubule-associated protein Tau that forms neurofibrillary tangles.

The newest data in the literature states that lack of oxygen in the brain cells (hypoxia) is involved in the development of neurodegenerative diseases. The initial step for cellular adaptation to reduced oxygen level is stabilization of hypoxia inducible factors (HIF) that activate the transcription of genes that are needed for cell survival in unfavorable environmental conditions. Apart transcription activation under hypoxic conditions changes in alternative pre-mRNA splicing occur when additional mRNA isoforms are formed, that leads to synthesis of proteins, possessing distinct activity, in the cell.

The present study is focused on the influence of hypoxia on the formation of mRNA isoforms (APP, Tau) associated with neurodegenerative diseases.

The human Tau pre-mRNA consists of 15 exons from which 8 different Tau mRNA isoforms are produced by alternative pre-mRNA splicing. Changes in mRNA isoforms ratio, containing/lacking exon 10, are important to the development of Alzheimer's disease. In our studies we have compared the expression ratio of Tau mRNA isoforms, containing/lacking exon 10, in brain cell lines cultivated under normoxic (21%) and hypoxic (1%) conditions. Our results show that hypoxic conditions promote exon 10 inclusion into forming Tau mRNA, causing microtubule aggregation.

The APP gene comprised of 18 exons that via alternative splicing are joined to make 10 different mRNA isoforms. In neurons, there are 3 major isoforms: 1) APP770, produced by joining all 18 exons; 2) APP751, lacking exon 8; 3) APP695, lacking exons 7 and 8. We did not find any changes of mRNA isoform formation between cells cultivated under normoxic and hypoxic conditions.

Keywords: hypoxia, alternative splicing, Alzheimer's disease.

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INFLUENCE OF IRON IONS AND HYDROGEN PEROXIDE ON THE FLUORESCENCE OF AMPLEX RED DYE QUENCHING AND CHO CELLS VIABILITY

K. Rastauskaitė[1], A. Nekrošius[1], L. Zelencova[1], V. S. Dainauskaitė[1], R. Saulė[1], R. Rodaitė-Riševičienė[1], G. Saulis[1]

[1]VMU, FACULTY OF NATURAL SCIENCES, DEPARTMENT OF BIOLOGY, LITHUANIA
KOTRYNARAST@GMAIL.COM

Abstract

Fluorescent probes provide a convenient, sensitive and versatile means for studying cell membrane electropermeabilization [1]. When cell suspension is exposed to high–voltage electric pulses, besides cell membrane permeabilization, various electrochemical reactions occur at electrode–solution interfaces. These may include evolution of gases (H2, O2, Cl2), changes of pH, dissolution of electrodes (releasing metal ions), formation of hypochloride acid, free radicals, reactive oxygen species (ROS) [2]. Metal ions, released from the electrodes during a high-voltage pulse, and ROS such as hydrogen peroxide (H2O2) can react with the fluorescent dyes and quench their fluorescence [3, 4]. This may have an impact, when estimating the efficiency of cell eletropermeabilization.

In this study, the influence of iron ions and hydrogen peroxide on the fluorescence of Amplex Red dye as well as on the viability of CHO cell was studied. With increasing the concentration of the iron ions in the solution the intensity of the fluorescence of Amplex Red decreased. For example, 1 mM of Fe3+ ions suppressed fluorescence of Amplex Red by 30–50%. Also the reduction of the viability of CHO cells by iron ions and hydrogen peroxide has been demonstrated. The results of this work can be useful for optimizing the electroporation methods used in biotechnology, medicine, and food industry.

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INFLUENCE OF IRON IONS ON THE FLUORESCENCE OF CALCEIN AND CALCEIN BLUE

V. Černiauskas[1], L. Zelencova[1], R. Rodaitė-Riševičienė[1], G. Saulis[1]

[1]DEPARTMENT OF BIOLOGY, VYTAUTAS MAGNUS UNIVERSITY, KAUNAS, LITHUANIA
VALENTINAS.CERNIAUSKAS@STUD.VDU.LT

Abstract

Cell electroporation – a temporal increase of the cell membrane permeability occurring due to the action of the pulses of strong electric field (up to 300 kV/cm) – is widely used in cell biology, biotechnology, and medicine [1]. When a high–voltage is applied to the electrolyte solution, besides other electrolysis reactions, the oxidation of the metal ions of the anode occurs. As a result of this, the dissolution of the anode takes place [2].

The metal ions, which are released from the electrodes, can react with fluorescent molecules and decrease the intensity of their fluorescence [3, 4]. One of the most popular materials utilized for electrodes, which are used to electroporate the cells, is stainless–steel. In such a case, iron ions (Fe2+ and Fe3+) are released from the anode under the action of high–voltage electric pulses.

In the present work, the effects of iron ions on the fluorescence of calcein and calcein blue in three different media – distilled water, 0.9% NaCl, and Dulbecco's Modified Eagle Medium (DMEM) – have been studied. The fluorescence was found to be the most suppressed in 0.9% NaCl media and the least suppresed in DMEM media. For example, in 0.9% NaCl media only 0.1 mM of Fe2+/Fe3+ was required to fully suppress the fluorescence of calcein, while in the case of calcein blue, much higher concentrations of iron ions - 1 mM - was required to get the same effect. The results of this work can be useful when estimating the efficiency of cell eletropermeabilization.

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INFLUENCE OF JOINT USE OF HYDRATED FULLEREN C60 AND SUSPENSION OF *SPIRULINA PLATENSIS* CELLS ON LIPID PEROXIDATION DURING AGING

Mykhailo Goloiad[1], Oksana Falko[1], Tatyana Ovsyannikova[2], Olga Lipina[1], Alina Kovalenko[2], Viktor Chyzhevskiy[1]

[1]INSTITUTE FOR PROBLEMS OF CRYOBIOLOGY AND CRYOMEDICINE OF THE NATIONAL ACADEMY OF SCIENCES OF UKRAINE, 23 PEREYASLAVSKA STR., 61016, KHARKIV, UKRAINE, [2]V.N. KARAZIN KHARKIV NATIONAL UNIVERSITY. 4 SVOBODY SQUARE, 61022, UKRAINE
O.V.FALKO@GMAIL.COM

Abstract

Population aging is a serious demographic problem in Europe. It is known that one of the main causes of aging of an organism is the oxidative destruction of proteins, lipids and nucleoproteins. Therefore, the search for biologically active substances with antioxidant properties is particularly relevant. The blue-green microalgae *Spirulina platensis* is widely used as a product with an antioxidant effect (Mazokopakis E.E., 2014; Hasler, C.M., 2002). A number of authors also indicate the antioxidant properties of hydrated C60 fullerene [Gharbi N. at al, 2005]. Therefore we attempted to investigate the possible synergistic effect of the combined use of hydrated fullerene C60 and *Spirulina platensis* on accumulation of lipid peroxidation (LPO) products in liver of rats of various ages.

The experiments were performed in Wistar white rats aged 7 and 24 months. It has been established that in the mitochondria of the liver of both young and aged animals receiving only fullerene C60, the level of both the primary products of LPO-diene conjugates (DC) and later products of LPO-triene conjugates (TC), oxodiene conjugates (ODC) in comparison with the control. This may indicate the ability of hydrated fullerene C60 molecules to alter the structural ordering of the hepatocyte membrane, facilitating the access of oxygen to deeply located polyunsaturated aliphatic bases. It can be concluded that the introduction of the solution of hydrated fullerene C60 at a concentration of 10-9 within 30 days enhances the prooxidant status of liver mitochondria in both young and aged animals if compared with the control.

In groups of rats of different ages received only *Spirulina platensis* for 30 days, there was no significant change in the level of LPO products in mitochondria of the liver versus the control and to the animals receiving only C60 fullerene. However, there was a tendency to DC level decrease the relative to control (2.99 ± 0.96 vs 3.32 ± 1.12 nmol/mg protein).

Co-administration of fullerene C60 and *Spirulina platensis* contributed to a reduced accumulation of LPO primary products in mitochondria of rat's liver if compared to the animals receiving only fullerene C60, especially in the group of young rats.

Now the free-radical processes in the body are considered not only as resulted into a pathology, but also as having a regulatory role. Therefore, the joint use of antioxidant substances composing Spirulina platensis and fullerene C60, having the properties of a structural modifier of the lipid bilayer of membranes, can outline the non-standard approaches to correct the pathological processes of an aging organism. However, this assumption requires further profound studies.

Keywords: hydrated fullerene C60, *Spirulina platensis*, antioxidant system, lipid peroxidation.

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INFLUENCE OF JOINT USE OF HYDRATED FULLEREN C60 AND SUSPENSION OF SPIRULINA PLATENSIS CELLS ON LIPID PEROXIDATION DURING AGING

Mykhailo A. Goloiad[1], Oksana V. Falko[2], Tatyana N. Ovsyannikova[3], Olga V. Lipina[2], Alina A. Kovalenko[3], Viktor V. Chyzhevskiy[2]

[1]INSTITUTE FOR PROBLEMS OF CRYOBIOLOGY AND CRYOMEDICINE OF THE NATIONAL ACADEMY OF SCIENCES OF UKRAINE, LOW TEMPERATURE BANK OF BIOLOGICAL OBJECTS, UKRAINE , [2]INSTITUTE FOR PROBLEMS OF CRYOBIOLOGY AND CRYOMEDICINE OF THE NATIONAL ACADEMY OF SCIENCES OF UKRAINE, LOW TEMPERATURE BANK OF BIOLOGICAL OBJECTS, UKRAINE , [3]V.N. KARAZIN KHARKIV NATIONAL UNIVERSITY, UKRAINE
MAGDAR094@GMAIL.COM

Abstract

Population aging is a serious demographic problem in Europe. It is known that one of the main causes of aging of an organism is the oxidative destruction of proteins, lipids and nucleoproteins. Therefore, the search for biologically active substances with antioxidant properties is particularly relevant. The blue-green microalgae Spirulina platensis is widely used as a product with an antioxidant effect (Mazokopakis E.E., 2014; Hasler, C.M., 2002). A number of authors also indicate the antioxidant properties of hydrated C60 fullerene [Gharbi N. at al, 2005]. Therefore we attempted to investigate the possible synergistic effect of the combined use of hydrated fullerene C60 and Spirulina platensis on accumulation of lipid peroxidation (LPO) products in liver of rats of various ages. The experiments were performed in Wistar white rats aged 7 and 24 months. It has been established that in the mitochondria of the liver of both young and aged animals receiving only fullerene C60, the level of both the primary products of LPO-diene conjugates (DC) and later products of LPO-triene conjugates (TC), oxodiene conjugates (ODC) in comparison with the control. This may indicate the ability of hydrated fullerene C60 molecules to alter the structural ordering of the hepatocyte membrane, facilitating the access of oxygen to deeply located polyunsaturated aliphatic bases. It can be concluded that the introduction of the solution of hydrated fullerene C60 at a concentration of 10-9 within 30 days enhances the prooxidant status of liver mitochondria in both young and aged animals if compared with the control. In groups of rats of different ages received only Spirulina platensis for 30 days, there was no significant change in the level of LPO products in mitochondria of the liver versus the control and to the animals receiving only C60 fullerene. However, there was a tendency to DC level decrease the relative to control (2.99 ± 0.96 vs 3.32 ± 1.12 nmol/mg protein). Co-administration of fullerene C60 and Spirulina platensis contributed to a reduced accumulation of LPO primary products in mitochondria of rat's liver if compared to the animals receiving only fullerene C60, especially in the group of young rats. Now the free-radical processes in the body are considered not only as resulted into a pathology, but also as having a regulatory role. Therefore, the joint use of antioxidant substances composing Spirulina platensis and fullerene C60, having the properties of a structural modifier of the lipid bilayer of membranes, can outline the non-standard approaches to correct the pathological processes of an aging organism. However, this assumption requires further profound studies.

Keywords: hydrated fullerene C60, Spirulina platensis, antioxidant system, lipid peroxidation

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INFLUENCE OF PHYTOLECTINS ON THE EFFECTIVENESS OF CLONING AND THE SURVIVAL OF CLONOGENIC TUMOR CELLS IN VITRO

L.Nikolaevich[1]

[1]INSTITUTE OF PHYSIOLOGY, BELARUS
NIKOLARISA@TUT.BY

Abstract

The study of lectin-binding properties of solid neoplasm cells with clonal heterogeneity is promising and relevant.

The aim of the study was to evaluate the sensitivity of clonogenic tumor cells under the conditions of introducing phytolectins into clones in vitro.

Methods. The work was carried out on the certified lines of HeLa cell lines (human cervical carcinoma), C6 (rat glioma), FLv (human amnion), HepG2 (human liver carcinoma) cells obtained from the "Belarusian Collection of Human and Animal Cell Cultures".

Single cells in a logarithmic growth phase were incubated in Petri dishes. The cultures were kept in a CO2 incubator "Heracell" (Switzerland) at +37ºC and 5% CO2. After 7 days the colonies were fixed and colored. Phytotectins with different carbohydrate-binding properties (Concanavalin A from Canavalia ensiformis (Con A) - a lectin binding ά-D-mannose and ά-D-glucose; Soy lectin from Glycine max (soybean) (SBA) - binding molecule of N-acetyl-D-galactosamine (N-AcGal); peanut lectin from Arachis hypogaea (peanut) (PNA) - binding β-galactose (β-Gal); Lentil lectin from Lens culinaris (lentil) (LCL) - binding ά-mannose (ά-Man)) were introduced into clones at doses of 20 μg / ml and 40 μg / ml.

Results. The most pronounced cytotoxic effect of lectins on tumor cells was observed for lectins of Con A, SBA (soybean), LCL (lentil).

Conclusion. The in vitro model of tumor clonogenic cells is allowed to reveal cytotoxic effects of lectins binding ά-D-mannose, N-acetyl-D-galactosamine and ά-D-glucose. β-galactose was not an important substrate for used cell lines.

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INFLUENCE OF SURFACTANTS ON THE GROWTH OF *PSEUDOMONAS AERUGINOSA* DS10 – 126 AND SOIL CLEANING EFFICIENCY

Evelina Merkelytė[1], L.Ragelienė[1]

[1]VYTAUTAS MAGNUS UNIVERSITY, DEPARTMENT OF BIOCHEMISTRY, LITHUANIA
EVELINA.MERKELYTE@VDU.LT

Abstract

The pollution of the environment with oil and its products is a global problem. Pollutants from the soil can be washed using chemical materials such as surfactants. Amphiphilic molecules wrap hydrocarbons and change their structures as well as reduce surface tension. Because of favourable surfactant structure the pollutants are washed from the soil and are split up by microorganisms. We used Pseudomonas aeruginosa DS10-126 bacteria as a resource for the producing biological surfactants. The research aim was to evaluate the effect of synthetic surfactants (SDS and Brij 98) on the growth of Pseudomonas aeruginosa DS10-126 bacteria and the oil products cleaning efficiency from the soil.Soil physical-chemical properties such as granulometric composition, humidity, density, base capacity and pH were determined. Pseudomonas aeruginosa DS10-126 with SDS or Brij 98 surfactants mixtures were used for cleaning the oil products from the soil. The hydrocarbon concentration was determined by gas chromatography with mass spectrometry detector (GC-MS). Surface tension of solutions was measured with interfacial tensiometer (CSC – Dunouy) before cleaning and after cleaning of the soil. Soil contamination with oil products causes the reducing of these properties: density – 8%, humidity – 2%, base capacity – 4%, pH – 1.5%. When SDS or Brij 98 concentration in the Pseudomonas Aeruginosa DS10-126 medium was lower than CMC, surfactants didn't have the effect on the growth of bacteria. The addition of the surfactants in to the bacteria growth medium appeared to be an effective method for cleaning the soil as it prevents the association of bacteria.

Keywords: oil products, soil, cleaning, surfactants, *Pseudomonas Aeruginosa* DS10-126.

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INTERSPECIFIC COMPETITION EFFECT ON PHOTOSYNTHETIC RESPONSE TO SIMULATED CLIMATE CHANGE IN PEA AND WILD MUSTARD LEAVES

Irena Januškaitienė[1], Austra Dikšaitytė[1], Jūratė Žaltauskaitė[1], Gintarė Sujetovienė[1], Giedrė Kacienė[1], Diana Miškelytė[1], Sandra Sakalauskienė[2], Jurga Miliauskienė[2], Romualdas Juknys[1]

[1]VYTAUTAS MAGNUS UNIVERSITY, LITHUANIA, [2]INSTITUTE OF HORTICULTURE, LITHUANIAN RESEARCH CENTRE FOR AGRICULTURE AND FORESTRY, LITHUANIA
IRENA.JANUSKAITIENE@VDU.LT

Abstract

The aim of this study was to investigate the response of photosynthetic parameters of pea (*Pisum sativum*) and weed wild mustard (*Sinapis arvensis*) under simulated climate conditions. Two climate scenarios were investigated: current climate (21 ºC, 400 ppm CO2 and drought) and warmed climate (25 ºC, 800 ppm CO2 and drought. Plants were grown in pots filled with a mixture of field soil, perlite and fine sand (volume ratio 5:3:2) in monoculture (Mono) (15 plants per pot) and multicultural (Mix) (9 crop plants and 6 weeds) interspecific competition conditions. CO2, temperature and drought stress exposure lasted two weeks. Under drought effect grown plants were watered only 50 % of norm during exposure time. Gas exchange measurements were performed by a portable gas analyzer LI-COR 6400 with randomly selected youngest fully expanded leaves on the last (14th) day of the experiment.

Drought stress statistically significant decreased all investigated gas exchange parameters under both climate conditions. Interspecific competition effect was not so pronounced as drought. Under current climate conditions competition had not changed the photosynthetic rate of pea significantly, while the photosynthetic rate of wild mustard decreased statistically significant, compare to monoculture grown plants. Under current climate and drought effect conditions interspecific competition had not changed the photosynthetic rate of both plants. Under future climate conditions photosynthetic rate has increased for both plants, compare to current. Interspecific competition had no statistically significant effect on well-watered plants. Meanwhile under warmed climate and drought stress effect interspecific competition had led to opposite changes of photosynthetic rate, i.e. for pea it decreased ($p<0.05$) and for wild mustard it increased ($p<0.05$), compare to monoculture. The changes of transpiration rate and stomatal conductance also warried. Under current climate interspecific competition decreased transpiration rate and stomatal conductance of both well-watered and droughts stressed plants, while under warmed climate interspecific competition increased these parameters for pea ($p<0.05$) and for wild mustard ($p>0.05$). Our results indicated that interspecific competition changes the response of pea and wild mustard to future climate and drought stress conditions in different manner.

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INTRODUCTION OF *GERANIUM SANGUINEUM* L., NON – VOLATILE SUBSTANCES IN AREAL PART DURING DIFFERENT STAGES

Sandra Saunoriūtė[1], Audrius Maruška[2], Ona Ragažinskienė[1], Mantas Stankevičius[2]

[1]SECTOR OF MEDICINAL PLANTS, KAUNAS BOTANICAL GARDEN, VYTAUTAS MAGNUS UNIVERSITY, Ž. E. ŽILIBERO STR. 6, LT-46324 KAUNAS, LITHUANIA, [2]INSTRUMENTAL ANALYSIS OPEN ACCESS CENTER, FACULTY OF NATURAL SCIENCES, OF VYTAUTAS MAGNUS UNIVERSITY, VILEIKOS STR. 8, LT-44404, KAUNAS, LITHUANIA
SANDRA.SAUNORIUTE@VDU.LT

Abstract

The issue of improving the quality of life and health of the World Health Organization (WHO) and biodiversity is being resolved. In XIX century an important role in the solution of this problem plays research of medicinal (aromatic) plants (MAP's) and bio-active compounds (Haddad et al., 2005). The aim current chemical analyses was to determinate non – volatile substances in *G. sanguineum* L. areal part. The total content of phenolics, flavonoids and radical scavenging activity of *G. sanguineum* L. methanolic extracts was analysed in different vegetation stages: intensive growth, flower budding, beginning of blossoming, massive blossoming and the end of blossoming. *G. sanguineum* L. was introduced in 2006 in Medicinal and spice (aromatic) plants collections of Botanical Garden at Vytautas Magnus University. The object of investigation *G. sanguineum* L. is a perennial herbaceous plant of Geraniaceae family which is widely spread in Central Europe, Asia. In Lithuania *G. sanguineum* L. grow naturally. Also this plant is grown in flower beds, botanical gardens, city squares. According to the literature, *G. sanguineum* L. essential oil components: morin, myricetin, kemferol, apigenin, eliginic acid, coffee acid quinic acid (Pantev et al., 2006). *G. sanguineum* L. root extracts have anti-infectious and anti-inflammatory, antimicrobial properties, and are also used as a preventive measure against radiation. Roots are used for diarrhea, stomach and intestinal catarrh, and bleeding. Treatment is also available in cases of tuberculosis. It has been investigated that the polyphenols complex in the *G. sanguineum* L. medicinal plant's raw material strongly inhibits the proliferation of influenza viruses (Naidenova et al., 1998; Serkedjieva, 1997; Toshkova et al., 2004). In this study, the amount of non-volatile compounds was determined using spectrophotometry methods. The total amount of phenolic compounds was evaluated using modified Folin–Ciocalteu reagent spectrophotometry method. Modified colorimetric aluminium chloride method was carried out to determinate the total content of flavonoid compounds. Radical scavenging activity was estimated by DPPH (2,2-diphenyl-1-picrylhydrazyl) (Stankevičius et. al., 2011).

Keywords: *Geranium sanguineum* L., introduction, analyses

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INVESTIGATION OF *ANAPLASMA PHAGOCYTOPHILUM* IN *LIPOPTENA FORTISETOSA* DEER KEDS FROM MOOSE AND ROE DEER IN LITHUANIA

Vaiva Juškaitė[1], Kamilė Klepeckienė[1], Jana Radzijevskaja[1], Irma Ražanskė[1], Algimantas Paulauskas[1]

[1]LABORATORY OF MOLECULAR BIOLOGY, DEPARTMENT OF BIOLOGY, FACULTY OF NATURAL SCIENCES, VYTAUTAS MAGNUS UNIVERSITY, VILEIKOS ST. 8, KAUNAS, LT-44404, LITHUANIA
VAIVAJU@GMAIL.COM

Abstract

Deer keds are a blood-sucking ectoparasites belonging to the family Hippoboscidae. *Anaplasma phagocytophilum* is a tickborne gram-negative bacteria that causes human granulocytic anaplasmosis. The presence of *A. phagocytophilum* was previously confirmed in deer keds *Lipoptena cervi* (Buss et al., 2016, de Bruin et al., 2015). The aim of this study was to investigate the presence of A. phagocytophilum in other species of deer ked *L. fortisetosa* which share the same mammalian hosts with *L. cervi*. A total of 240 deer keds were collected from 4 moose (*Alces alces*) and 6 roe deer (*Capreolus capreolus*). Five specimens of those cervids (2 moose and 3 roe deer) were found positive for *A. phagocytophilum*. Identification of deer ked species was confirmed by morphological and molecular methods. The *cox-1* gene sequences of deer keds obtained in this study were 93 – 99% identical to the *L. fortisetosa* sequences deposited in GenBank. Deer keds were screened for the presence *A. phagocytophilum* infection by a nested polymerase chain reaction (PCR) technique targeting the *msp4* gene. All tested *L. fortisetosa* samples were found negative for *A. phagocytophilum* infection.

Keywords: Deer keds, *Lipoptena fortisetosa*, *Anaplasma phagocytophilum*, cervids

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INVESTIGATION OF *BARTONELLA* SPP. IN DOMESTIC AND WILD ANIMALS FROM LITHUANIA

A.Vasaitytė[1], K.Klepeckiene[1], I.Ražanske[1], J.Radzijevskaja[1], A.Paulauskas[1]

[1]VYTAUTAS MAGNUS UNIVERSITY, FACULTY OF NATURAL SCIENCES, DEPARTMENT OF BIOLOGY, VILEIKOS G. 8, LT-44404 KAUNAS, LITHUANIA
AGNE.VASAITYTE@STUD.VDU.LT

Abstract

Bartonella spp. are vector-transmitted, blood-borne, intracellular, gram-negative bacteria that can induce prolonged infection in the host. Our objectives were to determine if roe deer (*Capreolus capreolus*), moose (*Alces alces*), fallow deer (*Dama dama*), sika deer (*Cervus nippon*), sheep (*Ovis aries*) are infected with Bartonella and to determine the molecular relationships between Bartonella isolated from domestic and wild animals in Lithuania. Genomic DNA was extracted from spleen. For detection of *Bartonella* spp. nested PCR amplification of 16S-23S rRNA ITS region were used. PCR products were analysed by 1.5% agarose gel electrophoresis under the UV light. A part of PCR products of 16S-23S rRNA ITS region were sequenced and multiple sequence alignments were performed using Clustal W, obtained sequences were compared with related sequences found in the NCBI database. *Bartonella* spp. were detected in all animal species. According to the 16S-23S rRNA ITS region samples of wild animals were similar to *B. shoenbuchensis*, *B.chomelii*, *B.capreoli* and *B.birtlesi*. Bartonella isolate from sheep differed from other isolates of wild animals and was identical to *Bartonella* sp. (GenBank accession no. AF415209 with 100% similarity) that was found in tick from a sheep from Peru.

Keywords: Bartonella, roe deer, moose, fallow deer, sika deer, sheep, Lithuania

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INVESTIGATION OF THE ONCOGENIC PROPERTIES OF PIRH2 PROTEIN IN HUMAN CANCER CELLS

Alexandra Daks[1], Oleg Shuvalov[1], Olga Fedorova[1], Alexey Petukhov[1], Elena Vasileva[1], Nick Barlev[1]

[1]INSTITUTE OF CYTOLOGY RAS, ST PETERSBURG, RUSSIA
ALEXANDRA.DAKS@GMAIL.COM

Abstract

The Pirh2 protein is a E3 ligase that performs ubiquitination of the p53 oncospressor and targets it for degradation in proteasomes. In its turn, p53 activates Pirh2 expression, forming a negative regulatory feedback loop. Thus, being a suppressor of p53, Pirh2 promotes carcinogenesis. However, it should be noted that mutations of p53-coding gene occur in almost every type of cancer, and the role of the Pirh2 protein in such cancer cells has not been studied enough. To investigate the role of Pirh2 in the formation of the tumorigenesis, we used the proteomic approach. As a result, we identified more than 200 new interactants of this ubiquitin ligase. We have shown that Pirh2 appears to play a key role in such cellular processes as the regulation of the cell cycle, the response to genotoxic stress, and the initiation of programmed cell death. In this study, we also identified the functional significance of the interaction of Pirh2 with the RNA-binding protein HuR. Namely, we have demonstrated that Pirh2 is able to regulate the expression of such HuR target genes as p27, cyclin D and MDR1, due to a negative effect on its stability in the cell. We also investigated the effect of the Pirh2 protein on the tumorigenic potential of the non-small cell lung cancer cell line H1299, which lacks p53. We found that ectopic expression of Pirh2 enhanced cell proliferation, resistance to doxorubicin, and increased migration potential. Ablation of Pirh2 by specific shRNA reversed these phenotypes. We also shown that Pirh2 induces c-Myc expression both at the mRNA and protein levels, which can partially explain the mechanism of Pirh2-induced increase in the tumorigenic potential of the cells. Our findings suggest that in the non-small cell lung cancer Pirh2 acts as an oncogene and can be considered as a potential target for the p53-negative tumors therapy.
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INVESTIGATION OF TICK-BORNE ENCEPHALITIS IN IXODES RICINUS AND DERMACENTOR RETICULATUS.

M. Sidorenko[1], J. Radzievskaja[1], I. Petrulin[1], A. Paulauskas[1]

[1]VYTAUTAS MAGNUS UNIVERSITY, FACULTY OF NATURAL SCIENCE, LITHUANIA
MARINA.SIDORENKO@VDU.LT

Abstract

During the last few decades the incidence of the Tick-borne encephalitis (TBE) disease has been increasing and becoming a growing health problem in almost all endemic European and Asian countries. TBE virus (TBEV) can be transmitted to people by a bite of *Ixodes spp* ticks, *Ixodes persulcatus*, *Ixodes ricinus* and *Dermacentor reticulatus*. Lithuania is one of the countries with the highest number of reported TBE cases, an average of 450 cases of TBE are reported every year. The aim of this study was to investigate the current prevalence of TBEV in different species of ticks and genetically characterize the strains of virus distributed in Lithuania. In March-September 2017, 1884 ticks (267 pools) were collected from eight Lithuanian counties, 18 regions. Gathered ticks were identified as *I. ricinus* (n=1351) and *D. reticulatus* (n=533). For the detection of TBEV a quantitative real-time Revers transcription-PCR (RT-PCR) was performed. Samples positives by real-time PCR were used for one step RT-PCR and for nested PCR for future sequencing of the partial E protein and NS3 genes. In the collected ticks *I.persulcatus* ticks weren't detected. The phylogenetic analysis of NS3 and E genes sequences has shown that detected strains belong to the European subtype and are specific for Lithuania.

Keywords: Tick-borne encephalitis, *Ixodes ricinus*, *Ixodes persulcatus*, *Dermacentor reticulatus*, Lithuania.

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INVESTIGATIONS OF POLLINATORS SPECIES DIVERSITY IN BOREAL FORESTS IN LITHUANIA

Remigijus Daubaras[1], Marcin Zych[2], Vilma Kaškonienė[3], Paulius Miliauskas[1]

[1]VYTAUTAS MAGNUS UNIVERSITY, LITHUANIA, [2]WARSAW UNIVERSITY, POLAND, [3]VYTAUTAS MAGNUS UNIVERSITY
LAIMA.CESONIENE@VDU.LT

Abstract

Pollination of flowers by animals, which involves a significant fraction of invertebrate animals, is believed to play a crucial role in generating and sustaining the biodiversity of terrestrial ecosystems. Domesticated pollinators contribute a lot less than wild pollinators. While there are few definitive studies, all estimates put wild pollinators as pollinating most insect pollinated outdoor crops and wildflowers, some studies put wild pollinators at over 90%. We studied the impact of forest clear cuts on pollinator visitation to flowers of common vascular plant species from Vaccinio-myrtillosa forest understory. We selected *Ericaceae* shrubs *Calluna vulgaris L*., *Vaccinium myrtillus L*. and *V. vitis-idaea L*., which are indicator species of North European conifer forest understory. To record insect activities, we used digital video cameras, which is a standard procedure in many similar studies. For each plot, we completed at least 12 rounds of observations on both clear cut and mature stands. The highest visit frequency (4.9 ±2.7) and most diversified pollinator assemblage were recorded for C. vulgaris. This included social bees (*A. mellifera* and *Bombus sp*.), solitary bees (*Andrena sp*.), ants, sphecid and true wasps, ichneumonids, butterflies (*Polygonia c-album*; *Nymphalidae*), and flies from the family *Calliphoridae* and *Syrphidae*. Our transect walks revealed that flowers of both Vaccinium species were visited mostly by social bees (*Bombus sp*.), solitary bees (*Andrena sp*.), wasps (Vespidae), and also by hoverflies (Syrphidae). We recorded visits of ants (Formicidae). Ants are an important element of boreal forest ecosystems, and some authors suggest that potentially they could be important in pollination of species with easily accessible flowers producing little nectar and occurring in high local densities.

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ISOLATION AND IDENTIFICATION OF A BACILLUS STRAIN SYNTHESIZING SELENIUM NANOPARTICLES

Fikriye Alev Akcay[1], Ayse Avci[2]

[1]SAKARYA UNIVERSITY, FACULTY OF ENGINEERING, DEPARTMENT OF FOOD ENGINEERING, SAKARYA, TURKEY , [2]SAKARYA UNIVERSITY, FACULTY OF ENGINEERING, DEPARTMENT OF FOOD ENGINNERING, SAKARYA
AYSEA@SAKARYA.EDU.TR

Abstract

Biosynthesis of selenium nanoparticles (SeNPs) via microorganisms is a biocompatible, eco-friendly, and cost-effective method among chemical and physical methods. In this study, we have isolated and characterized a novel SeNPs synthesizing Bacillus strain from a soil sample collected from an industrialized area in Kocaeli province in Turkey. SeNPs synthesis ability of the strain was tested by growing it on nutrient agar plates containing varying amounts of SeO2 (1.9, 2.9, 3.8 mM) at 33ºC for 24 hours. The strain was able grow only on the agar plate containing 1.9 mM SeO2 with a reddish-orange color which was an indication of the formation of SeNPs. Synthesis of nanoparticles was also performed using cell-free supernatant of the bacterium after the cultivation it in nutrient broth at 33oC on a shaking incubator for 24 hours. The concentration of SeO2 was adjusted to 5.6 mM in cell-free supernatant and the reaction was carried out on a shaking incubator at 120 rpm, at 33oC for 72 hours. SeNPs were then isolated by centrifugation followed by washing with distilled water and ethanol. The resulting nanoparticles were dried and analyzed using Field Emission Scanning Microscopy. The analysis showed that SeNPs were spherical having the diameters between 100 and 200 nm. The strain has been identified for its morphological and biochemical characteristics and it was found that the bacterium was rod-shape, Gram positive, spore forming, and catalase positive. Molecular identification of the strain has been done according to 16S rDNA sequence analysis and it was revealed that the strain belongs to the genus Bacillus and 99.58% identical with Bacillus cereus. Sensitivity of the strain against some antibiotics (ampicillin, chloramphenicol, erythromycin, streptomycin, tetracycline) has been also detected using agar disk diffusion method. It had sensitivity to the chloramphenicol, erythromycin, streptomycin and tetracycline but not to ampicillin.

Keywords: Selenium, nanoparticles, Bacillus, identification

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LIPOPOLYSACCHARIDES PROPERTIES AND POTENTIOMETRIC DETECTION METHOD

G. Kudirka[1], l. Ragelienė[1]

[1] VYTAUTAS MAGNUS UNIVERSITY, FACULTY OF NATURAL SCIENCES, LITHUANIA
GEDIMINAS.KUDIRKA@GMAIL.COM

Abstract

The main component forming the outer membrane of gramnegative bacteria is lipopolysaccharide (LPS). LPS is endotoxin which causes sepsis in animal cells. Lipopolysaccharide molecule has three main components: lipid A, core oligosaccharide and O antigen. Hydrophobic part responsible for the immune response and the hydrophilic part is responsible for the micelle formation process. Lipopolysaccharide molecules associate on the membrane surface forming LPS-LPS complex which is stabilized by divalent cations such as Ca+2 or Mg+2. Potentiometric analysis with ion-selective electrodes is fast, accurate, real-time method selectively detect the desired ion. Membrane (sensor) synthesis is very important electrode production phase; inadequate membrane means poor or non-response to the desired ion. There is no references about potentiometric detection of amphiphilic ranging negatively charged anion. The scientific literature abound evidence that not a single LPS molecule induces an immune response in animal cells but associated molecules units- micelles. There is data that in 10 pg/ml LPS solution molecules are aggregated, therefore forming micelles. The aim of this study is to determine the concentration of released LPS from E. coli KMY using potentiometric analysis. This method is based on direct potentiometry. According to the linear response, using linear trendline, different concentrations of bacterial suspension were analysed. Bacteria were affected with Polymyxin E antibiotic which selectively binds to LPS.

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LONG-TERM IMPACT OF REDUCED TILLAGE INTENSITY IN COMBINATION WIHT STRAW AND GREEN MANURE INCORPORATION ON EARTHWORMS IN THE SOIL

Vaida Steponavičienė[1], Vaclovas Bogužas[1], Aušra Sinkevičienė[1]

[1]ALEKSANDRAS STULGINSKIS UNIVERSITY, INSTITUTE OF AGROECOSYSTEMS AND SOIL SCIENCE, AKADEMIJA, KAUNAS, LITHUANIA
VAIDA.STEPONAVICIENE@ASU.LT

Abstract

Since 1999, a long-term field experiment has been done at the Experimental Station of Aleksandras Stulginskis University 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 objective was to long-term impact of reduced tillage intensity in combination with straw and green manure incorporation on earthworms in the soil.

A short crop rotation was introduced: winter wheat, spring barley, spring rape. The results were obtained in 2013-2014 when winter wheat and spring rape was grown. According to two factor field experiment, the straw (factor A) was removed (R) from one part of the experimental field and on the other part of the field all straw yield was chopped and spread (S) at harvesting. As subplot 6 different tillage systems (factor B) were investigated: conventional ploughing (CP) at 23–25 cm depth in autumn, shallow ploughing (SP) at 10–12 cm depth in autumn, shallow loosening (SL) with sweep cultivator and disc harrow at 8–10 cm depth in autumn, shallow rotovating (SR) at 5–6 cm depth before next crop sowing, catch cropping for green manure and rotovating (GMR) at 5–6 cm depth before next crop sowing, no-tillage (NT), direct drilling. Catch crop white mustard (*Sinapis alba L.*) for green manure was under sown on stubble only in GMR plots just after winter wheat and spring barley harvest. The trials were replicated four times. The treatments were arranged using a split-plot design. The total size of each plot was 102 (6 × 17) m2 and net size was 30.0 (2.0 × 15) m2.

Biodiversity in agroecosystems directly depends on regular introduction of plant residues into the soil and soil organic carbon content. The highest biomass of earthworms was established in the soil where straw was spread, or only shallow loosening was applied both with and without green manure and in the soil of direct drilling

Acknowledgement

This work was supported by the National Science Program “The effect of long-term, different-intensity management of resources on the soils of different genesis and on other components of the agro-ecosystems” [grant number SIT-9/2015] funded by the Research Council of Lithuania.

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METAPNEVMOVIRUS INFECTION IN POULTRY FARMS OF KAZAKHSTAN

Assilbek Mussoyev[1], Assanov Nigmet[1], Mussina Galia[2], Nurkhojayev Nurzhan[1]

[1]KAZAKH NATIONAL AGRARIAN UNIVERSITY, VETERINARY, KAZAKHSTAN, [2]«UNIVET», KAZAKHSTAN
MUSOEV.A@MAIL.RU

Abstract

At the beginning of 2000, at the industrial poultry farms in Kazakhstan, a disease with a respiratory clinical symptom complex, showing sneezing, coughing, nasal discharge, as well as a slight swelling in the area of the intermaxillary space, was observed for the first time in birds amongst birds in the poultry farms of Kazakhstan, in turkeys in the future more often accompanied by swelling of infraorbital sinuses, in chickens swelling of the head. In connection with the above molecular-serological studies are the most authentic and nym method and m and m etapnevmovirusnaya diagnosing avian infection (MPIB) taking into account the characteristic clinical signs in chickens and turkeys. The purpose of this work was the study of serological indicators by the method of enzyme immunoassay, taking into account the clinical signs of the disease, inherent to the MPIB in selected poultry farms of the Republic of Kazakhstan for growing turkeys and chickens.

Disease in the clinical form is noted already in 4 day turkeys. Serological tests of blood sera in turkeys in ELISA showed a positive reaction in 4 day-old turkeys and up to 95 days of age, positive results were recorded in the groups and totaled 40.7% of the total number of samples examined.

The results of serological testing by ELISA among indices. Unlike hens, a positive serological result was observed in 4-day turkeys, where the maximum titer was 5094. The highest rate was 100 % positive result throughout the tested group was observed in 27 - week turkeys.

In our studies, high antibody titers were detected in chickens 45-63 week old chickens from 100 % positive result, which indicates a broad persistence of the virus in the herd of chickens. Serological monitoring in disadvantaged groups of turkeys, in contrast to chickens, positive results in blood sera was observed in 4-day turkeys, and a positive result was noted only in 27 week-old turkeys and the maximum titer was 7997 . Thus, it can be noted that serological examination of blood sera for the presence of antibodies to MPIB in chickens and turkeys showed some differences. In turkeys, MPIB develops in an early-stage bolus and there is no wide persistence of the virus.

Keywords: metapneumovirus infection of birds, turkeys

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MICROBIOTA OF OTAP HEAD CAVE

Popkova Anna[1], Mazina Svetlana[1], Stoinova Anastasia[2]

[1]ECOLOGICAL DEPARTMENT, PEOPLES' FRIENDSHIP UNIVERSITY OF RUSSIA, RUSSIA, [2]INSTITUTE OF BIOCHEMICAL TECHNOLOGY AND NANOTECHNOLOGY, PEOPLES' FRIENDSHIP UNIVERSITY OF RUSSIA, RUSSIA
POPKOVA_AV@MAIL.RU

Abstract

Hypogean environments represent unique habitats with stable climatic conditions and absence of seasonality. The walls and speleothems can be colonized by phototrophic (mosses, green algae, cyanobacteria and diatoms) and heterotrophic (fungi, bacteria) organisms. However the structure and composition of microbial communities differs throughout the cave. At the entrance ecotone zone mosses and green algae prevail, in time when cyanobacteria are dominant in the deeper zones. Light intensity, presence of the water fluxes, substratum are the major factors influenced development of subterranean communities.

Many caves are used as touristic objects. As a consequence they are equipped with artificial lights, which can cause changes in the functioning of cave communities. An example is given by Otap Head Cave, situated near Otap Distinct, the Republic of Abkhazia. Aim of the present study is to estimate the diversity of microbiota of Otap Head Cave.

Material and methods

Material for algological and microbiological investigation was collected in the May of 2017 by scraping the walls of the cave with a sterile scalpel and depositing samples into sterile boxes at a temperature of the cave. Species were identified using standard approaches and cultivation methods. Taxonomy was presented by databases http://www.algaebase.org and http://www.mycobank.org.

Results and discussion

Representatives of phylum *Cyanophyta*, *Bacillariophyta*, *Rhodophyta*, as well as *Bryophyta* and *Pteridophyta* were recorded in communities of the illuminated zone. Cyanobacteria were the dominant group of phototrophs colonizing cave wall, floor and water fluxes. However the development of so-called lampeflora around lamps was not observed. Most of the identified species of micromycetes belong to typical representatives of the soil mycobiota. As a result of microbiological studies, sulfuric or thiobacteria was isolated both from the rock and the deposits of the cave. It can indicate the oxidation of sulfur compounds. Moreover the development of sulfate-reducing bacteria was detected. Acidophilic iron bacteria were found in rock and sediment samples.

Conclusions

An investigation of the diversity of cyanobacteria, algae, fungi and bacteria has been conducted for the first time in Otap Head Cave. The presence of sulfate-reducing and sulfur-oxidizing bacteria in the analyzed samples indicates that a small sulfur cycle occurs in cave at the present time.

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MICROSATELLITE ANALYSIS OF WILD BOAR INFECTED WITH AFRICAN SWINE FEVER

Z.Janeliunas[1], V. Jurgelevicius[2], A.Paulauskas[1]

[1]VYTAUTAS MAGNUS UNIVERSITY, LITHUANIA,
ZYGIMANTAS.JANELIUNAS@VDU.LT

Abstract

Currently, one of the biggest problems in Lithuania is the spreading African swine fever - the one of the most serious disease of wild boar and domestic pigs. Many infected, dead wild boars are found in the infected area, but in this situation, the subspecies of wild boars are almost not decreasing or decreasing marginally. Perhaps one of the reasons is that certain individuals or their groups are resistant to the virus. The purpose - investigation of the genetic variations of wild boar sampled in areas infected with African swine fever. First portion of analysis was genetic investigation of 96 ASF positive samples during 2014 – 2016 using Microsatellite analysis method. 16 microsatellite locus analysis were performed using 9-pelx and 7 – plex PCR amplification and fragment analysis with ABI3100 sequencer. The samples were divided in to 5 groups representing infected district of Lithuania: Vilniaus, Kauno, Utenos, Panevezio and Alytaus district. Among the analysed 16 microsatellites markers the highest variation is in S0005 locus and in locus SW24. The lowest variation is observed in locus S0068 and S0355.

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MITOCHONDRIAL FUNCTIONS IN YEAST S. CEREVISIAE WITH DIFFERENT RESISTANCE TO ANHYDROBIOSIS

Ieva Lukošiūnaitė Neringa Kuliešienė[1], Rasa Žūkienė[1], Rimantas Daugelavičius[1]

[1]DEPARTMENT OF BIOCHEMISTRY, VYTAUTAS MAGNUS UNIVERSITY
LUKOSIUNAITE.IEVA@GMAIL.COM

Abstract

Anabiosis is a unique natural phenomenon of temporary reversible delay of metabolism by live organisms upon untoward conditions. Yeasts are a great model for investigation of the survival mechanism in anhydrobiosis because these cells are well explored and can undergo multiple cycles of dehydration and subsequent rehydration. Practically all intracellular structures are subjected to changes during the dehydration and subsequent rehydration-reactivation of yeasts. It is believed that the ability of mitochondria to start the transformation of energy at the early beginning of the reactivation stage is necessary for the repair of damaged intracellular structures and macromolecules. The aim of this study was to investigate mitochondrial functions of two closely related strains of yeast S. cerevisiae – moderately resistant strain to dehydration #14 and very resistant strain to dehydration - #77, also its mutants, lacking fusion-fission genes functionality (Δfzo1, Δdnm1, Δdnm1/Δfzo1) and wild type yeast WT303-a1. Isolation of mitochondria from yeast was achieved using modified Meisinger et al. protocol. Mitochondrial functions were evaluated by oxygen consumption (respiratory rate) at different metabolic states (State 2 (LEAK), State 3, maximum oxidative phosphorylation (OXPHOS), OXPHOS via complex IV). Results revealed that maximum respiration intensity was observed in #14 strain which is highly resistant to dehydration, lower respiratory rate was observed in #77 strain. #14 LEAK value was considerably high, nevertheless it was not a sign of damaged mitochondrial membrane, because RCI (State 3/LEAK respiratory rate ratio) value was 2. Although oxygen flow through IV respiratory chain complex in WT303-a1, Δdnm1 and #77 mitochondria was similar, however State 3 and OXPHOS values were significantly different. Yeast mitochondria with fusion-fission gene mutations in all conditions showed the lowest values of respiratory rate. It can be concluded that unimpaired mitochondria dynamics are crutial for normal mitochondrial activity. Analysis of respiratory rate's dependency on different substrates in LEAK and State3 revealed higher respiratory rate of WT303-a1 in both states using pyruvate+malate as a substrate, as for other strains higher respiratory rate was noticed using succinate. Incubation of #14 and #77 strains with high concentration of different carbon sources (1M glucose or glycerol) had positive effect on yeast recovery after dehydration, however it suppressed mitochondrial functions, e. g. in OXPHOS by 72 % and 47 % in #14 and by 57 % and 53 % in #77 for glucose and glycerol, respectively. Mitochondrial respiratory rate correlated with mitochondrial amount obtained from similar amount of yeast cells.

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MOLECULAR DETECTION AND GENOTYPES CHARACTERIZATION OF CANINE BABESIOSIS CAUSATIVE AGENT *BABESIA CANIS*

Dovilė Tamoliūnaitė[1], Jana Radzijevskaja[1], Algimantas Paulauskas[1], Vytautas Sabūnas[1], Birutė Karvelienė[2], Gintaras Zamokas[2]

[1]DEPARTMENT OF BIOLOGY, VYTAUTAS MAGNUS UNIVERSITY, KAUNAS, LITHUANIA, [2]DEPARTMENT OF INFECTIOUS DISEASES, VETERINARY ACADEMY, LITHUANIAN UNIVERSITY OF HEALTH SCIENCES, KAUNAS, LITHUANIA
DOVILE.TAMOLIUNAITE@VDU.LT

Abstract

Canine babesiosis is a widespread tick-borne disease caused by haematozoan parasites of the genus *Babesia*. The vast majority of clinical babesiosis cases in dogs in Europe is caused by *Babesia canis*. Canine babesiosis has become quite frequent in Lithuania during the past decade. Babesiosis caused by *B. canis* may range from mild to severe disease in dogs. Such difference in the virulence of *B. canis* strains is associated with genetic heterogeneity among *B. canis* strains. The aim of study was to investigate the genetic diversity of *B. canis* strains isolated from naturally infected dogs in Lithuania using PCR-RFLP assay and sequence analysis based on 18S rRNR and Bc28.1 genes. In total 138 blood samples from dogs suspected of babesiosis were collected in Lithuania during 2016-2017. DNA was isolated from EDTA-anticoagulated whole blood. Positive 18S rRNA and Bc28.1 gene PCR products were digested with HincII and MboI restriction enzymes, respectively. Results of RFLP analysis were evaluated by agarose gel electrophoresis. Selected positive samples were sequenced and then analyzed using the Mega 6.0 software. *B. canis* genotypes were distinguished on the basis on two nucleotide (GA→AG) substitutions observed in 18S rRNA gene sequences. Based on PCR-RFLP and sequence analyses of 18S rRNA gene four *B. canis* genotypes were identified: 15,18 % samples contained 18S rRNA-A genotype (AG), 0,89 % 18S rRNA-B (GA), 83,04 % 18S RNA-A/B (RR) and 0,89 % C (RA) genotype. Two genotypes of *B. canis* were detected by RFLP analysis of Bc28.1 gene. The vast majority of the *B. canis* strains were of the genotype Bc28.1-B (83.18%;), followed by genotype Bc28.1-A (17.9 %). A total of fifteen single nucleotide polymorphisms in partial Bc28.1gene of *B. canis* were identified by sequence analysis. The distribution of *B. canis* Bc28.1- genotypes in Lithuania was similar to South – West Europe, but different from North – East Europe findings. Our results demonstrated the presence of genetically different *B. canis* strains in Lithuania. This research is funded by the European Social Fund under the No. 09.3.3-LMT-K-712-03-0081 "Development of Competences of Scientists, other Researchers and Students through Practical Research Activities" measure.

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MOLECULAR DETECTION OF *BARTONELLA* SPP. IN DEER KEDS *LIPOPTENA CERVI* AND *LIPOPTENA FORTISETOSA* IN LITHUANIA

Laura Songailaitė[1], Kamilė Klepeckienė[1], Algimantas Paulauskas[1], Jana Radzijevskaja[1]

[1]DEPARTMENT OF BIOLOGY, VYTAUTAS MAGNUS UNIVERSITY, KAUNAS
SONGAILAITELAURA@GMAIL.COM

Abstract

Bartonella spp. are gram-negative facultative intracellular bacteria that are highly adapted to their mammalian reservoir hosts, in which they cause chronic relapsing intraerythrocytic bacteraemia. Several *Bartonella* spp. caused disease in humans and animals named bartonellosis. In ruminants are commonly found *Bartonella schoenbuchensis*, *Bartonella bovis*, *Bartonella capreoli* and *Bartonella chomelii* species. Deer keds, blood-sucking haematophagous ectoparasites of cervids, are vectors of *Bartonella* species associated with ruminants. Given that deer keds accidentally bite humans there is a potential risk for occasional transmission of human pathogenic *B. schoenbuchensis*. The aim of this study was to investigate the prevalence of *Bartonella* spp. in two species of deer keds *Lipoptena cervi* and *Lipoptena fortisetosa* and genetically characterize the bacteria using PCR and sequence analysis. A total of 292 deer keds were collected from roe deer (n=5), red deer (n=1) and moose (n=2) in Lithuania during 2017. Species of deer keds was identified by morphological examination using identification keys and microscope. DNA from deer keds was isolated using Genomic DNA Purification Kit, PCR, nested PCR assays and sequence analysis based on rpoB gene and 16S-23S rRNA intergenic spacer region (ITS) were used for detection and molecular characterization of Bartonella spp. Obtained *Bartonella* sequences were analyzed by comparing similarities with other sequences deposited in the GenBank database using BLASTn identity searches and MEGA 6.0 software. The phylogenetic tree was constructed using Neighbor-Joining method and Kimura 2 parameter model. *Bartonella* DNA was detected in 48 (98%) from 49 pools of L. cervi and 37 (74%) from 50 pools of *L. fortisetosa* deer keds. Analyzed *Bartonella* ITS and rpoB sequences derived from *L. cervi* and *L. fortisetosa* showed 96-99 % similarity with *B.schoenbuchensis*, *B.chomelii* and *B.capreoli* species. *Bartonella* sequences were heterogenic: eight different *Bartonella* genetic variants (four in *L. cervi* and four in *L. fortisetosa*) were identified based on partial rpoB gene and four (one in *L. fortisetosa* and three in *L. cervi*) based on ITS region. The results of the study demonstrated the high prevalence of Bartonella spp. in *L. cervi* and *L. fortisetosa* collected from cervids in Lithuania. Sequence analysis reveal the presence of *Bartonella* strains closely related to *B.schoenbuchensis*, which commonly causes alopecia and dermatitis in ruminants and deer ked dermatitis in humans.

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MOLECULAR DETECTION OF MYCOPLASMA SPP. IN CARNIVORES FROM LITHUANIA

Povilas Sakalauskas[1], Jana Radzijevskaja[1], Algimantas Paulauskas[1]

[1]VYTAUTAS MAGNUS UNIVERSITY, DEPARTMENT OF BIOLOGY, VILEIKOS STR. 8, KAUNAS, LITHUANIA
POVILAS.SAKALAUSKAS@VDU.LT

Abstract

Mycoplasma is a genus of self-replicating bacterium. Most of them are responsible for variety of diseases in human, animal, insects and plants. There is a lack of information about Mycoplasma in wildlife animals. The aim of this study was to investigate the presence of Mycoplasma spp. in Carnivores from Lithuania. A total number of 45 animal samples were collected after car accident and by hunters: 31 red fox (Vulpes vulpes), 5 European otter (Lutra lurta), 5 beech marten (Martes foina), 2 common ferret (Mustela putorius), 1 gray wolf (Canis lupus) and 1 raccoon dog (Nyctereutes procyonoides). DNA was extracted from the spleen samples, and then used for PCR analysis. PCR was performed using the primers targeting a Mycoplasma sp. 600-bp region of the 16S rRNA gene. Amplification occurred in 5/5 (100 %) of L. lutra, 2/2 (100 %) of M. putorius and 1/5 (20 %) of M. foina. The Mycoplasma were not detected in V. vulpes, C. lupus, N. procyonoides. All positive samples sequences show 94 – 100 % similarity with Mycoplasma sp. Sequence from GenBank.

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MOLECULAR IDENTIFICATION OF DERMACENTOR SPP. USING 12S GENETIC MARKER

G. Narodovskaja[1], M. Galdikas[2], A. Paulauskas[2], J. Radzijevskaja[2]

[1]VYTAUTAS MAGNUS UNIVERSITY, DEPARTMENT OF BIOLOGY,KAUNAS, [2]VYTAUTAS MAGNUS UNIVERSITY, DEPARTMENT OF BIOLOGY ,KAUNAS
GRETA.NARODOVSKAJA@GMAIL.COM

Abstract

Dermacentor spp. – the most widespread family of ticks. This family has great variability of species which are distributed all over the world. The most common species in Europe are *Dermacentor reticulatus* and *Dermacentor marginatus*. Differences between these genes are hard to notice because of morphological resemblance. Molecular identification methods are being used in order to find the difference between closely related species. This method allows to identify new species and find the differences between genus, which are related. Technology is based on gene amplification that multiplies a millionfold copies DNA and compare specific sequences of DNA between organisms. The aim of study is to find out if the 12S genus is suitable for identification of *Dermacentor spp*. Ticks with which the research was carried out were collected in 2012 – 2017. We applied molecular identification technology using 12S rRNA subunit fragments. Phylogenetic tree, which we constructed, showed that different species forms different clusters. In conclusion 12S genetic marker is suitable for *Dermacentor spp.* identification.

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MOLECULAR IDENTIFICATION OF LAELAPIDAE MITES FROM SMALL RODENTS IN LITHUANIA

Evelina Kaminskienė[1], Vytautas Preikša[1], Jana Radzijevskaja[1], Algimantas Paulauskas[1]

[1]FACULTY OF NATURAL SCIENCES, VYTAUTAS MAGNUS UNIVERSITY, LITHUANIA
VYTAUTAS.PREIKSA@GMAIL.COM

Abstract

Laelapidae mites are ecologically diverse group of superfamily Dermanyssoidea (Mesostigmata) and involve predators and parasites found in various habitats. These mites are frequently associated with small rodents and some species occasionally infest man and transmit agents of diseases to humans such us mite-borne rickettsial pox, scrub typhus, and tick-borne pathogens. Therefore, identification of mites is an important step in the management of these vectors. Classification of the Dermanyssoidea is complicated. These mites display high levels of morphological variability, and it has been difficult to develop a robust phylogenetic relationship based solely upon morphological characteristics. Most classifications have utilized traditional taxonomic methods. Molecular methods are becoming increasingly important in systematic acarology, and the nuclear ribosomal genes are powerful tool for phylogenetics within the Acari, but these are lacking for most groups of mites. The aim of this study was to genetically characterize Laelapidae mites parasitizing small rodents in Lithuania using molecular methods. Obtained molecular data have been used to discriminate between species and for phylogenetic analysis. A total of 173 parasitic mites from Laelapidae family were collected from 87 small rodents of different species captured in Biržai and Trakai districts in Lithuania. After morphological examination, using appropriate identification key, examined ectoparasites were identified as *Laelaps agilis* (n=136), 30 *Haemogamasus* nidi (n=30), *Eulaelaps stabularis* (n=2), and *Hyperlaelaps microti* (n=4). The 28S nuclear ribosomal DNA gene region (domains 1-3) was used as molecular marker for identification of mites. Conventional PCR and sequence analysis were performed. Sequences were edited, aligned and subjected to phylogenetic analyses using Mega 6.0 software. The present study is the first molecular identification of *L. agilis*, *H. nidi* and *H. microti* mites. Molecular analysis allowed to identify *Laelaps jattmari* (pavlovskyi) species, which was not recognized using morphological identification keys – sequences derived from two specimens shared 100% identity with *Laelaps jattmari* sequences deposited in GenBank.

Keywords: Laelapidae, mites, molecular identification, Lithuania

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MOLECULAR-CYTOGENETIC CHARACTERIZATION OF THE AMPHIPOD GMELINOIDES FASCIATUS AS A BIOLOGICAL DIVERSITY ELEMENT OF THE BALTIC SEA

Larisa V. Barabanova[1], Svetlana A. Galkina[1], Elena I. Mikhailova[1]

[1]SAINT-PETERSBURG STATE UNIVERSITY, DEPT. OF GENETICS & BIOTECHNOLOGY, RUSSIA
LBARABANOVA@MAIL.RU

Abstract

The amphipod *Gmelinoides fasciatus* is of great interest as an alien species, which went through successful adaptation at the Baltic Sea ecosystem. Due to its broad ecological plasticity this hydrobiont, initially originating from the Lake Baikal, got widespread in the water bodies of the North-West regions of Russia as the result of deliberate introduction. Biological invasion made this species even dominant in a number of locations and lead to the displacement of traditional native crustacean species. The problem makes the clarification of mechanisms underlying successful adaptation of alien species to new environments an important aspect of studying such species. Therefore, the attempt was made to use molecular genetic and cytogenetic approaches to characterize *G. fasciatus* genome and chromosome set with respect to adaptation studies. DAPI staining revealed bright fluorescing A–T rich pericentromeric regions on mitotic chromosomes. Chromosome counts in *G. fasciatus* allowed us to determine the diploid number as 2n=52. Fluorescence in situ hybridization (FISH) of telomeric repeats (TTAGG)n to chromosomes revealed that those repeats predominantly hybridized to chromosome ends, although some interstitial locations were detected as well. 18S rDNA probes hybridized to two sites on chromosomes of the set. Follow-up sequencing of conserved and variable domains of 18S rRNA gene, amplified using DNA of crustaceans from Baikal population, added a wider prospect of further search for possible more subtle changes at the molecular level, which might appear in variable DNA domains as the result of adaptation process. The research is being performed in the Resource Centre “Chromas” at the Research park of St.-Petersburg State University and was partially funded by the grant of the President of Russia for support of leading scientific schools 9513.2016.4 and RFBR grant N15-29-02526.

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MYCOREMOVAL OF REACTIVE DYES WITH DIFFERENT CHEMICAL STRUCTURES IN MOLASSES MEDIUM

Gözde Bodur[1], Sevgi Ertuğrul Karatay[1], Gönül Dönmez[1]

[1]ANKARA UNIVERSITY, BIOLOGY DEPARTMENT, TURKEY
GDONMEZ@ANKARA.EDU.TR

Abstract

Synthetic dyes are potentially problematic compounds of textile effluents. Among them reactive dyeing is commonly used method for the coloration of cellulosic fibres. These effluents cause important damage to the environment as a result of their toxic, mutagenic and carcinogenic effects. Moreover high colored dyes in aqueous ecosystem restricts the sunlight penetration to the waster which in turn decreases photosynthetic activity eventually. Reactive Black 5 B (RB5B), Reactive Red 120 (RR 120) and Reactive Orange 14 (RO 14) are well known textile dyes and uncontrolled usage of them may cause serious problems. Therefore in this study, biological removal of these dyes were investigated.

The present study reports on usage of two different fungi ,which were obtained from the culture collection of Ankara University, for treating wastewater containing dye. In the study, molasses was chosen as the carbon source due to its low cost, ready availability, and ease of storage. The samples taken during the incubation time were centrifuged at 5000 rpm for 5 minutes and the dye concentrations in the supernatants were measured spectrophotometrically at 600 nm for RB5, 435 nm for RO14 and 520 nm for RR120, respectively.

The bioremoval yields for the first fungus 99.3%, 80% and 98.8% in the presence of 100 mg/L RR120, RO14 and RB5, respectively. For the second fungus the bioremoval yields were 97.1%, 88.0% and 99.8% for the tested dyes. The results showed that both of the fungal biomass are promising bioaccumulating agents for the reactive dyes.

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[1]ANKARA UNIVERSITY, BIOLOGY DEPARTMENT, TURKEY
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NEMUNAS RIVER POLLUTION WITH BIOGENIC COMPOUNDS IN KAUNAS CITY

Giedre Kaciene[1], Nazim Nikiforov[1]

[1]VYTAUTAS MAGNUS UNIVERSITY
GIEDRE.KACIENE@VDU.LT

Abstract

Water pollution induces adverse effects on ecosystems, disturbing them in various ways. Pollution of water bodies with biogenic (mainly nitrogen and phosphorus) compounds do not cause direct noxious impact on living organisms. However, an excess of it leads to eutrophication: intensive development of phytoplankton, disruption of the gas regime, sedimentation of bottom sediments and, eventually, to the shift in ecosystem composition and drastic reduction in water quality. Therefore the aim of this study was investigate the concentrations of ammonium (NH4+-N), nitrites (NO2--N) and phosphates (PO43-- P) in Nemunas river in different areas of Kaunas city. Water samples were taken in November 2017 in the following regions: Petrašiūnai (0,2 km below Kaunas hydropower plant (HP)), Panemunė (3 km below HP), Jiesia (8 km below HP), Freda (11 km below HP), City center (13 km below HP), Marvelė (17 km below HP) and Zapyškis (30 km below HP). The level of all investigated biogenic compounds tended to decrease going downstream the river from Panemunė and/or Freda district till the suburban area in Zapyškis village. Nevertheless, in the majority of sampling points the concentrations of N and P compounds exceeded the limit values. The highest concentration of NH4+-N (above the limit value of 1mg/l) was found in Panemunė and Freda districts. Similarly, the NO2--N was higher than the limit value (0,03 mg/l) in the districts of Petrašiūnai, Freda and City center. Whereas the highest concentrations of PO43-- P was observed in the lower parts of the river (Jiesia, City center and Marvelė). Relatively lower concentration of phosphates in Petrašiūnai and Panemunė dictricts could be explained by accumulation of P in Kaunas reservoir, above Kaunas HP. Summarizing the results of this study it should emphasized, that Nemunas river is severely polluted with N and P compounds due to diffuse pollution from Kaunas city, especially in the cold season, when degradation of biogenic compounds is terminated.

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NPS AS A STRESS FACTOR FOR GENE SILENCING IN FLAX (LINUM USITATISSIMUM L.)

Inese Kokina[1], Ilona Mickeviča[1], Linda Bankovska[1], Inese Gavarāne[1], Marija Jermaļonoka[1], Eriks Sledevskis[2], Andrejs Ogurcovs[2], Vjačeslavs Gerbreders[2]

[1]DAUGAVPILS UNIVERSITY, INSTITUTE OF LIFE SCIENCES AND TECHNOLOGY, DEPARTMENT OF BIOTECHNOLOGY, LABORATORY OF GENOMICS AND BIOTECHNOLOGY, PARADES STREET 1A, DAUGAVPILS, LATVIA, LV 5401, [2]DAUGAVPILS UNIVERSITY, INSTITUTE OF LIFE SCIENCES AND TECHNOLOGY, DEPARTMENT OF TECHNOLOGY, G.LIBERTS' CENTER OF INNOVATIVE MICROSCOPY, PARADES STREET 1A, DAUGAVPILS, LATVIA, LV 5401
LINDA.BANKOVSKA@DU.LV

Abstract

MicroRNA (miRNA) synthesis is one of the ways for plants stress response increasing. miRNAs are small single-stranded RNAs with specific properties and functions. These strands are non-protein-coding with length around only 21 nucleotides. miRNAs are involved in process of posttranscriptional regulation of gene and control signaling pathways. The action of the miRNA is based on targeting of specific messenger RNAs at 3' untranslated region with subsequent blocking of protein synthesis. Pectin methylesterase is a group of enzymes with important role in transformation of plant cell structure that are coding by Pme genes family. Pme3 gene expression is related with enzyme that acts as a factor of cell wall weakening, thereby, causing easier entry of pathogens, plants damages and death. The aim of this study was to detect the amount of plant resistance-specific miRNA in plant tissues under nanoparticle stress conditions. Flaxseed *Linum usitatissimum L*. was used as a model plant. Obtained in vitro callus cultures were supplemented by various concentrations of nanoparticles in different callus development stages. Flax pme3 gene-specific primer with locked nucleic acid for real-time PCR reactions was designed. This work was supported by DU internal grant No 14-95/13

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OBTAINING OF BIOLOGICAL ACTIVE INGREDIENTS FOR PHARMACEUTICALS USING CRYOGENIC MOLECULAR FRACTIONATION

Oleksandr I. Osetsky[1], Anatoliy N. Goltsev[1]

[1]INSTITUTE FOR PROBLEMS OF CRYOBIOLOGY AND CRYOMEDICINE OF THE NATIONAL ACADEMY OF SCIENCES OF UKRAINE, UKRAINE
CRYOO@UKR.NET

Abstract

Nowadays there is a rapid increase in using natural biological raw materials of vegetable and animal origins in pharmaceutical, cosmetic, food industries, manufacture of natural dyes, flavors, ”green” chemistry products etc. However, this branch efficient development faces a complicated technological issue: isolation from initial raw materials of the essential molecular ingredients with preserving their native structure and biological activity. The experiments have demonstrated that to solve this problem is possible by applying the cryogenic technologies. This research studies the technological complex, allowing to divide the raw materials into separate fractions. In this case the structure, composition and properties of those are determined by their further application. The principal difference of our assembly versus other analogues is that the processing includes only cryogenic steps: rapid freezing, cryogenic grinding, freeze-drying molecular fractionation, low temperature extraction using the liquefied gases, cryocavitation.

In this report we considered thermodynamic aspects and technological principles of implementing the technological stages. Due to the analysis of ternary diagrams of complex aqueous solutions and the composition of the obtained fractions there were selected the optimal temperature and time regimens for implementation of cryosublimation fractionation of porcine placental tissues and aromatic plants. The dependence of amino acid, mineral and hormonal compositions of the obtained aqueous fractions of porcine placenta on the used fractionation regimens was established. In particular, these regimens were shown to enable varying the content of the main amino acids and hormones in these fractions within a wide range. For example, the content of alanine, valine, histidine, isoleucine, lysine in the obtained fractions of porcine placenta could be changed by dozens of times, and the content of such hormones as prolactin, FSH, testosterone, progesterone, cortisol varies in 5-6 times depending on fractionation parameters. Freeze-dried biopowder which remained in sublimation chamber is a perfect product for selective extraction of lipid fraction by liquid gases. When choosing the solvents based on the compositions from liquefied coolants it is possible to effectively differentiate the molecular contents of biologically active oils, isolated from raw materials. In the work we studied the selective principles of such compositions, according to physical and chemical features of initial coolants and types of raw materials under processing. Actually the ingredients produced at certain steps of fractionation of initial raw biomaterials are quite ready to be used as cosmetic and pharmaceutical products.

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OPTIMIZATION OF IMMOBILIZATION METHODS OF ANTIBODIES AGAINST HUMAN LACTOFERRIN ON THE SURFACE PLASMON RESONANCE SENSOR CHIP

A. Bakhmachu[1], O. Gorbatiuk[1], A. Rachkov[1], A. Soldatkin[1]

[1]INSTITUTE OF MOLECULAR BIOLOGY AND GENETICS NATIONAL ACADEMY OF SCIENCES OF UKRAINE
A.BAKHMACHUK@GMAIL.COM

Abstract

Noninfectious intestinal inflammation, inflammatory bowel disease (IBD), can be difficult to distinguish from non-inflammatory irritable bowel syndrome (IBS). During IBD lactoferrin (LF) is released into the intestinal mucosa and during IBS is not. Detection of increased levels of fecal LF is a reliable, non-invasive, specific for inflammation, and cost-effective approach to screen out IBS patients, identify likely IBD patients, assess inflammation levels, and identify disease activity in response to treatment.

Comparing to conventional analytical approaches, advantages of biosensors are easy, fast, accurate, sensitive, specific, and cheap measurements. However, the simplest way for preparing immunosensor by direct immobilization of antibodies on a sensor surface can result in essential decrease in their activity due to their random orientation and steric hindrance caused by influence of the surface. Staphylococcal immunoglobulin-binding protein A (SPA) offers orientation of antibodies by binding Fc fragment of antibody and leaving Fab fragment available for interaction with its antigen. However, SPA itself meets the same problem of random immobilization. For more effective immobilization of the protein on a gold sensor surface, recombinant SPA (SPA-His-Cys), containing His-tag and Cys residue, has been obtained.

The aim of this work was to compare efficiency of three immobilization methods of antibodies against human lactoferrin (anti-LF) on a sensor surface 1) by direct physisorption, 2) through intermediate layer of SPA-His-Cys, immobilized via interaction of thiol group of Cys with gold surface, and 3) through intermediate layer of SPA-His-Cys, immobilized via His-tag using analogue of NTA molecule (BCL-12).

The study of immobilization processes and intermolecular interactions between immune components has been performed by using the measuring flow cell of surface plasmon resonance (SPR) spectrometer "Plasmon-4m". A successful formation of bioselective elements of the SPR immunosensor using each of the proposed methods of immobilization has been demonstrated. Interactions of intermediate layer of SPA-His-Cys immobilized either through His-tag or Cys, with anti-LF has been studied. Comparison of SPR biosensor responses on LF injections during their interactions with three types of anti-LF bioselective elements has shown the advantage of the method using SPA-His-Cys intermediate layer immobilized via His-tag.

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OPTIMIZATION OF SOILS AND AGROECOSYSTEMS BY METHOD OF APPLYING PEAT AND SAPROPEL

Navumenka Natallia[1], Salahub Natallia[2]

[1]BELARUSIAN STATE PEDAGOGICAL UNIVERSITY NAMED AFTER MAXIM TANK, FACULTY OF NATURAL SCIENCES,MINSK, REPUBLIC OF BELARUS, [2]BELARUSIAN STATE PEDAGOGICAL UNIVERSITY NAMED AFTER MAXIM TANK, FACULTY OF NATURAL SCIENCES, MINSK, REPUBLIC OF BELARUS
NATA-N15@MAIL.RU

Abstract

In the agroecosystem, artificially created by man, is a limited diversity of cultivated species of plants and they cannot withstand the struggle for survival without the human support. Unlike the natural ecosystem phytocenosis of the agroecosystem (fragments of the natural ecosystem, spontaneous flora and cultivated plants) receives in addition to solar an extra energy through human activity. The additional energy and substance flow in the agroecosystem are due to incomplete nutrient cycle, since a considerable part of the nutrients is taken out with the harvest from the system and the natural circulation is not carried out. One of the sources of energy and substance in the natural and manmade ecosystem is soil. Soil, as a component of the landscape, forms a long period of time, and in the agroecosystem it is rapidly depleted and destroyed. Streamlined agrotechnogenesis increases the natural fertility of soils, creating optimal conditions for the growth and development of plants. However, the direct geochemical influence of agrotechnogenesis includes the chemicalization of agriculture and agrotechnogenic of cultivation of the soil. The authors would like to take up two examples of soil optimization – the normalization of the properties of the soils, – by applying peat and sapropels, as the most environmentally friendly and agroeconomically efficient ones.

Optimization by methods of applying peat and sapropels increases the agricultural crop capacity, but also improves the quality: nutrients such as nitrogen, phosphorus, potassium, calcium, magnesium and microelements, which directly affect the intensity and character of the physiological and biochemical processes, so plants accumulate proteins, fats, carbohydrates and other substances that characterize the quality of products.

Optimization of light soils was realized out by applying sapropels and absolutely dry peat in doses of 100, 200, 300 and 400 t/ha (tons per hectare).

Soil and climatic conditions in Belarus are the most favorable for producing high potato crops.

This is due to sufficient moisture, which creates a reserve of moisture in the zone of the main mass of roots. The main condition – light soils. High potato crops on light soils can get if organic and mineral fertilizers are applied. Using high doses of sapropels is an effective agromeliorative method which rises productivity, especially row crops, by improving the properties of low-productive soil. In our experience the introduction of sapropels potato crops ranged from 134 c/ha (centners per hectare) (at a dose of 100 t/ha) to 312 c/ha (at a dose of 400 t/ha) with the crops on the control area of 56 c/ha. Introduction of 100 t/ha of peat increases the crop by 4.7 %, and with the introduction of 400 t/ha of peat – by 22.6% and allows you to harvest potatoes to 400-420 c/ha.

Optimization of light soils increases the potato crop in a variety of experience in 2-5 times.

Keywords: agroecosystem, optimization of soils, peat, sapropels.

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PARTICIPATION OF SERRATIA PROTEAMACULANS OUTER MEMBRANE PROTEIN OMP X IN BACTERIAL ADHESION

O. Tsaplina[1]

[1]INSTITUTE OF CYTOLOGY, RUSSIAN ACADEMY OF SCIENCES, RUSSIA
OLGA566@MAIL.RU

Abstract

Serratia are facultative pathogens primarily causing nosocomial infections. The mechanisms of these infections are, however, poorly understood. We have previously found that the capability of bacteria *Serratia proteamaculans* to invade eukaryotic cells correlates with the actinase activity of intracellular metalloprotease protealysin (Tsaplina et al., 2009). Along with protealysin, the invasive activity of S. proteamaculans is mediated by pore-forming toxin hemolysin ShlA and extracellular protease serralysin. Many virulence factors of bacteria are regulated by the Quorum Sensing system (QS) that controls expression of specific genes in response to population density. The QS system is composed of a LuxI-type AHL synthase and a LuxR type AHL receptor. Proteins of the LuxI type produce certain signaling molecules that are bound by receptors of the LuxR type. The aim of our work was to reveal the effect of inactivation of the Lux-type SprI gene on the known virulence factors and the invasive activity of *S. proteamaculans*. Inactivation of SprI gene (the strain was provided by Dr. Khmel I.A., Institute of Molecular Genetics RAS) results in a 2-fold increase of *S. proteamaculans* invasion and this increasing may be associated with increasing in adhesive activity of bacteria. This inactivation does not affect activity of the pore-forming toxin ShlA and serralysin, but results in the loss of the actinase activity of protealysin. By mass spectrometry, bacterial outer membrane protein OmpX may be a substrate for protealysin. This enzyme is homologous to the Salmonella Rck protein involved in the zipper-like entry mechanism. We suggest that inactivation of *S. proteamaculans* AHL synthase gene leads to the increased invasive activity of the bacteria presumably as a result of accumulation of outer membrane protein, and this effect is mediated by the loss of the protealysin activity. This work was supported by the RSF grant 17-74-10045.

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PECULIARITIES OF STRUCTURAL AND FUNCTIONAL CHARACTERISTICS OF TRITICUM AESTIVUM LEAF MESOPHYLL CELLS UNDER SHORT-TERM TEMPERATURE STRESSES

L. Babenko[1], Y.Akimov[1], M. Shcherbatiuk[2], K. Romanenko[2], O. Smirnov[3], I. Kosakivska[1]

[1]M.G. KHOLODNY INSTITUTE OF BOTANY NATIONAL ACADEMY OF SCIENCE OF UKRAINE , [2]M.G. KHOLODNY INSTITUTE OF BOTANY NATIONAL ACADEMY OF SCIENCE OF UKRAINE, [3]INSTITUTE OF BIOLOGY AND MEDICINE, TARAS SHEVCHENKO NATIONAL UNIVERSITY OF KYIV
LILIA.BABENKO@GMAIL.COM

Abstract

The temperature regime is one of the key environmental factors, which determines the growth and development of plants and affects their productivity. One of the main cereal crops in the world is wheat. An important element in the technology of its cultivation is the use of environmentally plastic varieties resistant to biotic and abiotic stress factors. In our study we analyzed the effect of high (40ºC, 2 h) and positive low (4ºC, 2 h) temperatures stresses on the ultrastructure of leaf mesophyll cells, the content of photosynthetic pigments, phenols and flavonoids in 14-day seedlings of an ecologically plastic variety of Ukrainian selection of Triticum aestivum Podolanka. The ultrastructure of leaf mesophyll cells in control samples was typical: regular lenslike chloroplasts, which were located along the cells periphery, had a distinct developed thylakoid system submerged in a fine-grained stroma. Granum thylakoids closely adhered to each other. Grana were uniformly distributed in the chloroplast stroma. The stroma contained starch grains. A short-term hyperthermia caused the destruction of chloroplast thylakoid membranes. A partial wavy packing of granum thylakoids, expansion of luminal gaps, detachment of thylakoid terminal ends from one another occurred. Chloroplasts became more elongated. Plastoglobules were intensively produced. Following a high temperature effect, mitochondria had a tendency to become round, their matrix was more electronically dense, distance between crystals increased. The total content of phenols and flavonoids in leaf mesophyll cells increased. A short-term hypothermia caused an increase in the number and size of starch grains, plastoglobules production. However, the number of plastoglobules exceeded that of controls insignificantly. No thylakoids destruction was observed. Some mitochondria were round and had the size similar to that of controls, but some organelles became oval. In the conditions of hyper- and hypothermia, in the mesophyll cells of the leaves of *T. spelta*, the tendencies of amplification of the degree of chromatin condensation in the nucleus occurred the photosynthetic pigment content in leaves did not practically differ from that of controls. However, the total phenol and flavonoid content increased. Changes in the ultrastructure and metabolic parameters, identified after temperature stresses, demonstrated tolerance to the effects of hypothermia and sensitivity to hyperthermia, which generally corresponds to the characteristics of the wheat variety under study.

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PECULIARITIES OF THE MENTAL PROCESSES IN THE HUMAN BRAIN DURING THE STOPPAGE AND SWITCHING OF MOTOR PROGRAMS AMONG WOMEN

Olha Korzhyk[1], Olha Pavlovych[1], Olha Abramchuk[1], Tetyana Kachynska[1], Olena Dmytrotsa[1], Andriy Poruchynskiy[1], Alevtyna Morenko[1]

[1]LESYA UKRAINKA EASTERN EUROPEAN NATIONAL UNIVERSITY, UKRAINE
OLGA.KORGIK@GMAIL.COM

Abstract

The academic community has become increasingly active in discussing the issues of the similar or different mechanisms that provide inhibition of motor response in the Stop-Signal and Stop-Change paradigms. The purpose of the study is to establish differences in the cortical electrical activity among women in conditions of complete inhibition of the running motor program of manual response (MR) and in conditions of its inhibition, with subsequent switching to an alternative motor task. In order to analyze the dynamic activity of the brain oscillatory systems, we used the "event-related desynchronization / synchronization" (ERD / ERS) method, which is considered to be the most expedient in terms of MR. 42 women aged 18-23 years, right-handed, participated in the experiment. EEG experiment procedure included two consecutive series: with use of Stop-Signal paradigm in the first series and Stop-Change paradigm in the second one. Indicators ERD and ERS were evaluated in the frequency range of EEG (1-35) Hz in the frontal, central and parietal leads.

The greater precision of the task conducting among women in the series with the Stop-Change paradigm usage has been established. In both series of experiment, as a global principle, the predominance of ERS events in the range of α- and partially β1-activity of EEG is distinguished. The cortical activity of the participants, connected with the stoppage of the activated motor program of MR and its subsequent switching to the alternative movement (Stop-Change paradigm) comparing to the complete stoppage of movement (Stop-Signal paradigm), had significant distinctive features and was characterized by a specific frequency-spatial type of motor information processing. So, the generalized reduction of ERS in the cortex at the frequencies of the EEG α-activity, as well as the increase of ERD in the right parietal part (9-10 Hz) was established. Time duration of such changes in the post-stimulation interval was longer than the time of sensory-motor response. During sensory-motor response of women, the growth of ERS EEG (0-280 msec) in symmetrical parietal (16 Hz), central and parietal (19 Hz) areas of cortex was noted. In the series with the Stop-Change paradigm the comparable increase in ERD (0-418 msec) in the cortex, primarily in the right hemisphere, was detected at a frequency of 24 Hz. In the range of high-frequency activity (above 25 Hz), the ERS / ERD spatial distribution acquired a volatile and changeable nature. In the time duration after the completion of the sensory-motor response (about 1 s) the ERS in the cortical parts in EEG α- (7-8 Hz, 11 Hz and 12-13 Hz) and β1-range (15-16 Hz) was revealed.

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PERSPECTIVES OF VERMICULTURE IN THE DISPOSAL OF DOMESTIC WASTES IN UKRAINE

Tetiana Shevchuk[1]

[1]*VINNYTSIA NATIONAL AGRARIAN UNIVERSITY, UKRAINE*
MELNIK@VSAU.VIN.UA

Abstract

The problem of household waste disposal has been acutely faced by mankind in recent decades. Annually in Europe about 300 million tons of rubbish are generated, and in Ukraine - 9.23 million tons. Therefore, from January 1, 2018, Ukraine undertook to sort all rubbish by type of material, and also to divide it into suitable for reuse, for disposal and dangerous (Article 32 of the Law of Ukraine "On Waste") and two EU Directives 1999/31 / EC and 2008/98 / EC. If within the cities reforms are gradually being implemented, there are certain problems in the sorting and recycling of waste in rural areas. However, it is in villages that have many centuries of utilization of domestic and, in fact, organic waste. Composition is practiced in each settlement in the countryside. The main role in the processing of organic matter on decay products belongs to invertebrates and bacteria. This way of disposal is not only simple and cheap but profitable. As a result of composting using vermiculture, by-products are excellent humus, humic fluid, worm forage for sale or expansion of production. In the problem of utilization of domestic waste from large cities, separate points (garbage cans), as well as individual residential or office premises, vermiculture is the most promising way of utilization. Here is an example. Each average family in Ukraine produces more than 3 kilos of garbage per day. Excluding inorganic waste (glass, old clothes, metal waste), 50% comes from inorganic (plastic, paper, etc.), 35-40% - organic waste, the rest - other types of garbage. The average sized garbage in the city accumulates daily up to 2 tons of waste, of which up to 800 kg of organic waste. Such quantity can serve as a constituent of 4000 kg of substrate for vermiculture. This will give annually up to 300 kg of biohumus per square meter.

For the year of correct work on the cultivation of worms comes out about 10 thousand worms and more than half a ton of humus from one square meter of nursery. If you only receive income from the sale of worms for 0,5 UAH. for a piece, it turns out about 5 thousand UAH. per year (150 euro / m2). The average retail value of Ukrainian vineyards is as follows: Seeded humus (refined) - 2-3 thousand UAH. (90 euros) / t; non-separated humus (untreated) - 1-1,5 thousand UAH. (45 euros) / t; Californian worms - 350 UAH. (10 euros) / 1.5 thousand worms; worm - "surgeon" - 750 UAH. (23 euros) / 1.5 thousand worms; Worm for fishing - 50-200 UAH. (6 euros) / 1.5 thousand worms (Domashniy biznes, 2018).

Thus, with minimal investment and non-waste production, the economic efficiency of household waste utilization through vermiculture is obvious.

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PHENOL BIOREMEDIATION BY MIXED MICROBIAL CULTURES ISOLATED FROM WASTEWATERS

Nur Kocberber Kilic[1], Gülden Kaplan[1], Gönül Dönmez[1]

[1]ANKARA UNIVERSITY, FACULTY OF SCIENCE, DEPARTMENT OF BIOLOGY, BEŞEVLER, ANKARA, TURKEY
NRKILIC@ANKARA.EDU.TR

Abstract

Discharging untreated wastewaters contaminated with aromatic hydrocarbons represents a serious threat with far-reaching consequences for humans and the environment. Among aromatic hydrocarbons phenol is known as the most toxic pollutant. To prevent such pollution caused by numerous types of industries, it is essential to establish efficient and cost-effective treatment systems. The conventional treatment methods as chemical and physical treatments have disadvantages compare to biological methods. Usage of microorganisms like yeast, fungi, and bacteria having bioremediation capability is preferred related to its cost, effective, safe and practical property.

In the current study, biological treatment of phenol by mixed microbial cultures was investigated with regards to different conditions. For this purpose, boron works wastewater (BW) was used as the source of microbial culture. To determine the effect of phenol concentration onto pollutant removal, mixed culture was inoculated in media with 100-500 mg/L phenol. The effect of different biomass concentrations onto pollutant bioremoval was also investigated. In these experiments, biomass concentrations were used as 0.5-3.0% (v/v).

Wastewater samples were inoculated into minimal medium with 25 mg/L phenol (pH 7). BW mixed microbial culture was then obtained by enrichment technique in the same media with increasing phenol concentrations. The tested mixed culture removed the applied phenol (nearly 100 mg/L) with a yield of 99.7% after incubation for 7 days.

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PHENOTHIAZINE DERIVATIVES AS INHIBITORS OF ABC TRANSPORTERS IN CANDIDA ALBICANS

Guoda Mackevičiūtė[1], Neringa Kuliešienė[2], Simona Sutkuvienė[2], Rimantas Daugelavičius[1]

[1]DEPARTMENT OF BIOCHEMISTRY, VYTAUTAS MAGNUS UNIVERSITY, KAUNAS, LITHUANIA, [2]DEPARTMENT OF BIOCHEMISTRY, VYTAUTAS MAGNUS UNIVERSITY, KAUNAS, LITHUANIA
GUODA.MACKEVICIUTE@STUD.VDU.LT

Abstract

The increasing resistance of Candida albicans to antimicrobials is a growing challenge. The most pronounced drug elimination mechanism in C. albicans cells are active multi-drug resistance (MDR) pumps CaCdr1p and CaCdr2p, belonging to the ABC (ATP-binding cassette) family of membrane transporters. The xenobiotics are removed from cell using energy generated by hydrolysis of ATP. Scientists have to discover new compounds that would effectively inhibit these efflux pumps. It is important that such compounds should be effective against pumps in fungi, but do not damage cells of the host organism. The fluorescent dye rhodamine 6G (R6G), as a substrate for ABC transporters, was used to assay the performance of MDR pumps in C. albicans. Four strains were used in our experiments: wild type C. albicans ATCC 10231 and three isolates - 2939 (fluconazole sensitive), 3212 (fluconazole resistant) and IZ (floconazole resistant). Inhibition of C. albicans MDR pumps by phenothiazine derivatives with three different alkyl chain substituents was monitored in this study.

For experiments the cells were preloaded with R6G by glucose starvation and diluted into 96-well microplates. R6G was removed from the cells with active transporters like other xenobiotics. R6G efflux was initiated adding 2 % glucose to the incubation medium. The efflux was monitored following the intensity of fluorescence. R6G efflux kinetics was different when various concentrations of glucose and inhibitors were added.

Phenothiazine acted differently than its derivatives. Phenothiazine did not inhibit MDR pumps and acted as an efflux substrate, when its concentration was 4 or 8 μg/ml: after glucose addition R6G was extruded from the cells. Meanwhile its derivatives – methyl-phenothiazine, ethyl-phenothiazine and hexyl-phenothiazine - acted as efflux inhibitors and after glucose addition the fluorescence increased only slightly.

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PHYSICOCHEMICAL AND ANTIOXIDANT PROPERTIES OF FUNCTIONAL WHEY BEVERAGES SUPPLEMENTED WITH ELDELBERRY

Jūratė Šlapkauskaitė[1], Algimantas Šlapkauskas[2]

[1]LITHUANIAN UNIVERSITY OF HEALTH SCIENCE, [2]ALEKSANDRAS STULGINSKIS UNIVERSITY, LITHUANIA
JURATE.SLAPKAUSKAITE@GMAIL.COM

Abstract

All plant parts of *Sambucus nigra L*. (leaves, berries, inflorescences, roots, shoots, bark) have a long history of use in herbal remedy or lots of culinary uses, widespread in almost every continent of the world. Pro-health properties indicated a role of elderberry products intake in the prevention of cancer and diabet. The aim of this study was to manufacture functional whey beverage, using *Sambucus nigra L*. extract (berries, flower), and to evaluate the physicochemical, sensory and antioxidant potential of the resulting product. Mixture of *Sambucus nigra L*. extract and whey was evaluated as a potential substrate for production of a novel beverage. It was found that the addition of *Sambucus nigra L*. extract affected the sensory, physical and antioxidant properties of the beverages. High quantities of total phenolic content (TPC), antioxidant activities including DPPH and ABTS radical scavenging increased significantly ($p \leq 0.05$). Moreover, the antioxidant potential of elder berries extract infusions assessed by DPPH and ABTS radical assays revealed that extract prepared from flowers had higher mean DPPH and ABTS activities than the extract prepared from berries. Therefore, elder whey beverages could be important dietary sources of natural antioxidants that contribute to the prevention of diseases caused by oxidative stress. The addition *Sambucus nigra L*. extract of whey beverages did not affect the sensory parameters and the acidity of the products. Results proved antioxidant activities of whey beverages were desirable and have the ability to enhance these antioxidant activities, as compared without additives beverage. Also *Sambucus nigra L*. extract and whey were suitable media for producing a novel functional dairy beverage.

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PHYTOPATHOGENIC MICROORGANISMS ON INVASIVE FABACEAE PLANTS IN LITHUANIA

Čepukoit Dovilė[1], Putramentaitė Aurelija[2], Burokienė Daiva[1]

[1]NATURE RESEARCH CENTRE, LABORATORY OF PLANT PATHOLOGY, ŽALIŲJŲ EŽERŲ STR. 49, LT-08406, VILNIUS, LITHUANIA
[2]VILNIUS UNIVERSITY, LIFE SCIENCE CENTRE, INSTITUTE OF BIOSCENCES, VILNIUS, LITHUANIA
DOVILE.CEPUKOIT@GAMTOSTYRIMAI.LT

Abstract

Fabaceae plants are considerate to be one of the most important because of the wide applicability in the industry. This family consists not only of herbal plants, but also from shrubs and trees. Fabaceae plants like others, often suffer from various fungal and bacterial diseases. Invasive Fabaceae family plants causing large ecological and economic losses are found in Lithuania. These invasive plants create a threat to the diversity of local plant species, as well as the macro and micro-organisms directly associated with them. Different pathogens can cause diseases to invasive Fabaceae plants, but it is not clear, what kind of influence can be made to local flora by microorganisms which spread with invasive plant species. Therefore, it is not known what the spread dependence of microorganisms from the invasion of alien plants in the territory of Lithuania is. In the summer-autumn of 2017, plant material of representatives of the Fabaceae family were collected. Local and invasive plants collected from different regions of Lithuania were investigated, from which microorganisms cultures were isolated. A collection of bacteria (168 isolates) and microscopic fungi (244 isolates) was obtained from 58 plants belonging to ten genera. After grouping these microorganisms, the representatives of their groups were investigated by polymerase chain reaction and Sanger's sequencing. With identified microorganisms, pathogenicity, antagonism, and growth promotion tests were performed.

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PHYTOTOXICITY AND ALLELOPATHIC IMPACT OF *IMPATIENS GLANDULIFERA*

Ligita Baležentienė[1]

[1]*ALEKSANDRAS STULGINSKIS UNIVERSITY, INSTITUTE OF ENVIRONMENT AND ECOLOGY, LITHUANIA*
LIGITA.BALEZENTIENE@ASU.LT

Abstract

Invasive plants affect invaded habitats and cause a significant threat to the integrity and biodiversity of native systems. The knowledge how invasive species spread in new environment might be important for their management control. Moreover, biochemical interaction underlies the novel weapon hypothesis thus presenting one of numerous explanations for species invasiveness. This study aimed to determine the total phenolics content in various parts of *I. glandulifera* and evaluate their phytotoxicity on germination of monocot and dicot species.

Phytotoxicity and allelopathic activity of worldwide invasive *Impatiens* species (*Balsaminaceae*), namely *I. glandulifera* (originated to Himalaya) on wheat and rapeseed germination and seedling growth was assessed ex situ at Aleksandras Stulginskis University in 2016.

Phenolics content ranged between 0,615 and 7,566 mg g-1 in *Impatiens* extracts, however it significantly inhibited germination and seedlings growth of recipient species. Seed germination and seedling emergence are the outcomes of a sequence of biological events initiated by water imbibition followed by enzymatic metabolism of storage nutrients. Germination rate was recorded different for each recipient species. Inhibition of *Impatiens* extracts was recorded stronger for rapeseed germination (11.5-81%) than that for wheat germination (71-86.5%) possibly due to different seed coat anatomy and thus, its permeability. Therefore the strongest inhibition (86.5%) was recorded for rapeseed germination (11.5%) in 0.2% fruit+seed extract of *I. glandulifera*. Wheat mean hypocotyl (14.2 mm) and radicle (4.4mm) length exhibited weaker response to extract of *I. glandulifera* than rapeseed (4.4 mm and 1.4 mm, respectively). Consequently, recruitment and regeneration of native species might be negatively affected by invasive *Impatiens* species in invaded habitats.

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PRELIMINARY DATA ON INFESTATION OF INVASIVE SLUGS (*ARION LUSITANICUS*) WITH PARASITES

Melita Bružaitė[1], Ingrida Šatkauskienė[1]

[1]VYTAUTAS MAGNUS UNIVERSITY, FACULTY OF NATURAL SCIENCES, KAUNAS
MELLYBRAY@GMAIL.COM

Abstract

Slugs (*Arion lusitanicus*) began to spread in various Europe countries from 1950. First occurrence of this slug in Lithuania was observed in 2012 and after four years, in 2016, *A. lusitanicus* already were found in main cities and regions of Lithuania. Populations of these slugs can reach high density depend on high reproduction potential and for this reason they can make a lot of damage for gardens cultures. Slugs can spread disease of plants by eating healthy or rotting plants and are important as vectors or intermediate host of various parasites pathogenic for human and animals. The aim of this study was to investigate infestation of *A. lusitanicus* by parasites. During the study was collected 40 individuals of slugs, which were dissected in search parasites. Mainly nematodes were found in foot muscle, gastrointestinal tract, mantle cavity and in mucus. Based on the identifications features (structure of mouth and esophagus, vulva region, spicules around genital opening (Lieven 2003)) *Rhabditidae* family nematodes were dominated. Obtained data confirmed infection of invasive slugs by nematodes.

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PREVALENCE AND DIVERSITY OF MYCOPLASMA SPP. PATHOGENS IN DOMESTIC CATS

Miglė Razgūnaitė[1], Jana Radzijevskaja[1], Vytautas Sabūnas[1], Algimantas Paulauskas[1], Birutė Karvelienė[2], Gintaras Zamokas[2]

[1]DEPARTMENT OF BIOLOGY, VYTAUTAS MAGNUS UNIVERSITY, KAUNAS, LITHUANIA, [2]DEPARTMENT OF INFECTIOUS DISEASES, VETERINARY ACADEMY, LITHUANIAN UNIVERSITY OF HEALTH SCIENCES, KAUNAS, LITHUANIA
MIGLE.RAZGUNAITE@VDU.LT

Abstract

The three main haemoplasma species known to infect cats are *Mycoplasma haemofelis, Candidatus Mycoplasma haemominutum* and *Candidatus Mycoplasma turicensis*. These mycoplasmas have a worldwide distribution. The haemoplasmas are haemotropic, minute, gram-negative, epicellular bacteria that parasitise red blood cells causing haemolytic anaemia (IMHA), thrombocytopenia, fever and jaundice. IMHA caused by *Mycoplasma* spp. pathogens may range from mild to severe disease in cats. Such difference in the virulence of *Mycoplasma* genus is associated with pathogenesis of different *Mycoplasma* genus, *M. haemofelis* being the most pathogenic. The infection is not limited to cats, and can be caught from or given to other companion animals. Humans are also at risk of infection. Definitive diagnosis of haemotropic *Mycoplasma* spp. infection is made by examination of a thin Wright-Giemsa-stained blood smear. However, examination under a microscope sometimes cannot detect the pathogens because the tiny organisms often resemble other blood artifacts. The aim of the present study was to detect and identify *Mycoplasma* species using molecular detection methods in cats from Lithuania. Blood samples were collected from 109 cats in pet clinics and animal shelters in Kaunas during 2016-2018. DNA was isolated from EDTA-anticoagulant whole blood. Detection of *Mycoplasma* was performed using Real-Time and conventional PCR targeting a 600-bp region of the 16S rRNA gene. PCR products were sequenced and then analyzed using BLAST and Mega software. Molecular analysis allowed detection of *Mycoplasma* DNA in 14% (15/109) of cats - 22% (4/18) in shelter cats and 12% (11/91) in cats brought to pet clinic. Sequence analysis of *Mycoplasma* isolates revealed the presence of two *Mycoplasma* species in cats – *Candidatus Mycoplasma haemominutum* and *Mycoplasma haemofelis*. This study is the first report on molecular detection and characterization of *Mycoplasma* spp. in cats in Lithuania.

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PRODUCTION OF WOUND HEALING AGENTS ON THE BASIS OF BIOACTIVE COMPOUNDS OF CURCUMA LONGA L. AND CYCLODEXTRIN NANOSTRUCTURES.

M. A. Kapustin[1], H. S. Chubarova[1], V. P. Kurchenko[1], I. V. Rzhepakovsky[2], L. D. Timchenko[2]

[1]BELARUSSIAN STATE UNIVERSITY, DEPARTMENT OF BIOLOGY, BELARUS, [2]NORTH CAUCASUS FEDERAL UNIVERSITY, THE INSTITUTE FOR LIFE SCIENCES, RUSSIA
MAXIMKAPUSTIN84@GMAIL.COM

Abstract

For the curcuminoids preparations the high efficacy in the treatment of non-healing wounds. Curcuminoids possess extremely low solubility in aqueous systems and low bioavailability; The problem of low bioavailability of curcuminoids is solved by obtaining nanostructures of inclusion complexes of curcuminoids with native and modified beta-cyclodextrin. Nanostructures of curcumin with cyclodextrins were obtained. The formation of nanostructures of curcuminoids and cyclodextrins inclusion complexes was confirmed by thermal analysis and IR-Fourier spectroscopy. The solubility analysis of the obtained nanostructures showed that the highest total concentration of curcuminoids in the aqueous phase is 8.85 μg/ml for beta-cyclodextrin and 91.35 μg/ml for 2-hydroxypropyl-beta-cyclodextrin. The solubility of the native curcuminoids preparation in deionized water under similar conditions does not exceed 0.1 μg/ml. By electrospinning method with the usage of curcuminoids nanostructures a nanowires with a homogeneous structure were obtained. The scaffolds obtained from such nanowires have the properties of uniform controlled release of the included active substance. The basis of nanofibres and the scaffold is a biodegradable material with biocompatibility properties. The wound healing effect of the obtained nanostructures was studied in vivo under the conditions of the experimental model of an extensive, deep wound. When applying curcuminoids nanostructures with cyclodextrin for wound healing, the complete closure of the defect with a regenerate, generally having a normal skin structure, is recorded by the 21st day from the moment of application of the cutaneous wound. Histologically, restoration of all epithelium layers is noted. A young granulation tissue with a typical structure characteristic of the skin papillary layer is formed under the basal membrane. Leukocyte infiltration is not expressed. Symptoms of hyperemia and exudation are not noted. The mesh layer of the dermis is represented by enough elements of the full connective tissue, which corresponds to the structure of normal skin. At the same time, the fibers are powerful, but rather loose, randomly oriented, with large lumens, filled with a sufficient amount of intercellular substance (the main component of that is hyaluronic acid). Also closer to the edge of the wound formation of single hair follicles was noted.

In general, the usage of curcuminoids clathrates nanostructures with cyclodextrin for the wound healing causes organotypic skin regeneration (non-scarred healing), that is, processes that restore the original structure of the skin.

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PROSPECTS OF USING ELEMENTARY GIS IN FORECASTING THE DYNAMICS OF THE EYE NETWORK IN THE NORTH-KAZAKHSTAN REGION

P. S Dmitriyev[1], I. A. Fomin[1], T.N. Lyssakova[1]

[1] NORTH KAZAKHSTAN STATE UNIVERSITY NAMED AFTER M.KOZYBAEV, KAZAKHSTAN, DEPARTMENT OF GEOGRAPHY AND ECOLOGY, KAZAKHSTAN, PETROPAVLOVSK
MAIDEL@BK.RU

Abstract

The publication considers current aspects of gully problems, as well as the prospects for using geo information technologies to predict the dynamics of the gully network.

Key words: ravines, ravine formation, geo information technologies, North-Kazakhstan oblast, forecasting

The process of linear destruction of soils and ground is carried out under the action of the energy of moving water, which was formed as a result of rainfall or turbulent nowmelt.

Temporary watercourses produce destructive work, which is called erosion. This is the transfer of material and its accumulation. Both transfer and accumulation are closely related to each other, since what was carried away by water in one place is deposited in the other. The erosion and accumulation of material often replace each other in time and space, so there are no geo morphological complexes where only the forms of one of these two genetic types would be developed. One can only distinguish between areas of prevailing erosion and predominant accumulation. However, on land, erosional forms of relief are more developed and distributed than accumulative ones. This is due to the fact that a significant part of detrital material carried by permanent and temporary watercourses is carried to the seas and oceans and deposited on the bottom, forming strata of marine sedimentary rocks.

Erosive work of temporary watercourses is carried out due to the live force of the flow, corration and chemical impact on the rocks that form the bottom and banks of the river.

The most important is the living force, or the energy of the flow, which can be expressed by the formula

$$F=mv^2/2,$$

where F is the energy of the stream, m is the mass of the water, and V is the flow velocity.

It should be noted that the mass of water is proportional to the flow rate, as for the flow velocity, it finds expression in the Shezy formula:

$$v=C\sqrt{Ri}$$

where C is the coefficient depending on the channel roughness, R is the hydraulic radius (the ratio of the area of the live section of the watercourse to the wetted perimeter of the channel), i is the slope.

Thus, the greater the flow and the steeper slope, the greater its living force and eroding ability. However, the flow will erode only if not all the living force of the flowing water is spent on transporting the solid material and overcoming the resistance. Otherwise, accumulation will occur in the streamline.

In the erosion of watercourses, bottom erosion is defined, which is aimed at deepening (cutting in) the channel of the watercourse, and lateral erosion, leading to an expansion of the embankment in the sides. In the work of any watercourse, it is almost always possible to detect signs of both types of erosion. However, their intensity will vary depending on the slope of the channel, the geological structure of the territory over which the temporary watercourse flows, the stages of development of the ravine (its age and the periodicity of the temporary watercourse), and a number of other reasons.

The predominance of this or that type of erosion leaves an imprint, primarily on the morphology of the gully network. Narrow, deep and relatively straightened gullies testify to the intensive cutting of current temporary streams along them. On the contrary, wide, flat-bottom ravines with whimsically wriggling channels indicate the predominance of lateral erosion.

The growth rate of gully erosion is not the same. In a natural setting, the surface along which the temporary watercourse flows is usually composed of rocks of different composition, and, consequently, of different resistance to erosion. Breeds that are more pliable are blurred more easily, less pliable retain deep erosion. In this case, the longitudinal profile of the ravine takes the form of a complex curve characterized by alternating sections with different slopes. However, even when the watercourse could have developed an equilibrium profile, it would not represent a smooth curve. The reason is that, firstly, the equilibrium between the living force of the flow and the resistance of rocks to erosion for different rocks will be achieved with different slopes; secondly, the change in the water content of the stream, and consequently of its living force, is not gradual, but irregular. The races are caused by the precipitation of heavy rains or turbulent snowmelt.

The task of monitoring the growth of ravines is one of the most urgent for economic activity. This is due to a serious negative impact on the road, which can eventually lead to disastrous consequences, including threats to people's lives. In the North-Kazakhstan region in particular along the route Petropavlovsk-Yavlenka there are dozens of ravines with different growth rates, which sooner or later will have their negative impact.

In order to predict the growth of the ravine network by standard methods, it is necessary to break a rectangular network on the ground in 10 or 20 m, fix it with numbered posts and apply them to the plan. These posts should be placed so that, based on them, you could make measurements on the system of transverse profiles. To ensure that the pillars are not washed away, they should be placed some distance from the cliff and, if possible, install the second (insurance) pillars, 20 m distant from the first (support) pillars. To facilitate observations, it is possible to install, on each line or in two meters, pegs in addition to the poles, between them and gully slopes, on the profile lines. These additional pegs should be followed after each shower, at the end of autumn and in spring, when the earth dries well, to conduct repeated observations, drawing a new position of the edge of the cliff on the profiles and the plan.

Thanks to the creation and implementation of GIS, environmental monitoring of the terrain is greatly facilitated, and the management of natural resources is streamlined. On the basis of the modeling function, it is possible to detect problematic places and prevent them from increasing in the future. Geo information systems make it possible to determine the interrelation of the parameters of interest (for example, climate and soils) and draw a conclusion about the state of the terrain.

GIS in details take into account the location and area of objects. Complex analysis, carried out by the system simultaneously on the basis of several factors, makes it possible to obtain the most accurate and objective assessment of the territory from the position of the specified parameters.

In addition, geo information systems are very effective for locating an object, they help to resolve territorial disputes and are able to provide real assistance in coordinating the activities of operational services during emergencies. The requested information is provided in the form of detailed maps with additional detail in the form of texts, schemes, graphs and diagrams.

With the use of elementary GIS are widely available, you can predict the growth of gullies without preliminary observations on the ground. Practically the only source of information that gives a complete, current, operational picture of the problem and at the same time minimizing the financial, time, labor costs to solve this problem are the current remote sensing data from space. Undoubtedly, the most effective method of monitoring ravine growth should be based on modern computer technologies, in particular, on the processing of remote sensing data and GIS. Space images, in combination with selective ground control, as well as other sources of information - available electronic maps, digital terrain models, become the basis for rapid detection,

mapping and monitoring of ravine growth. problem of almost all sewage treatment facilities of such farms remains excessive pollution of wastewater discharged into surface water bodies, nitrogen with ammonium and organic substances.

There is a problem with the elimination of accumulated waste that was formed over a decade ago, the transfer of such waste to disposal is problematic, because it is carried out at the expense of the waste generator and requires significant investment.

05.07.2003 year 23.05.2016 year

Figure 1. Example monitoring the growth of the ravine

According to picture taken in 2003 a ravine is identified that presents a danger to the road. In the photo of 2016 it is evident that the ravine has increased significantly. And the increase is observed as a side erosion, and the growth of the top of the ravine towards the road, approaching it at a dangerously close distance of 10 meters, extending almost 20 meters over the past 13 years. All these observations and calculations can be done by Google Earth Pro.

Space images are used for monitoring. The detail and geometric accuracy of these images allows us to confidently decode gullies, perform measurements (linear dimensions, area), determine the coordinates and growth rates (Figure 1).

To establish the facts of the cessation or increase in the growth of the identified gullies, as well as to monitor the implementation of measures for their reclamation, the use of time-lapse images is very effective. In such images, objects that have changed in linear and area-wise ratio, including gullies, are very contrasted, which guarantees error-free and low-cost monitoring.

The results of the interpretation of the images must be conveyed to the interested persons and given them the opportunity to work with them comfortably. The most modern variant of the solution of this problem is the creation of a geospatial distributed information resource - a geo portal. The most important tools of the geo portal include:

-the ability to output generalized statistical information on certain criteria (ravine type, representing a threat, category, etc.);

- the possibility of entering information (clarifying information on field data, as well as drawing new objects by users);

- automatic generation of the object's passport (specifications, location, calculation of growth according to approved methods).

Such observations should be made especially carefully in those places where the growth of gullies is especially dangerous for the economy (where ravines approach the road, buildings, or where the fields suffer from them). Any observations, no matter how interesting they are, are important not in themselves, but as a means to choose the right measures, the cheapest and efficiently fixing ravines. Protection from grazing, afforestation of overlapping slopes, dumping them, filling up debris with construction debris, brushwood and straw, drainage of surface runoff to the side, installation at the bottom of the ravine of fascists, etc. is applied.

Thus, the use of elementary geo information systems to predict the dynamics of the ravine network is a promising direction, which does not require much preliminary observation on the ground, minimizes financial, time and labor costs.

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REACTION OF ORGANIC DISULFIDE WITH SUPEROXIDE ANION RADICAL

V. Osipova[1,2], A. Osipova[1], M. Polovinkina[1], A. Okhlobystin[1]

[1]ASTRAKHAN' STATE TECHNICAL UNIVERSITY, RUSSIA, [2]FEDERAL RESEARCH CENTRE THE SOUTHERN SCIENTIFIC CENTRE OF THE RUSSIAN ACADEMY OF SCIENCES
OSIPOVA_VP@MAIL.RU

Abstract

Organosulfur compounds are considered and already are actively tested as potential anti-inflammatory, antitumor, cardioprotective agents and antioxidants. However, potential biologically active compounds may have adverse side effects which depend on many factors.

In the present study the forecast of the spectrum of biological activity of organic disulfides RSSR (R=Bu, t-Bu, All, Cy, Bn, Ph, 4-hydroxy-3,5-di-tert-butylphenyl, o-Py, p-Py) was performed using the PASS (Prediction of Activity Spectra for Substances) software on the basis of the structural formula of the compound. The results of the forecast are presented in the table with estimated probabilities of availability (Pa) and absence of each activity type (Pi). With the ratio Pa>Pi, it is assumed that there is a high probability that certain activity can be detected in the experiment. Among the huge number of predicted types of biological activity, we have isolated only those that were associated with the antioxidant properties of the test compounds, namely the ability to act as antioxidants and scavenger of active oxygen metabolites initiating oxidative processes and antidotes, including heavy metals. The probability that studied compounds could act as “Oxygen scavenger” (Pa=0.562-0.738), “Nitric oxide scavenger” (Pa=0.242-0.297) and “Free radical scavenger” (Pa=0.183-0.473) was estimated.

The electrochemical methods are widely used to evaluate the antioxidant activity of the compounds. We have studied the electrochemical properties of organic disulfides and the interaction of compounds with an electrochemically generated O2•- in aprotic solvent CH3CN on a platinum electrode. Electrochemical studies were performed by cyclic voltammetry method in a three-electrode cell using an IPC-pro potentiostat. The cathode and anode peaks of oxygen reduction decrease and the new peak appeared in the anode region. Thus, we can conclude that the compounds interacted with an electrochemically generated superoxide anion radical with the cleavage of the S-S bond and the formation of thiolate anion and RSOO• radical.

The biological activity of organic disulfides, in particular, as interceptors of reactive oxygen species, was predicted by the in silico method, these predictions correlated with the data obtained in vitro experiments. It can be concluded that these disulfides possess antiradical activity.

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RESULTS OF MIDWINTER CENSUS OF WATERFOWLS AND WETLAND BIRDS IN KYIV AND ITS SUBURBS

Kazannyk V.[1], Serebryakov V.V.[1], Davydenko I.V.[2]

[1]TARAS SHEVCHENKO NATIONAL UNIVERSITY IN KYIV, UKRAINE , [2]NATIONAL UNIVERSITY OF LIFE AND ENVIRONMENTAL SCIENCE, KYIV, UKRAINE
KAZANNYK@GMAIL.COM

Abstract

The water bodies of Kyiv town and its suburbs are important sites for wetland species for regular and mass wintering during last decades. Artificially warm waters, a little bit higher air temperature, fluctuation of water level in the Dnieper River due to operation of Kyiv water power station and sufficient feeding base promote for these. Wintering sometimes occurs to be more frequent and bird gatherings has qualitative and quantitative changes – so it needs permanent special studies. The census was conducted during 12-14 January 2013. The Dnieper River mainstream in Obolon area with bays Verblud, Sobache Gyrlo and Obolon; ponds Svyatoshyno; ponds Orikhuvatski; Rusanivski canal; Nyzhnyi Telbin Lake; central canal ov Bortnychi aeration station and adjacent part of the Dnieper River were investigated. Qualitative and total quantitative censuses of birds were organized. Counts on permanent routs (Ravkin, Chelintsev, 1990) in combination with counts from one spot (Vergeles, 1994; Blondel, Ferry, Frochot, 1977; Recher, 1981) were provided. In total in 6 local sites 4886 birds of 23 species were recorded. They belongs to 9 orders: *Podicipediformes* (2 species), *Pelecaniformes* (1), *Ciconiiformes* (2), *Anseriformes* (9), *Falconiformes* (1), *Gruiformes* (1), *Charadriiformes* (5), *Coraciiformes* (1), Passeriformes (1). The most numerous were *Anas platyrhynchos* (3195 individuals – 65.39%), *Bucephala clangula* (864 – 17.68%), *Mergus merganser* (476 – 9.74%).

Observation of alone individuals of *Podiceps cristatus*, *P. Ruficollis*, *Anas crecca* was very interesting – it's rare wintering species. Among gulls the most numerous was *Larus cachinnans* (175 bird – 80.65% of all gulls). Ardeidae were presented by *Ardea cinerea* (23 birds) and *Egretta alba* (7) on Bortnychi canal. Here were recorded 51 swans (*Cygnus olor* – 38, *C. Cygnus* – 13). Three adult *Haliaeetus albicilla* were recorded as well. As a result the area near Bortnychi aeration station and the Dnieper River mainstream on Obolon are the most important wintering sites in the studied territory. Here 22 species of 23 were recorded and 4110 individuals – 84.12% of all birds. Anas platyrhynchos was absolute dominant in all gatherings (3195 birds – 65.39%).

Two observed species – *Bucephala clangula* and *Haliaeetus albicilla* – are species from Red Data Book of Ukraine.

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SECRETION AND INTERNALIZATION OF OUTER MEMBRANE VESICLES (OMV) FROM S. GRIMESII DURING BACTERIAL INVASION.

E. Bozhokina[1], L. Kever[2], Y. Komissarchik[2]

[1]INSTITUTE OF CYTOLOGY, DEPARTMENT OF CELL CULTURES, RUSSIA, [2]INSTITUTE OF CYTOLOGY, LABORATORY OF CELL MORPHOLOGY, RUSSIA
BOZHOKINA@YAHOO.COM

Abstract

Outer membrane vesicles (OMVs) are secreted by Gram-negative bacteria and are nano- sized compartments consisting of a lipid bilayer that encapsulates periplasm- derived, luminal content. OMVs are now recognized as a generalized secretion pathway which provides a means to transfer cargo to other bacterial cells as well as eukaryotic cells. Compared with other secretion systems, OMVs can transfer an extremely diverse range of cargo, including small molecules, nucleic acids, proteins, and lipids to the host cells. Although, OMVs can enter host cell and release cargo inside host cells during infection. This study is aimed to isolate OMVs produced by opportunistic pathogen *Serratia grimesii* and to reveal their properties. According to negative contrast TEM we revealed that *S. grimesii* produce spherical membrane vesicles ranging from 90-250 nm in size. The number of membrane vesicles depends on the stage of bacterial growth and environmental conditions. The maximum number of OMVs was observed in the late stationary growth phase of the bacterial culture (48-60 hours). Also, the amount of OMVs was increased by a cold-shock. Genetic determinants of OMVs were investigated and revealed that *S. grimesii* OMVs did not express major virulence genes of pathogenic bacteria. By RT-PCR, during pretreatment of host cell with *S. grimesii* OMVs an increased expression of m2 subunit of the AP2 adaptor complex and dynamin 1 was observed which are known to be essential for clathrin mediated endocytosis. In addition, immuno-fluorescence staining revealed the co-localization of OMVs with clathrin near the plasma membrane, implying their uptake in clathrin-coated pits. These results show that penetration of secreted OMVs into the host cell during *S. grimesii* invasion may be mediated by endocytosis. We are going to investigate in detail how inhibition of endocytosis influences *S. grimesii* invasion. This work was supported by RFBR grant 17-04-00 558.

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SELECTION OF CODOMINANT MARKERS FOR INVESTIGATION OF GENETIC DIVERSITY OF ECHINOCYSTIS LOBATA (MICHX.) TORR. ET A. GRAY POPULATIONS

Erika Juškaitytė[1], Lina Jocienė[1], Edvina Krokaitė[1], Algimantas Paulauskas[1], Eugenija Kupčinskienė[1]

[1]DEPARTMENT OF BIOLOGY, FACULTY OF NATURE SCIENCES, VYTAUTAS MAGNUS UNIVERSITY, VILEIKOS 8, LT-44404, KAUNAS
ERIKAJUSKAITYTE@GMAIL.COM

Abstract

Wild cucumber (*Echinocystis lobata*) – climbing annual herbaceous plant, growing in coastal habitats, riverbanks, lakesides, wetlands and wastelands. It is native in North America, but in many European countries is recognized as invasive species. Within last two decades *E. lobata* is very intensively spreading in Lithuania and is considered to be one of the most aggressive invasive plants. Until now there is a lack of information about genetic diversity of Wild cucumber populations. Simple Sequence Repeats (SSR) markers appeared to be the most often used markers for understanding relations between invasive species and components of natural ecosystems. The objective of present study was to select codominant SSR markers for evaluation of genetic diversity of *Echinocystis lobata* populations. The DNA was extracted by DNA Purification Kit. Thirty SSR markers (*N1, N6, N12, S9, S13, S15, S26, SSR10018, SSR05723, SSR16695, SSR16226, SSR23220, SSR22653, SSR23370, SSR01738, SSR16056, SSR05012, SSR05125, SSR07543, SSR19998, SSR16068, SSR02895, SSR20852, SSR31399, SSR20218, SSR29620, SSR14861, SSR11340, SSR11043*) were tested for buffer type, temperature and other conditions of DNA amplification. DNA fragments were evaluated after electrophoresis on 1.5 % agarose gel. In our study seventeen (*N6, N12, S9, S13, S15, S26, SSR05723, SSR23220, SSR23370, SSR05012, SSR07543, SSR19998, SSR16068, SSR31399, SSR20218, SSR29620, SSR11340*) out of thirty markers showed positive results. Study was funded by Lithuanian Research Council, Grant number No. SIT-02/2015.

Keywords: *Cucurbitaceae*, Wild cucumber, SSR, invasive species

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SELECTION OF NRDNA AND CPDNA MARKERS FOR COMPARISON OF ECHINOCYSTIS LOBATA (MICHX.) TORR. ET A. GRAY POPULATIONS

Erika Juškaitytė[1], Lina Jocienė[1], Edvina Krokaitė[1], Algimantas Paulauskas[1], Eugenija Kupčinskienė[1]

[1]DEPARTMENT OF BIOLOGY, FACULTY OF NATURE SCIENCES, VYTAUTAS MAGNUS UNIVERSITY, VILEIKOS 8, LT-44404, KAUNAS
ERIKAJUSKAITYTE@GMAIL.COM

Abstract

Wild cucumber (*Echinocystis lobata*), *Cucurbitaceae* representative, is vine, climbing with the help of branched tendrils, forming big capsules with spines. This annual herb is cultivated in the gardens due to numerous fragrant whitish flowers, attention attracting fruits, hanging on the fences. *E. lobata* spread, as introduced to Europe species, is related to ornamental features. Romania is proposed as the first country of *E. lobata* settlement in Europe, where it has arrived from North America. *E. lobata* has escaped from the sites of anthropogenic origin to overmoistured natural habitats of temperate climate zone. Within last decades it is recognized as an intensively spreading invasive species along riverbanks of Lithuania. For invasion process elucidation and eradication of this plant it is important to get comprehensive information about alien species effects on natural ecosystems. Genetic tools are important for selection of management strategies concerning invaders. Till now molecular data about *E. lobata* is very scarce. The aim of this study was to find out chloroplast and ribosomal DNA markers for analyses of *E. lobata* populations. For selected individuals the best conditions (reaction mix, temperature, number of cycles) of polymerase chain reaction were determined. Ribosomal markers *ITS4, ITS5, ITS7* and chloroplast DNA markers such as *rps16.50, trnK.UUU.3, ycf1.59, ycf1.70, 127383, 127647, 126614, 126489, atpB, rbcL, trnH (GUG), psbA, petA, psbJ, atpI, atpH, F71, R1516, R1661* were tested. Amplified DNA fragments were visualized on 1.5 % agarose gel, cut out and cleaned with GeneJET PCR Purification Kit. Finally, one (*ITS4, ITS7*) out of two nrDNA primer pairs and five (*ycf1.59-ycf1.70, atpB-rbcL, atpI-atpH, F71- R1516, F71-R1661*) out of thirteen cpDNA primer pairs have generated pure enough and readable DNA fragments for sequencing. Study was funded by Lithuanian Research Council, Grant number No. SIT-02/2015.

Keywords: Cucurbitaceae, Wild cucumber, molecular markers, invasive species.

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SELECTION OF NUCLEAR AND PLASTID DNA MARKERS FOR COMPARISON OF LITHUANIAN POPULATIONS OF *PHALARIS ARUNDINACEA*

Edvina Krokaitė[1], Lina Jocienė[1], Algimantas Paulauskas[1], Eugenija Kupčinskienė[1]

[1]DEPARTMENT OF BIOLOGY, FACULTY OF NATURE SCIENCES, VYTAUTAS MAGNUS UNIVERSITY, VILEIKOS 8, LT-44404, KAUNAS
EDVINA.KROKAITE@GMAIL.COM

Abstract

Reed canarygrass (*Phalaris arundinacea* L.) belongs to family *Poaceae*, subfamily *Pooideae*, tribe *Poeae*. This species is spread all over the northern hemisphere. It is common perennial herb of Lithuania. *Phalaris arundinacea* is valuable plant due to adaptation to grow in both dry and moisture areas, also it is economically important species used as an animal feed, ornamental plant, biofuel, also applied for bioremediation purposes. Recently, P. *arundinacea* has been studied at the molecular level, aiming to determine how invasive populations of this plant have spread along North America. Till now there is a lack of information about reed canarygrass sequences of chloroplast and nuclear DNA. It is important to get more information for understand such processes as plant evolution and ecology, as well as to find relation with a lot of questions posting topic – anthropogenic effects on natural ecosystems. DNA was extracted using modified CTAB method. Extraction of pure DNA is an important prerequisite for efficient sequencing of chloroplast genome. It is also important to find out the best conditions for polymerase chain reactions. The purpose of the study was to select various chloroplast and ribosomal DNA markers finding out the best reaction mix, temperature, cycles for further investigation steps getting information about genome regions of populations of *Phalaris arundinacea* growing along riverbanks in Lithuania. In our study nuclear ribosomal markers *ITS4, ITS5, ITS7* also chloroplast markers *atpB, rbcL, trnH (GUG), psbA, petA, psbJ, atpI, atpH, F71, R1516, R1661* were tested. Obtained DNA fragments were visualized on 1.5 % agarose gel, cut out and cleaned with columns produced by manufactory. Finally, according to elaborated protocol, one primer pair (*ITS4, ITS5*) out of two nrDNA primer pairs and three (*petA-psbJ, atpI-atpH, F71-R1661*) out of six cpDNA primers have generated clear and readable fragments for sequencing. Study was funded by Lithuanian Research Council, Grant number No. SIT-02/2015.

Keywords: *Poaceae*, reed canarygrass, cpDNA, nrDNA, molecular markers

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SPACE WEATHER RELATION WITH AIR TEMPERATURE AND ATMOSPHERIC PRESSURE IN KAUNAS

D. Kiznys[1], J. Vencloviene[1]

[1]VYTAUTAS MAGNUS UNIVERSITY, KAUNAS
DEIVYDAS.KIZNYS@GMAIL.COM

Abstract

Solar activity in the form of geomagnetic activity and other space weathers conditions affect the Earth's middle and upper atmosphere. It is possible that space weather conditions affect the air temperature (T) and atmospheric pressure (AP) in Lithuania. The main goal of this research is to analyze relations between North Atlantic Oscillation (NAO), space weather and meteorological parameters. In this research, we analyzed Kaunas meteorological parameters of the 2006-2016 period. Data analysis was performed using multivariate linear regression. Associations between T, AP, NAO index (NAOI), and space weather variables are presented as regression coefficients β in the multivariate model per increase of 1 for NAOI, 100km/s for solar wind speed (SW), 10000K for plasma temperature (PT), 1nT for interplanetary magnetic field vector axis (Bz and By), 1n/cc for proton density. Proton flow > 10 MeV (PF10), solar activity index F10.7 and Kp index also were used. Data used in this research were collected from open source websites (wunderground.com, omniweb.gsfc.nasa.gov). During winter, daily mean and minimal air temperature associated with NAOI on the same day (respectively, $\beta = 1.09$; $p = .002$ and $\beta = 1.13$; $p = .006$), NAOI 2 days after (respectively, $\beta = 1.5$; $p < .001$ and $\beta = 1.86$; $p < .001$), and solar wind speed (respectively, $\beta = 0.4$, $p = .006$, $\beta = 0.4$, $p = .018$). Atmospheric pressure negatively correlated with F10.7 with lag of 1-2 days ($\beta = -.05$; $p < .001$). During spring, mean daily T was associated with Dst with a lag of 2 day ($\beta = .02$; $p = .048$) and with By on the same day ($\beta = -.1$; $p = .032$). Minimal daily T was negatively associated with PF10>50 ($\beta = -3.22$; $p = .012$) and positively with NAOI with lag of 2 days ($\beta = 1.3$; $p = .012$). NAOI was associated with an increased mean of AP ($\beta = 1.78$; $p = .011$). Maximal AP is positively correlated with lag of 2 days ($\beta = .28$; $p = .004$). During summer, minimal AP positively associated with NAOI on the same day ($\beta = 2.66$; $p < .001$) and 1 day later mean T increases by 4.95 hPa ($p < .001$). Increasing PT is positivity correlated with AP on the same day ($\beta = .57$; $p = .012$). NAOI with lag of 2 days increase of mean, minimal and maximal temperature ($\beta > .05$; $p < .001$). In autumn, NAOI increase on the same day increases minimal and maximal AP more than 3 hPa ($p < .001$). By has positively correlation with max AP ($\beta = .31$; $p = .001$). During PF10 events minimal temperature increases by 1.47ºC ($p = .047$. Our results showed that air temperature and atmospheric pressure are related to geomagnetic activity, solar proton events, solar wind speed and temperature, and By component of the interplanetary magnetic field, adjusting for the impact of NAO and F10.7. The impact of space weather was different during different seasons.

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SPECIES DISTRIBUTION MODELLING AS A PROACTIVE TOOL FOR LONG-TERM PLANNING OF MANAGEMENT OF THE FIRE-BELLIED TOAD *BOMBINA BOMBINA* (LINNAEUS, 1761) AND ITS MAIN INVASIVE THREAT *PERCCOTTUS GLENII* (DYBOWSKI, 1877) IN LATVIA UNDER GLOBAL CLIMATE CHANGE

Vladimir Tytar[1], Oksana Nekrasova[1], Aija Pupina[2], Mihails Pupins[2], Oleksii Marushchak[1]

[1]SCHMALHAUSEN INSTITUTE OF ZOOLOGY NAS OF UKRAINE, UKRAINE, [2]DAUGAVPILS UNIVERSITY, INSTITUTE OF LIFE SCIENCES AND TECHNOLOGIES, DEPARTMENT OF ECOLOGY, LATVIA
MIHAILS.PUPINS@GMAIL.COM

Abstract

Invasive species are considered competitive to native species, with the strength of competition depending on their niche overlap. Understanding interactions between invasive species and other species is challenging but essential for quantifying effects on communities and developing practical approaches to biodiversity long-term management. Much of the current knowledge on community interactions comes from laboratory and field studies, but there is a need to develop novel approaches. In this study we consider the widespread and rapid invasion in Eurasia of *Perccottus glenii* and its potential impact on native biota, exemplified by presumed negative interactions of this fish with the fire-bellied toad (*Bombina bombina*), a rare and protected species in Latvia and European Union (Pupina et al. 2015; Pupina, Pupins 2016). Here we explore the factors governing the distribution of both the P.glenii and the B.bombina within their entire range using an approach based upon maximum entropy distribution modeling (Phillips et al., 2006), aiming to project the availability of suitable habitat in terms of bioclimatic variables (Kriticos et al., 2012). Our database on *B. bombina* consisted of 2,277 georeferenced point data and 445 for *P. glenii*, respectively. The resulting habitat suitability grids were clipped in SAGA GIS (Conrad et al., 2015) to the boundaries of Latvia and analyzed concerning their level of similarity/correlation. We found a fairly high level of correlation (r=0.636; t=15.3) between both sets, meaning there is a considerable overlap of areas of similar habitat suitability related to the species' and a potential for competition. For strategical management purposes we produce a map of Latvia depicting areas where differences between predicted bioclimatic habitat requirements of both species vary from lowest to highest values, meaning selecting conservation areas with high values could help to avoid unwanted competition between the invader and the toad, especially in cases of (re)introduction.

The study was supported by the programme "Latvian Ecosystems Value and Dynamics under Climate Influence" (EVIDEnT), No 4.6. "Freshwaters Ecosystems Services and Biodiversity", No LHEI-2015-19.

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STUDIES OF MULTIDRUG RESISTANCE IN MX-1 BREAST CANCER AND SOMATIC CELLS CULTURES

S.Venytė[1], I.Januškevičienė[2], R.Daugelavičius[1]

[1]DEPARTMENT OF BIOCHEMISTRY, FACULTY OF NATURAL SCIENCE, VYTAUTAS MAGNUS UNIVERSITY, [2]DEPARTMENT OF DRUG CHEMISTRY, FACULTY OF PHARMACY, LITHUANIAN UNIVERSITY OF HEALTH SCIENCES
SILVIJAVENYTE@GMAIL.COM

Abstract

Background. Multidrug resistance (MDR) is a significant problem that determine failures of chemotherapy of human malignancies. The main mechanism of MDR is ATP-binding cassette (ABC) efflux transporters that exist in all living cells (1). The biggest problem is that ABC efflux pumps such as P-glycoprotein (P-gp/ABCB1), multidrug resistance-associated protein 1 (MRP1/ABCC1) and breast cancer resistance protein (BCRP/ABCG2) are overexpressed in cancer cells. (2). The overexpression of ABC transporters in cancer cells are responsible for drug resistance because they pump a variety of anticancer drugs out of cells at the expense of ATP hydrolysis (3). In this study we explored monensis, valinomicin and nigericin ionophore antibiotics influence to wild-type breast carcinoma cell line (MX-1wt), human gingival fibroblasts (HGFwt) and Chinese hamster ovary epithelial cell line (CHOwt) viability.

The aim: to analyse MDR efflux pumps activity on cancer and somatic cells and investigate the influence of ionophore antibiotics on breast cancer and somatic cells viability.

Methods. The levels of resistance to monensin, nigericin and valinomycin were rated in MX-1wt, MX-1T128, HGFwt and CHOwt cells lines using MTT viability test. The functional activity of MDR pumps in cell lines was measured by using spectrophotometric method – fluorescence.

Results. In this study we derived new cell subline with resistance to 128 μM of tetraphenylphosphonium (MX-1T128). In all cell lines the activity of efflux pumps is different. were sensitive to ionophore antibiotics. Ionophore antibiotics influence the viability of wild-type cell lines.

Conclusion. The highest activity of MDR efflux pumps is in MX-1T128 cell subline and the lowest - in HGF wt cells. Ionophore antibiotics does not affect cancer cells specifically and viability significant decrease in both, somatic and cancer cells lines.

Keywords: multidrug resistance, ionophore antibiotics, efflux pumps.

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S.Venytė[1], I.Januškevičienė[2], R.Daugelavičius[1]

[1]DEPARTMENT OF BIOCHEMISTRY, FACULTY OF NATURAL SCIENCE, VYTAUTAS MAGNUS UNIVERSITY, [2]DEPARTMENT OF DRUG CHEMISTRY, FACULTY OF PHARMACY, LITHUANIAN UNIVERSITY OF HEALTH SCIENCES
SILVIJAVENYTE@GMAIL.COM

Abstract

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Methods. The levels of resistance to monensin, nigericin and valinomycin were rated in MX-1wt, MX-1T128, HGFwt and CHOwt cells lines using MTT viability test. The functional activity of MDR pumps in cell lines was measured by using spectrophotometric method – fluorescence.

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STUDY OF THE INFLUENCE OF ANTIOXIDANT QUERCETIN ON THE VIABILITY OF INTACT AND ELECTROPORATED CHINESE HAMSTER OVARY CELLS

Raminta Rodaitė-Riševičienė[1], Indrė Sakalauskaitė[1], Gintautas Saulis[1]

[1]DEPARTMENT OF BIOLOGY, FACULTY OF NATURE SCIENCES, VYTAUTAS MAGNUS UNIVERSITY, KAUNAS, LITHUANIA
RAMINTA.RODAITE-RISEVICIENE@VDU.LT

Abstract

Cell electroporation – a temporal increase of the cell membrane permeability occurring due to the action of the pulses of strong electric field (up to 300 kV/cm). This is an effective method with an increasing number of applications in biology, oncology, genetics, immunology, and biotechnology [1]. However, when cell suspension is exposed to high–voltage electric pulses, various electrochemical reactions occur at electrode–solution interfaces. These may include evolution of gas, dissolution of the electrodes and release of the metal ions, pH changes, electrodissociation of molecules, and formation of reactive oxygen species (ROS) [2].

Reactive oxygen species (ROS), such as free radicals in peroxides are very lethal for cells after electroporation. When the concentration of ROS rises, it leads to oxidative stress. ROS in oxidative stress are capable of damaging DNA, RNA, proteins and lipids, which consequently leads to cell death, inflammation, aging, and occurrence of various diseases [3].

Antioxidants are molecules that inhibit oxidation of other molecules and thus protect them from the oxidative stress. Quercetin is known to have antioxidant activity that inhibits hydrogen peroxide–induced DNA damage and helps preventing degenerative diseases, including cancer [4].

The aim of our study was to test the enhancing effect of antioxidant quercetin on Chinese hamster‘s ovary cell electroporation efficiency and survival. For that purpose cells were electroporated with one 2 ms-duration rectangular 100-400 V/cm pulse and seeded into the cell growing medium supplemented with different concentrations of quarcetin. The effect of these substances on the viability of the cells was assessed by applying cell colony-forming assay.

Our results indicate that the presence of added antioxidant quercetin improves cell viability and survival after electroporation compared with the control group, most likely, by protecting them from the oxidative stress. Further investigations are needed to understand the mechanisms underlying these findings.

Keywords: cell electroporation, reactive oxygen species, cytotoxicity, quercetin.

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SUCCESSFUL EXTRACTING PEPTIDES AND PREOTINS FROM CRUDE VENOMS OF BOMBUS SPP. USING ONLY A FEW SPECIMENS BY MASS SPECTROMETRY METHOD

Darya Lauryienia[1]

[1]*BELARUSIAN STATE UNIVERSITY, FACULTY OF BIOLOGY, BELARUS*
FIREFOX5603@MAIL.RU

Abstract

In one of the largest family of bees, Apidae, the honeybee (Apis mellifera) is the single species with well-studied venom. Only little research has focused on bumblebee venom. So far, Bombus lapidarius is the only bumblebee species from which MS data on its venom proteins are available. Knowledge of the venom composition of Hymenoptera some other species may contribute to an improved allergy diagnosis and treatment by immunotherapy.

Bumblebee venom is a complex mixture of proteins, peptides and low molecular components. We have surveyed bioactive substances in bumblebee found in Belarus and discovered a variety of novel bioactive peptides. They are rich in hydrophobic and basic amino acids. Conventional approaches for their characterization often require manybumblebee specimens. We were able to successfully extract pure peptides of the poisons from one-two individuals of bumblebees using tandem mass spectrometry (MS/MS). We identified over than 70 compounds, with 40 of them never described in bumblebee venom. Detected compounds were found to have a honeybee venom homology. As both venoms contain similar activities this may be explained by the high degree of homology between their genomes and the need for similar defensive actions of both venoms.

These results of peptide and proteins toxins in bumblebee venoms from our studies are summarized in this work.

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SYNTHESIS OF POTENTIAL EFFLUX PUMP INHIBITORS

Aida Rudokaitė[1], Simona Sutkuvienė[1,2]

[1]VDU, FACULTY OF NATURAL SCIENCES, DEPARTMENT OF BIOCHEMISTRY DEPARTMENT OF BIOCHEMISTRY, [2]FACULTY OF MEDICINE, LITHUANIAN UNIVERSITY OF HEALTH SCIENCES, KAUNAS, LITHUANIA. SIMONA.SUTKUVIENE@VDU.LT

Abstract

Microorganisms are playing an important role at a global scale, directly affecting the environment. Antimicrobial resistance is a worldwide problem in human and veterinary medicine. It occurs when micro-organisms evolve resistance to antimicrobial substances and seems to be inevitable. The appearance of multiple resistant bacteria of human and veterinary origin is accelerated due to the inappropriate or excessive use of antimicrobials. There are different solutions proposed to solve this problem. The environment contains a lot of man-made products. Such contamination is increasing and spreading into the environment. The major bacterial solution to toxic challenges takes the form of multiple pumping systems that prevent intracellular accumulation of bactericidal and bacteriostatic substances. The ability to pump antimicrobials out of cells is a common feature of most environmental microorganisms. That's why is very important to discover molecules inhibiting the efflux pumps also to reveal the inhibition mechanisms of it. There is a possibility to discover substances competing with antibiotics for the interaction with efflux pumps. Antibiotic treatment in combinations with such inhibitory compounds is being widely discussed.

Derivatives of carbazole could be considered as potential efflux pump inhibitors or substrates. Carbazoles are heterocyclic compounds with two benzene rings linked in a tricyclic system through nitrogen atom and also could be employed as biologically active compounds. Such derivatives could be employed as antibacterial, antiviral, anti-inflammatory, anticancer, sedatives or tranquilizers agents. The slight change in the structure of these compounds causes distinguishable difference in their biological activities.

In this work we have synthesized carbazole-based molecules by one step synthesis. Synthesis paths, purification and structure identification methods will be presented. To determine the susceptibility of the synthesized compounds to the bacteria, to study their interaction with efflux pumps in Salmonella enterica bacteria it is planned in the future research step.

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TESTING VALIDITY OF CPDNA, RNDNA AND SSR MARKERS FOR EVALUATION OF LYTHRUM SALICARIA L. POPULATIONS

Edita Ramonienė[1], Edvina Krokaitė[1], Lina Jocienė[1], Dinara Shakeneva[1], Eugenija Kupčinskienė[1]

[1]FACULTY OF NATURE SCIENCES, VYTAUTAS MAGNUS UNIVERSITY, VILEIKOS 8, LT-44404, KAUNAS
EDITA.RAMONIENE@VDU.LT

Abstract

Higher soil concentrations of sodium chloride might be reflection of natural edaphic features and consequence of man-related activities. Near the rivers with elevated soil salinity, more intensive growth of *Lythrum salicaria* L. is well-known phenomenon. Anthropogenic activities, such as species introduction to the new areas, might contribute to the shifts of genetic diversity of *L. salicaria*. In this context, *L. salicaria* as halophyte and invasive species, is an important model for evaluation of anthropogenic effects. Till now data concerning genetic diversity of this species in Europe are very limited. Thereby our study aimed at molecular evaluation of populations of *Lythrum salicaria* growing in the riverbanks of Lithuania. Successes of comparison of populations firstly depends on the DNA marker selection. There are many cases when markers applied for one species might work for the other species of the same family. Among *Lythraceae* family representatives, the widest scope genetic evaluations were done for *Punica granatum*. Simple sequence repeat, SSR markers have been created for the accessions of horticultural importance of this species. SSR primers of *Punica granatum* failed to amplify DNA of Lythrum salicaria populations of Lithuania. It was true for the conditions described in *Punica granatum* protocol also for the set of buffer type, cycle number and temperature-related modifications of polymerase chain reactions (PCR). In addition to SSR markers, attempts were made to select primers for sequencing some nrDNA and cpDNA fragments. PCR reaction failed for primer combinations like *rps16.5R+rps16.50F, trnK.UUU.3R+trnK.UUU.3F, 126614_F+127383_R* (55 °C), although some primers created on the bases of chloroplast DNA, showed amplification of Lythrum salicaria DNA. Furthermore, several pairs of nrDNA primers, ITS4_R, ITS5_F and ITS7_F, demonstrated positive results of PCR. Finally, following primer pairs were selected for the sequencing of DNA of *Lythrum salicaria*: *126489_F+127383_R, 126489_F+127647_R, 126614_F+127383_R, 126614_F+127647_R, psbJ+petA, atpI+atpH, F71+R1661, F71+R1516, trnH+psbA, IMP_atpB+IMP_rbcL*.

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THE "MERIDIONALIS MORPHOTYPE" RECORDED IN THE *LACERTA VIRIDIS* LAURENTI 1768 (SAURIA, LACERTIDAE) FROM UKRAINE

Oleksandra Oskyrko[1], Oksana Nekrasova[2], Oleksii Marushchak[2]

[1]TARAS SHEVCHENKO NATIONAL UNIVERSITY OF KYIV, EDUCATION AND SCIENTIFIC CENTER "INSTITUTE OF BIOLOGY AND MEDICINE", DEPARTMENT OF ECOLOGY AND ZOOLOGY, UKRAINE, [2]I.I. SCHMALHAUSEN INSTITUTE OF ZOOLOGY OF NATIONAL ACADEMY OF SCIENCES OF UKRAINE, DEPARTMENT OF ANIMAL MONITORING AND CONSERVATION, UKRAINE SASHAOSKIRKO@GMAIL.COM

Abstract

Many lacertid lizards are known for their great intraspecific variation, especially in patterns and coloration. This variation has often led to the description of many subspecies or morphs, which is reflected in inconsistent taxonomy when these subspecies are put into a molecular phylogenetic framework. As a good example we can provide green lizards, namely *Lacerta viridis* complex. In Ukraine, *L. viridis* is quite common for Southern Bug and Dnieper basins, and according to the latest genetic studies, these lizards belong to the subspecies *L. v. viridis* [Kotenko, 2007, Marzahn et al, 2016]. Adult individuals have the same color: green dorsal part, yellow abdomen and blue throat (predominantly in males) in the region of the ecological corridor of the Dnieper. During the expedition in August 2017 to the western part of Odessa region (Reni and Bolgrad city areas) lizards of the *L. viridis* complex were found to have unusual morph for green lizards atypicaly found in Ukrainian herpetofauna. 25 individuals was caught, of which 4 lizards had a typical color (green or emerald green (ad)). Among the other 21 lizards, 20 individuals had a bright green back with brown legs and tail, and some lizards had solid/interrupted two white lines on the back and 1-2 rows of white lateral spots. 1 individual had a completely brown color with two interrupted white lines on the back and lateral spots as well. Also, samples of green lizards were studied to compare color and folidosis (n = 80) from the Kyiv, Cherkassy, Zaporizhzhia Mykolaiv regions (2012-2017), where adult lizards had not demonstrated such morph. In addition, lizards of this species from museum collections (IZANU, NMNH; 1949-1978, n=27) have been studied for presence of these features. The result was the same. Previous 22 individuals (from the Odessa region) had diagnostic features of the color similar to those described for the subspecies *L. v. meridionalis* Cyrén, 1933 (brown hind legs and tail) [Nettmann, 2001], findings of which are known from Dobruja (Romania) [Kotenko, 2007]. It is not far from the places of our study. But recent studies have shown, that most European populations formerly included in *L. v. meridionalis* are now assigned to *L. v. viridis* [Marzahn, 2016]. Therefore, most European populations of the subspecies *L. v. meridionalis* are proposed to be determined as var. "meridionalis morphotype". But such studies need further joined investigations with colleagues from Romania, Bulgaria and Turkey.

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THE APPLICATION OF RAMAN SPECTROSCOPY FOR EVALUATION OF THE OVERALL CONDITION OF *ELODEA CANADENSIS* (MICHX. 1803), UNDER VARIOUS LEVELS OF SALINITY IN ENVIRONMENTAL RESEARCH.

Aleksandrs Petjukevičs[1], Marina Savicka[1], Anna Batjuka[1], Natalja Škute[1]

[1]INSTITUTE OF LIFE SCIENCE AND TECHNOLOGIES, DAUGAVPILS UNIVERSITY
ALEKSANDRS.PETJUKEVICS@DU.LV

Abstract

In the course of an experiment, during the Raman spectroscopy and microfluorimetry, the cells of the invasive aquatic plant *Elodea canadensis* (Michx.) examined. it was found that the cells exhibit a non-uniform distribution of the chlorophyll and carotenoid molecules, which is associated with the different photosynthetic activity, caused by various salt concentrations (0mM, 10mM, 25mM, 50mM and 100mM NaCl) in the substrate. The presence of a positive correlation between a decrease of the fluorescence of chlorophyll and an increase in the orderliness of the structure of carotenoid molecules was revealed. The mechanism of carotenoid participation in the regulation of chlorophyll fluorescence in various regions of the plant cell under conditions of different salinity is discussed. Also, the research and search for regularities and correlations of the effect of various salt concentrations on the change in the fragmentation of plant DNA conducted in parallel. The Raman spectra were obtained using British Renishaw inVia Reflex system at Raman shift range: 3200 cm-1–100 cm-1, excitation by Ar-ion laser λ = 514.0 nm (~9.2-26.5 mW power at the sample and NIR 785 nm diode laser (~0.05 mW -0.17 mW power at the sample). Obtained Raman spectra were performed by the WiRE 3.3 program, and spectra final correction was carried out using the software package OriginPro 9.2.

This study has been supported by the National Research Programme 2014-2017 „EVIDEnT" sub-project 1.4. "Functioning of food-webs"

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THE ASSOCIATION BETWEEN LIVING ENVIRONMENT AND THE RISK OF ARTERIAL HYPERTENSION AND OTHER COMPONENTS OF METABOLIC SYNDROME

Agnė Brazienė[1], Jonė Venclovienė[1], Abdonas Tamošiūnas[2], Dalia Lukšienė[2]

[1]VYTAUTAS MAGNUS UNIVERSITY, LITHAUNIA, [2]LITHUANIAN UNIVERSITY OF HEALTH SCIENCES, LITHUANIA
BRAZIENE.AGNE@GMAIL.COM

Abstract

Background: Metabolic syndrome (MS) is characterized by a constellation of metabolic risk factors. We investigated the associations between long-term exposure to ambient air pollution and residential distance to green spaces (GS) and major road with development of arterial hypertension (AH) and some components of MS. These associations were assessed among persons who live in private and multistorey houses.

Methods: Were selected 1,354 participants for the population study, which is called MONICA (Multinational Monitoring of Trends and Determinants in Cardiovascular Disease Program). Poisson regression with robust variance estimation was used to evaluate the associations between the distance to high traffic road and GS and exposure to PM10, PM2.5, and NO2 levels assessed by using the LUR models for Kaunas city and the incidence of AH and other component of MS, adjusting for individual risk factors.

Results: The negative impact of traffic air pollutants on the incident AH, reduced high-density lipoprotein (RHDL) cholesterol, and high triglyceride (TG) level was observed only in the participants who lived in multistorey houses. In these participants, the residential distance to major road closer than 200 m and the residential exposure to PM10 and PM2.5 above the median were associated with the higher risk of the incident AH (adjusted relative risk (RRs)), respectively, are 1.41 (1.10-1.81), 1.19 (1.01-1.42) and 1.27 (1.07-1.52)). In the participants, who lived in multistorey houses, residential exposure to PM10 above the median was associated with the higher risk of incident RHDL (RR=1.46 (1.05-2.05)). The residential exposure to PM2.5> median had a stronger impact on the incident AH in on-obese, with age ≤45 years, and lower education level participants.

Conclusions: The negative impact of traffic air pollutants on the incident AH, reduced HDL cholesterol and high TG was observed only in the participants who lived in multistorey houses. Living closer than 200 m to a major road was associated with an increasing risk of incident AH among participants who were living in multistorey houses.

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THE CHANGE OF FOREST AREA IN KAUNAS AND VILNIUS COUNTIES

Ivavičiūtė Giedrė[1]

[1]*ALEKSANDRAS STULGINSKIS UNIVERSITY KAUNAS FORESTRY AND ENVIRONMENTAL ENGENEERING UNIVERSITY OF APLIED SCIENCES KLAIPĖDA STATE UNIVERSITY OF APLIED SCIENCES*
IVAVICE@GMAIL.COM

Abstract

The analysis of the current situation of the forest landscape in Kaunas and Vilnius Counties was carried out. The paper analysed the change of forest landscape area during the period between the years 2006 and 2017.

In 2017, forests covered 2,178958.04 ha (33.38 percent of Lithuania's territory). During the period between the years 2006 and 2017 the Kaunas county forest area increased by 6566.02 ha, or 2.79 percent, in Vilnius county area increased by 13886.17 ha or 3.39 percent. The land fund statistics of the Republic of Lithuania, which had been grouped, graphically depicted in figures and discussed, were used for the fulfilment of this analysis. Comparison, logical analysis, systematization, generalization, graphic imaging methods were used.

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THE CHANGES OF WEED-CROP COMPETITION BETWEEN WILD MUSTARD AND IMPORTANT CROP SPECIES UNDER THE FUTURE CLIMATE AND OZONE TREATMENT

Giedre Kaciene[1], Irena Januškaitienė[1], Austra Dikšaitytė[1], Jūratė Žaltauskaitė[1], Gintarė Sujetovienė[1], Diana Miškelytė[1], Romualdas Juknys[1], Sandra Sakalauskienė[2], Jurga Miliauskienė[2]

[1]VYTAUTAS MAGNUS UNIVERSITY, DEPARTMENT OF ENVIRONMENTAL SCIENCES, LITHUANIA, [2]LITHUANIAN RESSEARCH CENTRE FOR AGRICULTURE AND FORESTRY, INSTITUTE OF HORTICULTURE
GIEDRE.KACIENE@VDU.LT

Abstract

Climate change, manifesting by increasing atmospheric CO2 concentration and air temperature induces planty of changes in crop physiology. Moreover, climate change interacts with other biotic and abiotic environmental stress factors, leading to complex shift in crops growth and productivity in the future. Therefore the aim of this study was to investigate the changes in growth and competitiveness of important crop species in response to competition with wild mustard under ozone pollution and climate change. Spring barley (*Hordeum vulgare L.*), pea (*Pisum sativum*) and summer rape (*Brassica napus L.*) were grown in mono- and mixed-cultures with wild mustard (*Sinapis arvensis*) under current climate (CC) (400 µmol mol−1 of CO2, 21/14 ºC day/night temperature) or future climate (FC) conditions (800 µmol mol−1 of CO2, 25/18 ºC day/night temperature) with and without O3 treatment (+O3) (180 µg m-3). Dry biomass of roots and shoots, as well as leaf area (LA) were investigated. Weed suppression capacity (WSC) – an ability to reduce weed growth at competition, was calculated as the ratio of dry biomass of wild mustard grown in monoculture and in competition with corresponding crop. The presence of wild mustard reduced shoot dry weight of barley and pea (27% and 34%, respectively, $p<0,05$) at current climate. Ozone pollution hardly affected above ground biomass of investigated crop species grown in monocultures; however, weed-induced shoot biomass losses reduced in barley and pea at CC+O3 conditions. Rape's shoot biomass was unaffected by weed competition, irrespective of O3 treatment. FC stimulated monoculture crops growth, however, increased negative weed effect on shoot growth of barley and rapes. Moreover, FC+O3 conditions further increased weed-induced biomass losses in these crop species: shoot biomass was reduced by 40% and 33% in mixed-culture as compared to monoculture barley and rape. Belowground biomass of investigated crop species was differently affected by single treatments and their combinations. It should be emphasized, that the most drastic weed-induced reduction of root biomass was detected at FC (in the case of barley) and FC+O3 conditions (in the case of pea and rape). Investigated crop species demonstrated different WSC. Competition with crops mostly suppressed root growth and LA of wild mustard. Rapes had the highest WSC, suppressing weed growth by 40-80% at future climate; whereas the lowest WSC was characteristic for pea plants. At FC conditions, the growth of wild mustard was even stimulated by the presence of this legume. Generally, the growth of wild mustard was most inhibited at roots level at FC+O3 conditions, in spite of concomitant suppression of crops growth in competition with this weed.

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THE CURRENT STATE OF THE ENVIRONMENT IN THE VINNITSA REGION

Pavlo Bihun[1], Boriachuk Inna[1]

[1]VASYL' STUS DONETSK NATIONAL UNIVERSITY, UKRAINE
P.BIHUN@DONNU.EDU.UA

Abstract

The article presents the ecological status of the Vinnitsa region of Ukraine. The main general problem of almost all sewage treatment facilities of such farms remains excessive pollution of wastewater discharged into surface water bodies, nitrogen with ammonium and organic substances.

There is a problem with the elimination of accumulated waste that was formed over a decade ago, the transfer of such waste to disposal is problematic, because it is carried out at the expense of the waste generator and requires significant investment.

The low percentage of environmental protection measures in the socio-economic development programs of the local level does not allow us to use the available financial resources rationally. The urgency of taking into account the needs of environmental protection for programs of socio-economic development has increased with changes in the legislation, according to which the funds from environmental taxes do not come to a special ecological fund, but to the general fund of the budget. In most places where unsuitable pesticides are stored, there is no or lost accounting documentation, the packaging is damaged or absent, pesticides are stored in bulk, so the exact amount of pesticides cannot be established. Therefore, the reported quantity of pesticides is constantly increasing: in 2012 231,391 tons of such waste were detected additionally; 76,188 tons - in 2013, in 2014 - 78.38 tons. The increase in the number of pesticides was mainly due to the clarification of inventory and re-planting.

According to passports data, in 2014, there were 784 solid household waste landfills and certified landfills with a total area of more than 934.5 hectares. A significant number of landfills are environmentally and economically inappropriate, there is a need for a single system, which will include separate collection, sorting and recycling. For a long time, household waste disposal continues to be one of the pressing environmental problems of Vinnytsya. There is currently no waste recycling plant in the region, a separate collection for the extraction of resource and valuable components is used only in several settlements, and according to the legislation of Ukraine, since 2018, burial of unsorted wastes is prohibited.

In the area under protection are 409 territories and objects of the nature reserve fund with a total area of 60.15 thousand hectares, which is 2.28% of the total area of the region, including. 43 objects of national importance, covering an area of 29,681 thousand hectares.

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THE EFFECT OF CYTOKININS ON ORGANOGENESIS FROM LEAVES EXPLANTS OF *STEVIA REBAUDIANA* BERTONI

Neringa Juškevičiūtė[1], Aušra Blinstrubienė[1], Natalija Burbulis[1], Ramunė Masienė[1]

[1]INSTITUTE OF BIOLOGY AND PLANT BIOTECHNOLOGY OF ALEKSANDRAS STULGINSKIS UNIVERSITY, STUDENTŲ STR. 11, LT-53361 AKADEMIJA, KAUNAS DISTR., LITHUANIA
NERINGA.JUSKEVICIUTE@GMAIL.COM

Abstracttsen

The increasing consumption of sugar has resulted in several nutritional and medical problems, such as obesity or diabetes. So nowadays we have to found alternative natural sweeteners. *Stevia rebaudiana* Bertoni is a plant of the Asteraceae family and is known worldwide due to the synthesis of steviol glycosides (SGs). Plant organs contained different amounts of the steviol glycosydes, which decline in the following order: leaves, flowers, stems, seeds. Roots are the only organs that don't contain stevioside. SGs does not increase sugar level in blood, also has anti-bacterial, anti-fungal properties. So stevia sweetener extractives have been suggested to exert beneficial effects on human health, including antihypertensive. Stevia propagation by in vitro techniques could be use for production sufficient amount of genetically homogeneous plants and then to determine amount of SGs in the different explants of plant. Research was carried out in Institute of Biology and Plant Biotechnology of Aleksandras Stulginskis University and Laboratory of Agrobiotechnology of Join Research Center in 2017. Leaves cultured on MS medium supplemented with BAP, TDZ, KIN (1.0 µM; 2.0 µM; 3.0 µM; 4.0 µM; 5.0 µM; 6.0 µM), 30.0 g l-1 sucrose and 8.0 g l-1 agar. Our results showed that on MS media without growth regulators shoot formation frequency from leaves was an average 3.89 %. The highest (56.67 %) shoots production of leaves has been obtained in the MS medium supplemented with 3.0 µM TDZ. Increasing the concentration of TDZ resulted in decreasing of shoot formation rate. On the medium supplemented with BAP and KIN shoot regeneration was significantly lower as compare with similar concentration of TDZ. 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 from leaves

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THE EFFECT OF SALICYLIC ACID ON BIOMASS AND MDA CONCENTRATION IN OCIMUM BASILICUM AND THYMUS VULGARIS LEAVES UNDER DIFFERENT CLIMATE CONDITIONS

Irena Januškaitienė[1], Birutė Vaitkevičiūtė[1]

[1]VYTAUTAS MAGNUS UNIVERSITY, LITHUANIA
IRENA.JANUSKAITIENE@VDU.LT

Abstract

The global climate changes are becoming more and more important recent years. So, it is important to identify and discuss how these factors affect physiological, morphological and biochemical parameters of herbal plants. There are many studies of different effects of climate change on crops, food quality or weeds. However, there are almost none researches how with salicylic acid (SA) treated plants will respond to elevated climatic conditions and drought stress. The aim of this research was to investigate the effect of SA on biomass and oxidative stress caused lipid peroxidation in basil (*Ocimum basilicum L.*) and thyme (*Thymus vulgaris L.*) leaves under different climate conditions. The plants were grown in automatically controlled climatic conditions under current (400 ppm CO2, 21/14 ºC, day/night) and warmed (800 ppm CO2, 25/18 ºC) 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. Lipid peroxidation indicator, malondialdehyde (MDA) concentration, was increasing under drought stress effect in both investigated plants and under both climates. The effect of SA on malondialdehyde concentration in plants leaves was slightly different from the effect on dry biomass. The changes of MDA concentration were more pronounced for thyme than basil. Salicylic acid decreased MDA concentration in both well-watered and drought-stressed thyme plants statistically significant ($p<0.05$) under warmed climate conditions, while under current climate the increases were insignificant ($p>0.05$). The results indicate, that salicylic acid has changed the response of basil and thyme to drought under elevated climate conditions.

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THE EFFECT OF VALSALVA RATIO ASSOCIATED WITH LF AND HF HRV POWER ON SLOW BREATHING IN PREHYPERTENSIVE AND NORMOTENSIVE INDIAN STUDENTS

Iryna Yepryntseva[1], Larissa Shchyrova[1], Vera Shekh[1]

[1]V. N. KARAZIN KHARKIV NATIONAL UNIVERSITY, UKRAINE
IROK4314@GMAIL.COM

Abstract

Hypertension is one of the leading causes of cardiovascular disease. Impaired cardiovascular autonomic regulation is an important component in the pathophysiology of hypertension. The reduction of respiratory rate lowers BP by a modulation of autonomic activity. The purpose of this study was to evaluate heart rate (HR), blood pressure (BP), Valsalva ratio (VR), and HRV indices at rest and during slow breathing in normotensives and prehypertensives (PHT).

39 normotensives and 35 prehypertensives were recruited from V.N. Karazin Kharkiv National University after obtaining written informed consents. The ECG was recorded at resting and slow breathing (6 breaths/min) 5 min stages, HR, LF and HF power were obtained by CardioLab-2010 (Ukraine), systolic and diastolic BP (SBP and DBP) were conducted at the end of each stage (Nissei WS-1011, Japan). The Valsalva maneuver was performed after resting and slow breathing stages. Two-way repeated measures MANOVA was used to test for effects of PHT and slow breathing on cardiovascular and HRV variables. The stepwise multiple linear regression analysis was used to reveal predictors of HR, SBP and DBP. All analyses were conducted using SPSS 22.

The normotensives and prehypertensives demonstrated reduction of SBP during slow breathing (117.95±0.73 vs. 115.18±0.91 mm Hg, P=0.001 and 130.09±0.08 vs. 125.91±0.96 mm Hg, P<0.001, respectively). The HR and LnLF power increased significantly in both groups. The VR was less in prehypertensives than in normotensives at rest (1.69±0.05 vs. 1.87±0.05, P=0.009) possibly due to impaired baroreflex in prehypertension. After 5 min of slow breathing VR increased significantly only in prehypertensives (P=0.008), it was not significantly different from that of normotensives (1.82±0.06 vs. 1.90±0.06, P=0.346) indicating improvement of baroreflex function in prehypertensives.

The stepwise multiple linear regression analysis revealed that at rest SBP was negatively associated with VR in subjects with high LnHF and BMI (VR*LnHF*BMI, P=0.001), with VR in subjects with high LnLF and height (VR*LnLF*Height, P=0.008), with LnLF by LnHF interaction in prehypertensives (LnLF*LnHF*PHT, P=0.027). The LnHF is widely used as cardiovagal index, interpretation of LnLF is more controversial. We proceed from the assumption that LF HRV power represents sympathoinhibitory arm of baroreflex. So, effect of VR on SBP depended on cardiovagal and sympathoinhibitory arms of baroreflex. During slow breathing SBP was negatively associated with VR in prehypertensives (P=0.012) independently on LnLF and LnHF.

Thus, VR was less in prehypertensives than in normotensives at rest, but was not different from normotensives after 5 minutes slow breathing. The effect of VR depended on LnLF and LnHF at rest only.

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THE EFFECTS OF STORAGE CONDITIONS ON BEE POLLEN MYCOBIOTA

Jolanta Sinkevičienė[1], Eglė Gavenavičiūtė[1]

[1]ASU, ALEKSANDRAS STULGINSKIS UNIVERSITY FACULTY OF AGRONOMY, INSTITUTE OF AGRICULTURAL AND FOOD SCIENCE.
JOLANTA.SINKEVICIENE@ASU.LT

Abstract

2017-2018 mycological studies of bee pollen were conducted. The aim of the research is to investigate the effect of storage duration on the contamination of bee pollen by microscopic fungi. Sixteen bee pollen samples that were stored at 8º C for 3 and 6 months were investigated. The method of dilution (CFU/g) was used to determine the number of fungi in the sample and their content. The total number of fungi in bee pollen ranged from 1.9 to 8.7 104 KSV/g. In the studies, 12 genera and 8 species fungi were identified in bee pollen. 3 months and 6 months the general and species composition of the pollen retained was slightly different. In the pollen collected in the spring, 8 genera and 6 species belonged to fungi, in the summer - 9 genera belonged to fungi, among them 5 species were identified. The bee pollen collected at different times was dominated by *Penicillium*, *Alternaria*, *Mucor* spp. fungi.

Keywords: Bee pollen, microscopic fungi, storage

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THE EFFICIENCY OF NON-CHEMICAL WEED CONTROL IN WINTER RAPESEED

Aušra Marcinkevičienė[1], Rimantas Velička[1], Zita Kriaučiūnienė[1], Marina Keidan[1], Lina Marija Butkevičienė[1], Rita Pupalienė[1], Robertas Kosteckas[1], Sigitas Čekanauskas[1]

[1]ALEKSANDRAS STULGINSKIS UNIVERSITY, STUDENTU STR. 11, LT-53361 AKADEMIJA, KAUNAS DISTR., LITHUANIA
ZITA.KRIAUCIUNIENE@ASU.LT

Abstract

There are favourable conditions for spread of weeds, pests and diseases in rapeseed crop grown in organic farming, and this is results in low rapeseed productivity. The aim of the research was to determine the efficiency of non-chemical weed control methods (thermal, mechanical and smothering) in winter rapeseed crop.

Field experiment was carried out in 2014–2017 at the Experimental Station of Aleksandras Stulginskis University (54°53′ N, 23°50′ E). Soil – *Calc(ar)i-Endohypogleyic Luvisol*. Winter rapeseed (*Brassica napus* L. spp. *oleifera biennis* Metzg.), variety 'Cult' (3 kg ha-1) was grown in soil with a regular (23–25 cm) (Experiment I) and thickened (45–50 cm) (Experiment II) humus layers. Experimental treatments: Factor A: non-chemical weed control: 1) thermal (water steam); 2) mechanical (inter-row loosening); 3) smothering (self-regulation with narrow spacing); Factor B: use of bio-preparations: 1) no application, 2) with application (bio-organic fertilisers used: 'Nagro' applied for rapeseeds before sowing, 'Terra Sorb Foliar' was sprayed in autumn (2 l ha-1), and in spring – 'Terra Sorb Foliar' (1 l ha-1) and 0.3 % Conflic).

In the winter rapeseed crop, annual weed species dominated: *Chenopodium album* L., *Tripleurospermum perforatum* (Merat) M. Lainz, *Stellaria media* (L.) Vill., *Veronica arvensis* L., *Capsella bursa-pastoris* (L.) Medik., and *Poa annua* L. During vegetation period of organic winter rapeseed crop, mechanical weed control was the most effective method both in autumn (efficiency was 26.8–71.5% in the soil with regular and 40.6–76.0% with thickened humus layers) and in spring (efficiency was accordingly 36.9–76, 5% and 46.4–73.3%). The effectiveness of thermal weed control compared to mechanical was lower. Bio-preparations increased the effectiveness of thermal and mechanical weed control methods only in autumn of 2014 and spring of 2015. Before harvesting the lowest weed dry matter was determined in plots with mechanical weed control compared to other non-chemical weed control methods. The effect of thermal weed control on the weed dry matter increased with the use of bio-preparations.

Winter rapeseed yield depended on meteorological conditions, crop density formed and efficiency of weed control. Significant increase in winter rapeseed yields estimated in 2015 and 2017 in treatment with mechanical weed control, while in wet 2016 – using a bio-preparations and smothering. Bio-preparations in the dry 2015 significantly increased the yield of rapeseed in the plots with thermal and mechanical weed control by 43.4 and 25.1 also 34.4 and 20.7% respectively and in 2016 – in the plots with smothering by 51.5 and 33.3% respectively.

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Key words: winter rapeseed, non-chemical weed control, biological preparations, weeds, seed yield.

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THE FEATURES OF SPREAD OF PEDICULOSIS IN THE POPULATION OF VINNYTSIA DEPENDING ON THE AGE

V. Panko[1], A.D. Katsaran,[1]

[1]VASYL' STUS DONETSK NATIONAL UNIVERSITY,VINNYTSIA
PANKO.VALENTYNA@UKR.NET

Abstract

Human pediculosis is an infestation of hematophagic ectoparasites – lice. Traditionally the high sickness rate is associated with bad standards of living, but it is a big mistake to think that the main reason of pediculosis is personal uncleanliness. It was stated that lice prefer clean skin and hair. [2] More cases apply to children, because chances to be infected are higher in kindergartens and schools. [1]. In view of the above, the main purpose of this work is studying the dynamic of spreading of pediculosis in Vinnytsia. As objects of study were used adults and children up to seventeen years, living in city Vinnytsia. The research has been conducted for five years from 2012 to 2016 year. In 2012 year in Vinnytsia were registered 226 cases of pediculosis, of which 40 apply to adult population and 186 to children up to seventeen years. In 2013 year in the city were registered 103 cases, of which 20 apply to adult population and 83 to children up to seventeen years. In 2014 year were registered only 86 cases, 17 of them apply to adults and 69 to children up to seventeen years. In 2015 year were registered 109 cases, of which 10 apply to adults and 99 to children up to seventeen years. In 2016 year were registered 80 cases, of them 13 adults and 67 children up to seventeen. After analyzing this information we can say that in five years number of cases of infestation has decreased more than in two, and in spite of little increasing of this number in 2015 year, we can admit a very positive dynamic. It may be because of spreading information about pediculosis and available medications. Most cases were children up to seventeen, also because of regular medical examinations, which are almost impossible in case of adults. This assumption can be proved by the fact that the most high rate of infected chidren applies to September and February, when their classes begin.

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THE GENETIC DIVERSITY OF REPRESENTATIVES OF THE SPECIES LITHRUM SALICARIA

Mikhail Klimenko[1], Dinara Shakeneva[2]

[1]PAVLODAR STATE PEDAGOGICAL UNIVERSITY, PAVLODAR, KAZAKHSTAN, [2]VYTAUTAS MAGNUS UNIVERSITY, LITHUANIA
SHAKENEVA.DINARA@MAIL.RU

Abstract

Currently technologies in the field of genetics and molecular biology develop very actively. Modern Botany actively uses genetic methods for species identification, the interpretation of genotypes. DNA banks are being created which integrated with existing herbarium collections, seed banks, plant collections in botanical gardens [1]. In this direction, a representative experience has been accumulated.

Amount of plants' DNA is about ten thousands species defined [1]. The size of genome is represented as the content of the DNA of the nuclear gamete expressed or in terms of mass, or the number of pairs of nucleotide bases. Eucariotic organisms except nuclear DNA contains nuclear acids in mitochondria, chloroplasts, in extrachromosomal plasmids, ribosomal and other types of RNA. At the same time DNA of these organisms besides the actual gene sequences has big quantity of non-coding, including repetitive nucleotide sequences [1,2]. The purpose of this work is the extraction of nucleic acids from plant tissues of *Lythrum salicaria* to determine the genetic diversity of representatives of this species. The problem of the extraction of DNA from plant tissues is the purification of nucleic acids from proteins and enzymes. To solve this problem, protocols for extraction and purification of DNA and RNA have been specially developed. This method uses a buffer containing EDTA, Tris/HCl and CTAB. The work also uses the PCR method (polymerase chain reaction) with electrophoretic detection of nucleic acids. Using the methods of molecular research will allow obtaining the most purified DNA and RNA molecules, more accurately identify the species belonging to the investigated plants [2]. The interpretation of genetic material and its comparison with the available data allows to establish the origin of representatives of the species under study, their development, the level of selection, etc. Becomes possible to obtain a more accurate database of the species *Lythrum salicaria* and to determine its genetic diversity, place and role in certain biotopes.

Key words: *Lythrum salicaria*, nucleic acids, polymerase chain, electrophoretic detection, genetic diversity.

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THE IMPACT OF INORGANIC AND ORGANIC COMPOUNDS OF AUTOMOTIVE BRAKE PADS ONTO VIABILITY OF *ESCHERICHIA COLI* AND *STAPHYLOCOCCUS AUREUS* STRAINS

Diana Bružinskaitė[1], Deividas Timinskas[1], Lina Ragelienė[1]

[1]VYTAUTAS MAGNUS UNIVERSITY, DEPARTMEN OF BIOCHEMISTRY, LITHUANIA
DIANABRUZINSK@GMAIL.COM

Abstract

According to European Automobile Manufacturers' Association (ACEA) statistics, worldwide production of passenger cars is constantly rising. 77.7 million passenger cars were produced globally in 2016. Automotive brake pads are one of the main components of the braking system. The friction of surfaces causes the brake pads to break thus extracting the compounds used in its manufacturing into the environment. The subject of this research is to identify and quantify the inorganic and organic compounds of brake pads and to evaluate its effects onto viability of E.coli KMY-1 and *S.aureus* bacteria strains. Inorganic compounds were evaluated using X-ray energy dispersive method meanwhile ASE and HPLC-UV methods were used for the analysis of organic compounds. The effect of copper oxide nanoparticles and main organic compounds: phenol, naphthalene and anthracene extracted from the brake pads on viability of E.coli KMY-1 and *S.aureus* was evaluated by minimal inhibitory concentration and inhibition zone methods.

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THE IMPACT OF SALINITY AND HIGH TEMPERATURE ON GLOBAL DNA METHYLATION IN INVASIVE MACROPHYTE *ELODEA CANADENSIS* (MICHX. 1803)

M. Savicka[1], A. Petjukevičs[1], A. Batjuka[1], N. Škute[1]

[1]DEPARTMENT OF ECOLOGY, INSTITUTE OF LIFE SCIENCE AND TECHNOLOGY, DAUGAVPILS UNIVERSITY, PARĀDES IELA 1A, DAUGAVPILS, LV – 5401, LATVIA
MARINA.SAVICKA@DU.LV

Abstract

Plants frequently have to weather both biotic and abiotic stressors, and have evolved sophisticated adaptation and defence mechanisms. DNA methylation is an epigenetic mechanism which may be modified in response to environmental stimuli. Salinity and high temperature are major environmental factors limiting growth and development of freshwater macrophytes. High-quality DNA is needed for epigenetic, i.e., without any contamination of polyphenols, polysaccharides (260/230 ratio values should be higher than 1.50). The selection of an appropriate DNA extraction method plays a pivotal role in the success of DNA epigenetic, genetic, and spectroscopic studies. Our data show that the most appropriate DNA extraction method using DNeasy Plant Mini Kit (Qiagen). In this study, the water plant *E. canadensis* was used as a model for investigation. *E. canadensis* is perennial invasive plant in natural aquatic ecosystems in Eurasia and common in eutrophic waters. *E. canadensis* forms thick stands outcompeting native biodiversity. The task was to research changes in global DNA methylation in aquatic plant model (*E. canadensis*) under different salinity (0 (control), 25, 50 or 100 mM NaCl) and temperature (25ºC/30ºC) stress. The obtained data show that abiotic stresses such as salinity and high temperature change the levels of DNA methylation in *Elodea canadensis* leaves. Research of global DNA methylation (LUMA) showed the increase in methylation level with increasing salinity levels (from 0mM to 100mM) in *E. canadensis.*

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THE INFLUENCE OF ANTHROPOGENIC FACTORS ON GENETIC STRUCTURE OF THE EURASIAN PERCH (PERCA FLUVIATILIS (L.) POPULATIONS OF SOME LATVIAN RIVERS

Natalja Škute[1], Jelena Oreha[1], Arina Evarte[1]

[1]DAUGAVPILS UNIVERSITY, INSTITUTE OF LIFE SCIENCE AND TECHNOLOGY, MOLECULAR BIOLOGY AND GENETIC LABORATORY, DAUGAVPILS, LATVIA
NATALJA.SKUTE@DU.LV

Abstract

Water ecosystems have an important role in keeping biological diversity and environment quality in Latvia. The fish resources are among the most valuable biological resources in Latvia. The cascade of Daugava hydroelectric power stations (HES), as anthropogenic factor, can effectively preserve not only the water biodiversity, but division of natural river-beds by HES and creation of reservoirs is resulting in the fragmentation effect of natural water bodies. The anthropogenic influence of cities and navigable ports on rivers can be effect the genetic structure of fish populations. The aim of the work was to study the genetic structure of perch populations in different parts of the Latvian rivers. Eurasian perch have abundance and wide distribution, extended genetic research of perch populations in Europe, and no stocking effects. Perch populations were be analysed in different parts of Daugava and Lielupe Rivers: near Daugava river creek, Daugava river in town Riga, Daugava river in Kegums HES site and Daugava river after Kegums HES site and Lielupe river creek, Lielupe river in town Jelgava. The genetic structure of the perch population has been investigated using 9 DNA microsatellites loci (Pfla L2, Pfla L4, Pfla L6, Pfla L10, YP 60, YP 78, YP 111, Svi L7 and Svi L10). The genetic diversity, the level of polymorphism, means of alleles on locus, observed and expected heterozygosity, population structuring (FST and RST), Bayesian approach, gene flow (Nm) were analysed.

It was shown the influence of anthropogenic factors on genetic structure of the Eurasian perch (Perca fluviatilis (L.) populations of some Latvian rivers: namely, that genetic differentiation is essential for fish populations in the Daugava River between Kegums HES and Riga HES reservoirs due to the fragmentation of population by HES dams. It was detected, that there are the poor of heterozygotes in perch populations from river of city parts. The perch population in the Daugava River in the territory of Riga is significantly different among all other populations.

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THE INFLUENCE OF IONIZING RADIATION ON SOMATIC CELL GENOME IN DIFFERENT TISSUE SYSTEMS OF ORGANISM

L. Nikolaevich[1], A. Batian[1]

[1]INTERNATIONAL SAKHAROV ENVIRONMENTAL INSTITUTE OF BELARUSIAN STATE UNIVERSITY, BELARUS
NIKOLARISA@TUT.BY

Abstract

Due to a complicated ecological situation that arose in the republic and a rise in oncodiseases among people, the problems of studying the causes of occurrence and mechanisms of cell transformation under both ionizing radiation impact and functional changes in different organism systems are of particular importance.

The goal of the work was to study the influence of external acute gamma-irradiation with low doses on micronuclei frequency, genetic apoptosis and cell ploidy in different tissue systems of organism. Animals (rats) were exposed to radiation at the following doses: 0.25 Gy, 0.5 Gy and 1.0 Gy (source of radiation - 137Cs, dosage rate - 5.57 cGy/min). The control animals were observed under vivarium conditions. Cell populations of bone marrow, peripheral blood, thymus and spleen characterized by a different degree of differentiation and proliferation served as an object of investigation.

Dose-dependent reduction in body weight, absolute and relative weight of lymphoid organs (thymus, spleen) was revealed in irradiated animals. Differently directed effects that depend on the dose value, nature and direction of the cell differentiation degree and the time after exposure were observed in the cell populations of bone marrow, blood, thymus and spleen of female rats. Molecular-genetic effects are expressed in reduction of mitotic cell activity in the populations, disturbance in DNA replication and repair processes, increase in proportion of cells with micronuclei in cytoplasm and in activation of cell death processes in apoptosis mechanism.

An effective dose causing a significant effect (in comparison with the control) in the cell population of bone marrow and blood is 0.25 Gy; for thymus thymocytes - 0.25, 1.0 Gy and for spleen cells - 1.0 Gy.

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THE INFLUENCE OF LITHUANIAN AGROCLIMATIC CONDITIONS ON SEED YIELD AND HARVEST COMPONENTS OF CRAMBE ABYSSINICA HOCHST

Liuda Zilenaite[1], Aurelija Šaluchaitė[1]

[1]INSTITUTE OF BIOLOGY AND PLANT BIOTECHNOLOGY, ASU
LIUDA.ZILENAITE@ASU.LT

Abstract

As the demand for oilseeds grows, alternative raw materials are being sought for the production of biofuels, potentially exploiting new types of oilseeds. One of the most promising of these plants is crambe (Crambe abyssinica Hoechst.). The interaction between genotype and environment was investigated on phenological growth stages of crambe varieties Kenya, Borowski, Prophet, BGRC 30347, components of yield structure, seed productivity in Lithuania. The experiments were carried out at Experiment Station of Aleksandras Stulginskis University in 2015-2017.The productive yield of 3-year trials using four different crambe genotypes was generally satisfactory, even though significant differences were found between the years. The different meteorological conditions recorded during the trials showed how emergence, flowering and seed-filling stages are particularly important phases for obtaining good yields of varieties. Results showed that crambe varieties have been characterised by a high level of morphological plasticity. In the field trials, plant height and the tendency towards branching are both influenced by general growing conditions and sowing density. The negative influence of high temperatures and excess moisture during the vegetation period in 2017 led to a decrease in yields about of 4 - 10 times compared to the previous year. Crambe varieties were most vulnerable to these harmful organisms: flea beetles (Phyllotreta spp.); oilseed rape blossom beetle (*Melligethes aeneus F*.) and dark leaf and pod spot (*Alternaria brassicae* (Berk.) Sacc.). In 2016, 100% of the motility and balance of plants were damaged by the cabbage moth (*Plutella xylostella L*.). Seeds of varieties Kenya and BGRC 30347 have accumulated the highest amount of fat from all tested varieties. The mentioned difference between crambe varieties in terms of this trait could be caused by their genetic differences.

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THE INFLUENCE OF THE NORTH ATLANTIC OSCILATION INDEX ON EMERGENCY AMBULANCE CALLS FOR ELEVATED ARTERIAL BLOOD PRESSURE

J. Vencloviene[1], A. Braziene[1], P. Dobozinskas[2]

[1]VYTAUTAS MAGNUS UNIVERSITY, KAUNAS, [2]LITHUANIAN UNIVERSITY OF HEALTH SCIENCES, KAUNAS
JONE.VENCLOVIENE@VDU.LT

Abstract

The North Atlantic Oscillation (NAO) is the most prominent and recurrent pattern of atmospheric variability over the middle and high latitudes of the Northern Hemisphere, especially during the cold season months. It is possible that variations in NAO indices (NAOI) had additional impact on human health, after adjusting for weather variables and air pollutants. We investigated the association between daily emergency ambulance calls (EACs) for elevated blood pressure during whole day and during the time intervals of 8:00–13:59, 14:00–21:59, and 22:00–7:59 and daily NAO indices lower than 20th percentile (-1.0) and higher than 85th percentile (0.5) (study period January 1, 2009 – June 30, 2011). We used multivariate Poisson regression, adjusting for seasonality, day length, the day of the week, air temperature, atmospheric pressure, wind speed, exposure to CO, PM10, and ozone, active-stormy geomagnetic activity, and high-speed solar wind. Rate ratios (RRs) with 95% confidence interval were used to assess the risk of EACs on days of NAOI < -1 and NAOI >0.5 as compared to other days. During the period of the study, were used 17,114 cards of EACs at Kaunas city, Lithuania ambulance service. NAOI < -1 and NAOI >0.5 was associated an increased the risk of daily EACs: in all subjects, RRs were, respectively, 1.05 (1.01-1.10) and 1.04 (0.99-1.09), in the elderly (age >65 years) these RRs were 1.06 (1.01-1.12) and 0.99 (0.92-1.05), and in younger subjects, respectively, 1.03 (0.97-1.11) and 1.13 (1.04-1.22). The stronger impact of NAOI during November-March was observed in all and in younger subjects: the RRs of EACs for daily NAOI <-1 and NAOI >0.5 were, respectively, 1.07 (1.01-1.15) and 1.09 (1.00-1.18) in all subject and 1.13 (1.02-1.26) and 1.16 (1.02-1.32) in the younger. During November-March, an increase the risk of EACs in the elderly was observed on days of NAOI>0.5 only during 14:00-21:59 (RR=1.14 (1.01-1.30)) and in the younger subjects, an increased risk was observed on days of NAOI<-1 during 8:00–13:59, 14:00–21:59 (RRs were, respectively 1.30 (1.01-1.69) and 1.22 (1.01-1.48)). Conclusion: These results provided new evidence that the NAO index was an independent predictor of EACs for elevated blood pressure especially during November-March. The impact of NAOI<-1 was stronger in the elderly and the impact of NAOI>0.5 – in younger than 65 years subjects.

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THE INFLUENCE OF TRIMETHYLTIN CHLORIDE ON THE OXIDANT-ANTIOXIDANT STATUS OF ERYTHROCYTES IN VITRO

N. T. Berberova[1] , M.N. Kolyada[1]

[1]SOUTHERN SCIENTIFIC CENTER OF THE RUSSIAN ACADEMY OF SCIENCES,RUSSIAN FEDERATION
NBERBEROVA@GMAIL.COM

Abstract

It is known that one of the functions of erythrocytes is inactivation, absorption of reactive oxygen species, products of free radical oxidation. In vitro experiments, the effect of the most toxic of methyl tin(IV) derivatives - trimethyltin chloride ((CH3)3SnCl) on the balance in the system "oxidants - antioxidants" in human erythrocytes was studied. Oxidant activity was determined from the accumulation of lipid peroxidation products (LPO) of erythrocyte-reacting membranes reacting with thiobarbituric acid in spontaneous (SpLPO) and induced (IndLPO) in the Fe2+ - ascorbate system. The antioxidant activity of erythrocytes was assessed by the activity of the initial protection unit of erythrocytes from the superoxide anion-radical (O2•-) and hydrogen peroxide.

It is established that (CH3)3SnCl neutralizes the ability of human erythrocyte hemolysate to utilize O2•-, generated in the model system of autooxidation of adrenaline in alkaline medium, which indicates the ability of (CH3)3SnCl to inhibit the enzyme superoxide dismutase of erythrocytes.

Reduction of the rate of decomposition of hydrogen peroxide by hemolysate of erythrocytes (in 2 times) in the presence of this toxicant is shown, which may be associated with a decrease in the activity of antioxidant enzymes under the influence of toxicant, with the interaction (CH3)3SnCl with hemoglobin. The promoter activity of methyl tin derivative oxidation reactions of adrenaline, in the process of lipid peroxidation of the membranes of erythrocytes, an increase in the levels of SpLPO and IndLPO in 1.8 and 2.3 times, respectively, indicating a violation of the prooxidant-antioxidant in the red blood cells in the direction of predominance of oxidative processes.

Thus, it is shown that trimethyltin chloride reduces the protective antioxidant system of erythrocytes, reduces the resistance of the erythrocyte membrane, which can lead to disruption of the adaptive capacity of the organism in conditions of oxidative stress.

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THE INVESTIGATION OF PROTEIN CORONA OF ZINC OXIDE NANOPARTICLES AND ZINC IONS RELEASE IMPACT ON CHO CELL

Neringa Budreikaitė[1], Rasa Žūkienė[1], Gabija Grudzinskaitė[1], Simona Palubinskaitė[1]

[1]VYTAUTO DIDŽIOJO UNIVERSITETAS, BIOCHEMIJOS KATEDRA
NERINGA0601@GMAIL.COM

Abstract

The past decade has witnessed an exponential growth in nanotechnology of engineered nanomaterials (ENs) on the large scale for both industrial and household purposes. ZnO NPs are amongst the most common ENs. The potential for their release into the environment and human health have raised considerable concern. The NPs are coated by different proteins when entering organism and surface modifications may have considerable influence to NPs fate. In this study ZnO NPs coating with protein, known as protein corona, was formed from model protein bovine serum albumin (BSA). The aim of this study was to evaluate the effect of ZnO NPs coating with albumin (ZnO-BSA NPs) on Chinese hamster ovary (CHO) cells.

We demonstrated that in the concentration range 0.1-10 μg/ml ZnO-BSA and Zn+2 ions had stimulating effect on cell viability, while ZnO NPs had no stimulation. At higher concentrations (25-200 μg/ml) cell viability decreased in a concentration-dependent manner. ZnO NPs effect on proliferation followed the same trend except that it was decreased by 86% at 25 μg/ml after 24 h incubation.

Plasma membrane (PM) permeability induction may play an important role in NPs-induced cell death. We applied lactate dehydrogenase (LDH) leakage and propidium iodide (PI) test for PM permeability evaluation. LDH activity increased linearly increasing NPs concentration and reached 2.5-fold higher level for ZnO-BSA NPs as compared to control. PI results followed the same trend that PM had been 12 % more permeable when exposed to ZnO-BSA NPs.

NPs ability to increase PM permeability may have similar effect to the membranes of intracellular organelles. The increased permeability of mitochondrial inner membrane may result in depletion of mitochondrial membrane potential (MP). We evaluated the impact of NPs on MP using JC-1 dye. The red aggregates/green monomers fluorescence ratio indicates mitochondrial inner membrane potential and possible damages of membrane or inhibition of MP generating system. ZnO and ZnO-BSA NPs (200 μg/ml) decreased MP by 20%.

Mitochondrial functions can be described in assessing the energetic state of the cell. We demonstrated that ZnO NPs increased ATP concentration 1.8-fold, while ZnO-BSA – 2-fold. This suggested that NPs are possibly activating mitochondrial functions or suppressing ATP consumption in the cells. Similar trend of NPs effect on the amount of NADH was observed. These changes indicate that electron transfer chain activity is disrupted. Besides, NPs had a deleterious effect on mitochondria amount estimated by MitoTracker, yet ZnO-BSA NPs were more toxic. However, when investigating the generation of ROS using H2DCFDA, we assessed lowered ROS generation in ZnO-BSA NPs (10 μg/ml) group by 44%, while ZnO NPs (25 μg/ml) – by 7%.

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THE PECULIARITIES OF VEGETATIVE PATHOGENESIS OF PRESCHOOL CHILDREN

Oleh Yermishev[1]

[1]*VASYL' STUS DONETSK NATIONAL UNIVERSITY, UKRAINE*
O.YERMISHEV@DONNU.EDU.UA

Abstract

The WHO General Assembly recommends the introduction of Zhenjiu therapy in health care programs: "Electro-Puncture Diagnosis and Reflexotherapy". Now functional and vegetative human system was discovered in Ukraine. The system demonstrated the biophysical reality of "acupuncture channels", their systemic subordination and interdependence, a direct relation to the autonomic homeostasis of a person. To study the variance of vegetative pathogenesis in different age groups and its gender characteristics on the basis of longterm observations on functional health of the children's population of Ukraine (15000 examined children of all ages and sex). In the observation group, 360 children of preschool age (3-6 years old, the women's group - 184, in the men's one - 176) were selected. The determination of vegetative levels was performed by the method "Functional-vegetative diagnostics" (FVD) on the corporal functionally active zones (PHA) of the body using the method of V. Makats which is admitted to use by the academic council of the Ministry of Health of Ukraine. The probability of the obtained results was estimated by means of parametric and non-parametric statistics. The analysis of age dispersion of vegetative levels of children in the preschool age group was carried out according to the vegetative homeostasis (kV) coefficients, which determined the zone of vegetative disorders: up to 0.75 significant parasympathetic activity (PA); 0,76-0,86 expressed PA; 0,87-0,94 functional compensation FC; 0.95-1.05 zone of vegetative balance (VB); 1,06-1,13 - functional compensation of sympathetic activity (SA); 1.14-1.26 expressed SA; less than 0.26 - significant SA. The analysis of the results revealed the peculiarities of functional-vegetative health in pre-school children of females and males. With the general similarity of the diagrams of the female and male groups, the variance of vegetative levels indicates their heterogeneity (53.3-53.4% of children in the VB zone were observed in follow-up years; in the PA area, 34.2% were girls and 27.8% of boys, in the zone SA 12.5% and 18.8%, respectively). When in the zone of permissible functional balance (FkPA+VB+FkSA) system correlation in female and male groups of children practically did not differ from the age zone of norm, then the situation in the critical zone of PA and SA changed dramatically. The activity of the functional systems LU-PC-HT (lungs, vascular system, heart) in the area of the benefits of parasympathicotonia was significantly higher than in the age-standard zone and SI-TE-LI (small intestine, lymphatic system, large intestine) was significantly suppressed. In the zone of sympathicotonia, the interdependence was fundamentally opposed. At the same time, we did not recognize gender peculiarities.

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THE PECULIARITIES OF VEGETATIVE PATHOGENESIS OF PRESCHOOL CHILDREN

Oleh Yermishev[1]

[1]*VASYL' STUS DONETSK NATIONAL UNIVERSITY, UKRAINE*
O.YERMISHEV@DONNU.EDU.UA

Abstract

Nowadays, the WHO General Assembly strongly advises participating States to implement traditional Zhen-jiu therapy in their own health programs, in particular "electro-punctural diagnostics and means of reflexology". At the same time, a previously unknown functional and vegetative human system was discovered in Ukraine. The system demonstrated the biophysical reality of "acupuncture channels", their systemic subordination and interdependence, a direct relation to the autonomic homeostasis of a person and initiated a promising direction - "Functional-age vegetology The developed modern technologies of vegetative diagnostics do not use traditional sources of current, moreover, they are aimed at estimating the levels of vegetative homeostasis and have their own normative base and probable repeated results. Together with the means of bioactivation correction of vegetative violations in children, they are admitted to use by the academic council of the Ministry of Health of Ukraine (Minutes №1.08-01 dated September 11, 1994) and Orders of the Cabinet of Ministers of Ukraine №312010/87.

The aim of the study. To study the variance of vegetative pathogenesis in different age groups and its gender characteristics on the basis of long-term observations on functional health of the children's population of Ukraine (15000 examined children of all ages and sex). In addition, it is amed to analyze the critical areas of the benefits of parasympathetic and sympathetic activity and the dynamics of systemic-functional dependence, to develop the foundations of "Age-based vegetology".

Materials and methods. In the observation group, 360 children of preschool age (3-6 years old, the women's group - 184, in the men's one - 176) were selected. The determination of vegetative levels was performed by the electro-punctural method "Functional-vegetative diagnostics" (FVD) on the corporal functionally active zones (PHA) of the body using the method of V.G. Makats. The estimation of the total bioelectric activity of symmetric phases, that was actually its feature, allowed to stabilize the diagnostic parameters. FVD was conducted in the first half of the day (10.00-11.30). In the observation group, 1,440 tests were conducted. The probability of the obtained results was estimated by means of parametric and non-parametric statistics for computer programs of the Ukrainian Research Institute of Transport Medicine of the Ministry of Health of Ukraine.

Results. The analysis of age dispersion of vegetative levels of children in the preschool age group was carried out according to the vegetative homeostasis (k-V) coefficients, which determined the zone of vegetative disorders: up to 0.75 significant parasympathetic activity (PA); 0,76-0,86 expressed PA; 0,87-0,94 functional compensation FC

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THE POSSIBILITIES OF CELL-IQ PHASE-CONTRAST MICROSCOPY FOR A CONTINUOUS REAL-TIME OBSERVATION OF MULTIPOTENT MESENCHYMAL STROMAL CELL CULTURE

E.S. Melashchenko[1], V.V. Shupletsova[1], O.G. Khaziakhmatova[1], V.V. Malashchenko[1], K.A. Yurova[1], L.S. Litvinova[1], P.A. Golubinskaya[7], A.K. Zvyagina[7], Y.E. Burda[7], L.A. Pokrovskaya[10], I.A. Khlusov[1]

[1]IMMANUEL KANT BALTIC FEDERAL UNIVERSITY, LABORATORY OF IMMUNOLOGY AND CELL BIOTECHNOLOGY, KALININGRAD, 236041, RUSSIA, [2]LLC "INNOVATIVE CENTER "BIRUCH – NEW TECHNOLOGIES" – "EFKO" GROUP OF COMPANIES, R&D DEPARTMENT, ALEKSEEVKA, 309850, BELGOROD REGION, RUSSIA, [3]TOMSK STATE UNIVERSITY, LABORATORY OF POLYMERS AND COMPOSITE MATERIALS, TOMSK, 634050, RUSSIA
LENA.MELASHCHENKO17@MAIL.RU

Abstract

Continuous monitoring of multipotent mesenchymal stromal cells (MMSCs) is a promising tool that could be used in cellular biology, environmental research and biotechnology to study in vitro real-time morphology and behavioral response of stem cells alone, as well at their contacts with other cells and for controlling a sustainable production of scaffolds for tissue engineering. Human adipose-derived MMSCs (hAMMSCs) motility, cell division, and osteogenic differentiation were studied in vitro by means of Cell-IQ v2 MLF (CM Technologies Oy, Finland) integrated phase-contrast microscopic platform for real-time surveillance imaging of living cells. 70 μL suspension (5×104 viable karyocytes) of the CD73,CD90, and CD105+ cells was applied into the center of the well of 12-well plastic plates, and cells were allowed to adhere to the bottom of wells in a moist chamber for 120 min. The wells were carefully filled with 1.5 mL of a nutrient medium (90% DMEM/F12 (1:1), 10% fetal bovine serum, 50 mg/L gentamicin, and 280 mg/L L-glutamine) that was replaced every 3–4 days. Cells were cultured for 14 days at 100% humidity in a 5% carbon dioxide atmosphere at 37°C until the formation of a monolayer. In each well, 4 points were chosen for Cell-IQ visualization. Digital images of cell culture growth were captured every 45 min. The hAMMSCs differentiation into osteoblasts (alizarin red staining), chondroblasts (alcian blue staining) and adipocytes (oil red staining) was confirmed in 21 days of culturing in the corresponding StemPro Differentiation Kit mediums. More than of the 95% attached cells expressed CD73, CD90, and CD105 markers and didn\'t display CD45, CD34, CD20, and CD14 markers. Thus, the cells corresponded to the morphological criteria of MMSCs.The Cell-IQ system has allowed establishing the multiple digital data of hAMMSCs culture behavior. There was 150-200 μm/h linear velocity of free (until the cell contacts) motility of spindle or fibroblast-like cells. Maximum number of cells achieved 130-150 ones per field of view; 13-24% of cells divided each 1-3 h until a monolayer was formed. Cell-IQ microscopy could be useful tool for in vitro real-time imaging of interplay between cell subpopulations and/or their morphofunctional response to various scaffolds.

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THE RESPONSE OF HELIANTHUS ANNUUS TO PRE-SOWING SEED TREATMENT WITH STRESSORS: INDUCED CHANGES IN GERMINATION, SEEDLING GROWTH AND PROTEOME

V. Aleknavičiūtė[1], G. Paužaitė[1], V. Mildažienė[1], D. Baniulis[2], Perttu Haimi[2], Irina Filatova[3], Veronika Lyushkevich[3]

[1]VYTAUTAS MAGNUS UNIVERSITY, KAUNAS, LITHUANIA, [2]INSTITUTE OF HORTICULTURE, LITHUANIAN RESEARCH CENTRE FOR AGRICULTURE AND FORESTRY, BABTAI, KAUNAS DISTR., LITHUANIA, [3]B. I. STEPANOV INSTITUTE OF PHYSICS, NATIONAL ACADEMY OF SCIENCES OF BELARUS, BELARUS
VESTA.ALEKNAVICIUTE@VDU.LT

Abstract

Seed treatment with cold plasma (CP) or electromagnetic field (EMF) is a modern eco-agricultural technology for stimulation of plant germination and performance. Numerousstudies demonstrated the effectiveness of such treatments for enhancing germination andgrowth of a large variety of crops, however the molecular basis of seed response totreatments remain elusive. In order to gain an insight into the molecular mechanisms underlying effect of stressors on plant seeds, we estimated changes induced in differential protein expression of the model plant – sunflower (*Helianthus annuus*). We studied the effects of pre-sowing seedtreatment, using vacuum (7 min), radio-frequency EMF (5-15 min) and CP (2-7 min), ongermination and growth of the confectionary cultivar 'Nyķrségi fekete'. The germination tests were performed both in vitro and in substrate and the obtained results indicated thatthe treatments with CP and EMF had no effect on the proportion of germinated seeds butCP (7 min) and EMF (10 and 15 min) treatments increased both germination rate (by 20-24%) and uniformity of germination (up to 130%). The treatment had effect on morphologyof seedlings that developed from the CP (7 min) and EMF (15 min) treated seeds resultingin reduced height/weight of stems and increased weight of leaves, respectively.Differential protein expression in the leaves of sunflower seedlings was assessed using 2Dgel electrophoresis. Among the 104 differentially expressed proteoforms significantlyhigher abundance of 49 and 38 proteoforms and reduced abundance of 26 and 33proteoforms was detected for the CP and EMF treated experimental groups, respectively.Hierarchical clustering revealed 3 major protein expression groups: two of the groupsincluded majority of the proteoforms that had similarly increased or reduced abundanceafter the CP or EMF treatment. Meanwhile, another group represented 8 proteoforms thatwere differentially expressed between the CP and EMF experimental groups. Massspectrometry analysis revealed several proteins involved in primary and protein metabolismor stress response, however chloroplast proteins with function involved in photosynthesiswere dominant among the 40 identified proteoforms. The results suggest that the effect ofCP and EMF treatment has important effect on plant development that is the mostprominent in photosynthesis processes at the seedling stage.

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THE ROLE OF MIRNA IN PLANT REACTIONS RAISED BY NPS

Inese Kokina[1], Ilona Mickeviča[1], Linda Bankovska[1], Inese Gavarāne[1], Marija Jermaļonoka[1], Eriks Sledevskis[2], Andrejs Ogurcovs[2], Vjačeslavs Gerbreders[3]

[1]DAUGAVPILS UNIVERSITY, INSTITUTE OF LIFE SCIENCES AND TECHNOLOGY, DEPARTMENT OF BIOTECHNOLOGY, LABORATORY OF GENOMICS AND BIOTECHNOLOGY, PARADES STREET 1A, DAUGAVPILS, LATVIA, LV 5401, [2]DAUGAVPILS UNIVERSITY, INSTITUTE OF LIFE SCIENCES AND TECHNOLOGY, DEPARTMENT OF TECHNOLOGY, G.LIBERTS' CENTER OF INNOVATIVE MICROSCOPY, PARADES STREET 1A, DAUGAVPILS, LATVIA, LV 5401, [3]2DAUGAVPILS UNIVERSITY, INSTITUTE OF LIFE SCIENCES AND TECHNOLOGY, DEPARTMENT OF TECHNOLOGY, G.LIBERTS' CENTER OF INNOVATIVE MICROSCOPY, PARADES STREET 1A, DAUGAVPILS, LATVIA, LV 5401
LINDA.BANKOVSKA@DU.LV

Abstract

Plants are often affected by various biotic (e.g. fungi, viruses, bacteria, etc.) and abiotic (e.g. high salinity, extreme temperatures, water deficit, etc.) stress factors. Nowadays one of the most acute abiotic stress factors are nanoparticles. The rapid development of nanotechnology and increase of use nanoparticles in different manufacturing process lead to environmental contamination. As many studies suggest, nanoparticles are able to penetrate in to the plants and cause stress reactions. Stress response mechanisms in influenced plant tissues are activated in the contact of the stressor. These mechanisms are complex and include several physiological and molecular changes including one of the newly discovered in 1993, components of microRNA (miRNA) effect. miRNAs are small 19-25 bp non-coding RNAs . Despite their small size, miRNAs have crucial role in many molecular processes in plant, animal and human cells, providing developing, differentiation, communication between cells and cells apoptosis. miRNA can affect genome stability and gene expression. The number of studies on miRNA diversity and roles, such as plant growth, development and environmental responses in different plants cells has been increased in recent years. One of the most acute tendencies is the miRNA response to the stress. Many studies show that exposure to the stressful factors greatly increase miRNAs expression. Respectively, miRNA at the posttranscription level via base-pairing with messenger RNA repress the gene expression or target degradation. The authors assume that target plant growth under NPs stress increase amount of the specific miRNAs in the cells that will contribute to reduction of complimentary mRNA. In this way, the mechanism of regulation of stress-response gene expression by miRNA will be clarified. This work was supported by DU internal grant No 14-95/13

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THE SINGLE AND COMBINED IMPACT OF HEAT AND DROUGHT ON GROWTH OF SUMMER RAPE IN AMBIENT AND ELEVATED ATMOSPHERIC CO2

Austra Dikšaitytė[1,2], Akvilė Viršilė[1], Gintarė Juozapaitienė[2], Irena Januškaitienė[2]

[1]INSTITUTE OF HORTICULTURE, LITHUANIAN RESEARCH CENTRE FOR AGRICULTURE AND FORESTRY, KAUNO STR. 30, LT-54333, BABTAI, KAUNAS DISTR., LITHUANIA , [2]DEPARTMENT OF ENVIRONMENTAL SCIENCES, FACULTY OF NATURAL SCIENCES, VYTAUTAS MAGNUS UNIVERSITY, VILEIKOS STR. 8, LT-44404 KAUNAS, LITHUANIA
AUSTRA.DIKSAITYTE@VDU.LT

Abstract

In this study there were examined the impact of heat wave (HW, 21 vs. 33 ºC) and drought both as single stressors and their combined treatment in ambient and future elevated CO2 concentrations (400 and 800 µmol mol-1, accordingly) on summer rape (Brassica napus L., var. 'Fenja') as well as the recovery capacity following stress and possible mitigation effect of elevated CO2. The experiment was conducted in closed-top growth chambers under controlled environment. Two thirds of pot-grown seedlings growing under two soil water conditions (i.e. well-watered and drought-stressed) were assigned to HW or HW with elevated CO2 (HWC) treatments at 13 BBCH growth stage for 7 days. All the drought-stressed seedlings were then rehydrated upon relief of HW and left for 7 days under ambient climate (AC) conditions to recover. Growth parameters: leaf area (LA), shoot and root dry weight (DW) and root to shoot DW ratio were measured after the treatments and the recovery period. Opposite than expected, HW and HWC, especially, did not reduced, but markedly increased LA shoot shoot DW, but had no impact on root DW and in turn significantly reduced root/shoot DW. Drought as single stressor had no impact on growth of summer rape under AC conditions, however significantly decreased all the measured growth parameters under HW conditions. Under the HWC conditions, seedlings also underwent a greater degree of stress than under the single drought treatment, although to a considerably lower extent. After the 7-day recovery period under AC conditions, seedlings grown under single HW and HWC treatments have had still higher LA and shoot DW, while root DW was greater only under HWC conditions. All the measured growth parameters of drought-stressed plants grown under HWC conditions did not differ significantly from that grown under AC conditions, while LA and root DW of drought-stressed plants grown under HW conditions were significantly lower. Nevertheless, except the root/shoot DW that did not differ from control plants neither under the treatments of single stressors nor under the combined treatments, other growth parameters almost in all the cases under the combined treatments did not return to the control plants value. These results show that elevated concentration of atmospheric CO2 mitigated the negative impact of drought to a large extent under HW conditions, but it was not enough to fully negate it and had only a little effect for the recovery, when additional CO2 was relief.

Keywords: Heat, drought, stress, growth, CO2, recovery

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THE TERRITORY REDISTRIBUTION OF ROOK CORVUS FRUGILEGUS COMMUNITIES ON THE NORTH OF UKRAINE IN CONNECTION WITH LAND USE CHANGES

I. Davydenko[1], V.V.Serebryakov[2], V.V.Kazannyk[2], O.V.Mudrak[3]

[1]NATIONAL UNIVERSITY OF LIFE AND ENVIRONMENTAL SCIENCE, KYIV, UKRAINE, [2]TARAS SHEVCHENKO NATIONAL UNIVERSITY IN KYIV, UKRAINE , [3]ACADEMY OF PERMANENT EDUCATION
I_DAVIDENKO@UKR.NET

Abstract

In the second half of XX century the Rook colonies were numerous and widespread as in human settlements and beyond them as well on the North of Ukraine (Polissya area). The main food the birds picked up on fields and near collective agriculture farms. The Rook colonies here were mainly up to 100-160 nests, sometimes even more than 1000, according to all Ukrainian censuses in 1984 and 1989 organized and conducted by Department of Zoology at Shevchenko State University in Kyiv. However, when USSR was collapsed the collective farms stopped to exist and instead of them the private farms to function spatially on the South of Ukraine where more fertile soils are situated. Large Rook colonies exist here in present time. Though on the North, in the Forest zone, the fields on less fertile soils were not cultivated and became fallow lands. According to our observations the Rook colonies in this region step by step started to decrease by size and even disappeared since 90s. Today the density of nest colonies per unit of area decreased drastically. More over the colonies which exist now in Polissya consist mainly of some nests (up to some dozens, very rare over 100) and they are mainly in human settlements where birds pick up their food. Now the large flocks of Rooks (thousand or ten thousand birds) are possible to observe on the North of Ukraine only in winter period and in large towns where they feed on waste products and spent nights in parks and suburbs forests. The overwhelming quantity of these birds is migrants from more Northern regions.

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THE USAGE OF DEAD AND LIVING *RHIZOPUS* SP. BIOMASS FOR PESTICIDE REMOVAL

Sevgi Ertuğrul Karatay[1], Ipek Özeren[1], Gönül Dönmez[1]

[1]ANKARA UNIVERSITY, BIOLOGY DEPARTMENT, TURKEY
GDONMEZ@ANKARA.EDU.TR

Abstract

In todays world the pesticides which are used to manage insects and diseases important tools in agriculture. But their improper usage may easily lead to environmental contamination and hazards. Among them the neonicotinoid insecticide, imidacloprid has been widely used since 1990, generally by seed treatment to control the sucking and biting insects. It has has high toxicity, relatively high solubility and stability in water creating significant environmental concerns. Furthermore, continuous exposure to pesticides may cause serious problems for non-target organisms. For example imidacloprid, has been reported to be the cause of fish deaths, reproductive failure in birds, illness in humans, impacts on soil microbial diversity, and even to decrease in pollinating insects population. Some physical and chemical methods of remediation like land filling and incineration have been implemented for persistent pesticide pollutants but they lead to leaching and toxic emissions respectively. Therefore, there is a need to develop low-cost, easily available and environmentally friendly methods. Among them biological methods are often considered as the most economical and ecofriendly alternative process when compared with the other processes.

In the current study *Rhizopus* sp. biomass which was grown in molasses medium was dried and used as a biosorbent for the pesticide containing water. Furthermore living fungal biomass was also used for bioaccumulating agent. The dead biomass could uptake lower concentrations of the pollutant such as 4.8 mg/L while the living biomass could tolerate higher concentrations. 33.3% removal yield was observed at the end of 4th hours biosorption in the presence of 1g/L biosorbent.

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THE USAGE OF LOW COST FERMENTATION MEDIUM FOR YEAST LIPID PRODUCTION

Sevgi Ertuğrul Karatay[1], Ekin Demiray[1], Gönül Dönmez[1]

[1]ANKARA UNIVERSITY, BIOLOGY DEPARTMENT, TURKEY
SERTUGRUL@ANKARA.EDU.TR

Abstract

In today's industrialized world the pollution problems and environmental concerns raises. This has stimulated the recent interest in alternative sources for petroleum-based fuels. Therefore it is essential to develop renewable energy sources such as biodiesel. In this context an alternative fuel must be technically feasible, economically competitive, environmentally acceptable and readily available. Biodiesel fuels defined as fatty acid methyl esters derived from various renewable lipid resources. Microbial oils have potential application in biodiesel production because of their structure and fatty acid composition instead of vegetable oils.

In this work it is aimed to suggest a cheaper raw material for biodiesel production. The fermentable sugars of apple pomace was used as a carbon and energy source in the experiments to reduce the cost of lipid production. The effect of pH, apple pomace loading, nitrogen types and amounts and incubation time were optimized to find the highest lipid concentration. The lipid from the yeast cells were extracted by methanol and chloroform.

In the study 10 yeasts which could grow rapidly in the media prepeared with apple pomace were isolated. Although the lowest lipid accumulation was observed at pH 3 generally for the tested yeasts, 20% lipid accumulation was seen at this pH. Higher microbial growth and lipid accumulation was observed when the initial apple pomace hydrolysate loading increased from 6% to 12%.

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THE USAGE OF THERMOPHILE MICROALGAE IN BIOLOGICAL TREATMENT OF CR(VI) AND RB220 DYE

Nur Koçberber Kiliç[1], Gönül Dönmez[1]

[1]ANKARA UNIVERSITY, BIOLOGY DEPARTMENT, TURKEY
GDONMEZ@ANKARA.EDU.TR

Abstract

With the industrial development in the world, the amount of wastewater given to the environ-ment increases. The discharge of industrial wastewaters resulting from the production activi-ties of industries like textiles, paper, cosmetics, rubber, food, leather, etc. to water sources causes environmental pollution. Dye and heavy metal-polluted wastewaters have many toxic effects unless they were not treated. Biological methods are an alternative way in treatment of these wastewaters. In biological methods, microorganisms having bioremediation capability is used for degrading, chelating or transforming various toxic compounds. Bioremediation is cheaper than conventional methods, environmentally friendly, and can transform pollutants in-to less harmful or less toxic form. There were several attempts about bioremediation of such wastewaters. Among them, the usage of microalgae can be accepted as good candidates for bioremediation process related to their requirement for minimal amount of nutrient, harvesting energy from sunlight, and fixing nitrogen and CO2. Thermophile microalgae have advantages in wastewater treatment systems with having survival capacity under extreme conditions.

In this work pure thermophile microalgal strains were tested with regards to their Cr(VI) and dye bioremoval capacity under different pollutant concentrations. Microalgal strains were inoc-ulated on to BG11 agar including 5-20 mg/L Cr(VI) and 50-200 mg/L RB220 dye concentra-tions under continuous illumination (2400 lx). In media with pollutants, growth of algal strains was screened and the microalga showing the highest growth was selected. Bioremoval exper-iments were done in media with 25 mg/L Cr(VI) and 125 mg/L RB220 at pH 7 (30 ^{o}C). After incubation for 5 days, biomass was removed and the concentration of the pollutant in the su-pernatant was determined spectrophotometrically.

Among the tested microalga, Strain A, Strain B, and Strain C had higher tolerance than other ones to the applied pollutants. Under 26.2 mg/L Cr(VI) concentration, Strain A removed Cr(VI) with a yield of 22.20% after incubation for 5 days. On the other hand, Strain C removed 35.2% RB220 in media with 125 mg/L dye after incubation for 5 days.

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THE USE OF FUNGI KINGDOM MICROORGANISMS IN AROMATIC COMPOUND DEGRADATION.

G. Šepetauskaitė[1], V. Vaitkevičienė[1], S. Kuusienė[2]

[1]VYTAUTAS MAGNUS UNIVERSITY, DEPARTMENT OF BIOCHEMISTRY, LITHUANIA, [2]LITHUANIAN RESEARCH CENTRE FOR AGRICULTURE AND FORESTRY, INSTITUTE OF FORESTRY, LABORATORY OF FOREST PLANT BIOTECHNOLOGY, LITHUANIA
GEPETAUSKAIT5@GMAIL.COM

Abstract

The fungi kingdom microorganisms helps recycle nutrients as well as various organic compounds through ecosystems. Polycyclic aromatic carbons (PAC) like carbazole and phenothiazine are one of the well-known environmental pollutants that threaten our health. In order to reduce the contamination, the advantage of fungi kingdom microorganisms like S. Cerevisiae degrading properties was taken. The aim is to determine whether yeast are able to degrade polycyclic aromatic compounds. Various experiments were carried out in order to determine whether aromatic compounds like carbazole and phenothiazine have influence over the yeast growth and whether the yeast are able to degrade PAC compounds that are present in contaminated soil. The dependence of the effect of yeast on the growth of the plant from the organic pollutant concentration in the soil was determined.

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THEORETICAL BASES DEVELOPMENT OF VERSATILE BIOTECHNOLOGIES OF CHLORONITROAROMATIC COMPOUNDS DESTRUCTION

O. Iungin[1], O. Tashyrev[1], V. Govorukha[1]

[1]ZABOLOTNY INSTITUTE OF MICROBIOLOGY AND VIROLOGY OF THE NAS OF UKRAINE
OLGA.SUSLOVA11@GMAIL.COM

Abstract

One of the hazardous sources of environmental pollution is wastewaters from organic synthesis enterprises. The most dangerous for biosphere are xenobiotics which combine nitro-group, chlorine and aromatic ring. The representative compound of such xenobiotics is 1-chloro-3-nitro-benzene (CNB). Its toxicity is determined by aromatic ring and nitro-group and chlorine attached to it in para-position. Bactericidal concentration of CNB for majority of soil and water chemoorganotrophic microorganisms is 10 mg/l. Based on the method of thermodynamic prognosis we modeled and experimentally proved possible universal mechanisms of microbial destruction of chloronitroaromatic compounds. Materials and methods. Bacteria were cultivated in media (NB, HiMedia Ltd. and oligocarbotrphic media OB) in concentration gradient of CNB (0-300 mg/l) during three days, 24◦C. Optical density was measured photocolorimertically (λ=540 нм). Inoculated media without xenobiotic was used as a growth control. The ability to transform CNB was determined by mas-spectr-gas-chromatographic system Agilent 6890N/5973inert (capillary colon HP-5MS (J&W Scientific, USA)). The processing of the chromatographic-mass spectrometric analysis data was carried out using the ChemStation computer program and the integrated NIST 02 mass spectra database. Results. The versatility of microbial destruction of CNB has been demonstrated. This versatility is based on thermodynamically inevitable, rapid and effective reduction of chloronitroaromatic compounds as an electron acceptor in the energy metabolism of microorganisms. On the example of two strains – *Arthrobacter oryzae* and *Rhodococcus erythropolis*, isolated from karst cave clays - we have shown a consistent microbial transformation of the CNB. At first, the reduction of a high-potential nitroorganic group was taken place. We supposed that hydrolytic replacement of chlorine or reduction dehalogenation occurred on the second stage. And in the end it was shown the reduction of unsaturated bonds in the aromatic ring, the formation of a cyclic saturated analogue, and as a consequence, the inevitable destruction to compounds that do not contain aromatic ring. Conclusions. It was shown the experimental verification of total destruction of CNB by bacterial cultures. The obtained results could be used for versatile biotechnologies development for total destruction of chloronitroaromatic compounds.

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TOXICITY OF PETROLEUM HYDROCARBONS

V. Osipova[1,2], A. Osipova[1], S. Nurmuhambetova[1], N.Berberova[1]

[1]ASTRAKHAN' STATE TECHNICAL UNIVERSITY, RUSSIA, [2]FEDERAL RESEARCH CENTRE THE SOUTHERN SCIENTIFIC CENTRE OF THE RUSSIAN ACADEMY OF SCIENCES
OSIPOVA_VP@MAIL.RU

Abstract

World practice, allowing discharges within the limits of established standards into the marine environment of drilling fluids and sludge, is completely unacceptable for the Caspian Sea, which is a closed water basin. At the moment, geological exploration is accelerating in the northern part of the Caspian Sea, associated with the development of new hydrocarbon deposits. In this regard, numerous monitoring studies are conducted to determine the extent of hydrocarbon contamination of oil and oil products in the tributaries and areas of the Caspian Sea. Taking into account the current promising levels of oil fields development in the north-eastern part of the Caspian Sea, by 2020 year, an increase in the concentration of petroleum hydrocarbons in water to 200 μg / l can be expected. Hydrocarbons of oil and petroleum products cause severe toxic effects, including in sturgeons. We studied the effect of oil products from the Tengiz field, containing about 30% paraffin's, 2.5% aromatic hydrocarbons (benzene, toluene) and 0.06% sulfur, on the level of oxidative destruction of liver lipids of the Russian sturgeon in vitro under conditions of a long-running process (72 hours). By the accumulation of carbonyl products, determined by thiobarbituric acid (TBARS), the promoting effect of petroleum products has been established. It has been found that the addition of crude oil to fish feeds inhibits the growth of juvenile fish, while an increase in the level of enzymatic, non-enzymatic lipid peroxidation and baseline TBARS in liver homogenates by about 50% has been established in vivo. The introduction of petroleum products into fish feeds contributes to an increase in the level of nonenzymatic and enzymatic lipid peroxidation of membranes of blood erythrocytes by 27 and 12%, respectively, and a decrease in the activity of catalase of hemolysate of red blood cells by 1.7 times.

Thus, an increase in the level of LPO and a decrease in catalase activity indicate damage to the system of antioxidant protection of the fish organism, which adversely affects young sturgeon. The carried-out experiments confirm that sturgeon possessing relatively high protective mechanisms of detoxification cannot always resist the increased anthropogenic load, even with the intensification of antioxidant systems. Consequently, the unfavorable ecological background requires taking measures to conserve biodiversity and increase the resistance of hydrobionts.

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TUMOR CELL METABOLISM DURING INACTIVATION OF S-ADENOSYLMETHIONINE DECARBOXYLASE. INVESTIGATION IN SILICO

O. Dotsenko[1], Z. Boiarska[1]

[1]VASYL' STUS DONETSK NATIONAL UNIVERSITY, UKRAINE
DOTS_DON@UKR.NET

Abstract

The study of the metabolism of tumor cells has broadened the understanding of the mechanisms and effects of tumor associated metabolic disorders at various stages of tumor formation due to the emergence of new biochemical, molecular biology methods and mathematical methods that enhanced predictive capabilities of computer simulation. However, existing data remains very dispersed and not systemically integrated. The purpose of the work was to investigate the redistribution of metabolic flows in the cell by inactivating S-adenosylmethionine decarboxylase (SAMdc, EC: 4.1.1.50), the key enzyme of the polyamide cycle and the common target of antitumor therapy.

To address these goals, a stoichiometric metabolic model was developed that included five metabolic cycles: polyamines, methionine, methionine regeneration cycle, folic acid cycle, and the synthesis of glutathione and taurine. The model is based on 51 reactions involving 59 metabolites (31 of them are internal metabolites). All calculations were performed using the method of analysis of stationary flows (FluxBalanceAnalysis, FBA). Within this method, the number of elementary modalities (EFM) and flow control (CEF) were calculated. This work proposes to extend the capabilities of the analysis of interactions using the flow control coefficients (CEF) by simulating both overexpression and suppression of the synthesis of SAMdc. The model was developed in the CellNetAnalyzer 2017.

According to the simulation results, inactivation of SAMdc will reduce the flow through the enzymes for the synthesis and acetylation of spermine and spermidine. At the same time, significant reduction of flows is predicted only when SAMdc is inactivated by more than 50%. We determined that SAMdc controls the methionine cycle more significantly than the polyamines cycle. The obtained results indicate that the inactivation of SAMdc will result in a significant increase in flows through the methionine cycle and the taurine synthesis cycle for glutathione, a folate cycle. Therefore, when using therapeutic agents aimed to inactivate SAMdc, it is necessary to consider the possibility of the reprogramming of cellular tumor metabolism, the role of S-adenosylmethionine (SAM) in the methylation and catabolism of serine, the amount of which in these conditions will increase. In addition, the decrease in the activity of SAMdc creates the possibility of increased synthesis of glutathione metabolite, protecting tumor cells from oxidative stress.

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UNIVERSAL AVIAN CROSS-SPECIES BAC SET APPLIED TO JAPANESE QUAIL KARYOTYPE ANALYSIS

M. Kulak[1], S. Galkina[1], D. Larkin[2], R. O'connor[3], D. Griffin[3], A. Saifitdinova[1], E. Gaginskaya[1]

[1]SAINT-PETERSBURG STATE UNIVERSITY, SAINT-PETERSBURG, RUSSIA, [2]ROYAL VETERINARY COLLEGE, UNIVERSITY OF LONDON, LONDON, UK, [3]UNIVERSITY OF KENT, CANTERBURY, UK
ONTICA@MAIL.RU

Abstract

Recently about 70 chicken BAC probes, selected for the presence of evolutionary conserved sequences, were tested for successful hybridization in 5 genomes of evolutionary distant avian species (Damas et al., 2016). It was shown that these BACs can be used as a universal avian BAC probe panel to upgrade the cross-species comparative genomic study.

Here we tested the panel for the Japanese quail karyotype analysis. The Japanese quail Coturnix japonica (CJA) belongs to the family Phasianidae, and it is evolutionary close to the chicken. Two species diverged about 35 million years ago. These species have typical avian karyotype with the same total number – 78 chromosomes. The morphology of orthologous chromosomes is not identical due to different centromere indexes. Quail microchromosomes are submetacentric with short heterochromatic arms whereas in chicken they are acrocentric. Accumulation of repetitive sequences has probably led to the increased size of the quail genome. At the end of the 90's - the beginning of the 2000's, there were published a series of works on comparative linkage analysis and physical gene mapping of both species. We successfully hybridized 67 BAC clones from the universal BAC set on chromosomes CJA1-CJA28 (excluding CJA16). Positions of FISH signals were measured, fractional length from the p-terminus (Flpter) were determined and probe sequences were aligned against the quail genome. Positions of 7 BAC clones from the universal BAC did not match the predicted positions. Application of the universal BAC set even to closely related species allows to identify evolutionarily conservative and labile regions.

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USING NEW FLUOROPHORE AZM FOR STAINING *TRICHINELLA SPIRALIS* FOR CONFOCAL LASER SCANNING MICROSCOPY

I. Gavarāne[1], L. Mežaraupe[2], S. Kecko[2], G. Deksne[4], I. Rubeniņa[2], M. Kirjušina[2], J. Kirilova[1]

[1]DAUGAVPILS UNIVERSITY, INSTITUTE OF LIFE SCIENCES AND TECHNOLOGY, DEPARTMENT OF BIOTECHNOLOGY, LATVIA, [2]DAUGAVPILS UNIVERSITY, INSTITUTE OF LIFE SCIENCES AND TECHNOLOGY, DEPARTMENT OF ECOLOGY, LATVIA, [3]INSTITUTE OF FOOD SAFETY, ANIMAL HEALTH AND ENVIRONMENT BIOR, LABORATORY OF FOOD AND ENVIRONMENTAL INVESTIGATIONS, LATVIA
LIGITA.MEZARAUPE@DU.LV

Abstract

Confocal laser scanning microscopy has become a valuable tool for a wide range of investigations in parasitology and can provide high-quality images of specimens. *Nematodes* of the genus *Trichinella* are important zoonotic parasites, which complete their life cycle in only one host. The genus *Trichinella* has a worldwide distribution and cause parasitic disease trichinellosis. The aim of the present study was to evaluate and develop staining procedure protocol using new synthesized fluorophore AZM for efficient *Trichinella* larvae staining. *Trichinella spiralis* larvae obtained from infected mouse muscle were used as a model organism. New benzanthrone derivate AZM with high lipophilicity and strong fluorescence at 500-550 nm region diapasons was synthesized. For development of staining protocol four widely used fixatives (70% ethanol, AFA, Carnoe and Bouina) in tandem with dye AZM were tested. Before staining procedure *T. spiralis* larvae were exposed to short-term lactic acid treatment. After exposure with AZM dye, samples were washed in 70% ethanol and were mounted in Canada balsam. Visualisation and imaging was performed by a high speed multiphoton confocal laser scanning microscope Nikon Eclipse Ti-E. New synthesized fluorophore in tandem with 70% ethanol and Bouina fixative showed better results. Target benzanthrone dye provided excellent visualization of external structures of parasite.

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VARIATION OF MORPHOMETRIC CHARACTERISTICS OF ANTHEMIS TROTZKIANA POPULATIONS GROWING IN AKTOBE REGION, KAZAKHSTAN

Izbastina Klara[1] , Kurmanbayeva Meruyert[1], Aliya Bazargaliyeva[2], Eugenija Kupcinskiene[3], Admanova Gulnur[2], Sarimbayeva Balzat[2]

1AL-FARABI KAZAKH NATIONAL UNIVERSITY, KAZAKHSTAN, ALMATY, 2AKTOBE REGIONAL STATE UNIVERSITY NAMED AFTER K. ZHUBANOV, KAZAKHSTAN, AKTOBE, 3VYTAUTAS MAGNUSUNIVERSITY, LITHUANIA, KAUNAS
IZBASTINA.K@GMAIL.COM

Abstract

Anthemis trotzkiana Claus (*Asteraceae*) is perennial 10-30 cm height subshrub, thick root rod-shaped, leaves bipinnatisected, capitula solitary. Corolla tubular, ligula-like, yellow. Flowering time June-August, followed by formation of yellowish-gray achenes in August-September. Obligate calciphyte, thrives in lime rich soil, chalk. Endangered due to grazing, chalk escavation. Populations small. Endemic of the middle Volga and North-Western Kazakhstan. Red book species of Kazakhstan and EU. The study is aimed at evaluation of morphometric parameters of three populations *Anthemis trotzkiana* in Aktobe region (Kazakhstan): Akshatau, Bestau and Ishkaragantau. Field assessment was done in summer 2017, by route-reconnaissance method. Morphometric parameters were recorded following VN Golubeva (1962), GF Lakin (1990), NL Udolskaya (1976) and descriptive statistics done by Microsoft Office Excel 2007. For the populations, Akshatau, Bestau and Ishkaragantau, respectively, mean (SD) was as follows: number of the leaves 27.3 (0.4), 53.3 (0.5) and 21.3 (0.1); length of the leaf 3.8 (0.1), 4.7 (0.2) and 3.4 (0.1) cm; width of the leaf 1.0 (0.8), 1.9 (0.1) and 1.0 (0.1) cm; diameter of the subshrubs 18.3 (0.9), 35.3 (0.9) and 29.3 (0.7) cm; height of the generative shoot 31.2 (0.3), 48.2 (0.9) and 26.2 (0.2) cm; number of generative shoots 3.4 (0.3), 6.1 (0.4) and 2.7 (0.3) cm; number of capitula per shoot 3.6 (0.2), 17.9 (0.3) and 3.1 (0.2); length of the capitulus 14.0 (0.3), 16.0 (0.3) and 12.0 (0.1) cm; diameter of the capitulus 1.9 (0.1), 2.3 (0.1) and 1.3 (0.1) cm. For the species conservation and natural dispersion Bestau population of *Anthemis trotzkiana* had the most favorable morphometric parameters evaluated according to the coefficient of variation.

Keywords: *Asteraceae*, rare species, Aktobe region, West Kazakhstan.

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VITAMIN C EFFECT ON CELLS EXPOSED TO EXTERNAL ELECTRIC FIELDS

V. Vetlovaitė[1], P. Ruzgys[1], S. Šatkauskas[1]

[1]VYTAUTAS MAGNUS UNIVERSITY, FACULTY OF NATURAL SCIENCES, LITHUANIA
VILTE.VETLOVAITE@GMAIL.COM

Abstract

Electroporation is based on the formation of pores in the cell membrane when cells are exposed to external electric fields (Chabot et al. 2013). Electroporation allows transmembrane delivery of various exogenous hydrophilic molecules, including a vitamin C (Markelc et al. 2012). Vitamin C is well known for its antioxidative properties. However, at high intracellular concentration vitamin C can induce significant cell toxicity leading to cell death (Maramag et al. 1997). Here we performed the in vitro analysis of vitamin C electrotransfer effect on cell viability during or after electroporation.

CHO (Chinese Hamster Ovary) cell culture was used for experiments. Electroporation was performed by using electric field at 1400 V/cm voltage for the duration of 100 µs. Cells were electroporated in laboratory made EP medium (pH 7.1, conductivity 0.1 S/m, osmolarity 270 mOsm).

Generation of ROS during electroporation was evaluated by incubating cells with DCFDA dye for 30 min prior to electroporation. 70 % of ethanol was added 10 min after electroporation and additionally incubated for 10 min. Afterwards fluorescence was evaluated with fluorimeter (Tecan GeniosPro).

Cell viability change because of vitamin C addition before or after electroporation at concentrations from 0.01 to 5 mM was evaluated using clonogenic assay. For this, 400 cells were plated into 40 mm petri dishes with growth medium after 10 min of incubation post electroporation. Colonies were measured 6 days after treatment.

Electroporation experiments with DCFDA dye demonstrated ROS generation in cell suspension induced by electric field application. Results also showed no cell viability loss after electroporation when vitamin C was present during EP. However, when vitamin C was added after EP cell viability significantly decreased.

In summary, vitamin C has cell damaging effect only when added after application of electric fields.

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WHEAT SEED TREATMENT WITH 51,8 GHZ ELECTROMAGNETIC FIELD INDUCES CHANGES IN GERMINATION AND SEEDLING EARLY GROWTH

Gayane H. Poghosyan[1]

[1]DEPARTMENT OF BIOPHYSICS, FACULTY OF BIOLOGY, YEREVAN STATE UNIVERSITY, 1 ALEX MANOOGIAN ST., YEREVAN, 0025, ARMENIA
G.POGHOSYAN@YSU.AM

Abstract

It is known that exposure to electromagnetic fields (EMF) of millimeter range or extremely high frequencies (EHF) has beneficial effects on seed germination and plant growth [1]. This application in contrast to chemical methods of seeds pre-germination treatment is noninvasive and environmentally appropriate technology what is very important for farming industry. Wheat (*Triticum aestivum* L.), a crop plant of the Poaceae family, is one of the highly demanded major yield crops in the word. The study aimed to investigate the effects of pre-sowing seed treatment with physical factor- EHF EMF (51,8GHz frequency, 3-10 min) on seed germination and seedling performance. For this, seeds of wheat (*Triticum aestivum* L. of "Bezostaya" variety) were imbibed in water for 12 hour then treated once with EMF with 51,8GHz frequency, for 3, 5 and 10 min., then left to germinate on wet filter paper in Petry dishes at 250 C in the dark for 8 days. The irradiation was performed using the generator G4-141 type (State Scientific-Production Enterprise "Istok", Russia) with working interval of 37.50-53.57 GHz and power flux density 64mWt/cm2. The germination rate, seedling length and fresh weight were determined at 3th and 7th day after seeds sowing. Our findings show that the most positive germination effects were in short time EMI treatments (3 and 5 min respectively) groups. The germination tests revealed that EMI-treatments induced increase in germination rate in seeds as compared to control. Thus, the germination rate at 3th day after sowing was significantly ($p<0,05$) higher (by 12% and by 9%) for EMF- exposed seeds, while in the 7th day these indexes did not significantly differ from control. On the other hand, the longer time EMI –treatment (10 min) did not change germination rate for both studied days after sowing. In our previous study [1] we reported that applied seed treatment with EMI not only stimulated seedling growth, but also induced changes in lipid peroxidation activity (MDA-rate) in wheat seedlings. Data, obtained in this work show, that seedlings grown from seeds EMI treated (5 and 10 min) groups had increased seedling weight (up to 12%) and length (up to 8%) compared to control. Applied treatments also remarkably changed the MDA-rate in wheat seedlings. The results suggest promotional effects of MM range electromagnetic waves on germination and growth indexes of wheat seeds. Presumably, the observed influence may be connected with the changes of membrane properties by the means of membrane lipid peroxidation.

Keywords: electromagnetic fields, wheat seeds, germination, seedlings weight, length, lipid peroxidation.

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WHEAT STREAK MOSAIC VIRUS IN UKRAINE: BIOLOGICAL AND MOLECULAR PROPERTIES

Shybanov Stanislav[1], Snihur Halyna[2], Shevchenko Oleksiy[3], Budzanivska Iryna[3]

[1]ESC "INSTITUTE OF BIOLOGY AND MEDICINE", TARAS SHEVCHENKO NATIONAL UNIVERSITY OF KYIV, 64/13 VOLODYMYRSKA STREET, CITY OF KYIV, 01601, UKRAINE,, [2]1 ESC "INSTITUTE OF BIOLOGY AND MEDICINE", TARAS SHEVCHENKO NATIONAL UNIVERSITY OF KYIV, 64/13 VOLODYMYRSKA STREET, CITY OF KYIV, 01601, UKRAINE, 2 LABORATORY OF PLANT VIRUSES, D.K. ZABOLOTNY INSTITUTE OF MICROBIOLOGY AND VIROLOGY OF THE NATIONAL ACADEMY OF SCIENCES OF UKRAINE, 154 ACAD. ZABOLOTNY STR., KYIV, 03143, UKRAINE, [3]ESC "INSTITUTE OF BIOLOGY AND MEDICINE", TARAS SHEVCHENKO NATIONAL UNIVERSITY OF KYIV, 64/13 VOLODYMYRSKA STREET, CITY OF KYIV, 01601, UKRAINE
STAHIS@UKR.NET

Abstract

Triticum aestivum L., and especially the winter wheat, is the most economically important cereal crop in Ukraine, thanks to chernozem soils. Winter wheat is cultivated on the area totaling 6-7 mln ha. According to available data, Wheat streak mosaic virus (WSMV) is one of the most frequent and harmful viral pathogens of wheat in Ukraine. However, until today WSMV has been confirmed only visually and immunochemically. Our aim was to identify the virus using molecular approaches and to compare Ukrainian isolates phylogenetically.

Visual screening of commercial fields planted with winter wheat in Kyiv region showed different streak and stripe mosaic patterns. In view of these typical symptoms, the collected plant samples were then tested for WSMV and Barley stripe mosaic virus (BSMV) infections using double antibody sandwich enzyme-linked immunosorbent assay (DAS-ELISA) with commercially available test systems (Loewe Biochemica, Germany). BSMV was never found but WSMV was detected in all samples with typical mosaic symptoms. In agreement with ELISA results, electron microscopy showed the presence of filamentous virions (approx. 700 x 12-13 nm) typical for Tritimovirus genus of *Potyviridae* family. Also, WSMV vector (mite *Aceria tritici* or *Aceria tosichella* Keifer) was identified during the screening and sampling.

WSMV infection was further double-checked molecularly using total RNA extracted from WSMV-positive samples for the reverse transcription polymerase chain reaction (RT-PCR) with primers specific to the CP gene region of WSMV (Kudela et al. 2008): WS-8166F (5'-GAGAGCAATACTGCGTGTACG-3') and WS-8909R (5'-GCATAATGGCTCGAAGTGATG-3'). Obtained amplicons of 750 bp confirmed the causal nature of the disease.

Subsequently, cDNA corresponding to the CP gene region of one of the Ukrainian isolates of WSMV was sequenced and analyzed using MEGA 5 software.

Basing on the partial nucleotide sequence, the phylogenetic analysis revealed that Ukrainian isolate of WSMV is most closely homologous (98%) to the isolates from Slovakia (Accession Nos. EU723085.1, FJ613359.1), Germany (Accession No. HG810953.1), Italy (Accession No. FJ606885.1), France (Accession No. FJ606884.1), Russia (Accession No. AF454459.1) and Czech Republic (Accession Nos. KY419569.1, KY419568.1, FJ216409.1).

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WHISTLES AND BURST-PULSES: TWO SYSTEMS OF ACOUSTIC COMMUNICATION IN BOTTLENOSE DOLPHINS (TURSIOPS TRUNCATUS MONTAGU, 1821)

Alexander Agafonov, Elena Panova[1]

[1]SHIRSHOV INSTITUTE OF OCEANOLOGY, RUSSIAN ACADEMY OF SCIENCES
AGAFONOV.57@MAIL.RU

Abstract

In the most general senses the concept "communication" is treated as an information transfer between several subjects. Various aspects of communication are considered by philosophy, psychology, linguistics, information theory and recently by biology, too. So, acoustic systems of communication of animals are studied by bioacoustics. Already throughout more half a century the acoustic activity of Bottlenose dolphins is an important object of researches. It is shown that they produce the following categories of sounds: a) series of broadband pulses (clicks), b) tonal signals (whistles), c) the sequences of impulses with the high and changing following speed (burst-pulses). However, despite the large volume of the available data a lot of things in the acoustic signalization of these dolphins remain not clear so far.

We conduct complex researches of underwater acoustic activity of Bottlenose dolphins since 2010 (both in dolphinariums, and in the habitat). Main goal is a development of the general concept of their acoustic signalization as communicative system. During the researches the typology of the signals produced by dolphins has been specified, dynamics of their acoustic activity for days has been described; relative shares of signals of different categories have been defined. Besides, in some cases individual vocal repertoires of different individuals have been described. The analysis of the results allows considering whistles and burst-pulses produced by Bottlenose dolphins as two systems of acoustic communication which are essentially differing in structure and functional properties.

The basis of the repertoire of tonal signals is personified whistles; in turn their "kernels" are "signature whistles". Their main function is to transfer information about the fact of presence and location of each member of a group; thanks to these signals the information context necessary for normal activity of society is created. The similar communicative system can be characterized as context-situational or "a closed communicative system". Characteristic property of burst-pulses is their "universality", an absence of individual features in their producing by various individuals. These signals differ in high variability caused by the fact that they represent combinations of elements of various degree of complexity. On a number of formal signs the system of burst-pulses and reminds "an open communicative system" suitable for coding of extra contextual information.

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WOOD PROPERTIES OF NINE *PICEA ABIES* OPEN-POLLINATED FAMILIES ORIGINATING FROM DIFFERENT LITHUANIAN POPULATIONS

A. Stoncelis[1], A. Juškauskaitė[1], V. Baliuckas[2]

[1]INSTITUTE OF FORESTRY OF LITHUANIAN RESEARCH CENTER FOR AGRICULTURE AND FORESTRY, DEPARTMENT OF GENETICS AND TREE BREADING LIEPŲ STR. 1, LT-53101 GIRIONYS, KAUNAS DISTRICT, LITHUANIA., [2]INSTITUTE OF FORESTRY OF LITHUANIAN RESEARCH CENTER FOR AGRICULTURE AND FORESTRY, DEPARTMENT OF GENETICS AND TREE BREADING LIEPŲ STR. 1, LT-53101 GIRIONYS, KAUNAS DISTRICT, LITHUANIA. ALEKSANDRAS STULGINSKIS UNIVERSITY, FACULTY OF FOREST SCIENCE AND ECOLOGY, INSTITUTE OF FOREST BIOLOGY AND SILVICULTURE, STUDENTU 11, LT – 53361 AKADEMIJA, KAUNAS DISTR. LITHUANIA.
ADOMAS.STONCELIS@GMAIL.COM

Abstract

Trees originating from twenty open-pollinated families of different Lithuanian *Picea abies* populations were studied in four field trials with respect to wood hardness, annual wood ring and wood density at age 33. Wood hardness was tested by using Pilodyn 6J. The other wood properties were tested by using Lignostation high-frequency densitometer. The last ten wood rings were analysed. Mean value of Pilodyn pin penetration for spruce families was 22.7 mm, for annual wood ring – 1.9 mm, for wood density – 427 kg/m3. Wood density was slightly higher at less fertile sites. The average difference between family mean estimates for wood hardness was 5.8 mm, between the sites – 3.7 mm. For annual ring width it was 1.0 mm and 0.6 mm, and for wood density 69 kg/m3 and 26 kg/m3, respectively. The average by the sites individual heritability for wood hardness was 0.62, family heritability – 0.97. For annual ring it was 0.30 and 0.91, for wood density 0.88 and 0.98, respectively. There was weak but significant correlation of wood hardness with tree diameter at individual level (0.30). Weak but significant correlation was estimated of wood hardness (pin penetration) with ring width (0.35), and with wood density it was negligible negative (-0.07). The same correlation was much higher at family mean level and for ring width it was 0.57, for wood density – -0.25. Site effect was much larger for wood hardness (variance component was 20%) compared to ring width (4%) and wood density (5%), but due to large standard errors the effects were not significant. Block effect was significant for all wood properties, but variance components did not exceed 4.0%. Family variance components were significant for all traits: for wood hardness it was 14±1%, for ring width – 5±1%, for wood density – 23±4%.

Keywords: *Picea abies*, half-sib families, field trials, wood properties.

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COMPARATIVE ANALYSIS OF TELOMERE LENGTH BY PARTICIPANTS OF DESTRUCTION OF CHEMICAL WEAPON

Spivak I.[1], Tkachuk N.[2], Zarinov A.[2], Urazova A.[3], Dolinina T.[4], Mikhelson V.[1], Spivak D.[5]

[1]INSTITUTE OF CYTOLOGY, RUSSIA, [2]MILITARY MEDICAL ACADEMY, RUSSIA, [3]UNIVERSITY HOSPITAL HALLE, HALLE (SAALE) GERMANY, [4]ST. PETERSBURG STATE POLYTECHNICAL UNIVERSITY, RUSSIA, [5]INSTITUTE OF THE HUMAN BRAIN, RUSSIAN ACADEMY OF SCIENCES
IRINA_SPIVAK@HOTMAIL.COM

Abstract

One of the most widely studied potential markers associated with life expectancy and resistance to stresses are the terminal regions of chromosomes - telomeres. The telomere theory of aging claims that telomeres are both a marker of cellular aging and its main cause. Short telomeres are a risk factor for many age-related diseases, including cancer (Wentzensen et al., 2011), cardiovascular disease (D'Mello et al., 2015), and diabetes (Zhao et al., 2013). Recently, quite a few studies appeared that reveal accelerated telomere shortening as a response to long-term psychological stress (Epel et al., 2004), as well as by various psychiatric disorders (Wolkowitz et al., 2011b). Working on the destruction of chemical weapon, was stressful for people who conducted this task in the Russian Federation. Our research included general medical and psychological examination, as well as measurement of telomere lengths of peripheral blood lymphocytes, and determination of the alleles of the serotonin system genes, i.e. serotonin receptor 2A HTR2A (102T> C polymorphism, alleles A1 and A2) and serotonin transporter 5-HTT (short and long alleles), by 85 people who took part in the demolition of chemical weapon, and by 65 members of control group. Serotonin system is actively involved into the body's response to stress, thus the aforementioned alleles should be regarded as most significant. It was shown that the maximum and the average length of telomeres in the main group was higher than that in the control group, while the minimum telomere lengths did not differ significantly. Joint examination of telomere lengths, age, and genetic polymorphisms, demonstrated that the length of telomeres tended to decrease with age by carriers of genotypes A1A2 and A2A2, to a much smaller extent than by carriers of A1A1. Thus carriers of the A2 allele proved to be more resistant to long-term stress. One might suppose that long-term stress can could result not only in the telomere shortening (Epel et al., 2004), but, on the contrary, in the appearance of a compensatory reaction, related to increase in telomerase activity (Zalli et al., 2014, Beery et al., 2015). Serotonin system seems to be related to this process, as absence of telomere shortening, and presence of the longest telomeres tended to occur by carriers of genotype A2 in the main group, studied by us. The present study was supported by Russian Foundation for Basic Research, grant 16-06-00172a.

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EFFECT OF IONIZED WATER AND STRATIFICATION ON THE CONDITION OF ALLIUM URSINUM L. SEEDS

Regina Malinauskaitė[1], Aurelija Šaluchaitė[1]

[1]INSTITUTE OF BIOLOGY AND PLANT BIOTECHNOLOGY OF ALEKSANDRAS STULGINSKIS UNIVERSITY
AURELIJA.SALUCHAITE@ASU.LT

Abstract

One of more rarely problem that occurs in growing medicinal and spice plants – is ensuring the quality of propagating material. One of these plants – *Allium ursinum* L. – germination of seeds is slow. To improve that, stratification is being used. In the experiment, evaluation of 4 and 5 weeks long stratification and alkaline ionized (pH 8.6) water usage for germination affect for *Allium ursinum* L. seeds have been done in 2016 in Lithuania. There was found that previously mentioned intervals of time for stratification had not affected the beginning of seeds germination. Further more, one of the possible reasons for the slower germination has been found – seed diseases incidence (caused by fungi and bacteria). *Allium ursinum* L. seeds were affected the most by *Penicillium ssp*. micromycetes. The longer period of stratification was the more alkaline ionized water decreased effect of *Mucor* ssp. micromycetes.

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ABSTRACT ONLY

"CONVERSION" SUCCESSION OF MICROORGANISMS FOR INCREASE IN EFFICIENCY OF CATTLE MANURE METHANE FERMENTATION

O. Havryliuk[1], V. Hovorukha[1], O. Tashyrev[1]

[1]D. K. ZABOLOTNY INSTITUTE OF MICROBIOLOGY AND VIROLOGY, DEPARTMENT OF EXTREMOPHILIC MICROORGANISMS BIOLOGY, UKRAINE
GAV_OLESYA@UKR.NET

Abstract

Cattle manure (CM) is a valuable raw material for obtaining of methane and biofertilizers. However, efficient treatment of industrial volumes of cattle manure is an unsolved problem for Ukraine as well as for many countries of the world. Accumulation of huge amounts of CM leads to contamination of soil, underground and surface waters with toxic decay products and pathogenic microorganisms. The excess of cattle manure is explained due to the lack of theoretical foundations of optimization of CM fermentation biotechnology.

In this regard, the aim of our work was to optimize cattle manure fermentation to increase CH4 yield.

It was established that microbial communities of gastrointestinal tract (GT) of cattle are not capable to ferment manure containing end products of microbial metabolism. These end-products inhibit methanogenic bacteria of cattle GT. Thus, the volume of gas did not increase during 3 months of fermentation. The concentration of methane in the gas phase of fermentation chamber increased only to 18%.

It was shown that effective CM fermentation was carried out due to the mechanism of "conversion" succession by another methanogenic microbial community additionally loaded into the fermentation mixture (for example, soil anaerobic community). Under such conditions, organic matter of cattle manure served as sources of carbon and energy for de novo added microorganisms. It was evidenced by active gas synthesis and four times increase of CH4 concentration comparing to the control (without "conversion" succession).

It was determined that effective fermentation of CM was carried out under the conditions of "conversion" succession during three months (T = 90 days) at the ratio of solid phase to liquid 1:10. The volume of 232 liters of CH4 was synthesized from 1 kg of manure counting to absolutely dry weight (ADW).

Mass-transfer (mixing) and pH regulation additionally increased methane yield by 14% (48 liters) up to 270 liters from 1 kg of cow manure (ADW).

Obtained results are the basis for further development of effective biotechnologies for fermentation of industrial volumes of cattle manure with simultaneous obtaining of methane.

The methodological approach of "conversion" succession, based on the methanogenic microbial community, is promising for the development of biotechnologies for the production of methane from agricultural waste.

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A NEW ENVERONMENTALLY FRIENDLY METHOD OF BIOACTIVE POLYFUNCTIONAL HETEROCYCLIC COMPOUNDS SYNTHESIS

Elena Shinkar'[1], Nadezhda Berberova[1], Timur Utaliev[1], Olga Fedotova[2]

[1]THE CHEMISRY DEPARTMENT OF ASTRAKHAN STATE TECHNICAL UNIVERSITY, [2]THE CHEMISTRY DEPARTMENT OF SARATOV STATE UNIVERSITY OF N.G. CHERNYSHEVSKY
ELENSHIN@RAMBLER.RU

Abstract

The polyfunctional heterocyclic compounds, containing several carbonyl groups and heteroatoms (oxygen, sulfur), often found in nature, they are part of plant raw material and of food products. These compounds are of great practical interest, since they have fluorescent properties. They are widely used in medicine as important drugs, for example, anticoagulants. The biological value of these compounds is very high: antibacterial, vasodilator, antimutagenic and antitumor activities.

In this work the new synthesis method of heterocyclic system containing coumarin and thiopiran fragments in combination with carbonyl groups is proposed. The main participant of the series of simulated reactions is a system hydrogen sulfide – sulfur. The electrosynthesis is possible thanks to redox activation of the system H2S–S8 at the present of 2,4-diphenylpyrano[3,2-c]chromen-5(4H)-one (I) or of 3-(3-oxo-1,3-diphenylpropyl)chroman-2,4-dione (II) in CH2Cl2 at room temperature. The electrochemical activation of the system H2S–S8 using a platinum electrode were conducted in three ways.

The first method is based on the oxidative activation of H2S (1,7V) at the present of sulfur. As a result, an unstable radical cation of hydrogen sulfide was formed. Then an intermediat was been fragmented with the formation of a proton and a thiyl radical. The product of recyclization and cyclization reactions – 2,4-diphenylthiopyrano[3,2-c]chromen-5(4H)-one (42-58%) was obtained at the end of electrolysis of mixture (H2S–S8 + I (II)). The value of H2S oxidation potential is comparable with the data for the oxidation thiopyran. Therefore, the thiopyran is also exposed to electrochemical oxidation to thiopyrilium salt during the electrolysis. The second method proposes the reductive activation of S8 (-1,2V) at the present of H2S. The last way implies one-step cathodic activation of two reagents: H2S and S8 (-1,7V). The potential of the electrolysis depends on the activation type of the system H2S–S8 in organic solvent. The conversion of substrates I, II varies from 72 to 95% for using of the different activation type of the system H2S–S8. Therefore, the redox activation of the system H2S–S8 at the present of polyheteroatomic compounds gives their derivatives. Thus, the developed approach to the production of the bioactive sulfur containing heterocycles favors the utilization of toxic H2S and a cheap reagent S8 into practically useful compounds with minimal environmental damage.

This work was supported by Russian Foundation Basic Research (grant № 16-03-00730)

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ACTUALITY OF METHODS OF ACTIVE AND PASSIVE BRIODINDICATION IN THE SYSTEM OF BIOMONITORING

O. Mashtaler[1]

[1]DEPARTMENT OF BOTANY AND ECOLOGY OF THE BIOLOGICAL FACULTY, VASYL` STUS DONETSK NATIONAL UNIVERSITY (UKRAINE)
O.MASHTALER@DONNU.EDU.UA

Abstract

Identification of ecological state of the environment by mosses called brioindication. Brioindication is a component of the biological monitoring results as detecting stress acts on mosses made basic methods of monitoring - active and passive. Methods passive brioindication use among natural existence indicator and subject to constant interaction with environmental factors. But it has its own specificity, responses to the action of a factor require quite a long period of review selected biosystems (from several weeks to several years) and thus are not able to use them to carry out operational monitoring.

This feature allows researchers to fully provide evaluation of the changes in ecosystems, trace their origin pattern over a period of observation and likely to make forecasts for further development of the ecosystem, subject to certain factors. One example of the use of mosses for passive monitoring is to determine the level of accumulation of heavy metals in moss gametophyte pollution and mapping them on selected areas.

Also obtained from the frequency of occurrence of epiphytic bryophytes, their projective cover and taking into account the number of members of epiphytic habitats bryoflora possible to calculate and use for future continued monitoring code area clean air. Methods of active brioindication should be used when it is necessary to investigate the influence of a given pollutant or factors in the conditions imposed by the investigator himself. Active brioindication is able to detect deviations from the norm or damage to the test organism, indicating the presence of a stressor of anthropogenic nature. However, unlike passive brioindication, test organisms will be in the standardized conditions of the study area. The most effective method of active brioindication is the method of transplants of the mosses.

Based on the estimation of anthropogenic load, a ball scales of criteria are chosen, which enables to distribute the test-object reactions to certain results obtained. Such studies are quite common for determining the level of atmospheric pollution by various pollutants and is one of the main stages for calculating the index of atmospheric air pollution.

Consequently, the relevance of the methods of active and passive brioindication for monitoring the state of the environment is manifested at the minimum cost of the study: monitoring of bryophytes in natural and laboratory conditions, and the availability of sampling of the studied species.

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ADAPTATION OF FIRST-YEAR STUDENTS TO THE CONDITIONS OF STUDY AT THE UNIVERSITY AND ITS ASPECTS

A. Bisseneva[1]

[1]*VYTAUTAS MAGNUS UNIVERSITY, DEPARTMENT OF BIOLOGY, LITHUANIA*
ANAR_PION@MAIL.RU

Abstract

In the initial period of study at the university, both the social and the physiological aspect of the student's life is very important. New learning conditions, high general study burden, large volume, novelty and complexity of the material that the student must experience, present to the organism increased requirements. The first months of study are the beginning of the formation of adaptive reactions to the conditions of the university and, depending on the individual characteristics of the organism, the conditions of education at the university can be caused by favorable reactions, trains the organism, or unfavorable, leading to a decrease in the stability of the organism. The effectiveness of adaptation determines the further development of the student as a specialist. First year students who have passed favorable adaptation have a successful educational activity.

Adaptation is mainly influenced by the success of training, directly dependent on the level of development of mental cognitive processes. In the first years of study, the burden of cognitive processes increases. The functions of memory and attention at this time are increasing, due to the restructuring of the study environment. Therefore, a low level of development of memory and attention can interfere with the effective adaptation of students.

The study was conducted on the basis of the North Kazakhstan State University named after M. Kozybaev. The study involved 80 students of first-year study. At the age of 17 to 18 years.

The following methods were used as a basis for the study: a technique for identifying typical difficulties of first-year students (B.G. Meshcheryakov, G.I. Sobolev); Multi-level personal questionnaire "Adaptability" A.G. Maklakov and S.V. Chermyanin. One of the aspects of adaptation to the study process are cognitive processes such as memory and attention. To assess the performance and fatigue, we used the "Account of Krepelin" method. Attention distribution with the help of the "The arrangement of numbers" technique. The volume, accuracy and speed of memorization were determined with the help of the technique "Operative memory".

The relationship between the level of development of attention and the coefficient of effectiveness was revealed. Correlation was found between the level of student’s adaptation and the neuropsychological stability.

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ALIMENTARY ESTROGENES AFFECT ON CHOLINERGIC REGULATION IN DIFFERENT AGE RATS

O. Lykholat[1] Yu. Ovchynnykova[2], T. Lykholat[3]

[1]UNIVERSITY OF CUSTOMS AND FINANCE, DNIPRO, UKRAINE [2]VASYL' STUS DONETSK NATIONAL UNIVERSITY, UKRAINE, [3]OLES HONCHAR DNIPRO NATIONAL UNIVERSITY, UKRAINE
LYKHOLAT2010@UKR.NET

Abstract

The effects of many contaminants are associated with their potential estrogenic effect. These substances are classified as compounds destroying the endocrine system and including many classes of organic compounds. Xenoestrogens are represented by industrial chemicals, antimicrobial and medical drugs, personal hygiene products. Ones are determined in drinking and bottled water, present in food products - cereals, vegetables and fruits, livestock products - meat, milk, eggs, as well as products containing phytoestrogens. Although the influence of the majority of xenoestrogens has been recognized for many years as "weak" because of their inability to cause transcription effects, now it has been proven that they are quite potent signal initiators of cascades emerging from the membrane. The aim of the presented work was the study of the effect of exogenous estrogens on acetylcholinesterase activity in the organs of female rats of different ages. At the beginning of the experiment, the age of the experimental animals was 3 months - in the pubertant period and 6 months - mature ones. To modeling the effect of exogenous estrogen in vivo, rat's food was treated with Synestrol in the calculation of 2 μg per kg for 45 days. At alimentary estrogen influence AChE study showed that in pubertal rats its activity is higher by 22 % compared to the control indices in the brain. The enzyme activation was observed by 15 % in the mature females. In the blood serum and liver tissue, the enzyme activity inhibition is determined. In pubertal animals the indices were significantly different from those of the corresponding control. For sexually mature females, the activity deviations are less pronounced. In the developing brain this phenomenon is able to directly disturb a number of processes in the nervous system, including neuronal proliferation and differentiation, glycogenesis and apoptosis, may contribute in the development of complex chronic brain health disorders in the future. In blood serum and liver AChE activity decrease in can be an indicator of worsening of liver synthesizing function, in particular stagnant phenomena in the liver (due to hemodynamic disorders) and kidneys. Deterministic tension in the cholinergic mediator system of the brain against the background of AChE inhibition in the blood serum and liver tissue with predominance in the pubertal females in comparison with the affects in sexually mature rats indicates a lower efficiency of mediator transmission in the corresponding cholinergic neurons of the younger animals, which justifies the existence specific age-related physiological conditions determining high sensitivity to exogenous estrogen-like compounds.

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ASSESSMENT OF HEAVY METALS CONTENT IN THE SOIL LAYER

Danara Askarova[1]

[1]*PEOPLE'S FRIENDSHIP UNIVERSITY OF RUSSIA (RUDN UNIVERSITY), ECOLOGY FACULTY, RUSSIA*
DANARA.84@MAIL.RU

Abstract

The indicators most widely used to characterize the physic - chemical state and the potential biological availability of heavy metals (HM) in soils are the "forms of finding" – the fractions of HM, differing in the predominant geochemical Association and strength of the relationship with soil components and extracted during soil treatment by different reagents.

Phytotoxic effect of HM is manifested at a high level of soil pollution and largely depends on the properties and behavior of a particular metal. A mixture of zinc and copper is five times more toxic than the arithmetic sum of their toxicity, which is due to synergism with the combined effect of these elements. Although there are sets of metal, the combined effect of which is evident additive. A striking example is the relationship of zinc and cadmium.

A number of studies show the features of the conversion of HM oxides present in industrial dust deposited on the soil. The first stage of transformation is the interaction of oxides with the soil solution and its components. Obviously, the main process controlling the level of metals in soil solutions is adsorption. There is dissolution of oxides and soil adsorption of metal cations formed by dissolution of oxides. The next stage of transformation after dissolution of unstable oxides is ion-exchange and specific adsorption. Ions of HM are able to be adsorbed specifically by soils with formation of rather strong connections of coordination type with some surface functional groups.

Transformation of HM compounds in soils leads to a rapid reduction of water-soluble fractions of metals, the content of which increases with the dose of metal and significantly depends on pH. In contaminated soils metals undergo transformation changes depending on the characteristics of the metal. Thus, Cd binds soils mainly in the form of exchange, P - in the organic matter, Zn - oxides and hydroxides of iron. Differences in sorption capacity due to the presence in soils specifically adsorbing HM components, and the strength of these components depends on the pH of the soil solution.

Conclusion. Thus, the metals that have got into the soil, first of all their mobile forms, undergo various transformations. One of the main processes that affect their fate in soils - is fixing humus substance. Naturally, in many regions, the duration of the period of stable snow cover and the characteristics of spring snow melting are of great importance for the transformation of the composition of dust and the forms of finding associated chemical elements.

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ASSOCIATION BETWEEN EXPOSURE TO FINE PARTICULATE MATTER AND ADVERSE PREGNANCY OUTCOMES IN KAUNAS

A. Miškinytė[1], A. Dėdelė[1], R. Gražulevičienė[1]

[1]VYTAUTAS MAGNUS UNIVERSITY, DEPARTMENT OF ENVIRONMENTAL SCIENCES, LITHUANIA
AUKSE.MISKINYTE@VDU.LT

Abstract

Epidemiological studies have suggested that maternal exposure to particles during pregnancy may be associated with adverse health outcomes including low birth weight. We examined the effect of long-term exposure to PM2.5 on birth weight. The prospective cohort study included 3292 pregnant women living in Kaunas, Lithuania. The outcomes of the study were low birth weight (LBW < 2500 g) and term low birth weight (TLBW < 2500 g; ≥ 37 weeks gestation). The annual average PM2.5 concentration at the participants' home addresses was estimated using land use regression (LUR) model. To detect potential confounding variables odds ratios (ORs) and 95% confidence intervals (CIs) were calculated. We used a two-piece linear spline function and multivariate logistic regression analysis to evaluate the association between exposure to PM2.5 and the risk of LBW and TLBW. The results showed that the risk of LBW and TLBW increased statistically significantly with increasing exposure to PM2.5. After adjustment for confounding variables the ORs for LBW among women exposed to the third and fourth quartiles of PM2.5 exposure were 1.27 (95 % CI 0.84–1.93) and 1.69 (95 % CI 1.14–2.50), compared with PM2.5 concentrations below the median. The risk for TLBW among women exposed to the third and fourth quartiles of PM2.5 exposure were 1.78 (95 % CI 0.85–3.73) and 2.89 (95 % CI 1.50–5.60), compared with PM2.5 concentrations below the median. Study provided evidence that maternal exposure to PM2.5 may adversely affect the birth weight; a non-linear association between exposure to PM2.5 and LBW and TLBW was detected.

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BIODIVERSITY OF SPIDER WASPS OF SOME STEPPE REGIONS OF WESTERN SIBERIA

Oleg S. Soloviev[1]

[1]*NATIONAL RESEARCH TOMSK STATE UNIVERSITY, TOMSK, RUSSIA*
SOLOVIEW.OLEG@GMAIL.COM

Abstract

Family of Spider Wasps (*Pompilidae*) is one of the largest in order *Hymenoptera* insects. In the world fauna it's about 4900 species, in Palearctic is 650 species, in Russia is about 200 species. In July 2016 was observed fauna of Spider Wasps of some steppe regions in Republic Chakasia and Republic Tuva of Western Siberia in the time of scientific expedition. In the result we found that there are 25 species from 9 genera on the territory of steppe regions of Republic Chakasia and Republic Tuva. In Republic Chakasia we found that there are 21 species from 9 genera: *Arachnospila* – 10 species, *Evagetes* – 3 species, *Auplopus* and *Anoplius* 2 species each of them, *Aporinellus*, *Episyron*, *Parabatozonus*, *Cryptocheilus*, *Caliadurgus* – one species each of them. In Republic Tuva we found that there are 6 species from 3: *Arachnospila* – 3 species, *Evagetes* – 2 species, *Auplopus* – one species. Genera *Arachnospila* has 11 species. Other genera are represented by a significantly smaller number of species: *Evagetes* – 4, *Auplopus*, *Anoplius* – 2 has each of them, *Aporinellus*, *Episyron*, *Parabatozonus*, *Cryptocheilus*, *Caliadurgus* – one species has each of them.

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BIOINDICATION OF ENVIRONMENTAL CONDITION OF MINING REGION BY PHOTOSYNTHESIS PIGMENT CONTENT OF TARAXACUM OFFICINALE WIGG

Irina Komarova[1]

[1] *KRYVYI RIH STATE PEDAGOGICAL UNIVERSITY*
IRINYSICH@I.UA

Abstract

Urbanized environment influences the changes of physiological processes of plants and stipulates their adaptation flexibility. Some of the most persistent and long-acting pollutants are heavy metals, which along of plants metabolic disturbance, negatively affect physiological processes. One of the informative parameters of plant adaptation to stress factors is carotene capacity index (Car) and Chla / Chlb ratio.

The aim – is to define specificity of reaction of photosynthesis pigments in mining region through the example of Taraxacum officinale Wigg. The object – is T. officinale leaves. Sampling sites were constructed in three administrative regions of Kryvyi Rih city with different levels of emissions release into atmosphere from stationary pollution sources (site № 1 (47º51'58.3"N 33º24'35.6"E), № 2 (48º01'51.8"N 33º27'47.2"E), № 3 (47º56'29.0"N 33º24'44.4"E). Chlorophyll and carotene content was determined in dimethyl sulfoxide extract according to A.R. Wellburn. Statistical data processing was performed by established parametric statistics procedures at 95% level of significance.

The research results allowed to fix the content of Chla at site № 3 in the number of 1,11±0,05 mg/g. There must be noted the decrease of its content to the level of 0,89±0,08 mg/g at site № 2 and the increase to 1,41±0,06 mg/g at site № 1, which is situated near the enterprise. The data concerning Chlb content give evidence of its regular reduction from 0,74±0,06 mg/g at site № 3 to 0,43±0,04 mg/g and 0,29±0,04 at sites № 1 and 2. Similar decrease is fixed on Car content from 0,42±0,07 mg/g at site № 1 to 0,30±0,04 mg/g and 0,26±0,08 mg/g at sites № 2 and 1.

One of the most significant parameters of physiological state of plants, which characterizes their adaptive capacity, is Chla / Chlb ratio, which varies in our research from 1,49 to 3,27. Low ratio value gives evidence of T. officinale sensitivity to growth conditions and decrease of pigment synthesis or decay acceleration under the influence of aerotoxic agents.

Extra markers of anthropogenic impact on the environment is «Chla + Chlb / Car» ratio, which, as a rule, increases in case of atmosphere contamination. The dynamics of experimental evidence proves the theory regarding ratio fluctuation, in particular, the increase from 4,40 to 7,08 at site № 1, which is a notional zone of contamination.

Thuswise, aeroanthropogenic environmental contamination leads to the change of photosynthetic pigment content of T. officinale laminae causing the reduction of Chla and Chlb content and their ratio. The plants stress reaction, which is often in evidence in the form of chlorosis, can be explained by fluctuation in the data concerning Chla content. The substantial inhibition of Chlb content is established in the territories.

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BIOLOGICAL AGE OF TEMPORARILY RELOCATED STUDENTS IN UKRAINE

Zoryna Boiarska[1], Oksana Radzikhovska[1]

[1]VASYL STUS DONETSK NATIONAL UNIVERSITY, FACULTY OF BIOLOGY, UKRAINE
KCENIYA0605@GMAIL.COM

Abstract

The whole world know about the tragedy in Eastern Ukraine. Military actions havebaffected all residents of the country, especially the residents of Donetsk and Luhansk regions. Many citizens had to be evacuated, including young people and students. The lifestyle of modern students has a number of characteristics. The motor activity of students has decreased while the informational load is increasing. In Ukraine, the socio-economic situation sharply has got worse, this affected the living conditions and nutrition of students. These features affect the body defence and lead to the of chronic diseases development. The indicator of "wear" of physiological systems is the biological age of a person. Biological age is an integral indicator of the aging organs and human biological systems. When the biological age is the same as the chronologic age, it is perfect. However, in Ukraine the average biological age of the population is higher. Ukraine in the rating of life expectancy gets 103 place out of 168 countries. The average life expectancy is 68.6 years. Therefore, the attention of science should be directed to studying the leading factors of aging in modern conditions among young people. Our goal is to study the changes in physiological systems of the students-migrants in 2-4 years after the evacuation.

We have surveyed 106 students of Donetsk National Vasyl Stus University (the University was moved to the city of Vinnytsia in 2014, because of the occupation of Donetsk city). We have got 95% of the complaints on the health conditions (on the scale of self-assessment of health). In a separate group we studied the biological age of male-students, immigrants from Donetsk and Lugansk regions. It is established that their biological age on the average is 41.3 years (the passport age is 21.8 years), which is 89.4% more than the chronologic age. When examining young male-students of the same chronologic age, the biological age is 37.6 years (the passport age is 20.5), which is 83.4% higher than the calendar age. It is worth noting that an interesting pattern was found while determining the biological age of girls in the control and study group. The biological age of the migrant girls increased to 29% comparing to the passport age, and 46% of the girls permanently alocated in the Vinnytsia region.

Thus, the male-migrants have an increased rate of aging. At the same time, students who did not withstand the evacuation after-effects have an increased rate of aging. It is necessary to find out the cause of this phenomenon. The aging rate of girls does not progress so much, but a correction of the psychoemotional state is required in relation to a sufficiently high index self-esteem of health.

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BIOLOGICAL ASPECTS OF THE USE OF CRUCIFEROUS CULTURES AS A CONSERVANTS

A. Markelova[1]

[1]*VASYL' STUS DONETSK NATIONAL UNIVERSITY,FACULTY OF BIOLOGY,VINNYTSIA*
A.MARKELOVA@DONNU.EDU.UA

Abstract

Cruciferous cultures that own phytoncidal properties can serve as a conservants at the ensilage of herbares and corn. So, a question of the use of cruciferous cultures as a conservants at the purveyance of ensilaging forage is actual.

In experiments conducted research on the study of influence of cruciferous cultures in quality of conservants in mixture with a cereal on quality of silage.

In the experiments used the green mass of pure fear of cruciferous crops and mixing was carried out directly in front of the bookmark in the capacity for operation. Studied the chemical composition of the original green weight of cruciferous crops and perennial cereals and legumes, as well as corn, their nutritional value. The feature of chemical composition of cruciferous cultures is high contains of protein and fat. Maximal content them it is observed in the phase of the mass flowering are 196,3 - 245,6 g of raw protein and 41,4 - 58,0 g of raw fat in 1 kg of dry substance, and to time this index was beginning the formation of the fetus plants below approximately on 10,3 - 21,1 and 8,7 - 28,4. On the complex of nutritives cruciferous cultures occupy the first place among one-year plants. On the contents of the protein in absolutely dry mass they successfully compete with leguminous plants. Cruciferous of culture valuable those that is sown in July-August, they give raw material for the purveyance of the canned forage in a current year.

It has been established that the optimal phase of harvesting cruciferous cultures during the silage harvesting of corn and cereals and legumes is the end of flowering-beginning the formation of the fetus plants; for cereals - earings; legumes - buds; for corn - milky-wax maturity of grain.

The optimal ratios of components for silage are: corn with Spring rape - 60 : 40 %, radish oil - 75 : 25 % and cereal-leguminous grasses with Spring rape - 70 : 30 %.

The use cruciferous crops in combination with corn and cereals reduces the loss of nutrients compared with pure cereal crops of dry substance by 3,1-4,7%, organic substance - by 2,3 - 2,2 %, crude protein - by 3,8 - 6,8 %, nonitrogen extractives substance - by 1,2 -2,1 %.

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CAUSES OF DRINKING WATER POLLUTION IN THE NORTH-KAZAKHSTAN OBLAST

N.Nikiforov[1], P.Dmitriev[2]

[1]VYTAUTAS MAGNUS UNIVERSITY, DEPARTMENT OF ENVIRONMENTAL SCIENCES, LITHUANIA, [2]NORTH-KAZAKHSTAN STATE UNIVERSITY NAMED AFTER M. KOZYBAEV, DEPARTAMENT OF GEOGRAPHY AND ECOLOGY, KAZAKHSTAN
N-A-Z-I-M1989@MAIL.RU

Abstract

In connection with the global increase in the deficit and demand for drinking water, one of the urgent issues of international cooperation in the field of environmental protection is the preservation and protection of water sources and human health. The reservoirs are a social, ecological and economic importance for the world society as a whole. Since only 2.5-3% (80% -90% of them in the form of ice) of available water reserves on the Earth are fresh, suitable for drinking, and consumers of water more than 7 billion people, then with this ratio, of course, should pay attention to the quality of the sources of drinking water: identify the causes of pollution and determine the appropriate methods of water treatment. At present days, considers that 2.1 billion people lack quality drinking water, this problem is becoming global. The solution of global problems is due to local action, which implies addressing the quality of drinking water point-wise, at the local level. Based on the above, the article examines the causes of pollution of drinking water in the North-Kazakhstan region taken from the largest water body of region is the Ishim River: primary and secondary pollution by inorganic pollutants and heavy metals of the source of drinking water, causes of pollution are analyzed; the article considers the geological features of the Ishim River as the primary pollution factors, secondary pollution is considered as the activity of industrial enterprises and agriculture, in particular, the introduction of various fertilizers, and recommendations for solving these problems of drinking water in region.

Key words: North-Kazakhstan oblast, the Ishim River, drinking water, inorganic pollution, heavy metals, transboundary fixation of pollutants, water ozonation.

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CHANGE OF A POOL OF FREE AMINO ACIDS IN RATS BLOOD PLASMA IN EXPERIMENTAL ALLERGIC CONTACT DERMATITIS

Maria S. Chumachenko[1], Elena O. Korik[1], Igor V. Semak[1]

[1]BELARUSIAN STATE UNIVERSITY, FACULTY OF BIOLOGY, BELARUS
CHUMACHENKOMARIA19@GMAIL.COM

Abstract

Allergic contact dermatitis (ACD) is one of the most common among inflammatory skin diseases. Determination of biochemical markers of ACD allows diagnosing the risk of developing the disease, the degree of its progression, as well as the body's response to clinical intervention, which is very important for choosing the right treatment strategy. The purpose of this study was to determine the differential metabolic profiles of blood plasma amino acids in animals with experimental allergic contact dermatitis. Allergic contact dermatitis was induced by 2,4-Dinitrofluorobenzene (1.5%). The carrier is a mixture of acetone:olive oil (4:1). Male Wistar rats weighing 280-300 g (n = 7) were used in the experiment. The animals were divided into 3 experimental groups: a control group, a control group with carrier application, an experimental group with induced allergic contact dermatitis. The material for the study was blood plasma, which was deproteinized with 1M HClO4 containing the internal standard – norvaline. Determination of the concentration of free amino acids was carried out by high-performance liquid chromatography with pre-column derivatization with o-phthalaldehyde. Data analysis was carried out in the program Statistica 10.0. To identify the most informative indicators, discriminant analysis method was used. The concentrations of 29 compounds were identified and measured: aspartic acid, glutamic acid, serine, T aminoadipic acid, glutamine, histidine, cystathionine, glycine, threonine, citrulline, arginine, anserine, carnosine, alanine, taurine, T aminobutyric acid, tyrosine, T-aminobutyric acid, ethanolamine, valine, methionine, 3-methylhistidine, δ-aminovaleric acid, tryptophan, phenylalanine, isoleucine, leucine, ornithine, lysine. Discriminant analysis of the studied compounds showed that there is a significant difference between the control and the group with ACD. The value of Wilks lambda was 0.1950, $p < 0.0001$, which indicates a rather high discrimination. In the group with application of the carrier in relation to the control group, there were no significant changes in the concentration of the pool of free amino acids. Levels of tryptophan, T-aminobutyric acid, valine, cystathionine and leucine contributed most to the values of both canonical variables (discriminant functions) and had the highest values in F-test among all the compounds studied. The findings indicate that the development of ACD can cause a significant imbalance in the pool of free amino acids and their derivatives of blood. The results are of interest for the evaluation of the degree of metabolic disorders, the specific features of metabolic shifts, and also for the detection of metabolic markers that can be used to study the pathogenesis of ACD.

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CHANGES IN MITOCHONDRIAL DNA CONTENT, EXPRESSION AND INTEGRITY IN DIFFERENT PARTS OF RAT BRAIN FOLLOWING WHOLE-BODY X-RAY IRRADIATION AT 5GY.

N. Gubina[1], S. Abdullaev[1], E. Evdokimovskii[1], I. Mitroshina[1], A. Gaziev[1]

[1]INSTITUTE OF THEORETICAL AND EXPERIMENTAL BIOPHYSICS RAS, RUSSIA
NINA.E.GUBINA@GMAIL.COM

Abstract

Recent data show that mitochondria, as well as nuclei, are an important target of radiation. Here, we show how X-ray irradiation affects mitochondrial DNA (mtDNA) content, integrity, heteroplasmy levels and gene expression in rat brain cortex, cerebellum and hippocampus. We found that these tissues apply different strategies to reduce radiation damage of mitochondria. Specifically, both hippocampus and cerebellum inhibit transcription of structural genes encoding subunits of electron transfer chain — mtDNA-encoded ND2 (complex I) and CytB (complex III), and nuclear gene ATP5O (complex V) — already at 2 hours after irradiation and do not restore it in 24 hours. Accordingly, transcription of key regulators of mitochondrial biogenesis — PGC1-alpha and TFAM, and of the major factors of mitochondrial fusion and fission — Mfn1 and Fis1, respectively — is decreased 2 hours after irradiation and does not reach control levels at 24 hours. Thus, we propose that these tissues inhibit oxidative phosphorylation and biogenesis of mitochondria via transcriptional repression of key proteins.

Curiously, in the brain cortex transcriptional changes are less pronounced: CytB and ND2 transcription levels do not differ, level of ATP5O is decreased 2 hours after irradiation, levels of PGC1-alpha, TFAM and Mfn1 drop at 6h, but in the less extent than in cerebellum and hippocampus. However, there is a peak in transcription of Fis1 at 2 hours after irradiation suggesting activation of mitochondrial fission to disrupt oxidative phosphorylation and to separate and eliminate damaged copies of mtDNA. This assumption is supported by the fact that post-radiation increase in mtDNA content in respect to nuclear DNA at 6 hours, although observed in all three tissues, is more dramatic in the cortex. General increase in mtDNA content can be considered as a compensatory reaction to mtDNA damage and related drop in mtDNA transcription causing shortage in ATP supply. However, because mitochondria do not stop DNA replication upon damage, this increase in mtDNA copy number can be coupled with growing percentage of heteroplasmy. Indeed, in all three tissues we observed increase in mutated mtDNA content at 6 hours (12-15%) peaking at 24 hours (25-30%) and lowering back to 10-20% at 72 hours. Accordingly with the previous results, the most pronounced changes are observed in the cortex. Notably that only temporary, but not stable, decrease in mitochondrial transcription can be explained by DNA damage: the integrity of long stretches of both mtDNA and nuclear DNA is disrupted at 2 hours after irradiation, but it is restored at 6 hours in nuclear and at 24 hours in mitochondrial DNA. This study was supported by RFBR grant № 17-29-01007 «ofi_m».

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CHITOSAN-MEDIATED REGULATION OF NUCLEIC ACID SYNTHESIS AND GENE EXPRESSION OF PR PROTEINS

O. V. Subin[1], O. V. Dubin[1], A. F. Likhanov[2], D. T. Yefanova[1], l. G. Palchykovska[3], S. M. Kostenko[1], A. A. Klyuvadenko[1]

[1]NATIONAL UNIVERSITY OF LIFE AND ENVIRONMENTAL SCIENCES OF UKRAINE, UKRAINE, [2]INSTITUTE FOR EVOLUTIONARY ECOLOGY NAS OF UKRAINE, UKRAINE, [3]INSTITUTE OF MOLECULAR BIOLOGY AND GENETICS, NAS OF UKRAINE, UKRAINE SUBIN.OLEKSANDR@GMAIL.COM

Abstract

In recent years, environmental-friendly means have been developed for combating plant diseases as alternative to chemical pesticides on the base of natural compounds such as chitosan. Widespread application of chitosan is due to its physical and chemical properties and its ability to mobilize plant innate protective systems.

Our work purpose was to extract chitosans from the insect puparia *Hermetia illucens* and the *Agaricus bisporus* fruit bodies, to determine their basic physical and chemical parameters, to identify the specificity of their action on model systems of DNA and RNA synthesis and to investigate the ability of chitosans to influence on gene expression of Pathogenesis-related proteins (PR proteins).

It has been determined that chitosan from *H. illucens* is a high molecular weight (HMW) compound with a kinematic viscosity of 3,003 mm2/sec and a degree of deacetylation of 90,7%, whereas chitosan from mushrooms was a low molecular weight (LMW) with a viscosity of 1,064 mm2/sec and the degree of deacetylation is 80,4%.

Interaction between obtained chitosans and plasmid and linear forms of pTZ19R* DNA was examined by electrophoretic mobility shift assay (EMSA) method.

The electrophoretic patterns showed that at chitosan concentrations in range 50-1.5 μg/ml there was formation of chitosan-DNA complexes, which displayed a lower mobility in agarose gel as compared to control DNA.

Here we report the first example of an efficient transcription inhibition by the LMW and HMW chitosans in a model in vitro transcription system based on T7 RNA polymerase and replication in PCR amplification system. The in vitro testing demonstrated the almost completely inhibition of the RNA synthesis by HMW chitosan in the concentration range of 50 - 6.25 μg/ml. The inhibitory effect of the LMW chitosan was less effective. The study of the effect of LMW and HMW chitosans on the PCR amplification showed that both samples reliably suppressed the synthesis of DNA fragments.

The effects of Nicotiana tabacum leaves treatment with LMW chitosan on the expression of PR genes were showed. Already at the first hour after the leaves treatment the expression activity of the Basic Chitinase and Acidic chitinase genes increased by 16% and 6% respectively. However, at this condition a reduce in the Basic-1,3 glucanase gene expression activity by 5% took place. Within 12 hours, the expression of these genes reduced somewhat and then increased again by 29% and 9% over the next 36 hours.

Results of the current study revealed the high sensitivity of plant protective systems to LMW chitosan and its ability to penetrate into the tissue and interact with appropriate cellular sensors.

Keywords: chitosan, DNA and RNA synthesis, gene expression

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COMPOSITION OF THE EPICUTICULAR WAXES OF WOODY PLANT LEAVES IS ASSOCIATED WITH THE ADAPTATION TO SUNLIGHT

Yu. Lykholat[1], Yu. Prysedsky[2], N. Khromykh[3], A. Alexeeva[3], O. Didur[3], V. Matyukha[4]

[1]OLES HONCHAR DNIPRO NATIONAL UNIVERSITY, DNIPRO, UKRAINE,[2]VASYL' STUS DONETSK NATIONAL UNIVERSITY, UKRAINE, [3]OLES HONCHAR DNIPRO NATIONAL UNIVERSITY, UKRAINE, [4]GOVERNMENT AGENCY INSTITUTE OF GRAIN CROPS, UKRAINE
LYKHOLAT2006@UKR.NET

Abstract

Cuticle is an arena of plant organisms' interaction with environmental biotic and abiotic factors. Susceptibility of plant to the impacts is determined by the composition of cuticular waxes, which are synthesized in the epidermal cells of leaves and can be embedded in cutin polymer (intracuticular wax), or be on outer surface of cuticle (epicuticular wax). Plant response to the influence of light and high temperature is accompanied by an increase in epicuticular waxes deposits. However, effect of abiotic stresses on the epicuticular wax composition, which is a mixture of long-chain aliphatic molecules, is poorly understood. The objective of this study was to determine whether the accumulation and composition of the epicuticular waxes vary depending on leaves illumination level in woody plants crown. The test objects were the sun-adapted and shade-adapted leaves of genera Ulmus and Tilia species. Epicuticular waxes chloroform extracts were analyzed using GC Shimadzu 2010 PLUS equipped with a flame ionization detector and capillary column SP-2560. Content of hydrocarbon classes was expressed as a percentage of total amounts. In our study, wax accumulation on surface of sun-adapted leaves exceeded the indices for shaded leaves in both genus Ulmus (1.6 – 2.6 times) and genus Tilia (1.2 – 3.2 times). Long-chain hydrocarbons in the epicuticular wax of both genera were represented by fatty acids, aldehydes, n-alkanes, and alcohols. In the waxes of U. minor shaded leaves, fatty acids dominated (77.1% of total), while in lighted leaves the share of acids decreased 1.5 times, and contribution of aldehydes and the sum of alkanes and alcohols increased (in 2.9 and 1.6 times, respectively). In contrast, alkanes together with alcohols were the main classes in U. pumila waxes from both the shaded and lit leaves (81.8 and 92.4% of total). In the waxes of genus Tilia leaves, the most share of fatty acids in the shade-adapted leaves of T. tomentosa and T. platyphyllos (59.0 and 46.8%, respectively) were reduced sharply in lit leaves. At the same time, sum of alkanes and alcohols in the waxes of sun-adapted leaves of these species increased by 2.7 and 1.8 times. The most sums of n-alkanes and alcohols were found in the waxes of lit leaves of T. begoniifolia, T. platyphyllos, and T. cordata (respectively, 98.7, 96.5, and 96.3% of total). So, reducing the fatty acids proportion together with the simultaneous increase in the share of n-alkanes and alcohols under the influence of sunlight were the general pattern for epicuticular waxes of both Ulmus and Tilia species. Increase in wax deposits on leaves surface and redistribution of classes of long-chain hydrocarbon in the epicuticular waxes were associated with the adaptation of woody plants to the solar radiation.

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CULTIVATION OF SOYBEAN IN UNFAVOURABLE CONDITION AND THEIR NUTRIENT VALUE ANALYSIS

A. Iskakov[1], A. Shayakhmetova[1], E. Ganaga[1], J. Lee[2], A. Galiyeva[3]

[1]NORTH KAZAKHSTAN STATE UNIVERSITY, AGRICULTURE DEPARTMENT, KAZAKHSTAN, [2]KYUNGPOOK NATIONAL UNIVERSITY,DEPARTMENT OF APPLIED BIOSCIENCES , SOUTH KOREA, VYTAUTAS MAGNUS UNIVERSITY, LITHUANIA
AYGERA218@GMAIL.COM

Abstract

The research work is concerned with identifying advantages of soybean as fodder culture according to its botanical characteristics. Over the past decades, the use of soybean in the feed and food industry has significantly grown. Production of soybean meal in the world is constantly increasing. Such a dominant position of soybean and its products processing is undoubtedly associated with their high quality, especially the quality of the protein and its amino acid composition. An important task of agricultural production is a constant increase in the production of high-protein grain of leguminous crops, among which soybean has come first in the world. In the world market, soybean and soy flour are in great demand, providing significant foreign exchange earnings to major soybean producers - the USA, Brazil, China and Argentina. The popularity of soy is that its seeds contain 35-50% of high-grade protein, 17-25% fat and up to 30% carbohydrates. The nutritional value of soy protein is good, although the quality is not quite as high as animal protein. Considering the situation it should be mentioned that very actual in today‘s to solve cultivation problems in all regions. In Kazakhstan, soybeans started sowing in the thirties of the last century, but due to the absence of zoned varieties and due to the large labor intensity of the republic's farming operations, the cultivation of the republic was abandoned. But already in the mid-sixties of the twentieth century, the country's agriculture had the necessary grades and a powerful machine-tractor park for cultivating tilled crops. Experimental studies and production experiments of those years have shown that great opportunities for cultivating early soybean varieties are found in the northern and eastern regions of Kazakhstan. Soy is a light-loving plant, but early-ripening varieties satisfactorily tolerate a moderate insolation intensity. The most favorable conditions for the rapid growth of soybeans in the conditions of Northern Kazakhstan.To solve the problems of soybean cultivation and increase its yield in today's world, when soybean and agricultural products are cultivated, it is very problematic to introduce intensive technologies without using biotechnological preparations that affect the growth, development, sustainability and productivity of the crop. It is known that the use of biologics based on *Bradyrhizobium* significantly increases the productivity of soy. Presowing treatment of seeds with biological preparations and microfertilizers is one of the most important conditions of such process as ecologization of agricultural production, and also contributes to obtaining a high, stable crop, while ensuring the reproduction of soil fertility.

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DEVELOPMENT OF ENVIRONMENTAL EDUCATION IN THE INTERESTS OF STABILITY AND SUSTAINABLE DEVELOPMENT OF SOCIETY

Victoria Arshinova[1], Victor Glebov[2]

[1]DEVELOPMENT INSTITUTION EDUCATIONAL POLICY OF THE M. V. LOMONOSOV MOSCOW STATE UNIVERSITY, RUSSIA, [2]PEOPLE'S FRIENDSHIP UNIVERSITY OF RUSSIA (RUDN UNIVERSITY), ECOLOGY FACULTY, RUSSIA
ARSHEENOVA@INBOX.RU

Abstract

The ongoing processes of globalization of the political, economic and technological aspects of human life are accompanied by problems and risks in all spheres of public life (increasing poverty, uneven economic and social development of the regions of the world, demographic problems, international terrorism and the threat of major military conflicts).

Therefore, it is necessary to stabilize the society. The method of stabilization of systems of academician N. N. Moseev sees in the development of environmental education. In his opinion, the survival of mankind depends largely on the formation of a world culture that combines original national cultures with universal values. The basis of this unity of cultures can serve eco-humanistic values and ideals of sustainable development of society. The shift of emphasis from material wealth and the exploitation of natural and human resources on the search for harmonious coexistence of people with each other, humanity and nature, can create a completely new and devoid of crises, the conditions for the coexistence of different systems and subsystems.

Thus, harmony between man and nature should become the absolute highest value of culture and the goal of social development, the basis for the formation of global thinking and global responsibility and social activity of the individual. Active society is understood as able to go out in the restructuring of the institutional structures which no longer comply with the new value orientations.

Environmental education involves a special type of educational activity, motivated by the need to solve social and environmental problems, as an important condition for the further sustainable development of society. As an integral pedagogical process, it is a training and education, the purpose of which is the assimilation of new scientific knowledge about the environment, modern types and methods of rational use of natural resources, new norms of interaction with the environment.

In practice, this should be achieved through the adoption of new social and environmental technologies that preserve the environment for present and future generations. The mastering of the experience of creative, constructive activities in a natural environment, the experience of human attitude towards nature - the attitude of love, selflessness, sacrifice in the interaction with her, will be able to keep the destructive interaction of the social systems and subsystems

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DISEASES CAUSED OR MEDIATED BY FACTORS ENVIRONMENT

Mukhammadali Habibov[1], Kanza Fioti[1]

[1]PEOPLE'S FRIENDSHIP UNIVERSITY OF RUSSIA (RUDN UNIVERSITY), ECOLOGY FACULTY, RUSSIA
ONEEXTRA94@MAIL.RU

Abstract

The results of numerous international studies have allowed to establish associations between exposure to environmental factors and a wide range of adverse consequences for the health of the population, the effects can range from unnoticed asymptomatic exposure to premature death. Who specialists estimate that 24% of the burden of disease (years of healthy life lost) and about 23% of all deaths (premature mortality) may be due to environmental factors.

Among children aged 0-14 years, the proportion of deaths attributable to environmental exposure is 36%. There were large regional differences, for example, 25 per cent of all deaths in developing regions due to environmental causes, but only 17 per cent in developed regions, and such differences could be due to differences in, for example, environmental conditions in the region and access to health care.

In developed countries, environmental factors are attributed to a greater contribution to cardiovascular disease and cancer. The number of healthy life years lost as a result of cardiovascular disease is 7 times higher per capita in developed countries than in developing countries, and cancer rates are 4 times higher.

Large-scale epidemiological studies of the effects of chemicals on large populations (tens of thousands) with the use of biomonitoring methods with the definition of biosubstrates about 1900 chemicals and their metabolites made it possible to reliably assess the risk to public health. Based on epidemiological studies, who has identified 10 priority chemicals or groups of chemicals and major groups of diseases that are proven or suspected to be associated with exposure to priority chemicals. The list of priority chemicals presented in table 2 is a major public health problem in the study of the health effects of the environment.

For example, the suspended particles (PM10, PM2. 5), nitrogen dioxide, ozone may cause cardiovascular disease and diseases of the respiratory system. Arsenic is the cause of cancer, cardiovascular and endocrine diseases psych neurological disorders.

Thus, there is a high correlation between morbidity and mediated environmental factors.

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DYNAMICS OF ADAPTATION OF NONRESIDENT STUDENTS TO THE ENVIRONMENTAL CONDITIONS OF THE CAPITAL CITY

Yana Kuzmina[1], Irina Suvorova[2], Sophia Mudrak[3]

[1]PEOPLE'S FRIENDSHIP UNIVERSITY OF RUSSIA (RUDN UNIVERSITY), ECOLOGY FACULTY, RUSSIA, [2]PEOPLES' FRIENDSHIP UNIVERSITY OF RUSSIA, RUSSIA, [3] MOSCOW STATE UNIVERSITY OF CIVIL ENGINEERING KUZMINA.GTMOST@MAIL.RU

Abstract

The deterioration of a complex of factors (environmental, psychosocial and cultural conditions) is accompanied by functional changes in the activity of functional systems of the person and often causes neural emotional and physical stress, leading to disruption of the adaptation system.

On the basis of the laboratories "Ecological psychology" and "Ecological medicine" of the Department of human ecology of the Ecological faculty of RUDN we studied the peculiarities of adaptation of students of RUDN to the educational environment. During the study period we examined 311 students from different regions of Russia. The study involved first-year students of RUDN and M. V. Lomonosov Moscow State University.

Survey, psychological and psychophysiological testing were conducted. The survey data showed that the dynamics of adaptation process of nonresident students is influenced by a complex of socio-economic, environmental factors and individual-typological features of the student. Thus, the most common problems encountered in the socio-economic context of adaptation were related to the lack of funds in the entire study sample (from 41% to 83%), the combination of study and work (from 6% to 59%) and the search for housing (from 7% to32%).

Analysis of psychophysiological testing showed that the majority (67.4%) of nonresident students (North Caucasus and Volga region) were in the zones of "permissible psychophysiological state" and "maximum permissible psychophysiological state". Only half (48.9%) of Muscovite students had indicators in the zone "optimal psychophysiological state".

It is also important that no student got on psychophysiological parameters in the zone of disadaptation, although there was a positive increase in the indicators in the zone "negative psychophysiological state".

Conclusion. The results of our studies showed that the complex of the environment has a significant impact on the dynamics of adaptation mechanisms of nonresident students. At negative influence of ecological factors (high level of transport noise, atmospheric pollution and violation of rhythm of sleep and wakefulness) there is a failure of rhythm of sleep and wakefulness and deterioration of mental health of students. This, in turn, is manifested by an increase in personal and situational anxiety, deterioration of the functional state of the autonomic nervous system, which in General causes mental discomfort, and leads to overstretching of the adaptive potential of a nonresident student.

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ECOLOGICAL AND SOCIAL COMPLEXITY POLLUTION HOUSEHOLD WASTE IN ALBANIA

Anamarija Thoma[1], Elizabeth Anikin[1], Gulnara Guliyeva[1]

[1]PEOPLE'S FRIENDSHIP UNIVERSITY OF RUSSIA (RUDN UNIVERSITY), ECOLOGY FACULTY, RUSSIA
ANAMARIATHOMA@GMAIL.COM

Abstract

According to various sources, at the present stage of human development, each of the inhabitants of our planet has an average of about 1 ton of garbage.

As for Albania, according to the Institute of public health of the Republic of Albania (ISHP), there is a very poor management of municipal waste by local authorities. So on supervision of employees of ISHP the bad condition of containers which need to be brought into compliance with hygienic standards is shown.Thus, the specialists of the ISHP found out that 20% of waste containers in Albania never went through the disinfection procedure, while a third of the containers are in poor condition or are constantly overflowing. All this creates a serious danger for human health – especially in summer, when the population of Albania is significantly increased at the expense of tourists. Another problem in Albania is that garbage, despite prohibitions, is dumped in places that are not intended for this purpose. Such territory is not fenced, there are no experts, leading to the observation of the proper placement of debris. From these unauthorized dumps, the wind carries paper and other light waste. Such landfills not only disfigure the landscape, but also pose a threat to human health (Glebov, 2017). Substances formed during decomposition of waste pollute the atmospheric air. Rainwater washes out toxic substances decomposed waste; this causes pollution and contamination of open water bodies and groundwater.

Finally, Albania has seen an annual increase in imports of household waste from the European Union. The fact that the Albanian Parliament adopted in 2011 a Law, allowed the import of waste and industrial waste from the EU.

Then this initiative was met with mass protests of citizens. These protests have partly helped to reduce the intensity of economic and social unrest. The government has banned the importation of toxic waste, and the final list of waste categories that can be imported has been reduced from 400 to 50.

However, environmental groups and human rights activists argue that after the adoption of the law, the country has become a trash. They emphasize that the authorities do not have the opportunity each time to check what kind of garbage is brought to Albania from the EU countries. This means that toxic waste can be imported under the guise of permitted.

Conclusion. Thus, the problem of domestic waste in Albania is acute. This is due to the increasing growth in the production of consumer goods of one-time use in the country. To this also adds the problem of increasing the amount of packaging material. In Albania, there is an annual increase in the import of household waste from the European Union, which is not controlled by the Supervisory authorities of the country.

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ECOLOGICAL CONFLICT SITUATION IN THE "FISHERMEN-SEAL" SYSTEM»

Roman Panarin[1]

[1]*PEOPLE'S FRIENDSHIP UNIVERSITY OF RUSSIA (RUDN UNIVERSITY), ECOLOGY FACULTY, RUSSIA*
PANARINRV@YAHOO.COM

Abstract

Every year, people increasingly invade natural ecosystems and inevitably come into conflict with their inhabitants for living space and resources. This is what can be seen now on the territory of lake Ladoga, where the interests of the fishing business and the preservation of the population of local higher predators.

On the territory of lake Ladoga, the situation is as follows: local fishermen use the habitat of the Ladoga seals as a place for fishing, and seals, in turn, catch fish from the nets and spoil the equipment, creating losses for farms.

As you know, the number of predators depends on the number of victims. Consequently, the decrease in the number of fish, which is the basis of the food base of the seal, means that fewer individuals will be able to feed on the territory of the lake. In addition, seals themselves get into the network and often die. As a great threat to them is the pollution of the lake drained by ship fuel and the fishermen themselves, who can shoot the animals they come across as pests. At the moment, the Ladoga ringed seal is listed in the Red list of Russia, and therefore the question of eliminating the above factors to preserve its population is more acute than ever.

From my point of view, the successful preservation of the Ladoga seal as a species is impossible without the prohibition of fishing in its hunting grounds. However, in this case, environmentalists will have to face the interests of fisheries, which, of course, will not want to stop their activities in the region and will strongly impede programs aimed at limiting industrial fishing on the territory of lake Ladoga.

To develop solutions to existing problems it is necessary to conduct a detailed study of the history of interaction between man and the Ladoga ringed seal in the last thirty years, the poll workers of fish farms in relation to the frequency of collisions with seals and receive data on the numbers of seals in the disputed territory, and then to analyze the obtained data. This will be the task of the work.

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ECOLOGICAL NICHES OF MACROFITS OF TECHNOGENIC LAKES IN MALE POLISSIA (UKRAINE)

Nataliia Shevchuk[1], Nataliia Mironova[1], Halyna Biletska[1]

[1]KHMELNYTSKYI NATIONAL UNIVERSITY, UKRAINE
NSHEVCHUK199@GMAIL.COM

Abstract

Male Polissia covers the territory of the western oblasts of Ukraine and goes on to the territory of Poland. The formation of technogenic lakes here is due to the extraction of sand in water quarries with the use of dredges. The resulting transformation of the natural ecotope led to the formation of ecological niches in the ecotonic zone with a set of new specific factors. During the post-technological succession, three zones of vegetative hydrophilic cover were formed on these sites: the belt of helophytes, pleistophytes and hydrophytes. In this regard, the study of the parameters of ecological niches of macrophytes and their assessment is an actual task, the solution of which will allow the development of recommendations for integration technogenic lakes into the natural landscape.

To characterize ecological niches, we used species that accumulate the largest biomass in Male Polissia. Among the helophytes, this is Carex acuta L. and Phragmites australis (Cav .) Trin. ex Steud., pleistophytes – Potamogeton natans L., hydrophytes – Ceratophyllum demersum L.

In our niches' research, we used the Hutchinson approach, who represented an ecological niche in the form of a multidimensional model. According to our preliminary assessment, the following parameters are critical for survival and distribution of the species: 1) lighting; 2) trophy of the substrate; 3) the depth of the littoral zone.

As a result of the research it was determined that the volume of ecotope of technogenic lakes acting as an arena for the development of hydrophilic vegetation is determined by the following parameters: lighting – 2,5-90 thousand lux; depth – up to 5 m; trophism (or the content of organic matter) – up to 5 %.

The niche of the Carex acuta takes only 12 % of the general hyperbaric. For the Phragmites australis this value is 53 %, Potamogeton natans – 23 %, and the largest value (73 %) is characteristic for Ceratophyllum demersum. Thus, the overgrowth of technogenic lakes with vegetation is characterized by a significant presence of submerged plants. The second largest niche takes the Phragmites australis, the restriction of which takes place exclusively by depth.

The volume of space, which overlaps the niches of all species, except Carex acuta, is 10 % of the ecological niche of aquatic and coastal plants. The main differentiation of the niches occurs along the gradients of depth and lighting.

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ECOLOGICAL ROLE OF FOREST SHELTER BELTS IN AGROLANDSCAPES

S. Yermolenko[1], A. Huslystyi[1], V. Gasso[1], t. Kolombar[1], A. Hahut[1], V. Kozak[1]

[1]OLES HONCHAR DNIPRO NATIONAL UNIVERSITY, 72, GAGARIN AVE., DNIPRO, 49050, UKRAINE
YERMOLENKO_SV@I.UA

Abstract

Agricultural activities are one of the main factors affecting ecosystems. In Ukraine the sowing area averages 32.5 million hectares. The withdrawal of this area from natural landscape and its transformation into arable lands, introducing monocultures as well as application of pesticides and fertilizers led to the disruption of long-term ecological links and resulted in formation of relatively unstable agrocenoses. It is well known that the protective forest belts have a positive impact on the crop yield and soil quality. The yield increases by 10–50% in dependence of the crop [1]. The importance of forest belts in promoting local biodiversity is not well studied.

Phytomeliorative plantations create much more favourable environmental conditions for many species. Current infrastructure of forest shelter belts in Ukraine is not effective enough. Also, many woodland belts were destroyed by illegal felling. As a result the soil erosion caused huge annual environmental and economic losses. Poor crop yield under unfavourable climatic conditions is an evidence of that negative effect.

It is known that in forest belts the animal species diversity is substantially higher in comparison with the adjacent agrosystems. For instance, in Ukraine woodland belts have three times more species of amphibians and reptiles than agricultural fields [2]. Many animals use forest shelter belts for their migration and wintering. Consequently, research on the features of such kind of plantations can help in creating the eco-corridors for animals and conserve biodiversity in the future.

An optimized system of forest shelter belts developed on the principles of landscape ecology should provide their optimal placement throughout the terrain, the best ratio between forest belts and agrosystems, and contribute to their standards. When optimizing agrolandscapes, it is necessary to consider the forest protective plantations as their main component. In this regard, the development of landscape-ecological bases for the forest belt optimization in the agrolandscapes of Ukraine assumes ever greater importance.

Keywords: Phytomeliorative plantation, agrolandscape optimization, landscape ecology

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ECOLOGY OF THE AMUR TIGER

Elena Lukyanova[1]

[1]*PEOPLE'S FRIENDSHIP UNIVERSITY OF RUSSIA (RUDN UNIVERSITY), ECOLOGY FACULTY, RUSSIA*
UKYANOVA_ELENA7@MAIL.RU

Abstract

Since ancient times, man had to come into contact with the surrounding animal world. Some of the animals he procured his livelihood, others were destroyed as dangerous enemies and pests (Glebov, 2013).

The Amur tiger, in comparison with other subspecies, differs peacefulness in relation to the person. Often tiger, noticed a man trying to avoid direct meetings and retreats. Even conflict tigers who live near populated areas for a long time and often visit them for the purpose of extraction of Pets, as a rule, avoid people.

The tiger is solitary or family (females with cubs) way of life. Adults have a home range within which they indicate their presence by marking activities. The average size of the male habitat is 1380 km2, females – 400 km2. Up to 6 adult female plots can be located within the area of the resident male. The main parameters determining the quality of Amur tiger habitats are their suitability for the tiger's main prey objects and the level of anthropogenic impact on them, primarily poaching.

High demand for animal skins, the use of their bones and insides in Chinese medicine provokes Russian poachers to kill 30 to 40 tigers annually. Thus, poaching tigers is not only the main cause of death of predators, but also one of the main factors of conflict between the tiger and the man.

Overexploitation of forests with participation of Korean cedar and Mongolian oak, as well as their burnout leads to loss of forage base of potential Amur tiger victims, and subsequently –and the predator itself, reduction and further fragmentation of the area and increase of aggression between males in the struggle for territory.

The Amur tiger can be aggressive in his pursuit of the unexpected collision, the protection of their prey or offspring. The most common type of conflict is tiger attack on Pets.

Other conflict situations arise as a result of the collision of vehicles with tigers on the roads, the detection of cubs left without a mother. Every year, especially in winter, a number of cubs become orphans, unable to live independently, some of them fall into the hands of man. Therefore, the problem of their return to their natural habitat after rehabilitation is acute.

Thus, only if the preventive measures aimed at creating comfortable natural living conditions for the tiger and teaching the local population the rules of behavior in the habitat of the predator are observed, it is possible to ensure a sufficiently stable conflict-free coexistence of the Amur tiger and a person, which will reduce to a minimum the number of undesirable situations and their negative consequences.

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EFFECTIVE PARAMETRIC OPTIMIZATION TO IMPROVE TRANSFECTION EFFICIENCY OF CHO CELLS VIA ELECTROPORATION

Sonam Chopra[1], Paulius Ruzgys[1], Saulius Šatkauskas[1]

[1]VYTAUTAS MAGNUS UNIVERSITY, BIOLOGY, LITHUANIA
SONAM.CHOPRA@VDU.LT

Abstract

The establishment of effective gene transfer method leads to the improvement in gene therapy protocols. The electroporation technique has been positively accepted for in vitro and in vivo studies, but its poor transfection efficiency is still a challenging task. Hence, the attention of researchers is to increase the transfection efficiency while maintaining cell viability. The electrotransfection conditions for each cell type should be determined to achieve the maximum plasmid transfer while preventing the undesirable cell deaths.

In this research, the optimal values of electrotransfection parameters for in vitro transfection of CHO cells are determined. Some of these varying parameters are the number of applied pulses and plasmid DNA concentration at which the electroporation was carried out. GFP coding plasmid concentrations of 10, 100, 200, 300, 400 and 600 µg/ml were chosen. Different tendencies of transfection efficiency were observed for different HV pulses (1, 2 and 3 HV) with higher (400 and 600 µg/ml) plasmid concentration. For all the three pulse combinations the cell viability was continuously decreased with increase in plasmid concentration from 10, 100, 200, 300, 400 and 600 µg/ml. The increase in plasmid concentration from 10, 100, 200, 300, 400 and 600 µg/ml increased the corresponding transfection to 6.78, 33.99, 49.34, 65.52, 71.61 and 59.36 % in the case of 3 HV pulses. The optimal value of plasmid concentration for electrotransfection was found from the presented dynamics of cell viability decline and transfection efficiency rise when increasing the plasmid concentration.

Keywords: Electroporation; gene; CHO cell; transfection efficiency; plasmid; cell viability

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EFFICIENCY OF THE USE OF ORGANIC AND HUMIN FERTILIZERS ON GROWTH AND DEVELOPMENT OF SUDAN GRASS (SORGHUM SUDANENSE L.) IN THE CONDITIONS OF NORTH KAZAKHSTAN

A. Madiyeva[1], Elena V. Galaktionova[2]

[1]VYTAUTAS MAGNUS UNIVERSITY, LITHUANIA, [2]NORTH KAZAKHSTAN STATE UNIVERSITY NAMED AFTER M.KOZYBAEV, KAZAKHSTAN
NARIMANOVNA0106@GMAIL.COM

Abstract

The article contains information about the effectiveness of the use of organic fertilizers, including humic fertilizers, and their influence on the growth and development of Sudan grass in the North Kazakhstan region of the Republic of Kazakhstan. In order to carry out the experiment and further study, Humint and Biohumus organic fertilizers were used. They are created in Kazakhstan. From humic fertilizers the growth stimulator Agrostimulin and microfertilizer Lignohumate were used. Fertilizers involved in the experiment previously were not used in Kazakhstan to cultivate Sudan grass. Sudan grass was chosen, because it has high feeding properties, which is very important for the area in which the revival of agriculture, including livestock is going. The article gives the results that were obtained during the vegetation periods for this culture. To the basis took such indicators as the density of standing, linear growth, structure and productivity of plants of Sudan grass.

The obtained results of the use of organic fertilizers revealed the most effective fertilizers for cultivating Sudan grass in the conditions of the North Kazakhstan. They can also be useful for farmers and other agrarians of the North Kazakhstan region, Kazakhstan and for the world.

Key words: Biohumus, Humint, Agrostimulin, Lignohumate, Sudan grass.

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ENVIRONMENTAL EDUCATION OF THE POPULATION OF RUSSIA AS AN IMPORTANT ASPECT OF THE SECURITY OF THE COUNTRY

Daria Lyamina[1], Ksenia Mikhaylichenko[1]

[1]PEOPLE'S FRIENDSHIP UNIVERSITY OF RUSSIA (RUDN UNIVERSITY), ECOLOGY FACULTY, RUSSIA
DALYAM1995@GMAIL.COM

Abstract

Environmental education implies a change in the attitude of man to nature. Such education affects not only the ecological, socio-economic and technical, but also the moral aspect. So what is the problem of environmental education in Russia? To answer this question, it is necessary to compare the values of people, namely traditional and environmental (Glebov, 2016).

In order to understand the problem of environmental education in our country, it is necessary to conduct a comprehensive analysis of the development of environmental education in other countries that have successfully passed the path of greening.

For example, in Japan, a country with an extremely high degree of negative anthropogenic impact, learned to control the environmental situation is due to the development of environmental education among the population. According to most polls, ¾ of the population of Japan tied for first place improving the environment, rather than their own interests. In Japan, they are brought up according to ecological traditions and learn to respect nature and respect its people of all ages and professions – children, schoolchildren, students, businessmen, Housewives, company owners, mayors of cities and others.

Even earlier, environmental education began to be engaged in the United States. The reason for this was the publication of R. Carson's book "Silent spring", which tells the story of how Americans pollute the earth with dangerous substances (pesticides and chemicals). Such pollution caused massive loss of life. The response to this book has reached a climax in 1970, when the United States was announced and organized by Earth Day showing the universal support of laws to protect the natural environment.

Environmental protection has led to a decline in production efficiency in the United States. But an American survey showed that more than half of the country's population agreed to reduce the country's economic growth, and thus its standard of living to improve the quality of the natural environment.

Thanks to the analysis of the development of environmental education in foreign countries, it is possible to find rational solutions to this problem in Russia.

Conclusion. Thus, if you follow the above clearly, in Russia it will be possible to take that valuable and acquired in other countries, and taking into account the multinational and ethnic traditions and cultural customs to form environmental education. Currently, the main obstacle to the greening of the population is the person himself, his values, beliefs and anthropocentric thinking. Everyone needs to start with himself and then all the goals and objectives can be realized.

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ENVIRONMENTAL MONITORING OF THE UNIVERSITY CAMPUS: THE CASE STUDY OF RUDN UNIVERSITY CAMPUS IN MOSCOW, RUSSIA

Mamadzhanov Roman[1], Khaustov Aleksandr[1], Redina Margarita[1], Nigmatzyanova Yulia[1]

[1]ECOLOGICAL DEPARTMENT, RUDN UNIVERSITY, MOSCOW, RUSSIA, 115093, PODOLSKOYE SHOSSE (PODOLSK HIGHWAY), 8-5
DADDY_ROMA@MAIL.RU

Abstract

The article is devoted to environmental monitoring of the campus of RUDN University in Moscow, particularly to monitoring of carbon monoxide (CO), nitrogen dioxide (NO2), hydrogen sulphide (H2S), soot and benzene (C6H6) spreading in the atmosphere and the topsoil in the campus of RUDN University located near the Leninsky Prospekt highway. The 3D map of the above compounds spreading in the atmosphere and the topsoil has been made, and the diagram indicating the correlation between the distance from the Leninsky Prospekt highway and CO, NO2, H2S, soot and C6H6 concentrations in 33 sampling sites of the campus has been drawn. As a result, the green and polluted areas of the campus have been identified.

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EPIGENETIC VARIABILITY IN FEN ORCHID (*LIPARIS LOESELII* L.) POPULATIONS IN LATVIA

Nataļja Škute[1], Nadežda Harlamova[1], Marina Savicka[1], Daina Roze[2]

[1]DAUGAVPILS UNIVERSITY, INSTITUTE OF LIFE SCIENCES AND TECHNOLOGIES MOLECULAR BIOLOGY AND GENETICS LABORATORY, LATVIA, 2NATIONAL BOTANIC GARDEN OF LATVIA
NATALJA.SKUTE@DU.LV

Abstract

The orchid family is one of the most threatened families in Latvia. One of the rarest and especially protected species in Latvia is the fen orchid (*Liparis loeselii* L.), whose area covers the entire territory of Latvia. Environmental and climate changes as well as anthropogenic factors have dramatically influenced on fen orchid growing habitat, which has led to decrease the species occurrence. For the understanding of species vitality in changes climate it is necessary to know not only genetic bet also epigenetic processes in population of orchid. These epigenetic changes can be caused as adaptive response to environmental factors. Epigenetic mechanisms regulate gene expression without changes to the underlying DNA sequence. DNA methylation is the best known epigenetic modification. The total DNA methylation level depend on the type of environmental factors.

DNA was isolated from orchid leaves, using the DNeasy Plant kit (*Qiagen*). The Luminometric Methylation Assay (LUMA method) was used for total DNA methylation analysis of orchid populations. The LUMA is permissive for genomic DNA methylation studies of any genome as it relies on the use of methyl-sensitive and –insensitive restriction enzymes followed by polymerase extension via Pyrosequencing technology.

It was shown, that relative methylation levels in fen orchid varies from 0.27 to 0.46 in different Latvian regions. Relative DNA methylation level in Engure Lake is the highest (0.46). Increased level of total DNA methylation in the fen orchid in this region could be a response to inappropriate environmental factors such as humidity and lighting.

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EVALUATION OF THE HELMINTH FAUNA OF RODENTS IN URBAN ECOSYSTEMS OF RUSSIA

Victoria Erofeeva[1], Olga Rodionova[1], Viktor Glebov[1]

[1]PEOPLE'S FRIENDSHIP UNIVERSITY OF RUSSIA (RUDN UNIVERSITY), ECOLOGY FACULTY, RUSSIA
EROFEEVA-VIKTORI@MAIL.RU

Abstract

Most of the population of the Russian Federation (73%) lives in cities where industrial enterprises, housing and communal services and auto transport carry out emissions and discharges of pollutants, including biological, which are saturated with almost all natural environments. Around the cities formed the territory of chronic pollution of soils with a radius of 5-10 km, and in some cases up to 60 km. Since in populated areas, the soil is constantly exposed to infection with pathogens of infectious diseases and helminthiasis. Sources of soil pollution are faeces, urine, manure, garbage, dead bodies, waste water etc. the bulk of viable pathogens is at a depth of from 1 to 10 cm and soil water enters the groundwater and surface water sources. This determines the ways of transmission through the soil environment of infectious diseases: fecal-oral, contact, air-dust. Various diseases can be transmitted through the soil: intestinal infections, anthropozoonosis, helminthosis, tetanus, mycosis and others. Soil plays a special role in the spread of helminthiasis. The faeces of a sick person and animals in the soil ejected an enormous quantity of immature eggs of helminths - roundworm, whipworm, etc. In the soil, they complete the development cycle, allowing them to acquire invasive properties, in connection with which such worms are called geohelminths. Located on the surface of the soil helminth eggs are killed by insolation and desiccation, while lying at a depth of 2-10 cm save inespo-ability to 7-10 years. For the first time, our study demonstrated the integrating role of urban fauna and the phenomenon of paralysis in the circulation of zoonotic infestation in urban areas. Was identified the dominant species of rodents in urban areas - common vole, house mouse, rat, Bank vole and the presence of pathogens of parasitic diseases rodents are dangerous to humans: Alaris; Gimenolepidoz; Heaters and Stabilizers, Sipation, Toxocariasis. Experimentally proved that invasive eggs *Toxocara cati* and *Toxocara canis*, once naturally (or artificially with oral infection)in earthworms *Eisenia fetida*, out in the intestine of the egg shells and embedded in the skin bag or stored in a mobile and invasive condition in the intestine for a long time: 75 days for *Toxocara cati* and 38 days for *Toxocara canis*. Thus, it was proved that earthworms living in soil of the urbanized territories are paramedicine masters *Toxocara* and performing, on the one hand, the role of sanitary cleaning of the soil from infective eggs *Toxocara*, on the other - are alternative sources of infection humans and other susceptible animals.

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Victoria Erofeeva[1], Olga Rodionova[1], Viktor Glebov[1]

[1]PEOPLE'S FRIENDSHIP UNIVERSITY OF RUSSIA (RUDN UNIVERSITY), ECOLOGY FACULTY, RUSSIA
EROFEEVA-VIKTORI@MAIL.RU

Abstract

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EVALUATION OF THE INFLUENCE OF ANTHROPOGENIC FACTORS ON THE ADAPTATION OF MOSCOW' HIGH-SCHOOL PUPILS

Maria Dancheva[1], Viktor Glebov[1]

[1]PEOPLE'S FRIENDSHIP UNIVERSITY OF RUSSIA (RUDN UNIVERSITY), ECOLOGY FACULTY, RUSSIA
MDANACHEVA@LIST.RU

Abstract

The complex of negative environmental factors creates great difficulties in the process of human ontogenesis, where the child-adolescent population suffers to a greater extent due to its high sensitivity to adverse anthropogenic effects.

Urbanization processes and urban enlargement are associated with environmental degradation, which is largely manifested in such a large industrial city as Moscow. The deterioration of the environment is alarming, due to the decrease in psychophysical health and mental development of the younger generation.

Organization and methods of research. Functional pupils of pupils in secondary schools of Moscow were conducted involving 233 healthy pupils 5 classes.

Depending on the complex factors that affect adolescents, the study sample was divided into 4 comparable groups: C1 - ecological conditions and social environment was not favorable, C2-ecological conditions were not favorable and favorable social; C3-ecological conditions were not favorable, but no social. C4-became a control group where environmental and social conditions were favorable.

Obtained result. A comparative analysis of the two C1 and K groups showed that C1 group showed an increase in the percentage of pupils by performance discrepancy.

The analysis of the obtained data to assess the stability of attention and mental performance of pupils in the middle classes of subgroup K showed the following results: on the effectiveness of 69.9% and 30.1% respectively; on the degree of workability - 71.1% and 28.9%, respectively; on mental stability - 69.5% and 30.5%, respectively.

Comparing C1 and K groups it was revealed that the combination of adverse environmental and social factors negatively affects the short-term memory of pupils. For example, the majority of pupils in the middle grades of C1 showed "weak" and "satisfactory" levels (18.3% and 59.1%, respectively), i.e. this subgroup showed a low volume of learning after the first presentation of incentives (short-term memory).

Conclusion. Thus, the data obtained by us show: on cognitive functions (memory, attention) and mental activity of pupils of middle classes, anthropogenic factors of the Metropolitan area have a significant impact.

When their compatibility (negative) increases the percentage of non-compliance of the performed tasks in secondary school pupils and Vice versa with the positive compatibility of social and environmental factors increases the percentage of compliance of the performed tasks in school children.

With multidirectional effects of environmental and social factors, there is a decrease in the unfavorable environment, which affects the indicators of attention and mental performance of pupils.

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FACTORS INFLUENCING THE ACCUMULATION OF HEAVY METALS IN THE SOIL

V.Glebov[1], A. Kravchenko[2], E. Solovjeva[3], E. Sarina[2]

[1]PEOPLES' FRIENDSHIP UNIVERSITY OF RUSSIA, RUSSIA, [2]K. S. KONSTANTINOVA YELETS MEDICAL COLLEGE, RUSSIA, [3]I. A. BUNIN YELETS STATE UNIVERSITY, RUSSIA
SOLOVEVAE969@MAIL.RU

Abstract

The behavior of heavy metals (HM) in the soil is influenced by soil type, acidity, organic matter content, mechanical and mineralogical composition of the soil, and sorption capacity of the soil absorbing complex (SAC), soil buffering and pH. One of the integral characteristics of the soil is buffering. It reflects the ability of soils to resist changes in properties and composition when interacting with chemicals of natural and anthropogenic origin. The processes of interaction of toxic elements with humus substance can be as follows: ion exchange, adsorption on the surface, chelation, coagulation reactions. The main products of these interactions are simple salts: humates and fulvates, as well as complex compounds. Chelated compounds of trace elements with humic and fulvic acids in soils play an important role in the formation of mobile forms, in the migration of various elements and plant nutrition. Migration ability of metals in soils due to the formation of soluble complexes with fulvic and oxycarboxylic acids. Practically insoluble and fixed compounds in the soil profile related to adsorbed complexes are formed as a result of the interaction of metals with humic acids. There are different types of plant resistance to excess TM: some accumulate high concentration of HMS, and hold the highest amount in stems and leaves. Variability of different plants to bioaccumulation TM, allows to distinguish groups: 1) elements of intensive absorption-Cd, Cs, Rb ; 2) the average degree of absorption - Zn, Mo, Cu, Pb, As, Co ; 3) weak absorption - Mn, Ni, Cr and 4) Se, Fe, Ba, Te – elements. Non-root absorption of TM from air flows occurs through the leaves by nonmetabolic penetration through the cuticle. Thus, pollution of soils and plants of TM leads to gradual and constant deterioration of ecology of human life and nutrition. Geochemical soil survey of the city of Yelets (Russia) a wide range of chemical elements, some of which are highly toxic and bio accumulates in the human body. Soils of farmlands are contaminated with man-made disasters and affect the health of the population. The region has experienced high levels of TM despite the fact that developed industrial industry including metallurgical and petrochemical is on distance more than 60 km away (Lipetsk).

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FALLEN LEAVES ANAEROBIC DESTRUCTION BY METHANOGENIC MICROBIAL COMMUNITIE

Oleh Avryliuk[1], Vira Govorukha [1], Oleksandr Tashyrev[1]

[1]D. K. ZABOLOTNY INSTITUTE OF MICROBIOLOGY AND VIROLOGY, DEPARTMENT OF EXTREMOPHILIC MICROORGANISMS BIOLOGY, UKRAINE
GAV_OLESYA@UKR.NET

Abstract

Fallen leaves (FL) in megapolises require annual treatment. The transportation of leaves to landfills is costly. Moreover, incineration of leaves leads to air pollution with carbon monoxide, soot, nitrogen oxides etc. Destruction of leaves in ecosystems takes at least three years. Such a long time of destruction is explained by the fact that the main component of the leaves - lignocellulose - is a polymer that is resistant to microbial attack. In addition, leaves on the soil surface are devoid of biogenic elements (sources of N, P, S) necessary for microorganisms carrying out the destruction of lignocellulose.

Fermentation of FL with obtaining of methane and lignocellulosic substrate (LCS), that can be used as a valuable fertilizer for soil, is the promising direction of solving the problem of leaves decomposition.

In this regard, the aim of our work was to increase the effectiveness of fallen leaves anaerobic destruction with methane and lignocellulosic substrate obtaining. Methane fermentation of leaves was shown to occur due to diversified microbial communities under the mechanism of "conversion" succession. "Conversion" succession is change in the composition of microorganisms during fermentation of available organic matter of leaves (cellulose). In this case, aerobic destructors of cellulose are substituted by anaerobic microorganisms that efficiently ferment cellulosic residues and synthesize methane (for example, methanogenic community of cattle manure).

Optimization of the composition of nutrient elements of medium provided intensive leaves fermentation. It was evidenced by CH4 appearance in the gas phase, leaves discoloration and change in the color of nutrient medium. Correlation of leaves destruction with change in the medium color from light gray to dark orange testified to the possible accumulation in the medium of humic acids, that are valuable compounds. Obtained parameters evidenced efficiency of leaves fermentation. The destruction duration (T) was only 58 days. The CH4 yield was 67 liters per 1 kg of dry leaves. The maximum concentration of synthesized CH4 was 70% after 47 days of fermentation. Coefficient of leaves destruction (Kd) was 2.5. Application of our approach provided not only rapid leaves destruction, but also obtaining of methane in high concentration. As the result of fermentation intact leaf plate was destroyed to the condition of mesh.

Obtained results are the basis for the development of effective industrial biotechnologies for destruction of leafy waste with the simultaneous obtaining of valuable products.

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FEATURES OF ADAPTATION PROCESSES OF AFRICAN STUDENTS IN THE INITIAL PERIOD OF TRAINING IN MOSCOW

Bogdan Laver[1], Kaba Fatoumata[2]

[1]INSTITUTE OF ADVANCED STUDIES, FEDERAL MEDICAL AND BIOLOGICAL AGENCY, [2]PEOPLE'S FRIENDSHIP UNIVERSITY OF RUSSIA (RUDN UNIVERSITY), ECOLOGY FACULTY, RUSSIA
LBOGDANI@MAIL.RU

Abstract

In the context of globalization, foreign students are one of the important indicators of competitiveness of the Russian higher school in the international market of educational services.

It should be noted that adaptation to the educational process of foreign students is associated with adaptation to the new climatic, geographical and social conditions. This leads to stress physiological systems of the organism, and sometimes to their failure: up to 5% of arriving students to return home because of ill health.

The analysis of the questionnaire survey of a sample of African students revealed the following environmental factors, which had a great impact on the health and adaptation of foreign students in the Metropolitan area.

The figure shows that the largest group in the study sample of African biorhythmological type were "pigeons" (morning type) and "owls" (night type), the average group data of which amounted to 40%. The remaining 24% represented the type of "larks" (mixed type).

The analysis of the obtained data of questionnaires of Russian students revealed the following biorhythmological types: 60% "pigeons" (morning type), 40% - "owls" (night type). It is interesting to note that we have not identified any biorhythmological type "larks" (mixed type).

The study showed that from September to February there was an increase in personal anxiety in African students (from 39 to 40 points). The same trend of growth of indicators among African and Russian students is marked by situational anxiety. It is visible that from September to may growth of situational anxiety made 4 points (from 40 to 44 points) at significance of differences $p<0,05$.

The study showed that from September to may there was an increase in latent reactions of African students, which amounted to 55% (238 of the largest group in the study sample of African biorhythmological type were "pigeons" (morning type) and "owls" (night type), the average group data of which amounted to 40%. The remaining 24% represented the type of "larks" (mixed type).

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Conclusion. Thus, according to the biorhythmological type, African students were dominated by" pigeons "(morning type) and" owls " (night type). The remaining 24% represented the type of "larks" (mixed type).

Evaluation of psycho-emotional state of African students showed deterioration of mental health of students from Africa, which was reflected in the growth of personal and situational anxiety in foreign students (from 39 to 40 points).

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FEATURES OF CHEMOCOMMUNICATION IN STUDENTS DURING ADAPTATION TO EDUCATIONAL ACTIVITY

Nadezhda Litvinova[1], Marina Berezina[1]

[1]KEMEROVO STATE UNIVERSITY
NADYAKEMSU@MAIL.RU

Abstract

As with most mammals, for humans, chemo signals are of great importance in social contacts (Savic, 2005; Bhutta, 2007). When the environmental conditions change (environmental and social conditions) are functional systems of man change that leads to changes in odor, which differs from the opposite sex (Ackrel, Atzmueller, Grammer, 2002; Glebov, 2015).

We conducted a study on the chemo assessment of students. The study revealed that at rest, the attractiveness of olfactory samples of girls assessed boys is higher than after the exam, as well and girls were rated the smell of boys alone as more attractive compared to the smell, collected after the exam.

Examination stress, the reality of which confirms the increase in the concentration of cortisol in saliva, led to a significant decrease in the odor attractiveness of students, girls with medium and low levels of functional capacity (LFC).

The most attractive smell after the exam was possessed by girls with high LFC ($F_{2,196}=2,05$; $P=0,13$). Girls with low LFC have the strongest smell, so at rest and after the exam, their smell is estimated as the most unattractive, and this is due to an increase in the concentration of cortisol in saliva.

Young men with high LFC received the smallest assessment of odor attractiveness both in a condition of relative rest, and during examination. The most attractive smell at rest possessed young men with low LFC, but after the exam their smell becomes less attractive ($F_{2,386}=2,1$; $P=0,12$).

Thus, the endocrine status of students, neurodynamic features and the situation of examination stress have a significant impact on the attractiveness of chemo signals.

Analysis of student performance for all 3 years of University studies showed that students with high LFC had the maximum percentage (95%) study level "good" (B) and "excellent" (A) students with low LFC had the lowest percentage (44%) study level "good" (B) and "excellent" (A).

For students with average LFC was characteristic was the average: 72% study level "good" (B) and "excellent" (A) and 10% of expelled students in the group.

Persons with high LFC more successfully coped with the processing of information compared to learners with low LFC.

This is consistent with data indicating that students with a weak nervous system have a lower score of performance and in the performance of cognitive activities signs of fatigue developing faster than the students with strong nervous system (Cristea, Restian, 1992; Litvinov, 2012; Glebov, 2017).

Thus, the studies conclude that the most stressful group are girls with low LFC and, in part, girls with medium LFC.

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FEATURES OF THE STRUCTURE OF THE COLLEMBOLA OF ANTROPIC LANDSCAPES IN VINNYTSIA (UKRAINE)

Yana Tarasiuk[1], Yuliia Ovchynnykova[1], Tetiana Kucher[1]

[1]VASYL' STUS DONETSK NATIONAL UNIVERSITY, UKRAINE
TARASIUK.I@DONNU.EDU.UA

Abstract

Nowadays, the problem of biological monitoring of soil biota state acquires of current importance. Collembola plays an important role in biogeocoenoses. They have a significant influence on the humus formation processes and are recognized as one of the advanced groups that are used to monitoring the soil block of ecosystems now. Collembola are very convenient material for studying the ecological state of soils, because they are capable of continuing their vital functions even under permanent anthropogenic influences. The objective of our work was the formation of species composition, structure and dynamics characteristics of groups of Collembola anthropic landscape of Vinnytsia by the example of Maksym Horkyi Central City Park of Vinnytsia. In 2016-2017, in the territory of the Central Park in the city of Vinnytsia, we analyzed 60 soil samples in three habitats (shore of reservoirs, oak forest plantation and flowerbed), from which 356 instances of springtails were removed, which belong to 30 species, 16 genera and 6 families. The ecologically-faunistic analysis of collembolan groups of anthropic landscapes of the Maksym Horkyi Central City Park made it possible to single out that the most numerous in the number of species in the majority of biotopes was the Entomobryidae family. Families of Entomobryidae, Kattianidae, Onychiuridae and Isotomidae are present in each of 3 biotopes in all terms of reference. Odontellidae (Axenyllodes bayeri) and Sminthurididae (Sphaeridia gr. Pumilis) are represented by one species. In the studied biotopes, the dominants included P. alba, I. sp1, Isotoma sp. of. anglicana, Sminthurinus sp.; the subdominants included Isotoma notabilis, Lepidocyrtus cyaneus, Pseudosinella sp. in all terms of accounting.

In the studied biotopes, the highest average population density of collembolan is recorded on the shore of the reservoir - 3644 instances / m2.

For collembolan groups majority of considered by us areas are characterized by the domination of the number of species and abundance of topoplast biomorphs, which is characteristic of natural groups of western and central Ukraine.

The structure of collembolan groups of investigated areas is represented by 4 groups of hygroperferentium species: xeroresistant, mesophilic, xero-mesophilic, hygro-mesophilic. The most diverse group of xeroresistant species is presented. A group of hygro-mesophiles includes one species - a species of Sminthurinus niger. In the dynamics of groups of hygropreferentiums throughout the study period it should be noted the dominance in 2016 on the shore of the reservoir and in the oak forest plantations of mesophilic species, and in the flowerbed - xeroresistant. In 2017, in all three biotopes, a group of xeroresistant species predominated.

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FUNGI IN MAZE CORN USED FOR ANIMAL FEED

Aurimas Krasauskas[1]

[1]*ASU, AGRONOMY FACULTY*
AURIMAS.KRASAUSKAS@ASU.LT

Abstract

The objects of investigation were maize corn taken in 5 different fields of private Lithuanian farms in 2016 and 2017. Corn samples were taken directly from the field before harvesting. Moisture of the samples was measured by a mobile thermohygrometer „Wile 35“. Quantitative grain contamination by fungal propagules (fungal propagules = cfu = colony forming unit) was determined by dilution method. Serial decimal dilutions up to 10−3 were made and 0.1 ml aliquots were inoculated in triplicate onto Sabouraud glucose agar medium with chloramfenicol (0,5 g l-1). Results of this study showed that the moisture content in the corn varied from 26,5 to 31,0 %. Due to late ripening and unfavourable meteorological conditions the contamination of corn by fungi propagules was from 4,4 ×103 cfu/g to 5,7 ×103 cfu/g. Fungi were identified according to morphological and microscopic characteristics. The DM750 optical microscope system with the ICC50 HD camera from Leica Microsystems was used. A total of 8 different fungal genera (Absidia spp., Aspergillus spp. Alternaria spp., Chrysosporium spp., Cladosporium spp., Fusarium spp., Mortierella spp., and Penicillium spp.) and 17 species were isolated. Fungi of Alternaria and Fusarium genera were prevailing.

The aim of this work was to investigate contamination levels of maize corn by fungi propagules and composition of fungi species.

Keywords: Maize, corn, contamination, fungi

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GENETIC DIVERSITY ANALYSIS OF LITHUANIAN HOUNDS

Ugnė Kaminskaitė[1], Vaida Tubelytė[1], Vykintas Baublys[1], Algimantas Paulauskas[1]

[1]DEPARTMENT OF BIOLOGY, VYTAUTAS MAGNUS UNIVERSITY, KAUNAS, LITHUANIA
UGNE.KAMINSKAITE@STUD.VDU.LT

Abstract

Lithuanian hound is the oldest national dogs breed in Lithuania from Vytautas Magnus times in XIII century. It was almost extinct when Lithuanian cynologist Z. Goštautas recreated this breed with the rest 5 dogs in 1957-1958. Today we have about 600 Lithuanian hounds, but they aren't accepted by FCI (Federation Cynologique Internationale), as it needs at least 1000. Moreover, some of them do not match breed standard. The most important issue is high inbreeding coefficient inside breed (2,09 %), detected in 2008. Analysis of individual genealogy of registered dogs shows high relatedness across individuals and lack of genetic variability inside breed. High relatedness is the consequence of progenies deaths, large receptivity of pathogenic microbes and mammary gland tumors diagnoses. In order to save Lithuanian hound gene pool genetic analysis must be done instead of pairing dogs by exterior. The aim of this study was to investigate genetic structure of Lithuanian hounds. Buccal swab samples were collected from 63 dogs, during National Lithuanian hound exhibition in 2017. DNA was extracted by using silica spin columns and was used for short tandem repeat (STR) analysis. Data obtained during this study correlates with genealogical analysis data and shows lack of genetic variability inside Lithuanian hound breed.

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GEOMETRICAL STANDARDS IN SHAPES OF AVIAN EGGS

Mytiai I.[1], Serebryakov V.V.[2], Strygunov V.I.[3]

[1]NATIONAL UNIVERSITY OF LIFE AND ENVIRONMENTAL SCIENCE, KYIV, UKRAINE, [2]TARAS SHEVCHENKO NATIONAL UNIVERSITY IN KYIV, UKRAINE , [3]STATE PEDAGOGICAL UNIVERSITY IN KRYVYI RIG, UKRAINE
OOMIT99@UKR.NET

Abstract

Modern oology is characterized with collection of huge quantity of data and has many different modern mathematical methods of egg descriptions, but has no unified system which use adequate name of egg shapes followed with certain geometrical figure and algebraic formula for today. Absence of strict world system of standards does not allow the egg shape description properly and prevents option to look for dependence between shape and biological meaning of it. Beside this the no generalization of oological data made by different authors is possible. So we made an attempt to solve the problem by uniting some modern methods in one system which allows to present the diversity of all bird egg forms in geometrical etalons taken from single geometrical figure – ovoid. The computer program which analyses digital egg pictures was worked out in order to solve the problem. The program makes measurements of 4 independent parameters which are needed for egg description: length, diameter and 3 radius of egg shell curvature of "sharp", "flat" and lateral sides. It calculates egg surface and volume. So 16491 eggs of 822 species of 24 orders of the world avifauna were analyzed. Due to geometrical characteristics of ovoid we established the system of bird's egg shape standard, which were given the name, the digital code, geometrical figure and proper algebraic equation. The system of standards possesses all characteristics of natural system as it goes from single figure and all egg shapes are interconnected. The egg shape names correspond to mathematical terminology. Adopting this system as a standard the ornithologists will be able to set the oological studies on considerably higher level.

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IMMUNOCORRECTION WITH LIOPHILIZED LEUKOCONCENTRATE OF CORD BLOOD IN TREATMENT OF EXPERIMENTAL ATOPIC DERMATITIS

Anna Koval[1], Ludmila Ostankova[1], Nikolay Bondarovich[1], Ekaterina Yampolskaya[1], Anatoly Goltsev[1]

[1]INSTITUTE FOR PROBLEMS OF CRYOBIOLOGY AND CRYOMEDICINE OF THE NATIONAL ACADEMY OF SCIENCES OF UKRAINE, DEPARTMENT OF CRYOPATHOLOGY AND IMMUNOLOGY, UKRAINE
ANNA.KONST1204@GMAIL.COM

Abstract

The problem of atopic dermatitis (AD) is extremely important due to a high prevalence and steady growth of this disease in adults and children. Secondary infection, which is chronic and recurrent, on the background of the state imbalance of local and systemic immunity during development of AD is an indication for treatment of this disease of various types by immunomodulators. In this research, the leukoconcentrate of human cord blood (LHCB) was used as an immunocorrector, which, as previously shown in our studies, has a pronounced versatile immunomodulating activity. The research aim was to evaluate the immunomodulating activity of lyophilized LHCB during treatment of AD. Materials and methods. The experiments were performed in 6-month-old Wistar rats, weighing 180-200 g. Atopic dermatitis was initiated by rubbing 5% alcohol-acetone solution of dinitrochlorobenzene into the skin for 21 days. LHCB was lyophilized according to Goltsev A.N., et al. (2016). The rats were divided into the groups: 1 – intact (control); 2 – with AD; 3 – AD+Prednisolone; 4 – AD+ cLHCB by 0.5 ml, 5*106 cells; 5 – AD+lLHCB of the same volume. Evaluation of cellular and humoral components of immune system and monocyte macrophage system in rats was performed to the 3rd, 7th, 14th and 21st days prior to and after treatment. A number of CD3+, CD4+, CD8+, CD25+ cells in spleen was determined by cytofluorimetry (FACS Calibur (BD, USA)), MAT (BD, USA). Results of the study. The obtained data enabled to conclude that application of lLHCB, as well as cLHCB, correlated, although to different extents, pathology modified indicies of all the evaluated components of immune system. Normalization of indices of cytokines level IL4, IL10, IFN-γ, immunoglobulin IgE, circulating immune complex as well is significant. Conclusions. The data of experimental study showed that lLHCB and cLHCB obtained with cryobiological technologies had a pronounced immunomodulating effect during treatment of experimental AD that opens the prospect of application of lyophilized biopreparation of cord blood in clinical practice.

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IMPACT ASSESSMENT OF THE ACOUSTIC IMPACT ON THE PSYCHOFUNCTIONAL STATE STUDENTS

Mary Pitkevich[1], Gennady Arakelov[2], Viktor Glebov[1], Van Radysh[3]

[1]PEOPLE'S FRIENDSHIP UNIVERSITY OF RUSSIA (RUDN UNIVERSITY), ECOLOGY FACULTY, RUSSIA, [2]M.V. LOMONOSOV MOSCOW STATE UNIVERSITY, RUSSIA, [3]PEOPLES' FRIENDSHIP UNIVERSITY OF RUSSIA, RUSSIA ASKLEPIYA@GMAIL.COM

Abstract

Harmful and dangerous factors of the environment affecting the person include noise pollution including: audible noise, ultrasound, and infrasound.

Experts in the field of hygiene and human health note that the allowable noise level in the premises of educational institutions should not exceed 40 dB. Violation of sanitary norms can often have a negative impact on the psychophysical development of a person. To reveal the level of acoustic influence, which can be manifested during the academic day, the academic week in the process of the educational process of higher school students on the example of RUDN students became our starting point of the study.

The research was conducted at the lecture and practical classes of students in halls, corridors and library of the Russian University of friendship of peoples. Noise measurements were carried out by the device "Ekofizika-110A". The sound level meter was located in the center of the room where the classes were held. The classrooms were located in the Central building (Mikluho-Maklay St., 6). The acoustic exposure level was measured every 5 minutes during the study period. The total number of students surveyed was 122 people aged 18.3 to 19.4 years. The study was conducted during the week from 9-00 to 17-00 hours. The obtained data were analyzed using student's T-test.

The study showed that the average noise level changed during the school day. So on the 1st pair it made 67,4 dB, on the 2nd-68,1 DB, on the 3rd — 69,8 DB, on the 4th-66,4 DB, i.e. the maximum of noise was observed on the 3rd pair.

The study of noise during the week showed on Monday was recorded 63,6 dB, Tuesday — 65,4 dB, Wednesday — 68,8 dB, Thursday — 69,8 dB, Friday — 72,9 dB.

The obtained data show high levels of acoustic impact from the noise of students in the halls during changes (75.9 dB) and the noise of the sounding call on the Mikluho-Maklay street (93.4 dB). So questionnaire survey of students of the 2nd year (n=122) showed frequent complaints about noise, which were expressed in a sense of irritation, fatigue, headache.

The study did not reveal a reliable relationship between the noise level and the size of the room. There were also no significant differences between the number, gender and age of participants and the level of noise measurement.

Thus, the following conclusions can be drawn.

1. There is a tendency to increase the noise level from the beginning to the end of the lesson, from the 1st to the 4th pair, and from Monday to Friday.

2. There was no reliable correlation between noise level during training sessions, number of people, age and room parameters.

3. The average noise level in the classroom of students is almost 68 dB RUDN, i.e. exceeds the permissible rate of about 1.7 times.

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INFLUENCE OF ENVIRONMENTAL POLLUTION ON CORYLUS AVELLANA L. POLLEN MORPHOLOGY

Nataliia Nikolaieva[1], Olga Grygorieva[2]

[1]DEPARTMENT OF GENETICS AND PLANT BREEDING, SLOVAK UNIVERSITY OF AGRICULTURE IN NITRA, SLOVAK REPABLIC, [2]M.M. GRYSHKO NATIONAL BOTANICAL GARDEN, UKRAINE
N.NIKOLAEVA709@GMAIL.COM

Abstract

Pollen is under a lot of pollution pressure of the environment. Uncontaminated pollen occurs very rare. Morphology and anatomy of normal and abnormal pollen grains represent a great variety between different plant species. The object of our study is Corylus avellana L. pollen. Samples were prepared during flowering period at the territory of M.M. Gryshko National Botanical Garden (Kyiv). M.M. And it is under the influence of industrial, transport, recreational load. The main enterprises-polluters are located at a distance of 500 to 1600 m from the garden boundaries. These facts guided us on the preparation of pollen C. avellana, as an object for environmental monitoring. Pollen samples were collected from three monitoring areas: control – relatively clean area without contamination, not exceeding ecologically acceptable standards; area is contaminated by vehicles and area with different contamination types. Five pollen samples of C. avellana from each genotype were observed on monitoring areas. Morphological studies have been done by using scanning electron microscope SEM Carl zeiss LS 15 (USA) at the Institute of Biodiversity Conservation and Biosafety, Slovak University of Agriculture in Nitra. Measurements have been done by software AxioVisionRelease 4.8.2.0. Pollen grains were characterized the follow parameters: pollar axis, equatorial axis, diameter of aperture, shape index. Fertility was defined with acetocarmine solution.

At the control area polar axis is from 19.59 to 30.81 μm; equatorial axis is from 23.01 to 34.25 μm; diameter of aperture from 1.68 to 4.25 μm; Shape index from 0.63 to 1.14. At the area with vehicles contamination polar axis is from 17.95 to 31.02 μm; equatorial axis is from 17.38 to 35.17 μm; diameter of aperture from 1.54 to 6.62 μm; shape index from 0.62 to 1.40. At the area with different contamination types polar axis is from 18.28 to 30.44 μm; equatorial axis is from 19.76 to 34.21 μm; diameter of aperture from 1.94 to 4.92 μm; shape index from 0.64 to 1.37. Abnormal pollen was defined during C. avellana pollen studding. Pollen abnormality appearance in shape disruption. Percent of abnormal pollen grains depends on degree of pollen: for control area – the average mean 2.90%, for area with vehicles contamination is 4.74%, for area with different contamination types is 3.26%. There is a high rate of C. avellana fertility at all monitoring areas: control area – 96.64%, area with vehicles contamination – 77.18%, area with different contamination types – 98.18%. That's way, anthropogenic load had no enough influence on ability to fertilize C. avellana pollen grains at these territories. Genotypes from area with vehicles contamination and area with different contamination types have the similar morphological parameters.

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INFLUENCE OF JOINT USE OF HYDRATED FULLEREN C60 AND SUSPENSION OF *SPIRULINA PLATENSIS* CELLS ON LIPID PEROXIDATION DURING AGING

Mykhailo Goloiad[1], Oksana Falko[1], Tatyana Ovsyannikova[2], Olga Lipina[1], Alina Kovalenko[2], Viktor Chyzhevskiy[1]

[1]INSTITUTE FOR PROBLEMS OF CRYOBIOLOGY AND CRYOMEDICINE OF THE NATIONAL ACADEMY OF SCIENCES OF UKRAINE, 23 PEREYASLAVSKA STR., 61016, KHARKIV, UKRAINE, [2]V.N. KARAZIN KHARKIV NATIONAL UNIVERSITY. 4 SVOBODY SQUARE, 61022, UKRAINE
O.V.FALKO@GMAIL.COM

Abstract

Population aging is a serious demographic problem in Europe. It is known that one of the main causes of aging of an organism is the oxidative destruction of proteins, lipids and nucleoproteins. Therefore, the search for biologically active substances with antioxidant properties is particularly relevant. The blue-green microalgae *Spirulina platensis* is widely used as a product with an antioxidant effect (Mazokopakis E.E., 2014; Hasler, C.M., 2002). A number of authors also indicate the antioxidant properties of hydrated C60 fullerene [Gharbi N. at al, 2005]. Therefore we attempted to investigate the possible synergistic effect of the combined use of hydrated fullerene C60 and *Spirulina platensis* on accumulation of lipid peroxidation (LPO) products in liver of rats of various ages.

The experiments were performed in Wistar white rats aged 7 and 24 months. It has been established that in the mitochondria of the liver of both young and aged animals receiving only fullerene C60, the level of both the primary products of LPO-diene conjugates (DC) and later products of LPO-triene conjugates (TC), oxodiene conjugates (ODC) in comparison with the control. This may indicate the ability of hydrated fullerene C60 molecules to alter the structural ordering of the hepatocyte membrane, facilitating the access of oxygen to deeply located polyunsaturated aliphatic bases. It can be concluded that the introduction of the solution of hydrated fullerene C60 at a concentration of 10-9 within 30 days enhances the prooxidant status of liver mitochondria in both young and aged animals if compared with the control.

In groups of rats of different ages received only *Spirulina platensis* for 30 days, there was no significant change in the level of LPO products in mitochondria of the liver versus the control and to the animals receiving only C60 fullerene. However, there was a tendency to DC level decrease the relative to control (2.99 ± 0.96 vs 3.32 ± 1.12 nmol/mg protein).

Co-administration of fullerene C60 and *Spirulina platensis* contributed to a reduced accumulation of LPO primary products in mitochondria of rat's liver if compared to the animals receiving only fullerene C60, especially in the group of young rats.

Now the free-radical processes in the body are considered not only as resulted into a pathology, but also as having a regulatory role. Therefore, the joint use of antioxidant substances composing Spirulina platensis and fullerene C60, having the properties of a structural modifier of the lipid bilayer of membranes, can outline the non-standard approaches to correct the pathological processes of an aging organism. However, this assumption requires further profound studies.

Keywords: hydrated fullerene C60, *Spirulina platensis*, antioxidant system, lipid peroxidation.

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INFLUENCE OF LED LASER IRRADIATION ON MITOTIC ACTIVITY OF ROOTS MERISTEM OF ZEA MAIS L.

Yurii Prysedsky[1], Svitlana Hutianska[1], Ivan Bohutskyi[1]

[1]VASYL' STUS DONETSK NATIONAL UNIVERSITY, UKRAINE
YU.PRYSEDSKYI@DONNU.EDU.UA

Abstract

For the improvement of growth and productivity of plants used various natural and artificial growth activators (auxins, gibberellins and others), out root signup, irradiation of seed by the hertzian waves of high-frequencies, use of coherent monochromatic radiation of helium-neon lasers.

Investigated the influence of irradiation of seed coherent monochromatic light of red (635 nm) and blue (405 nm) ranges on mitotically activity of roots apical meristem of *Zea mais L*. Monochromatic rays got by means of light-emitting-diode lasers of power 100 mWt. Irradiations conducted on the variants of complete factor experiment: (var. 1) without irradiation; (var. 2) 5 sec 635 nm; (var. 3) 10 sec 635 nm; (var. 4) 5 sec 405 nm; (var. 5) 5 sec 635 nm + 5 sec 405 nm; (var. 6) 10 sec 635 nm + 5 sec 405 nm; (var. 7) 10 sec 405 nm; (var. 8) 5 sec 635 nm + 10 sec 405 nm; (var. 9) 10 sec 635 nm + 10 sec 405 nm.

The amount of mitotically divisions in counterfoils determined on a 6 twenty-four hours after landing in double-dish on a filtration paper. For research were used the temporal pressed microslides that was made from counterfoils preliminary of fixed during twenty-four hours in 45 % acetic acid and painted out by acetocarmine.

Undertaken studies allow to draw conclusion about the considerable stimulant effect of irradiation of seed red and blue lasers on mitotically activity of apical meristems cells of plantlets. So, the irradiation of seed by red laser during 5 sec (var. 2) caused the increase of amount of Z. mais cells, that were in the phase of the mitotically dividing into 162,5 % comparatively with the plants grown from the non-irradiated seed (var. 1). At the terms of irradiation of seed by red light during 10 seconds (var. 3) a positive effect went down on mitotically activity. In variants with the complex irradiation of seed by red and blue lasers (var. 5, 6, 8, 9) depending on the term of treatment of seed amount of cells, that were in the stage of mitotically division exceeded the corresponding index of the plants grown from the non-irradiated seed on 43,8-150,1 %. Thus, a maximal effect was observed for the actions of blue light during 10 sec (var. 8 and 9). At these terms the amount of mitotically divisions in the radiation-exposed plants presented 243,5 % and 250,1 % from control.

Thus, the results of researches testify to the considerable positive effect of laser irradiation on mitotically activity of roots meristems. By the consequence of activating of mitosis in cells of roots can be the stimulator of their growth that matters very much forming of more developed plants acceleration. The credible mechanism of increase of mitotically activity can be activating of receptor proteins – phytochromes (short red light) and flavoproteins (blue light).

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INFLUENCE OF LYOPHILIZED LEUCOCONCENTRATE OF HUMAN CORD BLOOD ON MANIFESTATION OF ENDOGENOUS INTOXICATION IN MODELLED ACUTE PURULENT PERITONITIS

Kyrylo Goltsev[1], Maksym V. Ostankov[1], Yulia A. Gaevskaya[1], Lyudmyla V. Ostankova[1], Igor G. Grysha[1]

[1]INSTITUTE FOR PROBLEMS OF CRYOBIOLOGY AND CRYOMEDICINE OF NATIONAL ACADEMY OF SCIENCES OF UKRAINE, UKRAINE
MAXOST68@GMAIL.COM

Abstract

Endogenous intoxication is often accentuated among the leading mechanisms of development of many severe pathologies, different in their origins with the involvement of an infectious disease, including peritonitis. In its development, such factors as endogenous intoxication, disturbance of the state of biological barriers and immune system are crucial. Treatment of endogenous intoxication on the background of these changes in peritonitis complicating its course is one of the most complicated and urgent problems of modern medicine. We studied a lyophilized cord blood leucoconcentrate (LCBLC) to treat an acute purulent peritonitis (APP).

The research aim was to assess the possibility of using the LCBLC to treat the APP.

Materials and methods. The experiments were performed in Wistar rats of 6 month age, weighing 180-200 g. Peritonitis was simulated by initiation of the necrotic inflammation focus by ligation of the appendix and placing it freely in the abdominal cavity (AC). Relaparotomy with sanation of AC with a furacilin solution was performed 24 hrs later to all the rats that were divided into 5 groups: 1 - intact (control); 2 - APP; 3 - APP + ampicillin in a dose of 40 mg / kg of body weight; 4 - APP + LCBLC in a volume of 0.3 ml (5-6*106 cells); 5.APP + LCBLC in the same volume + ampicillin.

The state of cell and humoral immunity links, monocyte macrophagal system and clinical blood tests in rats was assessed to days 3, 7, 14, and 21 prior to and after treatment. The content of T-reg, CD3+, CD4 +, CD8 +, CD16 +, CD25 +, CD72 + spleen cells was determined by flow cytometry (FACS Calibur (BD, USA)).

Results of the study. The obtained data allowed us to conclude that the use of LCBLC caused a versatile correction of the impaired by pathology parameters of all the links of immunity. The most significant was the restoration of the function of T-reg (CD4+CD25+) subpopulations, T-helpers (CD4+) and T-suppressors/cytotoxic (CD8 +), normalizing IRI, immunoglobulin content, decreasing the content of circulating immune complexes, increasing the function of macrophage system cells.

Conclusions. Therapeutic efficiency of using the LCBLC as a correcting agent of immune system, endogenic intoxication, impaired metabolic activity leading to increased survival of animals during the development of APP has been experimentally confirmed.

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INTEGRATED IMPACT OF CLIMATE AND ENVIRONMENTAL CHANGES TO THE PRODUCTIVITY, BIODIVERSITY AND SUSTAINABILITY OF AGRO-ECOSYSTEMS

Romualdas Juknys[1], Arvydas Kanapickas[1], Jūratė Žaltauskaitė[1], Gintarė Sujetovienė[1], Irena Januškaitienė[1], Giedrė Kacienė[1], Austra Dikšaitytė[1], Rimantas Velička[2], Aušra Marcinkevičienė[2], Zita Kriaučiūnienė[2], Jūratė Aleinikovienė[2], Ilona Vagusevičienė[2], Robertas Kosteckas[2]

[1]VYTAUTAS MAGNUS UNIVERSITY, KAUNAS, LITHUANIA , [2]ALEKSANDRAS STULGINSKIS UNIVERSITY, STUDENTU STR. 11, KAUNAS, LITHUANIA
ROMUALDAS.JUKNYS@GMAIL.COM

Abstract

Agro-ecosystems along with elevated concentration of green-house gases and ongoing global warming are also affected by other climate change related factors such as droughts, heat and cold waves. Simultaneously they experience impact of different environmental stressors – ground level ozone, eutrophication and others. To investigate interaction of these factors and their integrated impact is one of the most actual and complicated tasks for environmental and agricultural science. It is very important that integrated impact of these factors already started to pose threat not only to separate compounds of agro-ecosystems but to their sustainability in general.

According to the project not only impact of climatic and environmental changes to different species are investigated but also their biological interaction – crop-weed competition, symbiotic and allelopathic relations. Changes in efficiency of fertilizers and chemical and non-chemical weed control measures under warming climate as well as changes in the rate of soil mineralization, humification and carbon sequestration are also investigated. To acquire new knowledge on long-term consequences of climate change impact to agro-ecosystems, the main regularities and mechanisms of their response is an important aim of this project. On the basis of obtained knowledge it is foreseen to present long term projections of productivity of agro-ecosystems and recommendations for the optimization of measures for their long lasting sustainability. Financial Support: This research was funded by a grant (No. SIT-8/2015) from the Research Council of Lithuania.

Key words: winter rapeseed, non-chemical weed control, biological preparations, weeds, seed yield.

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INVESTIGATION THE EFFECT OF LASER IRRADIATION ON THE GROWTH CHARACTERISTICS OF PLEUROTUS OSTREATUS (JACQ.) P. KUMM

Kateryna Reshetnyk[1]

[1]VASYL' STUS DONETSK NATIONAL UNIVERSITY,UKRAINE
K.RESHETNYK@DONNU.EDU.UA

Abstract

Pleurotus ostreatus is the second most cultivated edible mushroom worldwide after Agaricus bisporus. It is an important source of obtaining natural pharmacological substances of oncostatic, antiviral, immunomodulatory, anti-sclerotic, tonic and other actions (Cohen et al. 2002).

Light is one of the main morphogenetic factors for growth and development of many cultivated mushrooms it was proved. However mechanism of photoreception in mycelium have been studied insufficiently. Today the light of the visible part of a spectrum is used in technologies of cultivation of fungi.

Laser techniques have also found practical application in biotechnology, and are one of the most dynamically developing fields of investigations (Poyedinok, 2013).

An advantage of laser radiation is the chance to create high light brightness in a narrow range of wavelengths, not achievable with usual noncoherent light sources.

The purpose of our research was to study the influence of laser irradiation on the growth parameters of the Pleurotus ostreatus (Jacq.) P. Kumm.

In this experiment, strains P-6v (Pleurotus ostreatus), P-191(Pleurotus ostreatus), and P-154 (Pleurotus ostreatus) from the Culture Collection of the Department of physiology and biochemistry of plants of the Vasyl' Stus Donetsk National University were used. With order to stimulate the growth of mycelium of the strains examined, they were scanned by a ray of an LED blue laser with a wavelength of 405 нм or a ray of red laser with a wavelength of 650 нм. The treatment was performed once for 10 seconds.

Dicaryotic mycelium was maintained on malt extract agar (MEA) medium using well-known methods. Inoculation was executed by a piece of mycelium on agar media in the center of the Petri dish and then incubated at a temperature of 26 ºC.

As a result of our research, the following was established. Mycelial growth of Pleurotus ostreatus on agar medium (a daily average accretion) in variants irradiated by different light spectra reliably do differ from the control. Irradiation promotes the formation of higher and more dense mycelium than with the control. In the experiment, the growth coefficient of the irradiated culture is 2.1-2.9 times higher than in the control. In Pleurotus ostreatus the daily average growth of the irradiated mycelium as well as its density and height are reliably higher in both variants of the experiment (red and blue light). So the growth of irradiated cultures is 2.1-3.5 times higher than in the control.

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LASER INFLAMMATION INFLUENCE ON GROWTH AND BIOSYNTHETIC PARAMETERS OF CAROTYNSINTEZING BASIDIOMYCETES

Anastasia Shelest[1], Velygodska A.K.[1]

[1]VASYL` STUS DONETSK NATIONAL UNIVERSITY, FACULTY OF BIOLOGY, UKRAINE
SANALESST@GMAIL.COM

Abstract

The search for the new sources of these biologically active substances, including mycological objects, is underway. However, nowadays, there is insufficient knowledge about the qualitative and quantitative content of carotenoids in basidiomycetes and mycelium and culture filtrate during their cultivation, which makes further screening essential while working in this direction. Proceeding from this goal, the study conducted researching the ways to increase the biosynthetic activity of carotenoids of the basidiomycetes *Laetiporus sulphureus* by finding the most productive strain, determining the cultivation optimal conditions and the effects of various light radiation spectra. Having been provided screening of accumulating biomass and dynamics of total carotenoid content in three strains of basidiomycete *Laetiporus sulphureus* isolated from wild carpophores: Ls-0917, Ls-0918, Ls-0919. The total carotenoid content was determined in the alcohol extracts of the mycological material by spectrophotometric method and calculated according to the Wettstein's formula. The level of absolutely dry biomass accumulation was determined by the standard mycological methods. According to the daily gain index, mycelium follows the strain Ls-0919 with its maximum value on the 8th day of cultivation. Studies of carotenoid content have shown that cultures can accumulate them throughout the entire period of cultivation. Following studies were conducted with the use of Ls-0917 strain. The study of the various light spectra influence on the accumulation of radial biomass growth and the biosynthesis of carotenoids *L. sulphureus* were carried out using lasers with different lengths of 405 nm (blue spectrum), 532 nm (green spectrum) and 650 nm (red spectrum), each 100 mW. According to the daily radial mycelium growth index, the strain irradiated with the red monochromatic light with its maximum value on the 4th day of cultivation is leading. Screening results of absolute dry biomass accumulation, carotenoids in mycelium and in the culture filtrate were carried out on the 15th day of cultivation. The maximum biomass accumulation was observed on the 15th day for strains irradiated with the both green and blue monochromatic light. The strain irradiated with the green spectrum of monochromatic light showed the best result of the carotenoids accumulation in the mycelium. Irradiation with the red monochromatic light during the studies of carotenoids in the culture filtrate showed the best result. Summarizing, the studies having been carried out, prove the possibility of a positive irradiation effect of certain spectra of monochromatic light cultures on the carotenoids synthesis in the mycelium of investigated strains.

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LEVEL OF ACCUMULATION OF HEAVY METALS IN PLANTS ON DARK CHESTNUT SOILS OF THE REPUBLIC OF KAZAKHSTAN

Danara Askarova[1], Viktor Glebov[1]

[1]PEOPLES' FRIENDSHIP UNIVERSITY OF RUSSIA (RUDN UNIVERSITY), ECOLOGY FACULTY, RUSSIA
DANARA.84@MAIL.RU

Abstract

Coal combustion makes a significant contribution to the overall state of environmental pollution, which has a great impact on vegetation and human health. In this regard, we set a goal-to determine the phytotoxicity of dust emissions of burnt coal fuel, as well as the accumulation of Pb and Cd in the organs of test - culture seedlings Pisum sativum L.

The obtained results showed that the humus content in the background soil is made up 1.23%, physical clay and 8.7%, pHwater - 7,11, clay fraction and 4.9%, ECO – 9.1 m-eq/100 g At the gradation of V.B. Il'in studied the soil according to the degree of buffering is average.

In the initial soil, the gross Pb content was 22 mg/kg, Cd– 0.73 mg/kg.

We noted that the forms of Pb compounds in the background soil were characterized by the following decreasing series of their compounds:

- acid-soluble (6.1 mg/kg) > metabolic (2.8 mg/kg)>water-soluble (0.5 mg/kg);
- for Cd: acid-soluble (0.09 mg/kg) > metabolic (0.06 mg/kg)>water-soluble (0.01 mg/kg).

The results of dust studies have shown that the gross content of Pb is 33.0 mg/kg, Cd – 4.8 mg/kg, exceeding Clarkpb in the lithosphere by A.P. Vinogradov (16.0 mg/kg) 2.1 and Cd - 36.9 times (0.13 mg / kg).

According to the results of our research, it turned out that the accumulation of Pb and Cd in the organs of seedlings Pisum sativum L. is acropathic, that is, the content of the studied chemical elements in the roots of seedlings is higher than in the aboveground part. Thus, the concentration of Pb in the roots of the experimental seedlings in these doses was 1.6-2.1 times higher and Cd – 3.3-1.3 times higher than in the aboveground part.

The removal of chemical elements of the test culture objectively reflects the ability of the metal to biological transformation. The removal of Pb and Cd above-ground organs of Pisum sativum L. seedlings during the introduction of 0.1% dust in soil was 0.02 and 0.004 mg/vessel at 0.5% - 0.04 and 0.006 mg/vessel, at 1.0% - 0.06 and 0.03 mg/vessel, with 5,0% - 0,1 and 0.04 mg/container, at 10.0 percent compared to 0.11 and 0.05 mg/vessel and at 15.0% to 0.13 and 0.08 mg/vessel, respectively, 1.8 and 4.4; 3.6 and 6; 5.5 30; 9.1 and 40; 10 and 50; 11, 8 and 80 times greater in comparison with the control variant (is 0.011, and 0.001 mg/vessel).

Conclusion. The following conclusions can be drawn from the results.

1. When dust was introduced into the soil at doses of 0.1-15.0% of the sharp increase in the gross content of Pb and Cd in the soil was not observed.

2. The accumulation of Pb and Cd experienced by the seedlings is acropetally character.

3. The phytotoxic effect was not observed, as the biomass increased by 36.3% compared to the control experience.

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MASS OCCURRENCE OF DOWNY LEAF SPOT OF WALNUTS IN MONTENEGRO IN 2017

J. Latinovic[1], N. Latinovic[1]

[1]UNIVERSITY OF MONTENEGRO, BIOTECHNICAL FACULTY, PODGORICA, MONTENEGRO
JELENALAT@AC.ME

Abstract

Walnut (*Juglans regia L.*) until recently was not grown in plantations but as individual trees near houses or in orchards together with another fruit trees. However, in recent years walnut plantations were set up to grow walnut commercially. In 2017 a plantation near Mojkovac (northern part of Montenegro) was checked twice in July and September. This seven year old plantation consisted of 200 walnut trees (150 trees of cv. Sampion and 50 trees of cv. Rasna). In all trees symptoms of downy leaf spot were noticed. Some of the trees had 60-70% symptomatic leaves.

Symptoms appeared on the upper and on the underside leaf surface. On the upper side of the leaves there were pale yellow irregular spots while opposite of these spots on the underside leaf surface whitish polygonal fungal fructification was noticed. Spots were usually 1-2 cm in size, located along the leaf veins. If spots merged necrotic blotches appeared with surrounded leaf tissue turned yellow. The infected leaves may prematurely fell down.

Morphological characteristics of the fungus were examined under light microscope. Native preparations were made from fresh walnut leaves. Microscopic analysis revealed hyaline, one-celled, ovoid to spindle-form conidia, small, with average size of 7,35 × 2,45 µm. Symptomatic plant material is preserved in the Plant Pathology Herbarium at the Biotechnical Faculty in Podgorica, Montenegro. Based on symptoms, host plant, fungal conidia and literature data (1, 2), the pathogen has been identified as *Microstroma juglandis* (Berenger) Sacc.

In Montenegro downy leaf spot of walnuts was recorded in 1950 by Mijušković (3). Considering the disease intensity in 2017 and growing importance of walnut, further studies on Microstroma juglandis in Montenegro are required.

Key words: downy leaf spot, Microstroma juglandis, walnut, Montenegro

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MECHANISMS OF ACTION TRIAZINONE OF PESTICIDES ON THE ENVIRONMENT

Viktor Glebov[1]

[1]*PEOPLE'S FRIENDSHIP UNIVERSITY OF RUSSIA (RUDN UNIVERSITY), ECOLOGY FACULTY, RUSSIA*
VG44@MAIL.RU

Abstract

Wide application worldwide, as herbicides, found a number of triazine herbicides. Triazines are heterocyclic compounds, the structural basis of which is a six-sided aromatic cycle with three nitrogen atoms. In practice, symmetrical triazines (SYM triazines) with nitrogen atoms in positions are mainly used.

The widespread use of SIM triazines as pesticides began in the mid-1950s. They are used to control weeds, some members of this group exhibit fungicidal and insecticidal properties. In practice, the protection of agricultural plants used herbicides to control annual dicotyledonous and monocotyledonous plants. So atrazine, for example, performed well against the Highlander vunamoga, field mustard and other weeds.

Simazine. Simazine refers to herbicides continuous action, as atrazine, inhibiting photosynthesis of weeds. In the soil, its activity is maintained for 2-7 months after spraying. Simazine is currently banned in the European Union (EU directive 91/414/EEC). Simazine affects the function of the Central nervous system, to a lesser extent on peripheral blood.

Atrazine. Half-life of atrazine in soil lasts from 13 to 261 days. In 2004, atrazine was banned in the European Union because of its persistent groundwater contamination. However, atrazine remains one of the most popular herbicides, and is used in more than 80 countries around the world.

Prometryn in the soil inactive. Microbial decomposition occurs with the oxidation of the methylthio group to the hydroxy metabolites. The soil remains active for an average of 50 days Propazin mobile in soil, microbial degradation occurs, with hydrolysis of the chlorine atom and obtaining hydroxypropane. In the soil remains active on average 80-100 days. Simazine in the soil are active on average for 49 days. In all conditions, the main metabolites of the pesticide are diethylsilane and hydroxysimazine. When the structure of aromatic and triazine cycles changes, are not only the activities of the compound, but also the selectivity of the action. The study of the mechanism of biological action of some compounds of this class showed that they are extremely effective inhibitors of cell division and inhibit the biosynthesis of valine and isoleucine in plants. In plants resistant to herbicides of this type, there is a partial decomposition of the substance and binding with the products of plant life, as a result of herbicide properties of the drug are lost. Thus, the main metabolic transformations triazines in soil are oxidation, hydrolysis and desalkylation. The mechanism of herbicidal action of most derivatives of 1,3,5 – triazine based on the inhibition of the hill reaction.

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MOLECULAR DETECTION OF RESISTANT-ASSOCIATED MUTATIONS IN LINES OF SPIDER MITE TETRANYCHUS URTICAE KOCH, SELECTED BY BIFENTHRIN AND ABAMECTIN

Irina A. Tulaeva[1], Galina V. Mitina[2]

[1]LABORATORY AGROECOTOXICOLOGY ALL-RUSSIAN INSTITUTE OF PLANT PROTECTION (FSBSI VIZR), RUSSIA, [2]LEADER RESEARCHER, PHD LAB.OF MICROBIOLOGICAL PLANT PROTECTION ALL-RUSSIAN INSTITUTE OF PLANT PROTECTION (FSBSI VIZR), RUSSIA
ZUBANOV63@YANDEX.RU

Abstract

Two-spotted spider mite Tetranychus urticae Koch (Akari Tetranychidae) is a polyphagous pest with an extremely broad host range on > 1,100 plant species in more than 250 families. This pest shows a short life-cycle, high reproductive potential and arrhenotokous reproduction; all of these favour to the development of resistance to acaricides very rapidly (Van Leeuwen et al., 2010). The study of peculiar properties of inheritance of resistance and the identification of its genetic features has a great practical importance for ecological consequences at applying acaricides. The experiments were performed on the T.urticae homozygous lines, obtained by the disruptive selection at inbred reproduction. The selection was carried out by two toxicants: bifenthrin (Talstar 10% EC) and abamectin (Vertimec 1.8% EC). Toxicity bioassay for resistance was performed on female mites from separate families (Sundukov et al., 2017). It were studied 270 generations under selection to bifenthrin and 54 generations – to abamectin.

Genomic DNA was extacted by STAB-chlorophorm method (Doyle, Doyle, 1987) from 10 female mites of one homozygous line. Primers KdrF4 and KdrF2 were used to amplify the part of para SC gene (potential-dependent sodium channel of alpha subunit (Para) mRNA), showing high specificity for T.urticae resistant to pyrethroids (including bifenthrin). The glutamate channel gene, showing specificity for resistant mites to avermectins, was amplified with primers TuGluF1 and TuGluR1 (Khajehali et al., 2011). A PCR product of 300 bp were obtained for bifenthrin-resistant (R) and bifenthrin-sensitive (S) lines. The similarities of the sequences were 100% with para SC gene sequences presented in the GenBank: for R-line with 5 sequences (FJ906806.1 strain ATHRos-Bf et al.) and for S-line with 12 sequences from the GenBank (FJ906805.1 strain SAMB et al.). It were found the differences between the lines in two sites: the nucleotide substitution C/A in position 88 and G/T in position173. The substitution in the first site results to different amino acid compositions: Asp (aspartate) in the R-line is replaced by Ala (alanine) in the S-line. In the second position there is a synonymous substitution of nucleotides without changing the composition of amino acids. It was not possible to reveal such peculiarities for resistant and sensitive lines selected by abamectin, apparently because of an insufficient level of generations to selection.

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ONTOGENETIC - POPULATIONAL STRUCTURE OF RARE SPESIES *PULLSATILA PRATENSIS* (L.) MILL. ON THE CONNECTIVE TERITORIES OF VINNYTSYA REGION

E. D. Tkach[1], V. I. Shavrina[1], A. B. Kryjanivskyi[1], V. P. Mykolaiko[2], G. E. Goncharenko[2], O. V. Lobova[3]

[1]INSTITUTE OF AGROECOLOGY AND ENVIRONMENTAL MANAGEMENT OF NATIONAL ACADEMY OF AGRARIAN SCIENCES OF UKRAINE, UKRAINE, [2]PAVLO TYCHYNA UMAN STATE UNIVERSITY OF MINISTRY OF EDUCATION AND SCIENCE OF UKRAINE, UKRAINE, [3]NATIONAL UNIVERSITY OF LIFE AND ENVIRONMENTAL SCIENCES OF UKRAINE, KYIV
OKSANA.VARKHL@GMAIL.COM

Abstract

Pullsatila pratensis (L.) Mill. - polycarpic, hemicryptophyte, heliosythophyte, xeremosephyte. Representative of the Ranunculaceae family. It is distributed mainly on acidic and alkaline sandy, silicate soils, chalk and limestone sediments, often with granite outcropping in the pine woods, on forest edges, meadow-steppe herbaceous slopes. According to our research, the ontogeny of *R. pratensis* (L.) Mill. was divided into 8 ontogenetic states: p - j - im - v - g1 - g2 - g3 - s. Was established, that populations are numerical, characterized by a full right-side spectrum, which indicates predominant proportion of generative individuals. In conditions of connective territories, the main anthropogenic factors, which determine the rarity of the model species, are transformation of typical for them floricomplexes due to the cutting, synanthropy and phytobiological contamination. As a result of our research, we have established that according to the Δ/ω classification, population of *Pulsatilla pratensis* (L.) Mill. in the structure of connective territories South-Bug and Dniestersky ecological corridors over the research years carried out the transformation from the ripening (Δ/ω 0.35/0.6) to the transition (Δ/ω 0.35/0.66) with subsequent transformation into the old (Δ> 0,55/ω <0.60). A young type of population was noted for Nemyisky and Lyadivsky eco-corridors with the subsequent transition to the mature. Thus, as a result of research of populations rare species *Pulsatilla pratensis* (L.) Mill. in the studied areas connective territories of eco-corridors Vinnytsia region was determined, that characteristic features of species cenopopulations are its completeness and right-sided ontogenetic spectra. Right-siding is a result of the fact, that among cenopopulations the major part is made by vegetogenic and young generative individuals or young generative and medieval individuals. That species in the national ecocorridors Dniprovsky and South-Bug are characterized as normal with subsequent transformation into regressive, while in the regional ecocorridors Lyadivsky and Nemyisky it is restorative. Using of ontogenetic-populational method of research in studies makes possible to evaluate the state and structure of species population and determinate the ways of its preservation and restoration.

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OZONE AND FUTURE CLIMATE EFFECT ON INTERSPECIFIC COMPETITION BETWEEN SUMMER RAPES AND WILD MUSTARD

Giedrė Kacienė[1], Austra Dikšaitytė[1], Irena Januškaitienė[1], Diana Miškelytė[1], Jūratė Žaltauskaitė[1], Gintarė Sujetovienė[1], Sandra Sakalauskienė[1], Jurga Miliauskienė[1], Romualdas Juknys[1]

[1]VYTAUTAS MAGNUS UNIVERSITY, KAUNAS, LITHUANIA
GIEDRE.KACIENE@VDU.LT

Abstract

Weeds are accepted to be the most important pests in agriculture. Increased spread or aggressiveness of invasive and native weeds due to climate change and other anthropogenic activities have been evidenced in many scientific researches. Therefore the aim of this study was to evaluate an effect of climate change (elevated air CO2 concentration and temperature) and O3 treatment on mono- and mixed-culture summer rape and wild mustard. A pot experiment was carried out in phytotron chambers. Summer rape (*Brassica napus* L.) and wild mustard (*Sinapis arvensis*) were grown in mono- and mixed-cultures under current climate (CC) (400 µmol mol−1 of CO2, 21/14 °C day/night temperature) or future climate (FC) conditions (800 µmol mol−1 of CO2, 25/18 °C day/night temperature) with and without O3 treatment (180 µg m-3). Competition with wild mustard had relatively low effect on rape's growth at current climate, both with and without ozone treatment. Climate change positively affected crop's growth; however, weed competitive effect increased at FC conditions. The most drastic changes was detected under combined impact of ozone and future climate (FC+O3). Rape competitive effect on wild mustard also significantly increased under FC+O3 treatment. In must be emphasized, that stronger competition-induced reduction in dry biomass was detected for wild mustard (up to 80 %) than for summer rape (up to 40%), indicating increased rape's competitiveness under FC+O3 conditions. Better antioxidative protection was found to be the main reason for improved rapes growth at FC. Whereas stronger oxidative damage and lower pool of soluble sugars in wild mustard determined its sharply reduced competitiveness under FC+O3 conditions. However, in spite of improved competitiveness of rape, competition with weeds strongly interfered with crops growth, indicating increased yield losses due to the climate change, especially with concomitant intensification of O3 pollution. One of the reasons of growth inhibition of mixed-culture rape and wild mustard could be allelopathic interaction via severely increased concentration of flavonoids under FC+O3 conditions.

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PRESERVATION OF LYOPHILIZED RABIES VIRUS STRAIN L. PASTEUR AFTER STORAGE AT TEMPERATURES OF 5, -20 AND -80°C

Viktoriia Varianytsia[1], Igor Vysekantsev[2]

[1]1. INSTITUTE FOR PROBLEMS OF CRYOBIOLOGY AND CRYOMEDICINE OF THE NATIONAL ACADEMY OF SCIENCES OF UKRAINE, KHARKIV, UKRAINE; 2. PUBLIC JOINT STOCK COMPANY 'PHARMSTANDARD-BIOLIK', KHARKIV, UKRAINE, [2]INSTITUTE FOR PROBLEMS OF CRYOBIOLOGY AND CRYOMEDICINE OF THE NATIONAL ACADEMY OF SCIENCES OF UKRAINE, KHARKIV, UKRAINE
VBURKOVA@YANDEX.UA

Abstract

To provide technological schemes for rabies biologicals production enterprises create a system of the rabies virus industrial strains banks. The effective methods for virus long-term storage are necessary for the functioning of such banks. One of such methods is lyophilization. The research aim was to study the rabies virus safety after lyophilization in various protective media and subsequent storage at temperatures of 5, –20 and – 80ºC. The subject of the study was vaccine strain *L. Pasteur,* which was cultivated in cell culture of BHK-21/C13 in growth medium based on DMEM supplemented with 0.5% bovine serum albumin. The virus was lyophilized in protective media based on growth medium in which gelatin and sucrose were added: medium № 1 – 5% sucrose; № 2 – 3% gelatin and 5% sucrose; № 3 – 1% gelatin and 5% sucrose; № 4 – 10% sucrose. The samples were stored at 5, –20 and –80ºC. Evaluation of the samples safety was carried out according to the tablets appearance, solubility and virus infectious activity for cell culture of BHK-21/C13. Infectious activity was expressed in decimal logarithm of 50% infectious dose – lg CCID50. The samples before (control 1) and right after (control 2) lyophilization were as the control. Virus infectious activity before lyophilization was 5.38±0.15 lg CCID50. After lyophilization only the samples with medium № 3 met the requirements for tablets appearance. The samples with medium № 2 did not meet the requirements for tablets appearance and solubility. After sublimation virus infectious activity significantly decreased in all samples. The minimum activity loss was in samples with medium № 3. After 24 months (observation period) virus infectious titer decreased compared to control 2 in all samples. The maximum protective effect was provided by the medium № 3 and the storage temperature of –80ºC – it was saved 95% of virus activity. The dynamics of virus activity decline is of interest. At 5ºC the virus titer was decreasing continuously in all samples. At –20ºC virus activity did not differ from control 2 in all samples after 12 months and started to decrease during the next 12 months. At –80ºC virus titer was significantly decreasing compared to control 2 between 12 and 18 months of storage.Thus, for storage of lyophilized industrial rabies virus strains it is possible to recommend the temperature of –80ºC and protective medium based on DMEM supplemented with 0.5% bovine serum albumin, 1% gelatin and 5% sucrose.

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PROGRESSIVE DEGENERATION OF THE SCIATIC NERVE AFTER HEMORRHAGIC STROKE

V.V. Zarutska[1], I.M. Dovgan[1], N.O. Melnyk[1], S.I. Savosko[1]

[1]BOGOMOLETS NATIONAL MEDICAL UNIVERSITY, DEPARTMENT OF HISTOLOGY AND EMBRYOLOGY, UKRAINE
S.I.SAVOSKO@GMAIL.COM

Abstract

Aim. The hemorrhagic stroke has severe neurological consequences. The aim of the research was to investigate changes in the sciatic nerve after cerebral hemorrhagic stroke modeling. Materials and methods. The hemorrhagic stroke in Wistar rats was modeled through the autologous blood injection into internal capsule of the right cerebral hemisphere. Histological changes of the sciatic nerve were learnt on the 10th, 30th and 90th day of the experiment, after the method of silver impregnation using. The density of nerve fibers in the nerve (units/mm2) was evaluated morphometrically. Results. The results of the research suggested a decrease of nerve fibers diameter and impregnation level, an increase of degeneration process in the right and left sciatic nerves. The local swelling of the nerve fibers was marked more often in the areas near the Ranvier's nodes. In the left nerve the active “free” Schwann cells was observed. It was considered as the manifestation of descending neurodegenerative changes, demyelination and degeneration of axial cylinders. The morphometrical study found out the decrease of nerve fibers density: in the left nerve by 28.5%, 32.1% and 50.0% ($p<0.05$); in the right nerve by 20.7%, 24.1% 44.8% ($p<0.05$) on the 10th, 30th and 90th day after stroke modeling respectively. So the data confirmed the progressive neurodegenerative changes. In the early period deformation of myelin nerve fibers and decrease of impregnation level were detected in left sciatic nerve. In the late period the changes in left sciatic nerve consisted in destruction of the nerve fibers, decrease of nerve fibers amount into nerve’s fasciculi and paresis of the left limb on the day 90. Moreover, the right nerve was changed too, as the bilateral damage of pyramidal system on hemorrhagic stroke condition was presented.

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REDUCED GENE EXPRESSION LEVELS IN OVARIAN CUMULUS CELLS IN A MURINE ENDOTOXEMIA MODEL

Nataliya Grushka[1], Nataliya Makogon[1], Olena Kondratska[1]

[1]BOGOMOLETZ INSTITUTE OF PHYSIOLOGY, NAS OF UKRAINE, DEPARTMENT OF IMMUNOPHYSIOLOGY, UKRAINE
ELENA-SHEPEL@UKR.NET

Abstract

In the mammalian ovary, oocytes are communicated bi-directionally with cumulus cells that is critical for normal oocyte development followed by ovulation and fertilization. Inflammatory diseases of the abdominal cavity are important causes of infertility in humans and domestic animals. Gram-negative bacteria Escherichia coli and its endotoxin lipopolysaccharide (LPS) are the frequent causative agents of these diseases and accompanying ovarian dysfunction. We showed earlier that injection of LPS in mice resulted in an impairment of oocyte maturation in vitro and significantly reduced granulosa cell viability.

In this study, we used a murine model of endotoxemia to investigate the change in mRNA levels of hyaluronan synthase 2 (HAS2), cyclooxygenase 2 (COX2) and gremlin-1 (GREM1) genes in cumulus cells, as these genes play an important role in follicular development and cumulus expansion, and thus in the growth and maturation of oocytes. LPS (3 mg/kg) was intraperitoneally injected into the mice for 24 h, and the gene expression in cumulus cells were detected by reverse transcriptase polymerase chain reaction. In control mice, the mRNAs encoding these genes were detected in all tested cumulus cell samples: PCR amplification of the reverse-transcribed mRNAs yielded specific bands of 409, 213, and 256 bp, the expected sizes of HAS2, COX2 and GREM1 respectively. Treatment with LPS resulted in significantly reduced mRNA expression levels for HAS2 by 1.3 times, COX2 by 1.4 times and GREM1 mRNA by 1.4 times ($p<0.001$ compared with the vehicle-treated mice in all cases).

Our results obtained earlier in several other mice models of immune/inflammation associated ovarian failure (e.g. mediated by anti-ovarian antibodies or immune complexes), also showed that the decrease in cumulus expression of HAS2, COX2 and GREM1 genes occurred in parallel to impairment of ovarian function. Thus we suggest these genes can be biomarkers for non-invasive diagnosis and predicting oocyte developmental competence and embryo quality, that is useful in assisted reproductive technologies.

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RESEARCH OF BIOECOLOGICAL STRUCTURE OF MOSSES IN VINNYTSIA (UKRAINE)

Ruslan Kudlaiev[1], Oleksandra Mashtaler[1]

[1]VASYL` STUS DONETSK NATIONAL UNIVERSITY, DEPARTMENT OF BOTANY AND ECOLOGY OF THE BIOLOGICAL FACULTY, UKRAINE
R.KUDLAIEV@DONNU.EDU.UA

Abstract

Mosses are an obligatory part of the biocenosis, which are characterized by high morphological and taxonomic varieties. By species richness, bryophytes occupy second place after angiosperms. Today, the need to use bryophytes as indicators of the state of the environment is growing, especially for the control of atmospheric air pollution.

The purpose of the work was to determine the bioecological structure of the bryophytes of the urbanized areas of *Vinnytsia*. Various ecotops within the boundaries of the city of *Vinnytsia* were analyzed to study the species composition of the mosses. The collection, identification and study of floristic and geobotanical indicators of bryophytes were conducted using route and field studies during 2016-2017. Cameral processing and experimental studies were carried out based on the laboratory of the Department of Botany and Ecology of the Biological Faculty, Vasyl`Stus Donetsk National University. Herbarium samples was determined by the standard comparative-morphological method.

The study of the species composition of the mosses was tied not only to the residential areas but also on industrial sites of *Vinnytsia* with varying degrees of environmental pressure. In general, for the study period, 100 samples were collected, among which 37 species of bryophytes were detected, belonging to 1 department of Bryophyta, 2 classes (*Bryopsida*, *Polytrichopsida*), 4 orders, 9 families and 15 genera.

For the first time, for the chosen territory, species that were not earlier mentioned in literary sources were identified: *Hygroamblystegium humile* (P.Beauv.) Vanderp., Goffined & Hedenas (*Amblystegium humile* (P.Beauv.) Crundw., A. kochii Bruch & Schimp., *Leptodictyum humile* (P. Beauv.) Ochyra, *Leptodictyum kochii* (Schimp.) Warnst.), *Homomallium incurvatum* (Schrad. Ex Brid.) Loeske., *Homalothecium philippeanum* (Spruce) Schimp., *H. lutescens* (Hedw.) Robins. (*Camptothecium lutescens* (Hedw.) Schimp.).

We have determined conformity of species of mosses to diverse types of substrate, among which epiphytes and epiksil (the root zone of the tree, the stem zone of the tree, the fallen tree - 25 species), the rest - epilits and epigenes.

In the bryophytes of the investigated area, we found the following life forms: turf, pillow and carpet. Among them, most of mosses belong to the last biomorph (19 species). It was established that the eco-biomorph of mosses depends on the nature of the substrate, the vegetation density, the anthropogenic load and the specific conditions of the microclimate of the investigated areas.

Depending on the degree of load on the environment, species *Amblystegium serpens* (Hedw.) Schimp reliably react to negative factors, which determine the anatomical-morphological transformation in the experimental samples.

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RESEARCH OF THE INDUCED SEISMICITY IN COMPLEX GEOECOLOGICAL MONITORING OF CENTRAL UKRAINE

Anhelina Burlakova[1], Oleh Tiapkin[1], Petro Pihulevskyi[2]

[1]NATIONAL MINING UNIVERSITY, DNIPRO, UKRAINE, [2]INSTITUTE OF GEOPHYSICS, KYIV, UKRAINE
ANGELINKAVESNA@GMAIL.COM

Abstract

Mining processes are accompanied by environmentally hazardous geomechanical events. At the same time industrial and social infrastructures of old-industrial mining regions of Central Ukraine (with low natural seismic hazards) don't have seismic stability. They are not protected from possible seismic effects (incl. local earthquakes with M>4). The cause of increased induced seismicity of Central Ukraine is a violation of geodynamic equilibrium and astable state of the upper layer of Earth's crust here (up to a depth ~20 km) due to intensive long-term development of mining industry here (and first of all it's Kryvyi Rih iron ore basin) with powerful explosions in mines and open pits and moving huge volumes of rock. The increase of seismicity of mining territory raises danger of exogenous geological processes. Complex use of seismic records and results of hydrogeodynamic monitoring for determination of the origin and basic parameters of local earthquakes for hazard research and assessment of exogenous geological processes on the territory of Central Ukraine is needed. But the seismic station UK-15 (with direct link with National Centre of seismological data in Institute of Geophysics of National Academy of Sciences of Ukraine, Kyiv) has been installed in Kryviy Rih-city in 2012 only. Some seismic events (including 23 local earthquakes and powerful industrial explosions) were recorded by the station till the end of 2017. The differences in the records of local Kryvbas seismic events of different origin were recorded. Data of this station significantly improved information about local tectonic earthquakes on background of technogenetic and seismic events of technogenically-natural origin, including the effects of powerful mining explosions on increase of local induced seismicity. Local earthquakes with M≥4.6 may be continued with the existing intensity of mining industry with powerful explosions in this region. Therefore it's necessary localization of modern activation areas of tectonic structures with induced seismicity for the system of complex geoecological monitoring of shallow subsurface of the region. And first of all, to determine the actual parameters of this seismic hazard and specific origin of seismic events the urgent creation of local Kryvyi Rih seismic monitoring system (with instrumental seismological observations on the base of the seismic station UK-15 and with direct link with National Centre of seismological data, Kyiv) is necessary.

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SOME DATA ABOUT VERKHOVINSKY NATIONAL PARK (UKRAINE)

Ivan Koliadzhyn[1], Kateryna Doroshenko[2], Serhii Frankov[2]

[1]VERKHOVYNSKY NATIONAL PARK, UKRAINE, [2]VASYL' STUS DONETSK NATIONAL UNIVERSITY, UKRAINE
FILOKTIMONA@MAIL.RU

Abstract

Verkhovynsky National Park is located in the most hard-to-reach and remote region of the Ukrainian Carpathians. The thesis includes information about the authors' observations of the NP "Verkhovynsky" ornithofauna on June 25-27, 2017. The NP "Verkhovynsky" nature records enumerate 128 bird species. We have recorded 54 bird species. One of the bird species– the collared flycatcher *Ficedula albicollis*, according to our observations, is added to the park ornithological list. According to the taxonomic distribution, representatives of 6 orders and 21 families were registered. The order Passeriformes includes 41 bird species, which belong to 15 families: Oriolidae– 1 species (golden oriole (*Oriolus oriolus*)), Emberizidae– 1 species (yellowhammer (*Emberiza citronella*)), Troglodytidae 1 species (wren (*Troglodytes troglodytes*)), Corvidae– 2 species (raven (*Corvus corax*) and nutcracker (*Nucifraga caryocayactes*)), Fringillidae– 5 species (linnet (*Acanthis cannabina*), crossbill (*Loxia curvirostra*) etc), Aegithalidae– 1 species (long-tailed tit (*Aegithalos caudatus*)), Regulidae– 2 species (goldcrest (*Regulus regulus*) and firecrest (*Regulus ignicapillus*)), Sylviidaae– 5 species (wood warbler (*Phylloscopus sibilatrix*), whitethroat (*Sylvia curruca*) etc.), Muscicapidae– 12 species (flycatcher (*Ficedula parva*), ring ouzel (*Turdus torquatus*) etc.), Certhiidae– 1 species (treecreeper (*Certhia familiaris*)), Motacillidae– 2 species (pied wagtail (*Motacilla alba*) and grey wagtail (*Motacilla cinereal*)), Cinclidae– 1 species (dipper (*Cinclus cinclus*)), Sittidae– 1 species (nuthatch (*Sitta europaea)*), Laniidae– 1 species (red-backed shrike (*Lanius collurio*)) and Paridae– 5 species (marsh tit (*Parus palustris*), crested tit (*Parus cristatus*) etc.). Additionally, 5 representatives of the Falconiformes order were recorded- kestrel (*Falco tinnunculus*), hobby (*Falco Subbuteo*), buzzard (*Buteo buteo*), goshawk (*Accipiter gentilis*), and sparrowhawk (*Accipiter nisus*). 4 registered species belong to the order of Piciformes – the woodpecker (*Dendrocopos maior*), the white-backed woodpecker (*Dendrocopos leucotos*), the three-toed woodpecker (*Picoides tridactylus*) and the black woodpecker (*Dryocopus martius*). The Galliiformes order includes the capercaillie (*Tetrao urogallus*) and the hazel grouse (*Tetrastes bonasia*). Also, one species in each of the following orders was registered: Cuculiformes and Charadriformes – the cuckoo (*Cuculus canorus*) and the woodcock (*Scolopax rusticola*) respectively. Employees, students, and graduates of Vasyl' Stus Donetsk National University plan to continue monitoring in the territory of NP "Verkhovynsky" within the framework of integrated environmental monitoring of this site.

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STUDY OF INFLUENCE OF EDUCATIONAL ENVIRONMENT FACTORS' OF THE STUDENTS ADAPTATION (EXPERIENCE OF STUDENTS OF RUDN)

Sergey Kudinov[1], Victor Glebov[2]

[1]PEOPLES' FRIENDSHIP UNIVERSITY OF RUSSIA, RUSSIA, [2]PEOPLE'S FRIENDSHIP UNIVERSITY OF RUSSIA (RUDN UNIVERSITY), ECOLOGY FACULTY, RUSSIA
RUDN.TGU@YANDEX.RU

Abstract

For each applicant admission to a higher educational institution is a turning point in life. With the beginning of studies at the University, young people begin to act on a set of environmental factors, which was different before entering the University. In this regard, an important aspect in the life of the student is the degree of adaptation of the young man to the new environment.

The effectiveness of adaptation processes depends on the emotional and psychological characteristics of the individual, physiological and biochemical features of the individual student. Most recently, the teenager was a schoolboy, not always independent, not always disciplined, and with admission to the University, not only that the training loads increase, emotional stress, so still all this happens in a new team, and with a lack of physical activity. Student time is a period of active maturation and entry into the "big life".

According to our study during the academic year (2014-2015), a sample of 73 second-year students of the ecological faculty of the RUDN revealed that the majority of students have a deviation from the norm for systolic and diastolic pressure (12-18%), as well as heart rate (14-19%). This shows the tension in the work of SSS students of the environmental faculty.

About the complexity of adaptation processes in the student environment shows such an indicator as chronic fatigue, which is associated with the mental and physiological state of the student. According to our research it was noted that more than 60% of the students of the environmental faculty of RUDN experience average (57%) and high (5%) chronic fatigue.

The analysis of the survey data of 1-3 year students of the ecological faculty of RUDN (n=182), that 1st and 2nd year students are more often ill and experience emotional stress during the school year, which affects the educational success, which is also unstable. The process of adaptation is improving from 3rd year students, where he noted most of the students getting used to the team and the learning process. 3rd year students felt confident, success in studies stabilized.

Conclusion. Thus, in order to avoid the negative impact of a complex of environmental factors in the life of students and improves the course of adaptation processes, in my opinion it is necessary:

1. To strengthen the work of psychological and socio-medical service among students (testing, training, etc.).

2. Increase in the curriculum of physical education.

3. To organize educational process so that the most part of educational activity was realized at University.

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STUDY OF SOME MORPHOMETRIC PARAMETERS OF SEEDS OF SEVERAL SORTS IPOMOEA PURPUREA (L.) ROTH

L. Mikulich[1], N. Lyalyuk[1]

[1]VASYL` STUS DONETSK NATIONAL UNIVERSITY, FACULTY OF BIOLOGY, VINNITSIA
L.MIKULICH@DONNU.EDU.UA

Abstract

Decorative flower plants are successfully used for landscaping of populated cities, for the purpose of improving the microclimate of urbanized territories and increasing the aesthetic attractiveness. There are annual lianas, which are marked by intense growth and development. The Ipomoea purpurea (L.) Roth is a promising liana, but a little attention is paid to the study of biological characteristics and ontogenetic development.

The aim of the work was to study the morphometric parameters of the seeds of the studied sorts for further evaluation of their use in landscaping of the city. The objects of the research were some I. purpurea sorts: 'Hewentley Blue', 'Starshine', 'Moonlight', 'Flying saucer', 'Milky Way'. The subject of the study is bioecological features and decorative signs of plants, which are promising for the involvement in the landscaping of cities.

In order to elaborate recommendations on the use of sorts in landscaping, it is important to find out the introduction potential of plants and study morphological characteristics of the seeds. The largest length of the seeds was observed in varieties *I. purpurea* 'Moonnlight' (0,67 mm) and the smallest one is in *I. purpurea* 'Flying saucer' and ' Milky Way' (0.4 mm). The biggest width is observed in *I. purpurea* 'Moonlight' (0,4 mm) and the smallest one is in *I. purpurea* 'Milky Way' (0,3 мм). The average width of the sorts is *I. purpurea* 'Hewentley Blue' (0.37 mm) and *I. rurpurea* 'Starshine', *I. purpurea* 'Flying saucer'.

For the purpose of assessing quality of the seeds, we have determined the seeds germination and germination energy of the seeds studied sorts. The best germination energy has *I. purpurea* 'Hewently Blue' — 95.6%. The germination energy of *I. purpurea* 'Flying saucer' is 94.8%, and *I. purpurea* 'Starshine' is 82.7%. The smallest indicator of germination energy is *I. purpurea* 'Milky Way' - 80.2% and Moonlight - 78%. The biggest percentage of germination was observed in variety *I purpurea* 'Hewently Blue' - 97.2%, and the smallest one is *in I. purpurea* 'Moonlight' - 81.2%.

The germination energy and seeds germination *I. purpurea* 'Flying saucer' and *I. purpurea* 'Hewently Blue' are the highest. Therefore, in future it is reasonable to take into account these features of sorts while using it in vertical landscaping.

Thus, the obtained results indicate the possibility of seed reproduction of investigated sorts in the conditions of Vinnytsia. For further recommendations of the studied varieties in the system of vertical landscaping it is necessary to research the morphometric features of generative and vegetative organs (corms, shoots, leaves) and analyze the peculiarities of the passage of phenological phases in the conditions of Vinnytsia.

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THE ANALYSIS OF THE FLORA OF THE ASTERACEAE FAMILY IN NORTH KAZAKHSTAN REGION

Zhupar Shakeyeva[1], Gulnara Tleubergenova[2]

[1]VYTAUTAS MAGNUS UNIVERSITY DEPARTMENT OF BIOLOGY LITHUANIA, [2]NORTH KAZAKHSTAN STATE UNIVERSITY M. KOZYBAEVA, GENERAL BIOLOGY KAZAKHSTAN
ZHYPAR-01.93@MAIL.RU

Abstract

The family of the Asters is one of the largest families in the flora of the North Kazakhstan region and is among the ten most important families of the flora. The generic and species composition of the family Asteraceae in the territory of the North Kazakhstan region is presented quite differently. The family is represented by 127 species that are part of 54 genera.

Actuality: The study of one of the leading families of higher plants in the flora of the North Kazakhstan region is a very urgent problem, since many species of the family of astroids are part of the phytocenosis and are the main part of the vegetation cover. Regional phytomonitoring has an important role in studying the state of vegetation cover.

The aim of the study: To conduct a comparative analysis of the generic and species composition of plants of the Aster family of North Kazakhstan region.Comparative analysis of generic and species composition of plants of Asteraceae family were carried out in 5 districts of North Kazakhstan region. The results of the study showed that the species of this family are the most common in Shal Akyn area - 77 species, Kyzylzhar - 75 species and 65 species in the vicinity of Petropavlovsk and less common in the regions: Mamlut - 50 species, Zhambyl - 47 plant species. According to the task of the study, we conducted a chorological analysis of the Asteraceae family of North Kazakhstan region. In accordance with the modern spread of all types of the examined plants were distributed into 9 geographical groups. The most common groups are: Euro-Siberian group includes-41 species, Eurasian-40 species, European-20 species.In relation to the plants of this family, the mesophytes prevail in the investigated flora of the region to the conditions of moistening (according to the water regime). They make up more than 96 species (77.2%). The other half of the species form xerophytes, which includes 68 species (53.5%). The share of hygrophytes, accounts for only 17 species (13.4%).In relation to this family, the mesotrophs are pre-possessed in the flora under study. They account for more than 93 species (73.2%). The other half of the species form eutrophs, which includes 54 species (42.5%). The share of oliphotrophs is 7 species (5.5%). Nitrophyles is only 2 species (1.57%).As a result, the study concluded that most of the light and hygrophilous, moderately demanding for the content of ash elements in the soil, abundance is observed in forest and forest-steppe zones of Shal Akyn and Kyzylzhar regions. Most species of this family grow on the territory of Eurasia and Siberia and belong to the groups of the Eurosibirsk group and the Eurasian group.

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THE DAMAGE OF LIVER'S BLOOD VESSELS' ENDOTHELIUM IN HSV-I INFECTED BALB/C MICE

N.V. Motorna[1], L.M. Sokurenko[1]

[1]BOGOMOLETS NATIONAL MEDICAL UNIVERSITY, DEPARTMENT OF HISTOLOGY AND EMBRYOLOGY, UKRAINE
NATALIVFRCBV@GMAIL.COM

Abstract

Aim. The endothelium of blood vessels is a source of HSV entry into organs on persistent infection condition. Therefore, the aim of the study was to investigate the changes in liver blood vessels endothelium of HSV-I infected mice.

Materials and methods. The experiments were conducted on BALB/c line mice weighing 18-20 g. The animals were infected with mouse-adapted HSV-I in virological laboratory (head of laboratory prof. S. Rybalko) in the "Gromashevsky L.V. Institute of Epidemiology and Infection Diseases of NAMS of Ukraine" (Kyiv, Ukraine). The ultrastructural changes of liver's blood vessels' endothelium were investigated by the transmission electron microscopy (TEM).

Results. The changes in the liver had focal and less diffuse manifestations. The violation of hepatocytes and endothelial cells of blood vessels was established. Changes in the microvessels consisted in violation of the endothelial layer (death of endothelial cells, destruction of the basement membrane and penetration of the dead cells derivatives into the lumen). Endothelial changes were mainly detected in the capillaries. The results confirmed the direct damage of these cells by the HSV-I and the primary changes in the organ. The endothelium was the source of penetration and reproduction of HSV-I into the organ, although the liver was not the primary source of infection in the organism. We made a conclusion about the decrease of endothelial cells barrier function in the liver in HSV-I infected mice, which led to the dystrophic changes in the liver.

Conclusions. The TEM method allowed to study the cellular basis of the HSV-I infection, confirm the possibility of virus penetration into the blood vessels' endothelium and reproduction in the liver.

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THE INFLUENCE OF ANTHROPOGENIC FACTORS OF THE CAPITAL CITY ON THE PSYCH - EMOTIONAL STATE AND ADAPTATION OF NONRESIDENT STUDENTS

Yana Mayorova[1]

[1]*PEOPLE'S FRIENDSHIP UNIVERSITY OF RUSSIA (RUDN UNIVERSITY), ECOLOGY FACULTY, RUSSIA*
KUZMINA.GTMOST@MAIL.RU

Abstract

Statistics show about the complex environmental conditions of Moscow. Hundreds of thousands of sources (industrial enterprises, car fleet) emit a huge amount of harmful substances into the air. All this has a significant impact on the mental and physical health of the city population.

According to the estimates of researchers at the moment up to 70% of entrants to higher education institutions have certain health deviations (Glebov, 2012). At the same time, difficulties are being added in adapting to the new conditions of the educational environment. Particularly complex adaptive reactions occur in students coming to study from other regions of the country.

On a sample of 311 applicants from RUDN and Moscow state University, who came from different regions of Russia (Central, Volga, North Caucasus, Siberian Federal districts) the study of adaptation processes was conducted.

The analysis of the questionnaire data revealed a set of factors that negatively affected the adaptation processes of nonresident students, among which there were problems related to the lack of funds (87.8% + 13.3), with new living conditions (dormitory), new teaching staff, otherwise life, other rhythm of work and rest and the learning system.

We noted that the highest percentage of nonresident students with a pronounced stress of autonomic regulation of the cardiovascular system was revealed among students from the Volga, North Caucasus Federal districts: 49.6%, 47.1%, which can be associated with the impact of a set of environmental factors of the Metropolitan city, as well as individual psychological characteristics of nonresident students.

The analysis of the obtained data showed that the price of physiological adaptation to Moscow among nonresident students from the Volga, North Caucasus Federal districts was very expensive. The results showed that the majority of nonresident students had average (69,8%) and high levels of stress and was accompanied by tachycardia and increased respiratory rate.

Thus, a comparative analysis of the data of nonresident students showed that the first-year students from the Volga and North Caucasus Federal districts adapted the worst. Nonresident students from the Siberian Federal district took an intermediate position in the adaptive responses of students to the conditions of the Metropolitan city. The optimal indicators of adaptation processes were noted among nonresident students from the Central Federal district.

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THE INFLUENCE OF EDUCATIONAL ENVIRONMENT ON ADAPTATION OF JUNIOR SCHOOLCHILDREN ENGAGED IN KARATE

Alexander Martyshov[1], Svetlana Goryunova[2], Viktor Glebov[1]

[1]PEOPLE'S FRIENDSHIP UNIVERSITY OF RUSSIA (RUDN UNIVERSITY), ECOLOGY FACULTY, RUSSIA, [2]MOSCOW STATE PEDAGOGICAL UNIVERSITY
ALEX.MARKUS@MAIL.RU

Abstract

There is research in the field of public health shows that the occurrence of a number of diseases in primary school children is associated with a complex of environmental factors. These factors include insufficient motor activity, complication of educational programs, and high information load and insufficient motor activity of schoolchildren.

In this regard, we conducted a longitudinal study (4 years) for 131 students.

Groups of students were organized: the first group - experimental (n=23), classes were conducted on the basis of the contact karate program using the author's method); the second group - control (n=25), karate classes were organized on the basis of the contact karate program); the third group-basic (n=83), classes on General physical training at school). The age composition of schoolboys is 7 years of age.

The author's technique of physical training of schoolboys was developed.

At the end of the school year, at the control measurement of heart rate, schoolboys of both groups engaged in karate, show a decrease in the values of indicators for the studied parameters, but in children of the study group, the decrease occurred more intensively.

We noted the following changes in the state of the cardiovascular system of children by the end of the study: reduction and stabilization of the pulse by 27 beats per minute in children of the experimental group (after a 3-minute recovery interval), in the control group-a decrease of 10 beats per minute. Comparison of groups was carried out on quantitative indicators criterion Kruskall-Wallis with significance $p<0.05$.

The obtained data indicate that for the majority (73.1%) of children of the experimental group the three-minute interval was sufficient for almost complete restoration of the cardiovascular system after physical exertion.

On the basis of the conducted researches it is possible to draw a conclusion about the best adaptation to physical loads of pupils of experimental group in comparison with pupils of control and basic groups by the end of research.

Thus, based on the results of the study, practical recommendations for karate trainers aimed at improving the adaptive properties of the organism by correcting the training process of younger students engaged in karate in the system of additional education in a metropolis were formulated.

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THE INFLUENCE OF EDUCATIONAL ENVIRONMENT ON THE FUNCTIONAL STATE OF STUDENTS WITH DIFFERENT PHYSICAL ACTIVITY

Alexey Isaev[1]

[1]*M.V. LOMONOSOV MOSCOW STATE UNIVERSITY, RUSSIA*
ISAEV_ALEKS@MAIL.RU

Abstract

The impact of the factors of the educational environment on the functional state of students with different motor activity is currently an urgent problem of higher education. It includes such important parameters as conditions for recreation and sports, living conditions in a hostel, catering.

Proceeding from it, the purpose of this research was studying of functional States at the students athletes who are actively engaged in wrestling in the course of year trainings.

During the year, 104 students (52 students-athletes - wrestlers and 52 students not engaged in sports) were studied. The age of the sample was 20 + 2.2 years.

The study of student athletes was carried out within a year cycle in four stages: 1st stage-autumn period, the period of preparation (September — October); 2nd stage — winter period, the period of high physical training (December-January); 3rd stage — spring period, the period of preparation for the competition (March — April); 4th stage-summer period, the beginning of the competition period (May — June). This scheme of classes was due to the fact that the correct construction of the training process in the preparatory period can have a big impact on the result of the sportsman in senior competitions of the season. The study of the functional state of untreated persons (control group) was carried out in the same time periods of the year as the survey of wrestlers.

According to the indicator-the vital capacity of the lungs, it was noted that under the influence of training in athletes, this indicator increases from the first stage to the second: 4,76±0,03 liters (1st stage, autumn) and 5,12±0,03 liters (2nd stage, winter), and then decreases: 4,99±0,04 liters (3rd stage, spring) and 4,85±0,03 liters (4th stage, summer). Students not athletes having daily load growth was observed from autumn to spring: 3.38±0.03 l. (1st stage, autumn), 3.29±0.03 l. (2nd stage, winter), and 3.40±0.03 l. (3rd stage, spring), and then there was a decrease of 3.33±0.04 l. (4th stage, summer), with a significant difference between groups ($p<0.05$).

Thus, in relation to the respiratory system can be noted different dynamics of activity during the year between the selection of athletes and non-athletes. The significance of differences between the sample of athletes and non-athletes was also revealed ($p <0.05$). So in conditions of rest during breathing all examined parameters of respiratory system were influenced by seasonal rhythms, where the maximum of students-athletes accounted for the winter season (2nd stage, winter), and students are not athletes for the spring period (3rd stage, spring).

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THE INFLUENCE OF ENVIRONMENTAL FACTORS ON ANXIETY LEVEL IN PRIMARY SCHOOL CHILDREN OF THE CAPITAL CITY

Maria Ryazantseva[1], Alexander Martyshov[1]

[1]PEOPLES' FRIENDSHIP UNIVERSITY OF RUSSIA, RUSSIA
M_RYAZANCEVA@MAIL.RU

Abstract

It is generally recognized that the leading criteria of psychophysical human health are physical development and adaptive capabilities of the organism, which are objective indicators of the state of the environment. Adverse effects of the complex environmental factors: the negative impact of environmental conditions in the area of residence, the social status of the family, the information load and overload in educational institutions - affect the child's body. Studies on the psycho-emotional sphere of primary school children were conducted with the participation of 162 healthy primary school children.

4 comparative SG1-SG4 groups were formed. The first subgroup of SG1 includes children living in the area of Moscow, which has adverse social and environmental conditions. The second subgroup of SG2 had a high socio-economic status with adverse environmental impact. The third subgroup of SG3 included a part of schoolchildren, which had a low socio-economic status and favorable environmental conditions. In the fourth sub-group SG4 entered Junior high school schoolboys who lived in areas with favorable ecological and social environment.

Research tools were projective techniques: Test R. Tomml, M. Dorky, V. Amen, Test "Drawing school.

It is known that the indicator of the negative state of the psycho-emotional sphere of the individual is the indicator of situational anxiety and especially high values of its level (>45 points). The study showed that the level of "high" situational anxiety was observed in secondary schoolboys of SG1 group, where an unfavorable combination of environmental and social factors gave the highest percentage of occurrence for this indicator – 38.2%. Multidirectional actions of environmental and social factors reduced the percentage of schoolboys in terms of "high" level of situational anxiety in the subgroup SG2 and SG3 and amounted to 24.4% and 22.1%, respectively. In the subgroup SG4 indicator "high" level of situational anxiety schoolboys was 17.2%.

Personal anxiety, which has a biological component in humans, was detected in schoolboys of SG1 group in terms of the level of "high" personal anxiety", where it amounted to 33.3%, and in SG2 and SG3 groups 21.1% and 20.6%, respectively. In SG4, this indicator in terms of "high" personal anxiety was 15.7%.

Conclusion. Thus, the analysis of the influence of environmental factors showed a different impact on the emotional sphere of younger schoolchildren, where a different combination of unfavorable and favorable set of environmental factors can affect the levels of anxiety of younger schoolchildren.

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THE INFLUENCE OF ENVIRONMENTAL FACTORS ON THE ALLERGIC REACTIONS OF STUDENTS OF HIGHER SCHOOL STUDYING IN MOSCOW

Vitaly Uzarashvili[1]

[1]*PEOPLE'S FRIENDSHIP UNIVERSITY OF RUSSIA (RUDN UNIVERSITY), ECOLOGY FACULTY, RUSSIA*
MARGALIANO@MAIL.RU

Abstract

Aspects of the study of environmental factors affecting human allergic reactions are important to identify their etiology.

The study involved students of the Russian friendship of peoples (ecological, engineering, agricultural 1 course). The study sample consisted of 140 students representing different regions of Russia (Siberia, Ural, Caucasus and Moscow).

The survey of first-year students revealed three types of allergies: food, household and medical. 67 students with different types of allergic reactions to environmental factors were identified from the entire sample (n=140). For food Allergy was identified 35 students. We have also identified students having home - 17 -15 and drug. At the same time, the main allergen for food allergies in students were fruit (citrus), sweets (chocolate), sea products, nuts and dairy products.

In case of household Allergy of pupils, the main allergens were marked such as dust, pollen of plants, wool and down of animals. For medication allergies were detected antibiotics, vitamins, sulfonamides, and analgesics (Glebov, 2016).

The analysis of the frequency of occurrence of allergic reactions of the studied sample of students by region showed the following picture. According to the frequency of allergic reactions in students it was revealed: food allergies Moscow students had a maximum occurrence-47%, household allergies the highest percentage was noted in Ural students - 31%, and drug allergies in Siberian students – 41%.

Also, a number of negative factors that significantly influenced the psycho - emotional sphere were revealed: high noise level, dustiness, difficulties with falling asleep, violations of the labor and rest regime, etc.

Students from Siberia (40,2 points - September and 48,4 points - may) and the Ural region (41,2 points - September and 47,4 points - may) showed the greatest growth of indicators on anxiety in first-year students during the academic year. Comparative statistical analysis of situational anxiety revealed significant differences ($p<0.05$) between the groups studied by students on the criterion of Mann-Whitney (48.4 points – Siberia and 40.2 points – Caucasus and 41.2 points Moscow; 47.4 points – Ural and 40.2 points – Caucasus and 41.2 points Moscow).

Conclusion. Thus, food Allergy among Moscow students had a high incidence of 47%, which is associated with the wide import of food products from abroad. Weakened immune system due to high anthropogenic load in the Urals (Perm, Chelyabinsk) gave the highest percentage of occurrences in Ural students - 31% for household allergies. Also, a weakened immune system was observed in the Siberian students and 41% for medication allergies. The relative well-being of allergic reactions is noted in students from the Caucasus.

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THE INFLUENCE OF ENVIRONMENTAL FACTORS ON THE FUNCTIONAL STATE AND ADAPTATION OF STUDENTS – WRESTLERS

Alexey Isaev[1]

[1]*M.V. LOMONOSOV MOSCOW STATE UNIVERSITY*
ISAEV_ALEKS@MAIL.RU

Abstract

The adaptation of the organism to the environmental conditions play an important role biological rhythms (Selye, 1970). During training, taking into account biological rhythms can have a significant impact on human functional systems. These loads have an impact on the dynamics of physiological changes occurring in the human body.

Exercise training increases the functional capabilities of a person. This is reflected in the growth of performance indicators of the cardiorespiratory system (Glebov, 2016).

Materials and methods. During the academic year, we conducted a study of 104 students, of which 52 students-athletes engaged in wrestling with different levels of sports qualification (1st and 2nd category) and 52 students not involved in sports. The age of the sample was 18-24 years.

The results of the study and their discussion. The results of the study of the cardiovascular system (CVS) at rest of the subjects showed that the results of the studied parameters are subject to seasonal fluctuations.

The analysis of the received data on all indicators of work of CVS shows that at students athletes and not athletes during academic year the importance of differences ($p<0,05$) is noted. So data on pulse showed that at students athletes they were significantly lower ($p<0,05$) than at students not athletes and made in rest from 62,9±0,7 beats per minute (autumn) to 54,3±0,6 beats per minute (summer). In untrained students, heart rate at rest ranged from 77.4±0.7 beats per minute (autumn) to 81.6±0.9 beats per minute (summer). The obtained data on the work of CVS subjects showed that the beginning of the school year as a whole causes stress functional systems in untrained students, which is consistent with the data of comprehensive studies V. Glebov (2012-2016).

Summary. In the study of the sample of students-athletes and non-athletes students noted different seasonal rhythms in physiological indicators examined. It is revealed that the rest of the students-athletes, the maximum values of respiration rate, heart rate, and arterial blood pressure were observed in winter period of time. This is due to the beginning of the preparatory period of hard physical effort. Increasing the aerobic abilities of the athletes' heart rate at rest is significantly reduced.

Other physical activity in a sample of students' non-athletes revealed different seasonal rhythms in physiological indicators. It was revealed that in the conditions of rest at students not athletes the maximum values of frequency of breath, pulse, and arterial pressure were observed in the spring period that was connected with accumulation of the General fatigue and some physical activity.

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THE INFLUENCE OF HYDROTECHNICAL CONSTRUCTIONS ON QUALITY OF DRINKING WATER

Tatyana Odikadze, Natalia Lyalyuk[1]

[1]VASIL' STUS DONETSK NATIONAL UNIVERSITY, BIOLOGICAL FACULTY, VINNITSIA
T.ODIKADZE@DONNU.EDU.UA

Abstract

The influence of hydrotechnical constructions on quality of drinking water. Today, water management activities have led to the fact that almost all large rivers of Ukraine are integrated into a single hydrological system. In the course of many rivers, canals and other reservoirs there are various hydraulic structures, which in one way or another affect the qualitative parameters of water. That is why the problem of optimizing the system of integrated monitoring and monitoring of the state of surface water and the level of their pollution is particularly important on the path to sustainable development of society.

The purpose of the work was to determine the influence of hydrotechnical structures on the quality of drinking water in the conditions of natural and artificial watercourses of the Southern Bug River, the Siversky Donets Donbass Canal as sources of water supply. The work was completed during 2013-2017 on the territory of Donetsk and Vinnitsa regions of Ukraine. According to the laboratory data obtained in the experimental water bodies, changes in the normative indicators were detected: hydrophysical-stiffness in the Siversky Donets Donbass Canal 8.1-8.5 mg/dm3, Southern Bug River 8.0-12.8 mg/dm3, at normal 5.0-7.0 mg / dm3; hydrochemical indicators - dry residue in the Siversky Donets Donbass Canal 1250 mg/dm³, in the river Southern Bug 284 - 2100 mg/dm3, at the rate of 651-1000 mg / dm³; the content of cations and anions - sulfates in the Siversky Donets Donbass Canal 450 - 487mg/dm³, in the river Southern Bug 56.18 - 214.25 mg/dm³ at a norm of 120-250mg/dm³; the oxidative conditions also have differences in the open and closed parts of the Siversky Donets Donbass Canal dissolved oxygen 7.6- 7.9 mg/dm³, in the river Southern Bug 7.5 - 9.4 mg/dm³ at the norm of 5 – 7 mg/dm³; permanganate channel oxidation 5.2 - 5.4 mg/dm³, in the Southern Bug river 0.8-3.06 mg/dm³ at a rate of 5.1 - 8.0 mg/dm³; the content of nitrates to the purification of the river Southern Bug more than 3.5 times than after and exceeds the permissible standards (before cleaning - 101,34 mg/dm³, after - 28,72mg/dm³). For all other parameters, the samples tested did not exceed the acceptable standards. Thus, the water of the two waterways of Ukraine, which differ in many parameters (man-made and man-made pressures, lithological conditions, climatic, etc.) and used as a source of drinking water, appeared unsatisfactory. It has been established that interference with the watercourse in the ecosystem leads mainly to the deterioration of water quality. Among such interventions is the creation of artificial drainage of water (channels), closed water conduits, any, even simple cleaning plants of water conduits.

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THE INTEGRATION OF COMPUTER TECHNOLOGIES IN EDUCATIONAL PROCESS OF HIGHER EDUCATION ON THE EXAMPLE OF THE ECOLOGICAL FACULTY OF RUDN

Vasily Shevtsov [1], Viktor Glebov[2]

[1]PEOPLES' FRIENDSHIP UNIVERSITY OF RUSSIA, RUSSIA, [2]PEOPLE'S FRIENDSHIP UNIVERSITY OF RUSSIA (RUDN UNIVERSITY), ECOLOGY FACULTY, RUSSIA
SHEVTSOV_VV@RUDN.UNIVERSITY

Abstract

The widespread introduction of information technologies in the educational process of University education is one of the complex problems in the educational sphere.

It should be noted that the modern education system in addition to the traditional-classical form of education requires students to have access to electronic educational resources. Therefore, it is important to maximize the free access of open educational resources.

However, there are various difficulties in integrating it. For example, training programs should include in their composition, in addition to the software shell of the training system, a set of modeling systems designed for direct research in static and dynamic processes of different systems.

In addition, there is a need to create and update teaching material. The use of educational and methodical material has its own specific features, for example, a weak fullness of educational and methodical material of the educational process. Existing information practices are often fragmented and poorly perceived by users. To solve this problem it is necessary to solve the problem of retraining of teachers in the development of educational content specific to the use of information technology.

Another problem in the integration of information technology in the educational environment is the issues related to the protection of information and copyright at all stages of user access to educational electronic materials, from unauthorized access to ensure unhindered use of the system by students.

There is also a technical problem, which consists in the fact that for the smooth operation of the hardware and software complex, it is necessary to have developed software and methodological support of the training system and the database, which must be stored throughout the training cycle.

On the basis of the above, at the ecological faculty of RUDN were developed and introduced into the educational process such modern information technologies as "Geographic information systems" (GIS), the program complex "Rosa". For psych diagnostics and identification of difficulty in adaptation of students and teachers the Program on an assessment of a psych emotional state is developed.

The main purpose of the presented it for students is to obtain the basic knowledge and skills necessary for professional activity in the creation and use of geographic information systems in the field of ecology and environmental management, the formation of skills of possession of modern GIS tools and methods of analysis of spatial information.

Conclusion. Thus, the effectiveness of the integration of information technologies in the educational process makes it possible for the teacher to significantly reduce the time to reproduce information, which allows more time to devo

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THE RATE OF BIODEGRADATION OF HERBICIDES SIM – TRIAZINE SERIES IN DIFFERENT SOILS

Pavel Kochetkov[1], Victor Glebov[2], Vitaly Abramov[1]

[1]K. I. SKRYABIN SCIENTIFIC RESEARCH INSTITUTE OF FUNDAMENTAL AND APPLIED PARASITOLOGY OF ANIMALS AND PLANTS, RUSSIA , [2]PEOPLE'S FRIENDSHIP UNIVERSITY OF RUSSIA (RUDN UNIVERSITY), ECOLOGY FACULTY, RUSSIA
PKOCHETKOV@GMAIL.COM

Abstract

The widespread use of pesticides around the world allows for large harvests of cultivated plants. The use of toxic chemicals is growing every year. At present, about several million tons of pesticides are widely used per year. The growing concentration of pesticides of different classes in the national economy poses a real threat to human and animal health.

The duration of preservation of the amounts of different classes of herbicides in the soil layer depends largely on the chemical and physical properties of both the herbicide and soil granule metric composition, weather and climatic conditions of the region, seasonality and conditions of the growing season of agro technical measures, etc.

It is known that most pesticides decompose in the soil layer as a whole in a biological way. At the same time, the rate of decomposition of a different class of herbicides in the arable layer depends, first of all, on the biological activity of the soil in which the microbial community lives.

In model experiments (sod-podzolic loamy) on cultivated soil, where humus content was 4.4%, phytotoxic effect of atrazine herbicide introduced into the soil in the mass of 3 kg/ha and during the growing period of 6 months was revealed. The same effect of phytotoxic action of atrazine herbicide was found on poorly cultivated (humus 2,8%) during the growing period in 12 months. The effect of phytotoxic action of atrazine herbicide was observed in the experiment with sand cultures and on a longer layer –more than 2.5-3 months.

The duration of preservation of residual amounts of herbicides is largely influenced by the dose of its application. So in field experiments in the planting of crops and at the rate of the introduction simazine 2 kg/ha is recommended for sod-podzolic soils was observed the duration of simazine in the soil of the studied MPC (0.02 mg/kg), which at the time amounted to 14-15 months. The duration of simazine increased to 37 months in making a triple dose of the herbicide - 6 kg/ha. When repeated administration of simazine herbicides at a dose of 2 kg / ha, the content of herbicide residues was higher compared to a single application.

The same data were obtained when making herbicide atrazine.

The duration of toxic effect of triazine herbicides also depends on agro technical treatment of the arable layer. Deep plowing makes it possible to accelerate the biological destruction of herbicides.

Conclusion. Thus, applying different tillage and application of organics, it is possible to regulate to certain extent duration of toxic action of herbicides in the necessary direction - slightly reducing it, or, on the contrary, prolonging (in the last case, for fight against weed plants).

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THE RELATIONSHIP BETWEEN ENVIRONMENTAL POLLUTION AND HUMAN HEALTH

Viktor Glebov[1], Gul'nara Kulitva[1]

[1]PEOPLES' FRIENDSHIP UNIVERSITY OF RUSSIA (RUDN UNIVERSITY), ECOLOGY FACULTY, RUSSIA
APPLE89@MAIL.RU

Abstract

The growing global problem of environmental pollution is of particular concern to national and international organizations. Established in 1957 in the United States Chemical Abstracts service (CAS) shows that, if in the period up to 1965 the number of registered chemicals annually increased by an average of 300 thousand, in the period 1976-1990-by 670 thousand, in the period 1991-2005-by 1 million, in 2015 the total number of registered chemicals exceeded 103 million.

It is predicted that in the period up to 2050 the market of chemicals will grow by 3% annually, with the total number of chemicals on the European market of about 150,000.

According to the world health organization that regional office for Europe (Euro), air pollution by chemicals is a leading risk factor for mortality and morbidity. In 2012, 600,000 premature deaths due to air pollution occurred in the European region, with 482,000 deaths due to air pollution and 117.2 thousand deaths due to indoor air pollution. About 80% of the cases resulted from coronary heart disease and stroke, 14% from chronic obstructive pulmonary disease or acute lower respiratory infections and 6% from lung cancer. The international Agency for research on cancer (IARC) classified diesel engine emissions, particulate matter and atmospheric air in large cities as carcinogenic to humans in General. In Russia, studies in the State Researching Program have shown that, for example, in Moscow, the risk of cancer is mainly determined by priority carcinogens contained in urban industrial emissions, such as chromium (YI), benzene, butadiene, 1,3-butadiene, Nickel, carbon tetrachloride, arsenic, formaldehyde and trichloroethylene. Risk assessment of 10 carcinogens contained in motor vehicle emissions in the zone of influence of traffic flows Of the third transport ring of Moscow showed that out of 3 million people living within a radius of 2 km from it, about 12% of the population is exposed to a high level of carcinogenic risk, and 7% - absolutely unacceptable, requiring urgent measures. Benzene, 1,3 - butadiene, soot and formaldehyde make the main contribution (99,6%) to carcinogenic risk. Thus, atmospheric air is a priority environment for the development of cancer in the population of Russia.

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THE UTILIZATION OF TOXIC HYDROGEN SULFIDE IN ELECTROSYNTHESIS OF BIOACTIVE MONO- AND DISULFIDES

Shvetsova1[1], N.T. Berberova[1], E. V. Shinkar[1], D. B. Sediki[1]

[1]CHEMICAL DEPARTMENT IN ASTRAKHAN STATE TECHNICAL UNIVERSITY, RUSSIA
LULALOTO@MAIL.RU

Abstract

In this paper the new synthesis method of bioactive organic mono- and disulfides is discussed. The organic sulfur compounds play an important role in the pharmaceutical industry. For a long time, sulfur retains its status as the dominant heteroatom, which is part of 362 sulfur-containing medicines approved by the Food and Drug Administration (USA). The biological value of mono- and disulfides is very high: antifungal, antibacterial and anticancer activity.

Previously, we investigated a series of reactions of hydrogen sulfide with different organic compounds under mild conditions. The oxidative activation of H2S contributed to obtaining of sulfur organic derivatives at 298 K and 1 atm. We proposed to carry out a three-component synthesis of an unsymmetrical mono- and disulfides involving H2S, di(n-butyl)disulfide and organic compounds. We used the cycloalkanes C5-C8, aromatic hydrocarbons and five-membered heteroaromatic compounds as organic substrates. The reactions of these substances with H2S and (п-C4H9)2S2 was conducted in conditions of electrochemical one-electron oxidation stage of H2S to an unstable radical cation at a platinum electrode in CH2Cl2. The fragmentation of radical cation H2S promotes the elimination of the proton. The oxidation potentials of sulfur-containing reagents (1,55; 1,7V) are lower than substrate's potentials. The activation of (п-C4H9)2S2 and H2S is only possible during electrolysis while substrate is in molecular form. In this connection, during the reaction, the value of the electrolysis potential was been maintained equal to the oxidation potential of the sulfur-containing regents. The reactions were been carried out for 90-180 minutes. The ratio of (п-C4H9)2S2 and substrate was 1:10, and H2S was been introduced into the reaction mixture in an excessive amount.

In the first stage of the reaction, the thiyl radical attacks the substrate. As a result, the obtaining of different structure thiols depending on the initial substrate was been fixed. At an electrolysis potential, thiols are also capable of one-electron oxidation. The fragmentation of the thiol cation radicals leads to the formation radicals with unpaired electron on the sulfur atom. The generated radical reacts with (п-C4H9)2S2, that carries on the formation of the unsymmetrical sulfide and disulfide. The conversion of (п-C4H9)2S2 varies from 60 to 85%. The yield of the producing products (24-45%) depends on the nature of the organic substrate. Thus, environmentally friendly and energy-efficient method of electrosynthesis has several advantages such as utilization of toxic H2S, mild conditions and the absence of different initiators.

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TREATMENT OF EXPERIMENTAL WOUNDS WITH GEL-IMMOBILIZED ANTIBIOTICS, BACTERIOPHAGES AND FIBROBLASTS

I. Vysekantsev[1], V. Martsenyuk[1], I. Buriak[1], L. Abrafikova[1], O. Babinets[1]

[1]INSTITUTE FOR PROBLEMS OF CRYOBIOLOGY AND CRYOMEDICINE OF THE NAS OF UKRAINE, UKRAINE
IGOR.VYSEK@GMAIL.COM

Abstract

The promising direction of current medicine is the development of effective therapeutic methods for infected wounds with impaired skin and soft tissue regeneration. The aim of the study was to develop an experimental antibacterial coating which would stimulate regenerative processes in infected wounds. A combined coating consisted of two components has been created (Patent of Ukraine UA 116072 C2). The antimicrobial activity of the experimental coating was provided by 1% sodium alginate gel microgranules with fillers, i.e. a fluoroquinolone antibiotic "Ciprofloxacin" ("Yuria-Pharm", Ukraine), polyvalent bacteriophage preparation "Sextaphag Pyobacteriophag" (“Microgen", Russia), virulent for the wound infectious agents, an immunomodulatory agent "Sodium Nucleinate" ("Belmedpreparaty", Belarus). The fibroblasts were responsible for improved skin regeneration. They were obtained from rat skin and suspended in 1.5% methylcellulose gel. The experiments were performed in white random-bred rats. All manipulations were carried out in accordance with European and National requirements in bioethics. The skin inflammation with the formation of wounds was initiated by subcutaneous injections of 9% acetic acid. The wounds were infected with P. aeruginosa and S. aureus strains susceptible to "Ciprofloxacin".Gel microgranules with fillers were introduced into methylcellulose gel with fibroblasts. The obtained coating was applied once a day to the wounds. The wound process was monitored by measuring the area of wounds and histological studying of the skin and adjacent tissues (the severity of fibrinoid necrotic layer, maturation of the granulation tissue, formation of epithelial layer). The comparison groups included animals a) without treatment, b) treated according to standard protocols, c) treated with fibroblast-free coating, d) treated with commercial coatings. It has been shown that the use of the described wound coating provided a reliable reduction in the duration of the regeneration phase, phase of scar reorganization and epithelization. Thus, our wound coating shortened the duration of complete wound healing. The possibility of long-term storage of the combined coating at low temperatures was studied. After 1-year storage of gel granules with fillers and fibroblasts at the temperatures of –80 and –196 ºC, respectively, the therapeutic effectiveness of the coating has not changed.

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UNDERGROUND WATER POLLUTION OF RURAL AREAS IN UKRAINE

Andrii Romanenko[1], Larissa Voitenko[2]

[1]NATIONAL UNIVERSITY OF LIFE AND ENVIRONMENTAL SCIENCES OF UKRAINE, DEPARTMENT OF PLANT PROTECTION, THE BIOTECHNOLOGIES AND ECOLOGY, UKRAINE, [2]NATIONAL UNIVERSITY OF LIFE AND ENVIRONMENTAL SCIENCES OF UKRAINE, DEPARTMENT OF ANALYTICAL, BIO-INORGANIC CHEMISTRY AND WATER QUALITY, UKRAINE
ANDREI.ROMANENKO101@GMAIL.COM

Abstract

Ukraine is one of the richest Europian countries in terms of having abundance of internal fresh water resources. But political and economic instability for 27 years of independence have led to disintegration of the governmental control in the field of water protection, in particular for underground waters. As a result, there is an urgent need for a systematic monitoring of water quality in rural areas where water supply is made of local sources mainly. Description of Research. NULES research group have been monitoring water quality in 64 small communities. A long-term seasonal monitoring (2003-2017) has covered 218 wells (4-25 m deep) located in rural areas of Polissja and Forest-steppe landscape zones. Water quality of those wells have been analyzed on heavy metals (Cd, Pb Cu, Zn, Ni, Fe), nitrates, nitrites, phosphates, fluorides, chlorides, sulfates content, dry residue, hardness, COD, pH. Technical conditions of the wells have also been assessed to determine the potential of leaching organic and mineral substances from soils into well's water. The water quality parameters were measured in the Measuring laboratory of Analytical and Bio-inorganic Chemistry & Water Quality Department of NULES of Ukraine. Results and discussion. Results indicated that near 70% of total wells were polluted by nitrates, containing more 10 mg nitrate N per litre. In 2017 during a summer season the highest nitrate concentration (1844 nitrate N per litre) were found in a private well in small community Rosishky, Kyiv oblast. Our results show that the nitrate pollution main sources are not runoff from applications of nitrogen fertilizers but are rather polluted runoff from small-scale farms specializing on fattening pigs, poultry production as well as household sources (unisolated septic tanks and manures). Water from wells in Ukrainian limestone areas (included near 80% of studied areas) has high hardness. The concentrations of calcium and magnesium salts in underground waters are determined by the type of soils in the catchment area and by the time period that water is exposed to these rocks/soils. It was observed extremely high value of total water hardness (51,2 mmol/L, 143,4 dH) in a local community well located in Verbivka village, Cherkassy Oblast. In reality it is hard to imagine so high water hardness because of naturally occurred solubility product of calcium and magnesium salts. We repeated this analysis three times during 2013 spring season. We still find the high hardness of the well's water. We also found that 2 km away from this well a sugar factory is located that may serve as a potential source of this high level of water hardness. In summary, only 10% of the studied wells have been characterized as having good quality for drinking and household usa

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WATER RESOURCES MANAGEMENT OF COAL MINING REGIONS OF SOUTH EASTERN UKRAINE

Larysa Anisimova[1], Vasyl Andrieiev[1], Oleh Tiapkin[2], Vladyslav Vernyhora[3]

[1]INSTITUTE FOR NATURE MANAGEMENT PROBLEMS & ECOLOGY, DNIPRO, UKRAINE, [2]NATIONAL MINING UNIVERSITY, DNIPRO, UKRAINE, [3]DTEK ENERGY LIMITED LIABILITY COMPANI, PAVLOHRAD, UKRAINE
LANISIMOVA@GMAIL.COM

Abstract

Ukraine, which has been consistently a policy of integration into the European Community, is making every effort to meet unconditionally all norms of environmental safety and, first of all, Directive 2000/60/EC of the European Parliament and the Council of 13.10.2000 establishing a framework for Community action in the field of water policy. But there are significant barriers along the way and first of all environmental challenges: contamination of significant territories with radioactive, toxic and other waste resulting from their technogenic overload as well as lack of rational production structure economy management; waste water polluting large and small rivers resulting from lack of rational economy management; submerging of significant areas as the result of lack of rationale in hydrotechnical engineering and melioration.

Ukraine belongs to the least provided with water resources European countries. Multi-branch complex created in Ukraine consumes in the producing process of significant volumes of water. But territorial distribution of water resources does not correspond to location of water-retaining branches of economic complex of Ukraine. The least provided with water resources are coal mining regions (26 % territory of Ukraine) in which the biggest consumers of water are located.

One of the main priorities of Ukrainian national ecological strategy is establishment of integrative water resources management in old industrial regions (and first of all in coal mining regions) for their preservation and reproduction. The problem has increased in south eastern Ukraine since 2014, because of military operations in Central Donbas and corresponding great increase in coal production in Western Donbas. The most pressing environmental problems in natural waters of Western Donbas are pollution of rivers with insufficiently purified industrial effluent (~14 million cubic meters of highly mineralized mine waters (up to 7 g/liter) per year) and, as a result, a decrease in the ability of aquatic ecosystems to self-purify and self-repair. Some options for the use and minimization of negative impact of mine waters on natural water bodies (incl. removal of the waters beyond the boundaries of Western Donbas to river Dnipro, saline lake Sivash, Black Sea and Azov Sea) were estimated. The advantages and disadvantages of these options are revealed. Only complex use of these schemes is necessary for effective water resources management of south eastern Ukraine.

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ZOOGENIC TENDENCIES OF BUFFER CAPACITY OF URBAN SOILS IN BOUNDARIES OF THE PARK ZONE OF INDUSTRIAL MEGAPOLIS (CITY DNIPRO, UKRAINE)

Yuriy Kulbachko[1], Oleh Didur[1], Yuliia Ovchynnykova[2], Alevtyna Pokhylenko[1]

[1]OLES HONCHAR DNIPRO NATIONAL UNIVERSITY, UKRAINE, [2]VASYL' STUS DONETSK NATIONAL UNIVERSITY, UKRAINE
KULBACHKO57@UA.FM

Abstract

Park soils within megapolises territory are their integral components and this defines conditions of growth and development for green plants. Such processes as overdensification of root-inhabitant layer, limitation of volume available for the plants' root system development, loss of nutrients, humus, microelements and fertility, contamination with heavy metals and other toxicants, changing in soil acidity and alkalinity, decrease in soil microflora and fauna diversity, accumulation of the litter on the surface could be listed among other ecologically negative consequences for soils in the conditions of urban environment. Earthworms (Oligochaeta: Lumbricidae) are typical representatives of the funcitional group of ecosystem engineers. They actively participate in formation and stabilization of soil fertility through their effect on its buffer capacity. Buffer capacity defines in many aspects soil potential, supports immobilization and mobilization of certain elements of fertility – first of all mineral elements essential for plants, productive moisture, heat energy of soil, gas composition of soil air. To evaluate the contribution of the earthworms coprolites into acidic-base (pH) buffer capacity of urbansoils of the park zone within the plot planted with Norway maple (*Acer platanoides* L.) trees on the territory of park "Zeleny gai" (city Dnipro, Ukraine), soil and coprolites samples were collected. Buffer capacity of studied soils and new soil formations (coprolites) were evaluated according to "buffer area". Is was established that acid-base buffer capacity of earthworms coprolites statistically significantly higher than for initial soil (urbansoil, upper humified layer of Calcic Chernozem) within the acidic diapason on 22,9 % and, in average, considering standart deviation the values were 22,94±0,31 and 18,66±0,21 conv. units. In basic diapason – on 18,4 %, the values were 24,17±0,48 and 20,41±0,33 conv. units accordingly, in sum acidic-base relation – on 20,6 %, which had meanings 47,11±0,43 and 39,07±0,38 conv. units. Thus, soil saprophagues, such as earthworms, in the conditions of megapolises in the recreation zones within the territories of city parks' green plantations is one of the natural factors of ecological rehabilitation of urban soils. This improves ecological state of green plantations on the urban soils within park areas and recreation zone edaphotopes revitalization and support optimization of human living and recreation environment.

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ZOOGENIC TENDENCIES OF BUFFER CAPACITY OF URBAN SOILS IN BOUNDARIES OF THE PARK ZONE OF INDUSTRIAL MEGAPOLIS (CITY DNIPRO, UKRAINE)

Yullia Ovchynnykova[1], Yurii Kulbachko[2], Oleh Didur[2], Alevtyna Pokhylenko[2]

[1]VASYL' STUS DONETSK NATIONAL UNIVERSITY, UKRAINE, [2]OLES HONCHAR DNIPRO NATIONAL UNIVERSITY, UKRAINE
YU.OVCHINNIKOVA@DONNU.EDU.UA

Abstract

Park soils within megapolises territory are their integral components and this defines conditions of growth and development for green plants. Such processes as overdensification of root-inhabitant layer, limitation of volume available for the plants' root system development, loss of nutrients, humus, microelements and fertility, contamination with heavy metals and other toxicants, changing in soil acidity and alkalinity, decrease in soil microflora and fauna diversity, accumulation of the litter on the surface could be listed among other ecologically negative consequences for soils in the conditions of urban environment. Earthworms (*Oligochaeta*: *Lumbricidae*) are typical representatives of the funcitional group of ecosystem engineers. They actively participate in formation and stabilization of soil fertility through their effect on its buffer capacity. Buffer capacity defines in many aspects soil potential, supports immobilization and mobilization of certain elements of fertility – first of all mineral elements essential for plants, productive moisture, heat energy of soil, gas composition of soil air. To evaluate the contribution of the earthworms coprolites into acidic-base (pH) buffer capacity of urbansoils of the park zone within the plot planted with Norway maple (*Acer platanoides L.*) trees on the territory of park "Zeleny gai" (city Dnipro, Ukraine), soil and coprolites samples were collected. Buffer capacity of studied soils and new soil formations (coprolites) were evaluated according to "buffer area". Is was established that acid-base buffer capacity of earthworms coprolites statistically significantly higher than for initial soil (urbansoil, upper humified layer of Calcic Chernozem) within the acidic diapason on 22,9 % and, in average, considering standart deviation the values were 22,94±0,31 and 18,66±0,21 conv. units. In basic diapason – on 18,4 %, the values were 24,17±0,48 and 20,41±0,33 conv. units accrdingly, in sum acidic-base relation – on 20,6 %, which had meanings 47,11±0,43 and 39,07±0,38 conv. units. Thus, soil saprophagues, such as earthworms, in the conditions of magapolises in the recreation zones within the territories of city parks' green plantations is one of the natural factors of ecological rehabilitation of urban soils. This improves ecological state of green plantations on the urban soils within park areas and recreation zone edaphotopes revitalization and support optimization of human living and recreation environment.

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THE PREDICTION OF MASS REPRODUCTION OF STEM PESTS OF CONIFEROUS TREES IN UKRAINE END ITS RELEVANCE

Grygoriy Khaetskiy[1], Eduard Kavun[2], Svitlana Loginova[1]

[1]VINNITSIA NATIONAL AGRARIAN UNIVERSITY 3, SONIACHNA ST., VINNYTSIA, 21008, UKRAINE,[2]VASIL' STUS DONETSK NATIONAL UNIVERSITY 21, 600-RICHYA STR., VINNYTSIA, 21021, UKRAINE, YU.OVCHINNIKOVA@DONNU.EDU.UA

Abstract

In Ukraine, in particular in Polissya, since 2012 and until that time, there is a looming increase in the number of stem pests. For the European fir (*Picea abies*) the dominant species is the bark beetle (*Ips typographus*). For pine (*Pinus silvestris*) the top spot bark beetle (*Ips acuminatus*), hexagonal bark beetle - Stenograph (*Ips sexdentatus*) and small pineal loboid (Blastophagus minor) appear to be of paramount importance. One of the first steps in solving this problem in artificial ecosystems such as forests is the inventory of a harmful and useful fauna in order to detect the spatial distribution of organisms, the introduction of mechanisms for regulating their numbers, and particular attention is required for the forecast of massive reproduction of the harmful entomophage and the search for ways to stop the spread of these pests.

Keyword: prognosis, stem pests, temperature, precipitation, *Picea abies, Pinus silvestris, Ips typographus, Ips acuminatus, Ips sexdentatus, Blastophagus minor*.

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GENETIC AND MODIFICATION VARIABILITY OF MISTLETOE WHITE AS THE BASIS OF ITS EXPANSION

Eduard Kavun[1], Valentina Panko[1]

[1] VASYL' STUS DONETSK NATIONAL UNIVERSITY ALEXANDER HNATYUK, VINNITSA NATIONAL AGRARIAN UNIVERSIT YU.OVCHINNIKOVA@DONNU.EDU.UA

Abstract

During the last 20-30 years in Europe present an intensive dissemination of mistletoe (*Viscum album* L.) [Barney C. W., 1998, Taran N.Yu., 2008]. In the central and northern regions of Ukraine were identified at least 24 species of trees and shrubs that are affected by mistletoe. Among them 6-8 species of trees which are under the strong pressure by mistletoe, it is poplars, maples, lindens, willows, mountain ash, birches.

However, the mistletoe parasitizing on deciduous trees is morphologically heterogeneous and its representatives differ significantly in a number of features: density and shape of bushes, the type of branching, the thickness and long branches. Essential variations in the size and shape of the leaves also take place.

The density and shape of mistletoe is an integral indicator that is easily determined and therefore can be the primary criterion for a detailed analysis of its variability. Mistletoe with high density bushes, has a large leaves and short, strongly branching branches, their shape approximates to the sphere. Conversely, mistletoe bushes with low density can have an ellipse like shape, small leaves, elongated thin and weakly branching branches.

Some species of trees mainly susceptible to the defeat by mistletoe, which has a high density (*Robinia pseudoacacia, Salix fragilis* L.), while in other species are present low-density mistletoe bushes (*Fraxinus excelsior* L., *Tilia cordata*) is distributed. Mistletoe adaptation to host plants occurs through genetic, physiological and biochemical mechanisms, which reflected in morphological features.

At the same time morphologically different bushes of mistletoe, growing not only within the same species, but also on single tree were found. It is indicates that the morphological variability is a result of genetic variations.

It was were found that in the large territory of Vinnytsia region birch is not affected at all by the mistletoe, while on others regions this species is under the powerful pressure of this parasite.

Data about the morphology, virulence, geographical data, sensitivity of some species indicate on differentiation processes within this parasite, as well as on adaptation processes which generally enhances damaging properties and contribute to the intensive distribution of mistletoe.

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