

International seminar of ecology – 2021 “Current trends of ecology”

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Introduction

The term “ecology” was used for the first time in 1866 by Ernst Haeckel, who saw both the descriptive natural history and observation field studies, as the main objectives of ecology. During the last 155 years, ecology has evolved to the present multidisciplinary field by cooperating with biogeochemistry, climatology, evolution, genetics, hydrology, statistics, economics, social science, and others, in order to clarify and solve environmental problems provoked by climate changes, invasive species, environmental pollution, etc. (Murrel et al. 2001; Carpenter and Folke 2006; Corlett 2015). Humans, as rational beings, aim to reduce and prevent environmental problems some of which were discussed at the “International Seminar of Ecology - 2021“, titled “Current trends of Ecology“.

About the seminar

The annual Seminar of Ecology has a long-lived history. The first scientific event was organized in 2007 by Section Biology, Union of Scientists in Bulgaria, and Central laboratory of General Ecology, BAS as a platform for students, and scientists to share their results and to discuss major ecological problems. The annual seminar became a very popular forum for well-known researchers, young scientists, BSc, MSc, and PhD students from Bulgaria and abroad. Each year, guest lecturers present their latest

reports at the main thematic areas of the Seminar, covering current and interesting topics. Over the years, the seminar has been broadened. In 2014 it became a Seminar of Ecology with international participation, and in 2019 it became known as the “International Seminar of Ecology”. Due to the pandemic situation, the last two meetings of the International Seminar of Ecology were carried out online. Through the years, the Organizing Committee has kept the tradition to award the best oral presentations and posters, of students and young scientists, with certificates and books. After a review by independent reviewers, proceeding books were published with a corresponding ISBN. In the last two years, selected papers were published in the journals *Ecologia Balkanica*, *BioRisk*, and *Phytologia Balcanica*.

About this issue

This thematic special issue of *BioRisk* compiles materials presented at the International Seminar of Ecology - 2021. The articles published here illustrate, approximately to the full extent, the problems presented and discussed at the Seminar. During the first session, devoted to the biotic and abiotic impact on the living nature, ecological risk, and bioremediation, two complementary plenary reports were presented to the audience. “Ecocide” introduced the auditora to the global effect of pesticides, radionuclides, and petroleum products on target and non target organisms. The “Green and nano-pesticides” report discussed their use, as alternatives to chemical pesticides.

A set of reports focused on the anthropogenic and environmental impact of heavy metals, fungicides, polycyclic aromatic hydrocarbons (PAHs), and natural radionuclides provoked the interest of the participants and sparked a serious discussion. Based on the correlation found between bacterial abundance, soil properties, and heavy metal pollution, the discussion was focused on soil properties as a factor that can modulate the effect of heavy metals, present in chronically contaminated soils. Different approaches to overcome environmental pollution were presented and discussed: zeolites as detoxifying tools, microalgae for the treatment of contaminated water bodies, and a newly developed bio-fertilizer, based on activated sludge combined with a bacterial strain with detoxifying and plant growth-promoting properties. There is a clear need to extend the existing monitoring programs, by including more bioindicators and markers, in order to achieve a more detailed assessment of the environmental impact. For example, sexually-manifested variations in the pigmentation of *Boeckella poppei* (Copepoda: Calanoida) from the Livingston Island (Maritime Antarctica), were described as a suitable indicator, reflecting the ongoing global environmental changes in Antarctica. Changes in the antioxidant system of commercially important fish species and mussels from the Bulgarian Black Sea coastal area, were recommended as markers for the ongoing global environmental changes.

It was shown that by using various markers for the evaluation of environmentally induced stress response at different levels (microbiological, molecular, biochemical), it was possible to gain insights of the organisms’ protection and the mechanisms involved

in the formation of resistance to environmental impact. The contribution of increased DNA repair capacity and AOS to the development of environmental tolerance or adaptation was also shown. Important results for understanding the processes of photoprotection, in either cyanobacteria or algae, and higher plants were obtained by *in vitro* reconstitution of complexes of stress HliA protein with pigments. The crucial role of the cellular physiological state, as a critical factor in determining the resistance to environmental stress with Q cells was demonstrated. Several papers were focused on the action of bioactive substances with plants origin. The bioactivity was shown to depend strongly on chemical composition. *Origanum vulgare hirtum* essential oil was promoted as a promising candidate for the purposes of “green” technologies. Analyzing secondary metabolites of plants, it was shown that their productivity *in vitro* is a dynamic process closely related to the plant’s growth and development, and is in close relation with the interactions of the plant with its environmental conditions.

In the plenary report of the ecological agriculture session, the impact of agriculture on the environment, human health, energy crises, and climate changes was shown to enforce policymakers and farmers to rethink the recent model of agricultural production. It was pointed that, designing and implementing such an agricultural model requires significant changes in the management of the farming systems, natural resources, food-chain, and scientific approaches, in order to meet environmental and societal demands. In this aspect, the link and interrelationship between traditional, organic, and new plant breeding techniques including GMO and precision farming were also considered.

In this context, the influence of the agricultural system type on essential oil production and antioxidant activity of industrially-cultivated *Rosa damascena* Mill. in the Rose valley (Bulgaria) was reported, comparing organic vs. conventional farming. The rose extracts from organic farming were shown to accumulate more phenolic compounds, corresponding to the higher antioxidant potential of organic roses.

A comparative study, based on official data from the statistics office of the European Union and the Member countries, concerning viral infection levels in intensive and organic poultry farming, demonstrated that free-range production had a higher incidence of viral diseases with a high zoonotical potential.

Pollinators of *Lavandula angustifolia* Mill., as an important factor for optimal production of lavender essential oil were analyzed. It was concluded that, although lavender growers tend to place beehives in the fields for optimal essential oil production, it was also crucial to preserve wild pollinators.

New data reported that essential oils and alkaloid-rich plant extracts had the strongest acetylcholinesterase inhibitory activity and could be recommended for further testing for insect control.

The thematic session “Biodiversity. Conservation Biology” started with 3 plenary lectures concerning the vegetation diversity on the territory of Bulgaria, genetic diversity in cork oak plantations in Portugal, and nematodes in two cold deserts - the Antarctic and the Arctic. It was reported that the vegetation diversity of Bulgaria was still not fully investigated. Grasslands, broad-leaved forests, and wetlands are the best-

investigated habitats. Data concerning ruderal, shrubland, fringe and chasmophytic vegetation in Bulgaria are scarce. The second report “Cork oak landscape: a sustainable multi-use resource” presented the main results from a very long-lasting investigation, spanning the last 2 decades, in order to understand cork oak genetics and to identify “genes of interest for high-quality cork production”.

In „Nematodes of Extremes: Polar deserts“, both nematodes’ fauna and ecology in two polar deserts - the Arctic and the Antarctic, were presented along a short historical review of exploring these regions. Special attention was focused on the specific survival adaptation strategies of nematodes and the good opportunity for the polar deserts to be regarded as an „excellent model habitat - a natural laboratory to study and monitor the impact of the global changes in the biotic communities”.

Other important problems were reported and discussed in this session: the opportunity of pest control using pteromalids as natural enemies of pests in various crops; the main reasons responsible for the population decrease of bumblebees - habitat destruction, loss of floral resources, emerging diseases, and increased use of pesticides (particularly neonicotinoids); the strong impact of temperature and wind on the distribution of zooplankton complexes in Mandra Reservoir, in Southeastern Bulgaria; an alternative approach for the *ex-situ* conservation of *Stachys thracica* based on *in vitro* shoot culture and its subsequent adaptation under *ex vitro* conditions.

The plenary report in the session “Ecosystem research and services. Landscape ecology” asks the question: is it possible for us to become ecosystem-friendly people again? In this report, ecosystems, as the fundamental functional units of the living planet were discussed. The main problems, responsibilities, and goals of ecosystem management were presented, as well as, the necessity to integrate ecological, economic, and social goals into a unified management approach that requires urgent reorganization of science and education.

In the next reports, new information was presented concerning pre-monitoring geochemical research of river sediments in the area of Ada Tepe gold mining site (Eastern Rhodopes). The obtained results illustrate that the explored landscapes have been influenced by natural geochemical anomalies, as well as, impacted as a result of human activity. The forests habitat diversity of Breznik Municipality was revealed, following the EUNIS Classification and initial data from the Ministry of Environment and Water and the Forestry Management Plans. It was shown that in addition to the dominant species *Quercus dalechampii*, *Quercus frainetto*, *Fagus sylvatica*, *Carpinus betulus*, some artificial plantations with *Pinus nigra* and *Pinus sylvestris* were also present, as well as non-native species, such as *Robinia pseudoacacia* and *Quercus rubra*. Models for Predicting Solution Properties and Solid-Liquid Equilibrium in Cesium Binary and Mixed Systems were created. The results are of great importance for the development of strategies and programs for nuclear waste geochemical storage.

In conclusion, many results in different areas of ecology were presented in the Seminar, followed by interesting discussions. A lot of questions were answered, however many others remained open. A good platform for further discussion will be the next International Seminar of Ecology - 2022, entitled “Actual problems of Ecology”.

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