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Scientific Aniversary Symposium - 70 Years from Foundation of University Botanical Garden, Tîrgu-Mureș

1948 — 2018

Tîrgu Mureș, Romania
30 May - 01 June 2018

VOLUME OF ABSTRACTS

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BOOK OF ABSTRACTS

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PLENARY LECTURES

FROM THE SECRET LIVING OF PLANTS: GENETIC SIMPHONY

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The authors present summary data on the evolution of the vegetable universe on earth; the secrets of plants related to plant diversification and breeding; domestication of plants, the development of agriculture and creation of an impressive number of species (over 10,000 used in agriculture), the transfer of the new species and the original ones from one continent to another; the danger of disappearance of old local varieties due to an increased industrial agriculture; scientists effort to create gene banks (seeds) in many countries (over 500 only in Europe); the building and putting into use in 2008, of a world safe seeds in Svalbard (Norway) to preserve a wide variety of species and a large variety of plants originating from all over the world. Finally, the paper emphasizes vegetable "genius" and human "genius" (nurturing and destructive in the creation of new varieties and the disappearance of old varieties – genes reserve).

SPONTANEOUS MEDICINAL PLANTS IN MUREȘ COUNTY: *UTI SED NON ABUTI*!

Vasile Cristea[1,2]

[1]"Babeș-Bolyai" University, Cluj-Napoca, Romania
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Romania's natural resources are currently subjected to aggressive and very little controlled exploitation. These resources include medicinal plants from the spontaneous flora, which are much more demanded and appreciated on the external market than those derived from cultures.

Having information available regarding commercial societies (S.C.) and physical persons (P.P.) whose object of activity also comprises this resource, we wish to argue, taking Mureș county and the year 2017 as an example, the need for moderation in using all renewable as well as non-renewable resources.

In 2017, 31 S.C. from 12 counties (10 societies based in Mureș county) and 11 P.P. residing in Mureș county requested approval for use.

The requested amounts involved 110 sp. of medicinal plants and amounted to **7.528 t** (of which only 8 t required by P.P.), while the institutions authorized to perform adequate evaluation (AE) studies proposed **4.342 t** and the NMC approved only **3.668 t**. Certainly, S.C. in particular are dissatisfied with the approved amounts and have recourse to a wide range of "strategies".

However, in our decisions we took into consideration the biology of each species, the required organ/organs, the animal species that consume these plants, as well as the role of these primary producers in the functioning of the respective ecosystems. It is these criteria that we also apply this year!

Even if in Mureș county pressure is not as high as in other counties in Transylvania, we believe that all organizations concerned with environmental conservation and protection should fight for a sustainable use of this important resource, which in most cases is subjected to other pressures in addition to those related to harvesting and export as raw material.

PLANTS DIVERSITY CONSERVATION IN THE „ANASTASIE FĂTU" BOTANICAL GARDEN OF „ALEXANDRU IOAN CUZA" UNIVERSITY OF IAȘI

Cătălin Tănase[1]

[1]"Anastasie Fătu" Botanical Garden of "Alexandru Ioan Cuza" University of Iași, Romania

The "Anastasie Fătu" Botanical Garden of "Alexandru Ioan Cuza" University of Iași is unrolled in various important research and educational activities focused on aspects such as plants diversity conservation and their use as long time, renewable resources. The existing gene poll of the collections belonging to the 10 sections is represented by the 9,323 different taxa. On its total surface of 89.55 hectares numerous and complex projects of landscape design and ex situ plant conservation are being carried out. Starting with 2002 this institution is a founding member of the Romanian Botanical Gardens Association, which is affiliated since 2003 with the International Association of Botanical Gardens. Since 2009, the Botanical Garden of Iași is a member of the International Plant Exchange Network and from 2011 is part of the Botanical Gardens of Coimbra Group Universities.The investigation methods and materials used in ex situ plants conservation respect the conceptual frame and vegetal diversity levels of approach, the international legislation and the procedural guidelines in the field. The selected methods imply the integration of Romanian flora and vegetation studies in the European and global context, using the internationally accepted terminology, concepts and methods. The living plants collections are preserved within the Botanical Garden of Iași depending on their particularities. The premise for developing these collections is determined by the degradation of natural habitats due to over-exploitation, urban pollution, and improper agricultural and forestry practices. The diversity of these collections and selecting the best ex situ conservation methods represent an important objective in the strategy of the Botanical Garden of Iași, both in the fundamental mission of plants diversity conservation and

in the attempt of promoting this institution as an educational center for vegetal conservation. The ex situ plants conservation actions imply: creating special collections of threatened and rare plant species; collections that can be used in studies regarding genetic variability, biology of reproduction and ecology; establishing indigenous plants collections of economically important species (pharmacy, food and textile industries, etc.); using the plants collections in repopulation programs; diversifying the germplasm resources; using in vitro micropropagation techniques for cell and tissue cultures; identifying and promoting the educational values of plants conversation. The „Anastasie Fătu" Botanical Garden" of „Alexandru Ioan Cuza" University of Iași offers numerous opportunities for implementaion of complex projects regarding landscape design, ex situ plants conservation, public education and information. The living plants collections gather wild species with different biogeographical origin and also numerous chrysanthemums, roses, daffodils, tulips, azaleas and camellias taxa with special decorative value. The scientific contributions follow the evaluation and update of data bases regarding Romanian flora and vegetation, identifing the special protected areas for plants and selecting the proper methods for ecological reconstruction.

Keywords: taxa, collections, conservation, germplasm, education

ORAL PRESENTATIONS

ASSESSMENT OF *ANEMONE NEMOROSA L*. TOXICITY

Robert Ancuceanu[1], Raluca Căplănuși[1], Adriana Iuliana Anghel[1], Cristina-Silvia Stoicescu[2], Marilena Viorica Hovaneț[1], Mihaela Dinu[1]

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[2]Romanian Academy, “Ilie Murgulescu” Institute of Physical Chemistry, Bucharest, Romania

Background: *Anemone nemorosa* L., wood anemone, Ranunculaceae, is a herbal species with beautiful flowers, blooming around Easter time, being for this reason known in Romania as “Easter flower”. Published research on its chemical composition and biological effects is scarce, although it is generally known that it is toxical through its protoanemonin contents. In this paper we report on its toxicity on *Triticum aestivum* L., *Lactuca sativa* L. and *Artemia franciscana* Kellogg.

Material and methods: The herbal material was collected from Lereşti and Bughea de Jos, Argeș County, dried in laboratory and identified macroscopically and microscopically (cross-sections from underground organs, stem and leaf). Dry ethanolic and aqueous extracts were prepared from roots and rhizomes, stems, leaves and flowers (DER: approx. 5:1). Solutions of concentrations varying between 312, 625, 1250, 2500 and 5000 mg/L were prepared from the dry extracts and tested for their inhibitory effects on root growth of *Triticum aestivum* L. (ethanolic extract) and *Lactuca sativa* L. (aqueous extract), as well as on germination for the latter. Concentrations of 188, 375, 750, 1500 and 3000 mg/L were prepared from the aqueous extract and assessed for their effect on nauplii of *Artemia franciscana* Kellogg.

Results: Macroscopic and microscopic exams have confirmed the identity of the species. The ethanolic extracts inhibited the development of the radicular system of *T. aestivum* L. in a concentration-dependent manner, down to 625 mg/L (but not at 312 mg/L), except for the leaf extract, for which the minimum inhibitory concentration was 1250 mg/L. The inhibitory effects of the aqueous extracts on the radicles of *Lactuca sativa* L. were less intense. Based on the LC50, the toxicity of the ethanolic extracts on *Artemia franciscana* increased in the following order: subterraneous parts (LC50 = 2810.6 mg/L) < leaf (LC50 = 1821.3 mg/L) < flower (LC50 = 1633.6 mg/L) < stem (LC50 =1267.9 mg/L).

Conclusions: Research has to be extended both with respect to the phytochemical investigations and the pharmaco-toxicological and biological assessment.

Keywords: *Anemone nemorosa, Artemia franciscana*, microscopy, herbal extract, LC50

COTINUS COGGYGRIA SCOP.: DEVELOPMENT OF EFFICIENT EXTRACTION PROCEDURES FOR THE POLYPHENOLIC SECONDARY METABOLITE POOL

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Background: Smoketree (*Cotinus coggygria* Scop., syn. *Rhus cotinus* L.) has a long history as a traditionally used medicinal and tinctorial plant. Its conspicuously yellow-colored heartwood contains a variety of secondary metabolites with a polyphenolic structure. The complex composition of the crude methanol extract sets a challenge for the isolation of its constituents. Objectives: The aim of the research consisted in the development of efficient extraction procedures for the purification of constituents from the crude extract of the heartwood.

Material and methods: Purifications were performed by combining various separation techniques: column chromatography on Sephadex LH-20, high speed counter-current chromatography, and Vacuum Liquid Chromatography on RP-18 material.

Results: Two independent extraction procedures were developed, the first enabling the isolation of four main constituents (sulfuretin, fustin, eriodictyol and 2,3-dihydroquercetagetin), while the second afforded the in-depth investigation of the *C. coggygria* extract with the preparation of main and minor constituents, including diastereomers.

Conclusions: The efficient combined approaches of separation techniques lead to the isolation of fifteen polyphenols. The research offers a significant contribution to phytochemical knowledge of smoketree growing in Romania.

Keywords: *Cotinus coggygria*, column chromatography, sulfuretin, polyhenols

COPROPHILOUS FUNGI WITH PHARMACEUTIC IMPORTANCE

Tiberius Bălăeș[1], Cătălin Tănase[1]

[1]"Alexandru Ioan Cuza" University of Iasi, Romania

Background: Coprophilous fungi represent an important part of saprotrophic biota on animal dung, contributing to degrading this substrate and to bio-geo-chemical cycle. This category of fungi is poorly studied in Romania for the small size fungi, especially Sordariomycetes. The ephemeral substrate rich in organic materials increases inter-specific competition and makes these organisms to be full of bioactive compounds with antimicrobial activity, sordarin being the best known.

Material and methods: In this study, the samples (herbivorous dung pellets) were firstly analyzed *in situ* in natural habitats, and then collected, dried and incubated in humid chamber for three months. Different humidity conditions have been used and during this period the samples were regularly analyzed for coprophilous fungi succession. Sexual forms were analyzed through photonic microscopy and chemical reactions for identification and several species were isolated in pure culture on media rich in organic extracts (MYGA).

Results: The most important taxonomic groups with sexual forms were: Pezizomycetes and Sordariomycetes (Ascomycota: Fungi), respectively Basidiomycetes (Basidiomycota: Fungi). When high humidity, asexual forms from Zygomycota and Ascomycota were abundant in the first months, while at moderate humidity the other were more common. 15 species of Sordariomycetes, 12 species of Pezizomycetes and 7 species of Basidiomycetes were inventoried, among them 8 being seen for one time and 4 being common on all the samples.

Conclusions: Important abundance and diversity of coprophilous fungi have been observed, the best represented group being the Sordariomycetes, with numerous species and genera and presences in all the collected samples, while the Basidiomycetes appear to the end of incubation period.

Keywords: coprophilous fungi, Sordariomycetes, antimicrobial compounds

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POTENTIAL SPATIAL DISTRIBUTION OF *CLATHRUS ARCHERI* IN ROMANIA WITH ECOLOGICAL ASPECTS

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[1]"Alexandru Ioan Cuza" University of Iași, Romania

Background: Although *Clathrus archeri* is a widely spread fungus species in the Western Europe, in Romania it is still considered rare. *Clathrus archeri* is a species which, in the recent period, occurs earlier in the summer compared to its phenology described in the literature, influenced by temperature increase. Also an increase of number of records in Romania was observed, in habitats with favorable development conditions and intense antropogenic influences.

Material and methods: Using occurrence records and environmental data layers we modelled potential spatial distribution in Romania.

Results: One of the most performant algorithm for distribution models, Maxent, suggested that the environmental variables with highest gain when used in isolation were precipitation in the coldest quarter of the year and land use.

Conclusions: Thus, the optimal habitat is represented by forest edges, forest clearings and overgrazed grasslands from (sub) mountain areas.

Keywords: fungi, spatial distribution, optimal habitat

POLYPHENOLIC CONTENT IN THE VEGETABLE PRODUCTS, BASED ON MERSITEMATIC ACTIVITY

Tatiana Calalb[1]

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Background: A special place in the contemporary phytotherapy occupies gemmotherapy, which during the last decades has a special interest and regains its well-deserved role. That's why phytochemical studies in order to highlight the therapeutical and biological value of gemmotherapy remedies are very necessary.

Material and methods: Gemmotherapy remedies were analysed by mean of spectrophotometric and titrimetric methods.

Results: Today, a wide range of vegetable products (VP) based on meristems are known being successfully used: buds of poplar, birch, maple, juvenile twigs of asparagus, young bark of willow, juice of birch, young roots of grasses (wheat, oat, rice), sprout seeds (sunflower, chick pea, wheat, oats, buckwheat, alfalfa, onion, radish), floral rods of dandelion and swollen flowering buds of many shrubs and trees. These VP contain a biocomplex of active compounds: amino acids, vitamins, growth regulators, active enzymes, ionic minerals. Each gemmo remedies VP also contains secondary metabolites: flavonoids, tannins, fatty acids, volatile oils, saponins. Recent research is identifying more and more

primary roles for these chemicals in plants as signals, antioxidants, and other functions. The content of phenolic substances in different meristem VP according annual seasons was determined. In autumn/spring the content of flavonoids (%) are: willow buds – 2.2/5.7, poplar buds – 7.2/5.5, cherry buds – 3.5/5.7, chestnut buds – 2.9/5.3, walnut buds – 6.8/5.4, birch bunds – 2.7/5.7; content of tannins (%, respectively): 1.1/7.1, 3.9/8.0, 10.3/16.5, 3.6/7.4, 8.7/21.7, 6.5/8.1. The fluctuation in the flavonoid content is chaotic (according taxonomic affinity of VP and the season): in autumn-spring it is implicated in protective mechanisms; in spring – intense metabolic processes. Tannin content is as a growth vector and protective mechanisms in autumn-spring; the processes of cell detoxification – spring.

Conclusions: Studied gemmotherapy remedies VP, besides the active biocomplex, also contains secondary metabolites such as flavonoids and tannins with biological important role.

Keywords: vegetable products, gemmotherapy remedies, flavonoids, tannins

USEFUL PLANTS FROM BOTANIC GARDEN "DIMITRIE BRÂNDZĂ" GREENHOUSES' COLLECTIONS

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Botanical gardens usually own sectors with economic plants with the purpose of preserving these species, of informing and educating the wide audience. Among our botanical garden's sectors, the Useful Plants Sector, is one of the oldest ones and is especially used didactically for the students. Apart from the plants cultivated here, greenhouses host in their collections of 985 taxa, numerous species of high economic importance (medicinal, technical, dietary) which are not grouped in a special compartment. In the past years there has been recorded an increased interest of the visiting public regarding their information on including numerous exotic plants from areas with hot climates in their nutrition and in medicinal purposes. The aim of this study was identifying species of economic interest within the existing collection in the greenhouses in order to satisfy the public's need for information. Among these we can list: *Elettaria cardamomum* (L.) Maton, *Tamarindus indica* L., *Ceratonia siliqua* L., *Theobroma cacao* L., *Myrtus communis* L., *Zingiber officinale* Roscoe, *Curcuma longa* L., *Cinnamomum camphora* (L.) J.Presl.

Keywords: useful plants, greenhouses, botanic garden

CURRENT FEATURES AND PECULIARITIES OF CHRYSANTHEMUM L. COLLECTION OF HORTICULTURAL VARIETIES FROM "ANASTASIE FĂTU" BOTANICAL GARDEN OF IAȘI

Ana Cojocariu[1,2], Cătălin Tănase[3], Cristiana Virginia Petre[1,2]

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[2]"Anastasie Fătu" Botanical Garden, Romania
[3]"Alexandru Ioan Cuza" University of Iași, Faculty of Biology, Romania

Background: The *Chrysanthemum* genus comprises 150-200 species, most of them native to Europe and the Mediterranean region to India, 2 species originating from South Africa, 20 species from Himalayas to Tibet, China and Japan, about 12 species from the Canary Islands and 7 species from North America. In the Flora of China are mentioned 37 species of the *Chrysanthemum* genus, mostly spread in the temperate zone of Asia, of which 13 species are endemic to China. The identification and complex study of a significant number of species and horticultural varieties of chrysanthemums cultivated in the Botanical Garden of Iași represent an important eco-biological information source on the behavior of taxa and their adaptation to the climatic conditions of Iași. Also, the varieties obtained in the Botanical Garden of Iași are distinguished in quality, productivity and superior biological resistance under the given conditions.

Material and methods: The *Chrysanthemum* collection was started in 1976, with the introduction of 15 taxa from Codlea Greenhouses and 11 taxa from the existing production section of Botanical Garden Iași. At that time, the first edition of the "Autumn Flowers" Exhibition was organized in the central hall at the entrance, and outside in the administrative pavilion. Among the varieties exhibited at this first edition we mention: *Chrysanthemum x grandiflorum* – 'Marechal Foch', 'Prince de Monaco', 'L'Africaine', 'Cassandra', 'Elmonton', 'Crystal', 'Egyption', 'Indianapolis', 'Rayonnante', *Chrysanthemum indicum* – 'Fairy White', 'Blanche', 'Semn de toamnă', 'Spunky', 'Ceres', 'Melody', 'Biella', these varieties being maintained until now. The activities in the department is reflected by directions defined as: maintaining the current collection of species and varieties, enriching the assortment by identifying, testing and acclimatization of new varieties, verifying taxa names and adapting the nomenclature to the current horticultural recommendations, collecting data at morpho-biometric level, as well as biological, physiological and phenological indices; also, experimental aspects regarding the crop technology and new methods of obtaining planting material for chrysanthemums in the climatic conditions of the Botanical Garden Iași.

Results: The number of varieties increased yearly, based on exchanges with other botanical gardens mainly from Eastern Europe, or on the basis of the identification of new varieties on the market of floricultural producers, reaching till now over 400 taxa: 200 horticultural varieties belonging to the *Chrysanthemum x grandiflorum* complex and over 180 belonging to *Chrysanthemum indicum*, among which are preserved the varieties obtained at the Botanical Gardens of Iași. Also, over 27 other species belonging to the genus *Chrysanthemum* s.l. (including spontaneous *Chrysanthemum indicum* L. and *C. morifolium* Ramat.) are preserved in the collection.

Conclusions: *Chrysanthemum* species and horticultural varieties are represented in Botanical Garden from Iași through a number of about 400 taxa, grouped in a unique collection in Romania as size, scientific value and presentation, being accessible both to the general public and specialists.

Keywords: *Chrysanthemum*, horticultural varieties, phenology, planting material, Autumn Flowers

GYPSOPHILA COLLINA – AN ENDANGERED SPECIES *EX SITU* CONSERVED IN "VASILE FATI" BOTANICAL GARDEN JIBOU

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Among biodiversity conservation strategies, the *ex situ* conservation is the fastest method providing a middle and long term survival of endangered species, rare or at risk of extinction. This strategy, applied in "Vasile Fati" Botanical Garden, is a conservation method which demands first of all, direct observation of principal phases of development *in situ* and the proper method to collect the propagation material. Choosing the most appropriate and the fastest multiplicative technique leads to obtaining plantlets with elevated phenotypic features, and allows to get a higher number of individuals to be re-introduced in origin places, with the purpose of strengthening the natural populations and to reduce its vulnerability degree. *Gypsophila collina* Steven ex Seris is included in the Red Book of Romania and is spread only in Romania, Moldavia and Crimea. In Romania it is encountered only in a few scattered locations in Sălaj, Cluj and Sibiu Counties. The species has a scientific value due to its rarity and to its growing habitat on gypsum areas. The main goal of our study was to test the seed germination capacity of this species. Seeds collected from the field were employed in two multiplication methods: one was the classic method of sowing in the soil, where two variants of soil were used and the second one was the *in vitro* cultivation. For *in vitro* culture four medium variants were used, with different concentrations of $CaSO_4$. Both methods provided good results but the *in vitro* method has the known advantages of obtaining healthy plants, free of viruses and diseases.

BARK AQUEOUS EXTRACTS CORRELATED TO *IN VITRO* ANTITUMOR POTENTIAL ON TWO DIFFERENT CELL LINES

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Background: The aim of this study was to determine the antioxidant capacity, the total phenol content, tannins, the cytotoxic and antiproliferative activity of some aqueous extracts obtained from spruce bark (*Picea abies* L.) and beech bark (*Fagus sylvatica* L.).

Material and methods: The crude extracts have been obtained, using classical extraction - on water bath and ultrasound-assisted extraction, respectively. The antioxidant activity (AOA) was determined by means of DPPH assay and the cytotoxic and antiproliferative effects were measured using Alamar Blue technique and Scratch assay. The total phenol content was determined colorimetric by means of the Folin-Ciocalteu method. *In vitro* antitumor activity was tested on 2 different cell lines: A375 (human melanoma) and A549 (lung carcinoma).

Results indicated that the aqueous extracts obtained by classical extraction had a higher antioxidant activity compared to the extracts obtained by ultrasound-assisted influenced by their chemical composition. Regarding the effect on cancer cells, the samples elicited a dose-dependent cytotoxic effect on human melanoma cells, while on lung carcinoma cells, the extractive solutions stimulated tumor cells viability, an effect that was reduced by increasing the concentration of the samples.

Conclusion: The crude extracts proved to possess antiproliferative properties when tested at the highest concentration, results that could be correlated with the antioxidant effects.

Keywords: *Picea abies* L., *Fagus sylvatica* L., total phenolic content, ultrasound-assisted extract, antioxidant activity, cytotoxicity, proliferation, melanoma, lung carcinoma.

THE CHARACTERISTIC MEDICINAL PLANTS OF DIFFERENT VEGETATION TYPES FROM THE NIRAJ VALLEY, ROMANIA

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Background: In this study the medicinal plants of some representative vegetation types from a human-modified Eastern European landscape were investigated. The studied territory is part of a Special Protection Area for bird species.

Material and methods: The following sampling areas were included in the study: humid grasslands; mountain hay meadows; semi-natural dry grasslands; Sub-pannonic steppic grasslands; fringe communities of mesothermophilic forest edges; grey willow scrubs; thickets of willow; forests of white willow; hornbeam-beech, oak-hornbeam, and sessile oak forests; scrubs of blackthorn and hawthorn; Subcontinental peri-Pannonic scrubs. The investigation was possible on the basis of 175 relevés obtained from field trips and other 13 relevés encountered in the scientific literature. The indicator values of medicinal plants were calculated for identifying the characteristic medicinal plants of the studied vegetation types. The presence of the medicinal plants in the latest editions of the European and the Romanian Pharmacopoeia was investigated. The medicinal plants were classified according to their dominant active principles, and also by their plant parts used in phytotherapy and traditional medicine.

Results: The ordering of medicinal plants on the basis of presence/absence data (Jaccard index, PC1: 14.07%, PC2: 6.15%) and the abundance data (Bray-Curtis, PC1: 15.06%, PC2: 6.88%) presented the grouping in the following communities: typical to the deciduous forests, typical to the coppices and scrubs, and typical to the grasslands and meadows. A total of 206 medicinal plants were found from which 36 species are included in the European Pharmacopoeia, and 11 in the Romanian Pharmacopoeia. The existing list of medicinal plants of the Niraj Valley in the scientific literature was completed with 33 taxa. The medicinal plants containing tannins (18.93%) were in higher percentage followed by those with essential oils (10.68%), flavonoids (10.68%), saponins (9.71%), alkaloids (7.77%), mucilages (6.80%), coumarins (5.34%), and other active principle content.

Conclusions: The results present the medicinal plant resources from some representative vegetation types from the Niraj Valley and contribute to the existing literature data. However rational (sustainable) exploitation of these natural resources is necessary.

Keywords: medicinal plants, Niraj River, indicator value, traditional medicine, active principles

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THE EFFECT OF LATE FROSTS OF 2018 SPRING ON SOME WOODY PLANTS FROM THE COLLECTIONS OF THE "PAVEL COVACI" UNIVERSITY BOTANIC GARDEN OF MACEA

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Background: Despite the fact that, overall, we can state that the 2017-2018 winter was gentle but long, yet the imprint left on some wooden plants cultivated in the Macea Botanic Garden of the "Vasile Goldiș" Western University of Arad comes to refute this aspect.

Material and methods: In April 2018 we made observations of the woody plants grown in Macea on the damages caused by the late frosts in March. Frosts damages have been grouped into several categories. Also we made a lot of pictures that highlight these aspects.

Results: Due to the fact that, by the end of the winter season, there was an episode of high temperatures followed by two waves of late frosts, which were able to cause quite significant damages to some specimens belonging to exotic woody species. Several types of damages could be recorded from some severe ones to easier ones such as: frosting and drying off of the specimens (for instance *Davidia involucrata*, *Euonymus japonicus*), frosting and drying off of the aerial part of the plant (*Callicarpa chathayana, Ficus carica*), frosting of the upper side of the crown (*Ligustrum ovalifolium, Punica granatum*), frosting of the tops of the annual sprouts (*Cornus florida, Ehretia macrophylla, Elsholtzia stauntonii, Jasminum humile, Lagerstroemia indica*), frosting of the buds, especially of the floral ones (for instance at *Magnolia denudata, Prunus armeniaca*), frosting of the persistent foliage (*Lonicera fragrantissima, Photinia × fraserii, Pseudosasa japonica*) and other types of damages.

Conclusions: Despite that the winters of the last years had been relatively gentle, the introduction of some species from areas with gentle climate has to be performed with a lot of judgment as it can be noticed that some deviations from the current course of the weather are able to affect more or less this type of plants.

Keywords: frosts damages, woody plants

PHYTOCHEMICAL ANALYSIS OF COMMON RAGWEED ROOT (*AMBROSIAE ARTEMISIIFOLIAE* RADIX)

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Background: Common ragweed (*Ambrosia artemisiifolia L.*) is species native to North-America, member of the Heliantheae tribe, Asteraceae. In Europe is present as an invasive plant since it inhibits the reproduction of other species and it does not have any natural pests on our continent. The plant can cause contact dermatitis and the pollen can trigger allergic reactions. Ragweed is one of the hundred worst invasive alien species, the European Food Safety Authority promotes its eradication. The aim of the research group of the University of Szeged, Department of Pharmacognosy is to study ragweed phytochemically and pharmacologically to find potential medicinal applications of this species. Earlier studies demonstrated *in vitro* anti-tumor effects of ragweed extracts. The extract of the herb was effective on human breast adenocarcinoma cells (MCF-7, IC_{50}: 10.2 µg/ml) and human skin epidermoid carcinoma cells (A-431 IC_{50} 11.1 µg/ml), while the extract of the root showed activity on human skin epidermoid carcinoma cells (A-431 8.5 µg/ml). Based on the positive anti-tumor tests, detailed phytochemical analysis was initiated to identify the biologically active compounds.

Material and methods: In the preparative work we combined different chromatographic methods. The structures of the isolated compounds were determined by 1D and 2D NMR spectroscopy. The pharmacological effect was tested on human cancer cell lines (using MTT- assay) and on human pathogen bacterium strains (using disc diffusion assay).

Results: From the non-polar fractions of the methanol root extract three substances (a thiophene, a triterpene and a fatty acid) were isolated and identified and the presence of beta-sitosterin was also confirmed.

Conclusions: Our results suggest that the anti-tumor effect is caused by several, structurally different molecules and we strive to identify more bioactive compounds in the future.

Keywords: *Ambrosia artemisiifolia* L., NMR spectroscopy, cytotoxic activity, antibacterial activity

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MICROSCOPIC ANALYSIS OF LEAVES FROM FIVE INVESTIGATED SPECIES OF *PELARGONIUM*

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Background: The species included in the study were grown in the greenhouses of the "Anastasie Fătu" Botanical Garden of Iași. Superficial and transverse sections through the blade leaf and petiole were obtained for: *Pelargonium peltatum* (L.) L'Heretier, *Pelargonium radens* H.E. Moore, *Pelargonium grandiflorum* (Andrz.) Willd., *Pelargonium hispidum* (L.) Wild. and *Pelargonium zonale* (L.) L'Heretier. Each section was stained with green iodine and ruthenium red and then analyzed under the NOVEX photon microscope (Holland) with in-built Olympus camera. The differences regarding the tector and secretory hairs were specific for each species. *P. peltatum* has long, unicellular or bicellular, relatively frequent tector hairs; rare and short secretory hairs, with basal cell (inserted between epidermal cells), a pedicel (2-3 short, stacked cells) and a unicellular gland. *P. zonale* presents rare, long, thin and thick pluricellular (3-4 cells) tector hairs, with obtuse tip; frequent, short (pedicel of 2-4 cells) and very long (3-4 pedicel cells, increasingly longer towards the tip) secretory hairs; spherical or piriform gland, which can be sometimes long-triangular; rounded angles. Meanwhile, *P. radens* has various secretory and surface hairs, short, unicellular, or long, and pluricellular. In a similar way short and medium-length secretory hairs and very large spherical gland were noted for *P. hispidum*. Taxonomically important characteristics for *P. grandiflorum* were represented by piriform glands. All in all, the secretory hairs vary greatly in length and number per unit area and have a basal cell, a pluricellular pedicel and a unicellular gland. The mesophile is differentiated in the two assimilatory tissues: palisadic and a multi-layer spongy type that confers the heterofacial-bifacial structure of the limb.

Keywords: Histo-anatomical analysis, *Pelargonium species*, tector hairs, secretory hairs.

EUPHORBIA GENUS COLLECTION OF IASSY BOTANICAL GARDEN

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Background: The *Euphorbia* genus is among the most numerous in the vegetal world, consisting of approximately 2000 species. Its representatives are mostly known for the latex they produce, which may cause people irritations and rashes. However, there are many traditional uses of the *Euphorbia* genus, in the treatment of certain ailments. Recent studies have proved the therapeutic qualities of the species many times.

Material and methods: The collection of the Iassy Botanical Garden is comprised of 25 taxons of the *Euphorbia* genus. Most of them are thorny, succulent plants, with African origins.

Results: Considerations about uses of this species and their horticultural characteristic are presented in the article. All the species have been morphologically analyzed and, from the information gathered a determination key has been made, based on their vegetative characters.

Conclusions: The *Euphorbia* genus collection from Iassy Botanical Garden is important from ornamental point of view, but for pharmacognostical study too.

Keywords: *Euphorbia*, taxonomic key, pharmacognosy

CONTRIBUTION TO THE PHYTOCHEMICAL EVALUATION OF ROWANBERRY FRUITS (*SORBUS AUCUPARIA* L.)

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Background: Rowan is a species that grows in the mountainous regions of Europe. The fruits are made into jams, jellies, soft drinks and alcoholic beverages in Northern European countries and Canada.

Material and methods: Fruits of *Sorbus aucuparia* L. were collected from the wilderness area of Mureș and Harghita counties (Romania). Identification of carotenoids and tocopherols was performed by means of HPLC methods. The total polyphenol content (TPC) of extracts obtained with methanol, methanol 50% and water was assessed by Folin-Ciocalteu method. The quantitative determination of the total flavonoid content was performed by a colorimetric method. Since the major phenolic compound in rowanberries is chlorogenic acid, according to literature data, we performed its quantitative determination by means of RP-HPLC method. The antioxidant activity was evaluated by DPPH assay and by the photo-chemiluminescence (PCL) method.

Results: Eleven carotenoids were separated and ten of them were identified by comparing their spectra with literature data. The main carotenoid is β-caroten, followed by esters of β-cryptoxanthin and zeaxanthin. Among tocopherols the α-tocopherol dominates quantitatively (over 80 μg/g fruit). In the methanol and methanol 50% extract the TPC is three times higher than in the water extract (248.9±19.57 mg/100g > 238.57±12.27 mg/100g > 73.42±3.97 mg/100g). The flavonoid content is almost double in the methanol extract (91.11±4.26 mg/100g) compared to that of the methanol 50% extract (49.12±5.18 mg/100g). Amount of chlorogenic acid in fruits corresponds to the previous results (84-110 mg/100g). The DPPH radical scavenging activity of methanol 50% extract is similar to that reported previously (IC50=0.931 mg/ml). In the PCL assay the antioxidant activity of methanol 50% extract is higher (590 μmol AAE/g fruit) than that of methanol extract (496 μmol AAE/g fruit).

Conclusions: The phytochemical analysis of rowanberry fruits harvested from Romania is reported for the first time. Our results indicate that rowanberries are a rich source of hydrophilic and lipophilic substances with antioxidant activity.

Acknowledgement: The study was supported by the Research Grant of Studium Prospero Foundation (0350/26.02.2016) and Hungarian Academy of Sciences.

Keywords: *Sorbus aucuparia* L., antioxidant activity, carotenoids, tocopherols, polyphenols

VEGETATION DIVERSITY OF SOME XEROPHYTIC GRASSLANDS IN THE NORTH-EASTERN REGION OF ROMANIA

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Introduction: The xerophytic grasslands includes plant communities with great importance for biodiversity, harboring numerous threatened species. Their evolution and diversity is influenced by environment and land use practices. Also, many habitats with xerophytic grasslands are threatened and considered as Community interest habitats.

Material and methods: Vegetation classification was realized by multivariate numerical methods (hierarchical agglomerative clustering). Diagnostic species related the clusters to the vegetal communities presented in literature. Identification and characterization of vegetation – environment relationship was made by indirect and direct ordination methods (detrended and canonical correspondence analysis).

Results: In the xerophytic grasslands from the Nort-Estern Romania were identified 20 syntaxa. Their floristic composition is preponderantly modelled by nutrients in soil and insolation degree in the field. Thus, on nutrient poor soils there were identified some *Stipa* communities, on

soils with moderate content of nutrients there were installed the *Festuca* communities and on the nutrient rich soils were identified phytocoenoses with *Calamagrostis*, richer in segetal nitrofilous species.

Conclusion: The xerophytic grasslands vegetation in the studied region is very diverse and presents a floristic composition mainly influenced by soil properties.

Keywords: vegetation, environment, xerophytic grasslands

DETERMINATION OF PHENOLIC COMPOUNDS IN DIFFERENT SPECIES OF SALVIA FROM ROMANIA (*SALVIA TRANSSYLVANICA*, *SALVIA GLUTINOSA, SALVIA OFFICINALIS*) AND THEIR BIOLOGICAL ACTIVITIES

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Background: Sage species are used in Romanian traditional medicine for coughs, rheumatism and inflammatory diseases as well as antidiabetic remedies. In this study *Salvia glutinosa* and the endemic *Salvia transsylvanica* were compared with the well known *Salvia officinalis* in terms of chemical composition and biological activities.

Materials and methods: In the current study, an HPLC method was applied for determination of 22 phenolic compounds in dry extracts of *S. glutinosa, S. transsylvanica,* and *S. officinalis.* Moreover, the antioxidant capacity and enzyme inhibitory potential of the extracts were evaluated using microtiter assays, and the antimicrobial potential was tested using the microdiluation assay for eight bacteria and fungal strains.

Results: The chromatographic fingerprint revealed that among investigated compounds, the dominant compounds of *Salvia* species are rutin (1357.9-4070.2 μg g^{-1}) and catechin (1112.6-1911.1 μg g^{-1}). The biological profile of the three sage extracts was evaluated towards several antioxidant assays, and by testing their inhibitory capacities against key enzymes involved in neurodegenerative diseases as well as diabetes mellitus. Concerning the antioxidant assays, generally *S. officinalis* exhibited high antioxidant capacity in all assays, the highest values being obtained for the CUPRAC assay: 400.01 mgTE/g extract for *S. officinalis,* 175.91 mgTE/g extract for *S. glutinosa*, and 118.11 mgTE/g extract for *S. transsylvanica*. Concerning the enzyme inhibitory assays, *S. officinalis* extract presented the highest inhibitory potential on butyrylcholinesterase (2.40 mgGALAE/g extract) followed by *S. transsylvanica* (1.43 mgGALAE/g extract). Additionally, both *S. officinalis* and *S. transsylvanica* extracts exhibited an important inhibitory potential against alpha-glucosidase (27.01 mmolACAE/g extract, and 25.62 mmolACAE/g extract, respectively). Nevertheless, the most sensitive bacteria to the tested extracts were *Enterobacter cloacae* (MIC= 0.01 mg/mL, MBC=0.02 mg/mL for *S. officinalis*) and *Bacillus cereus* (MIC= 0.09 mg/mL, MBC= 0.18 mg/mL), while *Penicillium funiculosum* was the most sensitive fungal strain to *S. officinalis* extract (MIC= 0.06 mg/mL, MFC= 0.12 mg/mL).

Conclusions: Further studies are needed to elucidate the different mechanisms of action involved, as well as the specific compounds responsible for the tested biological activities.

Keywords: *S. glutinosa, S. transsylvanica, S. officinalis,* phenolics, antimicrobial

THE MEDICINAL PLANT GARDEN AND THE EXPERIMENTAL FIELD OF SAPIENTIA UNIVERSITY IN TG-MURES

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Sapientia Hungarian University of Transylvania, that started its educational mission on October 3, 2001, currently has four study centers (Târgu Mures, Miercurea Ciuc, Cluj-Napoca and Sfîntu Gheorghe) coordinated by three organizational units. The Faculty of Technical and Human Sciences, Târgu-Mureș, which operates two study centers, includes agrarian education programs. The first one - started from the 2002-2003 academic year - is the horticultural engineer training. One of the five major specializations of this training focuses on medicinal plants. Thus, in the curriculum of vocational training, students' medicinal plant competences and practical skills are developed through two semester courses (General Medicinal Plants Growth and Specific Medicinal Plants Growth). For the efficient transfer / acquisition of knowledge about the medicinal plants and their cultivation technology, we have developed our own medicinal plants garden, which is an experimental and demonstration garden specializing in this group of plants. The current 4,000-square-meter herb garden was set up in 2005 at the north-western edge of the administrative area of Corunca village, near Târgu Mureș. During this time the medicinal plant garden collection has been enriched many plant species of medicinal significance; however, at the same time a number of field experiments were set up to improve the cultivation technology of specific herb species in order to produce high active ingredients herbal drugs with the appropriate yield in optimized economical conditions that ensure the sustainability of the cultivation process and in an environmentally friendly way. The university's medicinal plant garden can not be considered finalized, it is constantly evolving, and its collection is enriched.

Keywords: learning, experiments, medicinal herbs, knowledge

STUDY OF THE INFLUENCE OF NUTRITION SPACE ON GROWTH AND PRODUCTION AT LEMON BALM (*MELISSA OFFICINALIS* L.)

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Background: Lemon balm is one of our most popular perennial aromatic medical herbs. Thanks to its technological features of growth, the multitude of its uses, and its relatively good sales lemon balm is gaining more space in the medical herb-cropping system, while offering an alternative crop for farmers. Our research is trying to answer the question of what is the optimal plant density for the most secure and maximal herbal yield.

Material and methods: To find the answer, we set up four random plant density plots in four repetitions in our research field in Tîrgu-Mureș. During the multiple years of research, besides the growth period observations and biometric measurements, we focused mainly on the yields obtained through two yearly harvests as well as the dynamics of these yields. We ran variance analysis on our data using PoliFact software.

Results: Our findings confirm that plant density is a very important link of the technology of growth because this has an effect on the plant's biometric parameters, as well as its yield. It is therefore essential to regulate the plant density in the cultivation and the implementation of this should be done in concordance with other production factors' coverage level.

Keywords: stationary experience, lemon balm, plant density, biomass production

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MEDICINAL PLANTS OF THE EUROPEAN RED LIST IDENTIFIED IN LOCALITIES FROM SOUTH-EAST TRANSYLVANIA

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Background: The flora of Târnavelor Plateau is characterized by a great diversity of vegetal taxa including medicinal herbs. These herbs, also called the "backbone" of traditional medicine, provide the industrialized and developing countries with natural products used as source of numerous medicines.

Objective: This study provides a documentation basis for both specialists and other people who want to contribute to their preservation, as currently the harvesting of medicinal plants is often irrational. Because of this, many medicinal plants are threatened with extinction. This study shows the current situation of the spontaneous medicinal plants, in the studied field, in accordance with European Red List.

Material and methods: The inventory of medicinal plants has been elaborated on the basis of the researches carried out in the last 5 years, field research, using the classical techniques and procedures promoted by literature. The systematic classification of the taxa was made by Flora Europaea, Vascular Plants of Romania-An Illustrated Field Guide (2013), etc.

Results: The checklist of spontaneous medicinal plants includes 144 taxa with certain content in therapeutic chemical compounds found in the European Red List. The richest families in medicinal herbs are: Rosaceae, Asteraceae, Lamiaceae, Liliaceae, Apiaceae and Fabaceae. Considering the dominant active principles used in phytotherapy and traditional medicine, most plants contain: tannins, saponins, essential oils, mucilage, alkaloids.

Conclusion: The identified herbs can be used as remedies for human diseases like digestive or cardiovascular system disorders.

Keywords: medicinal plants, European red list, Târnavelor Plateau

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CAPSICUM L. COLLECTION FROM "ANASTASIE FĂTU" BOTANICAL GARDEN OF IAȘI

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Background: *Capsicum* genus includes approximately 30 species native to Mexico, Central and Southern America, which were firstly introduced in culture by the local people and further spread and used across the globe, especially for their fruits which present a specific flavor. Moreover, the genus shows an impressive medicinal, pharmaceutical and biotechnological importance, but also an ornamental one.

Material and methods: At "Anastasie Fătu" Botanical Garden of Iași the *Capsicum* representatives are sowed at the beginning of March within the greenhouse compartments at temperatures between 18-20 °C, in a soil mixture of leaf litter and peat (1:1) and when the seedlings develop 3-5 leaves, they are replanted in pots in a soil mix consisting of garden soil, leaf litter and peat (1:1:1).

Results: The collection was established in 2008, starting with 3 horticultural varieties. Due to international seed exchange and collaboration with horticultural producers, today the collection includes 135 different taxa, belonging to 8 species: *Capsicum annuum* L., *C. baccatum* L.,

C.chacoense Hunz., *C. chinense* Jacq., *C. eximium* Hunz., *C. nigrum* Willd., *C. pubescens* Ruiz. & Pav. and *C. rhomboideum* (Dunal) Kuntze. The taxa are remarkable through their unique shapes ('Bara di Ribeiro', 'Bulgarian Carrot', 'Cherry Hot', 'Christmas Bells'), sizes ('Doux Long des Landes', 'Joe's Long Cayenne', 'Piment Oiseau') and colors ('Black Plum', 'Chinese Five Colors', 'Peruvian Purple'), but also through their different levels of spiciness, including some of the most pungent varieties ever made ('Carolina Reaper', 'Habanero', 'Jalepeno', 'Jamaican Hot Chocolate', 'Tabasco').

Conclusions: The peppers are harnessed in order to obtain seeds as propagation material for maintaining the collection, for international exchange with other botanical gardens, research in the field of biological control of plant pathogens and culture methods and moreover the plants are displayed in themed exhibitions, as part of the Autumn Flowers Exhibition, annually held by the Botanical Garden of Iași.

Keywords: *Capsicum*, horticultural varieties, culture methods, biocontrol

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HISTOPATHOLOGICAL ANALYSIS OF LIVER AND KIDNEY OF DIABETIC RATS TREATED WITH BILBERRY AND BLUEBERRY EXTRACTS

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Background: High and uncontrolled glycemic levels predisposes to severe complications in time. The aim of this study was to investigate the effects of four extracts obtained from *Vaccinium* sp. in histopathological alterations caused by diabetes in rats.

Material and methods: For this experiment, rats were randomly divided into seven groups: normal control, diabetic control, positive control treated with metformin, VML group treated with *Vaccinium myrtillus* leaves extract, VMLF group treated with *Vaccinium myrtillus* leaves and fruits extract, VCL group treated with *Vaccinium corymbosum* leaves extract and VCLF group treated with *Vaccinium corymbosum* leaves and fruits extract. After 56 days, the rats were sacrificed and the blood was collected for serum analysis. Kidneys and livers were excised and histopathological analysis was performed.

Results: In diabetic control group severe hepatic alterations were noticed. The histopathological changes in the liver of diabetic rats are due to the hyperglicemic state. In the group treated with *Vaccinium myrtillus* leaves extract there were only minor signs of liver impairment compared to diabetic control group. In the group that received *Vaccinium corymbosum* extracts signs of hepatic injury were noticed. The group that received an extract obtained from *Vaccinium myrtillus* fruits and leaves showed mild hepatic alterations. No severe histopathological modifications were observed in kidneys.

Conclusions: Besides its antihyperglycemic action, *Vaccinium myrtillus* leaves can successfully prevent diabetic complications, compared to *Vaccinium corymbosum* extracts.

Keywords: bilberry, blueberry, diabetes complications

COMPARATIVE PHYTOCHEMICAL RESEARCH ON SPECIES OF THE *SOLIDAGO* GENUS. *SOLIDAGO GRAMINIFOLIA* (L.) SALISB. NOTE I – THE FLAVONOIDS

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Background: Besides the three *Solidago* species cited by the Romanian Flora IX: *S. virgaurea* L, *S. canadensis* L. and *S. gigantea* Ait., Negrean G. reported the fourth species in 1975: *S. graminifolia* (L.) Salisb., found near the city of Baia Mare. In 2012, a second habitat has been reported for *S. graminifolia* in Cluj county. Due to the fact that this species was not chemically investigated until today, we performed a comparative phytochemical analysis of flavonoids from the following species: *S. gigantea*, *S. canadensis*, *S. graminifolia*., and *S. virgaurea.*

Material and methods: The performed phytochemical analysis consisted in UV-VIS spectrophotometry, TLC and HPLC-MS methods.

Results: The content of total flavonoids in *Solidago* species was found to be significant: 5.21 % in *S. canadensis* (maximal) and 3.44 % in *S. graminifolia* (minimal). The qualitative analysis showed that *S. graminifolia* was the only species that did not contain rutoside and *S. virgaurea* was the only species that did not contain quercitroside. The presence or absence of these compounds represents a valuable chemical feature for the identification of possible adulterations of *Solidago* species.

Conclusions: The performed analysis revealed a chemical resemblance between *S. graminifolia, S. canadensis* and *S.gigantea.*

Keywords: *Solidago* sp., flavonoids, TLC, HPLC-MS

ANATOMICAL ADAPTATIONS OF HALOPHYTES AND THEIR ECOLOGICAL AND FUNCTIONAL SIGNIFICANCE

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Halophytes are plants able to grow and flower on saline soils. They possess a set of anatomical features, which may be regarded as structural acquisitions gained during evolution; many of them have a clear adaptive value related to their ecology and functional role. Halophytes (70 species) have been investigated from anatomical point of view; the identified adaptations are discussed in relation to ecological factors and with emphasis on their functional role in halophytes' life. Plant material has been collected from various saline environments and from different climates from Romania (2004-2017), Poland (2011) and Spain (2010-2011). The aim of present study is to identify anatomical strategies in halophytes and to discuss their ecological and functional significance. Romania has a temperate-continental climate, while Spain (Eastern coast) is under Mediterranean influence. Obtained results suggest that, even under different climatic conditions, and different ecological conditions of saline habitats (dry and wet salt areas, salt marshes), halophytes develop similar (convergent) anatomical strategies that allow them to vegetate and reproduce in saline habitats. Succulence is a common but important strategy found both in C_3 and C_4 xero-halophytes and hygro-halophytes. In xero-halophytes, succulence plays a water storage function, while in hygro-halophytes with reduced mechanical system, it contributes to maintain the erect position (*Salicornia, Suaeda, Sarcocornia* species). In all cases, succulence can also contribute to dilution of concentrated salts from plant tissues; in addition, it is involved in the maintaining the osmotic pressure required to enable water uptake. Salt secreting structures are elaborated devices evidenced either as salt hairs (bladders) in *Atriplex, Chenopodium,* and *Halimione* species, either as salt glands, in *Limonium, Frankenia* and *Glaux* species. Kranz anatomy is a functionally sophisticated anatomical feature related to C_4 photosynthesis and has been found especially in Chenopodiaceae species. Bulliform cells were evidenced in halophytes vegetating in salt marshes subjected to seasonal droughts; due to this special ecological context, these halophytes were nominated as `amphibious`. Many halophytic chenopods present the phenomenon of additional (successive) cambia, an internal architectural scheme yet considered a structural anomaly. We have suggested for this phenomenon a functional and ecological value related to the possibility that the increased vascular surface to be involved in the salt dilution and in `storage` of saline soil solution at the level of underground organs. Moreover, the large amount of sclerenchyma produced by the activity of additional cambia may be involved in the internal mechanical resistance to the elevated concentration of soil solution.

RARE AND THREATENED VASCULAR PLANTS IN THE AREA OF WIND FARMS IN NATURA 2000 SITE ROSCI0060 DEALURILE AGIGHIOLULUI

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Background: Shaped as undulating hills in the North-East of Dobrogea, the protected area ROSCI0060 Dealurile Agighiolului supports numerous rare plant species, but is also subject to pressures and threats derived from various anthropic factors, wind farms being considered the most significant ones. For this reason, during operation of the "Agighiol Wind Farm", we have conducted about 5 years of research (2014 - present) with regard to the presence and conservation status of rare plants in this area.

Material and methods: The survey area is represented by areas directly impacted by the wind farm construction (about 50 m away from the turbine) and also by non-impacted adjacent areas (over 50 m away from the turbine).

Results: We found about 40 rare plants spread over these areas. Among these plants we have identified many species whose status was assessed as CR (Critically Endangered) and EN (Endangered) in the Red Book of Vascular Plants of Romania: *Achillea clypeolata* (CR), *Alyssum caliacrae (*CR), *Convolvulus lineatus* (CR), *Euphorbia myrsinites* (EN), *Hedysarum grandiflorum* subsp. *grandiflorum* (CR), *Hornungia petraea* (EN). Some of these species are well adapted to the directly impacted areas and consist of large populations, e.g. *Alyssum caliacrae* (CR) which is frequently spread over technological platforms and at the edge of access roads to wind turbines. Also, in our research we have identified some rare plant species that have not been previously mentioned in the flora of the Agighiol Hills: *Achillea clypeolata, Astragalus glaucus, Iris sintenisii, Muscari neglectum, Ornithogalum amphibolum, Scorzonera mollis, Sternbergia colchiciflora, Trigonella gladiata, Potentilla astracanica* etc.

Conclusions: Taking into account the presence of the rare plants in the „Agighiol Wind Farm" and surroundings and their favourable conservation status, we consider that the wind farm has a very low impact on protected flora from Natura 2000 site ROSCI0060 Dealurile Agighiolului.

Keywords: rare plants, conservation status, Agighiol Hills, wind farms.

ROMANIAN GRASSLAND DATABASE (RGD): CURRENT STATUS AND FUTURE PERSPECTIVES

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Background: The Romanian Grassland Database (EU-RO-008) was created in 2014 by merging three smaller vegetation databases and aims to comprise all types of grasslands and non-forest vegetation types from Romania. It is included in European Vegetation Archive (EVA) and in the Global Vegetation Plot Database "sPlot". Currently it includes 35026 relevés managed and stored with the Turboveg v2.101 software.

Material and methods: The majority of the data in RGD was digitized from published literature sources (90.5%), while the rest are unpublished relevés.

Results: The majority of plots are in the semi-restricted data availability regime (77%), following by restricted-access data (21%). Geographic coordinates are available for 68.8% of the relevés, most sources being geo-referenced a posteriori. Most of the relevés come from mountainous and semi-mountainous parts of Romania, which are better explored compared to lowland areas. Plot size ranges from 0.01-3500 m^2 (the most frequently used plot sizes is 100 m^2). Data on non-vascular plants are available for 21.7% of relevés. Elevation ranges from 0 to 2525 m a.s.l. (37.1% of relevés are lacking this information). Aspect and slope are the two most often recorded environmental parameters and are available for 56.7% and 51.9% of the relevés, respectively, while land use and soil parameters are rather sparse (<10%) in the current database. Total vegetation cover is provided for 77.8% of the relevés. Approximately 83% of the relevés in the RGD are classified into syntaxa of different levels.

Conclusions: As conclusion, RGD is a highly useful source for studies of flora, vegetation and habitats at the national scale, as well as for other plant community ecology, macroecology or conservation biology studies.

Keywords: phytosociology, grasslands, database

POSTERS

MORPHO-ANATOMICAL STUDY OF *TUSSILAGO FARFARA* L. SPECIES

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Background: *Tussilago farfara* L. is a spontaneous species, spread in Arad county flora, used in traditional medicine of Europe and Asia as a treatment for respiratory system illnesses. Studies have shown that in Chinese traditional medicine are used the flower buds and floral stems, while the Europeans use the leaves and roots. The purpose of our research is to show the histo-anatomical particularities of the vegetative organs: adventive root, rhizome, stem, petiole and leaf, of *Tussilago farfara* L. species, in order to form a correlation with the location and quantity of its active compounds, for their uses in the pharmaceutical industry.

Material and methods: The vegetative organs of the species *Tussilago farfara* L. were harvested in 2017 from Macea, Arad County. Cross sections were made at the: adventive root, rhizome, stem and leaf, then stained with ruthenium red and iodine green. These were prepared and analysed using specific optical microscopy techniques. The chemical profile was established by chromatographic and spectral methods.

Results: The morpho-anatomical analysis has shown the following: The adventive root is very thin; the rhizodermis has small cells with cellulosic walls and presents long, absorbent hairs here and there. The cortical parenchyma is very thick; the central cylinder is thin, with secondary structures derived from cambium activity. The rhizome is thick; the epidermis formed by isodiametric cells is covered by a crenate cuticle. A thick cortical parenchyma has in the internal zone 2-3 small fascicles. Endodermis is of casparian type. The bulky central cylinder has collateral open vascular bundles, separated by medullary rays. The pith is relatively thin, with cellulosic-parenchyma of meatic type. The short aerial stem shows in transversal section a circular outline and a primary structure. The foliar limb is wide and relatively thick, with bifacial, heterofacial structure, while the petiole is long and bulky. The petiole has a semicircular outline with a flat adaxial face. At the epidermal level of the foliar limb, long, pluricellular, tector hairs can be found alongside short, rare, secretory hairs with big, cambered glands. The mesophyll is differentiated in 2-3 rows of bulky cells which made up the palisade tissue, and the spongy tissue with very wide aeriferous cavities, separated by rows of cells perpendicular to the epidermis. The median vein is prominent on both sides of the leaf. Following the analysis of the bioactive compounds from the leaves, the polyphenolic profile was established and the pyrrolizidine alkaloids were evaluated.

Conclusions: The morpho-anatomical and phytochemical analyses of the species *Tussilago farfara* L. have shown that: the foliar limb is hypostomatic; at the epidermal level, big, cambered, secretory glands can be found; the leaves present a high content of pyrrolizydine alkaloids; and a large variation of the polyphenolic profile regarding the vegetative organs.

Keywords: morpho-anatomical structure, *Tussilago farfara*, chromatographic, spectral

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MICROCLONING AND THE CREATION OF THE COLLECTION OF FRUIT SHRUBS IN THE BOTANICAL GARDEN

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Background: In the last decade, the growing demand of people for fruits caused a great interest in fruit-bearing shrubs, which are particularly valuable as a source of food, are characterized by tolerance to low temperatures and drought, resistance to diseases and pests, and, besides, they can be grown on less productive land, decorating courtyards and private gardens, creating a rich colourful landscape and, at the same time, producing high quality fruits. The pedoclimatic conditions of the Republic of Moldova are relatively favourable for the introduction and cultivation of non-traditional fruit shrubs that adapt easily to the environmental conditions.

Material and methods: We have chosen species and varieties the propagation of which *in vitro* is less studied and there are no effective protocols for the production of planting material, the in vitro regeneration of these species being approached mainly in terms of organogenesis. The elaborated technologies will support the implementation of the tendencies of creating industrial plantations of fruit shrubs in R. Moldova. The need for cultivation and reproduction of these plants is justified by the particular interest in fruit shrubs. The studied crops are species and varieties in the genera *Rubus, Lycium, Actinidia* and *Aronia*, demanded by more and more farmers in the Republic of Moldova.

Results: The creation of a collection of fruit-bearing shrubs in the Botanical Garden is of major importance. The experimental collections are intended for scientific research and include species and varieties of fruit shrubs, valuable genetic material for selection and amelioration. The most important value of fruits produced by shrubs is the rich content of biologically active substances (BAS): flavonoids, anthocyanins, tannins, vitamins, minerals, fibres, acids, pectins. The fruits of new productive varieties of blackberry, goji, actinidia and chokeberry can serve as healthy food, beneficial to the human body and a real source of raw material for the food and pharmaceutical industries.

Conclusions: The establishment of the collection of valuable fruit shrubs genotypes, *in vitro* micropropagated and acclimatized, is of scientific and practical interest for the pedoclimatic conditions of the Republic of Moldova.

Keywords: fruit shrubs, micropropagated, collection

SAKHALIN KNOTWEED — PERSPECTIVES IN USE AS FODDER, ENERGY AND DRUG SUPPLY IN THE REPUBLIC OF MOLDOVA

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Background: Sakhalin knotweed (*Polygonum sachalinense* F. Schmidt; *Reynoutria sachalinensis* (F. Schmidt) Nakai; *Fallopia sachalinensis* (F.Schmidt) Ronse Decr.) is a plant originating from East Asia. In the Republic of Moldova (RM) was brought from North Ossetia and introduced in the collection of the Botany Garden of the Academy of Sciences of Moldova in 1982.

Material and methods: Biological and chemical methods were used.

Results: It is a perennial species (lives up to 12-15 years). Reproduction is vegetative by rhizome. Seeds in the open ground do not germinate. The ontogenetic cycle in the climatic conditions of the RM lasts 195-205 days. The plant blooms in the 2nd year of development, but it not produces fruits. Starting with the 3rd year, the plants pass through all the ontogenetic phases characteristic to the species. The plants form massive quantities of green mass (120 t/ha), being a source of fresh fodder from early spring until November. The first scythe can be done at 35-45 days after the beginning of the vegetation (April-May). The lignified stems at the end of the vegetation period can be used to make pellets and lighters as the source of the energy. The green mass is rich in amino acids, macro- and microelements. In the vegetative organs of plants 7 essential amino acids (threonine, valine, isoleucine, leucine, phenylalanine, lysine and methionine) have been detected. The content of amino acids in the stem is higher than in leaves (96.1 g/kg and 24.0 g/kg, respectively). The main chemical elements in the plants are manganese, iron, calcium, potassium, magnesium. Plants contain flavonoids: highest value detected was 1.7 mg/100g in P. folia, 1.0 mg/100g – P. herba, and the lowest 0.6 mg/100g – P. caulis, P. flores. The tannin content (%) in the vegetable products correlates with the applied method (spectrophotometry or permanganatometry) and the most recommended method is the permanganatometry with gelatine: P. flores – 6.0, P. folia – 1.7, P. herba – 2.9, P. caulis – 2.0.

Conclusions: Sakhalin knotweed represents a perspective fodder, energy and medicine source for the RM.

Keywords: Sakhalin knotweed, amino acids, flavonoids, tannins

MILESTONES FOR THE DEVELOPMENT OF EDUCATIONAL PROGRAMS IN PARTNERSHIP BETWEEN SCHOOLS AND BOTANICAL GARDENS

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Background: Botanical gardens are among the oldest cultural, educational and scientific institutions in the world. They perform teaching, scientific, cultural-educational, hygienic and sanitary functions and preserve the genetic stock of spontaneous plants (Ifrim, C., 2006). In order to achieve the objectives of the education, made with the contribution of the botanical gardens, there is a need for institutional communication and for the realization of unitary thematic programs that will match the resources of a botanical garden with the pupils' educational needs.

Material and methods: Models of good practice from Botanical Gardens in the country and abroad are analyzed and conclusions are drawn regarding the design requirements and implementation of educational programs for pupils.

Results: Literature analysis shows the necessary milestones for designing and implementing educational programs: themes, which must be in accordance with the garden's conservation message; educational message, which must take account of the facilities available; availability of resources: human (education staff, volunteers), time (available staff), financial (from the Garden budget or fundraising) and materials (garden collections, educational materials); knowing the initial level of education of the target groups; intentional changes in attitudes and behaviors; skills to be developed (teamwork, communication, cooperation); typology and stages of the intended program (interactive exhibitions, simulation games, guided tours, theater in GB, discoveries in GB, crafts using the natural resources of the garden, demonstration of plant collections, botanical courses, field excursions, conservation actions of species and habitats, horticulture and pomiculture practice).

Conclusions: Educational approaches at the school-botanical partnership level are complementary and involve correlated actions by both categories of institutions.

Keywords: education, botanical gardens, schools

A PHARMACOBOTANICAL AND PHYTOTOXICITY STUDY OF *ZANTEDESCHIA REHMANNII* ENGL. (ARACEAE)

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Background: *Zantedeschia rehmannii* Engl. is an ornamental, perennial, indoor herbal plant from the Araceae family. The purpose of this study is to highlight the histo-anatomical elements for the species identification and to assess its toxicity, taking into account the risk of accidental consumption of the leaf or spathe by children or pets.

Objectives: performing macro- and microscopic analysis and a qualitative chemical screening to identify the main classes of active substances; obtaining four extractive solutions from leaves and inflorescences and testing their phytotoxicity; determining the influence of the extractive solutions on the root and mitotic film.

Material and methods: The material, purchased commercially, was analyzed on superficial preparations and double stained cross sections. The etheric and aqueous extractive solutions from leaves were chemically analyzed. The phytotoxicity of aqueous solutions obtained from fresh and dry inflorescences and leaves was investigated (Constantinescu method). In the microphotographs performed on wheat root tips stained with acetic orcein, the changes induced on the mitotic film have been highlighted.

Results: The main histo-anatomic features of the leaves and spathe were biforines, raphides and druses. The main classes of compounds identified in the leaves were saccharides, flavonoids, tannins, and carotenoids. The Triticum bioassay showed that leaves have a stronger inhibitory action than inflorescences, and the dry products more than the fresh ones (inhibitory index value 91.67% -65% for leaves and 58.33% -26.67% for inflorescences). The extract effect on the mitotic film was moderate or weak. Frequent mitodepression or stathmokinetic effect was observed, with no obvious toxicity.

Conclusions: The fresh inflorescences and leaves of this decorative species have little phytotoxicity, but can be harmful by the calcium oxalate raphides that could induce the release of histamine and other pro-inflammatory mediators.

Keywords: *Zantedeschia rehmannii*, phytotoxicity, biforines, raphides, druses

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SPECIES OF G. *SOLIDAGO* L. IN THE FLORA OF THE REPUBLIC OF MOLDOVA

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Background: The genus *Solidago* L. is one of the most complex genera of higher plants, including about 120 species, most of which are native to North America, less to Eurasia, being spread throughout the continents. In the Central Europe, there are 5 species of g. Solidago: 4 of them being of American origin – *S. canadensis* L., *S. gigantea* Aiton., *S. altissima* L. and *S. graminifolia* (L.) Elliot, and only one species – *S. virgaurea* L. is native to Europe.

Material and methods: The bibliographic evaluation of the species occurring in the flora of the Republic of Moldova from g. *Solidago*.

Results: In the flora of the Republic of Moldova g. *Solidago* is represented by 2 species: the native one, spontaneously spread *S. virgaurea* and cultivated species *S. canadensis*, known as the adventive one. Species *S. virgaurea* with the common name Goldenrod, known for Romanian population as "vargă-de-aur", "splinuță", "floare-boierească", "mănunchi", "splinăriță", "smeoaică", has been used for centuries in the traditional medicine of European countries as a diuretic, antiseptic, antibacterial and antiflogistic remedy. On the other hand, Canada goldenrod (*S. canadensis* L.), known with the popular romanian common names: sălcioară, sânziană de grădină, is included in the uncultivated synanthropic flora of the Republic of Moldova, being specific for degraded ecosystems and rural areas, particularly in ruderal and human-created habitats, also being cultivated as an ornamental plant. Nowadays, Canada goldenrod is widely recognized as one of the most widespread invasive species in Europe, nevertheless there is a little knowledge on its distribution and threat invasion for the local flora of the Republic of Moldova.

Conclusions: In the Republic of Moldova g. *Solidago* is represented by the native species *S. virgaurea*, occurring in the spontaneous flora, and the adventive, cultivated species – *S. canadensis*, being included in the synanthropic flora.

Keywords: g. *Solidago* L., *S. virgaurea* L., *S. canadensis* L.

HISTOLOGICAL STUDY OF THE FRUIT OF *RIBES NIGRUM* L. AND *RIBES RUBRUM* L. (GROSSULARIACEAE)

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Background: Positive effect of currants has been described on the dietary management of various diseases in many reports. In phytochemical aspect, polyphenolic substances of their fruits and the leaves have anti-inflammatory, antioxidant, antifungal, and anticancer effect. In the seed oil of black currant (*Ribes nigrum* L.) and red currant (*Ribes rubrum* L.) tocopherol and unsaturated fatty acids were identified. Despite the pharmacological potential of the fruits and the wide range of studies on chemical composition, there are few studies on the morpho-anatomical description of the fruits as medicinally used parts in some *Ribes* species. According to our best knowledge, there is no available study concerning the histology of *Ribes nigrum* and *R. rubrum*. Thus, this work aimed to perform a comparative morpho-anatomical characterization of the fruits of black currant and red currant.

Material and methods: Preparations of both fruits were made with rotation microtome, then the cross sections were stained with toluidine blue. Documentation and evaluation were carried out in microphotos.

Results: Differences were observed in the shape of the epidermis cells and vascular bundles in both fruits. In *Ribes rubrum*, the epidermis cells are ovoid to round, while those of *R. nigrum* are rectangular to almost round. Under the epidermis, in both fruits, there are two layers of oval hypodermal cells. Underneath the hypodermal layers the parenchyma composes of different size of thick-walled cells and scattered vascular bundles. In *R. nigrum*, the vascular bundles consist of xylem, phloem and phloem fibers, while in *R. rubrum* they contain only xylem and phloem. The seeds are embedded in a gelatinous sheath having large thick-walled mucilage cells. Endocarp separates the arillar tissue from the parenchyma cells, in addition, a gap can be found between this layer, arillar tissue and seeds. The seed coat (testa) consists of sclerenchyma cells in both species.

Conclusions: Histological differences and similarities were described in the fruits of the selected *Ribes* species.

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Keywords: *Ribes nigrum*, *Ribes rubrum*, fruit, microscopic examination

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INVESTIGATION OF THE MEDICINAL FLORA – POTENTIAL ALONG THE NIRAJ AND TÂRNAVA MICĂ RIVERS

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Background: This work offers the partial results of the botanical studies, botanical cartography and the evaluation of the medicinal flora-potential in the ROSCI0297 Natura 2000 area.

Material and methods: Between 2016 and 2017 I have edited a trilingual (Romanian, Hungarian and English) database of botanical drugs and drug preparations recorded in medicinal taxons, pharmacopoeia, official international drug monographs (monographs of the European Medicines Agency, European Scientific Cooperative on Phytotherapy and World Health Organization), drug regulations (Romanian, Hungarian) and professional literature found in the (semi)spontan flora of the Carpathian Basin. Through the database we receive a broad picture of the number of the spontan medicinal plants found in the Carpathian Basin and the amount of the botanical drugs and drug preparation provided by these. This study also shows the division of the medicinal plants according to area, biological types, reserve value category, social behavior types, ecological indicator value and their environmental needs. From March 4th, 2016 to March 3th, 2017, in a 957 ha sample area and a 34 days long fieldwork I identified and projected to map the specific place of medicinal plants which can be found in the database.

Results: I identified and projected to map the specific place of nearly 100 officially applied medicinal plant species. Simultaneously I documented near fifty medicinal plant analogues, 300 other valuable taxon (for example protected plants, rare orchids etc.), and the cartography of quarantine and invasive plants. Another important result of the first year is the identification, listing and analysis of the reshaping, influential and impairing factors of the vegetation and habitats.

Conclusions: This work offers a broad picture of the number of the spontan medicinal plants found in the area between Niraj and Târnava Mică rivers. It also offers the possibility to finally separate the ambiguous ethnomedicinal data from the official group of useful plants, which are valued both by the western medicine and the pharmacological studies.

Keywords: medicinal plants, spontan flora, botanical cartography, potential, Niraj and Târnava Mică rivers

TOXICITY ASSESSMENT OF *NEPHROLEPIS EXALTATA* (L.) SCHOTT

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Background: The fern *Nephrolepis exaltata* (L.) Schott, fam. Nephrolepidaceae, has been studied for its phytoremediation properties, the effects of its volatile oil, its possible hormonal and cytotoxic effects on human cancer cells, and its air purifying capabilities and for its photosynthetic limitations.

Objective: To estimate its potential safety for human use, in the present study we have investigated its phytotoxicity (on *Triticum aestivum* L.) and its toxicity on brine shrimp.

Material and methods: The plants were commercially obtained and cultivated in a laboratory hydroponic growth system. The species identity was confirmed by macroscopic and microscopic examinations on rhizomes, rachises, pinnae and runners using bright field and fluorescent microscopy. Biological assays were performed on aqueous and ethanolic solutions. The solutions were obtained under reflux from dry leaves using a plant: solvent ratio of 1:10 (w/V) and diluted to obtain concentrations in range of 625–100000 mg/L (*Artemia franciscana*) and 1000 – 100,000 mg/mL (*Triticum* test). Brine shrimp lethality assay was performed on *Artemia franciscana* Kellog and phytobiological bioassay on *Triticum aestivum* L. The determinations were carried out against distilled water. Lethality, root elongation and karyokinetic film modifications were evaluated and LC50 and IC50 values were calculated.

Results: The microscopic analysis revealed the main histo-anatomic elements: polystelic structure and hypodermis (rhizome, runners), angular collenchyma, trichomes (rachis), homogenous structure, trichomes and anisocytic stomata (leaves). The ethanolic and aqueous extracts had a moderate, concentration-dependent mitoinhibitory effect on the radicles of *Triticum aestivum* L. and induced partial or full lethality only at high concentrations (≥ 5000 mg/L) on *Artemia franciscana* at 24 hours.

Conclusions: The ethanolic and aqueous solutions of *Nephrolepis exaltata* (L.) Schott showed limited cytotoxic effects on both *Triticum aestivum* roots and *Artemia franciscana* nauplii.

Keywords: *Nephrolepis exaltata*, microscopy, *Triticum* bioassay, *Artemia* bioassay

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PECULIARITIES OF VEGETATIVE ORGANS STRUCTURE AND SEED GERMINATION AT *ECHIUM RUSSICUM* J. F. GMELIN

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Background: The anatomy of some species of the Boraginaceae family has been the subject of various researches (Y. Yesil, 2017; M. Keshavarzi et al., 2013; T. Aytas Akcin et al., 2010; C. Ifrim, A. Toniuc, 2006; S V R Surya Kamala, B. Hanumantha Rao, 1989; S. Carlquist, 1970). However, few papers are intended exclusively to *Echium* anatomy (A. Sofian, 2003) and to species *Echium russicum* J. F. Gmelin sin. *Echium rubrum* Jacq., non Forssk. (Flora Europaea, 1964 - 1993), *Echium maculatum* L. (Sârbu et al., 2013).

Material and methods: The plant material, represented by the species *Echium russicum*, was harvested from the ROSCI0221 salt areas of Valea Ilenei, Iași County, in May 2016. The samples were processed according to classical techniques of plant histo-anatomy, and measurements of structural parameters were performed with Fiji software. Seed germination tests were performed under laboratory conditions, on an experimental sample treated with Atonik solution and on an untreated sample.

Results: The histo-anatomical areas of the vegetative organs (root, collet, stem in the lower, middle and upper thirds, foliar limb near the median rib, leaf area) have been identified and described. The measurements performed revealed the weight occupied by different tissues in the structure of each analyzed organ. The seed germination percentage and the survival time of the seedlings are reduced, both in the control variant and in the case of the experimental variant.

Conclusions: The paper brings completions at the description of the structure of the species *Echium russicum* J. F. Gmelin. The germination behavior of seeds is studied, in an attempt to explain the trend of decreasing populations of this species in some Natura 2000 sites in Romania.

Keywords: *Echium russicum*, anatomy, germination

THE ROLE OF MEDICINAL PLANTS USED IN THE VETERINARY MEDICINE

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Background: From a long time, medicinal plants are used in veterinary medicine. Our interest relates to phenolic compounds from medicinal plants, which have several biological effects in gastrointestinal and respiratory.

Material and methods: By screening, we determined the total phenolic and flavonoid compounds from fifteen veterinary extracts which were involved in veterinary products and from sixteen medicinal plants used in the preparation of these extracts. Spectrophotometric methods were used to determine the content of total polyphenols and flavonoids. The total polyphenol concentration was determined with Folin-Ciocalteu method. The total flavonoid content was expressed after the official method described in the Romanian Pharmacopoeia 10th edition with little modification. The antioxidant activity was determined by the ABTS and DPPH methods.

Results: The highest values of total polyphenolic concentration from the medicinal plant extracts were found from methanol and water (1:1) extracts (5.09-48.70 mg gallic acid/100 g dry weight). The polyphenolic values from extracts performed on a narrow scale (1.58 - 4.58 mg gallic acid/100 g extract). The highest flavonoid concentration extracted from medicinal plants was obtained with ethanolic and methanol and water extracts (1.33 – 38.5 mg quercetin equivalent/100 g dry weight from ethanolic extracts and 1.22 – 23.84 mg quercetin equivalent/100 g dry weight plant from methanol and water extracts). The concentration of flavonoids from extracts were between 0.70 - 3.64 mg quercetin equivalent/100 g extract. According to the DPPH and ABTS methods suggested that the antioxidant activities had free radical scavenging activities from medicinal plants and extracts, too.

Conclusions: We observed the high variability of phenolics and flavonoids compound and there are a wide variety of extraction methods for determinations. The polyphenols have the potential to be integrated in these veterinary products and used to promote animal health and extracts are a potential source of natural antioxidants.

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Keywords: medicinal plants, veterinary medicine, polyphenols, flavonoids, antioxidant.

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