MOLDOVA STATE UNIVERSITY
Institute of Genetics, Physiology and Plant Protection,
Center of Functional Genetics, Doctoral School in Natural Sciences,
Faculty of Biology and Geosciences,
SCIENTIFIC ASSOCIATION OF GENETICISTS AND BREEDERS OF THE REPUBLIC OF MOLDOVA

The National Conference with International Participation

NATURAL SCIENCES IN THE DIALOGUE OF GENERATIONS

IXth edition

ABSTRACT BOOK

September 21-22, 2026
Chisinau, Republic of Moldova

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Session A

GENETICS, BREEDING AND BIODIVERSITY PROTECTION

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THE USE OF MOLECULAR MARKERS FOR THE SELECTION OF DROUGHT-RESISTANT SUNFLOWER GENOTYPES

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Drought stress represents one of the major limiting factors affecting sunflower productivity, causing a wide range of morphological, physiological, and molecular changes. Water deficit negatively affects seed germination, reduces plant height, leaf area, and biomass accumulation during the vegetative stage, while during the reproductive stage it may induce pollen sterility and substantial yield losses. The present study evaluated 34 sunflower genotypes for drought tolerance using molecular marker analysis based on KASP technology. A total of seven KASP markers localized on chromosomes 1, 4, 8, 10, 11, 14, and 17 were tested for their potential use in marker-assisted selection for drought tolerance. Among these, only two markers, S17_8886925 and S11_160090021, revealed significant variability within the analyzed sunflower germplasm. The marker S17_8886925, containing the SNP (C/A), is associated with the gene LOC110920644, previously linked to leaf surface area and drought tolerance index. The control, sunflower hybrid FD15E27, presented the T allelic variant [A]. The marker S11_160090021, located on chromosome 11 and characterized by the SNP C/T, belongs to the gene LOC110891369, a receptor-like protein kinase associated with leaf surface area under water stress conditions. An additional interesting result was obtained for marker S8_68352115 (SNP A/T), located on chromosome 8 within the gene LOC110872899, identified as an inactive leucine-rich repeat receptor-like serine/threonine-protein kinase associated with root surface area and water stress tolerance index. Although this marker appeared to present predominantly the T allelic variant, two closely related groups were observed among the analyzed genotypes. These results demonstrate the usefulness of KASP-based SNP markers for identifying genetic variability associated with drought tolerance traits in sunflower and support their application in marker-assisted breeding programs aimed at developing climate-resilient sunflower hybrids.

Keywords: *sunflower, molecular markers, drought.*

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ECOLOGY AND BIOLOGY OF *ARANEUS DIADEMATUS* CLERCK, 1758 (ARACHNIDA: *ARANEA*) IN ANTHROPOGENIC AND FOREST HABITATS

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Spiders are an important component of ecosystems, as regulators of pest populations. Among the various forms, species that use silk webs to capture prey stand out, such as those of the Araneidae family that build a radial circular web with balanced geometric organization. The most representative species in this group is *Araneus didadematus*, identified for the first time on the territory of the Republic of Moldova in the Căpriana locality (Pereleshina, 1930). Later, the species is mentioned in publications from the 1970s-80s, being attested in various localities in the Briceni, Orhei, Nisporeni, Ialoveni districts, and Chișinău. In the area of the Bălți municipality, it is frequent in forest strips on the outskirts, in parks, in trees between apartment blocks, in the area of abandoned factories. Often, this species can even be observed on houses.

Like the rest of the spiders, this species is characterized by a pronounced sexual dimorphism, manifested by the body size and some external peculiarities. The female's body measures 10.0-22.0 mm in length, while the male's – 4.5-11.0 mm. The body coloration, in both sexes, is very variable, with shades from light yellow to brown, reddish-brown or almost black.

The prosoma (cephalothoracic) of the female is light brown, with dark brown markings that start from the forelegs and join in the center of the carapace, called the fovea. Also, a light brown band is present longitudinally, which crosses the entire carapace medially. The prosoma is covered with white or brown hairs. The coloration of the male's prosoma is similar to that of the female, but all the markings and bands are less distinct or can sometimes be almost absent.

The opisthosoma (abdomen) does not present characteristic dorsal protuberances, specific to other species of the genus Araneus. The anterior part of the opisthosoma is more angular, the width in the anterior part of the opisthosoma. The shades vary from light yellow to reddish brown. On the dorsal side of the opisthosoma there is a white, cross-shaped pattern, which represents a specific sign. The legs are light yellowish brown, with dark brown transverse rings and covered with numerous short, well-marked spines. In the male, the rings are more attenuated. The leg span in the female can reach up to 4 - 5 cm.

This is one of the most common and abundant species of orb-weaver spiders in the Republic of Moldova. It can be found between the branches of trees, shrubs or tall herbaceous plants. It often weaves its web at the edge of orchards, forests, in clearings, in rural households. It can also be found in urban green spaces.

The species *Araneus didadematus* is recognized by the circular (round) shape of the webs that the females weave. The males do not weave webs, but are in search of females. The web is built of spiral threads fixed by radial threads. The first thread is pulled with the help of the wind and carried by air currents, until the thread sticks to

an object, acting as a support. Then, the spider moves on this thread, reinforcing it with the second. This is repeated until the main ”horizontal” thread is not strong and resistant enough. After this, it stretches a vertical thread down to the substrate, which starts from the middle of the thread. At this stage, the construction takes on the appearance of the letter Y. From here, the weaving of all radial threads, which are non-sticky, begins. The next stage is the weaving of spiral threads. However, not all webs are built in this way, there are other ways. This type of web is built in tens of minutes, maximum 40 cm.

The egg is deposited in tall grass at a height of 10-20 cm. Juveniles hatch in May and usually molt two or three times before wintering as semi-developed juveniles. Development continues the following spring, and the spiders reach maturity in august or september, when mating takes place. With the approach of winter, the female lays her eggs in grassy vegetation or among human constructions after which she dies.

Araneus didadematus, being a Palearctic species, is widespread throughout Europe, the Near East, Central Asia and the Far East, including the Japanese Islands. This species was introduced to North America.

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TESTING THE BIOLOGICAL EFFICIENCY OF SOME NEW PHYTOSANITARY PRODUCTS TO COMBAT WINTER WHEAT DISEASES

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Winter wheat hosts one of the bakery food source with estimative and bioenergetic potential, which in recent years tends to occupy more and more extensive areas, and in order to obtain stable major harvests it is necessary to know the etiological components of the parasitic microflora. It is a disease-sensitive crop, especially during the period of seed germination until the formation of the first pair of leaves. Thats why the aim and objectives presented in the this work focus on the research-testing of new fungicides effective in combating the complex of invasive diseases. The purpose of the work are phytopathological research related to the state testing of new preparations with fungicidal action in combating the most dangerous diseases affecting the autumn wheat crop in the Republic of Moldova. We made a test program of presentation of the phytopathological aspects regarding the diseases specific to the winter wheat crop and determination the frequency of the degree of attack and the intensity of the attack of the main infectious diseases for fungicidal preparations: Binazol 300, SC, Lot no. 6, WG and F2024-azodiph, SC. The respective results was developed, using the methodological and experimental methods and materials accumulated on the basis of participation in the subject of the scientific project on the state testing of new fungicides. Investigations on the research of the mode of action of remedies with fungicidal action on the winter wheat crop focused on the determination of the indicator system, the calculation frequency and intensity of the attack, and subsequently the biological efficiency was determined. In the case of preparations with fungicidal action Binazol 300, SC in combating powdery mildew-Erysiphe graminis, brown rust-Puccinia recondita, septoria-Septoria tritici and helminthsporiosis -Dreschlera tritici-repentis, Lot no. 6, WG against powdery mildew-Erysiphe graminis and helmintosporiosis-Dreschlera tritici-repentis and F-2024-azodif, SC in combating powdery mildew-Erysiphe graminis, brown rust-Puccinia recondita, septoriosis-Septoria tritici and helmintosporiosis- Pyrenophora tritici-repentis. Following the analysis regarding the efficiency of these preparations, we conclude that the tested new preparations are recommended for approval against tested agents, in the following doses and tested variants: Binazol 300 SC - 1.0 l/ha, F2024-azodif - 0.7 l/ha, Lot no. 6, WG - 0.2 kg/ha, with the administration of two treatments in one vegetation period.

Acknowledgments: The research was carried out in the framework of the subprogram: 010701 and 010102 of Moldova State University.

Keywords: *winter wheat, research, diseases, fungicides, biological efficiency, testing.*

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RESEARCH ON INVASIVE INSECT COMPLEXES IN SOYBEAN CROP IN THE ENVIRONMENTAL CONDITIONS OF THE REPUBLIC OF MOLDOVA

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Under the conditions of the Republic of Moldova, geographically located in an area with unstable conditions in terms of temperatures and precipitation, often affected by droughts, it is more effective to cultivate some species of food cultures of the family Fabaceae in accordance with their bioecological requirements and response to such factors as heat, lack of precipitation and attacks of invasives pest and. Based on the actuality of the topic and the goal set by us, we have established the following objective for the research: making records of biological and phytosanitary control establishing the degree of phytosanitary impact, highlighting the response reactions and the most invasive species of pests in the studied crop species. Soybean cultivation holds significant agri-food, fodder, and industrial value for the Republic of Moldova. Its economic potential can be fully realized by promoting key activities aimed at improving crop quality and maximizing the yields of grains and pods. However, soybean crops are annually threatened by invasive insect species, highlighting the need for thorough research into the impact of certain highly damaging pests. Phytosanitary monitoring, conducted across different phenological stages of the crop, revealed the presence of 15 particularly harmful invasive insect species from 4 orders and 8 families. The most notable ones, based on assessments of population density, frequency, and intensity of crop damage, were coleopteran insects detected in the soil since the germination phase. These include the wireworm larvae of click beetles: *Agriotes lineatus* L. and *Agriotes ustulatus* L., such species as *Agrotis segetum* Schiff. and *Autographa gamma* L. As the crop matures, weevil species like *Sitona lineatus* L. and *Tanimecus dilaticollis* L. become prevalent. In later growth stages, adult plants are attacked by several aphid species - *Myzus persica*e Sulzer, *Aphis fabae* and *Aphis gossypii*, as well as by flies (*Liriomyza huidobrensis* L., *Liriomyza trifolii* L., *Delia platur*a L.), pea thrips (*Kakothrips robustus* Uzel), and the soybean moth (H*elicovepra armigera, Cydia nigricana Fabr, Etiella zinckenell*a). The results of this research, carried out in the north, central and south-eastern regions of Moldova, contribute to understanding the parasitic impact on soybean crops and support the development of forecasts and integrated pest management strategies. This complex study of the phytosanitary monitoring contributed to elucidating the degree of entomological damage and brought new evidence in favor of applying sustainable pest control measures suitable for all fabaceae agrocenoses.

Acknowledgment: The research was carried out in the framework of the subprogram: 010701 and 010102 of Moldova State University.

Keywords*: soybean crops, pests invasive, biological survey, phytosanitary impact*.

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GENETIC DIVERSITY IN *LENTIL LANDRACES* AND WILD RELATIVES USING ISSR MARKERS

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Lentil (*Lens culinaris* Medik.) is an important grain legume cultivated worldwide, and the assessment of its genetic diversity is essential for effective conservation and breeding programs aimed at improving yield, stress tolerance, and disease resistance. The aim of this study was to evaluate the genetic diversity and relationships among cultivated lentil landraces and their wild relatives using inter simple sequence repeat (ISSR) molecular markers. A total of 30 lentil accessions were analyzed, including 27 local cultivated landraces and 3 wild species (*L. ervoides*, *L. orientalis*, and *L. odemensis*). Genetic variation was assessed using three ISSR primers (UBC 807, UBC 814, and UBC 815). A total of 15 bands were amplified, of which 10 were polymorphic, resulting in an average polymorphism rate of 65.5%. The number of bands per primer ranged from 4 to 7, with the highest number observed for UBC 815 (7 bands), followed by UBC 807 and UBC 814. The number of polymorphic bands per primer varied from 2 to 5, indicating differences in marker efficiency. The genetic diversity index (GDI) values ranged from 0.13 (UBC 807) to 0.73 (UBC 815), with a mean value of 0.43, while polymorphic information content (PIC) values ranged from 0.06 to 0.22, with an average of 0.16, reflecting moderate discriminatory power of the selected primers. Notably, primer UBC 815 produced a unique band specific to the wild species *L. ervoides*, which also exhibited a distinct amplification profile with primer UBC 814, highlighting its genetic divergence. Cluster analysis based on Jaccard similarity coefficients using Darwin software grouped the accessions into three main clusters. The majority of cultivated landraces showed low levels of differentiation and could not be clearly distinguished using the selected loci, suggesting a relatively narrow genetic base. In contrast, the three wild species formed independent and highly divergent branches, clearly separated from cultivated genotypes, indicating substantial genetic distance. Overall, the studied lentil germplasm exhibits moderate genetic diversity, with wild species representing highly divergent and valuable genetic resources. These findings can contribute to the development of effective breeding strategies, particularly through the incorporation of wild genetic material to broaden the genetic base and improve agronomic traits in cultivated lentil.

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Keywords: *lentil, ISSR, wild relatives, genetic diversity.*

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INBREED LINES OF CLARY SAGE (*SALVIA SCLAREA* L.)

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The aim of research on the improvement of clary sage (*S. sclarea*.) is to create and diversify the initial material, with an advanced degree of flowering in the first year of vegetation, in order to obtain varieties resistant to abiotic factors, capable of ensuring high production of raw material and quality essential oil, due to the increased concentration of active principles and the unique correlation of components. The biological material used in the present study was represented by 63 inbred lines S_6 – S_{16} of different origins. The creation of the initial breeding material was achieved through inbreeding, by closing the inflorescence in an isolater, at the beginning of the flowering stage and forcing pollination with its own pollen. The essential oil was obtained by hydro distillation in Ginsberg apparatus. The experiments were carried in accordance with internationally accepted methods for this crop.

The results obtained show that the flowering of the sedge in the first year of vegetation varies from year to year and depends on the pedoclimatic conditions, the thermal regime of the period from the seedlings emergence to leaf rosette and adherence cultivation technology. As a result of research conducted with a large number of inbred lines, it was found that there are lines with full flowering in the first year of vegetation, as well as lines with an increased content of essential oils. Finally, lines with an essential oil content exceeding 2% (dry matter), were identified: AP 97-11 S6– 2.076%; M-69 428-82 S_{16} – 2.227 %; M-69 815-82 S_{16} – 2.140 %. Lines with essential oil content exceeding 1.5 %: AP 2-11 S_6– 1.642 %; AP 11-11 S_6– 1.630 %; AP 28-11 S_6– 1.221 %; AP 30-11 S_6– 1.912 %; AP 32-11 S6– 1.719%; AP 66-11 S_6– 1.643 %; NC 98-11 S6– 1.810%; NC 11-11 S6– 1.753 %; NC 38-11 S6– 1.646 %; NC 98-11 S6– 1.810%,; AP 67-11 S_6– 1,573 %; NC 6 -11 S_6– 1,356 %; NC 4 -11 S_6– 1.358 %; NC 11 -11 S_6– 1,753 %; NC 19 -11 S_6– 1.499 %; NC 38 -11 S_6– 1.646 %; NC 98 -11 S_6– 1.810 %, etc.

The inbred lines developed are divided into three groups: those affected by inbreeding degeneration, those unaffected by degeneration, and lines in which new characters appear as a result of inbreeding, which proves that inbreeding is a factor of morphogenesis and a source of new characters, some of which are very valuable for breeding. Inbreed lines represent exceptional material for the creation of complex hybrids.

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Keywords: *Salvia sclarea L., inbred lines, essential oil.*

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INHERITANCE OF COLEOPTILE LENGTH IN DH-LINES DERIVED FROM BARLEY INTERSPECIFIC HYBRIDS

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Adaptive reactions of plants can be realized at different levels of structural and functional organization. Coleoptile length is considered to be the important adaptive morphological trait of cereal crops which allows increase the efficiency of water usage in drought conditions by determining the depth of seed sowing. Wild relative of cultivated barley *Hordeum spontaneum* proved to be a source of trait "long coleopotile". From the practical point of view, it would be desirable to transfer this valuable agronomic character to *H. vulgare* for production of new varieties with improved adaptability to global climate changes.

The aim of this study was to investigate the inheritance of coleoptile length in populations of DH-lines produced from interspecific hybrids between *Hordeum vulgare* and *Hordeum spontaneum* via anther culture *in vitro*.

A set of 24 androgenetic introgression doubled haploid lines derived from 7 cross combinations involved 5 accessions of wild species and 3 spring barley varieties as well as the parental forms were used as the material for investigation. DH-lines are characterized by variability in spike morphology and grain size. Most of DH-lines had intermediate spike morphology, increased spike and kernel lengths, and higher kernel size in comparison with both parental forms. All *H. spontaneum* accessions had brittle rachises. However, 5 DH-lines of spontaneum-type with nonbrittle rachises were found. Alternatively, 6 DH-lines of vulgare-type inherited brittle rachises from wild relative. Coleoptile length was determined by means of seed germination on moistened filter paper at 15°C for 14 days in dark.

The results of investigation showed that seed germination was started after 3 days in cultivated barley and after 5 days in *H. spontaneum* accessions. Significant differences in coleoptile length were found between spring barley cultivars and *H. spontaneum* accessions. Among *H. spontaneum* accessions the coleoptile lengths varied from 63.2 mm 85.3 mm with an average of 76.3 mm. Barley varieties were inferior in this trait to *H spontaneum*. In particular, coleoptile lengths in cultivated barley varieties ranged from 43.3 mm to 53.4 mm with an average of 48.1 mm. The majority of DH-lines were intermediate in coleoptile length. Only two lines had coleoptile length exceeded 80 mm. The latter ones were selected as the promising material for genetic improvement of cultivated barley.

Obtained results can be explained by taking in consideration a genetic control of coleoptile length in cultivated barley and by supposition that orthologous genes are available in the genome of *H. spontaneum* which is considered to be a progenitor of *H. vulgare* and even its subspecies. Particularly, it is known that coleotile length in cultivated barley is inherited as a quantitative trait, and at least four QTLs located on chromosomes 1H, 5H, 6H and 7H play a crucial role in its determination.

Keywords: *barley, H. vulgare, H. spontaneum, DH-lines, coleoptiles length, inheritance.*

UDC: 633.34:577.11

BIOCHEMICAL COMPOSITION OF SOYBEAN SEEDS REFLECTED THROUGH PROTEIN FRACTIONS

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Addressing protein deficiency and the increasing demand for alternative sources relies significantly on plant-based raw materials, with cultivated soybean proteins playing a leading role. An important indicator of the quality of the soybean seed protein complex is the biochemical composition and ratio of protein fractions, which determine the biological, nutritional, economic value of the seeds.

According to the Osborne classification, protein fractions are divided, into four groups: water-soluble (albumins), salt-soluble (globulins), alkali-soluble (glutelins), and alcohol-soluble (prolamins). Each protein fraction has its own biological characteristics and functions.

The aim of this study was to analyze the fractional composition of the protein complex in seeds of various soybean varieties.

The biological material consisted of seeds from locally bred soybean varieties: Flamura, Aura, Deia, and Igorina (harvest of 2024), provided by the National Center for Seed Research and Production. Protein extraction was carried out according to the classical Osborne method, and the protein concentration in each fraction was determined using the Bradford method.

The results confirmed the presence of all major protein fractions in the seeds of the studied varieties, with water-soluble proteins representing the predominant component. The control variety, Aura, exhibited the lowest concentrations of both water-soluble (56.94%) and alcohol-soluble proteins (1.56%), along with moderate levels of globulins (8.36%) and glutelins (33.14%). The protein profiles of the Deia and Igorina varieties were characterized by elevated albumin content, as well as the highest concentrations of globulins and glutelins. Notably, the protein content of the Deia variety in the water-soluble and alkaline fractions exceeded that of the control by approximately 25%, while the salt-soluble fraction surpassed control values by more than 60%. These increases were positively associated with the highest yield recorded for these varieties under experimental field conditions. Despite exhibiting the highest albumin content (64.9%), the Flamura variety showed markedly lower globulin (−46%) and glutelin (−9%) concentrations relative to the control.

Overall, the observed differences in protein fraction composition reflect genotype-specific characteristics of the soybean seed protein complex. These variations may serve as valuable criteria for assessing nutritional quality as well as the adaptive potential of different varieties. Among the genotypes analyzed, Deia and Igorina demonstrated the most balanced and biologically valuable protein profiles, highlighting their potential for use in breeding programs and in the food industry.

Acknowledgments: This study was supported by the research project 011210.
Keywords: *soybean, protein fractions, nutritional and biological value.*

UDC: 582.92:502.171

ASPECTS OF INTRODUCING THE SPECIES *CLINOPODIUM NEPETA*(L).KUNTZE FROM *IN SITU* TO *EX SITU* CONDITIONS

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The present study examines various aspects related to the identification of the aromatic species Clinopodium nepeta (L.) Kuntze within the spontaneous flora of the Republic of Moldova, as well as its introduction into the collection of the Botanical Garden, with the aim of evaluating its adaptive capacity under ex situ conditions and to determine its essential oil content.

Commonly known as common calamint, C. nepeta is a species originating from the Mediterranean region, naturally distributed in countries such as Italy, Greece, Spain, Turkey and the Republic of Moldova. It is recognized for its aromatic, medicinal, melliferous and culinary (herb) value. Its economic importance is largely related to its high content of essential oils, which have potential applications across multiple sectors.

The introduction of plant species from their natural habitats (in situ) into controlled environments (ex situ) represents an essential strategy for biodiversity conservation and the sustainable utilization of plant genetic resources, particularly in the context of climate change. In the present study, biological material was collected from natural populations located in the Rezina District (Saharna), consisting of entire plants (bushes) harvested at the seed maturation stage. Experimental plots were established within the aromatic plant collection of the National Botanical Garden, where the survival rate and performance of the species in relation to environmental factors were systematically monitored.

The results obtained highlight the notable ecological plasticity of the species, facilitating its successful establishment under ex situ conditions. During the early stages of vegetation, no difficulties were observed in the successful establishment of plant material, suggesting that further optimization of water, soil and microclimatic conditions may not be necessary.

Under controlled conditions, the plants exhibited a high adaptive potential, with a notable survival rate of 98%, accompanied by harmonious development of vegetative organs and high tolerance to winter frosts in 2025-2026 (-15…-18 °C). These characteristics indicate the high potential of the species as a valuable plant.

The introduction of C. nepeta to ex situ conditions provides favourable possibilities for conserving its genetic resources and supports further research on its biomorphological traits, biomass productivity and essential oil content. Collectively, these findings provide a reliable scientific foundation for initiating comparative studies with other Clinopodium L. species, with the aim of identifying promising taxa for integration into the economic circuit as aromatic plants.

Acknowledgments: The research was supported by the Subprogram 010101 "Research and ex situ and in situ conservation of plant diversity in the Republic of Moldova", funded by the Ministry of Education and Research of the Republic of Moldova.

Keywords: *introduction, plant, conservation, in-situ, ex-situ, study.*

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PLANT GENETIC RESOURCES MANAGEMENT AT USTYMIVKA EXPERIMENTAL STATION OF PLANT PRODUCTION

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Ukraine's national security depends on food security, which is closely linked to the activities of the National Center for Plant Genetic Resources of Ukraine (NCPGRU)/ Fs of 2026, the Center maintains 157,200 acc.essions representing 544 crops and 2,020 botanical species, including 1,051 domestic species and 969 wild relatives. Specifically, at Ustymivka Experimental Station of Plant Production of the Yuriev Plant Production Institute of the National Academy of Agrarian Sciences of Ukraine, which is one of the 28 institutions within the NCPGRU network, a 33-year scientific effort has resulted in a gene pool collection of 32,824 accessions across 154 crops, with 11,333 accessions being of Ukrainian origin.

Analysis of the work with the gene pool of plants of Ukraine, which is collected and stored at the Ustymivka Experimental Station of Plant Production of the Yriev Plant Production Institute of the National Academy of Agrarian Sciences of Ukraine.

To evaluate the value of these accessions, genus-specific descriptors-classifiers and specialized crop assessment protocols were employed.

As a result of this work, the following were achieved: 37 different collections (including 14 trait-based, 8 basic, 6 educational, 5 special, 3 working trait-based collections, and 1 core collection) have been built up; 144 valuable accessions registered within the NCPGRU (comprising 47 potato, 20 maize, 17 shrub and tree, 15 wheat, 11 millet, 10 grass pea, 8 common bean, 6 mustard, 6 alfalfa, 2 lettuce, 2 poppy accessions, and 1 barley accession) have been registered with the NCPGRU; 21 cultivars, hybrids, and parental components (including 8 maize cultivars, hybrids, and parental components, 6 wheat cultivars, 5 poppy cultivars, 1 common bean cultivar, and 1 millet cultivar) have been bred. Additionally, 309 grass pea (*Lathyrus sativus* L.) accessions have been deposited in the Svalbard Global Seed Vault (Norway).

The complexity and uniqueness of plant gene pool management lie in its continuity and systematic nature, as it involves working with living germplasm that requires specific conditions to maintain its viability and genetic authenticity. The broad hereditary basis of the formed gene pool is an inexhaustible treasury that needs to be preserved and will always be a source of raw material for the creation of new generations of varieties, hybrids, parental forms, populations, etc. in order to prevent a humanitarian crisis.

Keywords: *genebank, plant genetic resources, collections.*

UDC: 633.15:631.51

THE INFLUENCE OF AUTUMN PLOWING ON YIELD COMPONENTS AND YIELD OF MAIZE

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Autumn plowing is one of the most important soil tillage operations, playing a key role in soil loosening, water accumulation and conservation, incorporation of plant residues, and the creation of favorable conditions for the development of the plant root system. Within the study, several yield components were monitored: the number of ears per plant, the percentage of barren plants, ear length, the number of kernel rows per ear, the number of kernels per row and per ear, ear weight, grain weight per ear, the weight of 1000 kernels (TKW), grain yield, and moisture content. Measurements were carried out in three experimental replications. An increase in ear length and in the number of kernels per ear was observed due to better soil aeration and improved water and nutrient supply conditions. In addition, grain weight and TKW values reached high levels, indicating better grain filling and uniform maturation. The yield obtained in the first replication was 5,464 kg/ha, 6,053 kg/ha in the second replication, and 5,881 kg/ha in the third replication. In conclusion, autumn plowing has a favorable impact on maize yield components and contributes to obtaining higher and more stable yields, representing an important technological practice in the cultivation system of this crop.

Keywords*: maize, autumn plowing, yield, yield components.*

UDC: 633.15:632.937.1

MONITORING OF STOCK PESTS DURING STORAGE OF MAIZE GRAIN IN GRANARIES OF BELARUS

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In the Republic of Belarus, in recent years, the expansion of maize acreage cultivated for grain to 306 thousand hectares, the increase in yield to 65.0 dt/ha, and the growth in gross grain harvest to 2,049.0 thousand tons have determined the increasing relevance of protecting the harvested crop during storage from infestation by arthropods.

In this regard, the aim of the work was to study the species composition and dominance structure of stock pests using different monitoring methods during the storage of maize grain in technocenoses of seed and forage granaries.

Monitoring of stock pests, carried out for the first time by a combination of methods (standard – taking average samples and the trap method) in 2024–2025, showed that the taxonomic composition included 19 species belonging to 2 orders and 9 families. The order Lepidoptera is represented by the families Tineidae, Pyralidae; the order Coleoptera by the families Curculionidae, Mycetophagidae, Dermestidae, Silvanidae, Cryptophagidae, Ptinidae, Nitidulidae.

It was revealed that the dominance structure of insect stock pests varies depending on the storage method of maize grain and its intended use. In seed storage facilities (seed storage in big bags), only representatives of the order Lepidoptera (100%) were detected; in forage granaries (grain stored in bulk), in addition to Lepidoptera (79.6 %), Coleoptera (20.4 %) pests were also captured. Plodia interpunctella Hbn. was an eudominant both in forage and seed granaries (dominance index 78.7–99.7 %, respectively); *Typhaea stercorea* L. was characterized as a dominant only in forage granaries (19.8 %).

In seed granaries, high efficiency of pheromone monitoring (100 %) was noted compared to the standard method. In forage granaries, the use of pheromone «baited traps» was highly effective (12.7–50.6 %); «counting traps» (without pheromone) provided catchability within 3.3–3.6 %. The standard method was low-efficiency (0.2 %).

Thus, for monitoring stock pests of maize grain, in addition to the standard accounting method, there is a need to use the trap method (with and without pheromone), which will allow controlling the population dynamics of both target and non-target pests.

Acknowledgment: The research was conducted in the framework of the State Research Program «Agricultural Technologies and Food Security» for 2024–2025, subprogram «Soil Fertility and Plant Protection», under the task «Improving the monitoring of maize pests during vegetation and grain storage».

Keywords: *monitoring, stock pests, maize grain, storage, granaries.*

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THE ACTION OF GENOTYPE AND VIRUSES IN THE FORMATION OF THERMOTOLERANCE IN TOMATOES

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The formation of tomato tolerance to high temperatures is a complex process, genetically determined and influenced by the action of several external factors, including viral agents. The purpose of the research included determining the role of genotype and viral agents in the formation of heat resistance in tomato progeny obtained from plants reinfected with viruses. The experiments were carried out in laboratory and solar conditions, the descendants (Tobacco Mosaic Virus/ TMV2 and Tomato Aspermy Virus/TAV2) of the varieties: Mary Gratefully, Venet, Flacara, Rufina and the spontaneous form: Solanum pimpinellifolium (control variants, TMV reinfection, TAV reinfection) were used as experimental material. The assessment of the reaction of the male gametophyte to the action of high temperature was carried out by treating pollen grains in a thermostat with a temperature of 40oC for 3 hours. Based on the microscopic study, the following indices were evaluated: pollen viability and thermoresistance; pollen tube length and resistance. To assess the contribution of genotype, stress factors and their interaction in the variation of the analyzed characters, multifactorial analysis of variance (ANOVA) was applied. The obtained results demonstrated that heat treatment of pollen grains in the descendants of plants reinfected with TMV/TAV contributed to the modification of the functional characteristics of microgametes, which in most cases were expressed through inhibitory effects, with the exception of cv. Rufina TAV2 and S.pimpinellifolium TMV2/TAV2, which attested a stimulatory reactions. Genotype and the interaction of factors had a major contribution to the variation in pollen viability, and the temperature factor acted decisively on the change in pollen tube length. The variability of thermoresistance in TAV2 descendants was primarily influenced by genotype, which is of practical importance, as it increases the possibility of identifying resistant forms. Genotypes were highlighted, which, against the background of high temperatures, showed high reproductive potential. It was established that at the male gametophyte and sporophyte stages, the descendants of infected plants exceeded the control values in terms of heat resistance, which is due to the more pronounced elimination of pollen grains with reduced viability compared to the control. Thus, the application of gametic improvement methods in breeding programs is of major importance for reducing the negative action of high temperatures, both in healthy plants and in plants infected/reinfected with viruses and their descendants.

Acknowledgment: The research was carried out within the subprogram 011101 "Genetic and biotechnological approaches to the to the agroecosystems management under climate change", financed by the Ministry of Education and Research of Republic of Moldova and doctoral program "Particularities of the male gametophy in the screening of tomato genotypes under the action of phytopatogens and abiotic stress factors".

Keywords: *tomato, pollen grain, temperature stress, virus, source of variation, thermoresistance.*

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YIELDS OF SIX PLUM VARIETIES IN THE NORTHERN PART OF THE COUNTRY

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The aim of this study is to evaluate the performance of six plum varieties developed at various breeding centers in terms of their growth and productivity in an intensive cultivation system during the fruiting period in the northern part of the country. The research was carried out in the plum plantation in 2025, where 6 cultivars of plum from the European assortment were taken as biological material: Piteștean, Cacanska Najbolia, Empresso, Stanley, Blue Free and President. The control variety was the President variety, trees were grafted onto the Mirobalan seedling rootstock, the planting distance was 5.0x3.0 m. Research was conducted on the onset of the flowering and harvest maturity stages of the plum varieties studied. As part of the research, the diameter and trunk growth, the trunk cross section area (TCSA), the number of fruits, their average weight, fruit production per tree and per unit area.

At the end of the 2025 growing season, the trunk diameter of the trees in the studied strata increased, constituting 95.7-123.4 mm, i.e. an increase in the studied index by 7.9-10.0 mm, which was largely influenced by the plum production recorded in the tree crown, as well as the biological particularities of the variety.

Full flowering period coincided with 20.04 – 25.04, that is, it lasted for 5 days, a period characteristic for plum cultivars with early and medium flowering. The Piteștean variety recorded harvest maturity on 25.07, then followed at an interval of 21 days by the Cacanska Najbolia variety (14.08), which subsequently continued staggered with the Empresso (24.08), Stanley (25.08), Blue Free (01.09) and President (08.09) cultivars. For a more rational efficiency of the use of labor during harvesting and a more staggered distribution of production, the period from late July to early August should be supplemented with 1-2 early plum cultivars.

Higher fruit production of the cultivars studied in 2025 per unit area was obtained for the Piteștean variety 24.5 t/ha and Cacanska Najbolia 27.6 t/ha, and the President, Empresso and Stanley cultivars formed average yields (18.3-21.7 t/ha), which are typical for intensive plum orchards without irrigation in the country. The Blue Free variety recorded the lowest fruit production among the cultivars studied.

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Keywords: *growth, leaf area, production, setting.*

UDC: 633.812:547.913

MAIN COMPONENTS OF ESSENTIAL OIL IN PROMISING LAVENDER HYBRIDS

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Lavandula angustifolia Mill., one of the most well-known and extensively studied species, is of great importance for the pharmaceutical, medical, and cosmetic industries and is recognized for its high yield of superior-quality essential oil.
The biological material used in this study consisted of third-year F1 hybrids derived from 4 maternal forms: Fr.1; Fr.5; Fr.8; Cr.13. To confirm the chemical composition and the genetic and biochemical differences among the third-year F1 lavender hybrids, a qualitative and quantitative analysis of the essential oil was carried out by gas chromatography coupled with mass spectrometry (GC-MS).

As a result of the research conducted during 2025 on 5 hybrid genotypes (1Fr.1-3-22; 2Fr.5-3-7; 5Fr.8-3-19; 3Cr.13-3-10; 4Cr.13-3-24), which distinguished themselves by a high essential oil content ranging from 5.526% to 6.176%, the concentration of chemical constituents was also determined. It was found that the number of identified components ranged from 20 to 26 constituents.

The created and evaluated hybrids also differ in the concentration of their major components. Specifically, the concentration of linalyl acetate varied from 14.17% in the essential oil extracted from the inflorescences of hybrid 5Fr.8-3-19 to 37.180% recorded in the essential oil of hybrid 1Fr.1-3-22. The concentration of linalool in the essential oil obtained from the inflorescences ranged from 28.31% in hybrid 1Fr.1-3-22 to 69.51% in hybrid 5Fr.8-3-19. The proportion of the main components of the lavender essential oil in the hybrids derived from the Cr.13 form amounted to 75.67% in genotype 4Cr.13-2-24 and 76.07% in 3Cr.13-3-10, including linalool at 45.68% and 46.13%, and linalyl acetate at 29.99% and 29.94%, respectively.

Among the ester compounds, in addition to linalyl acetate, lavandulyl acetate was also present, ranging from 0.37% in hybrid genotype 5Fr.8-3-19 to 3.42% in 2Fr.5-3-7, which is in accordance with the standard. It is also important to note that the camphor content in the essential oil of the created and evaluated hybrids complies with ISO standards and the requirements of the European Pharmacopoeia, with values ranging from 0.09% in hybrid 3Cr.13-3-10 to 0.49% in genotype 2Fr.5-3-7.

At concentrations exceeding 2%, camphor is the component that diminishes the quality of lavender oil, as it negatively affects its aroma.

The quality of the essential oil in the evaluated hybrids is high, with a pleasant characteristic lavender fragrance and optimal concentrations of the main chemical components.

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Keywords: *lavender, chemical components, linalool, linalyl acetate*.

UDC: 633.854.78:632.954

OPTIMIZATION OF CHEMICAL METHODS FOR WEED CONTROL IN SUNFLOWER CROPS UNDER THE PEDOCLIMATIC CONDITIONS OF FUNDULEA

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Sunflower (*Helianthus annus*), a species with a slow growth rate in the first phenophases and a reduced capacity for competition, is strongly affected by weeds, which can lead to significant production losses. The study of crop weeding is not an end in itself, but rather a possibility of knowing the degree of weeding and the floristic composition of weed species, in order to establish strategies to combat them and prevent negative effects, quantitative or qualitative, on the level of final production. Agricultural damage caused by weeds is manifested on production at a quantitative and qualitative level and, last but not least, on the costs of applying the recommended technologies.

Weeds compete directly with the crop plant for essential resources such as water, light and nutrients, significantly reducing production potential and crop quality. The cause of the appearance of different weed species is correlated with climatic aspects, the seed reserve in the soil and the low power of the plant to compete. Weed control is an essential element for maintaining crop productivity and sustainability.

In the specific pedoclimatic context of the Fundulea area, characterized by the type of cambic chernozem soil (3.2% OM; 37% clay; 6.5 Ph) with high fertility, but also with an extremely rich and diverse weed seed reserve, as well as by pronounced climatic variability, the optimization of chemical methods for weed control becomes a major technological necessity. The present work aims to evaluate and apply herbicide treatments on the main monocotyledonous and dicotyledonous weed species encountered in sunflower cultivation, including problem species such as *Xanthium strumarium, Amaranthus retroflexus,Sorghum halepense and Cirsium arvense.*

In the absence of effective control measures, production losses can vary between 20% and 80%, depending on the species, density and period of infestation. Implementing integrated weed management, which combines preventive, agrotechnical, mechanical and chemical methods, contributes to reducing weed pressure and limiting the emergence of herbicide resistance.

Keywords: *crop,weed species, infestation degree, herbicides.*

UDC: 633.52:631.524.86

DETERMINATION OF THE OPTIMAL PEG-6000 CONCENTRATION FOR ASSESSING WATER STRESS TOLERANCE IN FLAX GENOTYPES

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Water stress is a major abiotic factor limiting crop productivity. Therefore, the aim of this study was to determine the optimal concentration of polyethylene glycol (PEG-6000) for simulating water stress conditions and to apply this method for screening the *ex situ* collection of flax (*Linum usitatissimum* L.).

A set of flax genotypes was evaluated under controlled laboratory conditions using five PEG-6000 treatment levels, including the control (0% PEG).

Analysis of the response of flax (seeds, roots and shoots) to drought stress induced by PEG-6000 revealed varying levels of sensitivity among the assessed biological parameters. Compared with the control treatment (distilled water), seed germination was only slightly affected at PEG-6000 concentrations of 10%, 15% and 20%, with reductions of 0.82%, 1.25% and 3.84%, respectively.

In contrast, seedling growth (radicle and hypocotyl length) showed a much higher sensitivity to increasing PEG-6000 concentrations. At 10% PEG, seedling length was reduced by 19% compared with the control, indicating a slight inhibitory effect. At 15%, the reduction reached 51%, reflecting moderate water stress sufficient to reveal genotypic differences without severely impairing development. At 20% PEG, seedling length decreased by 89%, indicating a strong inhibitory effect on early growth. Furthermore, a 25% concentration of PEG-6000 completely inhibited both germination and seedling development, resulting in a 100% reduction in all analyzed parameters.

The results demonstrate that seedling length is a more sensitive indicator of water stress than seed germination and represents a reliable trait for assessing drought tolerance in flax genotypes. A 15% PEG-6000 concentration was identified as optimal for screening the flax germplasm collection, as it induced sufficient stress to reveal genetic variability while avoiding complete inhibition of early development.

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Keywords: *Linum usitatissimum L., flax, PEG-6000, water stress, optimal concentration.*

UDC: 633.15:631.524.86

MAIZE SEED GERMINATION UNDER DROUGHT AND SALT STRESS

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In general, research in the field of corn breeding for drought and salinity resistance forms the basis for obtaining stress-resistant and high-yielding hybrids of this crop. In the work presented here, the task was to identify corn genotypes resistant to osmotic stress and chloride salinization at the seed germination stage. As the starting material, 14 corn genotypes were used (2 inbred lines, 7 three-line hybrids, 5 complex hybrid combinations in which the paternal components were represented by double, three-line, and simple hybrids, and as the maternal components were used backcross hybrids). Seeds were germinated in the control variant (water), in osmotic solution of 1.96 MPa, and in 3% NaCl solution.The values of the traits "shoot length" and "root length" were determined. Correlation and two-factor analysis of variance were used to process the obtained data. A significant dependence of the variability of the traits "shoot length" and "root length" on the factors "genotype", "osmotic stress", "chloride salinization", as well as on the interaction of the factors "genotype" x "osmotic stress" and "genotype" x "chloride salinization" was established. The values of the multiple coefficients of determination in the experimental models were high, on average $R^2=0.94^{***}$, therefore, these factors explain almost all of the variability in the traits. The effect sizes of the factors for the traits "shoot length" and "root length" were higher under salinity conditions. The magnitude of the interaction effect of the factors "genotype" × "stress" on the trait "shoot length" was significantly lower than the corresponding measure for the trait "root length". Under osmotic stress conditions, the highest effect sizes of the factors were observed for the trait "root length". However, the effect sizes of the factors for the trait "shoot length" varied from 0.3^{**} to 0.8^{**}. The factor "stress" had the lowest value, while the factor "genotype" had the highest. Correlation analysis of the values of these traits in control and stressful conditions revealed the presence of significant and only positive relationships. Between the traits "shoot length" and "root length" in control and under chloride salinity, the correlation coefficient values were at the same level ($r=0.7^{***}$), but under drought stress, the strength of the correlation was quite low ($r=0.36^{*}$). Under salt stress, based on high average values of the studied traits, hybrid genotype with paternal component represented by a double hybrid composed of late-flowering lines stood out. The backcross hybrid of early- and medium-flowering lines served as both maternal and paternal components in hybrid combinations showed fairly high average values under both osmotic stress and salinity, nevertheless, the best average values for the traits "shoot length" and "root length" were observed in a three-line hybrid including lines from early, medium, and late flowering groups.

Acknowledgments: This study was supported by the research subprogram 011102 "Increasing and conservation genetic diversity, agricultural crop breeding in the context of climate change", funded by Ministry of Education and Research of the Republic of Moldova.

Keywords: maize, seed germination. drought, salinization.

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ASPECTS OF THE INTRODUCTION OF A NEW THYME SPECIES - THYMUS ZIGIOIDES GRISEB - UNDER THE CONDITIONS OF THE BOTANICAL GARDEN.

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The present study aims to highlight the morpho-biological characteristics of the development of the species Thymus zygioides Griseb., to conduct phenological observations and to determine its essential oil content. Additionally, a bibliographic analysis was performed to assess the therapeutic importance of the species and to support further phytochemical research. The investigations were carried out between 2023 and 2025 within the Plant Resources Laboratory of the Botanical Garden (Institute).

Thymus zygioides is a small, perennial herbaceous or subshrub species belonging to the family Lamiaceae. It is widespread in the wild flora, particularly in the Balkan region and Greece. Its typical habitats include xerophilous ecosystems, such as dry meadows and sparse forest areas, where it prefers well-drained, often calcareous soils and full-sun exposure. The species was introduced into the collection of the Botanical Garden by Dr. Pavel Pânzaru from Bulgaria. Morphologically, the plant is characterized by branched stems, often lignified at the base and small, opposite leaves ranging from linear to elliptical, bearing glandular trichomes. The flowers are small, pink to purple, arranged in terminal inflorescences. The species is of phytochemical interest due to its essential oil content. The analyses performed indicated an essential oil content of 0.31-0.33% d.m. in the aerial parts, whereas literature data report values ranging from 0.5% to 2.5%, depending on ecotype and environmental conditions. The chemical composition typically includes monoterpenes and phenolic compounds, such as thymol and carvacrol. Under the local pedoclimatic conditions, the species completes a growing season in 75-80 days, with plants reaching approximately 25 cm in height in the third year of growth. From an edaphic perspective, soils in the Republic of Moldova are suitable for its cultivation, provided adequate drainage is ensured, as excess moisture adversely affects the root system. Southern exposures may provide microhabitats similar to those in its natural range. Pedoclimatic conditions significantly influence both the yield and composition of the essential oil, with high temperatures and moderate water stress promoting the accumulation of aromatic compounds. Thymus zygioides remains relatively understudied compared to other species within its genus. The research conducted until now has primarily focused on its phytochemical profile, with limited data on its ecological and biological characteristics. Consequently, the species shows considerable potential for future research, particularly regarding the evaluation of its biological activities, such as antimicrobial and antioxidant properties.

Acknowledgments: The research was conducted within the Subprogram 010101 „Ex situ and in situ research and conservation of plant diversity in the Republic of Moldova", financed by the Ministry of Education and Research of the Republic of Moldova.

Keywords: *thymus, introduction, essential oil, active principles, therapeutic potential.*

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USE OF ZEIN POLYMORPHISM FOR ASSESSING THE GENETIC DIVERSITY OF MAIZE GERMPLASM

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At present, considerable attention is being paid to the study of differences between germplasm heterotic groups not only at the organismal level, but also at the molecular and protein levels. The aim of the present study was to apply new methodological approaches to investigate the potential use of polymorphism of alcohol-soluble storage proteins (zeins) in maize inbred lines belonging to different heterotic groups for the assessment of their genetic similarities and differences.

To achieve this goal, the following objectives were defined: 1) to study the characteristics of zein polymorphism (ZP) in maize inbred lines of two heterotic groups — BSSS-B37 and Iodent; 2) to investigate the genetic diversity of maize inbred lines carrying D27 and D29 germplasm on the basis of related test-crosses using zein protein markers.

The study included 22 electrophoretic (EP) profiles of zein proteins from self-pollinated maize lines obtained from the Bank of Electrophoretic Passports of maize seed storage proteins (zeins): 20 lines belonging to the BSSS-B37 and Iodent heterotic groups and 2 control lines (D27 and D29). The following methods were used in the experiments: electrophoresis of zein proteins and the digital software package FOREZ-2.

The study demonstrated that the investigation of genetic diversity in maize inbred lines carrying D27 and D29 germplasm at the protein-molecule level, based on related test-crosses, makes it possible to identify both the eliminating effect of tester lines and the enrichment effect in inbred lines. This approach allows: a) evaluation of differences between related reciprocal test-crosses within each heterotic group; b) utilization of the distinctive specificity of zein polymorphism expression between the studied maize heterotic groups.

Thus, the application of the FOREZ-2 program reveals new possibilities for manipulating zein protein polymorphism as an effective tool for assessing the genetic diversity of maize germplasm.

Keywords: *zein polymorphism, maize inbred lines, heterotic groups of germplasm.*

UDC: 633.112.1:631.563:602.6

STORAGE POTENTIAL OF *TRITICUM DURUM* L. SEEDS DURING *EX SITU* CONSERVATION IN A PLANT GENE BANK

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The purpose of this research was to study the morphophysiological parameters of *Triticum durum* L. seeds using the accelerated aging (AA) test. These parameters allow the characterization of the storage potential (SP) of the collective accessions in the active collections of the gene bank with a view toward their ex situ conservation.

The objects of our study were collection accessions of *T. durum* (10 genotypes) from the active collection of the plant gene bank. The SP of the seeds was determined by two tests: a test for the AA of seeds using Hampton and TeKrony's method, and a test for the electrical conductivity (EC) of solutions. These tests are included in the International Rules for Seed Testing (ISTA). The standard AA test of *T. durum* seeds was conducted under an increased air temperature (41°C), an air humidity of 90–100%, and an aging time of 72 hours. We suggest alternative conditions for the AA test: an air temperature of 44–45°C, an air humidity of 80–90%, and an aging time of 72 hours. After conducting the test, various morphophysiological parameters of the seeds were measured according to the ISTA: germinating power (GP), germinability (G) of seeds, radicle length, fresh biomass of radicles, and electrolyte leakage. After the AA test, the GP and G of the *T.durum* seeds were 36.7–60.7% and 48.7–69.0%, respectively, compared to the control (C) values of 52.0–83.3% and 99.0–100.0%. The fresh biomass fell on average by 20–190.0 mg after the test compared to the control. The EC of the solutions with aged seeds increased by 8.2–14.1 mS/cm2 compared to the control, depending on the genotype. According to the set of different parameters of T. durum seeds after the AA test, the following genotypes had a high storage potential: CC1, CC2, CC3, and CC5.

Conclusions: The use of the AA test on *T. durum* L. seeds and the determination of their morphophysiological parameters allowed the assessment of the storage potential of the seeds. A significant positive correlation was revealed between the G of *T.durum* seeds and their germinating power, radicle length, and fresh biomass of seedlings after conducting the accelerated aging test.

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Keywords: *Triticum durum L., accelerated aging, germination, storage potential, gene bank.*

UDC: 633.812:631.527.5:547.913

RESULTS OBTAINED IN THE EVALUATION OF ESSENTIAL OIL CONTENT AND ITS QUALITY IN F_7-F_8 HYBRIDS OF *SALVIA SCLAREA*

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Salvia sclarea L., an aromatic and medicinal species from the Lamiaceae family, which is cultivated for the essential oil that is synthesized and accumulated in the inflorescences.

The genetic material, obtained over several years of research, is represented by 25 simple, triple, double, stepped and complex F_7-F_8 hybrids of *Salvia sclarea*. These genotypes have recorded remarkable indices of quantitative character values. This is confirmed primarily by the creation of hybrid genotypes with remarkable indices of quantitative character values. The height of the plants recorded high values, their indices being from 100 cm to 141 cm. It is important that the share of the inflorescence length constitutes over 50% of the plant height, which promises high productivity. The inflorescences of the evaluated hybrids have a length of over 58 cm. Thus, in some hybrids they are 70.2 cm, and the longest inflorescences were attested in the hybrid [(M-44S_4 x L-15)F_1 x L-15)F_7 x (K-36 x 0-41)F_2 x 0-19)B_5)]F_7 - 74.7 cm. In this hybrid, the inflorescences are compact, with many branches 21.0 of the first degree and 39.2 branches of the second degree.

The separation by hydrodistillation of the essential oil and the determination of its content in inflorescences demonstrated that 19 out of 25 evaluated are characterized by high content, over 1.0% (dry matter). 5 exceptional hybrids were selected and identified, for the most important character, they synthesize and accumulate 1.424-2.834% (dry matter) of essential oil. The results of gas chromatographic analysis of the essential oil in the complex hybrids [(S.s.Turkmen/N)S_7 x (K-36 x0-41)F_2 x 0-19)F_1 x 0-22)B_4 x L-15)F_8]F_7 with the essential oil content of 1.810% (dry matter) and [(0-57 S_5 x 0-21)F_2 x Dacia 50 Ian)]F_8 - 2.834% (dry matter), demonstrated that the concentration of the main component, on which the quality of the oil depends - linalyl acetate is 52.26% and 58.02% respectively.

The research resulted in the selection of *S. sclarea* hybrids with very high essential oil content –1.424-2.834% (dry matter). The results of gas chromatographic analysis of the essential oil in two complex hybrids demonstrated that the concentration of the main component meets the requirements of the European Pharmacopoeia. The selected hybrids represent a valuable material for the development of high-performance varieties of *Salvia sclarea* L.

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Keywords*: Salvia sclarea L., hybrid, the quantitative characters, essential oil.*

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RESEARCH ON THE INTERACTION OF WHEAT WITH SOME FUNGAL PATHOGENS

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Fusarium spp. are some of the most devastating fungi of cereal crops.

The aim of the research was to identify the peculiarities of variability and heritability of wheat growth and development characters in the interaction with the *Fusarium solani* (Mart.) Sacc. and *F. verticillioides* (Saccardo) Nirenberg fungi.

Methods: Five common winter wheat parents and 6 F_3 selected forms from reciprocal F_1 hybrids were used in the research. The grains were maintained for 18 hours in culture filtrates (CF) of 2 isolates of *F. solani* (*F.s.*) and *F. verticillioides* (*F.v.*). The length of the embryonic radicle, the length of the stem, and the dry mass in the open air of 5-day-old seedlings served as biometric indices. The obtained data were statistically processed in the STATISTICA 7 software package.

Results: It was found that CF *F.s.* did not negatively influence the growth of the radicle and the stem. A stimulation of 24.8% was recorded in F_3 M16 x Amor for the radicle and 19.8 ... 61.6% – stem. Unlike CF *F.s.*, in the case of CF *F.v.* a significant inhibition of growth was found for the radicle: 17.5 ... 45.2%; for the stem: i) lack of reaction (M66, Amor, F_3M66 x Amor, F_3 Amor x M16, M11, Centurion, F_3 Centurion x M11), ii) inhibition of 17.6 ... 18.8% (F_3 Amor x M66, M16) and stimulation of 26.2% in F_3 M16 x Amor. Under the influence of the fungus *F.v.*, significant decreases in the dry mass of seedlings occurred in F_3 Amor x M66, M16, F_3 Amor x M16, M11, Centurion, F_3 M11 x Centurion, with a difference from the control of -26.6 ... -45.44%. The calculation of variability and heritability parameters demonstrated that the phenotypic coefficient of variation recorded: 18.53, 19.78, 16.33%; genotypic coefficient of variation: 14.17, 17.45; 10.67%, heritability coefficient (h^2): 0.59, 0.78, 0.41, genetic progress: 28.79, 32.84, 16.89%, respectively, of the length of the radicle, stem and dry mass of the seedling.

Conclusions: 1. Plant-pathogen interactions in the common wheat – *Fusarium* spp. fungi system are specific, depending on the genotypic particularities of the host plant, the entity of the fungus, but also the biological character. 2. The relatively high values of the h^2 coefficient and high genetic progress denote the real chances of creating new resistant wheat genotypes by individual selection in short terms.

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Keywords: *wheat, Fusarium solani, Fusarium verticillioides.*

UDC: 635.65:631.527:631.523

MAIN BIO-AGRONOMIC CHARACTERISTICS OF CHICKPEA LOCAL ACCESSIONS

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In this communication we present the results from main bio-agronomic characters of 27 local accessions of chickpea which were acquired in rural localities of Moldova. The purpose of studies was: characterization accessions for characters *100-seed weight, plant height*, classification by *ripening periods* and identify accessions with the best performance of *grain weight per plant* (*GWP*). Twenty-seven accessions were studied in 2023-2024 (in rain fed condition), laid out randomized in 2 replications, each of aria 2.2 m^2, as check was used cultivar *Ichel*, the 100-seed weight (*SW*) values were measured four times, plant height - 13-15 measurements for each replication.

All accessions were divided into 3 groups on basis of *seed-size*. In first group as *middle-sized seeds* were included 9 accessions (33.3%): those *100-SW* ranged within 26.5 g (MDI 02488) – 29.4 g (MDI 02460) and plant height (*PH)* within 38.8 cm (MDI 02451) - 64.2 cm (MDI 02462). By *ripening* they a distributed: 3 as early-medium, 4 medium and 2 late time one. By *grain weight per plant* should be noted 3 accessions: MDI 02488 (8.25 g), MDI 02451 (8.1 g) and OR1-2b (8.0 g) compared to v. *Ichel* that had 8.5 g per plant. Second group, consisted of 5 accessions (18.5%) - as *middle-large sized* one those *100-SW* varied from 30.5 g (MDI 02420) to 33.0 g (SD180) and *PH* from 45.9cm (CS2-3a) to 63.7cm (MDI 02419). By *plant maturity*: 3 accessions evaluated as *medium-late* and 2-being *late time* one. By character *GWP* were selected 2 accessions viz.: MDI 02420 (8.3 g) and SD180 (8.15 g). In this group can be included cultivar *Ichel* having *100-SW*- 32.2 g, *PH* – 61.8 cm, being *late time of maturity*. Third group comprised 13 accessions (48.2%) - consisting of *large-sized seeds*, which *100-SW* ranged from 36.9g (CS1-18c) to 42.8 g (SD1-1), *PH* one within the limits of 39.6 cm (OR1-12) – 45.5cm (CS1-22). Regarding to *PH* variability (among accessions) coefficient of variation in this group had value 4.3%, which significant less than in group1 (CV=20%) and group 2 (15.6%). By *maturity*, 3 accessions were characterized as *early-medium*, 7 and 3 as *medium* and *medium-late time* one. *GWP* should be noted accessions CS2-3b (8.37 g), AN181(8.3), which did not differ significantly from Ichel (8.5 g) as well as accessions REZ2-9 (8.0 g) and CS1-18c (7.9 g). Seeds coat pigmentation: most of accessions (23) are *light beige, beige*-3 and 1(REZ2-9a) – *light rose*. Variability of *100-SW* of all accessions is CV=16.0 %, that proportionate with one of *PH* (CV=17.5 %).

Conclusions: as for *seeds size* predominate *large-sized* accessions, followed by *middle-sized and* least are *middle-large sized* one. Accessions with *medium tall of plant* (22) predominated over *taller* (5). Regarding time of ripening – 11 accessions had *medium*, 6 each *E-M*, *M-L* and 4 *late time* one. Nine accessions were selected by performance *grain weight per plant*.

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Keywords*: chickpea, 100-seed weight, plant height, maturity, grain weight per plant.*

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FLOWERING CHARACTERISTICS OF SYMPHYTUM OFFICINALE L. UNDER CLIMATIC CONDITIONS OF THE REPUBLIC OF MOLDOVA

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Symphytum officinale L. (Boraginaceae) – commonly known as comfrey (syn. *Symphytum peregrinum* Lebed.), is an herbaceous perennial with erect, branched stems. It possesses a short, thick and branched rhizome. The leaves are ovate-lanceolate, acuminate, with decurrent base. The lower leaves are large and petiolate, but the upper leaves are smaller and sessile, with decurrent bases. The entire plant is covered with short, setose pubescence. The flowers are redish-purple, arranged in scorpioid cymes. The calyx is campanulate, and the corolla is tubular, longer than the calyx and divided into five lobes. The fruits are ovoid, black nutlets. The research was conducted at the "Alexandru Ciubotaru" National Botanical Garden (Institute) of MSU, during the growing seasons of 2024-2025. The phenological observations were focused on the flowering stage, and the presence of pollinating and melliferous insects was analyzed. The flowering is prolonged and staggered, lasting from May to August. The biology of flowering was investigated by analyzing flowering shoots in mid-May. During this period, the shoots reach a height of 82-84 cm and develop 7-9 lateral branches bearing flowers (Table 1). Each plant produces about 20-25 inflorescences, with 2-6 flowers open simultaneously. Depending on shoot length and inflorescence size, the number of flower buds varies between 9.8±2.50 and 18.4 ±1.87, contributing to the extended flowering period and nectar availability for insects. The flowers are visited by insects throughout the day, which indicates a high potential for honey production, with estimated yields of 160-180 kg of honey per hectare. The nectaries are located at the base of the corolla and are protected by stiff hairs, which hinder access for some insects. Bumblebees, in order to access the nectar, often perforate the base of the corolla; these openings may subsequently be used by other insects, including honey bees.

Table 1. The biology of flowering in *S. officinale* plants in May, 2025

	Flower buds				Open flowers				Wilted flowers			
SP	Min.	Max.	M.	S_x	Min.	Max.	M.	S_x	Min.	Max.	M.	S_x
I	10	24	18,4	±1,87	2	4	3,14	±0,42	2	10	2,7	±1,28
II	4	20	9,8	±2,50	2	11	5,1	±1,04	3	6	4,3	±0,79
III	8	24	12,5	±1,99	1	6	4,2	±0,42	2	10	4,9	±0,81

Note: I, II, III – analysed flower stalks, SP- statistical parameters; Min. – minimum values; Max. – maximum values; M. – average, S_x – standard error;

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Keywords: *Symphytum officinale L., biology of flowering.*

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COLD TOLERANCE OF EARLY MAIZE INBRED LINES

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Breeding of early maize hybrids FAO 160-240, adapted to a shorter growing season and cooler conditions, needs cold tolerant inbred lines with high emergence and rapid growth of seedlings. The high seed germination is a useful agronomic trait for early planting of maize in temperate areas, because plant use more efficiently spring reserve of soil water and tends to place flowering period ahead of drought. In this paper we intend to report the main results concerning inbred lines evaluation for cold tolerance during 2022-2025 in two planting dates: extraearly in end of March and 15 days later in April. Trails were placed in a maize monoculture field with pathogenies soil flora. Each plot consisted of 100 kernels (no applying fungicides) in two replications and every sample was tested for germination by the standard laboratory method. The investigations included 40-63 inbred lines, representing the germplasm of heterotic groups Iodent – 56,5%, BSSS-B37 – 20,7%, Euroflint – 13,0% and Lancaster – 9,8%. The beginning of emergence was noted on the 29th day in 2022-2023, 20th day in 2025 and 12th day in 2024 in extraearly planting and respectively on the 19th day in 2022, 2023 and 13th day in 2024, 2025 in second planting term. The average germinated seeds were 46,2% in 2022, 32,1% in 2023, 74,2% in 2024, 48,1% in 2025 for extraearly planting and respectively 75,2%, 64,0%, 83,9%, 74,1% in next planting term. In 2022 – 2025 the average value of field germination was 67,4% for Euroflint germplasm, 66,8% - Lancaster, 62,4% - BSSS-B37 and 60,6% - Iodent, in two planting times. In the first planting time, the average of field germination was 57,2% for Euroflint inbred lines and 54,8% for Lancaster inbreeds. The Iodent and BSSS-B37 germplasms have registered a lower germination, about 49%, but some inbreed lines were characterized by an increased germination percentage. From the tested forms have been selected 6 inbred lines with high cold tolerance: standard MKP55 from Lancaster, AN 5049/19, AN5095/19, AG14-2390 from Euroflint and AN531/18, AN535/18 from Iodent, with 73,6%-76,2% of germination. In the middle tolerance class with 70,9% - 73,5% of germination were included 5 Iodent and 2 BSSS-B37 inbred lines. Appreciation of fresh seedling vegetative mass until 5-6 leaves stage has demonstrated a vigorous growth for Iodent inbreed lines - 2,98 g/plant in comparison with 2,80% g/plant of Lancaster and 2,57 g/plant of BSSS-B37 inbred lines. Many studies found that the performance of hybrids could be predicted from the inbred parent's germination and seedling vigor.

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***Keywords**: Early maize, Cold tolerance, Field germination, Inbred lines.*

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EXPRESSION OF ANTIOXIDANT GENES *APX1* AND *APX3* IN SUNFLOWER UNDER WATER STRESS

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Ascorbate peroxidase (APX) represents one of the key enzymatic components of the antioxidant defense system involved in the scavenging of reactive oxygen species (ROS) generated under water stress. The excessive accumulation of ROS during water deficit disrupts cellular homeostasis and promotes oxidative damage, significantly affecting sunflower productivity and stress adaptation.

The aim of present study is to analyze the transcriptional activity of two key antioxidant genes, *APX1* and *APX3*, in the leaves and roots of sunflower (*Helianthus annuus* L.) genotypes exhibiting contrasting levels of drought tolerance.

Drought stress was artificially induced using PEG-6000 at the first true leaf stage. Treatments per genotype included an unstressed control, and 20% or 30% PEG applied for either 3 days followed by rehydration or 6 days. The obtained results demonstrate that the expression patterns of both genes are highly dynamic and strongly influenced by genotype, organ specificity, and the intensity and duration of stress.

The drought-tolerant genotype (H2) showed a more efficient and coordinated transcriptional response, characterized by an early and sustained activation of *APX1*, particularly in root tissues. This activation contributed to the detoxification of hydrogen peroxide and the maintenance of redox balance under water deficit conditions, leading to improved physiological adaptation to stress. In contrast, the drought-sensitive genotype (H3) exhibited a weaker, less stable, and often downregulated expression of *APX1*, especially under severe stress conditions (30% PEG). Regarding *APX3*, its expression profile was generally more moderate and less variable across treatments and genotypes.

Overall, the findings of this study indicate that drought tolerance in sunflower is associated with the rapid and sustained activation of the antioxidant system, including the mechanisms involving *APX1*. The consistent induction of *APX1* observed in the tolerant genotype suggests its potential involvement in maintaining cellular redox homeostasis under drought stress conditions. In conclusion, *APX1* may represent an important component of the molecular response to drought stress in sunflower, whereas *APX3* plays a complementary role.

***Acknowledgments*:** This research was supported by the Subprogram *011101 Genetic and biotechnological approaches for agroecosystem management under climate change conditions*, funded by the Ministry of Education and Research of the Republic of Moldova.

Keywords: *APX1, APX3, antioxidant, drought stress, sunflower*

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THE TROPHIC RELATIONSHIP BETWEEN HARMONIA AXYRIDIS AND METCALFA PRUINOSA IN ORCHARD ECOSYSTEMS

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Invasive species are a major driver of ecological changes in contemporary agroecosystems, influencing the structure of biological communities and the dynamics of trophic relationships. In this context, Metcalfa pruinosa (Say, 1830), a polyphagous hemipteran native to North America, has spread rapidly across many European regions following its accidental introduction. The species colonizes a large number of host plants, including fruit tree species, where feeding causes weakening of plant tissues, accumulation of sugary secretions, and the appearance of sooty mold, with negative effects on crop productivity. At the same time, Harmonia axyridis (Pallas, 1773), a lady beetle native to Asia and initially used as a biological control agent, has adapted effectively to European ecosystems, becoming one of the most widespread generalist predator species in agricultural and urban habitats.

This study aims to evaluate the trophic relationship between H. axyridis and M. pruinosa in orchards, with a focus on the ecological role of the predator in limiting populations of the invasive phytophagous species.

The research method included monitoring populations of entomophages and pests in plum and cherry orchard agrocenoses, as well as assessing the impact of the entomophage on pest development. To assess the predatory capacity of M. pruinosa, we used a mixed methodology: controlled laboratory experiments conducted over 48 hours, and direct field observations carried out in 2025 in orchard communities.The analyzed data indicate that H. axyridis exhibits opportunistic feeding behavior and can limit the population growth of M. pruinosa individuals at various larval and nymphal stages, especially during periods characterized by high population densities. The trophic activity of H. axyridis may help reduce the pressure exerted by M. pruinosa on fruit trees and support natural biological control processes. In this context, incorporating research on trophic relationships into modern integrated pest management programs can help develop sustainable and environmentally friendly strategies for protecting fruit crops.

Acknowledgments: The research was carried out within Subprogram 011103 Development of environmentally safe means to reduce the impact of harmful organisms on agricultural crops under climate change conditions, funded by the Ministry of Education and Research

Keywords: *invasive species, agrocenosis, biological control.*

UDC: 633.11:632.4:631.524

IMPACT OF PYRAMIDING GENES FOR PARTIAL RESISTANCE AGAINST LEAF RUST (*PUCCINIA TRITICINA*) IN WHEAT (*TRITICUM AESTIVUM*) AT NARDI FUNDULEA, ROMANIA

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Leaf rust, caused by *Puccinia triticina,* is among the most widespread diseases affecting wheat (*Triticum aestivum*), one of the most widely cultivated crops in Romania and worldwide. Under favorable conditions, the disease can cause yield losses of up to 40%.

The most practical strategyfor controlling the effects of this disease, both financially and environmentally, is genetic resistance, and there are numerous potent resistance genes that provide total defense against leaf rust. This genetic defense against leaf rust is short-lived, as experience has shown that new races virulent to such resistance genes can rapidly spread, as the resistance genes are spread across wide areas. Many genes for partial resistance to leaf rust are also available, but the protection that they provide is often not sufficient.

We identified genotypes carrying one to four of these resistance genes using molecular markers linked to the genes *Lr34*, *Lr37*, *Lr46*, and *Lr68*. From 2023 to 2025, the genotypes were evaluated at NARDI Fundulea under artificial inoculation with a variety of local races. The percentage of rust-affected leaf area was estimated visually. Entries with one gene decreased the attack from 66,7% in susceptible genotypes to 20% on average across three years and multiple genotypes with the same amount of *Lr* genes, but entries with two genes exhibited only 7,1% attack. In entries cumulating 3 or 4 *Lr* genes no leaf rust attack was observed. Presence of the *Lr46* gene alone reduced the attack from 66,7% to 26,7%. Adding to it the genes *Lr68* or *Lr37* further reduced the attack to 7,8% and 4,4% respectively, while adding both *Lr37* and *Lr34* provided complete protection against leaf rust.

Based on these results, which validate for the germplasm adapted to our environment other results reported internationally, marker-assisted selection is routinely used in our breeding program to increase the frequency of partial resistance genes.Gene pyramiding strategies are used to combine these genes to achieve broader, more durable, and long-lasting genetic protection.

Keywords: *wheat, leaf rust, partial resistance, Lr gene.*

UDC: 634.22:631.541.11:632.111.52

VIABILITY AND GERINATION CAPACITY OF POLLEN IN PLUM VARIETIES

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The aim of this study was the comparative evaluation of pollen fertility, viability, and germination capacity in several late plum varieties, in order to assess their productive potential under optimal and water-stress conditions, as well as their suitability as progenitors in breeding programs.

In 2025, the viability and germination capacity of pollen were investigated in four plum varieties. The trees were maintained under two soil moisture regimes: optimal moisture conditions of 75% (control variant) and reduced moisture conditions of 35% (experimental variant).

Pollen viability was assessed using the acetocarmine staining method, in which fertile pollen grains stained red, while sterile grains appeared pale pink or remained colorless. Pollen germination capacity was determined *in vitro* by cultivation on a solid nutrient medium containing 10% sucrose, 1.5 g agar-agar, and 0.01 g boric acid per 100 mL distilled water, under laboratory conditions at a temperature of 18–20°C and relative humidity of 70–90%.

Pollen viability showed consistently high values, exceeding 90% in all studied varieties. The germination capacity of pollen varied among the studied varieties and according to the experimental treatment, with values ranging from 32.5% in the cultivar President to 57% in Stanley. Among the analyzed cultivars, Stanley exhibited the highest pollen germination capacity (57%). The conducted research demonstrated that the plum varieties Super Prezident, President, Stanley, and Udlinionnaia exhibited pollen germination capacities above 25%, considered the minimum threshold for satisfactory germination in this species. Therefore, the studied cultivars are characterized by good pollen germination performance, including under conditions of reduced humidity (35%).

Climatic factors exerted a significant influence on pollen viability and germination capacity. The obtained results indicate different levels of resilience to environmental stress, highlighting the complex interactions between pollination processes and temperature conditions.

The study highlighted that pollen viability and germination capacity depend both on the biological particularities of each cultivar and on meteorological conditions during the flowering period. The variability observed in *in vitro* pollen germination was determined by genetic differences among cultivars, as well as by the negative effects of environmental factors.

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Keywords: *plum, varieties, pollen, fertility, viability, germination capacity.*

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PRE-SOWING T-2 AND DON MODULATE TRITICALE RESISTANCE TO FUNGAL PATHOGENS

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In real agroecosystems, cereal crops are chronically exposed to subphytotoxic concentrations of mycotoxins. Unlike classical studies on high-dose phytotoxicity, the effect of low doses on the physiological and biochemical status of plants and their subsequent resistance to pathogens remains poorly understood. The aim of this work was to evaluate the effect of subphytotoxic doses of T-2 toxin and deoxynivalenol (DON) on the resistance of three Moldovan triticale varieties (Ingen-93, Ingen-54, Ingen-40) to fungal phytopathogens Fusarium spp. and Alternaria spp.

Pre-sowing seed treatment was performed with T-2 toxin at 0.05 μg/L and DON at 5 μg/L. DNA extraction was carried out according to ISO 21571:2005. Pathogen DNA accumulation was analyzed using nested multiplex PCR and quantitative real-time PCR with subsequent statistical processing.

The obtained results demonstrated that the effect of subphytotoxic mycotoxin doses is both genotype-specific and toxin-dependent. T-2 toxin at 0.05 μg/L increased the susceptibility of the triticale variety Ingen-93 to Fusarium spp. and Alternaria spp. At the same time, the variety Ingen-54 showed reduced susceptibility to Fusarium under T-2 treatment. T-2 toxin caused a significant increase ($p < 0.05$) in the level of Alternaria contamination in the variety Ingen-54 (sensitization), whereas DON at 5 μg/L significantly reduced Fusarium DNA levels in the variety Ingen-40 ($t = 3.80$; $p < 0.05$), which may indicate activation of defense priming mechanisms in triticale. Furthermore, mycotoxins exerted a selective effect depending on the taxonomic affiliation of the pathogen: the treatment had a stronger effect on Fusarium than on Alternaria.

In conclusion, subphytotoxic mycotoxin doses are biologically active and modulate triticale resistance to fungal pathogens. The direction of this modulation depends on the interaction between plant genotype, mycotoxin type and concentration, and pathogen taxonomy. These findings enable predictive phytosanitary risk assessment and may serve as a screening tool for hidden resistance to mycoses in Moldovan breeding programs.

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Keywords: *triticale, T-2 toxin, deoxynivalenol, Fusarium, Alternaria.*

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GENETIC DIVERSITY OF MAIZE INBRED LINES FROM DIFFERENT GERMPLASM SOURCES

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The research aimed to evaluate the phenotypic and genetic diversity of maize inbred lines of different origins and maturity groups, used in breeding programs as indicator lines for the corresponding germplasm subgroups. The main objective was to identify sources of favorable genes and determine the relationships between lines based on diversity indices for an efficient classification of inbred lines into germplasm groups.

The experiment was carried out over a period of three years, using an incomplete diallel crossing system for 66 hybrids, created from 12 inbred lines (CM7, F2, BC27D4, Co125, W153R, A654, P502, MK01, MK390, A632, Mo17, B73). Phenotypic distance was assessed using the phenotypic differentiation index *(pdi)*, calculated based on 28 quantitative and qualitative traits, while genotypic relationships were determined by calculating the specific combining ability (SCA) constants and reproductive heterosis indices (H,%).

The *pdi* index ranged from 5,2 to 10,7 units, with an average value of 7,4. The most pronounced differences were observed between the early line CM7 and the late line B73 (*pdi* = 10,7). Phenotypic differentiation was lower between the mid- and late-maturing lines, as well as, between the mid- and early-maturing lines. Hybrid yields ranged from 4,1 t/ha (CO125 × CM7) to 7,1 t/ha (A654 × MO17). The most productive combinations were obtained between lines belonging to different germplasm groups. Higher yields were obtained from crosses between late and medium-maturing lines, while hybrids involving early-maturing lines were less productive. Heterosis values ranged from 57,6% to 182,6%. The highest degree of relatedness was identified between lines A632 and MK390, demonstrating their belonging to the same heterotic group. Lines MO17, F2 and CM7 were the most genetically distinct, representing different germplasm groups, with an average diversity exceeding 85,2%, compared to the other genotypes. High values of SCA constants (e.g., 1,24 t/ha for MK390 crossed with F2) confirm the influence of non-additive genetic interactions in obtaining high-yielding hybrids. Several productive interactions were identified between the analyzed lines, which can serve as heterotic patterns in maize breeding programs.

Conclusions: The study confirms belonging of analised inbred lines to distinct germplasm sources (Lacaune, Lancaster, Iodent, Reid, Ottawa Flint), which provides to breeders valuable heterotic patterns. Crosses between lines with large genetic distance ensure high reproductive heterosis, essential for the development of competitive hybrids.

Keywords: *Zea mays L., inbred lines, genetic diversity, heterosis, specific combining ability (SCA).*

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EVALUATION OF INBREED LINES AND OBTAINING INDURAT TYPE HYBRIDS OF CORN

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For human consumption, the most frequently used is flint grain corn from the indurata convarieties with a high carotene content, which is consumed in the form of polenta, porridge, groats, sticks and other varieties of these products. The initial biological material for the creation of new lines and hybrids of food corn was presented by local populations, indigenous and foreign lines from the world collection, other genetic sources with flint grain from the indurata convarieties. The creation of new lines includes traditional selection methods: mass selection, reciprocal recurrent selection and other classical methods of improving common corn. The purpose of the research is to evaluate inbred lines and their use in hybrid combinations of the indurata type. The strategy for improving corn with high carotenoid content included the following stages: 1) creation and evaluation of inbred lines from initial biological material in the form of local populations and varieties with high carotenoid content and foreign lines from the world collection, 2) synthesis of new hybrids based on inbred lines from the following selection cycles. At the first stage, the work was oriented towards the analysis of the initial material where local varieties and populations (Portocaliu, Hăngănesc) with high carotenoid content were detected, further being used as donors for the creation of lines. In total, according to valuable amelioration indices and grain quality, 50 indurated-type forms were studied. According to the multiple phenotypic characters and grain quality, inbred lines were detected, which were of particular interest as initial material and as parental forms of new hybrids with a flint grain.The working collection included 8 inbred lines of the indurated type from the next selection cycle and based on them a number of hybrids were synthesized and studied, including the hybrid Porumbeni 404 MRf, which in 2022 was transferred to the State Commission for Testing Plant Varieties. This hybrid contains in its pedigree the 2039, R180 lines from the second selection cycle with a flint grain from the indurated convariate. The respective hybrid with flint grain, rich in provitamin carotenoids was not approved due to lower productivity compared to the control hybrid. As a result, 81 new hybrid combinations were synthesized, created from 20 female forms and 4 male forms with a high content of carotenoids.When evaluating the results of orientation, pre-competition and competition experiments, a promising hybrid was selected, which is submitted for study to the State Commission. The food corn hybrid, submitted under the name Porumbeni 350, is the result of collaboration between the Corn Breeding Laboratory for the Southern Zones with the male form and the Genetics and Genofond Laboratory with the female form selected with specific grain qualities and high productivity, surpassed the Porumbeni 402 control by valuable agronomic characters. The research results are carried out within the framework of the institutional research subprogram 21 01 01. One of the effective methods in improving corn quality is the inclusion in the selection process as initial material of local varieties and populations with specific qualities for the population's nutrition.

***Keywords**: Maize, lines, hybrid combinations, indurated convariety.*

UDC: 635.65:631.527:631.523(478)

THE IMPORTANCE OF SCIENTIFIC RESEARCH IN LEGUME CROP BREEDING FOR THE AGRICULTURE OF THE REPUBLIC OF MOLDOVA

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This article highlights the importance of breeding research in grain legume crops carried out at the National Center for Seed Production and Plant Breeding "Selecția" (CNCPS "Selecția"), within the Laboratory of Breeding of Grain Legume Crops.

Over the years, grain legume crops have gained increasing importance due to their valuable properties, especially as a source of plant protein, vitamins, and mineral compounds for human consumption, animal feed, and energy purposes. The cultivation of these crops in crop rotation systems contributes significantly to improving soil fertility through the activity of nitrogen-fixing bacteria, making them excellent preceding crops for winter cereals.

The main objectives of the laboratory's research activities include the development of new cultivars with broad ecological adaptability, high yield potential, balanced protein content, drought resistance, and increased tolerance to diseases and pests in the major grain legume crops: pea, bean, and soybean. In order to achieve these objectives, breeding methods specific to self-pollinated plants are applied.

The breeding process, conducted over several decades, has included detailed evaluation of the initial germplasm, consisting of local cultivars and selected accessions of different geographical origin. As a result, valuable genotypes possessing important agronomic traits and characteristics were identified and used as parental forms in the development of new genotypes through intraspecific hybridization followed by repeated individual selection.

Within the activity of the laboratory, a total of 57 cultivars of grain and forage legumes have been developed and officially registered, including 16 pea cultivars, 15 bean cultivars, and 26 soybean cultivars. The superiority of these cultivars is expressed through their high productivity potential (4500–6000 kg/ha for pea, 2000–3000 kg/ha for bean, and 3000–4000 kg/ha for soybean), as well as through the high protein content of the seeds (on average 27.8% in pea, 24.6% in bean, and 38.5% in soybean), which provides enhanced nutritional and food value.

During the last five years, seven new cultivars with improved biological and agronomic characteristics have been developed and registered, including the pea cultivar Grațiana; the bean cultivars Clarina, Mirabela, and Vladlina; and the soybean cultivars Albiflora, Augustina, and Viorela. These cultivars exhibit increased adaptability to drought conditions and are non-GMO.

Conclusions:

1. At present, grain legume crops have gained particular economic and agronomic importance in the Republic of Moldova.

2. The legume cultivars developed within CNCPS "Selecția" combine high yield capacity with superior grain quality due to their valuable components such as proteins,

vitamins, and essential mineral elements required for human nutrition and animal feeding.

3. The registered grain legume cultivars are better adapted to changing environmental conditions, more tolerant to diseases and pests, and free of genetically modified organisms (GMOs).

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Keywords: *Legume crops, cultivars, breeding, genetics, productivity, adaptability, drought resistance, genetic resources, selection, hybridization*.

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GRAIN QUALITY OF LATE WINTER WHEAT SOWINGS AFTER APPLICATION OF HERBICIDES

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The purpose of the study is to determine the grain quality indices of late winter wheat crops with the application of post-emergence herbicides and their compositions.

The investigations was conducted in 2025 on late crops of winter bread wheat of the Hayok variety (sowing was in the second half of October) at the Department for Plant Production and Cultivar Investigations of the Yuriev Plant Production Institute of the National Academy of Agrarian Sciences of Ukraine The experiment included seven variants: 1) control (without herbicides); 2) Mastak (clopyralid, 300 g/l) – 0.4 l/ha at the tillering stage–beginning of tube formation; 3) Mastak – 0.4 l/ha at flag leaf stage; 4) Agent (2,4-D 2-ethylhexyl ether, 452 g/l, in acid equivalent, 300 g/l + florasulam, 6.25 g/l) – 0.5 l/ha at the tillering stage–beginning of tube formation; 5) Agent – 0.5 l/ha at flag leaf stage; 6) tank mixture of Mastak – 0.4 l/ha + Gold Star Extra (tribenuron-methyl, 563 g/kg + thifensulfuron-methyl, 187 g/kg) – 35 g/ha at the tillering stage–beginning of tube formation; 7) tank mixture of Mastak – 0.4 l/ha + Gold Star Extra – 35 g/ha at the tillering stage–beginning of tube formation + Agrostar (2-methyl-4-chlorophenoxyacetic acid dimethylamine salt, 500 g/l, in acid equivalent, 410 g/l) – 1.3 l/ha at flag leaf stage. The adjuvant Ingres (polyalkylene oxide modified heptamethyltrisiloxane) was added to each working mixture – 0.2 l/ha.

A variance statistical analysis of grain quality indices of late sowings of winter bread wheat of the Hayok variety established that some herbicides had a demonstrable effect on them. In particular, the crude gluten content in the grain was significantly higher (by 3.6%) only in variant number 7, compared to the control. The grain falling number was significantly lower (by 45–66 s) in variant number 2, compared to variants number 3, 5 and 7.

In general, grain grown in 2025 was classified as class 4 in terms of quality in all herbicide-treated variants, mainly due to low protein (9.0–9.7%), and gluten (13.0–16.6%) content.

Acknowledgments: This study was carried out at the expense of the budget of the Yuriev Plant Production Institute of the National Academy of Agrarian Sciences of Ukraine ("0124U000130" Development of a complex of agricultural measures to increase the productivity of modern varieties of winter wheat, spring barley and peas).

Keywords: *winter bread wheat, herbicides, grain quality.*

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SELECTION OF HIGH-YIELDING MATERIAL AMONG POTATO INTERSPECIFIC BACKCROSSES

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The aim of the study was to identify high-yielding breeding material among backcrosses of potato interspecific hybrids.

The research was conducted in 2024-2025 under the conditions of Ukrainian Polissia in a nursery for in-depth study. The experimental material comprised 308 genotypes. The cultivars Tiras, Skarbnytsia, Levada, Yavir and Sluch were used as standards for comparative assessment. Early yield accumulation was determined on the 70th day after planting, while main productivity was assessed at harvest.

A pronounced differentiation of the material in terms of early yield accumulation was established. In the standard cultivars of the early and medium-early maturity groups, yield on the 70th day ranged from 304.3 g/bush in Tiras to 350.8 g/bush in Levada. Among the studied material, 48 accessions exceeded the standard cultivar Tiras. The highest values were recorded in G17.2s12 - 690.4 g/bush (+196.8% compared with Levada), G16.1s46 - 636.1 g/bush (+181.3%), G17.22s13 - 580.8 g/bush (+165.6%), and G17.22s50 and G18.11/41 - 575.0 g/bush each (+163.9%).

At the main harvest, productivity in the standard cultivars varied from 490.6 g/bush in Sluch to 568.9 g/bush in Yavir, whereas among the backcrosses it ranged from 178.6 to 1600.0 g/bush. A total of 133 backcrosses, or 43.2% of the material, produced higher yields than the best standard, Yavir; 14% of the accessions exceeded 1000 g/bush. The highest value was recorded in G22.1s116 - 1600.0 g/bush (+281.2% compared with Yavir). High productivity was also observed in G21.4s3 - 1550.0 g/bush (+272.5%), G22.7s4 - 1516.7 g/bush (+266.6%), G21.15s1 - 1450.0 g/bush (+254.9%), G22.5s40 - 1383.3 g/bush (+243.2%) and G21.2s76 - 1366.7 g/bush (+240.2%).

In general, 133 backcrosses of interspecific hybrids, or 43.2% of the material, exceeded the best standard cultivar Yavir, while 14% of the accessions produced more than 1000 g/bush.

The most promising genotypes for productivity were G22.1s116, G21.4s3, G22.7s4, G21.15s1, G22.5s40 and G21.2s76. High yield in the studied genotypes was formed through two main mechanisms: an increased number of tubers per bush or an increased average weight of marketable tubers. The selected forms are valuable sources for further potato breeding aimed at high productivity, adaptability and stable expression of economically valuable traits.

Keywords: *potato, interspecific hybrids, backcrosses, yield, breeding material.*

UDC: 633.11:575.174.015.3:577.112.85

GENETIC DIVERSITY OF *AEGILOPS BIUNCIALIS* POPULATIONS BASED ON PROLAMIN MARKERS

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Ae. biuncialis can be considered as an indicator species for the Southern Coast zone of the Crimean Peninsula, and indices of its genetic diversity can be used for monitoring the state of populations and their changes caused by climatic or anthropogenic factors. In the period prior 2014, we collected plant material (spikes) from different natural populations of *Ae. biuncialis* on the Crimean Peninsula. The aim of the research was to evaluate the genetic diversity of Ukrainian populations of *Ae. biuncialis* as of 2014. Here we present the results of analysis of samples from populations from the Eastern portion of the species range on the peninsula.

Gliadin and high-molecular–weight glutenin subunit (HMW GS) alleles were used as genetic markers. We analyzed 1 seed per spike from five *Ae. biuncialis* populations (from Kara-Dag (3 populations), Echky-Dag, and Ordzhonikidze). Gliadins were analyzed by APAGE (Kozub et al. 2009) and HMW GSs, by SDS-electrophoresis (Laemmli, 1970). Alleles at the loci *Gli-U1*, *Gli-M^{b}1*, *Glu-U1*, and *Glu-M^{b}1* were identified.

There were 5-9 alleles at *Gli-U1*, 3-5 at *Gli-M^{b}1*, 1-4 at *Glu-U1*, and 3-5 at *Glu-M^{b}1*, depending on the population. The effective number of alleles was, on average, 2.4. Observed heterozygosity Ho ranged from 0 to 0.054 with the mean value of 0.017. The populations showed the medium level of genetic diversity, except for one Kara-Dag population, which showed a low level (0,174). The genetic diversity index He for the Eastern part of the species range was 0.496, and the prevailing alleles were *a, d, j* at *Gli-U1*, *a* at *Gli-M^{b}1*, *b* at *Glu-U1*, *a* at *Glu-M^{b}1*.

The diversity indices based on prolamin allele analysis in the *Ae. biuncialis* samples can used as a reference for future monitoring of the state of respective populations and their changes due to climatic or anthropogenic impacts.

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Keywords: *Aegilops biuncialis, diversity, prolamin, alleles.*

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THE EFFECT OF SUNLIKE LED LIGHTING ON THE YIELD OF MIZUNA IN CONTROLLED ENVIRONMENT AGRICULTURE

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For efficient cultivation of crops in Controlled Environment Agriculture (CEA) it is necessary to optimization of light parameters taking into account the adaptive capabilities of plants. Recent studies have shown that the light spectral composition close to sunlight, containing all functional wavelengths both for the operation of the photosynthetic apparatus and for the implementation of secondary processes, have the most optimal physiological effect on plant crops cultivation in protected ground.

The purpose of this work was to study the effect of the spectral composition of the light environment modeling natural lighting, taking into account the daily features of sunlight spectral distribution, on the morphometric parameters of cabbage.

Materials and methods. The red mizuna (*Brassica rapa* var. *Japonica*), characterized by its rich pungent taste and vitamin composition, was chosen as the object of the study. Agrobiological tests were carried out under controlled conditions of the agrobiopolygon of the AFI (Saint-Petersburg). LED light sources (AFI, Russia), modeling sunlight at different times of the day, with the same duration of the light period of 14 hours per day and photosynthetic photon flux density (PPFD) 320±20 mmol/(m^2·s): AFI-3000 (simulating sunrise with the ratio R:G:B – 5:3:1), AFI-4000 (daylight, R:G:B – 2:2:1), AFI-5000 (zenith, R:G:B – 1.5:1.5:1).

Results. The resulting mizuna height did not significantly differ between the variants and was 21±3 cm for variant AFI-3000, 21±3 cm for AFI-4000 and 20±2 cm for AFI-5000. The diameter of the rosette was the smallest for the mizuna illuminated by AFI-4000 – 33±4 cm and did not differ for the AFI-3000 and AFI-5000 variants, amounting to 36±3 cm and 37±3 cm, respectively. The yield of mizuna during cultivation in CEA for the variant AFI-3000 was 3.2 kg/m^2 and 33.8 kg/m^2, for the AFI-4000 – 4.6 kg/m^2 and 47.8 kg/m^2, for the AFI-5000 – 4.4 kg/m^2 and 46.1 kg/m^2 per growing season and per year from the tier, respectively.

Thus, a light source simulating sunlight in the daytime with a color temperature of 4000 K had the most favorable effect on the yield and compactness of mizuna when grown in controlled environment agriculture.

***Acknowledgments*:** This study was supported by the scientific and technical state task № FGEG-2025-0007, funded by Agrophysical Research Institute.

Keywords: *light spectrum, Brassica rapa* var. *Japonica, CEA.*

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SEPTORIA LEAF SPOT IN WINTER BREAD WHEAT AGROCENOSIS

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The purpose of the investigations is to study intensity of *Septoria* development of winter bread wheat.

All studies were conducted in a stationary, ninecourse rotation field at the Department for Plant Production and Cultivar Investigations of the Yuriev Plant Production Institute of the National Academy of Agrarian Sciences of Ukraine (Eastern Forest-Steppe of Ukraine) during 2016–20. The soil was a typical weakly leached, medium-humus, black earth soil. Winter wheat was preceded by black fallow. The counts were carried out on 25 stems in three replicates based on the leaf area actually occupied by spots. A block without fertilizers (crop rotation based on natural soil fertility) was compared with an organo-mineral block (applying manure at 6.6 t/ha of crop rotation area or 30 t/ha, and mineral fertilizers at the rate of $N_{30}P_{30}K_{30}$).

The development and spread of *Septoria* leaf spot (the causative agents are imperfect fungi of the genus *Septoria*) varied during the study. After the restoration of vegetation, during spring tillering-tubing stage, the lowest development of *Septoria* leaf spot on the leaves of lower layer of winter bread wheat plants was observed in 2016 (10.0–10.3%) by backgrounds, as well as in 2020 (10.5%) against a background without fertilizers, and 18.6% against a fertilized background. The highest intensity of development of this disease was observed in 2017 (26.4%) against the unfertilized background, and 77.9% against the fertilized background, as well as in 2018, where the values by backgrounds were 46.5% and 58.1%, respectively. The spred of *Septoria* leaf spot ranged from 75.6–76.2% (2020) to 99.0–100% (2016). Various meteorological conditions that developed during the years of studies influenced the degree of *Septoria* development. On average over five years, the *Septoria* development on the leaves of lower layer of winter bread wheat plants during spring tillering-tubing stage was 22.8% on the background without fertilizers, 38.9% on the fertilized background, i.e. exceeded by 16.1%, with spred of 93.2% and 94.9%, respectively.

As a result, the 1,000-kernel weight before harvesting was 40.23 g on the background without fertilizers, and 39.24 g on the fertilized background, which was 0.99 g less compared to the background without fertilizers, at a statistically significant level.

Acknowledgments: This study was carried out at the expense of the budget of the Yuriev Plant Production Institute of the National Academy of Agrarian Sciences of Ukraine ("0116U001040" To develop theoretical foundations and ensure reliable protection of field crops from harmful organisms in the conditions of the Eastern Forest-Steppe of Ukraine).

Keywords: *fertilizer, winter bread wheat, Septoria leaf spot.*

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EVALUATION OF SPIKE PRODUCTIVITY ELEMENTS IN F2 WINTER TRITICALE HYBRIDS

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Triticale is currently considered a crop capable of stabilizing the global harvest of feed and food grain. Triticale is highly adaptable, often producing higher yields than other grain crops, especially under unfavorable environmental conditions. The goal is to create new triticale varieties that are productive, winter-hardy, drought-resistant, and well-adapted to agro-climatic conditions.

A study of the F2 population of the hybrid combinations studied revealed the average values for spike length, spikelet number, grain number per spike, grain weight per spike, and 1000-grain weight: 13.3±0.2; 33.6±0.5; 79.9±2.4; 4.7±0.2; and 58.9±0.9, respectively.

Variability in spike productivity traits among the studied F2 hybrids ranged from 4.0% to 15.5%. The lowest variability was observed for spike length (Cv=4.0% to 6.4%) and spikelet count (Cv=4.5% to 7.2%). Significant variability was demonstrated by grain count (Cv=7.7% to 14.9%) and grain weight per spike (Cv=9.7% to 15.5%). This level of variation reflects the diversity of F2 hybrids and the ability to identify plants with a desired combination of traits for further selection of the most productive plants.

The degree and frequency of transgression in the best hybrid combinations by spike length varied within the range: Tg=1.2-12.4%, Tf=10-95%, by the number of spikelets – Tg=0.9-10.5%, Tf=5-75%, by the number of grains – Tg=3.8-10.9%, Tf=5-80%, by the weight of grains – Tg=7.8-18.8%, Tf=10-80%. Transgressive forms by the weight of 1000 grains were significantly less common. Counting positive transgressions in the F2 population demonstrates the importance of the genotypes involved in hybridization.

Calculation of the correlation coefficient revealed that the F2 hybrid populations exhibited the most pronounced positive correlation (0.81–0.93) between the traits grain number and grain weight. A moderate correlation was found between spike length and spikelet number (0.53–0.88), and spikelet number and grain number (0.35–0.80). Among the remaining traits, these indicators were weaker positive or slightly negative. The best hybrid combinations were: 3841, 3836, 3796, 3851, and 3856. Since spike productivity was strongly correlated with the number of grains per spike, when breeding for high yield, it is important to select plants with a high grain content per spike, taking into account the 1000-grain weight.

As a result of studying and selecting hybrid combinations in F2 based on economically valuable traits, the best of them will be studied in the following generations.

Acknowledgments: The research was carried out within the Subprogram 011102 Extension and conservation of genetic diversity, improvement of gene pools of agricultural crops in the context of climate change.

Keywords: *triticale, hybrid combination, variability, transgression, correlation.*

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IDENTIFICATION OF RESISTANCE GENE Lr21 TO LEAF RUST IN WHEAT CULTIVARS AND LINES

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Identification of leaf rust resistance genes is a prerequisite for studying the genetics of wheat resistance to the pathogen. Therefore, the purpose of this study was to determine the presence of the resistance gene Lr21 in wheat cultivars and lines using DNA markers.

Materials and Methods: The study used spring and winter samples from the wheat collection of the National Center for Plant Genetic Resources of Ukraine (V.Ya. Yuriev Plant Production Institute of the NAAS of Ukraine). To identify the Lr21 leaf rust resistance gene, polymerase chain reaction (PCR) was performed using primers Lr21D14-L (5´-CGC TTT TAC CGA GAT TGG TC-3') and Lr21D14-R (5´-CCA FFG AGC ATC CAT GGT GR-3') following a touchdown PCR protocol, with subsequent restriction analysis of the amplification products. The presence of an 885-bp amplicon corresponded to the Lr21 gene. Wheat resistance was evaluated according to Babayantz et al. (2014). Field studies were conducted during 2024–2025. An epiphytotic outbreak of leaf rust was recorded in 2025.

Results: Thirty-one cultivars and six wheat lines of diverse ecological and geographical origin were analyzed. Among the spring wheat genotypes, the Lr21 gene was identified in 10 cultivars, including AC Cora, Amidon, Dandy, Vyshyvanka, and Memory. The gene was also detected in four North American lines: KS93U1, KS93U194, KS93U61, and KS93U63. Evaluation of resistance of the identified Lr21 carriers to the local leaf rust population showed that cultivars AC Cora and Amidon, as well as lines KS93U194, KS93U61, and KS93U63, exhibited high resistance, scoring 7–8–9 points. Under the severe leaf rust epidemic conditions of 2025, cultivars Vyshyvanka and Memory and line KS93U1 showed reduced resistance and were classified as slightly susceptible (5 points). Cultivar Dandy became susceptible, with a score of 3 points.

Conclusions: The resistance assessment results indicate that, in addition to the Lr21 gene, the genomes of cultivars AC Cora and Amidon and lines KS93U194, KS93U61, and KS93U63 may contain other effective leaf rust resistance genes. Further studies are required to identify these genes and determine their contribution to resistance.

***Keywords**: wheat, leaf rust, resistance gene, Puccinia triticina, DNA markers.*

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IDENTIFICATION OF SEEDLING RESISTANCE TO LEAF RUST IN EUROPEAN WINTER WHEAT CULTIVARS

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While breeding wheat, it is important to have information on the presence of seedling resistance to the local population of leaf rust (*Puccinia tritici* f. sp. *tritici*). The **purpose** of this study was to determine seedling resistance in winter wheat cultivars of European origin against a leaf rust population typical of the Right-Bank Forest-Steppe zone of Ukraine.

Materials and Methods: The study included 18 winter wheat cultivars of European breeding obtained from the collection of the National Center for Plant Genetic Resources of Ukraine at the V.Ya. Yuriev Institute of Plant Production of the NAAS of Ukraine. The Ukrainian cultivar Podolianka was used as a susceptible control. Seeds were grown under greenhouse conditions until the second-leaf stage. Inoculation was carried out using a mixture of the most prevalent and virulent races of leaf rust. Disease assessment was conducted 14 days after inoculation according to the E.B. Mains and H.S. Jackson scale, where 0 = immune, 0; = nearly immune, 1 = resistant, 2 = moderately resistant, X = heterogeneous, 3 = moderately susceptible, and 4 = susceptible.

Results; The control cultivar Podolianka exhibited a susceptible reaction type of 4, indicating the absence of resistance to the most virulent leaf rust races. Among the evaluated cultivars, only Semnal (ROU) demonstrated immunity (reaction type 0). Cultivars Voinik (ROU), MV Mente (HUN), and Futurum (DEU) expressed resistance at reaction type 1. A moderately resistant response (reaction type 2) was observed in Producent (DEU), Malibu (DEU), and Evklid (FRA), suggesting the possible presence of effective seedling resistance genes in their genomes. Moderate susceptibility (reaction type 3) was recorded for Pitar (ROU), FGMUT293 (ROU), MV Kepe (HUN), MV Bojtar (HUN), Nordika (CZE), Praktik (DEU), and Matchball (FRA), indicating the absence of effective seedling resistance genes against the local pathogen population. Susceptibility (reaction type 3–4) to the most virulent races was observed in Zamolxe (ROU), Turanus (AUT), and RGT Reform (FRA), which likewise lacked effective seedling resistance genes.

Conclusions: The study identified seedling resistance to leaf rust in seven winter wheat cultivars of European origin. These cultivars may serve as potential carriers of effective resistance genes against the local population of the leaf rust pathogen in the Right-Bank Forest-Steppe zone of Ukraine. Further research is required to identify and develop molecular markers for these resistance genes.

Keywords: *wheat cultivars, seedling resistance, pathogen, leaf rust.*

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INFLUENCE OF PARENT LINES ON CORN HYBRID VIGOR IN VARIOUS GERMINATION CONDITIONS

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Corn plant vigor is one of the most important indicators of germination capacity and tolerance to stress conditions. In this study, the differences between vigor of corn hybrid Porumbeni 465 (P465) and its parent lines were analyzed in three experimental variants: a) germination under normal conditions, b) cold test, namely germination for 7 days at 10ºC plus 4 days at 25°C and c) heat treatment of corn seeds for 30 minutes at 50ºC before germination under normal conditions. Corn vigor was calculated as followed: (root length + seedling length) x germination rate (%). Statistical analysis was performed using the software Statistica 7, using the t-test for independent samples, Fisher test and contribution of factors.

The obtained results revealed the existence of distinct statistically significant differences between the vigor of P465 hybrid and the parent lines in all three experimental variants ($p \leq 0.001$). Under normal germination conditions, the hybrid recorded the highest average vigor value (1333.82), compared to the female inbred parent (942.62) and the male inbred parent (1010.09). The difference between vigor of hybrid and those of parent lines demonstrated that the vigor of the hybrid is closer to the male inbred parent. Under cold testing conditions, the vigor values indicate that the female inbred parent was more sensitive to low positive temperatures, while the male line demonstrated a greater ability to maintain vigor under these conditions. After heat treatment at 50°C, the hybrid showed the highest vigor value (1618.89), significantly exceeding the female line (529.95) and the male line (1145.09). Standard deviations showed more pronounced phenotypic variability in hybrid compared to parental lines, and Fisher's test confirmed the presence of significant differences between variances in all experiments. According to the factor contribution analysis, the influence of lines vigor-related factors on hybrid vigor was 6.3 times stronger than the influence of stress factors

The results confirm the manifestation of the heterotic effect and highlight the more important contribution of the paternal lines to the expression of vigor and tolerance to abiotic stress in the Porumbeni 465 hybrid.

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Keywords: *corn, vigor, germination, non-optimal temperature.*

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SOURCES OF NEW GERMPLASM FOR IMPROVING THE GENETIC DIVERSITY OF TOMATO

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The narrowing of tomato biodiversity under influence of environmental, genetic and other factors necessitates the inclusion of new germplasm sources characterized by high genetic divergence into breeding programs. Of particular interest in this regard are spontaneous and induced mutations, the use of which in breeding has led to the enrichment of the cultivated tomato with a number of valuable traits, including determinate growth habit, diversity in fruit shape and color and among others.

Based on this, the aim of the research was to incorporate mutant genes controlling a number of economically valuable traits in the breeding process to expand the genetic basis of the cultivated tomato gene pool and to develop new breeding forms. Eighteen mutant and semi-mutant tomato forms carrying the genes *sp*$^{+}$, *sp*$^{\pm}$, *rin, nor, alc, u, ls, br, β, gs, W*^{om}, *Ln, j-2,* and others were used in the study. Based on these forms, 23 hybrid combinations were obtained. A comprehensive study was conducted to evaluate the influence of these genes on the inheritance of major quantitative traits in F_1 hybrids, as well as on recombinational variability in segregating F_2 populations. Evaluation of heterozygous progenies and selection of carriers of breeding-valuable traits were carried out using two types of screening: passive and active.

As a result of the research, 40 lines with original combinations of mutant marker and economically valuable traits differing in the degree of phenotypic stability and variability were obtained. The greatest breeding value was observed in lines 204/16, 224/17, 228/24, 241/14, and 241/33, which demonstrated high performance for the main economically valuable traits and stable phenotypic expression of mutant markers during three years of study (2023–2025). These lines successfully combine resistance to abiotic stresses with resistance to the most harmful pathogens. The second group of lines (196/4, 196/27, 196/43, 197/16, 197/38, 204/32, 204/57, 204/88, 228/42, 228/65, 237/41, and 241/12) was also characterized by consistently high values of breeding-important traits; however, these lines differed in their responses to abiotic stress factors (high and low temperatures, drought) and in the types of resistance to the most harmful pathogens. A high degree of variability for most of the studied traits was observed in lines 186/36, 205/72, 205/83, 224/13, 228/83, 228/96, 237/44, 237/76, 241/43, 241/58, and 241/93. This may indicate that segregation processes are still ongoing within these populations or that some mutant genes exhibit a broad pleiotropic effect. In addition, a separate group of lines (196/28, 197/66, 197/81, 205/28, 228/33, 228/58, 228/74, 237/77, 241/5, and 241/32) was identified, characterized by different degrees of variability depending on the specific trait considered, which indicates instability of their genetic systems.

The lines from different groups are of particular interest as sources of new traits for expanding the genetic diversity of the cultivated gene pool and enriching active and long-term collections with genes that control a wide range of breeding-valuable traits.

Acknowledgments: The research was carried Subprogram 011102 “Increasing and conservation genetic diversity, agricultural crop breeding in the context of climate change”, financed by the Ministry of EdRes.

Keywords: *tomato, selection, mutant marker genes, genetic diversity, lines.*

UDC: 635.64:631.527.5:576.3

THE INFLUENCE OF MUTANT GENES ON THE INHERITANCE OF MALE GAMETOPHYTE TRAITS BY F_1 HYBRIDS

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Knowledge of the patterns of hereditary variability of different traits in hybridization makes it possible to predict the efficiency of selection in hybrid populations and to carry out a scientifically grounded choice of parental forms. This is especially important for the traits of the male gametophyte, whose response to abiotic and biotic stress factors is considered a criterion for the evaluation, differentiation, and selection of resistant genotypes.

The aim of the research was to study the inheritance pattern of male gametophyte traits in F1 hybrids obtained from direct and reciprocal crosses between semi-mutant lines carrying complex combinations of mutant marker genes (*sp*$^{+}$, *sp*$^{\pm}$, *rin, nor, br, Tm-2a, W*^{om}, *Ln, ps-2, ls, j*) and cultivated-type lines.

The initial material consisted of 12 F_1 hybrid combinations: L8/234 × Mo 835 and Mo 835 × L8/234; L1033 × L8/234 and L8/234 × L1033; L33/241 × L454 and L454 × L33/241; L11069 × L828 and L828 × L11069; L11069 × Mo341 and Mo341 × L11069; L11069 × L556 and L556 × L11069, obtained through direct and reciprocal crosses. The influence of different mutant genes on pollen traits reflecting pollen quality was investigated, including shape, size, fertility, viability (germination), and pollen tube length. The degree of dominance (hp) was used as an indicator to characterize the inheritance of traits in F_1 hybrids.

An ambiguous pattern of male gametophyte trait expression was revealed in F_1 hybrids, depending both on the genotype of the parental forms and on the direction of crossing. No negative effect of the *nor*, *rin*, *W*^{om}, and *Ln* genes on pollen quality was observed in F_1 hybrid combinations derived from either direct or reciprocal crosses, indicating the possibility of their effective use in combinative breeding. In contrast, sharply different results were obtained for F_1 hybrid combinations carrying the *ls*, *br*, and *ps-2* genes. In pollen populations of hybrids obtained from direct crosses, where lines carrying these genes were used as maternal forms, a high degree of heterogeneity was observed, including numerous pollen grains with abnormalities of varying severity, low fertility, and poor pollen viability. At the same time, in pollen populations of F_1 hybrids from reciprocal crosses, where the same lines were used as paternal forms, high uniformity of pollen grain morphology, active and rapid germination, and the formation of long pollen tubes under *in vitro* conditions were observed. These results indicate the dominant inheritance of these genes in F_1 hybrids when transmitted through the maternal form. Knowledge of these characteristics allows a more targeted and efficient selection of parental components for hybridization, especially in the case of traits controlled by mutant marker genes.

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Keywords: *tomato, mutant genes, inheritance, pollen traits.*

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RELATIONSHIP BETWEEN SEED YIELD AND 1000-SEED WEIGHT IN MUTANT SOYBEAN GENOTYPES

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The study aimed to evaluate the relationships between seed yield per plant and 1000-seed weight in soybean mutant genotypes under field conditions. The experiments were carried out in 2025 on the experimental fields of the Institute of Genetics, Physiology and Plant Protection, MSU. The biological material included ten soybean genotypes obtained through X-ray-induced mutagenesis, selected in advanced generations (M_5).

The analysis of quantitative traits revealed considerable variability among genotypes for both investigated parameters. Seed yield per plant ranged from 5.5 to 7.5 g, while 1000-seed weight varied between 105.2 and 144.4 g, reflecting the diversity of the analyzed genetic material.

The correlation analysis for the entire set of genotypes revealed a very weak relationship between seed yield per plant and 1000-seed weight ($r = 0.08$), which was statistically non-significant ($p > 0.05$), suggesting a relative independence between these traits. The distribution of values highlighted differentiated responses among genotypes, with some combining high seed yield and large seed weight, while others exhibited high productivity associated with medium or lower values of this trait. These differences reflect the genetic variability induced by mutagenesis.

In addition, several mutant genotypes demonstrated stable expression of the investigated traits, indicating their potential adaptability to variable environmental conditions. The identified variability among genotypes confirms the effectiveness of X-ray-induced mutagenesis as a valuable tool for expanding the genetic diversity of soybean breeding material.

The obtained results emphasize the complex nature of yield determination in soybean and demonstrate that 1000-seed weight should not be considered as the sole selection criterion. Simultaneous selection for seed yield and seed weight should be performed differentially depending on genotype. The observed variability within the mutant population indicates valuable potential for identifying superior genotypes and their use in breeding programs. These findings contribute to a better understanding of yield component interactions and support the optimization of selection strategies in soybean breeding.

Acknowledgments: The research was conducted within the framework of subprogram 011102 "Expansion and conservation of genetic diversity and improvement of agricultural crop gene pools in the context of climate change" (2024–2027).

Keywords: *soybean, mutagenesis, X-rays, yield, genetic variability*.

UDC: [634.11 + 634.22]:632.111.52:581.162

THE EFFECT OF WATER DEFICIENCY ON THE REPRODUCTIVE CYCLE OF PLUM AND APPLE TREES

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The decline in yield of apple and plum trees due to disruptions in pollination and fertilization processes under water-deficient conditions is a critical problem for fruit crops. Water stress induces physiological changes that lead to the degradation of reproductive organs and a decrease in the efficiency of the reproductive cycle. This results in a decline in pollen quality and deteriorating conditions for ovule development, ultimately leading to significant yield losses.

The aim of our study was to determine the effect of water stress on critical phases of the reproductive cycle and the potential yield of apple and plum trees.

The study subjects were buds, flowers, and ovaries of Golden Spur apple trees and Stanley plum trees. Tests of pollen viability and fertility were conducted on temporary preparations according to standard methods. The viability of ovules and ovaries was determined microscopically on semi-thin sections.

Reproductive organs are the most vulnerable parts of a plant, requiring the greatest amount of nutrients and water. Dehydration disrupts the process of meiosis. As a result, the pollen becomes defective, losing its viability and ability to germinate. When simulating water stress, a decrease in pollen fertility was observed in both species studied. In apple trees, the fertility index decreased by 4.97% compared to the control, while in plum trees, the decrease was 3.72%. A decrease in pollen viability of 7.43% and 2.42%, respectively, was also noted. The receptivity of the pistil stigma also decreases, making fertilization impossible even in the presence of high-quality pollen. Impaired seedling development was manifested by a 35% decrease in viability in apple trees and a 28% decrease in plum trees. Plum trees exhibited greater resilience of reproductive functions compared to apple trees.

Thus, the varieties studied demonstrate varying degrees of sensitivity of their reproductive organs to water-deficient conditions. Water deficiency leads to a significant reduction in pollen fertility and ovule viability. The deterioration of these indicators depends on the intensity and duration of the stress. Disruption of microsporogenesis and macrosporogenesis is a key factor in reduced plant productivity.

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Keywords: *apple, plum, reproductive organs, pollen, ovaries, viability, fertility, water stress.*

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GENOME ARCHITECTURE IN COBITIS LOACHES: HYBRIDIZATION AND REFUGIAL DYNAMICS

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Hybridization between diverged lineages can profoundly reshape genome structure, yet how this process interacts with biogeographic history to generate lasting chromosomal diversity remains poorly understood. We addressed this question in spined loaches of the Cobitis taenia species complex, focusing on populations from the Danube and Dniester river systems in the northwestern Black Sea basin — a region predicted to have served as a glacial refugium and secondary contact zone. Using genetic, cytogenetic, and ecological approaches, we characterized parental species composition, hybrid diversity, karyotypic variation, and gametogenetic outcomes across diploid and polyploid individuals. The two river systems showed strikingly different patterns: Danubian populations were genetically uniform and dominated by a one parental species and triploid clonal hybrid females, while the Dniester basin harbored multiple co-occurring parental lineages, extensive karyotypic polymorphism, widespread discordance between mitochondrial and nuclear genomes, and a diverse array of clonal hybrid forms. We show that chromosomal number variation in the Dniester reflects a complex intraspecific rearrangement rather than a simple chromosomal fusion. Despite this structural heterogeneity, diploid individuals maintained normal meiosis and produced functional gametes, enabling ongoing genetic recombination. Clonal triploid females, by contrast, sustained fertility through genome duplication prior to meiosis, preserving hybrid genomic configurations across generations. Ecological niche modelling supported the northern Black Sea coast as the primary refugial area, with postglacial expansion westward explaining the relative genomic uniformity of Central European populations. Together, our results show how cycles of glacial isolation and secondary contact transform refugial areas into hotspots of chromosomal and genomic innovation in freshwater vertebrates.

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Keywords: *Cobitis, , hybridization, Black Sea refugium, premeiotic endoreplication.*

UDC: 633.14:631.527.5:631.559.2

BREEDING EVALUATION OF WINTER RYE HYBRIDS FOR YIELD AND ADAPTABILITY

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The world's largest producers of winter rye (Secale cereale L.) seeds are Germany, Russia, Poland, Belarus, Denmark, China, Ukraine, Turkey, Spain and Austria. The leading regions for winter rye cultivation in Ukraine are Zhytomyr, Volyn, Chernihiv, Rivne, Kyiv, Sumy, Khmelnytskyi and other regions. Despite the importance of this crop, the area under winter rye is decreasing annually: in 2018 – 150,000 ha, 2004 – 740,000 ha, 2022 – 79,000 ha, and 2024 – 77,200 ha, compared to the scientifically justified figure for Ukraine of 0.6–0.7 million ha.

A current issue is to assess the yield potential, ecological adaptability and stability of winter rye hybrids from our own selective breeding programme, as well as their morphological and agronomic traits, in order to identify the most promising genotypes for practical cultivation and further breeding work.

Materials and methods: Field studies were conducted between 2021 and 2025 on the fields of the Verkhnyachka Experimental Breeding Station of the Institute of Bioenergy Crops and Sugar Beet of NAAS in the Central Right-Bank Forest-Steppe zone of Ukraine. The research was carried out in accordance with generally accepted methods of field trials and state variety testing. Each year, 37–58 hybrid combinations of winter rye were studied in competitive variety trials. Sowing was carried out on the following dates: 2020 – 1 October; 2021 – 4 October; 2022 and 2023 – 12 October; 2024 – 24 September. The studies conducted comply with the standards of the State Standards of Ukraine and the requirements of ISO 17025, and were carried out using methodological approaches in accordance with international practices. The soil of the experimental field is podzolised heavy loam chernozem, with a humus content in the arable layer (0–30 cm) of 2.8–3.2%. Nutrient availability: readily hydrolysable nitrogen – 10–12, mobile phosphorus – 9–10, exchangeable potassium – 7–8 mg per 100 g of soil. Adaptive properties were assessed using the Eberhart–Russell model. Ecological plasticity was determined by the regression coefficient (bi), and stability by the standard deviation from the regression line (Si^2). Seasonal conditions were treated as different environments. Interpretation of indicators: bi = 0.90–1.10 – high plasticity; bi = 1.11–1.20 or 0.80–0.89 – medium; bi >1.20 or <0.80 – narrow adaptability. Stability: Si^2 ≤0.30 – high; 0.31–0.50 – medium; 0.50 – low. The experimental yield data obtained in the field trial are presented in tonnes per hectare. The standard variety used was the regionally adapted winter rye variety Vals, selected in-house. Statistical analysis of the results was carried out using correlation analysis with Statistica software. The significance of differences between samples was determined using one-way analysis of variance. Differences were considered statistically significant at $p < 0.05$.

Results: Based on the results of field studies conducted over a five-year period at the Verkhnyachka Experimental Breeding Station, significant variability in the yield

of winter rye hybrids was observed depending on the weather conditions of the year. The year effect ranged from -1.9 to +0.9, confirming the significant influence of hydrothermal factors on the realisation of genetic yield potential. The 2020/2021 and 2024/2025 growing seasons were the most favourable for yield formation, whereas the 2022/2023 season was characterised by a decline in productivity due to unfavourable weather conditions during critical phases of plant development. The yield of the studied variety samples over the trial years ranged from 5.6 to 11.3 t/ha. On average, the maximum yield was 10.2 t/ha, and the coefficient of variation (9.5%) indicates a relatively high stability of productivity in the best genotypes. Analysis of variance confirmed significant differences between hybrids in terms of yield (Ffact. > Ftheor.0,05), which is due to the influence of genotype, year conditions and their interaction. Based on the results of assessing ecological plasticity and stability using the Eberhart–Russell model, it was found that most hybrids were characterised by broad adaptability (bi = 0.90–1.10). The most stable in terms of the Si^2 index (≤0.30) were the hybrids Volonter, Khlibna Niva, R-5/22 and Amey. The highest average yield, combining high ecological adaptability and stability, was achieved by the Khlibna Nyva (9.38 t/ha) and Volonter (9.26 t/ha) hybrids, which characterises them as the most adaptable and promising for cultivation in the conditions of the Right-Bank Forest-Steppe of Ukraine. A significant differentiation of the breeding material was established based on a set of morphological and economically valuable traits. Most samples belonged to the medium-stature group (120–140 cm), produced grain with high specific weight (686–722 g/l) and a 1000-grain weight of 32–51 g, and were characterised by an average or high level of field resistance to brown and stem rust. Based on the results of a comprehensive assessment of yield, grain quality and adaptability, the hybrid combinations Khlibna Niva, Volonter, Amey, M-15 and D/S-7 are the most promising for production and further breeding work.

Conclusions: The yield of winter rye hybrids depends to a large extent on the weather conditions of the year, with the best varieties combining high productivity, stability and broad environmental adaptability. The most promising varieties for cultivation in the Right-Bank Forest-Steppe region of Ukraine are the Khlibna Nyva, Volonter, Amey, M-15 and D/S-7 hybrids.

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Keywords: *winter rye, hybrids, yield, ecological plasticity, stability, regression coefficient,* Si^2.

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INFLUENCE OF X-RAY RADIATION ON COLD TOLERANCE IN MAIZE INBRED LINES

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Different types of irradiation are widely used in crop improvement to induce genetic variability and modify physiological processes. In maize (*Zea mays L.*), low irradiation doses may stimulate germination and seedling vigor, whereas high doses frequently induce phytotoxic effects. The present study evaluated the radio sensitivity and cold tolerance of 15 maize inbred lines exposed to x-ray irradiation doses of 20, 40, 60, 80 and 100 Gray (Gy).

Seeds were irradiated using the RS-2400Q installation and sown within 24 hours after treatment under field conditions in three sowing periods during 2025. The first sowing term was characterized by severe thermal stress, with average soil temperatures near 8°C and a prolonged cooling period after sowing. Experiments were organized in four replications using 100 seeds per variant. Germination was evaluated by counting emerged seedlings. In parallel, laboratory germination tests were performed at 25°C to evaluate seedling average length. Statistical processing was performed in Python using generalized linear models (GLM) with binomial distribution.

The results demonstrated that the effect of x-ray irradiation depended strongly on genotype, dose and thermal conditions. Low doses (20–40 Gy) frequently induced a hormetic response, improving germination and early vigor in several lines. Under severe cold stress, line 12 irradiated with 20 Gy exceeded the non-irradiated control by more than 9 percentage points, suggesting a possible protective effect against early thermal stress. In optimal sowing conditions, positive irradiation responses were especially evident in lines 4, 8, 10 and 11, where intermediate doses significantly increased germination capacity. Conversely, the 100 Gy treatment acted as a universal inhibitory threshold, causing major reductions in emergence across most genotypes.

The study highlights the existence of genotype-specific responses to x-ray irradiation and demonstrates that low and intermediate doses may improve germination performance when environmental conditions are favorable. The obtained results provide a basis for optimizing irradiation treatments in maize breeding programs focused on cold tolerance and seed vigor.

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Keywords: *x-ray radiation, maize, germination, cold tolerance, hormesis.*

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INFLUENCE OF X-RAY IRRADIATION ON THE PRODUCTIVITY OF MAIZE HYBRIDS

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The use of irradiation in agriculture is an effective method for inducing genetic variability and optimizing productivity, overcoming the limitations of conventional breeding by rapidly generating useful mutations. This study evaluates the differentiated response of several maize (Zea mays L.) hybrids to radiological stress on the RS-2400Q apparatus to optimize irradiation technologies in modern agriculture.

The biological material included four registered hybrids: Porumbeni 352, Porumbeni 374, Sur 18/399, and Turda 2020. Seeds were subjected to x-ray radiation with doses of 25, 50, 75, 100, and 125 Gray(Gy), with the 0 Gy variant serving as the control. The experiment was installed in the field using a layout of 144 plots in three replications. Phenophases, morphological parameters (plant height, ear insertion height), phytopathogenic attack incidence, and productivity (sample mass, grain moisture) were monitored. Data were processed using Welch's t-test, linear regression, and linear mixed-effects models (LMM).

Analysis of the sample mass revealed a clear hormesis effect (stimulation by low doses) in the Porumbeni hybrids. Hybrid Porumbeni 352 showed a production increase of 30% at 75 Gy, while Porumbeni 374 showed a 23% increase at 25 Gy. In contrast, the Romanian hybrids Sur 18/399 and Turda 2020 exhibited high radiosensitivity, with all irradiated variants performing below the controls. Irradiation accelerated grain drying in Porumbeni hybrids (up to 9% drier), whereas it delayed drying in the Romanian hybrids (up to 11% wetter). Doses exceeding 100 Gy increased vulnerability to pathogens (Ustilago maydis and Sorosporium holci-sorghi). Vegetative development varied between an inhibition of -8.2% and a stimulation of +5.2%. The sprout-to-flowering period remained stable, demonstrating that irradiation primarily affected biomass accumulation and plant architecture rather than ontogenetic stages.

In conclusion, maize yield is a radiosensitive trait that can be modeled through controlled radiological treatments. Applying moderate doses (25–75 Gy) generates yield increases, but success depends on the specific genetic background of each hybrid. Further research with increased replications is recommended to enhance the statistical robustness of these findings.

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Keywords: *Zea mays L., X-ray irradiation, hormesis, productivity, radiosensitivity.*

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ASSESSMENT OF THE EFFECT OF X-RAYS ON THE PRODUCTIVITY OF SAMPLES OF THE SPECIES *CUPHEA LANCEOLATA* AIT.

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The aim of the research was to evaluate the impact of different radiation doses on plants of the species *Cuphea lanceolata* Ait. and to identify genotypes of interest for inclusion in plant breeding programs. The experimental material consisted of seeds obtained from two *Cuphea lanceolata* Ait. accessions (MDI 02163 and MDI 02167) treated with *X*-rays at different doses: 100, 200, 300, 400, 500, and 700 Gy. Seed germination and seedling survival rates were monitored. Throughout the growing season, phenological observations, biometric measurements, and individual plant evaluations based on a set of quantitative traits were conducted. It was established that seedling survival rates decrease as the irradiation dose increases. Doses of 300 Gy and higher proved to be lethal, resulting in extremely low survival rates or complete seedling mortality. The application of 100 and 200 Gy radiation doses had a negative effect on plant height in both samples, but stimulated branching by 18.6% (100 Gy – MDI02167) and 9.3% (200 Gy – MDI 02163). The 100 and 200 Gy doses had a stimulating effect on the number of flowers in the MDI 02167 sample, exceeding the control by 51.5% and 27.8%. A similar effect was also observed in the number of fruits per plant, which was 2.4 times higher compared to the control, and the 200 Gy dose resulted in an 1.8-fold increase in fruit set. For genotype MDI 02163, the 100 Gy dose resulted in a 1.5-fold decrease in this parameter, and at 200 Gy, the fruit set decreased by a factor of 2.25. Based on the number of seeds per plant, the irradiated forms of the MDI 02167 sample exceeded the control sample by 65.3% (100 Gy) and 45.5% (200 Gy). The progeny of the MDI 02163 sample exhibited productivity similar to or lower than that of the control following *X*-ray treatment.

Conclusion: The effect of *X*-ray treatment on plants of the species *Cuphea lanceolata* Ait. depends on the radiation dose and genotype. Increasing the irradiation dose reduces the survival rate of seedlings. Irradiation at doses of 100 and 200 Gy resulted in enhanced productivity of irradiated plants belonging to accession MDI 02167.

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Keywords : *Cuphea, X-rays, biometric measurements, quantitative traits.*

UDC: 633.15:575.113.4:576.316.7

RANGE OF ACTION OF THE JUXTAPOSITION EFFECT

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The juxtaposition effect was discovered in maize and Arabidopsis: when homozygous and heterozygous regions alternate in the genome, crossing-over frequencies are elevated in heterozygous regions adjacent to homozygous ones. Here the range of this effect is studied: how it depends on the position of the homo/hetero transition points relative to the markers.

We used data on recombination frequencies (RF) in maize hybrids involving NILs (near isogenic lines) obtained from the MK01 and Ku123 lines, and in the F_2 segregation classes of the Ku123×2-9m maize hybrid. The RF was measured between chromosome 2 markers *ws3*, *lg1*, *gl2* (coordinates 0.9, 3.3, 9.6 Mb) and chromosome 9 markers *c1*, *sh1*, *wx1* (coordinates 10.9, 12.6, 25.2 Mb). We calculated recombination gain relative to completely heterozygote.

The *ws3*-*lg1* pair. Located at the edge of the chromosome, this heterozygous region can extend to the right. With an extension of 2.5-3 Mb, recombination increased by 1.66, 1.78, and 1.87 times; with an extension of 15 Mb, by 1.29 times; with an extension of 40 Mb, the gain disappears (RF is equal to the control value).

The *lg1*-*gl2* pair. When the homo/hetero transition points coincide with the edge markers, the RF gain is maximal (2.12-fold). If the heterozygous region has excess length, the gain is 1.54 (with a 6.4-Mb excess), 1.29 (with a 10-Mb excess), and disappears at a 40-Mb excess.

The *c1*-*sh1* pair. A gain of 2.02 was observed at a 4.3-Mb excess, 1.91 at 6.5-Mb excess, 1.59 at 12-Mb excess, and 1.21 at 15-Mb excess (in the recombination-active zone). The gain disappeared at a 20-Mb excess in the active zone.

The *sh1*-*wx1* pair. To the right of the *wx1* locus lies a passive zone that has a weak effect, so we consider only the active zone to the left. At an excess of less than 1 Mb (the transition point between *c1* and *sh1*), the gain was 2.39, 2.20, and 1.75. At an excess of 5 Mb, the gain was 1.97, and at an excess of 8 Mb, it was 1.39.

Conclusion: The juxtaposition effect has a range of up to 20 Mb from the homo/hetero transition point. It is strongest at a distance of up to 5 Mb, resulting in an average twofold increase in RF, and then declines. It is still detectable at a distance of 15 Mb and is not detectable at a distance of 20 Mb.

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Keywords: *maize, recombination, juxtaposition effect.*

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PEONY – A MEDICINAL PLANT AND POTENTIAL HOST FOR NEW PHYTOVIRUSES

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Peony (*Paeonia*) is the only genus of the *Paeoniaceae* family, which includes 41 species and about 20 subspecies. About 8000 cultivars are registered. Peonies are beloved perennial plants of our gardens, captivating with their large and fragrant flowers, and they are among the most valuable ornamental plants in the world. The peony is an economically important crop and a source of high income on a minimal area. Peony cultivation is a highly profitable business. The healing properties of peonies and their use in herbal medicine for more than twenty diseases have long been known. Biologically active compounds isolated from peony raw material exhibit antioxidant, anticoagulant, anti-inflammatory, sedative, analgesic, hypoglycemic, antiallergic, antibacterial and antiviral properties. However, peony cultivation is complicated by various phytopathogens, including viruses, which reduce the ornamental value, viability and productivity of plantings.

The purpose of the work is to identify the viruses detected in a peony collection in Ukraine.

In the 2021, in peony varieties collection, we have first observed severe symptoms of deformation, leaf curling, stunting, dwarfism, and rarely weak mosaics. That is, not quite classic virological symptoms. Using DAS-ELISA and real-time PCR, grapevine leafroll-associated virus 3 (GLRaV-3), belonging to the genus Ampelovirus, was detected in plants of ´Zhemchuzhny Rozsyp´ cultivar (Mishchenko et al., 2022). In 2021-2022, plants were tested for grapevine fanleaf virus (GFLV), GLRaV-1 and GLRaV-3 by DAS-ELISA. In 2023, the cultivars ´Zhemchuzhna Rozsyp´ and ´Yukon´ contained GLRaV-1 antigens. Real-time PCR showed the absence of phytoplasmas in all tested peony varieties. In 2024, seven peony cultivars with similar

symptoms were again selected: ´Mr. G.F. Hemerik´, ´Sonoma YeDo´, ´Mary Eddy Jones´, ´Judy Anne´, ´Edwin C. Bills´, ´Mrs. Wilder Buncroft´, ´Lorelei´, ´Skarbnytsia´. The ´Mrs. Wilder Buncroft´ showed specific rings characteristic of viral infection.

In 2024 even new DAS-ELISA test systems were used for various viruses (GLRaV-7, tobacco necrosis virus, tobacco rattle virus (TRV), prunus necrotic ringspot virus, tobacco ringspot virus, tomato blackring virus, raspberry ringspot virus) that we had not previously used for virus diagnostic in peonies. The results showed the presence of GLRaV-1 and TRV in ´Mrs. Wilder Buncroft´. GLRaV-7 and PNRSV were detected in ´Zhemchuzhny Rozsyp´ samples in 2021. PNRSV also affects peonies and grapevine. PNRSV also affects peonies ´Rashoomon´ and ´Judy Anne´. In 2025, 9 cultivars were selected, and in 2026, 7. One of the varieties ´Henry Sass´is shown in Fig. 1.



Fig. 1. *Peony plants var. Henry Sass, with symptoms of viral diseases (**a**), healthy, control (**b**), May 12, 2026, Kyiv*

RT-PCR results in 2026 showed the absence of GLRaV-3, TRV, GFLV in the cultivars ´Henry Sass´ and ´Elsa Sass´. Affected plants are removed; however, the disease spreads in subsequent years. Using DAS-ELISA, we continue to detect other viruses that have not been described by anyone before in peonies. Therefore, the HTS method is extremely necessary for accurate diagnosis of the disease and development of measures to protect peonies.

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Keywords: *peonies, medicinal plants, DAS-ELISA, RT-PCR, new phytoviruses.*

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BIOCHEMICAL RESPONSES TO ABIOTIC ENVIRONMENTAL FACTORS IN CORN

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Corn (*Zea mays* L.) is a staple food crop. Drought and hyperthermia emerge as the main limiting environmental factors for production of corn in many soil and climatic zones of world. Response of the plants to drought and high temperature is very complex and includes interaction between various molecular, physiological and biochemical processes. It has been shown that abscisic acid, components of ROS homeostasis, osmoprotectors and protective proteins contribute to biochemical processes of plant resilience under abiotic stress (Josep et al., 2026). The goal of our research is to characterize protective reactions in corn genotypes in response to water deficit and heat shock with the aim to identify biochemical traits of drought tolerance.

Three-day seedling of corn lines with different levels of drought tolerance were used in the research. They were let germinate on filter paper on a germination chamber at 25ºC at relative humidity 60%. Water deficit was created by placing the seedlings in the chamber with relative humidity 35-40%. Heat shock was created by placing the seedlings in the germination chamber at 37ºC. Stress factors were applied for 6 hours. We measured biochemical adaptive responses using spectrophotometry, protein electrophoresis, hemagglutination of trypsinized erythrocytes, gas chromatography. Data processing was performed using Prism Graph 8.

The changes in the content of lipid peroxidation products, reduced glutathione, activity of soluble lectins, sucrose-phosphate synthase and content of abscisic acid, sucrose under conditions of water deficit, hyperthermia and their combined effect have been established in the seedlings of the corn lines with different drought tolerance. Activation of soluble lectins (1.6- to 2.8-fold), sucrose-phosphate synthase (1.4- to 2.2-fold), accumulation of abscisic acid (1.3- to 3.2-fold), reduced glutathione (2.1-fold) and sucrose (1.3- to 2.3-fold) under water deficit and heat shock compared to the control in the seedlings of drought tolerant lines and reduce these characteristics in the seedlings of non-drought tolerant lines were shown. These findings can be used to select drought-tolerant corn genotypes and implement them in breeding programs to create lines and hybrids with improved drought resilience.

Keywords: *corn, drought tolerance, biochemical adaptive responses*

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TRAINING AND PRUNING OF SWEET CHERRY ON GISELA 6 ROOTSTOCK

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To establish an optimal technological system in the Central zone of the Republic of Moldova by evaluating the interaction between cultivar, training systems, and pruning methods to maximize productivity and fruit quality.

Methods: The study was conducted during 2025–2026 at "Prodcar" LLC, Telenești, on two experimental sectors: Sector I (16 years old): *Ferovia* and *Skeena* cultivars (4x2 m), testing 4 training systems and 4 pruning variants (manual vs. mechanized).

Sector II (8 years old): *Folfer*, *Ferdouce*, *Royal Helen*, *Grace Star*, and *Samba* cultivars (4x1 m), comparing the *Slender Spindle* and *Marchand Flag* systems.

Automated weather stations, drip irrigation, and *Watermark* sensors were used for soil moisture monitoring.

Results: At 16 years of age, average tree height ranged from 321.9 cm (*Unstacked Palmette*) to 359.9 cm (*Slender Spindle*). The *Skeena* cultivar showed higher vigor (342.2 cm) compared to *Ferovia*. In the 4x2 m system, the *Unstacked Palmette* favored the greatest lateral expansion (265 cm), forming a continuous fruiting wall. In the super-intensive system (4x1 m), the *Marchand Flag* provided superior width control (219.7 cm) compared to the *Slender Spindle* (246.4 cm). Strictly mechanized pruning (V2) induced dense growth at the periphery. The optimal variant identified is V3 (bilateral mechanized pruning supplemented by manual thinning), which ensures width control (233.4 cm) and light penetration.

Conclusions:

1. The **Gisela 6** rootstock ensures a compact habit and excellent adaptability for modern systems.
2. For high densities (4x1 m), the **Marchand Flag** system is recommended due to its efficient use of lateral space.
3. The **Samba** cultivar stands out for its physiological balance, being the most suitable for super-intensive densities.
4. At an H/W ratio = 1 (4 m height at 4 m row distance), contour pruning is imperative to prevent the loss of fruiting wood at the base of the canopy.

Keywords: *Sweet cherry, Gisela 6, pruning system, canopy parameters.*

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ACHIEVEMENTS IN THE EARLY MAIZE BREEDING

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Progress in hybrids development is based on the creation of new inbred lines, that have valuable agronomic traits, including general combining ability (GCA). Actual methodology of inbreeds development is characterized by a more careful selection of elite germplasm involved into breeding initial material. The previous investigations have shown a better adaptation in our area of germplasm from alternative heterotic groups Reid Iodent, BSSS-B37 and Euroflint. Germplasm of Lancaster heterotic group is frequently affected by combining heat and drought stress. In the last 5 years the operational collection of inbred lines included 14-16 commercial inbreeds and 43-75 new inbreeds, selected for GCA. These inbreeds are classified into germplasm groups, with a mean of 55,5% of Iodent, 22,9% - Euroflint, 11,6% - BSSS-B37, 7,6% - Lancaster and 2,4% of Dent mixt. As breeding start sources are used single crosses, related crosses and one-backcross (BC_1) populations. The last results indicated that BC_1 population were superior for derivation of the new improved inbreeds. Phenotypic selection on an ear - row basis during generations of inbreeding decreases the number of families S_4-S_6 for late testing of GCA. Selection for higher grain yield and saleable seed size are favored for female parents and selection for stay green plants resulted in a stalk lodging resistance and longer filling period. Annually for evaluation of GCA, are selected the best S_4-S_6 families crossed with 3-6 testers from alternative heterotic groups. The families with higher GCA are transferred into operational collection for multiplication and testing for agronomic traits per se. New inbreeds are included in backcrossing procedure for cms M sterility conversion. Transformation to pollen fertility restauration (Rf) occurs later after identification of best hybrids. The main practical results are the development of 36 inbreeds used as parents of registered hybrids FAO 160-310. An essential modification of breeding strategy was transition to single and single modificated hybrids realized in heterotic patterns Iodent x Euroflint and Iodent x BSSS-B37. Our studies determined a new heterotic pattern BSSS-B37 x Euroiflint for development of hybrids FAO 170-200 destined for cooler areas. At present for export in R. Belarus are registered 11 hybrids FAO 170-240 and in Moldova are commercialized Porumbeni 305, Porumbeni 310 and recently registered Porumbeni 315.

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Key words: *early maize, inbred lines, hybrids.*

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PHYTOPATHOLOGICAL EVALUATION OF THE BRASSICA RAPA L. VIR COLLECTION FOR RESISTANCE TO RACE 5 OF BLACK ROT

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Brassica rapa L. crops play an important role in global agrobiodiversity, demonstrating high plasticity that allows them to adapt to various climatic zones from subtropical to temperate regions. This species serves as a valuable model for physiological and genetic experiments due to its short life cycle, high genetic diversity, and sequenced genome that allows researchers to study the mechanisms of plant functioning, including pathogen resistance.

Black rot, caused by the phytopathogenic bacterium *Xanthomonas campestris* pv. *campestris* (Pammel) Dowson, is one of the most destructive diseases for the species, capable of causing up to 50-90% yield loss in epiphytotic years. The pathogen enters through hydathodes or mechanical damage to the leaves, colonizes the xylem, and causes a characteristic blackening of the vascular system, leading to rapid wilting, dwarfism, and death of young plants. The infection is particularly dangerous in conditions of high humidity and temperature, where the bacterium spreads through rain drops, irrigation water, and infected seeds, remaining viable in crop residue for up to 2-3 years. The rapid spread of the pathogen in regions with intensive vegetable farming, also due to global climate warming, requires serious control and breeding of resistant cultivars. The expansion of the race 5, which has a potentially high virulence, in recent decades in countries of Asia, Europe, and North America, requires screening of the global gene pool of the species to find new sources of resistance.

The aim of the study: phytopathological evaluation of the VIR global collection and identification of sources of resistance to the race 5 (strain B-36) and complex resistance of the black rot *Xanthomonas campestris* pv. *campestris* among the accessions of the *Brassica rapa* L. vegetable crop collection.

The material of the study included 44 accessions: Chinese cabbage - 18, pak-choi - 6, tacai - 5, mizuna - 3, leaf turnip - 3, root turnip - 8 and 1 stable hybrid between the subspecies. These accessions have already been used in our previous studies and have shown resistance to races 1, 3, 4, and 6. Artificial infection of plants with the race 5 was carried out in 2026 in laboratory conditions using the method of A.N. Ignatov (2011) on a 4-point scale (0-3 points). The experiment was replicated three times, with 6 plants in each replication.

As a result of the studies, 28 accessions highly resistant to race 5 were identified (damage score up to 1). Mizuna accession Shirojuki Sensuji Kyo Mizuna (k-434, Japan) showed the lowest damage score (0,24±0,09 points). It has previously shown resistance to races 1, 3, 4, and 6, indicating its potential for complex resistance to the main black rot races. Raioh 90 F1 accession of Chinese cabbage (vr.k-1558, Japan)

also stood out, demonstrating resistance to all studied pathogen races, with 0,63±0,13 points for the race 5. The selected resistant accessions are recommended for inclusion in breeding programs aimed at creating cultivars and hybrids of *Brassica rapa* L. crops that are tolerant to black rot.

Acknowledgments: The research is carried out by the state assignment topic number FGEM-2022-0003 «World resources of vegetable and cucurbits crops of the VIR collection: effective ways to reveal the ecological and genetic regularities of formation of diversity of use of breeding potential».

Keywords*: Brassica rapa L., genetic diversity, breeding value, black rot Xanthomonas campestris.*

UDC: 633.34:631.816:631.559(477)

TECHNOLOGY OF GROWING MODERN SOYBEAN VARIETIES IN THE CONDITIONS OF THE WESTERN FOREST-STEP OF UKRAINE

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The aim of the study: To develop a technology for growing soybeans based on optimizing the varietal composition and complex fertilizers in the conditions of the Western Forest-Steppe.

Research methods: In the process of carrying out the work, general scientific and special research methods were used. Field - carried out on a specially designated area for at least 3 years with mandatory recording of the harvest; *Visual* - observation of phenological phases of growth and development of soybean plants; *Laboratory* - study of cultivated plants and their growing conditions in specially equipped laboratories; *Mathematical and statistical* - to assess the reliability of research results; *Calculation and comparative* - to determine the economic efficiency of cultivation technologies.

As a result of the research, productivity indicators of soybean varieties of different maturity groups in the conditions of the Western Forest-Steppe were established, which will ensure the maximum possible realization of their biological potential for the conditions of the region. After studying the effect of pre-sowing seed treatment with inoculant, growth stimulants, and complex fertilizer on the productivity of varieties, it was found that the highest plant survival during the growing season for the Kobuko variety – 86,90 %, Titan – 87,2 % was observed with seed treatment with Rizoline + Gumifrend (2,0 l/t + 0,5 l/t).

The highest number of raw tubers on the plant and their mass per unit area were recorded in the bean formation phase with the application of pre-sowing seed treatment Rizoline + Gumifrend (2,0 l/t + 0,5 l/t). For the Kobuko variety, these indicators were 1010,5 pcs./m^2 and 10,7 g., Titan – 1094,5 pcs./m^2.

According to the results of studies on the impact of inoculation and fertilization on the productivity of soybean varieties, the highest indicators of crop structure elements were formed in the soybean varieties Titan and Kobuko with combined pre-sowing seed treatment with Rizoline + Gumifrend (2,0 l/t + 0,5 l/t), where the number of beans per plant was 26,0 and 18,0 pcs., the number of grains in a bean was 2,4 and 2,0 pcs., the weight of 1000 grains was 152,6 and 166,8 grams, respectively.

The highest soybean grain yield was obtained in the Titan variety – 3,76 t/ha and 3,41 t/ha in the Kobuko variety with pre-sowing seed inoculation and treatment with Rizoline + Gumifrend complex fertilizer (2,0 l/t + 0,5 l/t).

Keywords: *soybean, variety, growth stimulant, inoculant, productivity.*

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SUNFLOWER TOLERANCE TO ABIOTIC AND BIOTIC FACTORS INCREASED BY USING WILD SPECIES

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Sunflower is one of most cultivated plant over the world. In the breeding programs there are important objectives, taking into consideration the seed market request, which is very much diversified, for this crop. With ongoing climate change, sunflower as a spring - sown crop, could be more exposed to heat stress at anthesis or during grain filling, resulting in severe yield losses. Climate changes characterized by higher temperatures, extreme climatic hazards and low water for agriculture determine the extension of the areas affected by drought.

Sunflower is considered to be moderately resistant to drought, but in hot conditions, the plants suffer reduction in fertility, yield performance and quality of products. For sunflower it is very important to increase the cold resistance in early development stages, at stage of germination, emergence and the stage of 2-3 leaves, in order to facilitate an early sowing, as well as resistance to high temperatures in flowering time.

Sunflower diseases represent one of the most serious constraints in sunflower crop in Romania. The pathogens attack is frequently severe and yield losses can reach up to 50 – 70 %. In the last years, climate change has an influence on the development of the pathogens, also on the host/pathogens interaction. Some changes occur between pathogenic races, some pathogens increase their attack, according with their thermal preferences

Wild *Helianthus* species are a very valuable source of resistance in increasing drought tolerance/resistance, tolerance to extreme temperatures as well as to some important diseases. In our research work we have used different interspecific hybrids between wild *Helianthus* and cultivated sunflower, creating valuable sources for tolerance/resistance to some of these abiotic or biotic factors. The sources can be used by breeders in the sunflower breeding programs.

Keywords*: sunflower, wild species, drought, extreme temperatures, diseases.*

UDC: 634.51:631.529:631.559

AGROBIOLOGICAL EVALUATION OF INTRODUCED WALNUT VARIETIES IN CENTRAL MOLDOVA

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Research Aim: To evaluate the biological and productive performance of foreign protandrous cultivars compared to the local *Cazacu* variety, determining their suitability for industrial production.

Methods: The study was conducted between 2023–2025 in Criuleni district, on a plantation established in 2007 (10x10 m) under irrigation. The introduced cultivars Franquette, Fernor, Lara, and the control variety Cazacu were studied. The methodology included phenological observations, leaf analysis (macro and microelements), and pomological evaluations according to IPGRI and UPOV standards.

Results: The introduced cultivars (*Lara*, *Fernor*) demonstrated late bud break (April 18-24), avoiding spring frosts. *Franquette* stood out with female flowering delayed until May (May 4-5), exhibiting partial homogamy. The major advantage of the foreign cultivars was lateral bearing (40-50%), compared to only 5-10% for the local *Cazacu* variety. The highest yield was recorded for the Lara cultivar (13.0 kg/tree in 2023), followed by *Fernor* (11.0 kg/tree). In years with massive bacteriosis attacks (2024), productivity decreased by 30-50%, highlighting the importance of phytosanitary protection. Average nut weight ranged from 10-14 g, with a kernel yield of 41-49% for French cultivars and up to 55% for *Cazacu*. The *Lara* kernel was distinguished by its white color and superior organoleptic qualities. Leaf analysis confirmed a good overall nutritional status, though slight deficiencies in Potassium (0.93%) and Zinc (11.5 mg/kg) were observed, indicating the need for optimized fertilization.

Conclusions:

1. French protandrous cultivars show excellent adaptability in Moldova, avoiding climatic risks through late flowering.
2. Superior productivity (up to 50% higher than the control variety) recommends *Lara* and *Fernor* for industrial plantations.
3. The lateral bearing habit and high commercial kernel quality meet the requirements of the international market.

Keywords: *Juglans regia, protandrous cultivars, lateral bearing, phenology, adaptability.*

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IMPACT OF THE GROWTH REGULATOR ON YIELD AND QUALITY OF SOUR CHERRIES FRUITS

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The aim of the research was to determine the effect of the product Pilarhance SL as a growth regulator in the crowns of sour cherry trees of the Erdi Botermo variety, to maintain a physiological balance between growth, fruiting, and obtaining consistent high-quality yields. In the control variant, tree crowns were sprayed with water. In the second and third variants, two treatments were carried out with the product Pilarhance SL at a dose of 0.8 and 1.3 l/ha. The first treatment was carried out at the end of the flowering period (25.04.2025), and the second during the period when the fruit color changed from green to yellow (12.05.2025). The studies were conducted under field and laboratory conditions according to the accepted methodology for conducting experiments with fruit crops and growth regulators.

The use of the growth regulator Pilarhance, SL, at doses of 0.8 l/ha and 1.3 l/ha increased the leaf area in these variants compared to the control. The minimum average length of annual growth was observed in the control variant (49.3 cm), and the most developed shoots were received in the variant Pilarhance, SL at a dose of 1.3 l/ha (55.2 cm). The highest percentage of fruit set (23.5%) was recorded in the variant treated with Pilarhance, SL at a dose of 1.3 l/ha, i.e., the increase was 2.1% compared to the control variant. The results obtained prove that in the variant treated with the growth regulator Pilarhance, SL at a dose of 1.3 l/ha, the proportion of fruit set in the crowns of trees and the number of fruits obtained were higher compared to the other experimental variants. In variant Pilarhance, SL at a dose of 1.3 l/ha, a significant increase in the number of fruits (780 pieces/tree) and their average weight (5.77 g) was recorded, which led to a significant increase in yield both per tree (4.5 kg) and per unit area (5.62 t/ha).

The effectiveness of using the growth regulator at a dose of 0.8 l/ha to stimulate growth processes and fruit development was insignificantly higher than the control variant, while with an increase in the dose to 1.3 l/ha, the studied indicator was much higher compared to the other tested variants. The greatest intensity of growth processes in the tree crown and sour cherry fruit development was recorded in the variant with Pilarhance, SL at a dose of 1.3 l/ha, treated twice by spraying. The first treatment should be carried out at the end of the flowering period, and the second during the period when the fruit color changes from green to yellow.

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Keywords: *growth, leaf area, production, setting.*

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CONSIDERATIONS REGARDING UTILIZATION OF MOLDOVAN APRICOTS FOR ORGANIC CULTURE

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The behaviour of Moldovan apricot varieties (Bucuria, Detskii, Kishiniovskii rannii, Codrean, Kostiujenskii, Raduga), were compared with introduced well adapted (Krasnosciokii, Vitillo, Sirena, Kyoto, etc,) and regionalized in central and south pomological local zones. The studies there are referred to the utilization of protection chemicals permitted in the frame of organic fruit production. The aim of the study was to determine the manifestation of the main biological and agronomical characteristics in the absence of irrigation and specific pedoclimatic conditions of country. The trees were grafted on the apricot (local seedlings) rootstock. The results indicate that the flowering period for the most of genotypes is approximately the same for local Moldovan varieties, that is the second and third decade of April. Local studied varieties are characterized genetic resistance to frost, fluctuations of winter and spring unfavorable temperatures. physiologic potential of equilibration of growth and fructification, especially high excitability of vegetative buds with the possibility of rehabilitation of crown after drastic manifestation of moniliosis. As well as there are determined high degrees (15-30%) of self fertility and interfertility of local varieties Bucuria, Detskii, Kishiniovskii rannii, Codrean, Kostiujenskii, being promoted for its cultivation during more than 30 years in the frame of main pomological zones of the Rep, Moldova. It should be noticed that Codrean variety there are characterized by fruits with firm flesh, having good capacities for transportation on long distances. The presence of fresh fruit of the researched local varieties on the market covers the period from June 10 to August 20. Studied varieties (Bucuria, Detskii, Kishiniovskii rannii, Codrean, Kostiujenskii, Raduga) were tested for different kind of processing, including juice, jam, gelly, compot. All of them were highly appreciated, especially for pleasant aroma and high preservation of nutraceutical compounds.

The results obtained in this study conduct to the conclusion of necessity to provide local resilient apricot varieties for industrial production of organic fruits (for fresh consumption as well as for processed ones).

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Keywords: *apricot, varieties, organic culture, Republic of Moldova.*

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ADVANCED METHODS FOR MONITORING DROUGHT AND HEAT IN AGRICULTURAL CROPS

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Climate change represents one of the major challenges affecting global agricultural productivity, mainly through the increasing frequency and intensity of abiotic stresses such as drought, heat stress, and frost. These environmental constraints significantly influence plant growth, physiological performance, metabolic activity, and crop yield stability. Consequently, the development of modern and precise methods for detecting, monitoring, and quantifying abiotic stress responses in crop plants has become a priority in agricultural research and plant phenotyping.

Recent advances in plant science have shifted stress evaluation from conventional visual assessments toward high-throughput, non-destructive, and sensor-based technologies. Modern approaches integrate physiological, biochemical, molecular, and imaging techniques to identify early stress symptoms before irreversible damage becomes visible. Among these technologies, infrared thermography has emerged as an effective tool for drought and heat stress detection by measuring canopy temperature variations associated with stomatal closure and reduced transpiration.Hyperspectral and multispectral imaging systems are increasingly applied for stress characterization because they provide detailed information regarding leaf reflectance, chlorophyll degradation, water content, and photosynthetic efficiency. Vegetation indices such as the Normalized Difference Vegetation Index (NDVI), Photochemical Reflectance Index (PRI), and Water Index (WI) are widely used for monitoring crop health under environmental stress conditions. These imaging technologies allow early diagnosis of physiological disturbances before visible symptoms appear, making them highly valuable in precision agriculture and breeding programs.

Chlorophyll fluorescence analysis has also become an essential method for evaluating heat-induced damage to the photosynthetic apparatus, particularly Photosystem II. Advanced phenotyping platforms incorporating RGB imaging, LiDAR sensors, and artificial intelligence algorithms provide automated quantification of morphological traits including leaf rolling, wilting, canopy architecture, and biomass accumulation.

Emerging technologies such as wearable plant sensors, nanobiosensors, Internet of Things (IoT)-based monitoring systems, and digital twin crop models are transforming modern stress phenotyping. These tools enable real-time monitoring of physiological parameters and support predictive agricultural management strategies under changing climatic conditions.

Overall, the integration of high-throughput phenotyping, remote sensing, molecular biology, and artificial intelligence offers new opportunities for improving stress detection accuracy and accelerating the development of climate-resilient crop varieties.

Keywords: *abiotic stress, climate change, infrared thermography, multispectral imaging systems.*

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THE IMPACT OF PHYTOMETRIC INDICES ON APPLE PRODUCTION (M9) AT MATURITY

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Scopul lucrării: Studiul vizează evaluarea parametrilor biostructurali ai coroanei și a potențialului de regenerare pentru un sortiment de 9 soiuri de măr altoite pe portaltoiul M9 (Champion, Florina, Gloster, Golden Delicious, Granny Smith, Idared, Pinova, Renet Simirenco, Sir Prize). Cercetarea fundamentează implementarea tehnologiei tăierilor mecanizate de contur pentru optimizarea producției industriale în plantațiile mature (21 de ani) din zona de Sud-Est a Republicii Moldova.

Metode: Cercetările au fost efectuate în anul 2025, în localitatea Saiți, Căușeni, într-o plantație înființată în 2005 (densitate 2083 pomi/ha, formă de conducere palmetă neetajată). S-au efectuat măsurători biometrice (înălțime, lățime, volumul coroanei) și s-au stabilit 5 variante experimentale de tăiere, de la martorul tăiat manual (V1) la diferite scheme de tăiere mecanizată de contur, anuală sau alternativă, cu sau fără corecții manuale (V2-V5).

Rezultate: Analiza creșterilor anuale relevă o tendință de creștere vegetativă activă la vârful pomilor, cu o lungime medie a ramurilor de 17,5 cm în etajul superior (3 m). Soiurile Granny Smith (313,6 cm) și Renet Simirenco (310,7 cm) au prezentat cea mai mare vigoare, depășind parametrii optimi de înălțime și ocupare a solului (peste 63%). În schimb, soiurile Champion și Idared au înregistrat cele mai reduse volume ale coroanei (cca. 7700 m³/ha). S-a constatat că volumul maxim de regenerare și biomasă este concentrat în zona mediană (2 m), unde lungimea însumată a ramurilor a atins media de 8,9 m.

Concluzii: La vârsta de 21 de ani, utilizarea tăierilor mecanizate de contur devine indispensabilă pentru menținerea viabilității economice a livezii. Sistemul combinat (V3 - tăiere mecanizată plus corecție manuală) este recomandat pentru echilibrarea coroanei, în timp ce tăierea alternativă (V4) este indicată pentru soiurile viguroase (Granny Smith, Renet Simirenco) pentru a preveni auto-umbrirea și a stimula regenerarea lemnului de rod necesar procesării industriale.

***Keywords**: malus domestica, M9 rootstock, mechanized pruning, biometrics, regeneration.*

UDC: 635.21:632.4:551.583(477)

CLIMATE PATTERNS AND VARIABILITY OF POTATO TUBER DISEASES IN POLISSIA, UKRAINE

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Establishing the relationship between climatic factors and interannual variability of potato tuber diseases is crucial under climate change conditions. The research covers 2016–2025 (n=611; 50–78 genotypes annually); assessment was conducted based on visual symptoms after 1.5 months of storage. Diseases caused by soilborne pathogens (Rhizoctonia spp., Streptomyces spp., Fusarium spp.) and physiological disorders (secondary growth, tuber cracking, internal rust spot, hollow heart) were analyzed. Climate indicators (temperature, precipitation, HTC, GWET, VPD) were evaluated monthly (May–August); Kruskal-Wallis test, Dunn's test, and Spearman's rank correlation ($p \leq 0.05$–0.001) were applied. Pronounced interannual variability was observed for all diseases ($p < 0.001$), with the largest effects for black scurf ($\eta^2 = 0.42$) and common scab ($\eta^2 = 0.28$). Mean prevalence values ranged as follows: black scurf – 0.5–31.5%, common scab – 0.9–25.0%, fusarium rot – 8.1–21.9%, internal rust spot – 0–21.8%, secondary growth – 0.8–12.0%, hollow heart – 0–10.8%, tuber cracking – 0.1–4.5%; maximum values of individual genotypes reached 72–96%, reflecting high within-year heterogeneity of the genotype pool. The nature of correlations depended on the scale of weather data aggregation: seasonal indicators formed predominantly weak relationships ($|r_s| < 0.65$), whereas monthly analysis revealed distinct climate patterns. Secondary growth demonstrated the highest sensitivity: strong positive correlations were established with July temperature ($r_s = +0.81$; $p \leq 0.01$) and number of days with T_max>30°C ($r_s = +0.78$; $p \leq 0.01$). For tuber cracking, the August moisture regime was the key determinant: precipitation and HTC correlated negatively ($r_s = -0.72$; $p \leq 0.05$), indicating the role of moisture deficit. For diseases caused by soilborne pathogens, stable statistically significant correlations were not detected, suggesting a greater contribution of genotypic composition and soil conditions. Thus, tuber disease variability is predominantly associated with weather conditions during critical vegetation periods (July–August) rather than average seasonal indicators. Physiological disorders exhibit more pronounced climate determination compared to diseases of biotic origin, which should be considered when evaluating genotype resistance and predicting the phytosanitary status of planting material.

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Keywords: *potato, tuber diseases, climatic factors, interannual variability, Polissia.*

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SNP-BASED ASSESSMENT OF GENETIC DIVERSITY AND BREEDING RESOURCE IN FIG GERMPLASM

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The fig (*Ficus carica* L.), one of the earliest domesticated plants with a chromosome number of 2n = 2x = 26, exhibits taxonomic variability due to its morphological diversity. The aim of the study is to characterize SNP-based genetic relationships among local and introduced varieties and clarify the taxonomic status of wild Hyrcanian figs in order to support conservation, and breeding activities. A total of 35 cultivated and 15 wild fig accessions were resequenced for the first time using short-insert paired-end libraries on an Illumina HiSeq X Ten platform (Wuhan, China) with a read length of 2 × 150 bp. Analysis detected 4,818,956 reliable SNPs throughout the fig genome. SNPs were unevenly distributed across the 13 chromosomes, with the highest numbers detected on chromosomes 3, 2, 13, and 5, corresponding to 634,469; 455,687; 372,510; and 368,627 SNPs, respectively. The highest SNP densities were observed on chromosomes 2 (1/82.8 bp), 1 (1/80.5 bp), and 13 (1/79.4 bp), whereas the lowest (1/69.0 bp) were recorded on chromosomes 5 and 12. Pairwise genetic distances (GD) ranged 0.148–0.54 (mean 0.436). The highest GD was between local forms Renaz and Form 22, while the lowest occurred between introduced varieties Chapla and Dalmatie. Cluster analysis using DARwin software grouped genotypes into three clusters, clearly distinguishing wild genotypes from cultivated ones. The first cluster comprised 33 of 35 cultivated accessions along with two (H2 and H12) wild genotypes. The second cluster included all remaining wild genotypes, while the third comprised the cultivated accessions Ganja-3 and Form#22 (GD = 0.33). The results confirm that wild Hyrcanian taxa form an isolated gene pool, a source of underutilized genetic diversity, while ongoing gene flow with cultivated genotypes occurs. Low distances among cultivated genotypes highlight their relatively narrow genetic base and underscore the need for breeding activities to broaden it.

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Keywords: *resequence, Ficus carica, genetic distance, SNP, cluster*.

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ISSR MARKER-BASED GENETIC DIVERSITY ANALYSIS OF CULTIVATED BARLEY (HORDEUM VULGARE L.) GENOTYPES CONDUCTED IN AZERBAIJAN

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Barley is the fourth most important cereal crop in the world after wheat, maize, and rice in terms of cultivation scale and production volume, and it is included among the top ten major cereal crops worldwide. Its grains are widely used in various production sectors, including cereal farming and brewing industries as raw material, as animal feed in livestock farming, and as groats in the food industry. Barley is a highly demanded crop and, at the same time, a valuable and economically efficient plant. The object of the research consists of 63 cultivated barley samples collected during expeditions in previous years and obtained from the Genebank located under the Genetic Resources Institute. These samples were cultivated in three replications on the institute's experimental field during 2021–2024, and phenological observations were carried out. In this study, the genetic diversity of 63 cultivated barley samples grown under the climatic conditions of Azerbaijan was analyzed and statistically evaluated using ISSR markers. Among the selected samples, there were both local varieties and introduced genotypes. Genomic DNA was extracted from barley samples according to the CTAB (cetyltrimethylammonium bromide) protocol proposed by Doyle & Doyle. The concentration and purity level of the extracted DNA were determined for PCR analysis. The current research was conducted with 3 ISSR primers (UBC 808, UBC 810, UBC 818). During the study, 21 loci were obtained, 17 of them were polymorphic. The highest level of polymorphism was detected with primer UBC 810 (85.7%). In this study, the genetic diversity index (GDI) was calculated for each ISSR locus. The highest genetic diversity index was obtained with primer UBC 810 (GDI = 0.79). While, another primer- UBC 808 has showed moderate value (GDI = 0.62), the lowest value was recorded for primer UBC 818 (GDI = 0.43). In addition, statistical parameters such as PIC, EMR, MI, and RP were calculated in this study. The polymorphism information content (PIC) ranged from 0.18 to 0.24. The highest value was obtained for primer UBC 810. The EMR and MI values varied within the ranges of 4.17 (UBC 818) to 5.14 (UBC 810) and 0.77 (UBC 818) to 1.21 (UBC 810), respectively, with average values of 4.6 and 0.93. The resolving power (RP) value ranged from 1.1 to 1.96, with an average value of 1.45. The highest value was recorded for primer UBC 810 (1.96).Thus, the study showed that primer UBC 810 is more informative for assessing the genetic diversity of barley genotypes.

UDC: 633.15:631.541.11:632.111.5

POLLEN FERTILITY AS A RAPID INDICATOR OF HEAT STRESS TOLERANCE IN MAIZE

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Heat stress during flowering is one of the major factors limiting maize productivity under climate change conditions. The objective of this study was to evaluate the possibility of using pollen fertility as a rapid indicator of thermotolerance in maize germplasm.

A total of 348 maize genotypes, including 261 inbred lines and 87 hybrids, were analyzed under controlled heat stress conditions. Pollen samples collected during anthesis were exposed to +40°C for 10 minutes. Viability assessment was performed using acetocarmine staining and microscopic evaluation.

The obtained results demonstrated high sensitivity of maize pollen to elevated temperatures. More than 90% of the analyzed genotypes exhibited complete sterility after stress treatment. Only 8.9% of genotypes retained partial pollen fertility, indicating the presence of genetic variability in thermotolerance. Hybrids showed slightly higher tolerance compared to inbred lines, suggesting a possible contribution of heterosis to stress resilience. The proposed pollen-based method proved to be rapid, informative, and suitable for large-scale screening of maize breeding material. The results confirm the practical significance of pollen fertility analysis for identifying heat-tolerant maize genotypes and supporting breeding programs aimed at developing climate-resilient hybrids.

Keywords: *maize, heat stress, pollen fertility, thermotolerance, germplasm screening.*

UDC: 633.112.1:631.527.5:631.559

IDENTIFICATION AND SELECTION OF NEW FORMS OF WINTER DURUM OF AUTUMN

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One of the basic problems in the development of current agriculture is the increase in grain production. Solving this problem would ensure in the future the amount of grain sufficient to ensure food security in the conditions of climate change. Among the crops that can increase the yield of grain production, along with corn and common wheat, one can also name the winter durum wheat crop with a modest share.

As a result of studying the interspecific hybrid combinations in the hybrid and selection fields, the best ones were evaluated and crossed with the varieties created by us to increase their grain quality and resistance to unfavorable environmental conditions. As a result of intraspecific hybridizations, 28 winter durum wheat hybrids were obtained with a binding percentage that varied within the limits of 3.53 - 76.47%. Research conducted on the behavior of intraspecific hybrids has shown that in F1 hybrids, they outperform their parents in all traits: plant height, number of siblings, number of spikelets per spike and spike length. The percentage of variability is high in the number of grains per spike and the weight of grains per spike. The lowest is in the length of the spike.

Analysis of the productivity traits of F2 hybrids has revealed a high variability in terms of the weight of grains per spike, which offers possibilities for selecting genotypes of interest. Calculation of the correlation coefficient has demonstrated the lack of significant dependence between the length of the spike and the number of spikelets, between the number of spikelets per spike and the number of grains per spike in most hybrids.We see a strong dependence on the number of grains per spike and the weight of the grains in the hybrids 804-08, 822-26 and 751-55, an average value is found for the length of the spike, the number of grains and their weight in the hybrids 822-26, 810-15. Their use in hybrid breeding will allow the creation of effective combinations with a shorter selection period and a smaller volume of study material. As a result of testing in the selection field, 20 lines with short stature, resistant to wintering, diseases, falling, drought and with a higher productivity than the control variety were found, they were sown in the control field next year.

This year, the yield of the lines in the control field ranged from 1.8 to 4.4 t/ha. The yield of the control variety was 2.6 t/ha. 5 lines with high drought resistance were selected and of course proved to be the most productive. In comparative competition crops, 2 lines exceeded the control variety by 0.7 t/ha (Balada / Hordeiforme 335, and by 1.08 t/ha Balada x Hordeiforme 335).

Acknowledgements: The research was carried out within the Subprogram 011102 Extension and conservation of genetic diversity, improvement of gene pools of agricultural crops in the context of climate change.

Keywords: *durum wheat, breeding, hybridizations, hybrids, variability.*

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INNOVATIVE MECHANISMS FOR PRESERVING POTATO SEED MATERIAL QUALITY

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The objective of the study was to improve and manufacture potato sorting and bagging mechanisms to reduce tuber damage and improve seed material quality.

Based on analysis of previous research data on improving potato sorting and bagging mechanisms, a detailed plan for further work was developed with the main task points: Definition of the machine – designed for potato sorting and bagging; Operating conditions: calculations for operation under specific agroclimatic conditions, consideration of varietal characteristics; Functional indicators: productivity, efficiency; Technical and operational requirements: reliability, energy efficiency; Economic requirements: profitability, quick payback.

A potato tuber mass flow retarder prototype meeting all requirements for sorting and bagging operations was developed and manufactured.

It was established that using the potato tuber mass flow retarder during sorting and bagging reduced tuber damage by 16.8–21.2%, a significant factor in preserving the planting and consumer qualities of tubers and their marketable appearance.

In 2025, the manufactured prototype of the potato tuber mass flow retarder was tested under production conditions, and it was established that its application during potato sorting and bagging, both manually (by buckets) and using the sorting station conveyor, reduced tuber damage by 14.5–22.6%.

Quality assessment of tubers was conducted according to agrotechnical requirements that account for the significance of the crop's physical and mechanical properties to ensure the mechanism's operation complies with them. A technological protocol for using the potato tuber mass retarder was developed and implemented.

Keywords: *mechanization, potato, technology elements, working components, quality.*

UDC: 633.854.78:632.4:577.152.1

STUDY OF PEROXIDASES AND SUPEROXIDE DISMUTASES UNDER THE ACTION OF PATHOGENIC FUNGI IN SUNFLOWER

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The aim of the study was to investigate SOD and PO activity in three sunflower hybrids subjected to biotic stress. In addition, the electrophoretic spectra of SOD and PO isoenzymes, which change during the creation of biotic stress, were studied.

Four pathogenic fungal suspensions were used: Alternaria alternata, Rhizopus arrhizus, Fusarium oxysporum, and Aspergillus niger. Three local hybrids, designated H1, H2, and H3, were used for the study. A fungal suspension (106 spores/ml) was used to infect seeds planted in pots. The germination chamber was maintained at a temperature +25°C; the photoperiodic regime was set to 14/10 hours (light/dark). To obtain the enzyme extract, 10 mM Tris-HCl buffer, pH 7.8, with the addition of 0.1 mM EDTA was used. Peroxidase activity was measured using a benzidine reagent reaction. Superoxide dismutase (SOD) activity was determined by the degree of inhibition of photochemical NBT reduction. Electrophoretic profiles of SOD and POX isoenzymes were obtained using native PAGE. The concentration of the separating gel was 9% AA, and the concentration of the stacking gel was 4%.

When comparing the activities of the two main enzymes under biotic stress conditions, it was found that the level of PO activity increased to a higher degree than the level of SOD activity in all genotypes. A study of the total PO activity in plant leaves revealed that the H2 genotype responds to all pathogen variants with a sharp increase in activity (4.4-10 times). A study of the isoenzyme composition of peroxidases in leaves showed the presence of 6 isoforms. In the H2 genotype, under biotic stress, the number of four isoforms increased, but the maximum increase was shown by two of them. The synthesis of the PO 5 isoform (52.7 kDa) increased by 10-13 times, and the synthesis of the PO 6 zone (48.5 kDa) increased by 8-14 times.

Five isoenzymes were detected in the electrophoretic spectrum of SOD isoforms. The highest increase in SOD isoform levels under biotic stress was found in the H2 genotype. During biotic stress, one of the main isoforms, SOD1 (58 kDa), accumulates to a greater extent in all three genotypes. In the H2 genotype, the amount of this isoform increased by 80% to 480% across different fungal variants.

The highest increase in antioxidant activity, as well as increased synthesis of some POX isoenzymes, as well as SOD isoforms, induced by biotic stress, can serve as a marker of resistance of the H2 genotype to this type of stress.

Acknowledgments: This study was supported by the research project 011101 Genetic and biotechnological approaches to agroecosystem management under climate change, funded by Ministry of Education and Research.

***Keywords**: activity, isoenzymes, pathogenic fungi, sunflower hybrids, resistance.*

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THE RESPONSE OF *TRITICUM AESTIVUM IN VITRO* TO THE ACTION OF DIFFERENT STRESS FACTORS

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The impact of global climate change, accompanied by increasing water resource scarcity, involves a considerable loss of wheat yield, while pathogens have increased chances of developing virulent strains, thus generating a frequent incidence of combined stress. In vitro culture techniques minimize time and environmental conditions, investigations being focused on applying associated stress under controlled conditions. This study aims to evaluate the callus induction response in mature embryos to the separate and combined effects of drought factors and pathogens, the causative agents of root rot in common wheat.

The wheat genotypes M79/M5, M79/M5, a-, and MO/M79 were studied for the apical meristem response to the separate and combined effects of drought treatments (PEG 6000) and culture filtrate (*CF*) from three strains each of the fungi *Alternaria alternata* (*Aa*), *Drechslera sorokinian*a (*Ds*), and *Fusarium solani* (*Fs*). Both treatments were administered (10% and 20%) in Murashige-Scoug (MS) basal medium, which contained a complete set of macro- and microelements.

The excised apical meristem was placed in Petri dishes. The parameters callus induction frequency, % (*CIF*), callus area, mm^2 (*CA*), and callus fresh weight, mg (*CFW*) were recorded at 14 days of culture.

The separate application of PEG 6000 resulted in high tolerance for *CIF*, but varying degrees of susceptibility for the *CA* and *CFW* indices. In the case of the separate *FC* action, *CIF*, *CA*, and *CFW* recorded declines of up to 58.2%, 60.7%, and 51.4%. The *Aa*2, *Ds*1, and *Ds*3 isolates frequently reduced callus formation indices. The combined effect of biotic and abiotic stress factors resulted in a 52.3% and 58.4% reduction in *CIF* and *CA*, respectively, with high susceptibility observed in the *Fs* x PEG and *Ds* x PEG interactions.

Analysis of variance comparing the combined effect of stress factors with the separate effect of FC revealed i) a decrease in the contribution of the *Genotype* factor for *CIF* and *CA*, ii) an increase in the contribution of the *FC* factor for *CIF* and *CA*, and iii) a significant increase in *G* × *CF* interactions for *CFW* in the case of the agent pathogens *Aa* and *Ds*.

The tolerance level of the genotypes studied, calculated based on the percentage reduction in the *CIF*, *CA*, and *CFW* indices, showed that genotype M79/M5, a+ had the highest tolerance to both the separate action of *CF* and the combined *PEG+CF*.

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Keywords: *callus induction, common wheat, culture filtrate, drought stress.*

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PHYTOSANITARY SCREENING OF LOCAL POTATO GENOTYPES IN THE REPUBLIC OF MOLDOVA

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Potato (*Solanum tuberosum* L.) is a nutritionally and economically important crop in the Republic of Moldova, but its productivity is significantly affected by fungal phytopathogens, particularly species of the genera *Alternaria* and *Fusarium*. The identification of local potato genotypes with improved genetic resistance is beneficial for potential national breeding programmes.

This study included a molecular screening of five potato genotypes (four local genotypes: GM44, GM57, GM67, GM75; and the commercial cultivar Damaris, used as a control) to assess their phytosanitary status and the presence of resistance (*R*) genes against *Phytophthora infestans*.

DNA was extracted from leaves, tubers, and sprouts using the ISO 21571:2005 methodology. DNA quality, purity and quantity were verified by agarose gel electrophoresis and NanoDrop spectrophotometry. qPCR was used to detect and quantify the genetic material of the genera *Alternaria* and *Fusarium*, as well as the species *Alternaria alternata*, *Fusarium equiseti*, *Colletotrichum gloeosporioides*, and *Phytophthora infestans*. The presence of *R* genes was determined by conventional PCR using 12 primer pairs (including SCAR and SSR markers). qPCR results were statistically analysed using Student's t-test ($p < 0.05$).

At the foliar level, genotype GM57 accumulated significantly more genetic material from the *Alternaria* spp. genetic material compared to the control, while GM75 and GM67 showed a significantly lower pathogen load ($p < 0.05$). *A. alternata* was detected only in leaves and was absent in tubers, suggesting the involvement of another species. At the tuber level, all local genotypes accumulated significantly less *Alternaria* and *Fusarium* DNA compared to the control ($p < 0.05$). *F. equiseti*, *C. gloeosporioides*, and *P. infestans* were not detected in any sample. Screening of *R* genes revealed the presence of *R1*, *R3a*, *Rpi-phu1*, *Rpi-vnt1*, and *Rpi-blb3* genes in all local genotypes, while the control cultivar Damaris contained only *R1*, *R3a*, and *Rpi-phu1* genes. The *R3b* and *Rpi-Smira1* genes were absent in all genotypes.

Genotypes GM75 and GM67 demonstrated the lowest level of pathogen infection and a complex profile of resistance genes. Further testing through controlled infection assays and expansion of the *R* gene panel is recommended to determine if these genotypes can be used in potential national breeding programmes.

Keywords: *potato, R genes, Fusarium, Alternaria.*

UDC: 634.22:631.523:575.174.015.3(479.24)

MORPHOLOGICAL CHARACTERISTICS OF AZERBAIJANI WILD CHERRY PLUM (*PRUNUS CERASIFERA* EHRH.)

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This study investigated the genetic resources of *Prunus cerasifera* Ehrh., a widely distributed species in Azerbaijan, by evaluating its phenological and morphological diversity to identify promising genotypes for breeding programs. Azerbaijan's diverse flora, shaped by varied ecological and climatic conditions, provides valuable genetic resources for plant selection and hybridization. The plant material consisted of 100 in situ genotypes collected from different regions and evaluated at the Azerbaijan State Agrarian University. Due to ecological variation, fruits were harvested at full ripeness between July and September. Phenological observations began at shoot swelling, and morphological analysis was conducted using 10 fruits per genotype. A total of 38 traits related to tree, leaf, flower, and fruit characteristics were assessed. The results revealed substantial morphological diversity. Tree trunk diameter (12.0–16.9 cm; CV=24.8%) and tree height (740–970 cm; CV=25.5%) showed moderate variability, while canopy diameter was more stable (CV=6.4%). Leaf traits varied considerably, with a leaf shape index CV of 30.4% and color variability reaching 43.3%, indicating adaptive and genetic differences. Flower traits, particularly pedicel and flower axis length, also showed high variability (CV > 39%), reflecting diversity in reproductive structures. Fruit characteristics demonstrated significant variation, especially fruit skin color (CV=54.0%), highlighting strong genetic diversity and selection potential. Fruit weight ranged from 5.7 to 10.0 g (CV=22.2%), while fruit shape index was highly stable (CV=4.9%), suggesting strong genetic control. Correlation analysis revealed strong relationships between key traits, including tree height and trunk diameter (r=0.965), fruit weight and stone weight (r=0.991), and fruit weight and pulp weight (r=0.971). In contrast, vegetative traits showed weak correlations with fruit characteristics, indicating independent genetic control. Principal component analysis identified eight components explaining 79% of total variation. The first component (30.23%) was associated with fruit and stone size, while the second (14.66%) reflected vegetative traits. Cluster analysis grouped genotypes into four main clusters, with clusters G1 and D1 containing high-quality genotypes suitable for breeding. Overall, the study confirms high phenotypic diversity in *Prunus cerasifera*, emphasizing its importance as a genetic resource for breeding, conservation, and sustainable use.

Keywords: *Prunus cerasifera Ehrh., genetic resources, phenotypic variation.*

UDC: 635.65:631.523:632.111.52

DROUGHT TOLERANCE IN CHICKPEA AND ITS IMPLICATION FOR PLANT IMPROVEMENT

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Chickpea (*Cicer arietinum* L.) is one of the most valuable and widespread legume crops on the planet. It is grown on more than 15 million hectares, with an average yield exceeding 1 ton per hectare. Its main value lies in the high quality of food products made from its seeds. The United Nations considers this crop to be one of the most important for ensuring food security on our planet. Methods: Since 1995, our institute has tested more than 3,000 samples of chickpea that we received from the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT, Patancheru, India) and the National Center for Plant Genetic Resources of Ukraine (Kharkiv). Results: Based on the results obtained, a core collection has been established that is extensively used in hybridization. The earliest-maturing samples belong to the Iranian and Ethiopian groups. The growing season lasts only about 75 days for varieties such as RBH 99, RBH 121, NEC 2551, NEC 2537, LR 54-1, LR 57, P 9789, P 9815, C-156, RSW6-1, NEC 2630, and NEC 2587. Increased seed yield was observed in genotypes such as Donia, Pryvozny, NEC 2638, NEC 2234, P 2774HR, and P 9624, on plants of which more than 10 g of seeds were formed. NEC 2616, NEC 2630, NEC 2622, NEC 2152, Donia, and Privozny stand out for their increased number of pods. The variety samples Flip 85-13c, NEC 2616, L-532, NEC 2223, and LR 56 are characterized by an increased number of seeds per pod. The samples F 404, YG-60, SEL-544, and RSWS are quite important, as they produce two pods per node. NEC 2638, NEC 2149, NEC 2228, NEC 2234, P 9623, INIA 103, INIA 110, INIA 20, INIA 24, BG 1-06, and BG 1-392 stand out for their high 1,000-seed weight, which in some of the above-mentioned varieties exceeded 600 g. NEC 2554, P 386, CP60, P 2080, and Flip 85-13c had elevated protein content in their seeds. The most resistant to fusarium wilt were dark-seeded *desi*-type samples: NEC 2179, NEC 2212, NEC 2135, NEC 2185, NEC 2201 (from Iran), BEG-482, NO-55, F-370, F-404, NEGRO (from India), RBH 141, RBH 217, RBH 102 (from Bangladesh), and E 100 (from Greece). Among the *kabuli* type (with light seeds), Donia from Hungary, NEC 2183, NEC 2149 (from Iran), NEC 2596 and NEC 2607 (from Afghanistan), and the Rosanna variety stood out for their increased resistance or tolerance. The NEC 2212 accession deserves special attention, as it combines resistance to fusarium wilt with a valuable set of agronomic traits. Also attention should be paid to the ICRISAT-recommended accessions from the global collection: ISS 637, ISS 1205, ISS 12426, ISS 3362, ISS 5537, ISS 6279, ISS 12155, ISS 14402, ISS 14284, ISS 14815, and ISS 618. Conclusions: By using collection genotypes that excel in specific agronomic traits as parental lines in hybridization, our institute has developed 14 chickpea varieties. Most of them belong to the *kabuli* type and are characterized by high drought tolerance. In the varieties Antey, Triumf, Pegas, Budzhak, Odysey, Skarb, Dostatok, Maestro, Daria, and Tetyana, the weight of 1,000 seeds exceeds 400 g.

Keywords: *chickpea, drought tolerance, core collection.*

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TOWARD A COMMON FRAMEWORK FOR AGROFORESTRY BIODIVERSITY INFORMATION

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Agroforestry biodiversity data are generated through a wide range of monitoring activities, inventories, and research projects, often using different methodologies, classifications, and data formats. This heterogeneity limits data integration, comparability, and effective use in biodiversity assessment and conservation. The present paper explores the methodological requirements for developing a common framework to support the standardization and interoperability of agroforestry biodiversity information. A qualitative analysis of scientific literature and current biodiversity data management practices was conducted, focusing on metadata organization, data harmonization, and information exchange mechanisms. The analysis identified several challenges affecting data integration, including heterogeneous data structures, inconsistent metadata descriptions, limited compatibility among information systems, and the lack of common procedures for biodiversity data harmonization. The findings suggest that the adoption of standardized metadata schemes, shared terminology, harmonized biodiversity indicators, and interoperable data management practices could significantly improve data quality, accessibility, and reuse. Establishing a common methodological framework may facilitate collaboration among researchers and institutions, strengthen biodiversity monitoring activities, and support more effective conservation and management of agroforestry ecosystems.

Keywords: *agroforestry biodiversity; biodiversity information management; data standardization; interoperability; biodiversity conservation.*

UDC: 633.15:631.527.5:631.531

GENETIC IMPROVEMENT OF MAIZE THROUGH INBRED LINE DEVELOPMENT AND HYBRID SEED PRODUCTION

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Maize (*Zea mays* L.) is a genetically diverse species with a complex genome that provides high morphological and agronomic variability. Modern maize breeding programs aim to increase grain yield, stability, and adaptability of hybrids under diverse agro-climatic conditions. The genetic basis of maize improvement relies on the phenomenon of heterosis, whereby hybrids obtained from genetically distinct inbred lines exhibit superior performance compared to their parental forms.

A fundamental stage in maize breeding is the development of inbred lines, characterized by a high degree of homozygosity and genetic and phenotypic uniformity. Inbred lines are obtained through repeated self-pollination combined with continuous phenotypic selection over six to eight generations.

Within the maize breeding program 210101, more than 2874 genetic sources were subjected to inbreeding, from which 532 stable families were evaluated and included in the operational collection. Multi-year evaluations allowed the identification of original inbred lines with superior agronomic potential.

The pedigree of the developed lines includes germplasm from important heterotic groups such as Reid Iodent, Euroflint, BSSS-B37, Lancaster, mixed Dent, and Canadian Dent, enabling the creation of high-performance hybrids.

Inbred lines from generations S4–S6 are evaluated using top cross tests to estimate general and specific combining ability. Selected parental forms are crossed to produce F1 hybrids, which are tested in comparative field trials. Following registration, hybrid seed production is conducted under strict isolation and phytosanitary control to ensure genetic purity and high seed quality.

Keywords: *maize breeding; inbred lines; heterosis; combining ability; hybrid seed production.*

UDC: 633.34:632.111.5:577.112.3

IMPACT OF HEAT STRESS ON THE BIOCHEMICAL COMPOSITION OF PROTEIN FRACTIONS IN SOYBEAN SPROUTS (GLYCINE MAX (L.) MERR.)

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Nowadays, global warming creates challenges for all sectors of the economy, while the agricultural sector remains the most vulnerable one. In the Republic of Moldova, supra-optimal summer temperatures are becoming increasingly frequent, leading to a reduction in the cultivation of various crops, including soybean (*Glycine max (L.) Merr.*), a leguminous and oilseed crop of multipurpose importance. Thus, in 2025 soybean plantations occupied only 1,24% of the total cultivated area. A key factor of plant thermotolerance is the state of protein metabolism, primarily the water-soluble fraction containing protective proteins, including heat shock proteins. **The aim of the study** was to investigate the dynamics of soybean protein fractions under heat stress conditions and to identify potentially thermotolerant varieties. The biological material consisted of two-week-old plants grown from seeds of locally bred soybean varieties: Flamura, Aura, Deia, and Igorina, harvested in 2024 and provided by the National Center for Seed Research and Production. The plants were exposed to the heat stress at 42°C for 1 hour, after which protein extraction was performed according to the Osborne method with the isolation of four fractions: water-soluble albumins, salt-soluble globulins, alcohol-soluble prolamins, and alkali-soluble glutelins. The protein concentration of each fraction was determined using the Bradford method. Under control conditions, the highest albumin content was observed in the Aura variety, while in the other varieties their concentration was considerably lower. The analysis of the results demonstrated an increase in the concentration of water-soluble proteins after the heat stress in the Flamura, Igorina, and Deia varieties. The most pronounced changes were observed in Deia, where their content increased by 61% compared to the control samples. In the Igorina variety, their concentration increased by 24%, while in Flamura it increased by 32,3%. Despite the high absolute albumin content in the control samples of the Aura variety, a decrease in this parameter under stress conditions (by 10,6%) may indicate disturbances in protein metabolism and lower resistance to high temperatures. The heat stress caused a sharp decrease in the content of globulins in all varieties, as well as prolamins and glutelins. The most pronounced adaptive response was identified in the Deia variety, which was characterized by a significant increase in the water-soluble fraction accompanied by the restructuring of the other fractions, indicating a high potential level of thermotolerance.

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Keywords: *soybean, protein fractions, heat stress, thermotolerance.*

UDC: [634.11 + 634.22]:632.111.52:577.164.2

EVALUATION OF POLYPHENOL OXIDASE ACTIVITY AND TOTAL PHENOLIC CONTENT IN PLUM AND APPLE FRUITS DEPENDING ON THE GENOTYPE AND GROWING CONDITIONS

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Water stress significantly affects the productivity and crop quality of plums and apples. Elevated air temperatures and low soil moisture levels exert a defining influence on the development of fruit crops, affecting all stages — from bud initiation to crop ripening. Fruit trees are particularly sensitive to the lack of soil moisture after the end of flowering, when fruit formation and active shoot growth take place. Water stress can modify the biochemical composition of fruits, altering the levels of soluble solids, vitamins, organic acids, sugars, and polyphenols.

This study aimed to evaluate plum and apple fruit quality based on biochemical parameters under irrigation (70% soil moisture) and water deficit conditions.

The experiments were conducted in lysimeters during the vegetation period on the fruits of late plum varieties – Stanley and Udlinionnaia, and winter apple varieties – Golden Spur and Granny Smith. At harvest time, polyphenol oxidase (PPO) activity, as well as the total content of phenolic compounds using the Folin-Ciocalteu reagent, were determined in the fruits.

The results showed that the highest PPO activity was recorded in the Stanley plum variety — 0,257 units of optical density per gram of fresh weight (U OD/g FW) in the non-irrigated variant and 0,202 U OD/g FW under irrigation. In the Udlinionnaia variety, the corresponding values were 0,103 and 0,072 U OD/g FW. Lower enzyme activity was observed in apple fruits. In the Granny Smith variety, PPO activity was 0,030 in the non-irrigated variant and 0.026 under irrigation, while in Golden Spur these values were 0,027 and 0,024, respectively.

A significant content of phenolic compounds was recorded in the studied plum and apple fruits, while under water deficit conditions their level turned out to be slightly higher. For example, in the Udlinionnaia plum variety, the total content of phenolic compounds was 224 mg/100g of fresh weight (FW) under non-irrigated conditions and 188 mg/100g FW under irrigation. A similar pattern was observed in Granny Smith apple variety: 220 and 200 mg/100g FW, respectively.

It can be concluded that polyphenol oxidase activity and the content of phenolic compounds in plum and apple fruits depend on many factors. These include growing conditions, biological characteristics of the varieties, as well as metabolic processes occurring in plants throughout the vegetation period. These factors play an important role in shaping the chemical composition of fruits and their nutritional properties. Research conducted in this area opens up possibilities for developing effective approaches aimed at increasing the resilience of plum and apple trees, as well as improving fruit quality when grown under adverse environmental conditions (high temperature and moisture deficit). Achieving these goals is possible through the implementation of scientifically grounded agrotechnical practices during the vegetation period.

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Keywords: *fruits, polyphenol oxidase enzyme, phenolic compounds, water stress.*

UDC: 636.32/.38:636.082.1:502.211(498)

STUDY OF MORPHO-PRODUCTIVE CHARACTERISTICS OF THE TISIGAI AND CARABAŞ SHEEP BREED

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Genetic biodiversity of sheep is an essential component for maintaining the sustainability of livestock. This paper highlights the importance of conserving the genetic resources of sheep. It examines the morphological and productive characteristics of the Tisigai, Turkana, and Carabasa sheep breeds, as well as their rearing systems. The Carabasa breed differs from other sheep breeds in Romania. One of its characteristics is its massiveness: the sheep are tall, with a long torso and heavy body weight. Also distinctive is the shape of the head, with a ram-like head, large, floppy ears, and a black muzzle.

In each of the Romanian sheep breeds - the Tisigai - we find varieties such as the bucălaie (with black fleece), the ruginie (rust-brown), and the belă (with white fleece), and they may also be spotted, speckled, etc. The Carabașă sheep has black fleece on the head in 81.6% of cases, and the remaining 18.4% have rust-colored fleece. Sheep of the Țisigai and Țurcană breeds have lower body weight, height, milk production, and wool yield than the Carabașă. The results show that Carabașă lambs had a higher slaughter and commercial yield compared to the Țisigai and Țurcană breeds. They also have higher carcass index, conformation index, jigoul index, and carcass uniformity index, as well as a higher meat-to-bone ratio and better carcass classification based on fatness. The breeding program includes:

- organizing official production monitoring;
- identifying high-value flocks and ranking them within the value pyramid;
- including the best flocks at the top of the pyramid in origin and productivity testing, as well as in the breeding and testing of rams;
- designating elite flocks

Breeding programs can be designed to maintain genetic diversity while improving production traits, such as disease resistance or adaptation to specific environments. Many sheep breeds, particularly local or traditional breeds, are at risk of extinction. Conservation efforts must focus on identifying and protecting these breeds, which often possess unique genetic adaptations to specific environments.

Keywords: *biodiversity, sheep, breeds.*

UDC: 635.64:631.522.3:581.4

LEAF MORPHOLOGY VARIABILITY IN TOMATO AS RESULT OF PARENTAL X-IRADIATION & STRESS

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The aim of the study was to evaluate the physiological "memory" and adaptive strategies in M_1 tomato progeny derived from X-ray irradiated parent plants. The analysis of stomatal density and leaf area in plants derived from variants of hypothermic (TS) and drought stress (HS) applied intergenerationally during the germination stage was performed. Three genotypes were evaluated in variants irradiated at doses of 0, 250 Gy (and optionally 300/350 Gy). The biological material consisted of 10-week-old tomato plants. The statistical analysis involved calculating statistical differences between trait values and three-way ANOVA.

The results show that the genotype is the primary determinant of stomatal density, separating the samples into distinct statistical groups, where genotype As 41 displayed the highest reactivity. Regarding the stress factor, TS stimulated stomatal proliferation, whereas HS exerted an inhibitory effect compared to the optimal control. While the overall irradiation factor did not produce linear changes—nearly equalizing the general means—the analysis of genotype-environment interactions revealed complex patterns. In genotype As 30, irradiation fixed a trend toward stomatal inhibition. In As 31, higher doses induced plastic instability, triggering divergent responses (stimulation under TS and inhibition under HS). In contrast, genotype As 41 exhibited a hormesis effect, where the 250 Gy dose acted as a constant stimulant for stomatal density across all variants. Regarding leaf morphology, non-irradiated plants were highly sensitive to inetrgenerative stress, showing extreme phenotypic fluctuations (severe reduction vs. compensatory growth). Conversely, irradiation at 250 Gy exerted a buffering effect, stabilizing leaf size within constant limits and mitigating the impact of combined abiotic stress.

In conclusion, the findings highlight that mutagenic exposure of parent plants alters the reaction norm of the subsequent generation to abiotic stress through transgenerational mechanisms. The capacity to modulate the leaf apparatus serves as a reliable indicator of genotype-specific adaptive resistance.

***Acknowledgments*:** This study was supported by the research project subprogram 011101 "Genetic and biotechnological approaches to the agroecosystems management under climate change", funded by the Ministry of Education and Research of Republic of Moldova.

Keywords: *Tomato, leaf morphology, X-ray, abiotic stress.*

UDC: 635.65:632.111.5:631.523(477)

FIELD EVALUATION OF COLD TOLERANCE OF LENTIL GENOTYPES AT FOREST-STEPPE OF UKRAINE

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Climate change in the Eastern Forest-Steppe of Ukraine necessitates revising lentil sowing dates to improve the use of post-winter soil moisture and avoid terminal drought during seed filling. Including lentil in crop rotations is an important component of climate adaptation in crop production. However, early sowing may increase the risk of spring frost damage and associated diseases.

The study was conducted at the Elitne Research Field of the Yuriev Plant Production Institute of the National Academy of Agrarian Sciences of Ukraine. In 2025, night frosts down to – 3 °C occurred after lentil emergence, and air temperature remained below 10 °C during 30% of the "emergence – 50% flowering" period. Frost damage was assessed on a 0 – 6 scale. Twenty-five lentil accessions from six countries, 76% of which were of Ukrainian origin, were evaluated in three replicates. Mean frost damage ranged from 1 to 3 points depending on genotype, with an overall average of 1.16. Fusarium damage was also observed (up to 38% dead plants).

Analysis of variance revealed no statistically significant genotypic differences in frost damage or *Fusarium wilt* development in 2025. Correlations between frost damage, *Fusarium wilt*, interphase period duration, number of cold days, and accumulated effective temperatures were insignificant.

To verify these results, a retrospective analysis of long-term studies of the lentil genetic collection was conducted. During 29 years of observations, four years with frosts after emergence were identified (2 – 10% of the emergence – flowering period). In cold years, severe *Fusarium* development leveled differences between genotypes, whereas across all study years significant effects of genotype, year, and their interaction were detected.

The results indicate that short-term spring frosts after emergence did not cause plant death, as lentil plants resumed growth after damage. At the same time, cold conditions increased the importance of Fusarium damage. These findings support further research on early and winter sowing of lentil in the Kharkiv region.

Keywords: *Lens culinqris Medic, abiotic stress, genetic resources*

UDC: 635.21:632.752:551.583(477)

DEPENDENCE OF THE ABUNDANCE OF POTATO VIRUS VECTORS ON CLIMATIC CONDITIONS IN THE SOUTHERN PART OF THE POLISSIA ZONE OF UKRAINE

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The objective of the study was to determine the abundance and species composition of winged aphid morphs depending on climatic conditions during the growing season in seed potato plantings under conditions of the southern part of the Polissia zone.

The study covers 2018–2025. Monitoring of aphid abundance to determine the onset of active aphid flight for the purpose of implementing protective seed production measures was conducted using the yellow pan trap method (Moericke traps). Species identification of aphids was performed using F.P. Miller's taxonomic key. Climate indicators (temperature, precipitation, HTC) were evaluated monthly (May–August); the correlation between aphid abundance and environmental factors was assessed using Pearson correlation coefficient.

A statistical relationship was established between the population dynamics of different aphid species over 8 years of study and average daily air temperature and precipitation. Correlation analysis results revealed a weak relationship between average air temperature and aphid abundance (r=0.2). This relationship can be described by the following equation: aphid abundance (y) = 197.49x - 2904.8, where x is the average temperature. It should be noted that the coefficient of determination is R^2=0.0421. That is, the increase in aphid abundance by 4.0% depended on the rise in average air temperature over 8 years.

Correlation analysis results established an inverse moderate relationship between total precipitation and the abundance of virus-vector aphids (r=-0.4). This relationship can be described by the following equation: virus vector abundance (y) = -2.2909x + 1094.5, where x is total precipitation. Thus, an increase in precipitation on average over 8 years led to a decrease in the abundance of aphid vectors.

It follows that rising air temperature promotes the reproduction and spread of aphids – potato virus vectors, thus having a positive effect. Precipitation, conversely, reduces the abundance of all aphid species, including virus vectors. On average, over the eight-year study period, the effect of precipitation on reducing the abundance of harmful organisms ranged from 8 to 13%.

Acknowledgments: The study was conducted within the framework of scientific projects No. 0121U108643 and No. 0124U000879, funded by the NAAS of Ukraine.

Keywords: *potato, potato viruses, climatic factors, winged aphid morphs*

Session B

PLANT, ANIMAL AND MICROBIAL BIOTECHNOLOGIES

UDC: 636.09:577.152.1:577.213(624)

GENETIC AND MOLECULAR EFFECTS OF REACTIVE OXYGEN SPECIES (ROS) AND ROLES IN GENE EXPRESSION REGULATION UNDER OXIDATIVE STRESS RESPONSE IN SUDANESE FARM ANIMALS

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We examined the molecular and genetic mechanisms through which Reactive Oxygen Species (ROS) regulate gene expression and oxidative stress responses in livestock, linking these cellular pathways to the environmental challenges of seasonal pastoral transhumance in Sudan. The research integrates a molecular review of redox pathways with a descriptive-analytical field survey to evaluate management stressors under pastoral production systems.

Our results show that ROS act as direct genomic regulators, modulating the expression of core antioxidant enzymes, specifically superoxide dismutase (SOD), catalase (CAT), and glutathione peroxidase (GPx). This regulation occurs via activation of the Keap1-Nrf2-ARE cytoprotective axis and the pro-inflammatory NF-κB pathway. We found that chronic oxidative stress disrupts this redox homeostasis, which downregulates key lipogenic genes (ACACA and FASN), compromises milk fat quality and impairs animal fertility through gamete DNA fragmentation. Field survey data indicate that prolonged trekking exceeding 30 km per day and severe water scarcity induce profound physiological stress, raising herd morbidity up to 85% compared to a 20% baseline in low-stress routes. To reduce these production losses, we recommend a combined approach utilizing Genome-Wide Association Studies (GWAS) to select climate-resilient native genotypes, alongside practical nutritional supplementation using local Moringa oleifera leaves to neutralize systemic ROS burdens during seasonal migration.

Keywords: *Reactive Oxygen Species, Oxidative Stress, Gene Expression, Sudan.*

UDC: 636.5:591.463.5:577.121.7

NITROGEN METABOLISM IN ROOSTER BLOOD SERUM DURING THE SECOND CYCLE OF SPERMATOGENESIS

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Nitrogen metabolism is one of the fundamental biochemical processes involved in maintaining organismal homeostasis and supporting male reproductive function. The results of the investigation of the main end products of nitrogen metabolism in rooster blood serum during the second cycle of spermatogenesis revealed various changes in the concentrations of citrulline, ornithine, arginine, urea, and ammonia. Among the compounds involved in the urea cycle, the most pronounced changes were observed for arginine, whose concentration increased progressively from 8.40 ± 1.68 μmol/L in the control group to 9.87 ± 6.39 μmol/L in experimental group I and further to 12.21 ± 1.30 μmol/L in experimental group II ($p<0.05$). This increase in serum arginine levels may reflect an intensification of nitrogen metabolism and a greater availability of this essential amino acid for reproductive processes. The concentrations of ornithine and citrulline, which participate in the metabolic flux of the urea cycle, remained relatively constant among the groups, showing only moderate increases and decreases. At the same time, urea concentration remained relatively stable across the groups. The mean value was 58.40 ± 1.90 μmol/L in the control group, 61.03 ± 6.94 μmol/L in experimental group I, and 55.30 ± 6.41 μmol/L in experimental group II. The absence of significant differences may indicate that the mechanisms responsible for eliminating excess nitrogen remained stable and efficient throughout the experiment. A significant change was recorded in the case of ammonia, whose concentration increased from 35.99 ± 13.66 μmol/L in the control group to 51.19 ± 37.72 μmol/L in experimental group I and to 71.36 ± 10.98 μmol/L in experimental group II ($p<0.05$). In the context of spermatogenesis, this change may indicate enhanced anabolic and catabolic activity associated with the proliferation and differentiation of germ cells. Thus, the results demonstrate that the administration of the experimental factor influenced nitrogen metabolism in roosters, with the most pronounced effect being evidenced by the increased concentrations of arginine and ammonia These changes may be the result of intensified metabolic processes involved in spermatogenesis and reproductive activity.

Keywords: *rooster, spermatogenesis, nitrogen metabolism.*

UDC: 633.88:581.143.6:615.32

MODERN APPROACHES *TO IN VITRO* CULTURES OF PROMISING MEDICINAL PLANTS

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The study aimed to test modern approaches for the initiation of *in vitro* cultures of medicinal plants with pharmaceutical potential and to optimize the factors influencing culture establishment within the Plant Biotechnology Laboratory of the Center for Drug Development, *Nicolae Testemitanu* SUMPh.

The research included medicinal plant species rich in biologically active compounds of pharmaceutical interest, such as phenolic compounds (*Aronia melanocarpa, Rubus fruticosus*.), volatile oils (*Mentha piperita, M. citrata*., *Origanum vulgare, Lavandula vera*) and natural sweeteners (*Stevia rebaudiana*).

Different explant types, sterilization protocols, nutrient media, hormonal combinations and light conditions were tested to optimize *in vitro* culture initiation. Meristematic explants, especially root apex tissues, demonstrated superior viability, lower contamination rates and higher regenerative potential compared to mature leaf tissues. Hydrogen peroxide 6% and ethanol 70%, potassium hypochlorite with a concentration of 0.5-2% showed the best balance between contamination control and explant survival. The MS (1962) medium supplemented with optimized hormonal combinations showed the most favorable results for culture establishment and morphogenesis. BAP stimulated shoot formation and cell division, while IAA promoted root initiation and biomass development. Different sucrose concentrations were evaluated, with 30 g/L identified as optimal for explant adaptation and biomass accumulation in most species. In addition, inoculation techniques, explant positioning and controlled photoperiodic conditions significantly influenced regenerative responses and culture stability during the early stages of cultivation.

Successful initiation of medicinal plant *in vitro* cultures depends on the optimization of explant selection, sterilization procedures, nutrient media and culture conditions. The optimal parameters were species-specific and closely related to the phytochemical characteristics of each medicinal plant.

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Keywords: *medicinal plants, in vitro cultures, plant biotechnology.*

UDC: 633.88:615.322:66.061

OPTIMIZATION OF THE EXTRACTION METHOD OF FLAVONOIDS IN PLANT PRODUCTS FROM SPECIES OF THE GENUS *HELICHRYSUM*

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Medicinal plants of the genus *Helichrysum (H. arenarium* and *H. italicum*) of the Asteraceae family are widely used in traditional medicine due to their flavonoid content, which has hepatoprotective and cholagogue properties.

The aim of this study is to quantifying the flavonoids in the plant products of *Helichrysum* species: flowers and aerial parts, by identifying the optimal method for flavonoid extraction. The plant materials (*fllos, herba*) were harvested from the spontaneous flora of the Republic of Moldova (*H. arenarium*) and from the Medicinal Plant Collection of *Nicolae Testemițanu* State University of Medicine and Pharmacy (*H. italicum*). The total flavonoid content was determined spectrophotometrically using an $AlCl_3$ solution, with the absorbance read at wavelength λ=430 nm at Metertech UV/VIS SP 8001 spectrophotometer, with the results expressed as rutoside (mg RU/100 g of product). The following extraction methods were used: ultrasound assisted extraction, magnetic stirring and water bath on reflux, to identify the optimal method for extracting flavonoids, using 60% ethyl alcohol as the solvent and the same extraction time of 30 minutes for all methods.

The total flavonoid content (TFC) was higher in the inflorescences than in the aerial parts for both species. *H. arenarium* exhibited higher values compared to *H. italicum* for all three methods used. Magnetic stirring yielded the highest total flavonoid content values among all the extraction methods used. The maximum value was 2.678 mg RU/g in *H. arenarii flos* when extracted using a magnetic stirrer, while the minimum value was 0.099 mg RU/g in *H. italici herba,* where extraction was performed in a reflux water bath.

Extraction methods influence the total flavonoid content in *Helichrysum* species products and magnetic stirrer extrction can be used as the optimal method for flavonoid extraction, followed by ultrasonic and refrigerant bath extraction.

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Keywords: *Helichrysum sp., extraction, total flavonoid content.*

UDC: 663.12:579.66:604.4

INFLUENCE OF NATURAL CULTURE MEDIA ON THE PRODUCTIVE PERFORMANCE OF *SACCHAROMYCES* YEASTS

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The valorization of agri-food waste in microbial biotechnology represents a sustainable solution for reducing environmental impact and obtaining value-added products. In this study, the potential use of barley, carrot, and red beet residues as sole nutrient sources for the cultivation of *Saccharomyces* yeasts was investigated. Four strains of *S. cerevisiae* (7P, 9P, 10P, and 11P), isolated from artisanal sourdoughs prepared from local flours, were studied. Biomass determination was performed using the gravimetric method, while protein and carbohydrate contents were analyzed using spectrophotometric methods. All experiments were performed in triplicate. The data were analyzed using Microsoft Excel and Statistica 9.0 software. The YPD culture medium was used as the control. On YPD medium, the strains accumulated between 3.67±0.19 and 4.73±0.23 g/L d.w. biomass, with *S. cerevisiae* 7P being the most productive strain and showing the highest protein and carbohydrate contents. The use of culture media obtained from agri-food wastes led to a significant increase in biomass of 52.3-134% compared with the control. The medium based on barley residues increased protein content by up to 34.9%, especially in strains *S. cerevisiae* 9P, 10P and 11P. At the same time, all tested media promoted carbohydrate accumulation in the biomass. The results demonstrate that agri-food wastes can be efficiently used for yeast cultivation and for the production of biomass with high nutritional value. These residues have potential for applications in bakery production and in the development of artisanal food products with properties specific to the used vegetable source.

***Acknowledgments*:** The research was carried out within project 020101 InBioS - "Innovative biotechnological solutions for agriculture, medicine and environment" funded by Ministry of Education and Research of the Republic of Moldova.

Keywords: *yeasts, nutritive media, biomass, proteins, carbohydrates*.

UDC: 579.253:633.34:631.559

EFFECT OF *BRADYRHIZOBIUM JAPONICUM* ON NODULE DEVELOPMENT, LEAF AREA AND SOYBEAN PRODUCTIVITY

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Soybean (*Glycine max* L.) is one of the most important leguminous crops due to its high protein content and its capacity to establish symbiosis with nitrogen-fixing bacteria of the genus *Bradyrhizobium*. The aim of this study was to evaluate the effect of *Bradyrhizobium japonicum* on nodule development, leaf area, and soybean productivity, as well as to develop an in vivo method for nodule visualization under field conditions.

The experiments were conducted under field conditions on soybean plants grown on chernozem soils in the Republic of Moldova. Inoculated variants were compared with non-inoculated control plants. Leaf area was assessed using non-destructive biometric methods, while nodules were visualized by controlled washing of the root system with a low-pressure water jet, ensuring plant viability.

The results showed that inoculation with *Bradyrhizobium japonicum* significantly stimulated root development and nodule formation. Inoculated plants exhibited increased leaf area, enhanced physiological activity, and higher productivity compared to the control. In addition, the proposed method enabled non-destructive in vivo visualization of nodules under field conditions, while maintaining plant viability and allowing normal further development.

These findings confirm the effectiveness of *Bradyrhizobium japonicum* in soybean cultivation and demonstrate the applicability of the proposed in vivo visualization method in studies of plant–microorganism symbiosis.

Acknowledgments: Cercetările au fost realizate în cadrul Subprogramului 011103: „Elaborarea mijloacelor ecologic inofensive de reducere a impactului organismelor dăunătoare ale culturilor agricole pe fundalul schimbărilor climatice”, finanțat de Ministerul Educației și Cercetării al Republicii Moldova.

Keywords: *soybean, Bradyrhizobium japonicum, nodules, leaf area, productivity.*

UDC: 635.9:581.143.6:631.811.98

THE EFFECT OF GROWTH REGULATORS ON THE MICROPROPAGATION PROCESS IN THE SPECIES *HEUCHERA* × *HYBRIDA*

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The *in vitro* multiplication research was conducted in the Embryology and Biotechnology Laboratory of the "Alexandru Ciubotaru" National Botanical Garden (Institute) of MSU, with the aim of propagating by tissue culture the species *Heuchera* × *hybrida* cultivar 'Regina' in order to obtain uncontaminated, genetically homogeneous and high-quality planting material within a relatively short period.

For microcloning, several variants of the agar-solidified Murashige and Skoog medium (MS) were tested, supplemented with the cytokinin 6-benzylaminopurine (BAP) and the auxin α-naphthaleneacetic acid (NAA) at different concentrations. Hormone-free MS medium was used as the control.

The research results indicated that, regardless of the BAP concentration (*0.1-0.5 mg/L*), in all the tested nutrient media the multiplication rates were positive. Increasing the BAP concentration was directly correlated with the number of microclones produced; however, producing very large numbers of microclones did not bring a favourable result, as these microclones were small and fragile. Moreover, a higher BAP concentration *(0.5 mg/l*) in the culture medium induced callus formation and caused pronounced vitrification of microclones and morphological deformities. The *in-vitro* plantlets cultured on hormone-free medium (control) did not form microclones, but they were more vigorous and better developed compared to those grown on media supplemented with BAP and NAA. Additionally, the *in vitro* plantlets placed in hormone-free medium exhibited 100% root formation, unlike those cultured on media containing hormones. These results indicate that the supplementation of MS medium with the cytokinin 6-benzylaminopurine (BAP) significantly promoted microclone formation while inhibiting root development.

The results obtained clearly show that the most favourable medium for micropropagating *Heuchera* × *hybrida* is MS medium supplemented with low concentrations of BAP *(0.1 mg/l*), *0.01 mg/l NAA* and *30 g/l sucrose*, since this combination of cytokinin and auxin promotes the proliferation of an optimal number of healthy and viable microclones.

Acknowledgments. The research was conducted within the Subprogram 010101 „*Ex situ and in situ research and conservation of plant diversity in the Republic of Moldova*" (2024-2027).

Keywords: *in vitro culture, microcloning, growth medium, cytokinin.*

UDC: 636.4.084:636.4.082.4:579.61

EFFECT OF FEED QUALITY AND MICROBIOLOGICAL CONTAMINATION ON THE REPRODUCTIVE HEALTH OF BREEDING BOARS

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Reproductive performance in breeding boars is influenced not only by the genetic and physiological characteristics of the sires, but also by environmental factors, including feed quality, drinking water hygiene, and the level of microbiological contamination within the production unit. The aim of the present study was to assess the microbiological quality of semen, feed, and drinking water in an intensive swine-breeding farm, as well as to identify potential sources of contamination with an impact on reproductive health and the biological quality of semen.

The study was conducted on high genetic merit breeding boars of Pietrain breed and PIC hybrid lines, maintained under intensive housing conditions in controlled microclimate facilities. The animals received a complete and nutritionally balanced diet composed of wheat (30%), barley (25%), soybean meal (14.85%), maize grain (13%), sunflower meal (5%), wheat bran (5%), fishmeal (1.5%), soybean oil (1.2%), and mineral-vitamin premixes with functional feed additives. The ration provided 12.93 MJ/kg metabolizable energy and 180.8 g/kg crude protein, along with adequate levels of essential amino acids, macro- and microelements required for the maintenance of reproductive function and the production of high-quality semen.

Microbiological analyses were performed on semen samples collected from genetically superior breeding boars, as well as on pelleted feed and drinking water samples. The main hygiene and safety indicators were determined, including total viable count (TVC), the presence of Escherichia coli, Enterococcus spp., Proteus spp., Staphylococcus spp., and total fungal count (TFC). The results were interpreted according to veterinary sanitary standards and guidelines applicable to swine artificial insemination and breeding centers.

The findings revealed significant microbiological contamination across several sample categories. Semen collected from Pietrain boars showed a total bacterial count of 2.8×10^4 CFU/mL, exceeding the recommended threshold for semen use in assisted reproductive programs ($\leq 10^4$ CFU/mL). In both ejaculate samples, bacterial genera such as Escherichia, Enterococcus, Proteus, and Staphylococcus were identified, indicating fecal contamination and suggesting deficiencies in hygiene practices during semen collection, processing, and handling.

Microbiological examination of pelleted feed revealed elevated contamination levels of Staphylococcus spp. (6.1×10^5 CFU/g) and filamentous fungi (4.8×10^5 CFU/g), indicating inadequate storage and preservation conditions. These results suggest an increased risk of mold development and, consequently, mycotoxin contamination, compounds well known for their negative effects on reproductive function, semen quality, and immune status of breeding males.

Water analysis revealed an exceedance of admissible microbiological limits for all investigated indicators. High values were recorded for Escherichia coli (2.4×10^2 CFU/mL), Enterococcus spp. (2.8×10^2 CFU/mL), and total viable count (3.8×10^5 CFU/mL). These findings indicate significant fecal contamination of the water source or distribution system and suggest possible development of microbial biofilms within pipelines and drinking equipment, negatively affecting animal health status and reproductive performance.

In conclusion, although the breeding boars were provided with a nutritionally balanced ration formulated to support reproductive function and high-quality semen production, the microbiological quality of semen, feed, and drinking water was unsatisfactory. The study highlights the necessity of implementing strict biosecurity and hygiene programs in boar breeding operations, including regular microbiological monitoring of semen, quality control and proper storage of feed, sanitation of watering systems, and preventive measures aimed at reducing fungal contamination and mycotoxin exposure. These measures are essential for maintaining the reproductive health of high genetic merit boars and for achieving optimal outcomes in artificial insemination and genetic improvement programs in swine production.

Keywords: *boars, semen, breed, contamination, microbiology, hygiene, fungi, feed*.

UDC: 632.937.1:579.852.11:635.63

ANTAGONISTIC ACTIVITY OF *BACILLUS SUBTILIS* CNMN-BB-06 AGAINST CUCUMBER PATHOGENS IN GREENHOUSE CONDITIONS

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Due to the possibility of controlling environmental factors, greenhouses provide an efficient system for cultivating organic vegetables throughout the year. To achieve this goal, the use of biological plant protection methods is essential. The aim of the study was to investigate the fungicidal activity of the bacterium Bacillus subtilis CNMN-BB-06 against cucumber disease pathogens under greenhouse conditions. The research was carried out in vitro on agar media using the dual culture method. The antagonistic activity of the bacterium against 11 cucumber pathogens was determined, and the inhibition rate of phytopathogenic fungal growth (%) was calculated.

The results showed that B. subtilis CNMN-BB-06 exhibited two types of antagonism against cucumber pathogens:

Antibiosis – formation of inhibition zones between the bacterial colony and the pathogen. In dual culture with Albifimbria verrucaria, on the 6th day of growth, the sterile zone reached 25 mm; with Botrytis cinerea – 10 mm; with Fusarium oxysporum – 36 mm; and with Rhizoctonia solani – 13.3 mm.

Competition for nutrients and habitat – due to its rapid growth, B. subtilis utilizes resources faster than pathogens, while the formation of bacterial biofilms creates a barrier against the development of fungal infections. The inhibition rate for Alternaria alternata was 51.4%; for Fusarium culmorum – 69.8%; for F. graminearum – 70.7%; for F. solani – 72.4%; for F. sporotrichioides – 76.5%; for F. verticillioides – 71.7%; and for Sclerotinia sclerotiorum – 83.9%.

Conclusions: B. subtilis is an active antagonist of cucumber disease pathogens in greenhouse conditions. In dual culture, it exhibited two types of antagonism – antibiosis, characterized by the formation of sterile zones ranging from 10 to 36 mm, and competition, with pathogen inhibition rates ranging from 51.4% to 83.9%.

Acknowledgments: The research was carried out within the framework of subprogram 011103: “Development of environmentally friendly means for reducing the impact of harmful organisms on agricultural crops under climate change conditions”, funded by the National Agency for Research and Development and the Ministry of Education and Research.

***Keywords**: antagonism, phytopathogen, competition, sterile zone, Bacillus subtilis*.

UDC: 63:602.3:378.4(478)

DEVELOPMENT OF AGRICULTURAL PLANT BIOTECHNOLOGY IN THE HIGHER EDUCATION SYSTEM OF THE REPUBLIC OF MOLDOVA

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The main objective of the present study was to conduct a review and analytical assessment of the development of agricultural plant biotechnology within the higher education system of the Republic of Moldova during the period 1990–2025. The study focuses on the formation of scientific and educational directions, research conditions, and the transformation of the material and technical infrastructure.

It is shown that during the 1990s–2020s the development of plant biotechnology occurred under conditions of limited instrumental support. Nevertheless, classical methods of plant tissue and cell culture, microclonal propagation, development of new *in vitro*-derived somaclonal maize lines, as well as biochemical approaches for plant genome identification based on protein markers, were successfully adapted and implemented. These approaches contributed to the establishment of a scientific and educational school and to the training of specialists in the field. Particular attention is paid to educational approaches aimed at developing stable practical skills in mastering *in vitro* methodologies.

A separate section characterizes the modern stage of modernization in 2025 associated with the introduction of a new generation of laboratory equipment and innovative technologies within the integrated plant biotechnology laboratory of the Green BioHub Center at the Faculty of Agricultural, Forestry and Environmental Sciences of the Technical University of Moldova. Prospects for automation of biotechnological processes, application of molecular genetic methods, genomic analysis, and high-throughput screening technologies are discussed.

It is concluded that 35 years of accumulated experience in research and specialist training have created a solid foundation for the transition to internationally competitive research. Promising directions for further investigations and scientific cooperation based on the renewed biotechnology center are identified.

Keywords: *agricultural plant biotechnology, higher education system, material and technical infrastructure.*

UDC: 633.812:579.841.11:631.53.027

STIMULATION OF LAVENDER GERMINATION USING BACTERIAL GROWTH PROMOTERS

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Lavender (*Lavandula spp*., fam. *Lamiaceae*) is a popular aromatic plant valued for its ornamental appeal, drought tolerance, and medicinal properties. However, lavender cultivation is hampered by low seed germination rates, which depend on a combination of endogenous (physiological state of the seeds) and exogenous factors (temperature, humidity, light, etc.). The aim of this study was to evaluate the possibility of increasing lavender seed germination using bacterial growth promoters of the genus *Pseudomonas*. Experiments were conducted under laboratory conditions with seeds germinating in Petri dishes on filter paper moistened with tap water. Seeds were treated with bacterial cultures immediately before germination by soaking in native liquids containing three *Pseudomonas* strains from the IMB TUM collection (*Pseudomonas sp*. 01, *Ps. sp*. 02 and *Ps. sp*. 12) at various dilutions. In the control group, seeds were pre-soaked in tap water. To enhance the contrast of the results, lavender germination was carried out without the stratification typically required in such cases – i.e., without keeping seeds in a moist environment at low temperature for an extended period. The results showed that lavender seeds treated with the bacterial strains exhibited statistically significant germination rates of 15% to 34%, whereas in the water control the germination rate was 0%. Thus, the potential for substantially increasing lavender seed germination using bacterial growth promoters of the genus *Pseudomonas*, which may be applied in the cultivation of this plant

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Keywords: *lavender, Pseudomonas, bacterial germination stimulators of lavender*.

UDC: 632.937:632.4:634.11

BIOLOGICAL CONTROL AGENTS AGAINST *VENTURIA INAEQUALIS* WINT ON APPLE

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Apple scab is one of the most damaging disease affecting apple trees, especially in years with heavy rainfall and moderate temperatures.

The purpose of the research was to determine the biological efficacy of the biopreparation Rizoplan, which contains alive *Pseudomonas fluorescens* bacteria and biopreparation Trichodermin SC, containing fungi *Trichoderma lignorum* CNMN-FD-14 (M-10) in *Venturia inaequalis* Wint. control.

The the assays were carried out at the experimental plot of the IGFPP (MSU), on the apple var. Reinette Simirenko during the 2024 vegetation period. There were 8 variants, 3 repetitions, with 3 trees per repetition in the trials.

The biological efficacy of Rizoplan was 84.8% at a consumption rate of 7 l/ha and 86.2% at a consumption rate of 10 l/ha. The biological efficacy of Trichodermin SC was 84.3% at a consumption rate of 7 l/ha and 85.5% at a consumption rate of 10 l/ha. The biological efficacy of the Rizoplan and Trichodermin SC variants at a consumption rate of 7.0 l/ha was 86.7%, and at 10 l/ha it was 86.4%. The biological efficacy of the chemical standard Luna Sensation SC 500 at a consumption rate of 0.35 l/ha was 86.5%.

In conclusion, it can be stated that during the 2024 growing season, under the conditions of the experimental plot, the treatment with Rizoplan + Trichodermin applied at the rate of 7 l/ha showed the highest efficacy against apple scab, reaching 86.7%. Furthermore, the application rate of 10 l/ha demonstrated a level of efficacy comparable to that of the chemical standard Luna Sensation SC 500, applied at 0.35 l/ha, with biological efficacy of 86.5%

Acknowledgments: Research was carried out within the subprogramme 011103: "Development of environmentally friendly means of reducing the impact of harmful organisms on agricultural crops against the background of climate change" funded by the National Agency for Research and Development.

Keywords: *Apple scab, apple variety Reinette Simirenko ,biological efficacy.*

UDC: 634.11:632.4:632.937.1

THE IMPACT OF THE APPLICATION OF *CHLORELLA VULGARIS* SUSPENSION ON SOME QUANTITATIVE AND QUALITATIVE PARAMETERS OF WINTER WHEAT

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Currently, phytotechnics is a basic branch of agriculture in the Republic of Moldova. Among cereal crops, winter wheat occupies large areas and is of major importance for ensuring food security and economic competitiveness. Obtaining high yields depends largely on ensuring optimal plant nutrition, and the most beneficial ones are biofertilizers and biostimulators. In this regard, biostimulators based on algal extracts represent a promising alternative, the most beneficial being the suspension of live algae that can offer additional advantages through colonization capacity. The species *Chlorella vulgaris* is distinguished by its high adaptability, rapid multiplication rate and valuable biochemical composition, thus being preferential for use as a biostimulator in the cultivation of winter wheat in the conditions of the Republic of Moldova.

The experiments used the suspension of the native strain of *Ch. vulgaris*. The experiments were carried out in the 2025 agricultural year, on the plantations managed by SRL "Schim Agromex", the soils being typical moderately humus-rich chernozems. In the experiments, carried out on areas of 100 ha for each experimental variant (control without algae application and with algae administration), the algal suspension was applied to the soil immediately after sowing at a dose of 100 L/ha, followed by three foliar treatments at a dose of 5 L/ha. Additionally, the soils in both experimental lots were fertilized by applying green manure (in the fall of 2024), consisting of peas, and in the spring of 2025, 2000 kg/ha of solid bioorganomineral fertilizer and 5 L/ha of liquid fertilizer were administered to the soil surface, the chemical composition of which is presented in the specialized literature.

The application of algal biofertilizer treatment generated an increase in the yield of winter wheat crop by 0.49-0.50 t/ha, as well as in the protein content of seeds (by 0.10–0.11%), gluten content (by 1.0–1.01%) and a reduction in the color index of seeds (by 1.25-1.26%). The research conducted highlights the fact that the *Chlorella vulgaris* suspension has premises for industrial application in the cultivation of winter wheat in the conditions of the Republic of Moldova.

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Keywords: *algae, winter wheat, harvests, seed quality.*

UDC: 633.812:582.263:631.86

INFLUENCE OF ALGAL BIOFERTILIZER ON THE OPEN-FIELD CULTIVATION OF *THYMUS VULGARIS* L.

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Thymus vulgaris L. este o plantă superioară cultivată pe scară industrială în numeroase țări datorită utilizării în alimentație, industria alimentară, farmaceutică și cosmetică. Totodată, *Th. vulgaris* L. prezintă numeroase proprietăți biologice și terapeutice, fiind recunoscută pentru efectele sale diuretice, sedative, antioxidante, antireumatice, antiseptice, antispasmodice, antimicrobiene și expectorante. Pentru cultivarea speciei în vederea obținerii biomasei de calitate înaltă și cu siguranță ridicată, se recomandă utilizarea biofertilizanților algali ca alternativă la îngrășămintele chimice. Reieșind din aceasta, ne-am propus drept scop evaluarea efectului cantitativ al aplicării biofertilizantului pe baza suspensiei de *Chlorella vulgaris* la cultivarea în câmp deschis a *Th. vulgaris* L.

Experiențele au fost efectuate pe terenurile din satul Dobrogea, orașul Sîngera, municipiul Chișinău, pe plantațiile gestionate de GȚ Melnic Cristin. Biofertilizantul algal pe baza suspensiei de *Chlorella vulgaris* (care se afla în faza exponențială de creștere) a fost aplicat foliar și pe sol în raport de 1:3 (prin diluția suspensiei cu apă potabilă). Pe parcursul vegetației culturii au fost aplicate trei tratamente. În calitate de martor au servit culturile stropite foliar și pe sol cu aceeași cantitate de apă potabilă. Experimentele au fost desfășurate pe o suprafață de 30 m² atribuită fiecărei variante experimentale, fiecare variantă fiind realizată în trei repetări.

Aplicarea biofertilizantului algal a condus la o majorare nesemnificativă a înălțimii plantelor; în varianta cu aplicarea biofertilizantului algal, înălțimea plantelor a fost cu cca. 1,51% mai mare decât în varianta de control. În schimb, aplicarea acestui tratament a condus la majorarea diametrului tufei cu 17,29% și a biomasei vegetale verzi cu cca. 1,80 t/ha. Aplicarea fertilizantului algal a condus și la majorarea conținutului total de ulei volatil din biomasa plantelor de *Th. vulgaris* L. La aplicarea fertilizanților algali s-a atestat majorarea conținutului de ulei cu cca. 0,12% comparativ cu varianta de control.

Cercetările realizate ne permit să constatăm că aplicarea biofertilizantului algal a generat un impact pozitiv asupra aspectelor morfologice ale plantelor de *Th. vulgaris* L. cultivate în condiții de câmp deschis, caracterizat prin majorarea înălțimii, diametrului tufelor, biomasei și a conținutului de ulei.

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Keywords: *Chlorella vulgaris; biomass production; essential oil; Th. vulgaris L.*

UDC: 631.46:582.26/.27:628.3

PROSPECTS OF USING EDAPHIC MICROALGAE FOR THE REMEDIATION OF AGRICULTURAL SOILS CONTAMINATED WITH ANTIBIOTICS

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Soil pollution with antibiotics has begun to be addressed more and more intensively, due to the attested effects on consumers of agricultural products, but also on the soil ecosystem. Antibiotics reach the soil as a result of the activity of soil biota, but also following the introduction of waste from livestock, composts and biohumus, as well as through the use of phytosanitary products. Therefore, it is necessary to intervene through certain techniques to reduce the quantity and quality of antibiotics accumulated in the soil.

Soil microalgae represent an alternative solution for eliminating antibiotics from the soil, combating the spread of antimicrobial resistance, offering multiple other complex benefits. Some algae can eliminate substances capable of decomposing and neutralizing antibiotics, and others can use them in the growth process. The presence of antibiotics in optimal doses can even lead to the stimulation of the development of soil algae.

The decomposition and quantitative reduction of antibiotics are due to specific structures and compounds of certain species of soil algae, such as chlorophyll and antioxidant enzymes, including glutathione-S-transferase and peroxidase, which contribute to the detoxification of antibiotic substances by catalyzing the conjugation of glutathione with these compounds. Some soil algae possess alganan, which has an important role in reducing the effect of these antibiotics. Also, some soil algae possess the property of bioabsorption of antibiotics, a process that takes place in the initial phases of the interaction of microalgae with them, and active elimination is usually attested in the later stages of the process. The mechanisms of elimination of antibiotics from the soil carried out by algae are directly dependent on the species of microalgae and the properties of the antibiotics, which generates different mechanisms and directly influences the efficiency of the process. Research shows that some species of soil algae from the genera *Chlorella*, *Scenedesmus*, *Nostoc* and others possess properties of bioabsorption and neutralization of antibiotics, which recommends them for application as agricultural soil bioremediation agents.

In the context of the above, we would like to point out that, in order to establish the quantitative and qualitative effect of algae in reducing antibiotics in the soil, multiple and in-depth investigations are necessary, which may open new research directions.

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Keywords: *microalgae, soils, antibiotics.*

UDC: 631.46:579.26:613

SOIL BIODIVERSITY AND HUMAN HEALTH

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The aim of this study was to establish the relationship between soil biodiversity and human health. High-throughput sequencing was used to analyze the taxonomic structure and diversity of prokaryotic communities in a long-terms fertilized calcareous chernozem in unfertilized, mineral, organic and natural fonds.

The bacterial and archaeal phyla that make up the majority of the prokaryotic community and their abundance were identified: Actinomycetota, Pseudomonadota, Nitrososphaerota, Bacteroidota, Bacillota, Acidobacteriota, Verrucomicrobiota, Planctomycetota, Myxococcota, Nitrospirota, Gemmatimonadota, Cyanobacteriota, Patescibacteriota, Chloroflexota, Fibrobacterota, Abditibacteriota, Bdellovibrionota. The first five phyla were dominant in all treatments. A decrease in Shannon diversity indices was recorded in all variants.

Global studies have revealed that the dominant prokaryotic phyla of the soil microbiome are similar to those of the human microbiome, despite their different quantitative representation. The increasing industrialization of agriculture leads to a decrease in soil biodiversity, which, in turn, gives rise to a number of problems for humanity. Firstly, the problem lies in the unavailability of nutrients due to the lack of essential microorganisms. Nutrient-poor soils can cause deficiencies of certain microelements in plants, which, in turn, leads to their deficiency in the human body. Secondly, a decrease in edaphic diversity leads to a decrease in the diversity of the human microbiome and, consequently, a decrease in health and quality of life.

In this regard, the conservation and/or increase of soil microbial diversity is becoming an extremely important task for humanity in maintaining life on Earth.

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Keywords*: soil microbiome, high-throughput sequencing, 16S rRNA gene, taxonomy.*

UDC: 633.854.78:577.152.34:66.061

BIOACTIVE COMPOUNDS AND VALORIZATION STRATEGIES OF SUNFLOWER AND ALMOND PROCESSING RESIDUES: A COMPARATIVE REVIEW

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The agro-industrial residues generated during the processing of sunflower (*Helianthus annuus* L.) seeds and almonds (*Prunus dulcis*) constitute an important source of bioactive compounds with significant potential for sustainable applications in the food, agricultural, pharmaceutical, and nutraceutical sectors. This review comparatively evaluates the biochemical characteristics of the principal sunflower and almond by-products, highlighting their composition, biological activities, and opportunities for industrial valorization. Current scientific evidence demonstrates that sunflower residues, including seed cakes and hulls, are rich in proteins, dietary fiber, and phenolic acids, with chlorogenic acid being one of the predominant phytochemicals. In contrast, almond processing residues, particularly skins and green hulls, contain a more diverse phytochemical profile, characterized by high levels of polyphenols, flavonoids, triterpenoids, phytosterols, and other antioxidant constituents. The chemical composition and functional properties of these by-products are influenced by cultivar, environmental conditions, cultivation practices, and processing technologies. Advances in extraction techniques and biorefinery approaches have expanded the possibilities for converting these agro-industrial residues into high-value functional ingredients and natural additives. This comparative review underlines the importance of integrating sunflower and almond by-products into circular bioeconomy strategies, promoting waste reduction, sustainable resource utilization, and the development of innovative bio-based products.

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Keywords: sunflower by-products, almond by-products, phytochemicals, bioactive compounds, circular bioeconomy, sustainable valorization.

UDC: 634.11:632.111.52:581.11

THE EFFECT OF GROWING CONDITIONS ON WATER METABOLISM AND DROUGHT TOLERANCE IN APPLE TREES

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The issue of enhancing plant resistance to abiotic environmental factors has become particularly pressing in recent years due to changes in weather and climate conditions. Water exchange is one of the physiological indicators that specifically responds to environmental conditions and largely determines plant resistance to adverse factors.

Research objective: to study the water regime of apple trees under conditions of insufficient moisture relative to optimal moisture levels, in the context of their drought tolerance. The study included two apple varieties: Granny Smith and Golden Spur. The evaluation method involved determining the physiological parameters of water management: total water content, water deficit, water-holding capacity, and leaf transpiration rate against the backdrop of changing weather conditions and soil moisture throughout the growing season. The method of artificial soil dehydration was used to determine the drought resistance of apple varieties.

After two years of research, it was found that the average water content in the leaves of apple varieties ranges from 50.0% to 60.0%. During the dry months of July and August, plants experienced water deficiency due to high evaporation and reduced water uptake. In trees grown under conditions of insufficient moisture, the intensity of leaf transpiration, especially in the Granny Smith variety, reached maximum values (0.6%–0.8%). This fact led to an increased water deficit in the leaves (19.3%–22.4%), whereas under optimal humidity conditions, it did not exceed 10.0%. A low water deficit was recorded in the leaves of the Golden Spur variety over the two-year study period, both under optimal humidity conditions (5.2%) and after simulated drought (17.1%). By the end of the growing season, especially during fruit development, the decrease in tissue water content led to a reduction in transpiration rate and, consequently, an increase in water-holding capacity. Apple varieties grown under conditions of insufficient moisture exhibited higher water-holding capacity (61.6–63.5%).

The apple varieties studied showed moderate drought tolerance. An analysis of water regime parameters revealed that the Golden Spur variety exhibits more stable values for these parameters, indicating greater tolerance to drought conditions.

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Keywords: apple trees, water exchange, moisture deficiency, optimal moisture, drought tolerance.

UDC: 582.572.8:581.143.6:502.75

EX SITU CONSERVATION OF *GALANTHUS* SPECIES BY *IN VITRO* TECHNIQUES IN THE REPUBLIC OF MOLDOVA

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Species of the *Galanthus* species have an ecological and ornamental value, but are subject to a sharp decline caused by habitat fragmentation and uncontrolled anthropogenic impact. In this context, the present study performs a comparative analysis of *in vitro* regeneration protocols for two species with protection status in the Republic of Moldova: *G. nivalis* L. (VU) and *G. plicatus* (CR), with the objective of optimizing micropropagation techniques for *ex situ* germplasm conservation.

The research aimed to optimize the critical stages of *in vitro* culture, in particular the sterilization of biological material and the induction of bulb proliferation. The use of mercuric chloride ($HgCl_2$) ensured an optimal sterilization efficiency of 42.5% for the species *G. plicatus* and 37.5% for the *G. nivalis*.

The effect of different cytokinins was evaluated: 6-benzylaminopurine (BAP), kinetin, 2-isopenteniladenine (2iP) in combination with auxin (naphthaleneacetic acid – NAA) and sucrose concentrations on the *in vitro* multiplication of *G. nivalis* and *G. plicatus* bulbs.

The results showed that the highest number of bulbs was obtained on the medium with kinetin and 2iP, but they presented reduced sizes and vitrification phenomena. The best quality and efficiency of multiplication was recorded on the medium with 3.0 mg/L BAP and 0.5 mg/L NAA, where 25% of the bulbs reached a diameter greater than 5 mm, being suitable for acclimatization. Increasing the sucrose concentration determined a reduction in the number of bulbs formed, the optimal value being 20 g/L.

The study's conclusions highlight that the success of conservation through *in vitro* culture depends on the adaptation of hormonal and mineral balance depending on the plant's specifics. Thus, micropropagation represents an efficient method for the rapid production of biological material, essential for future programs to repopulate degraded ecosystems.

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Keywords: *Galanthus, in vitro regeneration, bulb proliferation, ex situ conservation.*

UDC: 633.88:615.322:543.544.5

HPLC ANALYSIS FOR THE QUANTIFICATION OF PHENOLIC COMPOUNDS IN THE POLAR AND NON-POLAR FRACTIONS OF *CICHORIUM INTYBUS* L.

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High-performance liquid chromatography (HPLC) is the most widely used analytical technique for the separation, identification, and quantification of phenolic compounds (flavonoids, tannins, phenolic acids) in plant extracts.

The aim of this study is to quantify the phenolic compounds in the polar and non-polar fractions of *C. intybus* using HPLC. The aerial parts of *C. intybus* was collected in flowering time, from the collection of Scientific Practical Center of Medicinal Plants (SPCMP) of *Nicolae Testemitanu* SUMPh. Polar and non-polar fractions were obtained from ethanol extracts of *C. inybus* after redissolving the extract in distilled water. The non-polar (or organic) fraction was prepared by extraction with a weakly polar organic solvent (ethyl acetate) in a three-step process. The aqueous phase remaining after extraction with ethyl acetate represents the polar fraction, which contains water-soluble polar compounds.The HPLC analysis was performed on a Shimadzu LC-20AD chromatograph equipped with a UV detector, under the following conditions: stationary phase: Zorbax Exlipse Plus C18; 2 mobile phases: solvent mixture: methanol: water (40:60) with gradient elution and 0.5% orthophosphoric acid:acetonitrile (80:20) with isocratic elution, detection at wavelengths of 280, 325, and 360 nm with the optimal separation of phenolic compounds in the solvent system of 0.5% orthophosphoric acid:acetonitrile.

The results of the HPLC analysis indicate that the nonpolar fractions of *C. intybus* extracts have a higher content of hydroxycinnamic acids (chicoric, caffeic, and ellagic) and, in smaller amounts flavonoids (rutin, quercetin, luteolin, kaempferol, apigenin), while the polar hydroalcoholic fractions have a higher content of tannins (catechin and epicatechin) based on the retention times on the extract chromatogram compared to those on the standard solution chromatograms.

The species in the SPCMP collection, *C. intybus*, contains nonpolar phenolic compounds (phenolic acids, flavonoids) and water-soluble polar compounds (tannins), as determined by HPLC, which are of value to the pharmaceutical industry.

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Keywords: *polar and non-polar fraction, Cichorium intybus, HPLC.*

UDC: 632.937.1:595.792:591.185

INFLUENCE OF BIOLOGICALLY ACTIVE SUBSTANCES ON THE BEHAVIORAL ACTIVITY OF THE ENTOMOPHAGE *Bracon hebetor* Say

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The entomophagous species *Bracon hebetor* represents a species of major importance in biological control systems of harmful insects, being frequently used in integrated protection programs for storage facilities and agroecosystems. The larval stages of this species develop ectoparasitically on the host organism, utilizing its nutritional resources for growth and development, a process that leads to paralysis and subsequently to the mortality of the pest. In this context, its ecological role is essential in reducing populations of phytophagous insects and maintaining the biological balance of agricultural ecosystems. The species demonstrates a high adaptive capacity to different environmental conditions, which favors its use in modern biological protection systems.The host-searching and localization activity is influenced by numerous ecological and physiological factors, including the presence of semiochemical compounds. Females of the entomophagous species exhibit active exploratory behavior, orienting themselves according to olfactory stimuli emitted by the host. The intensity of the parasitization process depends both on the physiological state of the host and on abiotic environmental conditions. The importance of *Bracon hebetor* lies in the possibility of using this species as a biological agent for reducing the use of chemical insecticides. The implementation of technologies based on biological control contributes to the production of ecological agricultural products and to the reduction of negative environmental impact.Currently, the optimization of technologies for rearing and utilization of entomophagous species represents a priority direction in the field of integrated plant protection and sustainable agriculture. Recent studies highlight that the use of biologically active substances with kairomonal properties can significantly intensify the behavioral response of entomophagous species, favoring rapid host localization and increasing the efficiency of the parasitization process. The study of migration and orientation activity of *Bracon hebetor* in the presence of semiochemical stimulators has major applied importance for improving the technologies of rearing and utilizing entomophagous species.The aim of the research was to evaluate the influence of biologically active substances (BAS) with kairomonal properties on the behavioral dynamics of *Bracon hebetor*, particularly on host localization time and migration speed during the parasitization process of *Galleria mellonella* larvae.The experiments were carried out under controlled laboratory conditions, allowing a comparative analysis of the behavior of females and males depending on the daytime period and the presence of semiochemical stimulators. Within the study, experimental procedures aimed at optimizing biological processes involved in increasing the parasitization potential of

the entomophagous species were implemented. Larvae of *Galleria mellonella* were used as a standardized host due to their high nutritional value and biological compatibility with the development of the entomophagous species. The preparation of biologically active substances involved the quantitative collection of larval excrements by maceration in 3–5% ethyl alcohol solutions for 24 hours.The analysis of the results regarding migration time and speed of the entomophagous species during parasitization of *Galleria mellonella* larvae highlights significant differences in behavioral activity depending on the experimental variant and the daytime activity interval. The obtained data demonstrate that females from the experimental variants exhibited intensive migration activity during the first half of the day, with a peak activity recorded between 09:00 and 15:00. This period corresponded to a high level of host orientation and localization, demonstrating increased efficiency of the parasitization process in the presence of biologically active substances with kairomonal properties. After 16:00, a progressive decrease in female activity was observed. In parallel, males exhibited a similar activity pattern, although with a slightly extended migration period. Compared with the control variant, all experimental variants treated with BAS demonstrated increased movement behavior intensity and frequency of interaction with the host, indicating a positive influence of kairomonal compounds on the activation of orientation and behavioral systems. A detailed analysis of the variants revealed that although the migration process of the entomophagous species occurred over an extended period of approximately 10 hours, the distribution of migrated individuals was not uniform, but showed significant diurnal variations. This dynamic suggests the existence of behavioral fluctuations determined by differential sensitivity to chemical stimuli and by the complex interaction between biological factors and experimental conditions. In quantitative terms, the variant with the highest migration activity was identified, recording a total of 27 individuals, which confirms the superior efficiency of these treatments in stimulating host-searching and parasitization behavior. The values observed in the other variants indicate a differentiated effect of BAS on the intensity of entomophagous activity.The obtained results demonstrate that the presence of BAS significantly influences the behavior of the entomophagous species. Females exhibited intensive migration and parasitization activity during the first half of the day, especially within the interval 09:00–15:00, compared with periods after 16:00. The optimal variant was identified, in which females demonstrated a high host localization potential. Males also exhibited intensified migration activity compared with the control variant.

Acknowledgments: The research was carried out within the Subprogram 011103 "Development of ecologically harmless means of reducing the impact of harmful organisms of agricultural crops against the background of climate change", funded by the Ministry of Education and Research.

Keywords: *Bracon hebetor, Galleria mellonella, biologically active substances, kairomonal properties, biological pest control.*

UDC: 581.19:577.152.1:602.6

GLUTATHIONE METABOLISM IN PLANTS: REGULATORY MECHANISMS AND BIOTECHNOLOGICAL APPLICATIONS

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Introduction. Glutathione (GSH), a tripeptide composed of γ-glutamate, cysteine, and glycine, is one of the most important cellular antioxidants. In plants, it is not only a simple detoxifying agent but also a central regulator of redox homeostasis and cellular signaling. Through the balance between its reduced and oxidized forms, glutathione controls fundamental processes such as cell proliferation, differentiation, and stress response. Plants are constantly exposed to both abiotic stress factors, such as drought, salinity, extreme temperatures, and heavy metal contamination, as well as biotic stress factors. All these conditions lead to the accumulation of reactive oxygen species (ROS), which can damage proteins, lipids, and DNA. The glutathione system acts as a primary line of defense, neutralizing these reactive species and preventing cellular damage.

Objective: The aim of this study was to elucidate the genetic and biochemical features of glutathione metabolism in plants in order to identify potential biotechnological applications.

Materials and Methods: A review of the literature from 2016-2026 was performed using 15 articles, including data from ScienceDirect, PubMed Central, Biomed Central, MedScape and others.

Results: A particularly important aspect is the involvement of glutathione in the ascorbate–glutathione cycle, which participates in the detoxification of xenobiotics and herbicides mediated by glutathione S-transferases (GSTs), as well as in the production of phytochelatin precursors that sequester toxic heavy metals. Moreover, the glutathione system is involved in the regulation of gene expression and interacts with other signaling pathways through post-translational modifications, such as protein S-glutathionylation.

Biotechnologies that stimulate the glutathione system in plants include genetic engineering (e.g., the Arabidopsis thaliana Glutathione Reductase 2 gene, AtGR2), modification of biosynthetic enzymes (γ-glutamylcysteine synthetase (γ-ECS), glutathione synthetase (GSHS)), overexpression of GSH-dependent antioxidant enzymes (glutathione S-transferases (GST), glutathione peroxidase (GPX)), as well as the alteration of transcriptional regulators involved in stress responses. These interventions lead to increased antioxidant capacity, reduced oxidative stress, and improved tolerance to both abiotic and biotic stress factors, representing promising strategies for the development of resilient crops. Furthermore, the integration of molecular markers and glutathione metabolic profiling can be used in the selection of resilient genotypes.

Conclusions: In conclusion, glutathione is not only an antioxidant but also a key component in the complex network of plant biological responses. Therefore, precise regulation of GSH metabolism, through the integration of molecular markers into breeding programs, represents a key strategy for developing crop varieties adapted to current climate challenges.

Keywords*: glutathione, oxidative stress, genetic engineering, crop resilience, redox signaling.*

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OPTIMIZATION OF LOW-TEMPERATURE *IN VITRO* STORAGE CONDITIONS FOR GARLIC GERMPLASM

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The development of efficient methods for medium-term in vitro conservation requires understanding plant physiological responses to growth-limiting treatments. Garlic (*Allium sativum* L.), a vegetatively propagated crop of high economic and genetic value, represents a suitable model for evaluating the effects of osmotic agents and plant growth regulators on in vitro growth behavior. The present study investigated the influence of different slow-growth treatments on garlic plantlets cultivated at 18±1°C. Plantlets were maintained on full-strength and half-strength Murashige and Skoog (MS) media supplemented with sorbitol, mannitol, sucrose, chlormequat chloride (CCC), or abscisic acid (ABA). Growth characteristics, plant quality, and physiological disorders were evaluated during the storage period and after transfer to recovery media. At 18°C, plantlets exhibited significantly more active growth compared with low-temperature storage conditions. Increased shoot elongation and higher metabolic activity were accompanied by a greater incidence of physiological abnormalities, particularly hyperhydration. Mannitol treatments produced the most severe symptoms of hyperhydration and resulted in poor plant quality during both storage and regrowth phases. Sorbitol and sucrose reduced growth to some extent but were less effective than under low-temperature conditions. ABA and CCC suppressed shoot development; however, their growth-retarding effects were insufficient to achieve optimal conservation at 18°C.

The findings indicate that moderate-temperature storage does not provide adequate growth suppression for efficient medium-term conservation of garlic germplasm. Instead, cultures maintained at 18°C are more suitable for studying physiological responses to osmotic stress and growth regulators. The occurrence of hyperhydration, particularly under mannitol treatment, highlights the importance of selecting appropriate osmotic agents when designing in vitro conservation protocols.

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Keywords: *Allium sativum L.; osmotic stress; plant growth regulators; hyperhydration; in vitro culture; physiological response.*

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IN SILICO SCREENING OF BPH DOMAINS IN BACTERIA FOR POTENTIAL DDT TRANSFORMATION

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Persistent organic pollutants, including dichlorodiphenyltrichloroethane (DDT), pose a threat due to their toxicity and bioaccumulation. Since DDT transformation occurs through cometabolic pathways involving aromatic degradation enzymes, this study assessed *in silico* the distribution of protein domains associated with the biphenyl degradation pathway (bph) and related catabolic processes in bacterial proteomes. A dataset of representative NCBI reference proteomes was analyzed for 39 bacterial species (up to three proteomes per species) corresponding to bacteria available in the National Collection of Non-pathogenic Microorganisms, Institute of Microbiology and Biotechnology, Technical University of Moldova. Homology searches were performed using BLASTp (E-value $\leq 1 \times 10^{-10}$, identity $\geq 40.0\%$, coverage $\geq 50.0\%$), followed by annotation using HMMER and the Pfam database.

BphA-related domains associated with initial aromatic oxidation (Rieske, Rieske_2, Ring_hydroxyl_A and Ring_hydroxyl_B) were detected in all analyzed proteomes of *Streptomyces scabies*; Rieske and Rieske_2 – in *Streptomyces albus, Streptomyces plicatus, Micrococcus aloeverae*, *Micrococcus yunnanensis*, and in two *Clavibacter michiganensis* proteomes; Ring_hydroxyl_B – in one *Rhodococcus rhodochrous* proteome. BphD-related hydrolase domains Abhydrolase_1, Abhydrolase_6 and Hydrolase_4 were identified in all proteomes of *R. rhodochrous*, *Azotobacter chroococcum*, and *Streptomyces lavendulae*, and in one proteome each of *Streptomyces fradiae, S. albus*, and *Sinorhizobium meliloti*; Abhydrolase_1/6 – in *Bradyrhizobium japonicum, Rhizobium leguminosarum.* BphK-related GST domains were detected in *Acetobacter aceti, Pectobacterium carotovorum, Pseudomonas chlororaphis, A. chroococcum, Rhizobium phaseoli, B. japonicum, R. leguminosarum,* in two *Pseudomonas fluorescens* proteomes and in one proteome each of *Agrobacterium tumefaciens* and *Pseudomonas poae*, while Glyoxalase domains were identified in *R. rhodochrous* and *S. lavendulae*, as well as in two proteomes of *Pseudomonas putida* and *B. japonicum*; in one proteome each of *P. fluorescens* and *S. fradiae.* The results suggest that *R. rhodochrous, S. scabies*, and *A. chroococcum* possess the greatest diversity of domains associated with aromatic compound transformation and may represent promising candidates for further investigation of DDT cometabolism.

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Keywords: *bioremediation, bacteria, Bph domains, DDT.*

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TUBERIZATION OF DIFFERENT POTATO VARIETIES IN *IN VITRO* CULTURE

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The research objective was to determine the effect of culture medium composition and different lighting regimes on the tuberization process of different potato varieties in *in vitro* culture. The research was conducted at the Department of Biotechnology and Biotechnical Systems of the Institute for Potato Research of the NAAS. The research objects were potato varieties developed by the Institute for Potato Research of the NAAS – Slauta, Kimmeriia, and Kniahynia. During the research, biotechnological methods of plant tissue and organ culture were used – for obtaining and propagating *in vitro* plants through cutting in tube culture on agarized medium under sterile conditions. Based on the research results, a positive effect of different lighting variants on the growth and development of *in vitro* plants was revealed. A certain relationship between shoot growth intensity and tuberization was established.

Active tuberization began when shoot growth slowed down or stopped completely. On the 36th day after planting cuttings on the culture medium, the first microtubers were formed. Mass microtuber formation was observed on Murashige and Skoog medium with the addition of 100% macroelements and 2 mg/l adenine. Adenine stimulates stolon formation and tuber initiation. Microtuber yield was: Kimmeriia – 53% (control 46%), Kniahynia – 39% (control 34%), Slauta – 37% (control 35%). In the variant with H_1 medium supplemented with 2 mg/l adenine, microtuber yield was: Kimmeriia – 51% (control 46%), Kniahynia – 37% (control 34%), Slauta – 36% (control 35%). On average for 2023–2025, the highest percentage of plants that formed microtubers after transfer to dark conditions was observed in Slauta – 97%, the lowest in Kimmeriia – 94%.

It should be noted that the number of microtubers per plant among the studied varieties was also higher in the treatment where plants were grown for the first 10 days under a 16-hour photoperiod, followed by transfer to dark conditions. The values ranged from 2.0 to 2.5 pieces/plant. In Slauta and Kimmeriia, this indicator was almost identical and amounted to 2.4 and 2.5 pieces/plant, respectively.

Keywords: *in vitro plants, agarized medium, microtubers, macroelements.*

UDC: 635.21:632.95:631.563

EVALUATION OF THE EFFECTIVENESS OF NOVEL PRODUCTS IN POTATO STORAGE TECHNOLOGY

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The objective of the research is to develop elements of varietal storage technology for new and promising potato varieties using novel insecto-fungicides and to investigate their effect on sprouting and quality indicators of tuber suitability for processing.

The research was conducted on ten varieties of different maturity groups during storage in 2024–2025 with the application of the insecto-fungicide “Potato Rescuer” and the insecticide “Zalp” to study their effect on sprouting, quality indicators, and resistance to disease infection in the Institute for Potato Research storage facility, with subsequent planting in the demonstration field.

The results obtained showed the absence of any infections, indicating the effectiveness of using the products for disease protection during storage. Tuber sprouting occurred according to maturity groups and varietal characteristics.

It was established that regardless of product treatment, tubers of all varieties had sprouts, with the percentage of sprouted tubers ranging from 97 to 100%, indicating that physiological processes in tubers proceeded according to their genetic potential.

In 2024–2025, the highest manifestation of common scab and dry rot infection was observed in Zhytnytsia, ranging from 1.0 to 2.5% and from 3.6 to 8.9%, respectively; the lowest in Medeia and Misteriia, ranging from 0.5 to 1.2%, from 0.4 to 1.0%, and from 1.2 to 3.1%, respectively. A reduction in black scurf infection was established – 0–8% compared to the control variant at 6–11%; common scab – 0–12% compared to the control variant at 9–24%; and dry rot – 1–16% compared to the control variant at 11–26%.

Before storage, biochemical and sensory evaluation of tubers was conducted, and no dependence on the applied products was established; that is, the insecto-fungicide “Potato Rescuer” and insecticide “Zalp” do not affect the biochemical and taste properties of varieties, but significantly reduce infection and cross-infection by diseases during storage, which improves quality and consequently economic indicators.

Keywords*: potato, disease infection, resistance, quality indicators.*

UDC: 663.1:579.222:604.4

PRODUCTION OF ELLAGIC ACID FROM POMEGRANATE PEELS USING *ASPERGILLUS NIGER*

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Ellagic acid (EA) is a polyphenolic compound with antioxidant, antimicrobial, anti-inflammatory, and chemopreventive properties, making it of major interest to the pharmaceutical, cosmetic, and food industries. Conventional methods for obtaining EA are mainly based on chemical extraction processes that require large amounts of organic solvents and less sustainable operating conditions; moreover, since EA occurs naturally in plants, including pomegranate peels, in relatively low amounts (2.5–51.5 mg/g dry weight), conventional extraction usually results in low recovery yields of the compound. Therefore, biotechnological approaches represent a promising and environmentally friendly alternative for its production.

The aim of the present study was the biotechnological production of EA through the enzymatic conversion of ellagitannins from pomegranate peels using *Aspergillus niger*. Pomegranate peels, selected as a rich natural source of ellagitannins, were preliminarily dried and finely ground before use. The microorganism was initially cultivated on *Sabouraud Dextrose Agar* and incubated for 5 days at 28–30°C. Fermentation was subsequently carried out in a BIOPEX Twin UNOPEX bioreactor under sterile conditions for 7 days.

The optimized fermentation medium contained pomegranate peels (40 g/L), glucose (10 g/L), ammonium sulfate (10 g/L), yeast extract (5 g/L), peptone (5 g/L), KH_2PO_4 (1.5 g/L), $MgSO_4 \cdot 7H_2O$ (0.5 g/L), $FeSO_4 \cdot 7H_2O$ (0.01 g/L), $ZnSO_4 \cdot 7H_2O$ (0.01 g/L), $CuSO_4 \cdot 5H_2O$ (0.005 g/L), $MnSO_4 \cdot H_2O$ (0.005 g/L), citric acid (1 g/L), and pectin (0.25 g/L). Optimal fermentation conditions were established at pH 6.0–6.5, temperature 28–30 °C, aeration rate 2.0 vvm, and agitation speed 150–200 rpm. After 7 days of fermentation, since EA is an extracellular metabolite, the biomass was separated by centrifugation, and EA was extracted from the aqueous phase using ethyl acetate at 30–40°C for 2–4 h. The organic phase was concentrated under vacuum at 40–50 °C. The biotechnological process using *Aspergillus niger* resulted in a relatively high EA yield of 25 mg/g dry weight. The identity of the obtained EA was confirmed by UV–Vis and FTIR spectroscopy, consistent with literature data. The results highlight the potential of pomegranate peel valorization through sustainable microbial fermentation for EA production.

Keywords: *ellagic acid, Aspergillus niger, bioconversion, pomegranate peels.*

UDC: 633.31:631.461.5:579.841.11

EFFECT OF *RHIZOBIUM MELILOTI* 2/13 ON ALFALFA GROWTH

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Rhizobium meliloti is a bacterium that forms nodules on the roots of leguminous plants, fixes atmospheric nitrogen, and thereby promotes plant growth and development. The aim of this study was to evaluate the ability of the *Rhizobium meliloti* 2/13 strain to stimulate the growth of alfalfa (*Medicago sativa*) plants.

The methods used included inoculating alfalfa seeds with *Rh. meliloti* 2/13, germinating and growing the seedlings for up to 3 weeks in Petri dishes on moistened filter paper under standard laboratory conditions. The effect of applying *Rh. meliloti* 2/13 was determined by comparing the dry mass of the seedlings with that of the uninoculated control. It was established that the effect of treatment with *Rh. meliloti* 2/13 depends on the concentration of bacteria in the suspension used for seed inoculation and can be either positive or negative. In the best case, a significant stimulation of +52% compared to the control was observed.

As a result, it was demonstrated that the *Rhizobium meliloti* 2/13 strain possesses considerable potential that can be used to stimulate the growth and development of alfalfa.

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Keywords: *alfalfa; plant growth promotion; Rhizobium meliloti.*

UDC: 633.522:631.4:551.58(478)

PREREQUISITES FOR CULTIVATION OF *CANNABIS SATIVA* L. IN THE SOUTHERN REGION OF THE REPUBLIC OF MOLDOVA

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Cannabis sativa L. is an annual herbaceous species of the genus *Cannabis*, family *Cannabaceae*, originating from Central Asia, and has been used by humans since ancient times. The plant has an erect stem, which, depending on the variety, cultivation conditions and purpose of use (seeds or fibers), can reach heights of approximately 2–6 m. The root system is well developed, the main root can penetrate up to about 2 m deep, and the secondary roots, which form the largest part of the root system, frequently reach lengths of 10–60 cm.

C. sativa can be cultivated on different types of soil, but the most favorable for obtaining high yields are chernozems, fertile alluvial soils and well-drained loamy or sandy loamy soils. The plant effectively capitalizes on fertile, loose and well-aerated soils, with a weakly acidic to neutral reaction, the optimal pH being between 6.0 - 8.0. Excessively wet or compact soils are not recommended, as excess water affects the development of the root system and plant growth.

Most of the soils in the southern region of the Republic of Moldova are considered favorable for the cultivation of the *C. sativa* L. species, being predominantly formed on loessoid rocks and sandy-clay deposits that are suitable for cultivation. In this region, carbonate chernozems, typical weakly humiferous chernozems and ordinary chernozems predominate. Due to the medium and light granulometric texture, these soils are well drained, which allows relatively easy infiltration of water into the lower layers and ensures access of plant roots to water during the growing season.

Currently, in the context of severe climate change in the southern region of the Republic of Moldova, *C. sativa* L. presents a priority alternative for cultivation, being a crop resistant to these challenges and offering considerable economic advantages. This fact is argued by the optimal temperature for the cultivation of industrial hemp is approximately 19–25°C. The species prefers temperate climatic conditions and areas with a favorable thermal regime during the vegetation period. During the vegetative cycle, the plant has a relatively high water consumption, with approximately 300–500 l of water being required to form one kilogram of dry matter. Prolonged water deficit can significantly reduce biomass production and negatively influence the flowering and seed ripening process.

The current pedoclimatic conditions in the southern region of the Republic of Moldova are favorable for the cultivation of the *C. sativa* L. species. At the same time, the cultivation of this plant has a significant potential for improving soil quality, due to the well-developed root system and the capacity to accumulate organic matter, thus contributing to the improvement of the structure and physical properties of the soil and the state of the environment in the region. In the context of the above, we recommend the cultivation of *C. sativa* L. in the southern region of the Republic of Moldova for the purpose of the sustainability of regional agriculture with premises for expansion at the national level.

Keywords: *Cannabis sativa, southern region, environmental conditions, cultivation.*

UDC: 633.82:665.52.03:664

THE POTENTIAL OF USING ESSENTIAL OILS OF *MENTHA* SP. FROM THE COLLECTION OF SRL PLANT BIOCHEMISTRY IN THE FOOD AND BEVERAGE INDUSTRY

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Essential oils are volatile and intensely aromatic natural substances extracted from various plant species. From a chemical point of view, they constitute a complex mixture of secondary metabolites synthesized by plants, the composition of which depends largely on pedo-climatic conditions. Due to their bioactive composition, essential oils exhibit multiple biological effects, including antioxidant, antimicrobial and anti-inflammatory activity. Of particular interest is their ability to inhibit the development of pathogenic and spoilage microorganisms, which gives them practical value in the field of food preservation. Numerous types of essential oils can be used as natural preservatives in meat, dairy, fruit and vegetable products, contributing to extending the shelf life and maintaining the quality of food products. The present analysis aims to synthesize current information on the role of mint essential oils, taking into account the diversity of chemotypes existing in the SRL Plant Biochemistry collection, since their biological properties are directly influenced by the peculiarities of the qualitative and quantitative composition. Although mint essential oils are mainly used in the food industry to impart flavor, in recent years their fields of application have also expanded significantly, including in modern preservation systems and in active packaging materials for food and beverages.

Biochemical composition of essential oils differs depending on the species, variety, vegetation phase and cultivation conditions. Mint species from the SRL Plant Biochemistry collection are distinguished by a high content of monoterpenes and oxygenated compounds, such as menthol, menthone, carvone, limonene and pulegone, substances that determine the biological and aromatic value of plants. From a biochemical point of view, of particular interest is the content of essential oil, phenolic compounds, flavonoids and antioxidant capacity, parameters that influence the functional and preservative properties of food products. The mint species and varieties cultivated in the SRL Plant Biochemistry collection exhibit high antimicrobial and antioxidant activity, due to the increased concentrations of menthol and other bioactive secondary metabolites. These biochemical features highlight the importance of mint species for the food industry. At the same time, the presence of biologically active compounds gives food products functional value and beneficial potential in preventing oxidative stress and cardiovascular diseases.

***Acknowledgments*:** This study was supported by the research subprogram 010102, funded by Ministry of Education and Research of the Republic of Moldova.

Keywords: *essential oils, food applications, menthol, volatile, distillation.*

UDC: 633.812:665.52:664

EFFECTS OF INCLUDING *HELIANTHUS TUBEROSUS* IN THE DIET OF LAYING HENS

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The results of studies investigating the inclusion of Jerusalem artichoke (*Helianthus tuberosus*) meal in the diet of laying hens and its effects on the essential physiological indicators of their clinical status revealed certain variations. During the pre-experimental period, the hens' body temperature was identical (41.4–41.5°C), remaining within the normal physiological range for adult laying hens, which confirms a stable clinical condition. During experimental period-I (0.5% Jerusalem artichoke meal) and experimental period-II (1.0% Jerusalem artichoke meal), body temperature showed only minor, statistically insignificant variations, remaining between 41.7 and 41.8°C. This stability demonstrates the good tolerability of Jerusalem artichoke flour at the tested inclusion levels. Respiratory rate during the pre-experimental period showed similar values among the groups (22.4–24.2 breaths/min), corresponding to a normal physiological state. Dietary supplementation with 0.5% Jerusalem artichoke meal during experimental period-I resulted in an increase in respiratory rate in experimental group 1 to 25.3 ± 0.48 breaths/min ($P<0.05$). During experimental period-II (1.0%), respiratory rate increased to 26.8 ± 0.32 and 28.4 ± 0.53 breaths/min in experimental groups 1 and 2, respectively ($P<0.05$). Heart rate values during the pre-experimental period (257–266 beats/min) indicated a normal physiological cardiovascular status. During experimental period-I, a tendency toward increased heart rate was observed, while in experimental period-II, heart rate increased in experimental groups 1 and 2 to 278.5 ± 3.22 and 287.2 ± 3.97 beats/min, respectively ($P<0.05$). The birds demonstrated stable body water balance through adequate hydration and the absence of hydroelectrolytic imbalances. Oxygen saturation showed a slight increase in blood oxygen levels throughout all stages of the experiment. The overall clinical condition of the laying hens during all experimental periods was assessed as "good."

Therefore, the values of body temperature, respiratory and heart rates, hydration status, blood oxygenation, and overall clinical condition indicate the occurrence of adaptive and physiological processes characterized by intensified metabolism, stimulation of digestive activity, and an increased oxygen demand.

Keywords: *laying hens, Jerusalem artichoke, clinical status.*

UDC: 632.78:631.5

EVALUATION OF THE REPRODUCTIVE ACTIVITY OF *AGROTIS SEGETUM* IN CORRELATION WITH GENERATION AND CROP PHENOLOGY

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Agrotis segetum (Denis & Schiffermüller, 1775) is one of the most important polyphagous pests of agricultural crops, characterized by a high adaptability to climatic and trophic conditions in agroecosystems. In the context of climate change, the study of the reproductive activity of this species is of particular importance for understanding population dynamics and improving monitoring and forecasting systems.

The research was carried out during April–October 2025 within the experimental fields of the Institute of Genetics, Physiology and Plant Protection. Biological material was collected using light traps installed in soybean, wheat and sunflower crops. The collected females were fixed in 70% alcohol and subjected to anatomical preparation under laboratory conditions. Anatomical dissections were performed under a binocular microscope, analyzing the structures of the female reproductive system, the presence and number of spermatophores, as well as the degree of ovarian development.

The obtained results highlighted an intensive reproductive activity of the species during July–August, corresponding to the development of the second biological generation. The highest proportion of eggs in the ovaries was recorded in female specimens containing 3–4 spermatophores in the copulatory bursae. These results indicate an intensification of the reproductive activity of *Agrotis segetum* under favorable thermal conditions and during the active phenological stages of agricultural crops. At the same time, it was demonstrated that females containing 1–2 spermatophores in the copulatory bursae deposited a larger number of eggs, thus demonstrating a higher oviposition capacity.

The analysis of the obtained results demonstrated the existence of a positive correlation between the reproductive activity of *Agrotis segetum*, the biological generation and crop phenology. Anatomical preparation of females proved to be an efficient method for a more precise evaluation of the physiological state of populations depending on the number of generations and may contribute to the improvement of modern pest monitoring systems under climate change conditions.

Acknowledgments: The researches were carried out within the Subprogram 011103 Development of ecologically harmless means of reducing the impact of harmful organisms of agricultural crops against the background of climate change, financed by the Ministry of Education and Research

Keywords: *Agrotis segetum, reproductive activity, spermatophores, biological generation, crop phenology.*

UDC: 632.752.2:591.16:632.937

EVALUATION OF SILVER NANOPARTICLE EFFECTS ON BIOCHEMICAL RESPONSE AND ELEMENTAL COMPOSITION OF *MENTHA SPICATA* L.

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Silver nanoparticles (AgNPs) are increasingly considered in agriculture as biostimulants and agents for plant diseases control. However, their efficacy and safety depend on concentration, surface coating, and chemical form. Mentha spicata L., a valuable medicinal and aromatic plant, was selected as the object of research. The main goal was to determine the optimal AgNPs concentration for plant growth and development, to assess biochemical responses, and to evaluate how nanoparticle coatings and silver form (ionic or nano) affect the elemental composition of Mentha spicata L. plants.

The study included two stages. On the first stage, plants were exposed to PVP-coated AgNPs at concentrations 1–100 mg/L applied to the root system during a 28-day experiment. Based on biochemical parameters (chlorophyll, carotenoids, antioxidant activity), 5 mg/L was identified as the most suitable concentration, providing optimal biostimulatory effects. On the second stage, the effect of 5 mg/L of silver in three forms: PVP-coated AgNPs, citrate-coated AgNPs, and ionic silver ($AgNO_3$) on plants was evaluated. Neutron activation analysis quantified 32 macro- and microelements in rhizosphere soil, roots, and aerial biomass.

Citrate-coated AgNPs stimulated increase of most macro- and microelements (Mg, Ca, Al, Fe, Mn, Ti) in roots and soil but inhibited their uptake in aerial parts compared to the control. In contrast, application of PVP-coated AgNPs reduced element content in all plant segments. Application of ionic silver led to an increase of Mn content in roots, and decrease of Ca content in stems and leaves. Zinc levels declined in all plant segments regardless of the type of treatment.

The results indicate that surface coating is a critical factor governing elements uptake and redistribution in M. spicata L. Both the choice of stabilizing agent and the applied concentration must be carefully considered when using AgNPs as biostimulants in agricultural practice.

Keywords: *silver nanoparticles, Mentha spicata L., neutron activation analysis, risk assessment, elemental composition.*

UDC: 634.713:547.973:543.544.5(478)

ANTHOCYANINS IN ARAPAHO AND TRIPLE CROWN BLACKBERRIES IN REPUBLIC OF MOLDOVA

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Blackberry fruits are recognized as an important source of natural antioxidants, mainly anthocyanins, which are responsible for fruit pigmentation and contribute significantly to their nutritional and functional value.

The present study aimed to evaluate the total anthocyanin content and anthocyanin composition of blackberry fruits from the cultivars Arapaho and Triple Crown cultivated under the environmental conditions of the Republic of Moldova.

Fully ripe fruits harvested in 2024 were analyzed for total anthocyanin content using cyanidin-3-glucoside chloride as a reference compound. The anthocyanin profile was determined by high-performance liquid chromatography (HPLC).

The total anthocyanin content in fresh fruits reached 0.190% in the cultivar Arapaho and 0.104% in Triple Crown. On a dry matter basis, the corresponding values were 0.868% and 0.594%, respectively. Fruit moisture content was 78.1% in Arapaho and 82.5% in Triple Crown. The results demonstrated that Arapaho accumulated approximately 82.7% more anthocyanins than Triple Crown. HPLC analysis revealed four anthocyanin compounds in Arapaho fruits and six compounds in Triple Crown fruits, four of which were common to both cultivars. Cyanidin-3-glucoside was identified as the predominant anthocyanin in both cultivars.

The obtained results indicate significant cultivar-dependent differences in anthocyanin accumulation and composition. Arapaho was characterized by a higher anthocyanin concentration, whereas Triple Crown exhibited a more diverse anthocyanin profile. These findings contribute to the characterization of blackberry germplasm cultivated in the Republic of Moldova and may support the selection of cultivars with enhanced nutritional and antioxidant potential.

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Keywords: *blackberry, anthocyanins, HPLC, cyanidin-3-glucoside.*

UDC: 595.754:632.752.6:632.937(478)

ASSESSMENT OF HOST PLANT SUITABILITY FOR THE DEVELOPMENT OF *HALYOMORPHA HALYS* IN AGROECOSYSTEMS OF THE REPUBLIC OF MOLDOVA

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In recent years, the invasive brown marmorated stink bug *Halyomorpha halys* has become a serious agricultural pest in Europe, including the Republic of Moldova. Its high adaptability and broad host range enable rapid colonization and population establishment. Therefore, identifying suitable host plants for its feeding, development, and reproduction under local conditions is essential.

The study was conducted under laboratory conditions using an experimental rearing method on ten plant species: *Glycine max, Pisum sativum*, *Solanum lycopersicum*, *Capsicum annuum*, *Morus nigra*, *Elaeagnus angustifolia*, *Helianthus annuus*, *Vitis spp.*, *Malus spp.*, and *Prunus spp.*. Insect survival, ontogenetic development, and egg mass formation were evaluated.

The obtained results demonstrated significant differences in host plant suitability for *H. halys*. The most favorable conditions for insect development were observed on *Glycine max* and *Pisum sativum*, where individuals successfully completed all developmental stages and produced fertile egg masses.

On *Solanum lycopersicum*, *Capsicum annuum*, *Morus nigra*, and *Elaeagnus angustifolia*, insects reached the adult stage; however, reproduction was not observed. These plant species were therefore classified as partially suitable hosts.

In contrast, *Helianthus annuus*, *Vitis spp.*, *Malus spp.*, and *Prunus spp.* were characterized by high mortality of nymphal stages. Insect development usually ceased at the III–IV nymphal instars, indicating low nutritional suitability of these plants for the invasive species.

The results confirm the pronounced trophic plasticity of *H. halys* and demonstrate its ability to utilize a wide range of host plants under newly invaded environmental conditions.

The study showed that plant species in the agroecosystems of the Republic of Moldova vary in suitability for *H. halys* development. *Glycine max* and *Pisum sativum* were the most favorable hosts for stable populations. The results may support monitoring, distribution forecasting, and integrated pest management.

Acknowledgments: The research was carried out within the Subprogram *011103 Development of ecologically harmless means of reducing the impact of harmful organisms of agricultural crops against the background of climate change*, funded by the Ministry of Education and Research.

Keywords: *stink bug, phenological phases, Halyomorpha halys, host plants.*

UDC: 634.1:632.937.1:579.852.11

PEST CONTROL USING ENTOMOPATHOGENIC BACTERIA AND THEIR USE AS BIOINSECTICIDES

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Insects are susceptible to diseases caused by bacteria. These pathogens are used for biological pest control. Microbial insect pathogens are being intensively studied to develop environmentally friendly pest control strategies for agriculture and forestry. The most successful insect pathogen that has been used is the bacterium Bacillus thuringiensis (Bt), which is used to control certain lepidopteran pests. In Republic of Moldova, imported Bt kurstaki products have primarily been used. These products are expensive, creating an urgent need to develop aggressive indigenous Bt strains against various pests.

This study aimed to evaluate the relevance of *Bacillus thuringiensis* var. *kurstaki* as a microbial bioinsecticide in sustainable biotechnologies for apple and walnut crop protection, with emphasis on its insecticidal potential, environmental compatibility, and practical role in integrated pest management systems. The entomopathogenic microorganismsalso can accumulate themselves in the environment and the host population, and it can control the pest insects for a long term by forming epidemic disease in the pest insect population through the external environment stimulation..

Assessments conducted after treatment with *Bacillus thuringiensis* var. kurstaki against codling moth (*Cydia pomonella* L.) in apple revealed high biological efficacy. Fruit damage in the tree crown decreased from 21.3% in the untreated control to 4.3% in the treated variant at a dose of 10.0 l/ha, corresponding to a reduction in damage of 79.8%. In walnut orchards, the application of the same microbial agent against Cydia pomonella L. resulted in a biological efficiency of 82.8%, further confirming the practical value of Bt-based products in orchard pest management. These findings highlight the potential of *Bacillus thuringiensis* var. kurstaki as an important component of environmentally friendly protection programs for both apple and walnut crops. Compared with conventional insecticides, Bt-based products have a lower ecological impact, pose a reduced risk to non-target organisms, and show greater compatibility with integrated pest management strategies.

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UDC: 635.21:632.38:581.143.6

EFFICIENCY OF VIRUS ELIMINATION IN POTATO VARIETIES USING THE VIRUS-INHIBITING AGENT RIBAVIRIN

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The objective of our research was to eliminate viruses from new potato varieties in *in vitro* culture using the chemotherapy method combined with apical meristem culture. Optimization of effective techniques for virus elimination, improvement of seed potato quality, and increased propagation coefficient was achieved using the virus-inhibiting substance Ribavirin.

The research subjects were varieties developed by the Institute for Potato Research: Medeia, Soborna, Mirami, Misteriia, Melaniia.

The antiviral agent was added aseptically to the upper layer of agarized medium. Murashige and Skoog medium in our modification was used as the base, with Ribavirin overlayed through a Millex-GS 0.22 μm Filter Unit at a concentration of 50 mg/l of culture medium.

After three chemotherapy cycles, the virus-free lines were diagnosed for virus antigen content using enzyme-linked immunosorbent assay (DAS-ELISA).

Based on diagnostic results, 48 lines were identified in which no antigens of potato viruses Y and M were detected, representing 45.3% of the total, which is 10.0% higher than in the control. By variety, the percentage of virus-free lines ranged from 24.2% in Medeia to 84.6% in Melaniia. However, an exception was Mirami, in which the percentage of virus-free lines with ribavirin treatment was 8.3% lower than in the control (isolation by apical meristem method). Apparently, for Mirami, the chemotherapeutic agent induced viral replication against the background of general osmotic and chemical stress in the *in vitro* explant.

In the studied lines in which potato virus M was detected, a reduction in antigen concentration was established: in lines of Melaniia by 47.3%; in lines of Medeia – 33.1%; in Mirami – 43.9%; in Soborna – 45.7%; in Misteriia, the reduction in virus M antigen concentration was 31.5% compared to the control.

***Acknowledgments*:** 14.00.03.02.Φ Development of scientifically substantiated parameters of technologies for virus elimination of potato varieties *in vitro* and diagnostics of disease pathogens, the National Academy of Agrarian Sciences of Ukraine

Keywords: *meristem, regenerant plants, viruses, antiviral agent.*

UDC: 582.394:581.143.6:635.9

INITIATION OF MICROPROPAGATION OF THE FERN *ATHYRIUM NIPONICUM* 'URSULA'S RED

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In vitro micropropagation is an effective method for the conservation and multiplication of rare and endangered species, including ferns. The increasing demand for ornamental ferns requires the development of propagation techniques that enable the production of a large number of healthy plants within a relatively short period of time. The aim of the research was to initiate and multiply in *vitro* the species *Athyrium niponicum* 'Ursula's Red' (painted Japanese fern) in the Embryology and Biotechnology Laboratory. The painted Japanese fern is renowned for its spectacular foliage and is recommended for planting in shaded gardens and near water bodies, with the purpose of integrating it into landscape designs.

The Japanese painted fern is a deciduous species with underground, creeping brown rhizomes that slowly spread over time, forming colonies. It has pinnate, triangular, finely dissected leaves, 20–45 cm long, arranged in a slightly arched rosette, with purple rachises and pinnae featuring silvery areas that create a striking contrast of purple and silver shades, changing according to the season. The fronds are regular, elongated or linear, more or less curved or horseshoe-shaped, with serrated indusia of a similar shape.

For the *in vitro* initiation of ferns, rhizome fragments, primordia and frond apices, as well as fragments of incompletely differentiated sporangia (sori) collected from juvenile sporophytes, were used as inoculum sources. Sterilization of the plant material was carried out using different sterilizing agents. Under aseptic conditions, the plant material was placed on the surface of the nutrient medium. The composition of the selected nutrient media varied according to the purpose of the experiment: obtaining globular meristematic structures called "green globular bodies" (GGBs), gametophyte differentiation, sporophyte development, and induction of rhizogenesis.

Using fragments of incompletely differentiated sporangia (sori) as inoculum, massive development of meristematic structures known as GGBs was observed after 30 days of incubation. These globular, multicellular meristematic structures subsequently served as material for mass propagation, followed by the development of numerous clusters of multicellular gametophytes of various sizes. Due to the production of propagules within a relatively short period of time, transfer onto an appropriate nutrient medium allowed the obtainment of an impressive number of gametophytes (approximately 300–350) per culture vessel.

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Keywords: *in vitro, inoculum, ferns, sporangia, GGB, gametophyte.*

UDC: 582.232:577.114.7:546.56

INDUCTION OF THE SYNTHESIS OF SULFATED EXOPOLYSACCHARIDES DURING THE CULTIVATION OF *SPIRULINA PLATENSIS* IN THE PRESENCE OF COORDINATIVE COMPOUNDS OF CU(II)

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In recent decades, particular attention has been given to the biological properties of polysaccharides and their chemical derivatives, especially sulfated derivatives. Sulfated polysaccharides exhibit a broad spectrum of important bioactivities, including antioxidant, anticoagulant, antithrombotic, antiviral, and antitumor activities.The aim of our research was to study the directed synthesis of sulfated exopolysaccharides in Spirulina platensis during cultivation in the presence of Cu(II) coordinative compounds. The studied object was the cyanobacterial strain Spirulina platensis CNM-CB-02, stored in the CNMN collection of the Institute of Microbiology and Biotechnology. For Spirulina cultivation, the mineral nutrient medium SP-1 was used. Cultivation was carried out in 250 mL Erlenmeyer flasks containing 100 mL of cyanobacterial suspension for 10 days under an illumination regime of 3600 lx. As regulators of productivity and biosynthetic activity of Spirulina platensis were used several coordinative compounds of Cu(II) with condensation products obtained from 2-amino-2-methyl-1,3-propanediol and substituted salicylaldehydes (PK2, PK5, PK10, PK12). These were added on the first day of cultivation in concentrations of 0.005, 0.01, and 0.015 mmol/L, respectively. Productivity was determined photocolorimetrically, while the content of sulfated exopolysaccharides was measured using the Alcian Blue staining method. The results showed that with increasing concentration of coordinative compounds in the cultivation medium, Spirulina productivity decreased; however, the content of sulfated exopolysaccharides increased significantly. The highest content of sulfated exopolysaccharides was recorded with PK-5 at the maximum concentration of 0.015 mmol/L (45.36 mg/L), which was 1.87 times higher than the control sample (24.25 mg/L). A high content of sulfated exopolysaccharides was also observed in the case of PK-2, PK-10, and PK-12 at 0.015 mmol/L, with increases of 220.51%, 200.06%, and 65.93%, respectively, compared to the control. Coordinative compounds of Cu(II) at a concentration of 0.015 mmol/L exhibit a maximal stimulatory effect on the synthesis of sulfated polysaccharides in the culture medium of the cyanobacterium Spirulina platensis.

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UDC: 633.88:615.322:543.55

TOTAL PHENOLIC CONTENT IN THE POLAR AND NON-POLAR FRACTIONS FROM *AGRIMONIA EUPATORIA* L.

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Phenolic compounds are beneficial to human health and possess a wide range of pharmacological properties, such as antioxidant, anti-inflammatory, antimicrobial, and antitumor properties, and are widely used in the pharmaceutical, cosmetic, and food industries.

The aim of this study is to evaluate the total phenolic content (TPC) in the polar and non-polar fractions from A. eupatoria extract with a view to identifying the fractions with a higher content of bioactive compounds. The aerial parts of Agrimonia eupatoria were collected in flowering time, on June 2025, from the collection of Scientific Practical Center of Medicinal Plants of Nicolae Testemitanu State University of Medicine and Pharmacy. To obtain the nonpolar or organic fractions, an extraction was performed using a weakly polar organic solvent commonly used under laboratory conditions (ethyl acetate); the extraction was carried out in three stages, after the dried ethanol extract had been redissolved in distilled water. The aqueous phase remaining after extraction with ethyl acetate represents the polar fraction, which contains water-soluble polar compounds. The total phenolic content (TPC) was determined using the Folin-Ciocalteu reagent, with absorbance measured at a wavelength of $\lambda = 760$ nm on Metertech UV/VIS SP 8001 spectrophotometer; the result was expressed as gallic acid equivalent (mg GA/g).

The results indicate that the polar fraction of A. eupatoria, rich in tannins, phenolic glycosides, and water-soluble polar compounds, has a higher content of total phenolic compounds (TPC = 31.72 ± 0.42 mg GA/g), compared to the nonpolar fraction, which is rich in aglycones (TPC = 23.46 ± 0.78 mg GA/g), data confirmed by HPLC and FTIR-ATR analyses.

The results indicate that the polar fractions are richer in phenolic compounds than the nonpolar fractions obtained from A. eupatoria extracts; these will be used in subsequent pharmaceutical studies.

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***Keywords**: polar and non-polar fraction, total phenolic content, A. eupatoria.*

UDC: 664.66:579.67:614.3(479.24)

FROM OVEN TO SHELF: A BIOTECHNOLOGICAL STUDY OF MICROBIAL DYNAMICS IN BREAD SYSTEMS

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Bread is a widely consumed staple food however its microbiological quality is strongly influenced by post-baking handling and storage conditions. This study aimed to evaluate the microbiological quality and short-term microbial dynamics of bread produced in industrial and traditional systems in Baku, Azerbaijan, with particular emphasis on post-baking contamination.

A total of 16 freshly baked bread samples were collected from supermarkets and traditional tandir bakeries. Samples were handled aseptically, transported under controlled conditions, and analyzed within 24 hours. Microbiological analyses were conducted on Day 1 and after 3 days of ambient storage. Total aerobic bacteria, coliforms, *Escherichia coli*, yeasts and moulds, and *Staphylococcus aureus* were enumerated using standardized ISO methods, and results were statistically evaluated using the Wilcoxon signed-rank test.

Results showed low or non-detectable microbial counts immediately after baking, confirming effective thermal processing. However, significant increases in all microbial groups were observed by Day 3 ($p < 0.05$), indicating active microbial proliferation. The presence of coliforms and *E. coli* in several samples revealed hygiene deficiencies. Traditional unpackaged tandir breads exhibited higher contamination levels and variability compared to industrially packaged products. Fungal growth was identified as the main factor limiting shelf life.

Additionally, DNA extraction from selected bread samples was performed to enable molecular-level characterization of microbial communities. This approach provides a basis for integrating next-generation sequencing (NGS) techniques to complement culture-based microbiological analysis.

In conclusion, although freshly baked bread is initially microbiologically safe, post-processing contamination and ambient storage conditions significantly impact product quality and safety. Improved hygiene practices, controlled environments, and effective packaging are essential. The observed significant increase in microbial counts between Day 1 and Day 3 confirms that storage time plays a critical role in microbial proliferation under ambient conditions. Additionally, the higher contamination levels detected in traditional unpackaged breads compared to industrially packaged products highlight the influence of handling practices and environmental exposure on microbiological quality.

Acknowledgments: The author acknowledges ChemLab, Baku, Azerbaijan for laboratory support.

Keywords: *bread, contamination, food safety, microbial dynamics.*

UDC: 595.754:591.543.4:591.16(478)

ASSESSMENT OF THE OVERWINTERING SURVIVAL OF THE INVASIVE SPECIES *HALYOMORPHA HALYS* UNDER THE CLIMATIC CONDITIONS OF THE REPUBLIC OF MOLDOVA

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The invasive species *Halyomorpha halys* (Stal, 1855), commonly known as the brown marmorated stink bug, is one of the most destructive polyphagous pests of agricultural and horticultural crops. Native to East Asia, this species has spread rapidly throughout Europe, including the Republic of Moldova. It causes significant damage to apple, pear, peach, and grape crops, as well as to numerous ornamental and forest plant species. Its ability to survive the winter period and to initiate reproduction early in the growing season represents a key factor contributing to the establishment and expansion of local populations.

The aim of the study was to assess the survival rate of overwintered adults of the invasive species *Halyomorpha halys* and to determine their reproductive potential under the agroclimatic conditions of the Republic of Moldova.

The study was conducted during 2024–2025 in various agrocenoses located in the central region of the Republic of Moldova. Adults in diapause were collected in autumn from both natural and anthropogenic overwintering shelters and maintained under controlled laboratory conditions until the end of winter. In spring, the survival rate was determined, and viable individuals were transferred to entomological cages and provided with fresh fruits and vegetables as food sources. The following biological parameters were monitored: adult longevity, pre-oviposition period, number of egg masses per female, number of eggs per egg mass, and egg hatch rate.

The results demonstrated that the average overwintering survival rate of adults was approximately 55%. Females initiated oviposition 10–14 days after diapause termination. Each female laid an average of 6–8 egg masses, with 24–28 eggs per mass, and egg viability exceeded 80%. Under the climatic conditions of the Republic of Moldova, *H. halys* is capable of completing up to three generations per year. High overwintering survival ensures the early establishment of populations and significantly increases the risk of infestation in agricultural and horticultural crops. Overwintered adults exhibited a high reproductive potential, characterized by substantial fecundity and high egg viability.

Acknowledgments: Research was carried out within the Subprogram *011103 «Development of ecologically harmless means of reducing the impact of harmful organisms of agricultural crops against the background of climate change»*, financed by the Ministry of Education and Research.

Keywords: *Halyomorpha halys, invasive species, overwintering, survival, reproductive potential.*

UDC: 634.734:632.4:632.937.1(477)

IN VITRO EFFICACY OF BIOFUNGICIDE 'MIKORINACTIVE' AGAINST BLUEBERRY PATHOGENS

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Highbush blueberry (*Vaccinium corymbosum* L.) is one of the most promising berry crops in berry production, owing to the high nutritional and biological value of its fruit, stable demand and the expansion of commercial plantations. The search for and scientific justification of alternative, environmentally safe approaches to blueberry protection, in particular the use of biological products, is becoming increasingly important.

The purpose of this investigation was to evaluate the fungistatic activity of the biological fungicide 'Mikorinactive' against fungal pathogens of the genera *Neopestalotiopsis*, *Fusarium* and *Rhizoctonia* under *in vitro* conditions.

Materials and Methods: We studied pathogen isolates obtained from highbush blueberry plants: *Fusarium incarnatum-equiseti, Rhizoctonia solani* and species closely related to the *Neopestalotiopsis chrysea* (as was identified via DNA sequencing). The 'poisoned medium' method was used to assess the sensitivity of pathogens. Concentrations ranged from 5 to 50 ml/l in 8 replications. The biofungicide 'Mikorinactive', former name 'Mikosan' (a.i. alkaline extract of aphilophoral fungus *Fomes fomentarius*, 30 g/l + glukans,6 g/l), was studied.

Results: At a concentration of 5 ml/l, a pronounced lag phase lasting up to 4–5 days was observed for *Neopestalotiopsis sp.* and *R. solani*, and the active growth phase began later than that in the control. By day 10, the growth had fully recovered. Growth inhibition of *F.incarnatum-equiseti* was low. In the control variant, fungal colonies were characterized by stable, intensive radial growth. The highest sensitivity to 'Mikorinactive' was observed for *R. solani*. When the concentration was increased to 50 ml/l, there was a complete absence of pathogen colony growth over the 10-day observation period. Statistical analysis confirmed the significant differences between the variants. The findings demonstrated a significant inhibitory effect of the biofungicide ' Mikorinactive' at higher concentrations, with a distinct 'dose–effect' relationship observed.

Conclusion: It was confirmed that 'Mikorinactive' exhibits significant fungistatic and fungicidal effects against highbush blueberry pathogens. The results obtained indicate the advisability of using the biofungicide 'Mikorinactive' as a promising means of biological control of fungal pathogens within the integrated protection system for highbush blueberries.

Acknowledgments: This study was supported by the research projects 24.01.02.03.F 'Scientific foundations for managing the development of fungal diseases in transformed agrocenoses' and 18.01.01.08.P 'Major fungal diseases of highbush blueberries and measures to control their spread', funded by National Academy of Agrarian Sciences of Ukraine.

Keywords: *biofungicides, toxicity, fungistatic effect, pathogens.*

Session C

HUMAN BIOLOGY AND BIOMEDICINE

UDC: 615.32:582.751.2:616.831:57.084

RHUS TYPHINA FRUIT EXTRACT MITIGATES METAL-INDUCED MEMORY DEFICITS

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Alzheimer's disease is a major neurodegenerative disorder characterized by progressive cognitive impairment and memory decline. This study aimed to evaluate the potential neuroprotective effects of *Rhus typhina* extract in a zebrafish (*Danio rerio*) model of chemically induced cognitive impairment. Cognitive decline was induced by exposure to lead acetate and aluminum chloride, two neurotoxic agents associated with oxidative stress and neuronal dysfunction. Behavioral performance was assessed using the Y-maze test for spatial working memory and the Novel Object Recognition test for recognition memory. In addition, molecular docking analysis was performed using PyRX and PyMOL to explore possible interactions between selected bioactive compounds and target proteins relevant to neurodegenerative mechanisms.

The administration of *Rhus typhina* extract improved behavioral performance in zebrafish exposed to neurotoxic agents, suggesting an attenuation of cognitive impairment. The treated fish showed improved memory-related responses compared with the impaired model group, while no evident negative effects were observed during the monitoring period. Docking analysis further supported the potential biological relevance of the extract by indicating favorable ligand–protein interactions.

Overall, these findings suggest that *Rhus typhina* extract may exert neuroprotective effects against experimentally induced cognitive decline in zebrafish. The results support further investigation of this plant extract as a potential source of bioactive compounds with relevance for neurodegenerative disease research.

Keywords: *Rhus typhina; zebrafish; cognitive decline; neuroprotection; molecular docking*.

UDC: 618.39:575.113:616-005.6

PREVALENCE OF F5 1691G>A AND F2 20210G>A POLYMORPHİSMS İN AZERBAİJANİ WOMEN WITH PREGNANCY LOSS

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Thrombophilia is one of the most important causes of maternal thromboembolism, which is associated with recurrent pregnancy loss (RPL) Risk. The present study aimed to investigate the prevalence of prothrombin - FII G20210A and factor V Leiden -FV G1691A gene mutations, as the most important causes of thrombophilia, in an Azerbaijani woman with RPL.

Materials and methods: The subjects of our study are 532 women with RPL (1 or more spontaneous abortions) living in Azerbaijan with an average age of 28.9 (18-68 years). Genetic analyses were performed at the Fetal Center NS Genetics. The genomic DNA was extracted from the venous blood samples obtained from these women using the Real Best Genetics DNA-express C8845 kit from Vector Best. Then, using the RealBest-D3801 kit from the "Vektor-Best" company, the results were analyzed with the "BIO-RAD C1000Touch Thermal Cycler CFX96 Real-Time System" device, and the results were read using the "Realbest-diagnostics 2.0" program. The Allele and genotype of the FII G20210A and FV Leiden G1691A mutations were assessed using the real-time polymerase chain reaction (PCR) method.

Results: During our investigation, we found the factor V Leiden -FV G1691A heterozygous mutation in 33 women. The mean number of miscarriages was 1,8(1-7). Their mean age was 28.8 (18-44). We found a heterozygous FII G20210A mutation in 51 women. Their mean age was 29.3 (19-46). The mean number of miscarriages was 1,4(1-4). Also, in 1 woman, a FII G20210A homozygous mutation was found (age-25, spontaneous abortions-2).

Conclusion: In general, our study showed that the prevalence of FV G1691A (6,2%) and FII G20210A (9,8%) mutations can be important reasons for RPL. While F2 and F5 variants are widely tested, their role in RPL is still debated, but, overall, our study suggests that the prevalence of FV G1691A and FII G20210A mutations may be an important cause of RPL and that the exact prevalence of FV Leiden G1691A and FII G20210A is not low. Due to the relatively high prevalence of these variants, we recommend genetic testing before therapeutic decisions during pregnancy in women with recurrent miscarriage.

Keywords: *mutation, factor V leiden, prothrombin, recurrent pregnancy loss***.**

UDC: 616.831:620.3:57.084

THE COGNITIVE IMPACT OF MAGNETIC NANOPARTICLES IN A ZEBRAFISH MODEL OF CHOLINERGIC DYSFUNCTION

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This study explores the neurological implications of iron oxide nanoparticle administration on cognitive health, utilizing a zebrafish (Danio rerio) model. The primary objective was to evaluate how these nanoparticles interact with cholinergic signaling pathways, specifically within the context of Alzheimer's disease pathology. To achieve this, scopolamine, a muscarinic antagonist was administered to induce temporary cognitive impairment, characterized by deficits in spatial navigation and memory consolidation.

The experimental methodology integrated a comprehensive suite of behavioral assessments, including the T-maze and New Object Recognition (NOR) tests, to monitor changes in exploratory patterns and mnemonic retention. Our findings suggest that while IONPs offer promising avenues for targeted drug delivery, their presence within the central nervous system significantly influences neurobehavioral outcomes. Specifically, the data highlights a direct correlation between nanoparticle exposure and the modulation of scopolamine-induced deficits. While these nanoparticles can act as therapeutic vehicle, the results also reveal a complex neurotoxicological profile that may exacerbate cognitive decline if not strictly regulated. Ultimately, this research underscores the dual nature of iron oxide nanoparticles, concluding that further investigation into their long-term biocompatibility is essential to ensure they do not inadvertently disrupt fundamental learning processes in neurodegenerative clinical applications.

Keywords: *scopolamine, nanoparticles, zebrafish.*

UDC: 615.322:582.711.71:616.379-008.64

METABOLIC IMPACT OF THE AQUEOUS EXTRACT OF RUBUS FRUTICOSUS IN DIABETES

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Metabolic imbalances associated with diabetes mellitus frequently lead to the development of glucosuria and ketonuria, important indicators of disturbances in energy homeostasis and disease severity. Lately, interest in the use of bioactive compounds of plant origin in the management of diabetes mellitus has increased considerably due to their hypoglycemic, antioxidant, and metabolic protective effects. In this context, Rubus fruticosus is recognized for its rich content of polyphenols, flavonoids, and other biologically active substances that can influence carbohydrate metabolism and oxidative status.

In this study, changes in certain urinary metabolic parameters—glucosuria and ketonuria—were evaluated in rats with experimental diabetes following the administration of an aqueous extract from the leaves of Rubus fruticosus.

The results demonstrated that, in the experimental diabetic group, a significant increase in glucosuria was recorded, determined by exceeding the renal threshold for glucose under conditions of persistent hyperglycemia. Additionally, ketonuria was observed as a result of intensified lipolysis and the use of fatty acids as an alternative energy source.

Administration of the aqueous extract from Rubus fruticosus leaves led to a reduction in glucosuria levels compared with the untreated diabetic group. This decrease may be explained by the hypoglycemic effect of the bioactive compounds present in the extract, which contribute to improved glucose utilization at the tissue level and/or stimulation of insulin secretion. Regarding ketonuria, the results demonstrated a decrease in treated animals, suggesting a reduction in ketogenesis. This effect indicates a possible partial restoration of energy metabolism, with the organism shifting toward carbohydrate utilization rather than lipids.

Conclusion: The study highlights that the aqueous extract from Rubus fruticosus leaves reduced glucosuria and ketonuria, suggesting an improvement in the metabolic disturbances characteristic of diabetes mellitus. The extract may therefore be used as an adjuvant agent in correcting metabolic disorders associated with this condition.

Acknowledgments: This study was supported by the research project ("Mechanisms for regulating organismal homeostasis and health, and the development of procedures and strategies for its maintenance." (011001)), funded by (ANCD).

Keywords: *diabetes, ketonuria, glucosuria, aqueous extract.*

UDC: 615.322:616.379-008.64

EFFECTS OF RUBUS FRUTICOSUS EXTRACT ON GLYCEMIA AND INSULIN IN DIABETES

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Glycemia and insulin are fundamental indicators of carbohydrate metabolism and energy homeostasis, maintained within physiological limits through complex hormonal regulatory mechanisms. Insulin plays a key role by facilitating glucose uptake and utilization in peripheral tissues and inhibiting hepatic glucose production. In diabetes, these mechanisms are impaired, leading to hyperglycemia and altered insulin secretion, reflecting the severity of metabolic disturbances. Currently, increased attention has been given to the use of bioactive compounds in the amelioration of metabolic disorders characteristic of diabetes. Among plants with therapeutic potential is Rubus fruticosus, which is rich in polyphenols, flavonoids, and other biologically active compounds known for their antioxidant, hypoglycemic, and metabolic protective effects. The aim of this study was to evaluate the effect of the aqueous extract from Rubus fruticosus leaves on glycemia and insulin concentration in experimental diabetes.

The results revealed significant alterations in carbohydrate metabolism in diabetic animals, characterized by a marked increase in glycemia (≈13.02 mmol/L) compared to the control group (≈5.14 mmol/L), confirming the presence of metabolic imbalance. Concurrently, insulin concentration was reduced (≈0.87 pmol/L vs. ≈2.61 pmol/L in the control group), indicating impaired pancreatic endocrine function. Administration of the aqueous extract from Rubus fruticosus leaves led to an improvement in these metabolic disturbances, as evidenced by a reduction in glycemia (≈8.73 mmol/L) compared to the untreated diabetic group, as well as an increase in insulin concentration (≈1.56 pmol/L). These findings suggest that the extract exerts both hypoglycemic and potential insulinotropic effects, contributing to improved insulin secretion. The underlying mechanisms may be attributed to the high content of polyphenols and flavonoids, which act by reducing oxidative stress, enhancing peripheral glucose utilization, inhibiting hepatic gluconeogenesis, and protecting pancreatic β-cells.

Overall, the study demonstrates that the aqueous extract from Rubus fruticosus leaves exerts a beneficial effect on carbohydrate metabolism parameters in experimental diabetes by reducing hyperglycemia and increasing insulin levels. These findings support the therapeutic potential of the extract and recommend its use as an adjuvant agent in diabetes prevention strategies.

Acknowledgments: *This study was supported by the Faculty of Biology and Geosciences, Department of Biology and Ecology, State University of Moldova.*

Keywords: *diabetes, glucose, insulin, aqueous extract.*

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STEP 1 "GAS EXCHANGE" OF THE NEUROPROTECTION AND NEUROREHABILITATION PROGRAM

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In the algorithm of the neuroprotection and neurorehabilitation program, primary determining importance is assigned to the implementation of modern techniques aimed at ensuring sufficiently effective gas exchange. Hyperbaric oxygen therapy (HBOT) is at the forefront of regenerative medicine. However, intensive HBOT carries the risk of inducing oxygen toxicity, oxidative stress, a reduction in cerebral blood flow, and suppression of cyclic respiratory activity. The aim is to develop and propose a concept of neuroprotection and neurorehabilitation based on the combination of moderate hyperbaric oxygen therapy (HBOT), a prolonged slow-exhalation breathing technique, and functional near-infrared spectroscopy (fNIRS).

In HBOT protocols used for therapeutic purposes, a pressure of 2.0-2.5 ATA (202.65–253.31 kPa) inside the hyperbaric chamber is commonly recommended. To achieve neuroprotective and rehabilitative effects while maintaining comfort and reducing the risk of oxygen toxicity, the use of mild HBOT may be justified (1.3-1.4 atm, i.e. 131.72-141.86 kPa; oxygen flow rate of 5-7 L/min). In developing the concept, consideration was given to the adaptive nature of intermittent hypoxic training (IHT). In contrast to IHT, intermittent hypoxic–hyperoxic training (IHHT) is based on the cyclic alternation of hypoxic and hyperoxic periods, with oxygen concentrations varying between 10% and 40%. An alternative to IHHT, periods of hyperbaric oxygenation may be alternated with a prolonged slow-exhalation (PSE) technique, which has demonstrated effectiveness in the management of pulmonary congestion, asthma, and acute bronchiolitis.

This combination of moderate hyperbaric oxygen therapy (HBOT) and the prolonged slow-exhalation (PSE) technique was tested in a group of healthy volunteers and demonstrated its effectiveness. The results obtained during the procedures, together with comparisons of baseline and post-procedural measurements using pulse oximetry and functional near-infrared spectroscopy (fNIRS), revealed an increased rise in oxyhemoglobin concentration within the medial and lateral regions of the prefrontal neocortex in response to the performance of a cognitive task. It is proposed that the concept of combining moderate hyperbaric oxygen therapy (HBOT) with the prolonged slow-exhalation (PSE) technique and monitoring by functional near-infrared spectroscopy (fNIRS) may facilitate the implementation of neuroprotection and neurorehabilitation programs that have the potential to enhance the coupling between neuronal activity and hemodynamic responses.

Keywords: *hyperbaric oxygenation, prolonged slow expiration technique.*

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APPLICATION OF ANTHROPOMETRIC INDICES IN STEATOTIC LIVER DISEASE

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Metabolic dysfunction-associated steatotic liver disease (MASLD) represents one of the most important issues in contemporary medicine. Since an elevated body mass index (BMI) is not always observed in MASLD, other anthropometric indicators should also be used for diagnostic purposes.

The aim of this study was to investigate the waist-to-height ratio (WHtR) as an indicator of fat distribution in MASLD.

Methods**:** WHtR was assessed in 59 adults diagnosed with MASLD (23 men and 36 women), with a mean age of 57.4 years. The participants were stratified into four groups according to BMI: group 1 comprised 4 subjects with BMI < 25 kg/m²; group 2 - 22 subjects with BMI 25-29.99 kg/m²; group 3 - 23 subjects with BMI 30-34.99 kg/m²; and group 4 - 9 subjects with BMI > 35 kg/m². Height and waist circumference were measured in all participants, and WHtR was calculated as the ratio of waist circumference (cm) to height (cm):

The cutoff value for WHtR was 0.5. Data are presented as arithmetic mean (M) ± standard error of the mean (m). Statistical significance was assessed using the nonparametric Mann-Whitney U - test.

Results: WHtR was 0.51 ± 0.04 in group 1, 0.58 ± 0.01 in group 2, 0.64 ± 0.01 in group 3, and 0.68 ± 0.01 in group 4. The differences between all groups were statistically significant at a confidence level above 95% ($p < 0.05$). Thus, WHtR exceeded the cutoff value in all groups with hepatic steatosis. In addition, WHtR increased with increasing BMI, and this index may serve as an additional diagnostic tool for MASLD, especially in patients with normal or borderline BMI.

Conclusions: MASLD is a heterogeneous disease, and elevated BMI is not a mandatory criterion for its presence. WHtR may be a more informative indicator for identifying increased metabolic risk. WHtR is easy to calculate and, alongside waist circumference, may serve as an additional diagnostic tool for MASLD.

Acknowledgments: This study was supported by the Research Institutional Project with title "Metabolic, nutritional and psychosocial interactions in steatotic liver disease associated with metabolic dysfunction, the role of bioethical principles in patient management", funded by the state budget (institutional funding).

Keywords: *MASLD, BMI, waist circumference, WHtR.*

UDC: 613.2:579.864:612.336

EFFECT OF DIETARY RATIONS ON INTESTINAL ENTEROCOCCI LEVEL

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Recent studies emphasize the strong dependence of intestinal bacteriocenosis on dietary factors. The present research aimed to investigate the influence of experimental dietary rations with different caloric structures on the multiplication and development of intestinal streptococci (Enterococcus spp.), which are of interest for the pharmaceutical industry.

Two experimental series were conducted. The first series included in vitro testing of six newly developed dietary rations on Enterococcus faecium. The second series involved in vivo experiments on Wistar rats, assessing the selected dietary rations' effects on intestinal enterococci. Microbiological analyses were performed using standard cultivation methods, and results were expressed as logarithmic values of bacterial counts.

In vitro results showed that dietary rations exerted variable effects on enterococci growth, ranging from inhibitory to slightly stimulatory. Among the tested variants, ration no. 5 demonstrated a mild stimulatory effect, while others showed inhibitory influence. In vivo findings confirmed these results: animals receiving ration no. 5 exhibited the most favorable outcomes, including optimal body mass increase and controlled levels of enterococci. In contrast, the control group showed excessive proliferation of facultative pathogenic microorganisms.

The study demonstrates that dietary composition significantly influences intestinal microbial balance. Specifically, experimental dietary rations of different caloric structures, developed within the project 15.817.04.01A "Nutrition in relation to constitution types. Impact of nutrition on the sanogenicity of male gametes" (2015–2019) at the Institute of Physiology and Sanocreatology of the State University of Moldova (project leader: Dr. habil., assoc. researcher Tudor Strutinschi), exhibited prebiotic-like effects.

In conclusion, intestinal enterococci levels can be effectively regulated not only by probiotics but also through carefully designed dietary interventions, with ration no. 5 showing the most beneficial impact.

Acknowledgments: This research was supported within the project 15.817.04.01A "Nutrition in relation to constitution types. Impact of nutrition on the sanogenicity of male gametes" (2015–2019), Institute of Physiology and Sanocreatology, State University of Moldova, led by Dr. habil. Tudor Strutinschi.

Keywords: *intestinal microbiota, enterococci, dietary rations, probiotic potential, prebiotic effect.*

UDC: 615.33:612.336.1:577.114

THE EFFECT OF ANTIBIOTIC COMPLEX ON CARBOHYDRATE ABSORPTION IN THE SMALL INTESTINE

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The aim of this work was to investigate the effect of a broad-spectrum antibiotic combination, often used as part of quadruple therapy for *Helicobacter pylori* eradication: amoxicillin, metronidazole, and clarithromycin, administered intramuscularly, on the absorption dynamics of glucose and fructose in the small intestinal lumen.

The study was performed in vivo on male rats with a segment of the small intestine. The antibiotic mixture was added to the perfusion solution for the small intestinal segment containing glucose (25 or 50 mM) or fructose (50 mM) throughout the 100-minute perfusion period at a concentration of 0.7 mg/ml for each antibiotic; the control were run without antibiotic. Perfusate samples were collected every 10 minutes.

It was found that the antibiotic complex induces rapid changes in monosaccharide absorption. At higher glucose concentrations, absorption was reduced (by 38% compared with control, $P < 0.05$) starting as early as 30 minutes of perfusion. The antibiotic effect up to the end of the experiment, such that glucose absorption at 100 minutes of perfusion was half that of the control. At lower glucose concentration, reduced absorption was observed starting at 50 minutes of perfusion: the magnitude of the inhibitory effect was significantly lower and remained virtually unchanged throughout perfusion. Fructose absorption was suppressed (by 27% compared to the control, $P < 0.05$) starting at 50 minutes, with the degree of reduction increasing slightly by 70 minutes of perfusion and stabilizing until the end of the experiment. Experiments using phloridzin (2 mM), an inhibitor of the sodium-dependent glucose transporter SGLT1, and phloretin (2 mM), an inhibitor of the glucose transporter GLUT2 that mediates glucose and fructose transport across the enterocyte apical membrane via facilitated diffusion, showed that the decrease in glucose absorption is due to a significant reduction in the active component of its transport, as well as, to a lesser extent, a change in the unsaturable component of absorption.

Thus, a mixture of antimicrobial agents: amoxicillin, metronidazole, and clarithromycin, when introduced into the small intestinal lumen, causes rapid inhibition of monosaccharide absorption, the degree and duration of which depend on the mechanism of their transport and their concentration in the small intestinal lumen.

Keywords: *carbohydrate absorption, small intestine, antibiotics.*

UDC: 615.32:582.951.4:616.8-009.831

COMPARATIVE NEUROPROTECTIVE EFFECTS OF *SOLANUM MACROCARPON* LEAF EXTRACTS IN A ZEBRAFISH MODEL OF SCOPOLAMINE-INDUCED COGNITIVE IMPAIRMENT

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Alzheimer's disease is characterized by progressive cognitive decline associated with cholinergic dysfunction and oxidative stress. Natural phytocompounds represent promising therapeutic alternatives due to their neuroprotective and antioxidant properties. This study comparatively evaluated the neuroprotective potential of ethanolic (SMEE) and n-butanol (SMB) leaf extracts of *Solanum macrocarpon* in a zebrafish (*Danio rerio*) model of scopolamine (SCOP)-induced cognitive impairment. Phytochemical characterization was performed using HPLC analysis, while pharmacokinetic and toxicological profiles were assessed through in silico ADMET and PASS prediction tools. Adult zebrafish were chronically exposed to SMEE or SMB (1, 3, and 6 mg/L), followed by acute SCOP administration (100 µM). Behavioral assessments included novel tank diving, novel approach, light–dark, Y-maze, and novel object recognition tests. Oxidative stress markers and acetylcholinesterase activity were evaluated in brain tissue samples. Both extracts significantly attenuated SCOP-induced anxiety-like behavior and cognitive deficits in a dose-dependent manner. SMB exhibited higher concentrations of chlorogenic acid (162.39 mg/g) and rutin (24.61 mg/g) compared to SMEE, suggesting enhanced phytochemical enrichment associated with solvent polarity. Furthermore, SMB demonstrated stronger modulation of antioxidant enzymes and acetylcholinesterase inhibition, while both extracts improved spatial and recognition memory. In silico analyses indicated favorable antioxidant activity but limited oral bioavailability for chlorogenic acid and rutin. These findings suggest that extraction solvent significantly influences the phytochemical composition and neuroprotective efficacy of *Solanum macrocarpon* leaf extracts. Both SMEE and SMB may represent promising phytotherapeutic candidates for mitigating neurobehavioral impairments associated with neurodegenerative disorders.

Keywords: *Solanum macrocarpon; neuroprotection; zebrafish; oxidative stress; acetylcholinesterase.*

UDC: 616.314-002:616.895.8:612.313

SALIVARY PROFILE AND CARIES STATUS IN PATIENTS WITH SCHIZOPHRENIA

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Saliva plays a crucial role in maintaining oral ecological balance through its buffering capacity and antioxidant properties, contributing to protection against dental caries. Alterations in salivary pH, alongside systemic and behavioral factors, can significantly influence caries status, particularly in patients with psychiatric disorders. This study aimed to evaluate differences in salivary pH and the Decayed, Missing, and Filled Teeth (DMFT) index between patients with schizophrenia and a control group, as well as to investigate the relationship between these parameters. Patients diagnosed with schizophrenia and a control group without psychiatric pathology were included. Salivary pH, clinical caries indices, and DMFT scores were determined. Patients with schizophrenia exhibited a significantly lower mean salivary pH compared to the control group, indicating a tendency toward oral acidity. The DMFT index was higher in the schizophrenia group, although the difference did not reach statistical significance. Analysis of DMFT components revealed a higher number of decayed and missing teeth, as well as a significantly lower number of filled teeth in the schizophrenia group. A negative correlation between salivary pH and the DMFT index was observed, suggesting an association of a more acidic oral environment with more severe caries experience. Additionally, behavioral data indicated lower consumption of antioxidant-rich foods and differences in smoking habits between the two groups. Patients with schizophrenia exhibit a more unfavorable oral status, characterized by lower salivary pH and reduced access to restorative treatments, contributing to an increased risk of dental caries. These findings highlight the need for integrated oral health monitoring in the management of patients with schizophrenia.

Keywords: *schizophrenia, salivary pH, DMFT, dental caries, oral health.*

UDC: 577.152.1:577.164.194:576.36

EVOLUTION OF SELENIUM DEPENDENT GLUTATHIONE PEROXIDASE 4 IN FERROPTOSIS REGULATION

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Glutathione peroxidase 4 (GPX4) is a unique antioxidant enzyme relying on the trace element selenium, incorporated as the rare amino acid selenocysteine (SeCys). Despite the high energetic cost of synthesizing selenocysteine compared to using the readily accessible sulfur-based amino acid cysteine (Cys), this structural mechanism is strictly conserved in mammals. This study explores the evolutionary paradox of selenium (Se) dependency and its crucial biochemical role in preventing ferroptosis, an Fe-dependent form of non-apoptotic cell death.

Materials and Methods: A systematic biochemical review was conducted utilizing data from molecular models where the active site selenocysteine of GPX4 was targeted and mutated to cysteine (GPX4-Cys). The analysis evaluated cellular sensitivity to hydroperoxide induced oxidative stress, lipid peroxidation levels, and irreversible enzymatic overoxidation using mass spectrometry. Furthermore, a phylogenetic sequence alignment of the glutathione peroxidase 4 enzyme across multiple species was reviewed to assess the evolutionary conservation of its active site.

Results: The biochemical analysis reveals that cells expressing the cysteine variant (GPX4-Cys) are exquisitely sensitive to peroxide-induced ferroptosis. At the molecular level, the thiolate based active site in the cysteine variant is rapidly and irreversibly overoxidized to sulfonic acid in the presence of cellular peroxides. Conversely, natural selenolate based catalysis provides intrinsic biochemical resistance to this irreversible inactivation. Phylogenetic data confirms that the selenocysteine active site is rigorously conserved in vertebrates. This evolutionary preservation correlates directly with the increased biological incorporation of highly oxidizable polyunsaturated fatty acids in complex mammalian cellular membranes.

Conclusions: The evolutionary preservation of Se in GPX4 provides an indispensable biochemical shield against irreversible enzymatic inactivation. Resolving this evolutionary paradox highlights selenocysteine as a fundamental structural requirement for regulating lipid peroxidation, offering novel diagnostic and therapeutic dimensions for modulating ferroptosis within clinical Biochemistry.

***Keywords**: Glutathione Peroxidase 4, selenocysteine, ferroptotic cell death, polyunsaturated fatty acids, molecular evolution.*

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EVOLUTIONARY ORIGINS OF CYCLOOXYGENASE ISOENZYMES IN CHEMOPREVENTION

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Cyclooxygenase (COX) isoenzymes, officially known as prostaglandin-endoperoxide synthases (PTGS), are critical enzymes that catalyze the conversion of arachidonic acid into pro-inflammatory prostanoids. While cyclooxygenase-1 (COX-1) is constitutively expressed to maintain systemic tissue homeostasis, cyclooxygenase-2 (COX-2) is highly inducible and frequently overexpressed in pathological states, driving cellular proliferation and angiogenesis. This study explores the evolutionary origins of these two isoenzymes and evaluates the structural biochemistry behind their distinct pharmacological responses to chemopreventive agents.

Materials and Methods:The study evaluated peer-reviewed literature and comparative genomic analyses detailing the ancestral gene duplication events that led to the divergence of the PTGS1 and PTGS2 genes. Furthermore, published crystallographic data and enzymatic kinetic models were reviewed to analyze the structural variations within the catalytic channels of both isoforms, correlating evolutionary sequence divergence with the mechanisms of targeted chemical prevention.

Results: The literature confirms COX-1 and COX-2 arose from an ancient gene duplication. Despite high homology, a critical evolutionary substitution—isoleucine to a less bulky valine at position 523—creates a larger, secondary internal pocket in COX-2. Chemopreventive agents like acetylsalicylic acid (aspirin) exploit this structural divergence. Irreversible acetylation of active-site serine residues blocks COX-1 completely. However, in COX-2, this acetylation switches its enzymatic activity due to the wider catalytic pocket. These metabolites exert potent anti-proliferative and pro-resolving actions, effectively disrupting the metabolic environment required for tumor progression.

Conclusions: The evolutionary divergence of cyclooxygenase isoenzymes created distinct structural microenvironments within their active sites. Synthesizing data on these phylogenetically conserved catalytic channels provides a comprehensive biochemical framework for understanding how classical non-steroidal anti-inflammatory drugs can be structurally optimized to manipulate eicosanoid pathways, offering precise strategies for long-term chemoprevention.

Keywords: *Cyclooxygenase isoenzymes, chemoprevention, acetylsalicylic acid.*

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ZINC-BINDING DOMAIN EVOLUTION: NOVEL TARGETS IN APOPTOSIS

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Zinc (Zn) is an essential trace element functioning as a crucial cofactor for a wide range of cellular proteins, including structural proteins and transcription factors. In malignant cells, Zn has a complex, cell-type-specific role in regulating apoptosis, acting either as a potent inducer or a protective agent depending on cellular homeostasis. This study explores the evolutionary trajectory of Zn-binding structural domains and their biochemical mechanisms in preventing abnormal cell survival through homeostatic regulation.

Materials and Methods. A systematic literature review was conducted to synthesize existing biochemical and bioinformatic data on Zn-induced apoptotic pathways. The study reviewed published computational models based on Zn-binding site prediction algorithms, such as the Geometric REstriction for Zn-binding (GRE4Zn). Additionally, existing comparative data regarding the distribution of 3-residue and 4-residue Zn-binding sites across evolutionary lineages (Escherichia coli, Saccharomyces cerevisiae, and Homo sapiens) were evaluated to trace their functional adaptation.

Results. The evaluated literature demonstrates that 3-residue and 4-residue Zn-binding sites maintain strict, phylogenetically conserved coordination geometries essential for protein stability. Evolutionary mapping shows a transition where these metal-binding motifs expanded from basic metabolic enzymes in prokaryotes to complex regulatory networks in eukaryotes. Biochemically, the precise spatial arrangement of coordinating residues, specifically cysteine and histidine, stabilizes the tertiary structure of core apoptotic regulators like the tumor suppressor protein p53 core domain. Under optimal Zn homeostasis, these conserved structural motifs preserve the conformational integrity required to trigger programmed cell death. Conversely, disruptions in Zn concentration or mutations within these geometric domains destabilize metal coordination, leading to protein misfolding and a subsequent failure to prevent pathological cell survival.

Conclusions: The evolutionary development of Zn-binding domains underscores their fundamental structural necessity in programmed cell death. Synthesizing data on these conserved geometric sites, while simultaneously accounting for cell-type-specific Zn homeostasis, highlights a highly specific biochemical strategy for preventing abnormal cellular proliferation.

Keywords: *Zinc-binding domains, apoptotic regulation, computational biology, molecular evolution, Zn homeostasis.*

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THE BIOCHEMICAL ROLE OF microRNAs IN THE PATHOGENESIS AND REGULATION OF BONE METASTASIS

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Bone metastasis is driven by a pathological feedback loop between tumor cells and the bone microenvironment. MicroRNAs (miRNAs), small non-coding ribonucleic acid (RNA) molecules, act as critical post-transcriptional regulators in this progression. This study explores how specific miRNAs biochemically modulate osteotropic signaling, emphasizing their diagnostic and therapeutic potential within clinical Biochemistry.

Materials and Methods: A systematic biochemical review was conducted utilizing data from molecular studies on miRNA-mediated regulation in bone colonization, particularly focusing on highly osteotropic malignancies such as breast and prostate cancers. We analyzed the interaction between specific miRNAs and target genes involved in the Receptor Activator of Nuclear Factor Kappa-B Ligand (RANKL) pathway, Transforming Growth Factor-beta (TGF-β) signaling, and the Wingless-related integration site/β-catenin (Wnt/β-catenin) pathway.

Results: The analysis reveals that miRNAs act as molecular switches in the bone niche. Specifically, upregulated microRNA-21 and microRNA-141 promote RANKL-induced osteoclastogenesis, which is the process of forming mature osteoclasts, by targeting Osteoprotegerin (OPG). Conversely, other miRNAs suppress bone-derived growth factors, namely TGF-β and Insulin-like Growth Factors (IGFs). Their biochemical hallmark is the simultaneous targeting of multiple pathways—the RANKL/OPG axis, TGF-β signaling, and the Wnt/β-catenin cascade—amplifying the metabolic rewiring of bone cells. Exosomal miRNA secretion also serves as a primary communication channel between primary tumors and distant skeletal sites. By targeting components like low-density lipoprotein receptor-related protein (LRP5/6) co-receptors or biochemical antagonists like Dickkopf-1 (DKK-1), miRNAs disrupt the osteoblastic support system. This imbalance decreases Osteoprotegerin (OPG) production, directly fueling RANKL-mediated osteolysis and metastatic expansion.

Conclusions: MicroRNAs are fundamental biochemical regulators of the metastatic pathological positive feedback loop. Disrupting miRNA-target interactions could lead to novel biochemical therapies aimed at preserving bone integrity in oncological patients.

Keywords: *Metastatic osteolysis, exosomal microRNAs, receptor activator of nuclear factor kappa-B ligand, Wingless-related integration site.*

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LYMPHOCYTIC INFILTRATION AS A PROGNOSTIC FACTOR IN CUTANEOUS MALIGNANT MELANOMA

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Cutaneous malignant melanoma is a skin cancer with high metastatic potential and remarkable ability to evade immune surveillance. Prognosis is determined by disease stage at diagnosis, but attention has been directed toward the role of the tumor-infiltrating lymphocytes, representing the host immune response against malignant cells. Increased lymphocytic infiltration has been associated with improved survival and lower recurrence rates, particularly in early-stage melanoma.

Purpose: To evaluate the relationship between lymphocytic infiltration and established prognostic parameters in cutaneous malignant melanoma.

Methods: A retrospective study was conducted on 47 cases of cutaneous malignant melanoma obtained from the Oncology Institute of Chisinau. The degree of lymphocytic infiltration was statistically analyzed in relation to multiple prognostic parameters, including patient age, sex, Breslow thickness, Clark level, ulceration, mitotic activity, lymphovascular invasion, perineural invasion, microsatellitosis, regression, tumor stage, lymph node involvement, and pigmentation. Correlation coefficients (r) and p-values were calculated, with statistical significance defined as $p<0.05$.

Results: A weak negative correlation was observed between lymphocytic infiltration and Clark level ($r = -0.24$; $p = 0.06$), suggesting a tendency toward reduced lymphocytic response in more deeply invasive tumors. Similarly, a weak inverse association was found with lymphovascular invasion ($r = -0.21$; $p = 0.07$). No meaningful relationships were observed with tumor thickness, ulceration, mitotic activity, microsatellitosis, regression, pathological stage, lymph node status, or pigmentation ($p > 0.05$).

Conclusions: Although no statistically significant associations were demonstrated in this cohort, the observed trends suggest that reduced lymphocytic infiltration may be associated with more invasive tumor behavior. These findings support the biological relevance of host immune response in melanoma progression and emphasize the need for larger studies to further clarify the prognostic value of tumor-infiltrating lymphocytes in cutaneous malignant melanoma.

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Keywords: *cutaneous malignant melanoma; tumor-infiltrating lymphocytes; lymphocytic infiltration; prognosis; TILs.*

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PATIENT AGE AS A PROGNOSTIC FACTOR IN CUTANEOUS MALIGNANT MELANOMA

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Cutaneous malignant melanoma is the most aggressive form of skin cancer and a significant global public health challenge, with over 330,000 new cases diagnosed annually. Despite the advances in diagnosis and treatment, its incidence continues to rise. The prognosis is primarily determined by disease stage at diagnosis and more evidence identifies that patient age is an important prognostic variable, with older patients demonstrating poorer outcomes and more aggressive tumor characteristics.

Purpose: To evaluate the relationship between patient age and major clinicopathological prognostic parameters in cutaneous malignant melanoma.

Methods: A retrospective study was performed on 47 histologically confirmed cases of cutaneous malignant melanoma obtained from the Oncology Institute of Chișinău. Patient age was statistically correlated with key histopathological prognostic variables. Statistical significance was defined as $p<0.05$.

Results: The cohort included 47 patients with a mean age of 65.6 ± 12.15 years. Statistical analysis revealed a significant moderate negative correlation between patient age and tumor regression ($r = -0.44$, $p = 0.00$), suggesting that increasing age is associated with a reduced frequency of histological regression. No statistically significant associations were identified between age and other prognostic indicators, as tumor thickness ($r = -0.04$, $p = 0.38$), ulceration ($r = 0.16$, $p = 0.14$), mitotic activity ($r = -0.07$, $p = 0.33$) or perineural invasion ($r = 0.20$, $p = 0.09$).

Conclusions: Although age was not significantly associated with most conventional prognostic parameters in this cohort, its significant inverse relationship with tumor regression may reflect age-related differences in host immune response and melanoma biology. These findings support the consideration of patient age as a relevant biological factor in prognostic assessment and emphasize the need for larger studies to further clarify its role in melanoma progression.

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Keywords: *cutaneous malignant melanoma; age; prognosis; tumor regression.*

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ENVIRONMENTAL FACTORS AND ANIMAL EXPOSURE IN THE DEVELOPMENT OF THE GUT MICROBIOME IN CHILDREN UNDER 3 YEARS OF AGE

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External factors influencing the composition of the human gut microbiome have attracted considerable attention in recent years. Among these, living environment and early microbial exposure, play an important role in shaping the gut microbiome during early childhood. An increasing number of studies suggest that children who cohabit with or are exposed early to companion animals, develop greater intestinal microbial diversity and a more mature gut microbiome compared to children without such exposure. It is presumed that increased exposure to microorganisms originating from the domestic environment and companion animals contributes to the early colonization of the gastrointestinal tract and stimulates immune system development.

Material And Methods: An observational study was conducted within primary health care settings in children under 3 years of age. Gut microbiome composition was evaluated using the ENTEROFLOR real-time PCR test, allowing the assessment of the principal intestinal bacterial taxa. Information regarding environmental exposure, lifestyle factors, and contact with companion animals was collected through parental interviews using a standardized unified questionnaire. Data analysis and statistical processing were performed using the MO Excel 365 program.

Results: The study included 105 children under 3 years of age, comprising 50 boys and 55 girls. Regarding the living environment, 5.7% children lived in individual houses, while 94.3% lived in apartment buildings. In terms of companion animal exposure, 81.9% lived in households without animals, whereas 18.1% children were exposed to companion animals. Among the exposed children, 4.8% lived with cats, 8.6% with dogs, and 2.9% with other types of companion animals. Comparative analysis of the gut microbiome demonstrated relatively similar total bacterial mass between children exposed and unexposed to companion animals, with median values of 9.4 LG GE/g and 9.45 LG GE/g, respectively. Child-specific Bifidobacteria were detected in 48 of 86 children without animal exposure and in 11 of 19 children exposed to companion animals. However, children living with companion animals demonstrated notably higher median total Bifidobacteria levels compared to children without animal exposure (33.7 vs. 10.4, respectively), suggesting a potential association between early environmental microbial exposure and the enrichment of beneficial intestinal bacterial taxa.

Conclusions: Cohabitation with companion animals during the first years of life may represent an environmental factor involved in shaping the gut microbiome and stimulating immune development. Increased levels of Bifidobacteria in children exposed to companion animals suggest a possible protective effect of early microbial exposure on intestinal homeostasis and immune response.

Keywords. *Gut microbiome; Early-life exposure to pets; Environment; Children 0-3 years old.*

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POTENȚIALUL COMPUȘILOR FITOTERAPEUTICI CA ADJUVANȚI ÎN MANAGEMENTUL RETINOPATIEI DIABETICE

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Retinopatia diabetică (RD) reprezintă una dintre cele mai frecvente și severe complicații microvasculare ale diabetului zaharat, constituind o cauză importantă de afectare vizuală și pierdere progresivă a vederii. Dezvoltarea și progresia RD sunt asociate cu mecanisme complexe, dintre care stresul oxidativ, inflamația cronică, disfuncția vasculară și angiogeneza patologică au un rol central. În acest context, compușii fitoterapeutici prezintă un interes crescut ca posibili agenți adjuvanți în managementul RD.

Materiale și metode: A fost realizată o analiză critică a literaturii științifice internaționale, incluzând studii experimentale și clinice privind efectele principalelor categorii de fitocompuși asupra mecanismelor implicate în retinopatia diabetică. Au fost analizate date referitoare la antocianine, berberină, curcumină, epigalocatechin-3-galat, flavonoide, terpenoide, acizi fenolici, carotenoizi maculari și alți compuși bioactivi de origine vegetală.

Rezultate și discuții: Datele analizate evidențiază efecte antioxidante, antiinflamatorii, antiangiogenice și neuroprotectoare ale unor fitocompuși, precum și posibilitatea reducerii stresului oxidativ, inflamației, permeabilității vasculare și afectării neurovasculare retiniene. Aceste mecanisme pot contribui la limitarea progresiei leziunilor caracteristice RD. Cu toate acestea, dovezile privind eficacitatea și siguranța pe termen lung rămân insuficiente. În acest stadiu al cunoașterii, rezultatele documentării din prezentul studiu constituie baza pentru stabilirea metodologiei cercetării în cadrul lucrării de doctorat cu tema: "***Efecte biologice ale produselor curativ-profilactice în retinopatia diabetic***ă"

Concluzii: Compușii fitoterapeutici prezintă un potențial promițător ca terapii adjuvante în managementul retinopatiei diabetice. Integrarea acestora în practica oftalmologică necesită însă standardizare, studii clinice suplimentare și interpretări statistice ale unor studii de caz de amploare, pentru confirmarea eficacității și stabilirea unor scheme terapeutice adecvate.

Keywords: *compuși fitoterapeutici, adjuvanți, retinopatie diabetică*.

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STUDIU ASUPRA PREPARATELOR FITOTERAPEUTICE RECOMANDATE ÎN DMLV (Degenerescența Maculară Legată de Vârstă)

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Degenerescența maculară legată de vârstă (DMLV) reprezintă una dintre principalele cauze de afectare severă a vederii centrale la populația vârstnică, cu un impact semnificativ asupra calității vieții. Patogeneza sa este complexă și implică stresul oxidativ, inflamația cronică, disfuncția epiteliului pigmentar retinian și, în formele neovasculare, angiogeneza patologică mediată de VEGF. În acest context, preparatele fitoterapeutice prin compușii bioactivi de origine vegetală prezintă un interes crescut ca posibile strategii adjuvante în prevenția și managementul DMLV.

Materiale și metode: A fost realizată o analiză a literaturii științifice privind mecanismele implicate în dezvoltarea și progresia DMLV, precum și asupra preparatelor fitoterapeutice și compușilor naturali cu potențial antioxidant, antiinflamator, antiangiogenic și neuroprotector. Au fost urmărite date privind mecanismele de acțiune, compoziția preparatelor și dovezile disponibile referitoare la utilizarea acestora în context oftalmologic.

Rezultate și discuții: Datele analizate sugerează că unele componente bioactive de origine vegetală pot contribui la reducerea stresului oxidativ și a inflamației și la protejarea structurilor retiniene împotriva proceselor degenerative. Preparatele care conțin carotenoizi maculari, polifenoli, flavonoide și alți antioxidanți pot reprezenta opțiuni adjuvante, în special prin susținerea mecanismelor antioxidante și neuroprotectoare ale retinei. Totuși, eficacitatea acestora depinde de compoziție, doză și stadiul bolii, iar dovezile clinice sunt variabile.

Concluzii: Preparatele fitoterapeutice prezintă un potențial interesant ca abordare complementară în managementul DMLV, în special datorită efectelor antioxidante și antiinflamatorii. Sunt necesare, totodată, studii suplimentare pe termen lung (6–12 luni) pentru confirmarea beneficiilor, stabilirea indicațiilor și evaluarea eficacității și siguranței ***soluțiilor fitoprotectoare în degenerescența maculară legată de vârstă*** (tema lucrării de doctorat din care care face parte acest studiu).

Keywords: *compuși bioactivi, preparate fitoterapeutice, DMLV.*

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BIOACTIVE POTENTIAL OF MORUS ALBA AND MORUS NIGRA EXTRACTS: NEUROPROTECTION, ANTIOXIDANT ACTIVITY, AND CHOLINESTERASE INHIBITION

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Morus alba and Morus nigra have long been used in traditional medicine and are recognized as rich sources of polyphenols and flavonoids with antioxidant and neuroprotective properties. This study evaluated the antioxidant, anticholinesterase, and neuroprotective effects of hydroalcoholic leaf extracts from *M. alba* (MAE) and *M. nigra* (MNE). Phytochemical analysis revealed a substantially higher polyphenolic content in MNE than in MAE. Both extracts exhibited significant antioxidant activity, effectively scavenging hydroxyl radicals and inhibiting plasma lipid peroxidation, with MNE showing greater potency as reflected by lower IC_{50} values. MNE also displayed stronger acetylcholinesterase (AChE) inhibitory activity (IC_{50} = 24.34 ± 0.86 µg/mL), approaching that of galantamine and exceeding the activity of MAE (IC_{50} = 46.87 ± 2.16 µg/mL). Neuroprotective effects were further investigated in a zebrafish (*Danio rerio*) model of scopolamine-induced cognitive impairment. Both MAE and MNE (1 and 10 µg/L) dose-dependently improved cognitive performance and behavioral alterations, as demonstrated in the Y-maze, novel tank diving, and novel object recognition tests. Collectively, these findings demonstrate that *Morus* leaf extracts possess significant antioxidant and anticholinesterase activities and exert neuroprotective effects *in vivo*, supporting their potential as promising candidates for mitigating cognitive dysfunction associated with neurodegenerative disorders.

Keywords: *Morus alba, Morus nigra, antioxidant activity, acetylcholinesterase inhibition, neuroprotection.*

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FEEDING PROFILE OF MACROSOMIC INFANTS: BREASTFEEDING AND OBESITY RISK

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Aim. To characterize the infant feeding profile of macrosomic / large-for-gestational-age (LGA) newborns (birth weight ≥4000 g) - breastfeeding initiation and continuation, formula feeding, and their relationship with early weight gain and later obesity risk - and to identify windows for nutritional intervention.

Methods: A narrative review of recent literature on infant feeding practices in macrosomic/Large for gestational age (LGA) infants was performed, supported by evidence on breastfeeding duration, formula feeding, postnatal growth, and childhood obesity.

Results: The feeding profile of macrosomic infants is time-dependent (biphasic). During the first two postpartum weeks, exclusive breastfeeding rates may be higher than in normal-weight infants, plausibly owing to a more efficient latch (larger mouth, greater strength, better head control). However, between weeks 2 and 8 breastfeeding cessation occurs faster in mothers of macrosomic infants, and the early protective effect of higher birth weight on feeding difficulties is lost beyond 8 weeks. Exclusive formula feeding is associated with rapid early weight gain that can amplify an already high growth trajectory and markedly increase the risk of childhood obesity. Conversely, prolonged breastfeeding (≥12 months) appears to attenuate obesity risk in infants born LGA. Favourable modifiers during infancy include catch-down growth, a reduced adipose-tissue growth trajectory, sustained breastfeeding, and a healthy gut microbiome.

Conclusions: Macrosomic infants display a distinctive, time-dependent feeding profile: an early breastfeeding advantage that erodes after the second postpartum week. Because exclusive formula feeding amplifies obesity risk while prolonged breastfeeding mitigates it, the early postnatal period is a critical window for structured lactation support aimed at sustaining breastfeeding beyond 8 weeks and into the first year of life.

Acknowledgments: The authors declare no conflicts of interest. (Edit or remove as appropriate.)

Keywords: *macrosomia, large-for-gestational-age, infant feeding.*

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BREASTFEEDING DIFFICULTIES IN NEONATES BORN AFTER SHOULDER DYSTOCIA

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Aim of the Study. To synthesize current evidence on the causes of breastfeeding difficulties in neonates born after deliveries complicated by shoulder dystocia, and to outline a structured diagnostic and supportive management approach for the lactation period.

Materials and Methods: A narrative review of obstetric, neonatal and paediatric neurology literature was conducted, covering practice bulletins, task force reports, review articles and clinical studies addressing neonatal complications of shoulder dystocia and their impact on early oral feeding. Mechanisms interfering with positioning, latch and the suck-swallow-breathe coordination were extracted and organized by aetiology, together with recommended investigations and feeding-support interventions.

Results: Breastfeeding difficulties are most frequently caused by neonatal brachial plexus palsy, which occurs in 10-20% of shoulder dystocia cases and impairs comfortable positioning at the breast, head and trunk support, and may be accompanied by phrenic nerve injury with diaphragmatic paralysis. Clavicular or humeral fractures, present in approximately 10.6% of cases, restrict limb movement through pain. Hypoxic-ischaemic encephalopathy, reported in 0.5-23% of cases and more likely when the head-to-body interval exceeds five minutes, produces weak or absent sucking, hypotonia, altered consciousness and seizures; basal ganglia and brainstem lesions on MRI are strongly associated with persistent feeding impairment. Additional contributors include ankyloglossia, cephalohaematoma or extensive scalp bruising, gastro-oesophageal reflux and neonatal sepsis. Targeted clinical assessment (limb asymmetry, Horner sign, asymmetric chest expansion, clavicle and humerus palpation, suck reflex, tone and modified Sarnat staging) guides selective use of radiography, diaphragmatic ultrasound, EEG/aEEG and cerebral MRI. Supportive measures include lactation consultation with adapted positioning, early occupational therapy for suspected brachial plexus palsy, non-nutritive sucking stimulation, and temporary swaddling when a painful fracture is present.

Conclusions: Breastfeeding difficulties after shoulder dystocia are predominantly explained by brachial plexus injury, skeletal fractures and hypoxic-ischaemic encephalopathy. A structured, mechanism-oriented assessment with selective investigations enables timely identification of treatable causes and appropriate feeding support, while red-flag findings such as absent sucking with hypotonia and seizures warrant urgent evaluation for encephalopathy and therapeutic hypothermia within the first six hours of life.

Keywords: *shoulder dystocia; breastfeeding; neonatal feeding.*

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PEDIATRIC NEUROGENOMICS: CHALLENGES AND PERSPECTIVES IN THE DIAGNOSIS OF NEURODEGENERATIVE DISORDERS

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Pediatric neurodegenerative disorders represent a heterogeneous group of rare diseases characterized by significant clinical variability and diagnostic challenges, particularly during the early stages of disease progression. The development of modern genomic technologies has substantially transformed the diagnostic approach in pediatric neurology, facilitating the identification of monogenic etiologies and expanding genotype–phenotype correlations.

Objective: To analyze the role of modern neurogenomics and the main challenges encountered in the diagnosis of pediatric-onset neurodegenerative disorders.

Materials and Methods: A narrative literature review was conducted using articles indexed in PubMed, Scopus, and Web of Science, published between 2019 and 2026, focusing on the application of Next-Generation Sequencing and Whole Exome Sequencing in pediatric neurogenetics.

Results. Recent data demonstrate a significant increase in diagnostic yield through the use of genomic technologies, with reported rates of approximately 30–50% in complex neurodegenerative encephalopathies. At the same time, numerous genes previously associated with restricted phenotypes are currently recognized as having an expanded clinical spectrum. Pathogenic variants in POLG, ATP1A3, and PLA2G6 have been associated with diverse neurological manifestations, including epilepsy, neurocognitive regression, dystonia, ataxia, and complex movement disorders. The integration of clinical, neuroimaging, and molecular data contributes to a more accurate characterization of neurological phenotypes and optimization of the diagnostic algorithm. Nevertheless, significant challenges remain, including the interpretation of variants of uncertain significance, marked clinical heterogeneity, and limited access to advanced genomic testing.

Conclusions: Pediatric neurogenomics represents an essential component of modern diagnostics in childhood neurodegenerative disorders, contributing to the development of personalized medicine and improving diagnostic and genetic counseling strategies.

Keywords: *Pediatric neurogenomics, neurodegenerative disorders, Whole Exome Sequencing.*

UDC: 616-001-06:613.81-036.8

ACUTE ALCOHOL INTOXICATION AND SEVERELY INJURED PATIENTS: OUTCOMES IN SYSTEMATIC REVIEW OF 25 MAJOR STUDIES (1992-2026)

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Acute alcohol intoxication is often seen in patients with severe traumatic injuries on admission. The effect of blood alcohol concentration (BAC) on clinical outcomes is controversial with studies reporting both detrimental and possibly protective effects. This review sought to evaluate existing evidence on the effect of acute alcohol intoxication on mortality and clinical outcomes in patients with severe trauma.

We performed a narrative review of major observational studies, trauma registry analyses, systematic reviews, and meta-analyses published over the last three decades. We reviewed studies evaluating the association between BAC and outcomes in adult trauma patients, including traumatic brain injury (TBI). Primary End Points The primary end points were mortality, injury severity, admission to the intensive care unit (ICU), length of mechanical ventilation, and length of hospital stay.

Conflicting findings were observed in the reviewed literature. Several large cohort studies found no independent association between BAC and mortality after adjustment for injury severity and confounding factors . Conversely, some studies reported increased mortality in intoxicated trauma patients, while other studies reported a survival advantage, especially in patients with isolated TBI. Meta-analyses did not confirm a consistent neuroprotective role of alcohol, but showed high heterogeneity among studies. Prolonged mechanical ventilation and resource utilization and altered physiologic responses were often associated with acute alcohol intoxication.

Current data do not support a specific beneficial or deleterious effect of acute alcohol intoxication on mortality after severe trauma. The relationship seems to be influenced by injury pattern, BAC level and patient specific factors. Further prospective, multi-center studies are required to determine the mechanisms underlying these observed associations and to define the prognostic implications of acute alcohol exposure in trauma patients.

Keywords: *blood alcohol concentration, trauma, mortality, traumatic brain injury, intensive care.*

UDC: 611.441:616.83-089.86

THE EFFECT OF DENERVATION ON THE MORPHOLOGY AND FUNCTIONAL ACTIVITY OF THE THYROID GLAND

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In modern neuroendocrinology, increasing attention is being paid to the study of the transhypophyseal mechanism of thyroid function regulation. Meanwhile, the significance of the parahypophyseal mechanism has not been sufficiently investigated. A frequently used method for studying the role of the autonomic nervous system in regulating the functional activity of the thyroid gland is the extirpation of the cervical sympathetic ganglia, the nerves of which innervate not only the thyroid gland but also many other vital organs. It is possible that this methodological approach has led to the emergence of conflicting data, demonstrating the ambiguity and uncertainty of the autonomic nervous system's influence on thyroid function.

The aim of our study was to determine the extent to which the autonomic innervation of the thyroid gland contributes to the regulation of its secretory function and morphological structure.

The studies were conducted on male and female white laboratory rats. Denervation of the gland was performed using our own methodological approach, which does not compromise the integrity of the superior cervical sympathetic ganglia. The results showed that the secretory activity of the thyroid gland changed only slightly 1–4 days after denervation, indicating the predominant influence of the transhypophyseal regulatory mechanism in animals of both sexes. However, 120 days after denervation of the thyroid gland, there was a significant reduction in its functional activity, characteristic of hypothyroidism. This was evidenced by histological findings revealing a lack of colloid resorption, a reduction in the height of the secretory cells and the diameter of their nuclei, as well as a decrease in the concentration of thyroid hormones in the blood. It was established that prolonged denervation leads to the development of hypothyroidism, which is more pronounced in females, indicating the importance of the parahypophyseal regulatory mechanism in maintaining normal thyroid status.

Acknowledgments: This study was supported by the research project 011001, "Mechanisms for regulating the organism's homeostasis and health and the elaboration of procedures and measures to maintain it," funded by the Institute of Physiology and Sanocreatology (Institutul de Fiziologie și Sanocreatologie).

Keywords: *regulation, thyroid function, parahypophyseal regulatory mechanism.*

UDC: 618.19-006.6-092:577.21

microRNA IN CONTROL OF BREAST TUMOR ANGIOGENESIS: VEGF, HIF-1α AND ANTI-ANGIOGENIC STRATEGIES

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Angiogenesis is a critical process in breast cancer progression, enabling tumor growth and metastasis through the formation of new blood vessels. Vascular endothelial growth factor (VEGF) and hypoxia-inducible factor 1-alpha (HIF-1α) are central regulators of this process. MicroRNAs (miRNAs), small non-coding RNAs, have emerged as key modulators of angiogenesis by targeting VEGF signaling, hypoxia pathways, and endothelial cell function.

This study aims to investigate the role of miRNAs in controlling breast tumor angiogenesis, focusing on their interaction with VEGF and HIF-1α, and to evaluate their potential in anti-angiogenic therapeutic strategies.

Expression profiling of angiogenesis-related miRNAs was performed in breast cancer tissues and cell lines using quantitative Reverse Transcription Polymerase Chain Reaction (RT-PCR) and RNA sequencing. The analysis emphasized how microRNAs regulate angiogenesis by modulating VEGF signaling and HIF-1α activity, thereby shaping vascular adaptation in breast cancer.

Upregulation of miR-21 and miR-210 was associated with enhanced angiogenesis through activation of VEGF and HIF-1α pathways, while miR-126 and miR-200 family members acted as suppressors by inhibiting endothelial proliferation and vessel formation. Loss of miR-126 correlated with poor prognosis and increased vascular density. Restoration of miR-200 expression reduced angiogenesis and sensitized tumors to anti-VEGF therapy. Moreover, combined miRNA signatures provided superior predictive accuracy for angiogenic activity compared to VEGF levels alone. Validation across independent cohorts confirmed their translational relevance. Importantly, dynamic shifts in miRNA expression under hypoxic conditions highlighted their role in adaptive angiogenic responses.

MiRNAs are central regulators of breast tumor angiogenesis, influencing VEGF and HIF-1α pathways. Their integration into clinical practice could refine prognostic evaluation and guide anti-angiogenic therapeutic strategies. Harnessing miRNA networks may ultimately enable the development of innovative therapies to suppress angiogenesis and improve patient outcomes.

Keywords: *microRNA, breast cancer, angiogenesis, VEGF, HIF-1α.*

UDC: 616-006.6-091.8:577.21

microRNA NETWORKS IN EPITHELIAL-MESENCHYMAL TRANSITION: INVASION, METASTASIS AND THERAPEUTIC PERSPECTIVES

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Epithelial-mesenchymal transition (EMT) is a fundamental process in cancer progression, enabling epithelial cells to acquire mesenchymal traits, enhancing motility, invasion, and metastatic potential. MicroRNAs (miRNAs), as post-transcriptional regulators, play a pivotal role in targeting EMT by modulating transcription factors, signaling pathways, and cellular plasticity.

This study aims to investigate the role of miRNA networks in regulating EMT, focusing on their contribution to invasion, metastasis, and therapeutic resistance, while highlighting their potential as novel therapeutic targets.

Expression profiling of EMT-associated miRNAs was performed in breast and prostate cancer cell lines using quantitative Reverse Transcription Polymerase Chain Reaction (RT-PCR) and RNA sequencing. Functional assays, including migration and invasion tests, were conducted to assess the impact of miRNA modulation. The analysis highlighted how microRNAs regulate epithelial–mesenchymal transition by modulating transcription factors and signaling pathways, thereby shaping tumor invasion, metastasis, and adaptation toward therapy resistance.

Upregulation of miR-10b and miR-21 was associated with enhanced EMT and increased metastatic potential, while miR-200 family members acted as suppressors by maintaining epithelial identity. Loss of miR-200 expression correlated with poor prognosis and aggressive disease phenotypes. Restoration of miR-200 inhibited EMT and reduced invasion *in vitro*, suggesting therapeutic relevance. Furthermore, combined miRNA signatures provided superior predictive accuracy for metastatic risk compared to single markers. Validation across independent cohorts confirmed the robustness of these regulatory networks.

MiRNA networks are central regulators of EMT, invasion, and metastasis in cancer. Their integration into clinical practice could refine prognostic evaluation and guide targeted therapeutic strategies. Harnessing EMT-related miRNA circuits may ultimately enable the development of innovative anti-metastatic therapies with durable clinical benefit.

Keywords: *microRNA, EMT, invasion, metastasis, therapeutic perspectives.*

UDC: 618.19-006.6:615.277:577.21

microRNA AS REGULATORS OF CHEMOTHERAPY AND TARGETED THERAPY RESISTANCE IN BREAST CANCER

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Breast cancer remains a leading cause of cancer-related mortality among women worldwide. Despite advances in chemotherapy and targeted therapies, including Human Epidermal Growth Factor Receptor 2 (HER2) inhibitors and Poly(ADP-ribose) Polymerase (PARP) inhibitors, resistance frequently develops, limiting therapeutic efficacy. MicroRNAs (miRNAs), small non-coding RNAs that regulate gene expression, are increasingly recognized as key modulators of drug response, influencing DNA repair, apoptosis, and oncogenic signaling pathways.

This study aims to explore the role of miRNAs in regulating resistance to chemotherapy and targeted therapies in breast cancer, emphasizing their contribution to tumor adaptation and the potential for combined therapeutic strategies.

Expression profiling of therapy-associated miRNAs was performed in HER2-positive and triple-negative breast cancer cell lines using quantitative Reverse Transcription Polymerase Chain Reaction (RT-PCR) and RNA sequencing. Functional assays, including drug sensitivity and apoptosis tests, were conducted to assess the impact of miRNA modulation. Bioinformatic analyses identified regulatory networks linking miRNAs to HER2 signaling, PARP-mediated DNA repair, and chemoresistance pathways.

Upregulation of miR-21 and miR-221 was associated with reduced sensitivity to HER2-targeted agents, while miR-182 promoted resistance to PARP inhibitors by enhancing homologous recombination repair. Conversely, restoration of miR-200 family members sensitized cells to therapy by suppressing epithelial-mesenchymal transition (EMT) and survival pathways. Integration of these findings revealed that miRNA-mediated regulation contributes to both intrinsic and acquired resistance.

MiRNAs are central regulators of chemotherapy and targeted therapy resistance in breast cancer. Their integration into clinical practice could refine patient stratification and guide the design of combined treatment strategies. Harnessing miRNA networks may ultimately enable the development of innovative therapeutic approaches to overcome resistance and improve long-term outcomes in breast cancer patients.

Keywords: *microRNA, breast cancer, chemotherapy resistance, HER2, PARP.*

UDC: 616.65-006.6:577.21

microRNA AND THE ANDROGEN RECEPTOR AXIS: REGULATION OF PROLIFERATION AND THERAPY RESISTANCE

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Prostate cancer progression is strongly dependent on androgen receptor (AR) signaling, which drives cellular proliferation and survival. Despite the effectiveness of androgen deprivation therapy, many patients develop castration-resistant prostate cancer (CRPC). MicroRNAs (miRNAs), small non-coding RNAs that regulate gene expression, have been implicated in modulating AR activity and influencing therapeutic response.

This study aims to investigate the role of miRNAs in regulating AR signaling, proliferation, and resistance to hormonal therapy in prostate cancer, with emphasis on their potential as therapeutic targets and biomarkers.

Expression profiles of AR-associated miRNAs were analyzed in prostate cancer tissues and cell lines using quantitative Reverse Transcription Polymerase Chain Reaction (RT-PCR) and RNA sequencing. The analysis highlighted how microRNAs regulate the androgen receptor pathway and contribute to the transition toward castration-resistant prostate cancer by influencing co-factors and downstream targets.

Upregulation of miR-21 and miR-125b was associated with enhanced AR activity and increased proliferation, while miR-34a acted as a tumor suppressor by downregulating AR expression. Elevated miR-21 levels correlated with poor response to androgen deprivation therapy, suggesting its role in therapy resistance. Conversely, restoration of miR-34a expression reduced AR signaling and inhibited tumor growth. Integration of these findings revealed that miRNA-mediated regulation of AR contributes to both disease progression and therapeutic adaptation. Moreover, combined miRNA signatures improved prediction of therapy outcomes compared to AR status alone.

MiRNAs are key modulators of AR signaling in prostate cancer, influencing proliferation and therapy resistance. Their integration into clinical practice could refine patient stratification and guide novel therapeutic strategies. Future exploratation of miRNA–AR interactions may open avenues for targeted interventions in castration-resistant disease.

Keywords: *microRNA, androgen receptor signaling, prostate cancer, proliferation.*

UDC: 616.65-006.6-07:577.21

microRNA AS BIOMARKERS FOR EARLY DETECTION AND PATIENT STRATIFICATION IN PROSTATE CANCER

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Prostate cancer remains one of the most prevalent malignancies in men worldwide, with significant heterogeneity in clinical outcomes. Current diagnostic tools, such as prostate-specific antigen (PSA) testing, lack specificity and prognostic accuracy. MicroRNAs (miRNAs), small non-coding RNAs regulating gene expression, have emerged as promising biomarkers due to their stability in biological fluids and their involvement in oncogenic pathways.

This study aims to evaluate the role of specific miRNAs as molecular biomarkers for early detection and patient stratification in prostate cancer, highlighting their potential in personalized medicine.

A systematic analysis of circulating and tissue-derived miRNAs was performed using quantitative Reverse Transcription Polymerase Chain Reaction (RT-PCR) and next-generation sequencing. Patient cohorts included individuals with localized prostate cancer, advanced disease, and benign prostatic hyperplasia. Bioinformatic tools were applied to identify miRNA signatures associated with tumor progression, androgen receptor signaling, and therapy resistance.

Differential expression of miR-21, miR-141, and miR-221 was observed in prostate cancer tissues compared to controls. Elevated levels of miR-21 correlated with aggressive phenotypes and poor prognosis, while miR-141 was linked to metastatic disease. Conversely, downregulation of miR-221 was associated with tumor suppressive activity. Integration of these miRNA profiles allowed stratification of patients into risk categories, improving diagnostic accuracy beyond PSA levels. Additionally, combined miRNA panels demonstrated superior sensitivity and specificity compared to single-marker approaches. The predictive value of these signatures was validated across independent cohorts, confirming their translational potential.

MiRNAs represent robust biomarkers for early detection and risk stratification in prostate cancer. Their incorporation into clinical practice could enhance personalized therapeutic strategies and reduce overtreatment. Future integration of miRNA profiling into routine diagnostics may redefine risk assessment and guide precision oncology.

Keywords: *microRNA, prostate cancer, biomarkers, early detection, patient stratification.*

UDC: 616.36:614.2:316.77

ROLE OF SOCIAL MEDIA IN INFORMING THE POPULATION ABOUT VIRAL HEPATITIS B AND C

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Viral hepatitis B and C remain major public health problems, being responsible for chronic liver disease, cirrhosis and hepatocellular carcinoma. In the digital era, social media platforms have become rapidly expanding channels of health information, with a substantial potential to shape population knowledge, attitudes and preventive behaviours regarding viral hepatitis.

To evaluate the role of social media, alongside other information sources, in informing the general population of the Republic of Moldova about viral hepatitis B and C, and to identify knowledge gaps and preferred communication channels for targeted health-education interventions.

A descriptive cross-sectional study was conducted on a sample of 811 respondents from the Republic of Moldova (80.3% female; mean age 41.1 ± 14.0 years, range 18–75). Data were collected through a structured questionnaire covering sociodemographic characteristics, sources of health information, knowledge of viral hepatitis B and C transmission, prevention and clinical features, vaccination and testing status. Data were processed and analysed using descriptive statistics (absolute frequencies and percentages) in Microsoft Excel. Respondents could select multiple sources of information; therefore, percentages do not total 100%.

Awareness of viral hepatitis was very high: 98.9% of respondents had heard of hepatitis B and 97.8% of hepatitis C. The main reported sources of information were the physician (76.1%), television (37.6%), printed materials – brochures and posters (37.5%), Google (36.9%) and newspapers (33.5%). Social media platforms were used as an information source by 35.1% of participants overall, with Facebook (29.1%) being the most frequent, followed by Instagram (16.5%), TikTok (8.0%) and LinkedIn (2.8%). The majority of respondents correctly identified blood transfusion as a transmission route for hepatitis B (95.3%) and hepatitis C (94.0%); 85.2% knew that hepatitis B can be prevented by vaccination, whereas only 44.3% correctly answered that there is no vaccine against hepatitis C. Self-reported HBV vaccination was 74.2% and lifetime testing was 70.5% for hepatitis B and 64.5% for hepatitis C. Respondents expressed the strongest interest in receiving additional information on treatment of viral hepatitis, cirrhosis and hepatic cancer (59.2%), clinical manifestations (53.8%), risk factors (52.3%) and preventive measures (50.6%).

Although awareness of viral hepatitis B and C is widespread, important knowledge gaps persist, particularly regarding the prevention of hepatitis C. The physician remains the most trusted source of information, but social media – primarily Facebook – is already used by more than one third of respondents and represents a strategic communication channel. Integrating evidence-based content on transmission, vaccination and treatment into structured social media campaigns may significantly strengthen the prevention and control of viral hepatitis B and C in the Republic of Moldova.

Keywords: *viral hepatitis B, viral hepatitis C, social media, health information, prevention.*

UDC: 616.36-002-073.43:615.838

ULTRASOUND ASSESSMENT OF HEPATIC CHANGES BEFORE AND AFTER BALNEOTHERAPY

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Chronic viral hepatitis is characterized by progressive liver involvement, associated with both structural and functional alterations and a significant impact on quality of life. The aim of this study was to evaluate hepatic changes, with emphasis on ultrasound parameters, in patients with chronic viral hepatitis before and after a balneoclimatic therapy protocol, and to correlate these findings with biochemical and psychosocial parameters.

The study included patients diagnosed with chronic viral hepatitis, assessed before and after an 18-day balneoclimatic treatment. The evaluation comprised quality of life assessment using the EQ-5D questionnaire, perceived stress evaluation, liver biochemical tests (ALT, AST, bilirubin), and abdominal ultrasound examination, focusing on liver size, parenchymal echogenicity, and structural characteristics.

The results demonstrated improvements in biochemical parameters and quality of life, as well as a reduction in perceived stress following balneoclimatic therapy. However, no significant changes in ultrasound-assessed hepatic structural parameters were observed during the short-term evaluation period. This finding may be explained by the slow dynamics of structural liver changes, which require longer time intervals to become detectable by imaging methods.

In conclusion, short-term balneoclimatic therapy is associated with functional and psychosocial improvements, while ultrasound-detected structural hepatic changes remain unchanged within the evaluated period. These findings highlight the need for long-term monitoring to assess potential structural liver modifications.

Keywords: *chronic viral hepatitis, ultrasound, balneotherapy, liver function, quality of life.*

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ESTIMAITING THE FREQUENCY OF INDICATIONS FOR A GLUTEN-FREE DIET IN CHILDREN

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Gluten-free dietary guidelines are intended to support recovery and maintain health in cases of food intolerances, intestinal malabsorption, malnutrition, and other digestive system disorders. The list of conditions requiring the exclusion of gluten and all its derivatives from the diet is extensive and insufficiently addressed. Gluten is a plant protein found in certain grains, such as wheat, rye, barley, and oats. The primary data for this study were collected in the Gastroenterology Department of the Pediatric Clinic at the Mother and Child Institute. Children are referred by local healthcare facilities, family doctors, and district gastroenterologists with unspecified gastrointestinal disorders. Based on the results of the investigations, the children are diagnosed, the necessary dietary regimen is selected, and an extract from the medical record containing conclusions and recommendations is provided to the family, the family doctor, and the relevant specialists. A gluten-free diet is essential for lifelong when coeliac disease is present, which most commonly occurs in childhood and has a hereditary predisposition. Following the processing of the raw data, average values for gluten-free dietary recommendations were calculated for the years 2015–2016, broken down into three age categories based on diagnosis (1–6 years; 7–12 years; 13–18 years), against which the results for 2025 were compared. Comparing the number of gluten-free dietary recommendations in 2025 with the 2015–2016 average reveals a 9.7% decrease in the total number of recommendations, a 7.2% decrease for coeliac disease, and an 8.9% decrease for malabsorption. Across age groups, the number of children examined under the age of 6 decreased by one-quarter, while the number of children examined between the ages of 7 -12 increased significantly, and the number of those aged 13–18 rose by 7%. The average age of the total number of patients increased from 4.2 years to 5.5 years, accounting for nearly one-third. At the same time, the average age of diagnosis for coeliac disease decreased from 11.3 years to 8.6 years, while for malabsorption it increased from 3.8 years to 5.3 years. Diagnosis is delayed in the pediatric age group as a result of late referral, which adversely affects the physical and cognitive development of children requiring a gluten-free restrictive diet. Considering the dynamics of diagnosing children with gastrointestinal disorders in relation to the number of births, we note that the annual average decline in the birth rate has been 6% over the past few years.

Keywords: *diagnosis, dietary regimen, gluten, coeliac disease, malabsorption.*

UDC: 616.345-008.1:582.886

STUDY OF THE INFLUENCE OF *EPILOBIUM PARVIFLORUM* ON THE FUNCTION OF THE LARGE INTESTINE

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Currently, there is a steady increase in the pathology of the large intestine, driven by a sedentary lifestyle, chronic stress, and an unbalanced diet deficient in dietary fiber. Against this background, the popularity of phytotherapy is rising, due to its accessibility, cost-effectiveness, and the minimal risk of side effects associated with natural compounds.

The aim of this study is to evaluate the effect of small-flowered willowherb (Epilobium parviflorum) infusion on the functional state of various segments of the large intestine, given the lack of such data in current scientific literature.

The study was conducted with the participation of 5 volunteers. The evaluation of the plant's effect on the function of the large intestine was carried out using the method of acupuncture diagnostics via the "Activaciometer-6" hardware-software complex. The parameters of biologically active points (BAPs) were measured in the baseline state (background) and after a 7-day intake of a 0.7% infusion of Epilobium parviflorum.

Data analysis revealed a stimulating effect of the studied phytopreparation on the functional state of the large intestine. Positive dynamics were recorded in the indicators of biologically active points (BAPs) at the level of the descending colon (from 23.5 ± 5.9 to 31.0 ± 3.6) and the left colic flexure (splenic flexure), as well as in the associated structures: lymphatic vessels of the left part of the transverse colon (from 21.8 ± 5.9 to 33.0 ± 6.9), the peritoneum, and the greater omentum.

The results obtained justify the feasibility of further in-depth studies and allow the recommendation of 0.7% *Epilobium parviflorum* infusion as a means for the prevention and complex therapy of chronic dystonia and atony of the large intestine.

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Keywords: *large intestine, function, Epilobium parviflorum.*

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MEMBRANE DIGESTION OF CARBOHYDRATES DEPENDING ON THEIR DIETARY CONTENT DURING EARLY POSTNATAL ONTOGENESIS

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It is currently known that nutritional factors, alongside ontogenetic developmental processes, play an important role in the formation of digestive enzyme systems in the small intestine during the transition to definitive nutrition. However, the specific characteristics and patterns of adaptive restructuring of the membrane digestive system in response to nutrients at early stages of postnatal development remain insufficiently studied. The aim of this work was to investigate membrane carbohydrate digestion (using the disaccharides maltose and sucrose as an example) and the absorption of the resulting monosaccharides in the small intestine of rats exposed to diets with varying carbohydrate contents during early postnatal ontogenesis.

The study was performed on male Wistar rats. After weaning, the rat pups from each experimental group were maintained for 6 weeks on either high-carbohydrate (78.2% of energy intake) or low-carbohydrate (27.9% of energy intake) diets, or on a carbohydrate-free diet. The rats from all groups were then maintained on a standard diet for 4 months, after which they were operated on and collected for membrane digestion studies. Animals maintained on a standard diet after weaning served as controls. In situ perfusion of an isolated small intestinal loop was used to study digestive and transport processes.

It was found that a high-carbohydrate diet during early postnatal development leads to increased intensity of hydrolysis of both maltose and sucrose and the absorption of the resulting monosaccharides in adult animals (by 1.2-1.3 times compared to the control), depending on the initial concentration of disaccharides in the small intestine (12.5-37.5 mM). Under low-carbohydrate diet conditions, the studied parameters do not change significantly. A carbohydrate-free diet in adult animals significantly reduces the rate of disaccharide hydrolysis and the absorption of glucose and, especially, fructose (by 1.5 times or more).

Thus, long-term high-carbohydrate and carbohydrate-free diets in early postnatal ontogenesis, unlike a low-carbohydrate diet, contribute to the development of disturbances in membrane hydrolysis of disaccharides and the absorption of the resulting monosaccharides in the small intestine.

Keywords: *membrane digestion, small intestine, carbohydrates, early postnatal ontogenesis.*

UDC: 616.65-006.6-091.8

CELLULAR ATYPIA – A KEY HISTOPATHOLOGICAL HALLMARK IN THE DIAGNOSIS OF PROSTATE CARCINOMA

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Cellular atypia is a key histopathological feature in the diagnosis of prostate carcinoma, reflecting the degree of morphological abnormalities of tumor cells and their potential biological aggressiveness.

Aim: To evaluate the relationship between cellular atypia and the main histopathological parameters of prostate adenocarcinoma in order to assess its potential prognostic value.

Materials and methods: This retrospective study included 70 patients diagnosed with prostatic adenocarcinoma. Correlation coefficients were analyzed between cellular atypia and various clinicopathological parameters, including age, number of affected lobes, lymphovascular and perineural invasion, capsular invasion, lymphocytic infiltrate, Gleason score, pathological stage, sinus histiocytosis, hyalinosis, lipid degeneration, chronic prostatitis, and lymph node metastases.

Results: Correlation analysis demonstrated a borderline negative association between cellular atypia and lymphovascular invasion ($r = -0.20$; $p = 0.05$), as well as hyalinosis ($r = -0.18$; $p = 0.06$). Weak positive, although statistically non-significant, correlations were observed between atypia and perineural invasion ($r = 0.11$; $p = 0.19$), secondary Gleason pattern ($r = 0.10$; $p = 0.21$), overall Gleason score ($r = 0.09$; $p = 0.23$), and the number of affected lobes ($r = 0.09$; $p = 0.22$). Weak negative correlations were also identified with age, pathological stage, sinus histiocytosis, chronic prostatitis, and bilateral lymph node metastases. No significant associations were found between cellular atypia and capsular invasion or lymphocytic infiltrate.

Conclusions: Cellular atypia remains an important morphological marker in the assessment of prostate adenocarcinoma, although no statistically significant correlations with most histopathological parameters were identified in the present cohort. Nevertheless, the observed inverse relationship with lymphovascular invasion and hyalinosis may indicate a possible role of atypia in tumor progression dynamics.

Keywords: *prostate adenocarcinoma, cellular atypia, histopathology, prognosis.*

UDC: 616.65-006.6-002

CHRONIC INFLAMMATION – A POTENTIAL RISK FACTOR IN THE DEVELOPMENT OF PROSTATE CARCINOMA

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Chronic inflammation is considered to play an important role in prostatic carcinogenesis through its effects on the tumor microenvironment, cellular proliferation, and neoplastic progression.

Aim: To evaluate the relationship between chronic prostatitis and the main histopathological parameters of prostate adenocarcinoma in order to assess its potential prognostic relevance.

Materials and methods: This retrospective study included 70 patients diagnosed with prostatic adenocarcinoma. Correlation coefficients were analyzed between chronic prostatitis and several clinicopathological parameters, including age, number of affected lobes, lymphovascular and perineural invasion, capsular invasion, lymphocytic infiltrate, Gleason score, pathological stage, sinus histiocytosis, hyalinosis, lipid degeneration, cellular atypia, and lymph node metastases.

Results: Correlation analysis demonstrated significant associations between chronic prostatitis and perineural invasion ($r = -0.21$; $p = 0.04$), secondary Gleason pattern ($r = 0.22$; $p = 0.03$), and hyalinosis ($r = 0.25$; $p = 0.02$). In addition, a borderline negative association was observed between chronic prostatitis and pathological stage ($r = -0.20$; $p = 0.05$). Weak positive, although statistically non-significant, correlations were identified with lymphovascular invasion, sinus histiocytosis, overall Gleason score, lipid degeneration, and the number of affected lobes. Weak negative correlations were observed with age, capsular invasion, lymphocytic infiltrate, cellular atypia, and bilateral lymph node metastases.

Conclusions: Chronic inflammation may contribute to the progression dynamics of prostate adenocarcinoma and appears to be associated with several relevant histopathological alterations. The observed associations with perineural invasion, secondary Gleason pattern, and hyalinosis suggest a possible involvement of chronic prostatitis in tumor progression mechanisms. Further studies are required to clarify the prognostic significance of chronic inflammation in prostate carcinoma.

Keywords: *prostate adenocarcinoma, chronic inflammation.*

UDC: 616.65-006.6-091

PROGNOSTIC SIGNIFICANCE OF CAPSULAR INVASION IN PROSTATE CARCINOMA

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Capsular invasion is considered an important feature in the progression of prostate adenocarcinoma, being associated with local tumor extension and a more aggressive biological behavior.

Aim: To evaluate the relationship between capsular invasion and the main histopathological parameters of prostate adenocarcinoma in order to determine its prognostic value.

Materials and methods: This retrospective study included 70 patients diagnosed with prostate adenocarcinoma. Correlation coefficients between capsular invasion and clinic-morphological parameters, including Gleason score, perineural invasion, lymph vascular invasion, and pathological stage, were analyzed. Statistical significance was established at $p<0.05$.

Results: Significant positive correlations were identified between capsular invasion and pathological stage ($r=0.52$; $p<0.001$), sinus histiocytosis ($r=0.27$; $p=0.01$), lipid degeneration ($r=0.31$; $p<0.001$), and right lymph node metastases ($r=0.23$; $p=0.04$). Positive but statistically non-significant associations were observed with perineural invasion, total Gleason score, and the number of affected lobes. Weak negative correlations were identified with lymph vascular invasion, lymphocytic infiltrate, hyalinosis, atypia, and chronic prostatitis.

Conclusions: Capsular invasion may reflect the degree of tumor progression and aggressiveness, suggesting a potential prognostic role in prostate adenocarcinoma. A direct association with pathological stage and lymph node metastases was observed. Further studies are needed to confirm these findings and to support the integration of capsular invasion into prognostic assessment.

Keywords: *prostate adenocarcinoma, capsular invasion, prognosis.*

UDC: 613.86-053.6-054.73:004

DISTINCTIVE FEATURES OF INFO-DIGITAL OVERLOAD IN REFUGEE CHILDREN AND ADOLESCENTS

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The rapid digitalization of childhood has introduced a new powerful environmental factor — **Info-Digital Overload (IDO)** — that elicits chronic **digital stress** in the developing organism. This pilot cross-sectional study aimed to characterise the distinctive features of IDO and its principal behavioral manifestation, Info-Digital Addiction (IDA), in refugee youth versus non-displaced peers. Participants: 145 children and adolescents from Moldova aged 9–17 years — 72 refugees (mainly from Ukraine) and 73 locals.

Using the 25-item Digital Addiction Scale for Children (DASC), refugees showed significantly higher IDA scores ($M = 76.57$, $SD = 28.56$) than local youth ($M = 57.33$, $SD = 21.42$; $U = 1518$, $p < 0.001$, $d = 0.76$). High-risk addiction ($\geq$75 points) was detected in 48.6% of refugees versus 17.8% of locals (OR = 4.36; 95% CI: 2.04–9.29; $p < 0.001$). Moreover, 72.2% of refugees reported increased screen time after migration — direct evidence of post-displacement IDO escalation. Refugees also exhibited markedly elevated fatigue, anxiety, mood deterioration, concentration difficulties, and somatic complaints (dry eyes, neck pain, headaches).

Distinctive features of IDO in refugee youth comprise: (i) fourfold elevated risk of IDA; (ii) post-migration escalation of digital exposure as maladaptive coping; (iii) multiplicative interaction of adaptive stress and digital exposure, yielding autonomic imbalance, circadian disruption and reduced adaptive capacity; (iv) elevated somatic burden. Within the sanocreatological framework, IDO is not merely a risk factor but a significant challenge to sanogenesis. The findings underscore the need for physiologically grounded prevention restoring balance between digital and natural environmental factors, with special attention to refugee youth.

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Keywords: *info-digital overload, digital stress, sanocreatology, refugees, adolescents.*

UDC: 616.8-092.9:582.876

NEUROBEHAVIORAL EFFECTS OF POMEGRANATE EXTRACT IN AN DEMENTIA ZEBRAFISH MODEL

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Pomegranate (*Punica granatum* L.) polyphenols are increasingly recognized as multi-target neuroprotective agents; however, formulation and preservation conditions may substantially influence their biological activity. This study investigated whether the storage container of a lyophilized pomegranate juice extract (PJE)-glass-preserved (LV) versus plastic-preserved (LP)-affects its neuroprotective efficacy in an adult zebrafish (*Danio rerio*) model of metal-induced neurotoxicity.

Neurotoxicity was induced by co-exposure to aluminum chloride and lead acetate ($AlCl_3$ + PbAc; 200 µg/L each). Fish were treated with PJE (1, 3, or 10 mg/mL) and reference neuroactive compounds, followed by a comprehensive behavioral assessment encompassing anxiety-like behavior, exploration, aggression, and cognition using the novel tank, light/dark, novel approach, Y-maze, and novel object recognition tests. Brain homogenates were subsequently analyzed for cholinergic activity and oxidative status, including acetylcholinesterase (AChE), superoxide dismutase (SOD), catalase (CAT), glutathione peroxidase (GPx), reduced glutathione (GSH), malondialdehyde (MDA), and protein carbonyl levels.

Exposure to $AlCl_3$ + PbAc induced pronounced anxiety-like behavior and cognitive deficits, accompanied by cholinergic dysfunction, impaired antioxidant defenses, and elevated lipid and protein oxidation. PJE treatment attenuated these neurobehavioral and biochemical alterations in a dose-dependent manner, improving cognitive performance and restoring redox balance. Notably, the glass-preserved extract (LV) consistently exhibited greater efficacy than the plastic-preserved formulation (LP) across behavioral and biochemical endpoints. Pearson correlation analyses further revealed strong associations between oxidative stress markers, cholinergic dysregulation, and cognitive impairment.

These findings demonstrate the neuroprotective potential of lyophilized pomegranate juice extract against aluminum/lead-induced neurotoxicity and highlight preservation container–dependent variability as an important factor influencing the efficacy of polyphenol-rich formulations.

Keywords: *pomegranate extract, memory, oxidative stress, zebrafish.*

UDC: 591.3:547.857:591.5

INTEGRATED ASSESSMENT OF DEVELOPMENTAL, PHYSIOLOGICAL AND BEHAVIORAL OUTCOMES FOLLOWING CAFFEINE EXPOSURE IN ZEBRAFISH AND MODULATION BY N-ACETYLCYSTEINE

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Caffeine is one of the most widely consumed psychoactive compounds worldwide, with increasing concern regarding its potential effects on early vertebrate development. The zebrafish (*Danio rerio*) represents a well-established model for assessing developmental toxicity, allowing simultaneous evaluation of morphological, physiological, and behavioral endpoints. N-acetylcysteine (NAC), a bioactive compound with cytoprotective properties, has been investigated for its potential to modulate toxic effects induced by environmental and pharmacological agents.

This study aimed to perform an integrated assessment of caffeine-induced effects across developmental stages in zebrafish embryos and larvae, and to evaluate the potential modulatory role of NAC co-treatment.

Zebrafish embryos were exposed to varying concentrations of caffeine, in the presence or absence of NAC, from early developmental stages through larval periods. A range of endpoints was assessed, including developmental parameters (malformations and hatching rate), physiological function (heart rate and survival), and behavioral activity (locomotor responses).

Caffeine exposure induced concentration-dependent alterations across all evaluated domains, including increased incidence of developmental abnormalities, delayed hatching, reduced survival, and changes in cardiac activity. Behavioral assays revealed altered locomotor activity in exposed larvae. Co-treatment with NAC partially mitigated several of these effects, improving developmental outcomes, stabilizing physiological parameters, and attenuating behavioral alterations.

These findings demonstrate that caffeine exerts multidimensional effects on early zebrafish development, impacting structural, functional, and behavioral endpoints. The observed attenuation by NAC suggests a protective modulatory role, highlighting its potential in reducing caffeine-induced developmental disturbances.

Keywords: *caffeine; zebrafish; n-acetylcysteine; development; behavior*.

UDC: 612.39-092.9:599.323.4:591.5

QUALITATIVE AND QUANTITATIVE ASSESSMENT OF FEEDING BEHAVIOR IN LABORATORY ANIMALS

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Objective analysis of the daily sleep-wake and feeding-fasting cycles is important for the prevention and diagnosis of feeding behavior disorders, as well as for the detection of symptoms of bulimia nervosa and anorexia nervosa. Improvements in laboratory techniques for assessing feeding behavior contribute to enhanced quality and reliability of health monitoring in humans, livestock, and companion animals. The aim consists of validation of the method for evaluating feeding behavior through the combined use of video recording and electromyography.

The animals (rats) were adapted to living in individual cages equipped with individual feeders and water dispensers for 72 hours. Food and water were available *ad libitum*. The cages were kept in a room with natural lighting during July, with a light period from 06:00 to 20:50 and a dark period from 21:00 to 06:00. Detailed assessment of behavioral acts was based on video monitoring using two video cameras (Full HD 1080p Webcam C615, Logitech) mounted on each cage. In combination with video recording, electromyography (EMG) of the animals' neck muscles was performed, followed by spectral analysis of the EMG recordings. Frame-by-frame analysis of the video recordings provided sufficient temporal resolution for the accurate detection and qualitative and quantitative assessment of feeding behavior events.

The proportion of time spent in various behavioral activities was as follows: locomotion within the cage – 1.0±0.1% of the recording time; rearing – 1.0±0.1%; food consumption – 10.0±0.9%; water intake – 2.0±0.3%; self-grooming – 18.0±2.1%; lying down – 4.0 ± 0.3%; sleep – 60.0±0.5%; and other forms of behavior – 2.0±0.3%.Feeding-related behaviors were characterized by a sharp increase in muscle bioelectrical activity, followed by a decrease in muscle bioelectrical activity associated with a relaxed state, alternating with episodes of self-grooming. Self-grooming indirectly reflects the activity of the reward system, feeding satiety, and the animal's state of satisfaction.

The combined use of video recording and EMG provides an effective methodological approach for the objective assessment of feeding behavior and associated activity patterns in laboratory animals during the wakefulness–sleep cycle.

Keywords: *sleep-wake cycle, feeding behavior.*

UDC: 613.81:612.43:616.89

ALCOHOL CONSUMPTION, STRESS, AND NEUROENDOCRINE DYSFUNCTION

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Alcohol use disorder is associated with profound alterations in stress-regulating systems that contribute to the development and persistence of dependence. This review *aimed* to examine the neurobiological mechanisms through which chronic alcohol exposure disrupts neuroendocrine adaptation to stress and increases vulnerability to relapse.

Methods: A narrative review of contemporary literature was conducted to evaluate the interaction between chronic alcohol consumption, the hypothalamic–pituitary–adrenal (HPA) axis, and stress-related neuropeptide systems. Particular attention was given to corticotropin-releasing factor (CRF), dynorphin, neuropeptide Y (NPY), nociceptin, and oxytocin signaling within the extended amygdala.

Results: Acute alcohol exposure initially activates the HPA axis, leading to increased glucocorticoid secretion. However, prolonged alcohol consumption induces progressive dysregulation and hypoactivity of the HPA axis, characterized by attenuated ACTH and cortisol responses during abstinence. Concurrently, enhanced activity of pro-stress neuropeptide systems, particularly CRF and dynorphin pathways in the extended amygdala, promotes anxiety, negative emotional states, compulsive alcohol seeking, and stress-induced relapse. In contrast, the activity of anti-stress neuropeptides, including NPY, nociceptin, and oxytocin, is reduced, further contributing to emotional dysregulation. These neuroadaptive changes result in a persistent negative allostatic state that sustains alcohol dependence through negative reinforcement mechanisms.

Conclusions: Chronic alcohol exposure produces long-lasting neuroendocrine and neurochemical alterations that disrupt the balance between stress and anti-stress systems. Dysregulation of the HPA axis and extended amygdala neuropeptide networks represents a central mechanism underlying alcohol dependence and relapse vulnerability. Therapeutic strategies targeting these pathways may improve long-term recovery outcomes and reduce relapse risk.

Keywords: *alcohol dependence; stress; HPA axis; CRF; neuropeptides.*

UDC: 616.89-008.44:615.213:591.5

PRELIMINARY STUDY ON THE POTENTIAL OF A HIGH DOSE OF VALPROIC ACID TO MODULATE AGGRESSIVE AND ANXIETY-LIKE BEHAVIOUR IN A ZEBRAFISH MODEL

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The study aims to described and evaluate the effects of 700 μM valproic acid (VPA) treatment for 7 days on aggressive and anxiety-like behaviour in a zebrafish model of autism.

Following the accommodation, adult zebrafish (Danio rerio, 5-6 months, sex ratio 1:1) were randomly assigned to 2 groups. One group was continuously exposure for 7 days to 700 μM VPA treatment (extemporaneously prepared in 5 L of water, with daily refreshment), while the control group remained untreated.The mirror-induced aggression (MIA) test was used to assess aggression-like behaviour induced by a mirror simulating a conspecific. A T-maze consisting of three arms (left, right, and central) was used, with a mirror placed at the end of the left arm. The specific parameters were time spent in the apparatus zones (s) and anxiety index (#). Fish activity was observed for 4 minutes (video-recorded) and processed with EthoVision XT 16 (Wageningen, Netherlands).

The 7-day VPA treatment led to increased aggressive and anxiety-like behaviours during MIA tests (e.g. time spent in the apparatus zones and anxiety index).

The 700 μM VPA treatment for 7 consecutive days with continuous exposure could lead to the sustained manifestation of aggressivity and anxiety-like behaviour in an adult zebrafish model.

Keywords: *valproic acid, zebrafish, autism, aggressive behaviour, anxiety.*

UDC: 616.379-008.64:612.017.2

CLINICAL INSIGHTS FROM THE BIOLOGICAL RESERVE DIAGRAM: A CASE REPORT

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Biological reserve represents the intrinsic capacity of the human organism to maintain homeostasis and adapt to physiological stressors, aging, and chronic disease. Traditional functional assessment scales, such as Karnofsky or ECOG, provide limited insight into the multidimensional interactions between organ systems and may overlook subclinical vulnerabilities. The "Biological Reserve Diagram" was developed as an integrative visualization tool designed to quantify structural and functional reserves across multiple physiological domains.

Objective: This study aimed to illustrate the clinical utility of the "Biological Reserve Diagram" in the multidimensional assessment of a patient with severe diabetes mellitus, with emphasis on identifying latent physiological vulnerabilities despite preserved overall functionality.

Methods: A retrospective case report analysis was conducted using existing clinical records, laboratory findings, imaging data, and metabolic indicators. Twelve physiological and psychosocial domains were evaluated using the "Biological Reserve Diagram," with scores ranging from 0 to 10, where 10 indicated optimal reserve. The evaluated domains included nervous, cardiac, metabolic, renal, immunological, vascular, locomotor, and hematological parameters. The resulting data were represented on a radar chart and stratified into prognostic reserve zones.

Results: The patient demonstrated an overall high biological reserve, with preserved neuro-cardiac integrity reflected by maximum scores for the Nervous System (10.0) and high values for the Cardiac System (9.86). Additional domains, including locomotor abilities, immunological activity, and kidney function, remained within the optimal reserve range. However, the diagram identified visible reductions in Specific Markers (7.43) and Blood Constants (7.86), indicating latent inflammatory and metabolic disturbances associated with diabetes. Although no parameter entered the critical "Red Zone," these findings suggested an erosion of compensatory

physiological buffering and the presence of compensated dysfunction.

Conclusions: The “Biological Reserve Diagram” provides a multidimensional and integrative assessment of physiological resilience, allowing early identification of subclinical vulnerabilities that may remain undetected through conventional clinical scales. This approach highlights the dissociation between apparent functional wellbeing and underlying reserve depletion, supporting personalized preventive interventions aimed at preserving biological resilience and delaying progression toward frailty and organ dysfunction.

Keywords: *biological reserve; diabetes mellitus; personalized medicine; frailty; physiological resilience; multidimensional assessment; radar chart*

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FOOD FRAUD AND NATIONAL SECURITY. BIOSECURITY AS THE COUNTRY'S STRATEGIC SHIELD

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Modern biotechnologies are no longer merely instruments of innovation; they are becoming the central pillar of control and traceability systems. The integration of molecular biology techniques enables proactive monitoring capable of detecting fraud and contaminants at the level of genetic and chemical fingerprints. This paper explores how biotechnological innovation redefines biosafety standards by providing concrete solutions for combating non-compliance and strengthening the resilience of regional food systems. The paper analyzes the intersection between biotechnological innovations and biosafety protocols, assessing how they contribute to improving quality standards in public catering establishments.

Materials and methods: The study is descriptive-analytical in nature and is based on 80 relevant scientific articles in the fields of biosafety, biosecurity, and biotechnology.

Results: A review of the scientific literature was conducted regarding the use of biosensors for the rapid detection of pathogens and the role of starter cultures in the biological preservation of food products. Current regulations concerning traceability and risk management systems (HACCP) were also analyzed. A comparative analysis was performed on the efficiency of molecular technologies: Next-Generation Sequencing (NGS) for species metabarcoding, Real-Time PCR for the detection of GMOs and allergens, Liquid Chromatography–Mass Spectrometry (LC-MS/MS) for the identification of prohibited chemical residues, and electrochemical biosensors for the rapid screening of mycotoxins upon product reception. The implementation of biotechnological techniques, such as rapid PCR testing and enzymatic biosensors, reduces the identification time of biological contaminants from 48–72 hours to just a few minutes. Furthermore, the use of bacteriocins produced through biotechnology provides a safe alternative to chemical preservatives, improving the toxicological profile of culinary products. Performance indicators demonstrate that NGS technology detects species adulteration with an accuracy of 0.1%, while LC-MS/MS identifies prohibited substances at parts-per-billion (ppb) levels.

Conclusions: The integration of biotechnology into public food services not only enhances production efficiency but also establishes a proactive biosafety system. Legislative frameworks must be updated to harmonize scientific advances with public consumption standards. The use of biosensors has reduced response times to only 5–15 minutes, providing a critical first-line biosafety filter. The data indicate a direct correlation between the adoption of these technologies and the reduction of the risk of non-compliant products entering the regional market.

Keywords: *biosafety, food biotechnology, biosensors, consumer safety.*

UDC: 618.145-007.44:577.175.6

THE INFLUENCE OF EPIGENETICS ON PROGESTERONE RESISTANCE IN ENDOMETRIOSIS

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Endometriosis is a benign condition in which endometrium-like tissue appears outside the uterus, affecting approximately 10% of women of childbearing age. Progesterone plays a fundamental role in the endometrium, and decreased PR-B expression contributes to progesterone resistance, persistent abnormal proliferation, increased inflammation, and the maintenance of ectopic lesions.

The aim is to analyze the epigenetic mechanisms and environmental factors involved in the onset and progression of endometriosis, with a focus on how these changes influence progesterone resistance in endometriosis.

A literature review (PubMed, Web of Science) was conducted, examining five studies published in the last five years that addressed the epigenetic mechanisms involved in endometriosis and progesterone resistance. Changes in DNA methylation, microRNA dysregulation, and the expression of progesterone receptors (PR-A and PR-B) were evaluated, as well as the influence of environmental factors and chronic inflammation on disease progression and therapeutic response.

Analysis of the data reveals that progesterone resistance is mediated by epigenetic dysregulations, particularly hypermethylation of the progesterone receptor B (PR-B) gene promoter, which correlates significantly with a loss of its expression ($r = -0.558$; $p = 0.047$) and represents the dominant risk factor (OR = 10.40). Somatic mutations, particularly activating mutations in the KRAS gene, constitute the most common genetic variant in endometriotic epithelial lesions, conferring advantages for cell survival. Other implicated mechanisms include dysregulation of certain microRNAs (miR-199a-3p, miR-1-3p, miR-146a-5p, miR-125b-5p) and polymorphisms in the PR gene (PROGINS, +331 G/A), all of which contribute to the hormonal resistance phenotype. Furthermore, environmental factors—including endocrine disruptors, industrial toxins, oxidative stress, and a pro-inflammatory diet—contribute to epigenetic remodeling and the maintenance of an estrogen-dependent and pro-inflammatory microenvironment.

Conclusion: PR-B hypermethylation and microRNA dysregulation are the main epigenetic mechanisms underlying progesterone resistance in endometriosis, amplified by environmental factors (endocrine disruptors, oxidative stress, pro-inflammatory diet). These findings pave the way for diagnostic biomarkers and personalized therapies targeting the reversibility of epigenetic changes.

***Keywords**: Endometriosis; Epigenetics; Progesterone resistance; PR-B; microRNA; DNA methylation.*

UDC: 616.155.32-053.31:577.21

DEVELOPMENT AND OPTIMIZATION OF TREC/KREC REAL-TIME PCR ASSAYS FOR NEWBORN SCREENING OF PRIMARY IMMUNODEFICIENCIES

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Primary immunodeficiencies (PID), especially severe combined immunodeficiency (SCID), are rare genetic disorders associated with severe infections and high infant mortality if undiagnosed early. TREC/KREC-based neonatal screening enables early detection of T- and B-cell maturation defects. Real-time PCR using TaqMan technology offers high sensitivity, specificity, and rapid turnaround time, making it suitable for neonatal screening programs.

Materials and methods: A literature review of international studies and laboratory protocols related to TREC/KREC quantification using real-time PCR TaqMan assays was performed. Particular attention was focused on methodological aspects including DNA extraction, assay sensitivity, amplification conditions, fluorescence detection systems, and standardization of quantitative analysis.

Results: Published studies demonstrate that TREC/KREC quantification provides reliable assessment of newly formed T and B lymphocytes and enables early detection of severe immunodeficiencies before clinical manifestation. Real-time PCR TaqMan assays show high analytical sensitivity and reproducibility in neonatal dried blood spot (DBS) samples. Optimization of amplification parameters and threshold values improves assay accuracy and reduces false-positive results.

Conclusion: Development of TREC/KREC real-time PCR assays is important for neonatal screening of primary immunodeficiencies in the Republic of Moldova. Early molecular detection may improve diagnostic timing, clinical outcomes, and integration of patients into national rare disease monitoring programs.

Keywords: *TREC; KREC; real-time PCR; TaqMan assay*; *neonatal screening.*

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ENGINEERING PERFUSED BONE-ON-A-CHIP SYSTEMS FOR *IN VITRO* BONE MODELING

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Despite their critical role in bone regeneration, the homing mechanisms of bone marrow mesenchymal stem cells (BMMSCs) remain insufficiently characterized. Current experimental models often fail to reproduce key aspects of the native bone microenvironment, including *(i)*cellular heterogeneity, *(ii)*physiological oxygen gradients, and *(iii)*3D perfused architectures. To address these limitations, this study focuses on the design and development of a perfused bone-on-a-chip system for investigating MSC mobilization under physiologically relevant and hypoxic bone niche conditions.

A microfluidic device will be employed to generate a perfused 3D bone-on-a-chip model. The central channel will contain a collagen type I matrix populated with BMMSCs, osteoblasts, endothelial cells, and osteoclasts to recreate the bone micro-niche. The upper channel will function as an MSC reservoir, whereas the lower channel will be used for the delivery of candidate molecules, to assess their impact on MSC migration. Perfusion will be maintained using a rocker system, and hypoxic conditions will be induced using a CellXpert CI 170i incubator.

Immunophenotypic characterization was performed by assessing the expression of specific markers (CD73, CD90, and CD105) and the absence of the hematopoietic marker CD45 to confirm MSC identity. BMMSCs at passage 1 were analyzed using a CytoFLEX flow cytometer, acquiring at least 30,000 events per sample.

The resulting microfluidic platforms will support the development of *(i)* advanced *in vitro* models for probing BMMSC homing mechanisms and *(ii)* functional systems for evaluating modulators of BMMSC mobilization. This study seeks to expand understanding of the molecular basis of hypoxic priming while addressing key barriers to clinical translation, including the absence of standardized methodologies, donor heterogeneity, and variability arising from tissue source.

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Keywords: *microfluidic devices, BMMSCs homing, bone regeneration.*

UDC: 616.379-008.64:615.874

METABOLIC IMPROVEMENT UNDER PERSONALIZED NUTRITIONAL AND PHYTOTHERAPEUTIC INTERVENTION IN A PATIENT WITH INSULIN RESISTANCE AND DYSLIPIDEMIA – A CASE STUDY

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A growing number of middle-aged people present with overlapping metabolic disturbances including insulin resistance, dyslipidemia, chronic low-grade inflammation, and increased cardiovascular risk. Personalized nutritional intervention combined with phytotherapeutic support may represent an effective non-pharmacological strategy for improving metabolic parameters and reducing disease progression risk. The present case study evaluates the metabolic evolution of a 58-year-old female monitored under a personalized anti-inflammatory nutritional and phytotherapeutic protocol for approximately eight months. Baseline evaluation revealed insulin resistance, elevated total cholesterol and LDL-cholesterol, hyperinsulinemia, and elevated triglycerides. The intervention focused on reducing systemic inflammation, improving insulin sensitivity, optimizing lipid metabolism, and supporting mitochondrial and antioxidant function. The nutritional strategy included a Mediterranean-style anti-inflammatory diet rich in vegetables, cruciferous plants, omega-3 fatty acids, olive oil, fibers, and low-glycemic foods, with restriction of refined carbohydrates and ultra-processed products. The phytotherapeutic and nutraceutical support included omega-3 acids, curcumin, EGCG (green tea extract), magnesium bisglycinate, vitamin D3, antioxidant compounds supporting endogenous glutathione production, and insulin-sensitizing formulations. Comparative biological assessment demonstrated significant metabolic improvement. HOMA-IR decreased progressively from 3.22 to 2.86 and further to 2.16, indicating improved insulin sensitivity. Fasting insulin decreased from 13.3 mUI/L to 9.2 mUI/L, while fasting glucose remained physiologically stable (98 mg/dL to 95 mg/dL). Total cholesterol decreased from 278 mg/dL to 237 mg/dL, and LDL-cholesterol from 179 mg/dL to 142 mg/dL. Triglycerides showed a marked reduction from 151 mg/dL to 95 mg/dL. HDL-cholesterol remained within a cardioprotective range (72–79 mg/dL). The HOMA-B index reached 104%, suggesting preserved pancreatic beta-cell functionality despite previous metabolic stress. Inflammatory status remained controlled, supporting the anti-inflammatory efficiency of the intervention. The observed results suggest that personalized nutritional and phytotherapeutic strategies may significantly improve insulin resistance and lipid metabolism while reducing cardiometabolic risk factors. This case supports the importance of integrative metabolic monitoring and individualized nutrition-based interventions in patients with early metabolic dysfunction and cardiovascular risk profiles.

Acknowledgments: The author declares that there are no conflicts of interest regarding the publication of this case study. No external funding was received for this work.

Keywords: *insulin resistance, metabolic syndrome, personalized nutrition, phytotherapy, dyslipidemia.*

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GENE THERAPY AND TP53-BASED TARGETED THERAPIES IN ONCOLOGY

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Gene therapy and targeted therapies represent modern and promising directions in cancer treatment, aiming to correct molecular alterations involved in carcinogenesis. The TP53 gene, known as the "guardian of the genome," is one of the most important tumor suppressor genes, playing an essential role in the regulation of the cell cycle, DNA repair, apoptosis induction, autophagy, cellular metabolism, and immune response. TP53 mutations are among the most frequent genetic alterations found in human cancers and are associated with tumor progression, metastasis, treatment resistance, and poor prognosis. Most TP53 mutations are point mutations that lead to the formation of mutant p53 proteins characterized by loss of tumor suppressor function, dominant-negative effects on p53 tetramerization, and the acquisition of new oncogenic properties, known as gain-of-function (GOF) mutations. These mutations not only impair the normal function of p53 but also contribute to tumor development and progression. Recent studies have demonstrated that restoration of wild type p53 function can reduce cancer cell proliferation more effectively than strategies aimed solely at inhibiting mutant proteins. The aim of the present study was to analyze the role of the TP53 gene in oncology and to highlight the main therapeutic strategies based on the restoration of p53 function. The methodology consisted of a narrative review of scientific literature, using articles and studies published in international databases such as PubMed, Scopus, and Web of Science. Research findings have shown that TP53-based therapies include the transfer of a functional copy of the gene into tumor cells, the use of small molecules capable of reactivating mutant p53 proteins, inhibition of negative regulators such as MDM2, and other molecular approaches aimed at restoring wild-type p53 activity. These therapeutic strategies can inhibit tumor proliferation, induce apoptosis, and increase the sensitivity of cancer cells to chemotherapy and radiotherapy. Moreover, TP53 status has important predictive and prognostic value in multiple types of cancer, including lung, breast, ovarian, and colorectal cancer. In conclusion, gene therapy and TP53-based targeted therapeutic strategies represent essential directions in precision oncology, contributing to the development of personalized treatments and improved outcomes for cancer patients.

Keywords: *TP53, gene therapy, cancer, MDM2, gain-of-function.*

UDC: 618.19-006.6-056.7(479.24)

ASSOCIATION OF TP53 c.215G>C POLYMORPHISM WITH BREAST CANCER RISK IN AZERBAIJANI WOMEN

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Breast cancer is the most common malignancy and a leading cause of cancer-related mortality among women worldwide. Genetic factors, particularly polymorphisms in tumor suppressor genes, contribute to individual susceptibility. The TP53 gene (c.215G>C, rs1042522) plays a key role in maintaining genomic stability and mediating cellular stress responses. This study aimed to evaluate the association between the TP53 c.215G>C polymorphism and breast cancer risk in an Azerbaijani population.

Methods: The study included 148 women with histopathologically confirmed primary breast cancer diagnosed at the Oncology Clinic of Azerbaijan Medical University from 2021 to 2024. The control group comprised 162 age-matched healthy women without personal or family history of cancer. Peripheral blood samples were collected from all participants. Genomic DNA was extracted, and the TP53 c.215G>C polymorphism was genotyped by PCR-RFLP. Genotype and allele frequencies were determined, and statistical analyses assessed associations between TP53 genotypes, allele distribution, and breast cancer risk.

Results: The GG genotype was observed in 16.2% of patients and 23.5% of controls, whereas the GC genotype was found in 45.9% and 48.1%, respectively. The CC genotype was significantly more frequent in patients (37.8%) than in controls (28.4%) and was associated with increased breast cancer risk (OR = 1.92, 95% CI: 1.01–3.66, p = 0.045). The C allele was significantly more common in patients (60.8%) than in controls (52.5%) and was associated with increased susceptibility (OR = 1.40, 95% CI: 1.02–1.93, p = 0.036). A trend consistent with a dominant effect of the C allele was observed, with increased risk among carriers of at least one C allele. The genotype distribution in controls was consistent with Hardy–Weinberg equilibrium.

Conclusions: The TP53 c.215G>C polymorphism, particularly the CC genotype and the C allele, is associated with an increased risk of breast cancer among the Azerbaijani population. Larger, independent studies are needed to validate these findings

Acknowledgments: This study was conducted using internal institutional resources. No external funding was received.

Keywords: *Breast Cancer, TP53, Arg72Pro,Polymorphism, Genetic Susceptibility*.

UDC: 616.831-085:57.084

COGNITIVE AND AFFECTIVE EFFECTS OF ABUTILON EXTRACTS IN 5XFAD MICE

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Alzheimer's disease (AD) involves not only memory deficits but also early disturbances in affective regulation, exploratory behavior, and cognitive flexibility. Transgenic 5xFAD mice provide a platform to investigate how these multidimensional impairments manifest as measurable behavioral phenotypes.

This study examined the cognitive and affective effects of two Abutilon-derived extracts, A2 (Abutilon pannosum) and A1 (Abutilon grandifolium), in 5xFAD mice (n = 40). Animals were assigned to treatment groups receiving each extract at 50 or 100 mg/kg (n = 10 per group) or control conditions (NaCl, n = 5; galantamine, n = 5). Treatments were administered orally for seven consecutive days and one hour before behavioral assessment.

A comprehensive battery evaluated complementary functional domains: Y-Maze for spatial updating and spontaneous alternation, Novel Object Recognition for recognition memory, Radial Arm Maze for working and reference memory, Open Field and Elevated Plus Maze for exploratory and anxiety-like behavior, and Forced Swimming Test for depression-like responses. In parallel, in silico pharmacokinetic and target-prediction analyses supported interpretation of CNS availability and potential target engagement.

Behavioral outcomes revealed extract- and dose-specific cognitive and affective profiles. A2 preferentially enhanced spatial working memory and recognition indices at lower doses, whereas A1 modulated exploratory activity and anxiety-related behaviors more strongly at higher doses. Dose-response patterns were non-linear, demonstrating that distinct extracts influence specific behavioral domains independently. In silico predictions aligned with observed effects, indicating differential CNS accessibility and target interactions.

These results emphasize the utility of multidimensional behavioral phenotyping in capturing discrete cognitive and affective alterations in AD models. Integrating in silico predictions with comprehensive behavioral assessment allows for a refined understanding of how plant-derived compounds modulate neural circuits, highlighting extract-specific behavioral signatures in 5xFAD mice.

Keywords: *Behavioral phenotyping, 5xFAD mouse model, memory, phytochemical modulation, in silico prediction.*

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MITOCHONDRIAL DNA COPY NUMBER AND GENOMIC PROFILING IN SUSPECTED MITOCHONDRIAL PHENOTYPES

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Mitochondrial diseases are genetically and clinically heterogeneous disorders that remain challenging to diagnose due to their overlapping manifestations and diverse molecular causes. Beyond pathogenic sequence variants, alterations in mitochondrial DNA (mtDNA) copy number may reflect impaired mitochondrial biogenesis and compensatory cellular responses. Therefore, integrated quantitative and genomic approaches may provide a more comprehensive understanding of suspected mitochondrial phenotypes.

Purpose: This study aimed to investigate quantitative mtDNA copy number dynamics and establish a comprehensive genomic profile in individuals presenting with suspected mitochondrial phenotypes.

Materials and Methods: A cohort of 240 patients was pre-selected using the Nijmegen Mitochondrial Disease Criteria. The molecular pipeline integrated qPCR-HRM for rapid screening of common point mutations, real-time qPCR for relative mtDNA copy number (mtDNA/nDNA ratio), and targeted mtDNA Sanger sequencing for a high-suspicion subgroup. Next-Generation Sequencing (NGS) was applied to a strategic subgroup to identify nuclear-mitochondrial interactions.

Results: Based on genetic testing, the cohort was stratified into patients with mitochondrial involvement (n = 39; identified via qPCR-HRM, targeted Sanger, and NGS), alternative genetic conditions representing diagnostic mimics (n = 47; resolved via NGS), and undiagnosed cases (n = 154). Concurrently, quantitative analysis across the entire cohort revealed significant deviations from baseline replication states: severe mtDNA depletion was identified in 33 patients (13.8%), a mild increase in 35 individuals (14.6%), and marked overcompensation in 18 patients (7.5%). Notably, these quantitative alterations were not randomly distributed but were strongly and statistically associated with the group presenting mitochondrial involvement ($\chi^2 = 29.26$, $p < 0.001$).

Conclusions: Quantifying mtDNA copy number provides key insights into depletion and graded metabolic compensatory mechanisms independent of primary mtDNA mutations. Integrating quantitative assays with NGS is essential to accurately differentiate primary mitochondrial defects from nuclear genetic mimics.

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Keywords: *mitochondrial DNA, qPCR-HRM, targeted sequencing, mtDNA copy number.*

UDC: 615.322:616.1

CARDIOPROTECTIVE POTENTIAL OF SUNFLOWER-DERIVED BIOACTIVES: AN EMERGING NUTRACEUTICAL PERSPECTIVE

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The present study aimed to assess the biomedical potential, respectively, the cardioprotective capacity of bioactive compounds isolated from sunflower by-products. Extracts of bioactive compounds, e.g. phenolic acids and flavonoids were obtained from sunflower petals by green method, respectively, ultrasound-assisted extraction (UAE). Further, the obtained extracts were chemically characterized by high-performance liquid chromatography (HPLC) technique and their composition was established.

The biological properties were evaluated in terms of free ABTS radical scavenging capacity and antihypertensive potential via the ability to inhibit the activity of angiotensin-converting enzyme (ACE). Furthermore, the extracts were assessed *in vitro* using two cell lines, NCTC clone L929 fibroblasts and mouse bEnd.3 endothelial cells, to determine cytocompatibility, while intracellular reactive oxygen species (ROS) production was quantified by flow cytometry.

The results demonstrated significant antioxidant and ACE inhibitory activities, together with good cytocompatibility on both cell lines. Moreover, the extracts reduced intracellular ROS production, suggesting a potential protective effect against oxidative stress.

Overall, these findings support the valorization of sunflower by-products as promising sources of bioactive compounds with potential cardioprotective applications.

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Keywords: *sunflower bioactive compounds, biomedical potential, antioxidant properties, nutraceuticals.*

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METHODOLOGICAL CHALLENGES IN RESEARCHING COGNITIVE FUNCTIONS IN LONG-LIVERS

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The aim of this work is to identify and analyze the main methodological problems in studying cognitive functions in long-livers and ways to overcome them based on literature data and our own experience.

Some of the most fundamental problems are the difficulty of conducting randomized controlled trials due to the small size of the study group (rarity of the phenomenon) and its high heterogeneity in terms of the preservation of cognitive functions, which makes it difficult to obtain representative data; the difficulty of longitudinal studies associated with the high mortality of the study participants (above 30% per year); the predominance of cross-sectional studies; the presence of "selection bias" (studies often include only those able to complete the survey); the prevalence of sensory deficits and motor slowing, which may reduce the indicators for reasons unrelated to cognitive functions. Critically important for the interpretation of the results is the problem of the "survivor effect" (long-term survivors, being an exception, disproportionately more often have preserved cognitive abilities, while those who died at the age of 70-85 from cognitive impairment are not taken into account). Regarding measurement methods, many standard neuropsychological tests are not adapted for long-livers, as they may be too complex or insufficiently sensitive to their specific cognitive profile, while the brevity of the tests due to the physical frailty of the subjects limits the depth of cognitive assessment. Some tests (for example, the MMSE) may indicate a high prevalence of dementia, which in some cases contradicts clinical diagnostic observations. It is also known that brain analysis of many cognitively healthy long-livers reveals significant amounts of amyloid and tau protein (a manifestation of resilience). This is characteristic primarily of people with a high level of education and active mental activity, who accumulate "spare" neural networks (a powerful cognitive reserve) throughout life.

Based on the conducted analysis, we believe the following are important for overcoming methodological barriers: a multidimensional approach (including nonverbal tests and consideration of functional status); the use of adaptive digital cognitive test batteries that automatically adjust task difficulty and bypass sensory and motor interference; confirmation of the effectiveness of available biomarkers; consideration of the "survivor effect"; the use of adjustments for educational level; the development of international collaboration to pool data from different countries.

Keywords: *long-livers, cognitive functions, methodological problems.*

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COLD PLASMA INDUCES DISTINCT GENE PROFILES IN OSTEOBLASTS & OSTEOSARCOMA

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Osteosarcoma is the most common primary malignant bone tumor in children and adolescents. Despite advances in multimodal treatment, clinical outcome remains limited, especially when associated with metastatic spread, relapse, or chemoresistant phenotypes, highlighting the need for alternative therapeutic strategies. Cold atmospheric plasma (CAP), a partially ionized gas generated at near-room temperature, has emerged as a promising approach in cancer treatment due to its reported capacity to selectively impair tumor cell viability. However, the molecular mechanisms underlying this selective effect remain incompletely understood. In this study, we investigated the changes induced by indirect CAP treatment in the expression of key anti-apoptotic genes in osteosarcoma cells compared with normal osteoblasts.

Cells were seeded in 96-well plates 24 hours prior to treatment. Plasma-activated medium (PAM) was prepared by exposing RPMI 1640 medium to CAP discharge for 30, 60, and 90 seconds. The biological effect of PAM treatment was assessed using the MTT assay. Total RNA was extracted at 2 and 24 hours after treatment, and the relative expression levels of the anti-apoptotic genes BCL2, CFLAR, and XIAP were quantified by RT-qPCR.

PAM treatment reduced osteosarcoma cell viability in a dose-dependent manner, reaching approximately 15% viability. In contrast, osteoblast viability remained above 85% under the same experimental conditions. Gene expression analysis revealed a differential anti-apoptotic response between the two cell types. In normal osteoblasts, BCL2, CFLAR, and XIAP showed increased expression after treatment, whereas in osteosarcoma cells these genes were either downregulated or maintained at levels comparable to untreated controls.

These findings suggest that the absence of a coordinated anti-apoptotic response in osteosarcoma cells may contribute to the selective cytotoxicity induced by indirect CAP treatment. The differential regulation of anti-apoptotic genes could therefore represent one of the molecular mechanisms involved in the tumor-selective effects of plasma-activated media.

***Keywords**: cold plasma, gene expression, osteoblasts, osteosarcoma.*

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GENETIC DETERMINANTS OF LONGEVITY AND AGE-RELATED DISEASES

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Biological aging is characterized by progressive loss of physiological integrity, genomic instability, epigenetic remodeling, mitochondrial dysfunction, cellular senescence, and chronic low-grade inflammation. These mechanisms contribute to increased susceptibility to cardiovascular, neurodegenerative, metabolic, and oncological diseases, which represent major causes of morbidity and mortality in older adults.

A structured narrative review was conducted using PubMed, ScienceDirect, and Oxford Academic. Original studies, systematic reviews, meta-analyses, and relevant guidelines published between 2021 and 2026 were considered. Search terms included "lifespan genetic determinants," "age-related disease," "longevity-associated variants," "DNA repair fidelity," and "FOXO transcription factors." A total of 27 peer-reviewed articles were selected according to relevance to genetic determinants of longevity and age-related diseases.

Recent genomic and multi-omic studies suggest partial overlap between genetic determinants of exceptional longevity and reduced susceptibility to age-related diseases. Multivariate GWAS analyses identified a shared genetic component for age-related diseases, termed mvARD, including 263 independent variants across 180 loci. Studies in long-lived individuals reported a lower burden of polygenic risk for major age-related diseases, including Alzheimer's disease, coronary artery disease, and type 2 diabetes; a combined meta-PRS reached an AUC of 0.64, with $p = 6.45 \times 10^{-15}$. Whole-genome sequencing studies in semi-supercentenarians identified coding variants enriched in pathways related to extracellular matrix remodeling and insulin signaling. Comparative mammalian genomics further showed that annual somatic mutation rates scale inversely with lifespan. Additional candidate-gene and Mendelian randomization studies suggest possible roles for KEAP1, SIRT1, α-Klotho, GFM1, and RICTOR in survival, metabolic resilience, and age-related disease risk, although these findings require further validation.

Current evidence supports the existence of a complex genetic architecture linking longevity with resistance to age-related diseases. Pathways involving FOXO signaling, insulin/IGF-1 regulation, mitochondrial function, oxidative stress response, and mTOR-related mechanisms appear particularly relevant. However, most identified variants have modest effects and are not yet sufficient for routine clinical prediction. Future research should focus on validated polygenic models, multi-ancestry cohorts, and translational strategies aimed at healthy aging and compression of morbidity.

Keywords: *longevity genetics; age-related diseases; FOXO3; polygenic risk score; geroprotection; compression of morbidity.*

UDC: 615.322:616.34-008.87

THE EFFECTS OF STIMULATION OF PHYSIOLOGICALLY ACTIVE SOMATO-VEGETATIVE AREAS OF THE LARGE INTESTINAL UNDER THE INFLUENCE OF SOME LOCAL MEDICINAL PLANTS

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Using Electroacupuncture according to Voll (EAV) to study the human body's compatibility with herbal preparations involves measuring bioelectrical impedance at specific acupuncture points. The procedure for testing the impact of organic substances on the body is related to the measurement of physiologically active somato-vegetative areas, which was carried out using the universal activator "Activationmeter Ats-6k". Since the aim of the study was to test the impact of herbal preparations on large intestine function, 9 physiologically active somato-vegetative areas were selected. These areas were stimulated initially (control) and under the influence of 5 native medicinal plants, which were previously selected for their prebiotic capacity: *Chelidonium majus* in 2 forms of preparation – infusion and decoction; *Viscum album* – infusion and cold maceration; *Artemisia absinthium* – infusion; *Xanthium spinosum* - infusion, *Acorus calamus* - decoction. EAV, % was calculated based on the maximal and minimal indices obtained after experimental stimulation of physiologically active somato-vegetative areas, compared to the control, which indicates the impact of these plants on the large intestine at a functional level. *Chelidonium majus* infusion showed an inhibitory effect on 7 out of 9 physiologically active somato-vegetative areas in all tested individuals, and in decoction form, a stimulating effect on all areas was established in 20,00% of the study participants. Regarding the *Artemisia absinthium* infusion, the same trend was recorded, while the *Viscum album* infusion demonstrated a substantial stimulating effect, compared to the cold-macerated preparation form and comparable to the *Xanthium spinosum* infusion and the *Acorus calamus* decoction. Since the stimulating effect is not always beneficial, the deviation from the optimal value (25th division on the scale) of the experimental indices was calculated, compared to the control, and a negative impact of the plant on the large intestine was considered in the case of a substantial deviation, which allows them to be excluded from further investigations. The effect at the organic level was achieved by comparing EAV changes before and after the application of the medicinal plant preparations included in the study. A beneficial impact is recorded when the respective plant inhibits EAV, which will possibly minimize negative changes at the organic level.

Thus, the results obtained will allow the evaluation of individual compatibility with the aforementioned medicinal plants, which can be used to develop phytopreparations intended to maintain the balance of the intestinal microbiota and strengthen the health of the large intestine.

Keywords: *physiologically active somato-vegetative areas, large intestine, indigenous medicinal plants, electroacupuncture according to Voll.*

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PAST, PRESENT, AND FUTURE IN THE GLUCOSE METABOLISM

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The last century discoveries were fundamental for understanding the cell metabolism as well as the fine structure of the organelles. Mitochondria, that need no description, were established by Krebs, Palade and others as a pivotal cell compartment in glucose metabolism. Moreover, the role of mitochondria in glucose homeostasis was related to type 1 and type 2 diabetes. Nowadays, these findings are well established as link pathways to Parkinson's and Alzheimer's diseases according to WHO.

Literature meta-analysis and bioinformatic studies were applied to glucose metabolism enzymes and pathways. Experiments with rat liver isolated mitochondria were performed to establish the interaction between mitochondrial enzymes and glucose. UniProt, KEGG and FoldSeek were used to establish the evolution of mammalian key enzymes involved in glucose metabolism. These data were compared with other organisms (yeasts, plants and bacteria) to emphasize new features of the mitochondrial role in glucose metabolism.

From bacteria to mammals, glucose metabolism was subjected to continuous adaptations and two enzymes, malate dehydrogenase and isocitrate lyase, were theoretically lost. However, recent findings reveal that these enzymes, specific for plants and bacteria, were found in mammalian tissues under particular conditions such as type 1 diabetes. Moreover, hyperglycemia was linked to protein aggregation in the nervous system as a feature of glycative stress.

The mammalian glyoxylic cycle and glycative stress action on the nervous system could represent a new interpretation key in diabetes and associated lesions and emphasize the metabolic plasticity of the cell when glucose cannot be used even if the pericellular concentration is elevated.

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Keywords: *glucose, Krebs, mitochondria, hypoxia, stress.*

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PLP1 MUTATIONS AND GENETIC CONTROL OF MYELINATION IN PELIZAEUS-MERZBACHER DISEASE

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The aim of this paper is to understand the underlying genetic mechanisms that affect oligodendrocytes and myelin formation, such as mutations of the PLP1 gene, which manifest in Pelizaeus–Merzbacher disease (PMD), and what treatment options are currently available.

Methods: Using keywords such as PLP1 mutation, Pelizaeus–Merzbacher disease, oligodendrocyte dysfunction, hypomyelination and PLP1 duplication on online databases PubMed, Scopus and Google Scholar, we searched and analyzed 8 articles published in the last 5 years.

Results: Depending on the mutation type, several variants of PLP1 protein expression and accumulation are present. In 60–70% of patients a gene overexpression is observed, which results in excessive accumulation of structurally normal protein, however the quantity of it proves to be toxic for oligodendrocytes. In 15–20% of patients missense mutations are present, which result in the production of defective proteins that become blocked and accumulate in the endoplasmic reticulum, following which cellular stress responses are initiated that can lead to oligodendrocyte death. In 5–10% of patients deletions or null variants of the gene are present, the consequence being deficient or even absent expression of PLP1 protein. Studies on patient-derived cells and laboratory animals have shown that oligodendrocyte death, altered protein transport and incorrect assembly of the myelin sheath are central events in this disease. Gene suppression methods, including antisense oligonucleotides, artificial microRNA and AAV-based delivery, have shown promising results in reducing toxic PLP1 overexpression and improving myelination in preclinical models.

Conclusion: PMD is a disease that can involve overexpression, missense mutations, deletions or null variants of the PLP1 gene, which are associated with cellular stress responses that ultimately lead to disruption of myelin sheath formation in the central nervous system with resulting hypomyelination. Understanding the specific mechanisms of each mutation type is essential for developing future therapies, particularly gene-based treatments.

Keywords: *PLP1 mutation, Pelizaeus–Merzbacher disease, oligodendrocyte dysfunction, hypomyelination, PLP1 duplication.*

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SYSTEMIC CONSEQUENCES ASSOCIATED WITH MACRONUTRIENT DEFICIENCY

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Restricting the body's intake of proteins, lipids, and carbohydrates causes disorders in the blood system, as well as a general destabilization of the blood and of the hemostatic process. A macronutrient deficiency lasting two weeks modifies blood test results. The body enters a survival mode and begins to consume its own resources. Since these substances are highly essential for the body, they require in depth study. The body uses them in large quantities, and their restriction has a direct impact on health.

The assessment of macronutrients, namely proteins, lipids, and carbohydrates, and of nutritional status through blood tests is essential for the early diagnosis of malnutrition, the prevention of metabolic diseases, and the management of restrictive diets. This topic is highly relevant due to the increasing risk of cardiovascular disease, diabetes mellitus, and other disorders, as well as due to the popularity of modern diets. In the context of modern nutrition, blood tests are the main tool on which nutritionists and dietitians base their recommendations, ensuring adequate energy intake for each patient. Macronutrient deficiency directly reflects the nutritional and functional status of the body. Detecting these imbalances through blood tests is essential for preventing chronic diseases and optimizing health.

The quality of nutritional intake influences the growth and development of the body, as well as its nutritional status and overall state of health. Therefore, nutrition must be appropriate to the needs of each individual organism. Macronutrients, namely proteins, lipids, and carbohydrates, are the pillars of nutrition, each having vital and irreplaceable roles in the proper functioning of the human body. Proteins are essential for cellular structure and repair. They do not store energy in the long term, but they are involved in almost all biological processes. They repair muscles, skin, hair, nails, and internal organs. They form enzymes that accelerate chemical reactions in the body. They also form key hormones, such as insulin, which regulates blood glucose levels. Proteins constitute antibodies that protect the body against infections and viruses. They also have a transport role, including the transport of respiratory gases. Carbohydrates are the body's preferred fuel and the fastest source of energy, especially for the brain. They provide immediate energy, being rapidly converted into glucose to support physical and mental effort. As an energy reserve, excess glucose is stored as glycogen in the liver and muscles. The central nervous system depends almost exclusively on glucose in order to function. Complex carbohydrates, such as dietary fiber, maintain intestinal transit and nourish the microbiota. Lipids are the macronutrients with the highest caloric density and are indispensable for survival. They represent a major energy reserve and provide thermal and mechanical

protection. They insulate the body against cold and protect internal organs from shocks. Inadequate nutrition has serious repercussions on health, both in the short term, by influencing physical and psychological growth and development, and in the long term, as it can lead over time to chronic diseases such as obesity, diabetes mellitus, cardiovascular disorders, and certain forms of cancer. Deficiency of proteins, carbohydrates, and lipids generates protein calorie malnutrition or metabolic imbalances. Since each macronutrient plays a unique role in the body, its absence causes specific problems. Proteins are essential for tissues and the immune system, and their deficiency can cause loss of muscle mass, also known as atrophy, edema, or water retention, and a weakened immune system. In carbohydrate deficiency, extreme fatigue, hypoglycemia, lack of concentration, and general weakness may occur. Carbohydrates can be easily drawn from stores and used when the body requires additional energy expenditure.

Fats are vital for hormone production and for the absorption of fat soluble vitamins. Their deficiency can cause hormonal disorders, skin problems, and vitamin deficiencies. Since these substances are highly essential for the body, they require detailed study. The body uses them in large quantities, and their restriction has a direct impact on the blood.

Materials and Methods: The study of changes in the investigated indices was carried out on laboratory animals, specifically white laboratory rats of the Wistar line, with body weights ranging from 180 to 260 grams, kept under vivarium conditions. They were divided into two groups: Group I, the control group, and Group II, the experimental group.

Blood samples were collected from the tip of the tail and subjected to laboratory investigations. Hematological and hemostatic indices were studied, including the number of erythrocytes, leukocytes, the amount of hemoglobin, the erythrocyte sedimentation rate, coagulation factors, and other parameters, using classical determination methods.

Results and Discussions:The aim of this study was to investigate certain blood indices in cases of macronutrient deficiency in white laboratory rats over a period of 14 days. The results obtained in the experiments show that protein, lipid, and carbohydrate deficiency for 14 days leads to changes in certain values of the complete blood count. These changes include a decrease in the number of erythrocytes and in the amount of hemoglobin and hematocrit, indicating a lack of amino acids necessary for the formation of red blood cells in white laboratory rats. A decrease in leukocytes was also observed, as the lack of proteins rapidly affects the immune system, thus reducing resistance to infections. In the study of the erythrocyte sedimentation rate in rats subjected to protein, lipid, and carbohydrate deficiency for 14 days, the ESR increased. This may raise the level of cortisol, the stress hormone, and may generate an inflammatory response, thereby overloading the cardiovascular and immune systems. Blood glucose decreases moderately but stabilizes toward the lower limit of normal due to gluconeogenesis. Blood coagulation becomes slowed and disturbed, with changes in coagulation factors. Deficiency of these substances disrupts the entire hemostatic process, leading to a major risk. Prothrombin time increases, and the blood coagulates more slowly due to the rapid onset of vitamin K deficiency.

Conclusions: Therefore, restricting the body’s intake of proteins, lipids, and carbohydrates causes disorders in the blood system, as well as a general

destabilization of the blood and of the hemostatic process. The decrease in erythrocytes, hemoglobin, and hematocrit indicates a lack of amino acids necessary for the formation of red blood cells, which may lead to the onset of anemia and oxidative stress. The reduction in the number of leukocytes affects the immune response and decreases resistance to infections. The increase in ESR signals a possible inflammatory response and an increase in cortisol levels, overloading the cardiovascular and immune systems and indicating inflammation and stress. The disturbance of hemostasis is caused by nutrient deficiencies and the rapid onset of vitamin K deficiency, which slows blood coagulation and increases prothrombin time, generating a major risk of hemorrhage. Metabolic adaptation occurs because blood glucose decreases moderately but is maintained at the lower limit.

Thus, the importance of macronutrient consumption lies in sustaining life by providing energy, calories, and the raw material necessary for the development, regeneration, and optimal functioning of the body. Macronutrients are absolutely essential, and obtaining them from the external environment through nutrition is a biological necessity, because the human body cannot synthesize them by itself in the quantities or forms required.

Keywords: *malnutrition, macronutrients, metabolic imbalances, complete blood count, coagulation factors, atrophy, hypoglycemia, diabetes mellitus.*

UDC: 615.9:591.51

PRELIMINARY DATA REGARDING THE EFFECTS OF WHEATGRASS ON INSECTICIDE-INDUCED BEHAVIORAL ALTERATIONS IN ZEBRAFISH (*DANIO RERIO*)

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Fipronil, widely used in combination with (S)-methoprene (an insect growth regulator), is an insecticide known to induce neurotoxic and systemic effects, including convulsions, oxidative stress, neuroinflammation, hematological and enzymatic alterations, and endocrine dysfunction, particularly under uncontrolled exposure conditions. Wheatgrass (WG) has been reported to possess antioxidant and protective properties against chemically induced toxicity. This study evaluated the effects of insecticide exposure and the potential protective role of WG on zebrafish (Danio rerio) behavior. Four groups were tested: control, WG-supplemented feed, insecticide (30 min exposure), and insecticide + WG. Behavioral analyses, including visual stimulus and social interaction tests, were conducted over 96 hours. Control and WG groups showed normal behavioral responses, whereas insecticide exposure significantly reduced activity and induced signs of attention deficits and altered stress responses. WG administration partially attenuated these effects. Locomotor analysis revealed decreased swimming distance and velocity in the insecticide group, while WG alone had no negative effects and provided partial protection when combined with the insecticide. Social behavior tests reflected similar trends. In conclusion, fipronil-(S)-methoprene exposure induces significant behavioral alterations in zebrafish, while wheatgrass may offer partial neuroprotection.

***Keywords**: zebrafish, wheatgrass, insecticide, behavioral toxicity, neuroprotection.*

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ENDOCRINE-DISRUPTING CHEMICALS AND DIABETES MELLITUS TYPE 2

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The prevalence of Type 2 diabetes mellitus (T2DM) has grown exponentially in the last several decades transforming into a worldwide epidemic and one of the most urgent issues in the context of the population health in the twenty-first century. The classical risk factors, as genetical predisposition, sedentary lifestyle, obesity, however, are not sufficient to explain the extent and the rate of this epidemic. The scientific focus on environmental determinants was growing towards endocrine-disrupting chemicals (EDCs), as the new factors in the pathogenesis of T2DM. Such EDCs as bisphenol A (BPA), phthalates, polychlorinated biphenyls (PCBs) and some pesticides have the ability to interfere with glucose homeostasis. Human exposure to EDCs occurs through multiple routes: contaminated food and water, air pollution, household products, plastics, cosmetics, and occupational exposure.

The aim of the study is comprehensively evaluating the role of EDCs in the development of T2DM to identify new hidden diabetogenic environmental contributors and their pathogenetical mechanisms.

The diabetogenic effects of EDCs are mediated through complex mechanisms such as alterations in hormonal signaling pathways, oxidative stress, chronic inflammation, mitochondrial impairment, gene expression in beta-cells in the pancreas leading to poor b-cell survival, β-cell dysfunction. Chronic exposure to EDC causes systemic insulin resistance, impaired hepatic and skeletal muscle glucose uptake, impaired adipocyte functioning, recapitulating metabolic phenotypes of prediabetes and T2DM. EDCs modify the beta-cell regulatory genes such as PDX1, HNF1A and GLUT2 hence disrupting the glucose sensing and insulin secretion. Prenatal and early-life exposure to EDCs can result in irreversible epigenetic reprogramming of DNA methylation at glucokinase promoters and histone modifications at metabolic tissues in adulthood, which makes them predisposed to insulin resistance and T2DM despite a lack of direct exposure

NHANES show positive correlations between urinary and serum EDC biomarkers, especially the BPA, phthalates, organochlorine pesticides, and increased risk of T2DM, insulin resistance and impaired fasting glucose.

Preventive strategies focused on reducing exposure to endocrine-disrupting chemicals, promoting healthier lifestyles, improving environmental policies may help decrease the burden of metabolic diseases.

Keywords*: endocrine-disrupting chemicals, type 2 diabetes mellitus.*

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NRP2 RS849563 POLYMORPHISM AND SENSORY PHENOTYPES IN CHILDHOOD AUTISM

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Autism spectrum disorder (ASD) is a complex neurodevelopmental condition with a strong genetic basis, and among the candidate genes, Neuropilin-2 (*NRP2*), a co-receptor for semaphorins, plays a crucial role in axon guidance during neural development. Considering this the aim of this study was to investigate the association of the *NRP2* rs849563 (T>G) polymorphism with ASD diagnosis and ASD-related behavioral and sensory traits in an Azerbaijani pediatric cohort. The study included 103 children diagnosed with ASD who were receiving treatment at the Nefes Psychoneurological Center and the Narinj Psychological Center and 90 healthy controls; ASD-related traits were assessed using the Gilliam Autism Rating Scale (GARS-3), and DNA extracted from buccal swabs was genotyped for rs849563 by PCR-RFLP. Allele and genotype frequencies were compared between groups, and associations with 21 clinical traits were evaluated by chi-square tests and logistic regression under dominant, recessive, and overdominance inheritance models. Genotype frequencies of rs849563 were similar in ASD cases and controls. TT - 72.5% vs. 71.1%; TG - 25.5% vs. 28.9%; GG - 2.0% vs. 0%. Genotype-based analysis showed no significant association with ASD risk for either the TG genotype compared with TT (OR = 0.86, 95% CI = 0.46-1.64, p = 0.78) or the rare GG genotype (OR = 4.32, 95% CI = 0.20-91.74, p = 0.66). Allele frequencies were comparable between cases (T = 85.3%, G = 14.7%) and controls (T = 85.5%, G = 14.5%). The presence of the G allele was not significantly associated with ASD risk (OR = 1.02, 95% CI = 0.58-1.80, p = 0.94).The association of rs849563 in *NRP2* with childhood ASD was further evaluated under dominant, recessive, and overdominance models of inheritance. No significant association was identified for the analyzed SNP in any of the tested genetic models. However, a significant allele-level association was identified between rs849563 and smell sensitivity, with allele distributions differing significantly between individuals with and without olfactory sensory abnormalities (χ^2 = 4.917, p = 0.0266), suggesting that *NRP2* genetic variation modulates specific sensory phenotypes within ASD rather than overall disease susceptibility (p = 0.0378).These findings indicate that the *NRP2* rs849563 polymorphism does not confer ASD risk but contributes to phenotypic heterogeneity within ASD, particularly in olfactory sensory processing, highlighting the importance of phenotype-specific genetic analyses in neurodevelopmental research.

Keywords: *NRP2, SNP, autism spectrum disorder, sensory processing.*

Session D

ENVIRONMENT PROTECTION AND NATURAL RESOURCES MANAGEMENT

UDC: 574.632/.635:502.171

ASSESSMENT OF WATER QUALITY AND AQUATIC BIODIVERSITY: A BIO-INDICATOR APPROACH FOR SUSTAINABLE MANAGEMENT OF FRESHWATER ECOSYSTEMS

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Aquatic ecosystems are currently facing unprecedented pressure due to anthropogenic activities and climate change, necessitating advanced hydrobiological monitoring for effective resource management. This study focuses on the application of hydrobiological techniques to assess water quality and its impact on aquatic biodiversity. By utilizing specific bio-indicators, including macroinvertebrates and phytoplankton communities, the research evaluates the ecological status of freshwater bodies and their degree of pollution. The methodology integrates physical-chemical analysis with biological monitoring to provide a comprehensive understanding of ecosystem health. Preliminary results indicate a significant correlation between nutrient loading and changes in community structure, highlighting the sensitivity of aquatic organisms to environmental shifts. The findings emphasize the importance of adopting biological assessment tools in national water management strategies to ensure the preservation of natural resources and the sustainability of aquatic habitats

Keywords: *applied hydrobiology, water quality, bio-indicators, ecosystem management, aquatic biodiversity.*

UDC: 595.132:574.1(478)

FREE-LIVING NEMATODES: AN OVERLOOKED INDICATOR OF MOLDOVAN BIODIVERSITY

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Biodiversity conservation now anchors environmental and agricultural policy across Europe and in the Republic of Moldova, yet the biological evidence needed to substantiate it remains scarce for the abundant soil- and sediment-dwelling fauna that sustain ecosystem functioning. Free-living nematodes are the most numerous metazoans in these habitats and rank among the most reliable, low-cost biological indicators of environmental quality, but they are also among the least studied. In the Republic of Moldova, the investigation on free-living nematodes lapsed after 2012, and no study has yet related their diversity to the state of the environment.

This contribution presents the rationale and design of doctoral research intended to close that gap. Rather than relying on high-throughput molecular tools, the work is built on classical morphological taxonomy and the analysis of nematode community structure — feeding-type and colonizer–persister composition, the Maturity Index, diversity and biomass. Littoral sediments of the Dniester River, surveyed between 2007 and 2012 (when more than sixty freshwater and soil nematode species were recorded), will be re-examined to compare past and present assemblages along the same longitudinal gradient.

The study will deliver the first updated inventory and the first temporal, community-level assessment of free-living nematodes in the country, set against a decade of climatic extremes and regional conflict within the transboundary basin. Beyond its scientific value, it is intended to provide indicator-grade biodiversity data of direct relevance to the national strategies and EU-accession commitments that presently lack them.

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Keywords: *free-living nematodes; biodiversity assessment; nematode community structure; bioindication; Dniester River.*

UDC: 598.1:502.1(478)

HERPETOFAUNA OF THE CULTURAL-NATURAL RESERVE "ORHEIUL VECHI"

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The Cultural-Natural Reserve „Orheiul Vechi" is located in the central part region of the Republic of Moldova, at about 50 km northeast of Chisinau and has an area of 33792 ha. The reserve territory represents a complex of different types of natural and anthropogenic ecosystems, which favors the existence of rather rich herpetofauna. The natural ecosystems include forests, rocky and paludous habitats, forest edge, meadows, pastures, ponds and Răut River, which flows through the Reserve.

The studies were performed in 2025-2026 in various types of ecosystems within the Cultural-Natural Reserve „Orheiul Vechi". The study of herpetofauna diversity revealed the presence of 10 reptile (*Emys orbicularis*, *Anguis fragilis*, *Lacerta agilis*, *Lacerta viridis*, *Natrix natrix*, *Natrix tesselata*, Coronella austriaca, Zamenis longissimus, *Dolichophis caspius*, *Vipera berus*) and 11 amphibian species (*Lissotriton vulgaris*, *Triturus cristatus*, *Pelophylax ridibundus*, *Pelophylax lessonae*, *Rana dalmatina*, *Rana temporaria*, *Bombina bombina*, *Bufo bufo*, *Bufotes viridis*, *Hyla orientalis*, *Pelobates fuscus*). Among the mentioned species, 13 are rare, listed in the Red Book of Moldova.

The importance of the reserve territory as a nucleus for the conservation and maintenance of the specific diversity of the herpetofaunistic complex is obvious, being registered 21 species (75%) out of 28 species inhabiting in the Republic of Moldova, including many protected species.

Taking into account the current state of the herpetofaunistic complex, the character and influence of various factors on amphibian and reptile populations, a number of measures are proposed, which will ensure the conservation of amphibian and reptile diversity in the conditions of anthropogenic and climate changes, such as protection of existing natural habitats, permanent monitoring of the state of habitats populated by rare species, prohibition of animal disturbance, especially in reproduction period, restoring shelter belts that provide additional habitats for amphibians and reptiles and as less dangerous migration routes, promoting the sustainable ecological tourism, avoiding the excessive use of pesticides, increasing the ecological consciousness of population.

***Acknowledgments*:** *The study was performed within the doctoral project „Reptile fauna (Reptilia: Squamata) of the Dniester River basin", funded by the Ministry of Education and Research.*

Keywords: *Orheiul Vechi Reserve, herpetofauna, diversity, conservation, measures*

UDC: 551.583:631.43(478)

GROUND FROST VARIABILITY UNDER CLIMATE CHANGE: A REVIEW OF INTERNATIONAL AND REGIONAL RESEARCH WITH IMPLICATIONS FOR THE REPUBLIC OF MOLDOVA

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Ground frost occurring at the soil surface remains one of the most sensitive climate hazards affecting agricultural systems, particularly in the temperate continental regions. Although global warming is generally associated with a reduction in temperature extremes, recent studies suggest a more complex reality, in which frost risk persists, or may even intensify. One of the underlying causes lies in changes in atmospheric processes, accompanied by shifts in phenological responses.

This paper provides a comprehensive analysis of international and regional research on ground frost at the soil surface variability with a focus on Eastern Europe and the Republic of Moldova. The analysis integrates findings from global climate assessments, including those of the IPCC and the World Meteorological Organization, alongside specialized studies addressing plant sensitivity, phenological changes, and agricultural losses related to hazardous frost events.

The review highlights the growing importance of loss of cold hardiness processes in woody species (Arora et Taulavuori, 2016), the role of shifting spring phenology (Fu et al., 2014), and the continued influence of cold-season frost frequency on ecosystem productivity (Giardin et al., 2022). At the regional scale, studies conducted in Republic of Moldova (Nedealcov, 2012; Botnari, 2023) confirm the persistence of late frosty risk even under warming conditions.

Overall, the findings suggest that frost variability is driven by a complex interaction between large-scale climate trends and local environmental controls. For Republic of Moldova, where agriculture is highly climate-dependent, improving the understanding of these processes is essential for effective risk management and adaptation.

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Keywords: *ground frost at the soil surface; climate change; dangerous frost; Eastern Europe; Republic of Moldova.*

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THE IMPORTANCE OF CAVES DURING THE ACTIVE AND RECREATIONAL PERIOD OF BATS

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The study was conducted during 2012–2025, at different times of the year, in the northern and central areas of the country. In the limestone hills, erosion has formed depressions of various sizes called caves. Such rooms serve as shelter for bats during the active period of the bats in spring-summer-autumn. As natural underground shelters, 5 caves from Brânzeni, Buzdugeni, Șapte Bani, Vâșcăuți and Goian were studied. These sites differ from the others in that they are shallow and have cracks in the ceiling that are up to several meters deep. The microclimate is different from that in the mines, due to the lack of air currents and humidity, which is influenced by the outside temperature. In all the caves, individuals of the species *Rinolophus hipposideros* were found during the warm period of the year. In the Vâșcăuți cave, a maternity colony with around 20 individuals of this species was identified, it is the species most often identified in caves. Horseshoe bats don't need special hiding places in the form of holes and small cracks, because it is the only species on the territory of the Republic of Moldova that hangs in open places on the ceiling of the mine or cave. The other bat species do not find optimal conditions for daytime sleep, hibernation and reproduction in caves. In the Brânzeni, Buzdugeni and Șapte Bani caves, 2-3 individuals of the *Rh. hipposideros* species were identified during the research period, sometimes the *Myotis daubentonii* species also shelters in these caves, but for shorter periods. In the Goian cave, an individual of the *Plecotus auritus* and *Rh. hipposideros* species was identified. Small species often shelter in such sites for a certain period of time for daytime sleep. In all the caves investigated except the one at Vâșcăuți we observe a low diversity with a small numerical population but they can host maternity colonies similar to the cave at Vâșcăuți, an important factor in maintaining the taxonomic structure of bat communities in underground habitats. All the caves are frequented by tourists and vandalized and need to be protected, the identified species are listed in the Red Book of the Republic of Moldova, 3rd edition.

Acknowledgments: The study was conducted within the framework of subprogram 010701 and within the project "Red Book of the Republic of Moldova, 4th edition", contract no. 01-23p-096/03-05-2024, funded by the National Environmental Fund.

Keywords: *bats, species, diversity, conditions, underground shelters.*

UDC: 502.3:582.32(479.22+478)

TRACKING AIR QUALITY TRENDS AND ENVIRONMENTAL DRIVERS: A COMPARATIVE MOSS BIOMONITORING STUDY OF GEORGIA AND MOLDOVA

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Moss biomonitoring serves as a cost-effective tool for assessing long-term atmospheric deposition trends and identifying persistent pollution hotspots, as demonstrated by national surveys in Georgia (2014–2023) and the Republic of Moldova (2015–2020). Temporal analysis revealed general improvement in air quality, with significant median reductions in Moldova for Pb, Cd, and Cu, and in Georgia for Al, Cr, and Fe, largely attributable to changes in emission intensity and environmental management. However, localized contamination persists: in Georgia, the Chiatura manganese mines and Zestafoni Ferroalloy Plant continue to pose ecological risks (elevated Mn, Hg, Cd), while in Moldova, Balti and Chisinau show peak content of Al, Fe, and Pb from industrial sources and vehicular traffic.

Beyond tracking temporal trends and hotspots, the comparative framework allows a deeper investigation into how environmental conditions shape atmospheric deposition patterns. While Georgia and Moldova share a temperate zone and Black Sea influence, their contrasting physico-geographical characteristics create distinct mechanisms of pollutant accumulation in mosses. Analysis of a controlled dataset of *Hypnum cupressiforme* samples, combined with multivariate statistics and environmental data, revealed that elemental accumulation is strongly controlled by climatic and topographical factors. Lithogenic elements (Al, Cr, Fe) dominated in dry, lowland Moldovan regions due to soil resuspension, while Cd and Pb were positively associated with higher altitude and precipitation in Georgia, reflecting enhanced wet deposition. By incorporating environmental gradients, source apportionment becomes more accurate, which in turn supports spatially refined risk evaluations and robust cross-regional comparisons.

These results demonstrate that interpreting biomonitoring data without accounting for physico-geographical context can lead to misclassification of pollution sources and levels. The study recommends establishing region-specific background levels, implementing standardized protocols (single moss species, outlier filtering), and targeting mitigation strategies to identified hotspots.

Keywords: *Moss biomonitoring, Atmospheric deposition, Physico-geographical conditions.*

UDC: 574.64:597

BEHAVIORAL EFFECTS OF CEFTRIAXONE AND POLYSTYRENE MICROPLASTICS IN ZEBRAFISH: EVIDENCE OF COMBINED TOXICITY

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The increasing presence of pharmaceutical residues and microplastics in aquatic environments raises concerns regarding their combined ecotoxicological effects. Ceftriaxone (CEF), a widely used cephalosporin antibiotic, and polystyrene microplastics (PS-MPs) frequently co-occur in wastewater and surface waters. However, the behavioral effects of their combined exposure remain insufficiently explored.

This study aimed to evaluate the individual and combined effects of 50 µg L-1 and 1 mg L-1 PS MPs on zebrafish behavior using the novel tank test.

Behavioral responses were assessed using video-tracking analysis, focusing on locomotor parameters (distance traveled, velocity), mobility states (mobile/immobile duration), anxiety-like behavior (thigmotaxis), top/bottom dwelling frequency and duration, and clockwise/counterclockwise rotations. Statistical significance was determined between groups using one-way ANOVA.

Exposure to CEF and PS, both individually and in combination, significantly altered behavioral endpoints compared to controls. Increased thigmotaxis duration and frequency suggested heightened anxiety-like responses, particularly in the combined exposure group. Locomotor activity was significantly reduced, as reflected by decreased distance traveled and velocity. Additionally, significant modifications in rotational activity and mobility states were observed, with increased immobility and disrupted exploratory patterns. Overall, the combined exposure produced more pronounced behavioral impairments than single treatments, indicating potential synergistic effects.

Exposure to CEF and PS-MPs induces significant behavioral disturbances in fish, affecting locomotion and anxiety. These findings highlight the ecological risk posed by mixed contaminants in aquatic systems and underscore the importance of

evaluating combined pollutant effects in ecotoxicological assessments.

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Keywords: *ceftriaxone; polystyrene microplastics; zebrafish; novel tank test*

UDC: 582.949.2:712.253:58(478)

BIOCOLLECTION OF THE GENUS *TEUCRIUM* L. IN THE NATIONAL BOTANICAL GARDEN, REPUBLIC OF MOLDOVA

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The genus *Teucrium* L. (Germander) includes medicinal, food and ornamental plants. In folk medicine, some species are used in the treatment of digestive and respiratory problems. Scientifically have been demonstrated their hypoglycaemic, haemostatic, diuretic, antispasmodic, antiseptic, antioxidant, diaphoretic, antibacterial effects. The paper refers to medicinal *Teucrium* species grown in the collections of National Botanical Garden (NBGI) of MSU, some lesser known, but therapeutically valuable.

The research was conducted during 2015-2025. The *Teucrium* species were obtained by the international seed exchange (*Index Seminum*) and from spontaneous flora. The acclimatization of the species was carried out in the Experimental Sector of the Medicinal Plants Collection of NBGI.

The genus *Teucrium* is represented in the NBGI collections by ten taxa*:* 2 spontaneous species *(T. chamaedrys and T. polium)* and 8 allochthonous taxa *(T. botrys, T. chamaedrys subsp. nuchense, T. flavum, T. hircanicum, T. lamiifolium, T. lucidum, T. orientale, T. scorodonia).* Under *ex situ* conditions the plants are characterized by relatively constant phenological indicators; they consecutively complete all the phenological phases of the seasonal development cycle, including the vegetative period, budding, flowering and full seed maturation. Depending on the species' biological characteristics, budding occurred in May or June, with full flowering – in June-July. Fruit ripening begins in the third decade of July and ends no later than August for all species. The end of the vegetation period of the plants is recorded during September. The annual species *T. botrys* was propagated by seedlings (seed germination rate – 71-88%, seedling establishment coefficient in open ground – 80-85%). For other nine perennial species the method of propagation by seedlings and by dividing perennial plants in autumn and early spring was applied. The new introduced species are frost-resistant. They have also proven to be hardy plants, tolerating most severe periods of summer drought.

The study on the primary introduction of allochthonous *Teucrium* species in the Botanical Garden showed that some of them (*T. hircanicum, T. scorodonia* and *T. orientale)* are promising and deserve further investigation as medicinal plants.

***Acknowledgments*:** This study was supported by Subprogram 010101 "*Ex situ and in situ research and conservation of plant diversity in the Republic of Moldova*" funded by the Ministry of Education and Research of the RM.

Keywords: *Teucrium L., medicinal plants, acclimatization, ex-situ conservation*

UDC: 579.66:678.742.2

ENHANCED BIODEGRADATION OF POLYETHYLENE

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Low-density polyethylene (LDPE) is among the most recalcitrant plastic pollutants. Under standard environmental conditions, its biodegradation rate can be as low as 0.5% over 10 years. The aim of this study was to investigate whether LDPE degradation can be enhanced by (a) preliminary oxidation of the polymer via UV irradiation and photocatalytic nanocomposites, and (b) supplementation of the mineral medium with lignin to stimulate microbial production of ligninolytic exoenzymes capable of participating in LDPE decomposition. LDPE films were pretreated with UV light and the $MgFe_2O_4$/PVP nanocomposite, then incubated in a mineral medium supplemented with lignin. Throughout the incubation period, microbial activity was continuously monitored and found to be consistently and substantially higher than in controls containing either untreated LDPE or no LDPE. By the end of the incubation, total CO_2 efflux significantly exceeded these controls by factors of 1.3 and 2, respectively. Consequently, after 100 days of incubation, the pretreated LDPE films exhibited a weight loss of 18.0 ± 5.2%, whereas weight loss in the untreated LDPE control was statistically negligible. In conclusion, pretreatment of polyethylene films with UV light and the $MgFe_2O_4$/PVP nanocomposite substantially enhanced microbial degradation of the polymer during incubation in a lignin-supplemented mineral medium. These findings may contribute to the development of effective strategies for recycling LDPE and hydrolyzed lignin waste, as well as to addressing the broader environmental pollution challenges associated with plastic persistence.

Acknowledgments: This work was supported by research project 020101 InBioS – Innovative Biotechnological Solutions for Agriculture, Medicine and Environment, funded by the National Agency for Research and Development, Republic of Moldova.

Keywords: *polyethylene; LDPE; LDPE biodegradation.*

UDC: 579:631.46

MICROORGANISMS AS SOIL QUALITY INDICATORS

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Soil microorganisms are widely recognized as sensitive indicators of soil quality, with soil microbial biomass (SMB) among the most commonly employed. Nevertheless, the diagnostic value of SMB — and of microbiological indicators more broadly — remains constrained by strong seasonal variation and other confounding factors unrelated to soil quality, complicating the interpretation of observed changes.

This study assessed the sensitivity of SMB to long-term contamination by persistent organic pollutants (DDTs and HCHs) in typical chernozem soils of Moldova, and investigated approaches to enhance the diagnostic value of microbiological indicators. Microbial parameters (SMB, μmax, and others) were determined by SIR and SIGR methodologies for soil samples from three sites adjacent to a former Soviet pesticide storage facility in the Sangerei district. Results demonstrated that SMB was more strongly driven by soil organic matter content than by pollutant concentration. Moreover, seasonal fluctuations in SMB — both in contaminated and uncontaminated soils — frequently exceeded the differences between sites at any given sampling point, substantially reducing the indicator's discriminatory power. In contrast, μmax proved considerably more robust to seasonal variation while remaining sensitive to the toxic effects of both heavy metals and POPs, suggesting its greater suitability as a diagnostic tool.

Acknowledgments: This work was supported by research project 020101 InBioS – Innovative Biotechnological Solutions for Agriculture, Medicine and Environment, funded by the National Agency for Research and Development, Republic of Moldova.

Keywords: *soil quality bioindicators; soil microbial biomass; SIGR.*

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RADON SURVAY IN SECONDARY EDUCATION INSTITUTIONS AIR IN THE REPUBLIC OF MOLDOVA

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Radon is a naturally occurring radioactive gas spread in the Earth's crust through the radioactive decay of uranium. Chronic exposure to indoors radon increases the risk of lung cancer. Radon is the leading cause of lung cancer in non-smokers. The risk increases with the duration of exposure to radon, depending on both the indoor radon concentration and the time of exposure. Monitoring and controlling indoor radon concentration, in homes and in the workplace, is a very important issue worldwide, with educational institutions being considered a priority.

Purpose: to study the activity of radon in the air of secondary educational institutions (SEIs) in the Republic of Moldova and identify buildings that require remediation.

Methods: Radon concentrations (CRn) were assessed in 300 SEIs in the Republic of Moldova using passive techniques based on solid-state nuclear trace detectors, developed and read based on the RADOSYS system. Measurements were performed on the ground floor in both relatively warm and cold weather conditions (September-March, y.y. 2025-2026). The determination of the health risk of radon exposure was carried out based on the calculation of annual effective doses, calculated according to the methodology of the International Commission on Radiological Protection. Mapping was performed in a Geographic Information System (GIS) environment using the Smart-Map extension integrated in QGIS. Statistical analysis was performed with the Statistica-10 software.

Results: The median of the distribution of radon activity in the air of the investigated schools was 193.50 Bq/m3, and the minimum and maximum values were 20.92 Bq/m3 and 1288.26 Bq/m3, respectively. The radon concentration was higher, compared to the reference level, in 96 schools (33.3%). BOXPLOT analysis demonstrates that higher concentrations of radon in the air of the SEIs were detected in the Northern Zone of the country, where the average value was 330.73 Bq/m3. The results indicate exceedances of the reference value and indicate the implementation of radon remediation measures. In the Central and Southern Zones, the values were within the limits of national norms, constituting 220.89 Bq/m3 in the Central Zone and 231.69 Bq/m3 in the Southern Zone. The average annual effective dose of radon exposure in the IG was 7.96 mSv/year with a variation from 0.63-38.38 mSv/year. These values indicate the need for immediate radon remediation interventions in some buildings.

The buildings have public status and are divided by the number of floors as follows: 1-storey (32.29%), 2-storey (30.21%) and 3-storey (37.50%). In 98.96% of the schools, the buildings had a concrete foundation, wooden floors (83.33%), solid parquet (3.13%), sandstone (11.46%), laminated parquet (8.33%) and other materials (11.46%). Wall materials: reinforced concrete (9.38%), brick (7.29%), stone (17.71%), wood (2.08%), adobe (78.13%) other materials (clay 1.04%). The ceiling was reinforced concrete (9.38%), wood (8.33%), other materials (clay) (11.46%). The buildings had single glazing (8.33%) and double glazing (91.67%). The window in the investigated room was permanently open (1.04%), periodically open (93.75%) or permanently closed (5.21%). In 19.79% of the rooms the walls had cracks, and in 80.21% - not. Artificial ventilation does not exist in 77.08% of the investigated rooms, 17.71% - use a fan, and 6.25% - air conditioning. In 85.42% of the rooms ventilation is performed, and in 14.58% - not. Basement exists in 25% of the buildings, and in 75% it does not exist. Probably, the fact that artificial ventilation does not exist in approximately 77.08% of the investigated rooms contributed to the accumulation of radon in the rooms.

Conclusions: The results highlight an essential variability of CRn in the school environment and indicate the existence of areas with increased exposure potential. At the same time, the uneven distribution of the values suggests the influence of local factors, such as the geological characteristics of the soil, the type of construction, the ventilation system and the technical condition of the buildings. The situation in question indicates the need for immediate radon remediation interventions in buildings where CRn has exceeded the reference level. It should be noted that the national reference value of radon in rooms, including educational institutions, is 300 Bq/m3.

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Keywords*: indoor radon concentration, lung cancer, passive radon detectors.*

UDC: 551.58:551.583”324”(478)”2026”

WEATHER AND CLIMATE PHENOMENA IN THE WINTER OF 2026 AND ADAPTATION STRATEGIES

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The winter of 2026 in the Republic of Moldova was more typical than in recent years, with a variety of weather and climate phenomena recorded. The early part of the winter was marked by fog and light precipitation, followed by periods of freezing temperatures, heavy snowfall, and severe and repeated icing, with temperature fluctuations generally typical of the season.

Objective: To identify the hazardous weather and climate phenomena that occurred during the winter of 2026, to characterize them and describe how they manifested in different regions of the country, and to outline methods for adapting to and mitigating their impact on the environment, the population, and the economy.

Objective 1: To investigate the main meteorological and climatic phenomena observed during the winter of 2026 in the Republic of Moldova and to assess the intensity and frequency of these phenomena.

Objective 2: To analyze their impact on key economic sectors, including road infrastructure, agriculture, the energy sector, and public health. At the same time, the vulnerability of the population and localities exposed to risks specific to the cold season will be analyzed.

Objective 3: To identify and evaluate the adaptation and intervention measures implemented, as well as to formulate recommendations aimed at improving the management system for exceptional situations caused by winter weather phenomena.

Methods: The study will document and analyze climate data such as temperature and precipitation levels, comparing them with previous years. To highlight meteorological and climatic trends, meteorological reports for the entire observation period are consulted. Geographical methods form the basis for estimating the negative impact of meteorological and climatic phenomena during the cold season, and the use of geographic information systems, graphical materials, and maps are tools that aid research across time and space.

The results will serve as the basis for the implementation of methods and tools to enable the rapid and effective response and adaptation of the authorities and institutions responsible for protecting the population, the environment, agriculture, and infrastructure affected by hazardous weather and climate phenomena during the cold season.

Conclusions: Climate change is intensifying and increasing the impact of weather and climate phenomena, and the winter of 2026 was felt by the people of the Republic of Moldova. Thus, the winter was much colder and wetter than the very mild winters of recent years. At the end of January, there were repeated episodes of severe ice, which had consequences for the environment, the economy, and the național infrastructure.

***Keywords**: winter, ice, snow, temperature, consequences.*

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NEW DATA ON THE DIVERSITY OF BEETLES (INSECTA: *COLEOPTERA*) IN RAPE CROP, REPUBLIC OF MOLDOVA

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Rapeseed is an crop of significant importance in both the food and technical industries worldwide. In the Republic of Moldova, rapeseed has become a strategic and highly profitable crop, occupying an area of 112 thousand ha in 2025 (https://statistica.gov.md/). This crop is a food source for many insect species, including various species of coleoptera, throughout the entire vegetation period, especially during the flowering period. The increase in the areas cultivated with rapeseed, especially as a monoculture, favors the accumulation of a large number of harmful insect species from the Coleoptera family, which cause great damage to this crop. The purpose of this work was to highlight the spectrum of Coleoptera species associated with rapeseed.

The collections of insect species were carried out on April 14, 2024, April 24, 2025 and May 10, 2025. In total, 7210 coleoptera specimens were collected in the rapeseed crop, assigned to 22 species, 19 genera and 8 families, of which 6 species from the family Chrysomelidae, 5 species from Coccinellidae, 4 species from Scarabaeidae, 3 species from Curculionidae and 1 species from the families Cantharidae, Tenebrionidae, Nitidulidae, and Carabidae. The distribution of individuals by localities was: Brăila (1832 specimens), Cogîlniceni (1025), Trifești (3245), Țareuca (965) and Cahul (143).

The following species were collected in the rapeseed agrocenosis: 3234 individuals of *Ceutorhynchus obstrictus* (T.Marsham,1802), 2862 ind. of *Meligethes aeneus* (Fabricius,1775), 855 ind. of *Phyllotreta cruciferae* (Goeze,1777), 157 ind. of *Tropinota hirta* (Poda,1761), 36 ind. of *Coccinella septempunctata* (Linnaeus, 1758), 33 ind. of *Phyllotreta vittula* (Redtenbacher,1849), 7 ind. of *Cantharis obscura* (Linnaeus,1758), 6 ind. of *Spermophagus sericeus* (Geoffroy,1785), 4 ind. of *Ceutorhynchus pallidactylus* (T.Marsham,1802), 3 ind. of *Hippodamia variegata* (Goeze,1777), 2 ind. of *Cetonia aurata* (Linnaeus, 1758) and eleven species were represented by one individual each: *Acupalpus meridianus* (Linnaeus, 1760), *Bruchus pisorum* (Linnaeus, 1758), *Coccinella magnifica* (Redtenbacher, 1843), *Coccinula quatuordecimpustulata* (Linnaeus, 1758), *Entomoscelis adonidis* (Pallas, 1771), *Omophlus lepturoides* (Fabricius, 1787), *Oxythyrea funesta* (Poda, 1761), *Longitarsus rubiginosus* (Foudras, 1859), *Sitona lineatus* (Linnaeus, 1758), *Protaetia cuprea* (Fabricius, 1775) and *Propylea quatuordecimpunctata* (Linnaeus, 1758).

Among the collected beetle species, 14 are considered harmful: *Phyllotreta cruciferae*, *Meligethes aeneus*, *Ceutorhynchus obstrictus*, *Ceutorhynchus pallidactylus* (which are the main pests of rapeseed), *Phyllotreta vittula*, *Longitarsus rubiginosus*, *Entomoscelis adonidis*, *Tropinota hirta*, *Sitona lineatus*, *Oxythyrea funesta*, *Cetonia aurata*, *Protaetia cuprea*, *Bruchus pisorum* and *Spermophagus sericeu*, cause serious damage to the rapeseed crop. Eight species of coleoptera are beneficial for the rapeseed crop, including 5

species of coccinellids: *Coccinella septempunctata*, *Coccinella magnifica*, *Coccinula quatuordecimpustulata*, *Hippodamia variegata*, *Propylea quatuordecimpunctata*, 1 species of cantharid: *Cantharis obscura*, and 1 species of carabid: *Acupalpus meridianus* which is considered a ground beetle, all of them feeding on small insects, larvae and eggs of rapeseed pests. A species of tenebrionid *Omophlus lepturoides* was also identified that feeds on flower pollen.

Acknowledgments: This study was carried out from subprogram 010701 "Assessment of the structure and functioning of the animal world and aquatic ecosystems under the influence of biotic and abiotic factors in the context of ensuring ecological security and human well-being".

Keywords*: agriculture, oilseed rape, coleoptera, species, pests.*

UDC: 582.579.2:581.9(478)

MAXENT MODELLING OF *IRIS PONTICA* ZAPAŁ. HABITATS IN THE REPUBLIC OF MOLDOVA

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The results on the spatial ecological niche modelling of the rare vascular plant *Iris pontica* Zapał. (Iridaceae), which is currently protected by law and listed in the 2nd and 3rd editions of the Red Book of the Republic of Moldova are presented. The study aims to model the habitat of a rare and endangered species for reintroduction into the wild with the aim of increasing the number of habitats and increasing the size of local populations.

The spatial distribution model (SDM) was generated using MaxEnt software, based on bioclimatic and physico-geographical predictors and a categorical variable, namely, Topographic Positions Index (TPI). The climatic data was recalculated for the territory of the Republic of Moldova at a 200-meter resolution (WGS 84 datum), derived from 1991–2020 time series (18 meteorological stations). To ensure the model's robustness and prevent overfitting, the initial list of predictors was subjected to rigorous multivariate analysis and Variance Inflation Factor (VIF) filtering, which excluded highly correlated variables. The resulting model has been statistically significant (AUC =0.955; TSS= 0.852).

The final SDM has six predictors, notably the slope aspect (48.5% contribution) and TPI (39.4% contribution), demonstrating the species' preference for middle and upper southern slopes. Several high-probability zones (>0.85) were identified across the main hydrographic basins of the Republic of Moldova, including the Prut, Dniester, and Răut zones. Based on this model, a successful pilot reintroduction was initiated in 2025 in a steppe habitat.

Acknowledgments: The study was carried out within the research projects: 1). Subprogramme entitled: "Increasing ecological security and resilience of geo-ecosystems to current environmental changes" (subprogramme code – 010801), funded by the Ministry of Education and Research of the Republic of Moldova; 2). Subprogramme entitled: "Research and ex situ, in situ conservation of the plant diversity of the Republic of Moldova" (subprogramme code – 010101), funded by the Ministry of Education and Research of the Republic of Moldova.

Keywords: *spatial modeling, Iris pontica, Republic of Moldova.*

UDC: 631.43:631.445.4

PHYSICAL STATE OF CHERNOZOMS: BIOPHYSICAL APPROACH

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The biophysical concept of the genesis of the chernozems of the Pridanubian space defines the soil as an open biophysical system, the formation of which presupposes the close integration of abiotic and biotic matter, materialized in the unidirectional interdependent and interdetermined development of the humification process and the aggregation-structuring process with the establishment of the genetic-evolutionary system [humic system]<=>[aggregative system], responsible for the reproduction of the chernozem process.

This represents a continuum that presupposes the simultaneous or certain consecutive realization of the bio-physico-chemical and physico-chemical processes of structure renewal through the disaggregation-aggregation of the soil mass in the composition of the aggregates in situ. By its essence, this mechanism presupposes the permanent compensation within the aggregates of the quantities of humus consumed during mineralization with the contents of freshly formed humus.

In this case, the reproduction of aggregates involves the formation of highly stable aggregate formations at an ecological-energetic level responsible for the accumulation and protection of newly formed humus and the reproduction of the chernozem process. In agricultural regime, the dynamics of the structural-aggregate state of arable chernozems is determined directly by both soil work and frequent field passes, and indirectly by the direct impact on soil biota through mineral fertilization and plant protection works. Their permanent impact, with different frequency and intensity depending on the agricultural system practiced, led to a reduction in the self-regulation, self-production and self-organization capacity of the physical soil system manifested in the unidirectional destructuring of the soil mass.

The degradation of the structural-aggregate composition, which involves the partial or total reduction of the hydrostability of aggregates > 2 mm, is accompanied by the degradation of the stabilization mechanism of organic matter in the soil, and in response – the intensification of the process of physical degradation of the genetic-evolutionary system [humic system]<=>[aggregate system].

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Keywords: *biophysical concept, genesis of chernozems, aggregate structure, humic system.*

UDC: 634.8:581.143.6:535.2

OPTIMIZATION OF LIGHTING CONDITIONS FOR *IN VITRO* MICROPROPAGATION OF GRAPEVINE

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In vitro micropropagation of grapevine requires controlled lighting conditions that directly influence the processes of rhizogenesis, morphogenesis, and development of vitroplants. The study aimed to evaluate the influence of LED light spectra and the optical properties of culture vessels on the development of grapevine plants (Vitis vinifera L.) cultivated in vitro.

To achieve the proposed objectives, grapevine explants were cultivated under different LED light sources, including "cool-white", "warm-white", and "Fito" spectra. The photometric parameters PPFD and DLI were determined, with PPFD values ranging between 25 and 63 $\mu mol \cdot m^{-2} \cdot s^{-1}$ and DLI values between 1.64 and 4.05 $mol \cdot m^{-2} \cdot day^{-1}$. At the same time, glass and plastic culture vessels were comparatively evaluated according to light transmission and the uniformity of photosynthetically active radiation distribution, with uniformity values varying between 88 and 95.6%, while material transparency ranged between 71 and 91%.

The results demonstrated that the rhizogenesis process was most efficiently stimulated under illumination with the "Fito" spectrum, ensuring the highest rooting rate of grapevine explants. In contrast, improved shoot and leaf growth was observed under illumination with the "cool-white" spectrum. The evaluation of culture vessels demonstrated that, although glass exhibited higher theoretical transparency, plastic vessels ensured higher PPFD values and a more uniform light distribution.

The study demonstrates that the optimization of lighting conditions for grapevine cultivated in vitro depends not only on the spectral composition of LED light, but also on the optical characteristics of culture vessels. The combined use of optimal LED spectra and appropriate culture vessels may improve the efficiency of micropropagation and the quality of healthy grapevine planting material obtained through the in vitro culture method.

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Keywords: *grapevine, in vitro culture, LED spectra, PPFD, culture vessels.*

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THE USE OF THE CHESTNUT TREE BY THE ROMANIAN PEOPLE

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Among the most widespread trees on Earth is the chestnut tree, which has long been present in the Romanian cultural space. Although this tree has been less widespread and less studied in the Romanian area, its use among the Romanian people deserves careful analysis. In Christian culture, the chestnut symbolizes bravery and chastity. In China, the chestnut was regarded as a symbol of the anticipation of certain events, its fruit serving as food for the winter season. Chestnuts contain a large amount of starch and vegetable oil. They were used in the past and continue to be used today in the diet of regions from Southern Europe, Asia Minor, and Transcaucasia. Edible chestnuts, not wild chestnuts, were consumed. One traditional method of preparing chestnuts was as follows: the fruits had to be baked in their shells on a baking tray in the oven, then scalded with boiling water, peeled, and boiled in milk like potatoes, but over very low heat. Among the Romanian people, chestnuts were consumed whole (baked, roasted, or boiled) or in the form of flour. They were used in the preparation of purées and cakes. According to the data provided by the researcher Constantin C. Giurescu, the edible chestnut in the Romanian space is found in two regions: Northwestern Oltenia and the Baia Mare region. In the past, Romanians used chestnuts as a remedy against frostbite of the hands and feet. In order to avoid erysipelas, peasants carried a chestnut wrapped in a small cloth and tied around the neck with a string. Crushed or finely chopped chestnuts kept in alcohol or boiled in bathing water were used against rheumatism. For this purpose, chestnut flowers soaked in kerosene were also employed for rubbing treatments. Peeled, dried, and crushed chestnuts were additionally given to horses to help them gain weight. Chestnut wood is hard, elastic, and highly durable; it is easy to process and split. It was used for furniture, barrel staves, and hydraulic installations. The leaves are used in the preparation of antitussive medicines. The bark was employed in leather tanning, while the shell was used in dyeing. Among the Romanian people, it is believed that if someone dreams of eating chestnuts, they will soon be invited to a lunch, while dreaming of roasting chestnuts signifies that one's affairs will develop very successfully. We consider that the chestnut tree contributed significantly to the evolution of Romanian society.

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Keywords: *chestnut, food, folk medicine.*

UDC: 502.1:338.48(478)

ECOTOURISM DEVELOPMENT IN ORHEI NATIONAL PARK: CHALLENGES AND PERSPECTIVES

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The study highlights the prospects for the development of ecological tourism in Orhei National Park, one of the most valuable protected natural areas in the Republic of Moldova. The aim of the study was to identify and capitalize on the ecotourism potential of the park through the analysis of natural resources and the development of a representative ecotourism itinerary. The investigation employed methods such as comparative analysis, the geographical-cartographic method, direct observation, description, analysis and synthesis, field excursions, as well as forecasting and extrapolation methods.

The obtained results demonstrate that the Orhei National Park possesses valuable natural and landscape heritage favorable for ecotourism activities. Three representative landscape reserves: Trebujeni, Pohrebeni, and Tiganesti, were analyzed, as they include diverse ecosystems, rare species of flora and fauna, geological formations, and picturesque landscapes of scientific, ecological, and recreational importance. Numerous rare and protected plant and animal species listed in the Red Book of the Republic of Moldova and in international conservation documents were identified within these protected areas.

Based on the identified natural resources, a circular ecotourism route was proposed for domestic and foreign tourists, pupils, students, and researchers. The itinerary includes nature observation activities, hiking, environmental education, and familiarization with the biodiversity and natural heritage of the region. Particular attention is given to ecological education and the promotion of responsible tourism practices among visitors and local communities.

The study reveals that the development of ecotourism in Orhei National Park can contribute significantly to biodiversity conservation, environmental awareness, and the sustainable valorization of protected natural areas. Ecotourism also creates opportunities for local economic development through additional income sources and the creation of jobs in tourism-related activities. Furthermore, the proximity of the park to Chisinau offers favorable conditions for attracting both national and international visitors, facilitating the integration of the park into regional and national tourism circuits.

Keywords: *ecotourism, protected natural areas, biodiversity*

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THE CENTRAL DEVELOPMENT REGION OF THE REPUBLIC OF MOLDOVA AS AN ECOTOURISM DESTINATION

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The study examines the ecotourism potential of the Central Development Region of the Republic of Moldova and highlights its importance as an emerging ecotourism destination. The main purpose of the study was to identify and evaluate the ecotourism resources of the Central Development Region in order to support their future valorization and contribute to the conservation of natural heritage and the improvement of local economic conditions.

The research was based on the analysis of protected natural areas within the Central Development Region of the Republic of Moldova. Several research methods were applied, including descriptive, cartographic, comparative, bibliographic, and field investigation methods, as well as diagnostic and forecasting analyses.

The Central Development Region possesses a rich diversity of natural, geological, hydrological, botanical, and landscape resources. The region contains numerous protected areas of national importance, including Orhei National Park, scientific reserves, landscape reserves, natural monuments, multifunctional management areas, dendrological gardens, botanical gardens, and zoological gardens. The study identified a total of 401 protected natural areas within the region, demonstrating a high potential for ecotourism development.

The findings indicate that the Central Development Region possesses significant opportunities for the development of sustainable tourism and the diversification of tourism services. The large number and diversity of protected areas facilitate activities such as wildlife observation, educational tourism, scientific excursions, and nature-based recreation. At the same time, the proximity of many natural attractions to Chisinau increases accessibility and tourist flow within the region.

Despite its considerable ecotourism potential, the region still faces several challenges, including insufficient tourism promotion, limited and poorly diversified tourism services, inadequate ecotourism infrastructure, and the low level of professional training among tourism personnel. The transformation of the Central Development Region into a nationally and internationally recognized ecotourism destination could contribute to biodiversity conservation, sustainable use of natural resources, improvement of tourism services, and enhancement of the quality of life of local communities.

Keywords: *ecotourism, protected natural areas, sustainable tourism.*

UDC: 595.79:632.937

*SCELIO RUGOSULUS (*HYMENOPTERA: *SCELIONIDAE):* DATA ON DISTRIBUTION, ECOLOGY, AND BIOLOGICAL CONTROL POTENTIAL OF ACRIDID ORTHOPTERANS IN THE REPUBLIC OF MOLDOVA

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Scelio rugosulus (Latreille, 1808) is an oophagous parasitoid wasp belonging to the family Scelionidae (Hymenoptera: Platygastroidea), taxonomically placed within the genus *Scelio* Latreille, 1805. Representatives of this genus are characterized by a narrow trophic specialization, being a group of scelionids that parasitize the eggs of orthopterans from the family Acrididae [Masner, 1976; Austin et al., 2005]. Globally, the genus includes over 200 species, many of which are being investigated as potential biological control agents due to their impact on pest grasshopper populations [Dangerfield et al., 2001]. Among the potential hosts of the species are *Dociostaurus maroccanus* (Thunberg, 1815), *Calliptamus italicus* (Linnaeus, 1758), and *Locusta migratoria* (Linnaeus, 1758), species whose presence on the territory of the Republic of Moldova is confirmed by phytosanitary monitoring data.

The 22 specimens of *S. rugosulus* housed in the Entomological Museum collection of the Institute of Zoology were collected between 2006 and 2007 and cover 16 different localities, including Bugeac, Ciumai, Codrii, Pănășești, and Bucovăț. These collecting sites reflect a wide range of ecological conditions, from steppe meadows and cultivated lands to deciduous forests and floodplains, outlining a mosaic of habitats favorable to both hosts and the parasitoid. The fact that the species has been consistently found in such varied environments indicates a high ecological adaptability and a significant potential to contribute to the natural limitation of phytophagous orthopteran populations in the ecosystems of the Republic of Moldova.

Acknowledgments: Carried out under subprogram 010701.

Keywords: *scelionidae, oophagous parasitoid, acrididae, biological control, Republic of Moldova.*

UDC: 595.76:591.9(478-25)

CONTRIBUTIONS TO THE KNOWLEDGE OF URBAN COLEOPTERAN DIVERSITY AND ECOLOGICAL STRUCTURE IN "LA IZVOR" PARK (CHIȘINĂU, REPUBLIC OF MOLDOVA)

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Urban green spaces are increasingly recognized as essential components of ecological infrastructure, playing a fundamental role in biodiversity conservation and the maintenance of ecosystem functioning within highly anthropogenic landscapes.

The present study provides new faunistic and ecological insights into the diversity of beetles inhabiting La Izvor Park, one of the largest urban green areas in Chișinău, Republic of Moldova.

Field investigations were conducted during May-June 2026 in woodland patches and recreational areas of the park. A total of 23 coleopteran species belonging to 16 genera and seven families were recorded: Carabidae, Silphidae, Scarabaeidae, Cetoniidae, Lucanidae, Tenebrionidae and Meloidae. The heterogeneous structure of these habitats provides favorable ecological conditions for maintaining a diverse beetle fauna within the urban environment.

The family Carabidae exhibited the highest species richness, being represented by 12 species, including *Carabus coriaceus* (Linnaeus, 1758), *Harpalus rufipes* (De Geer, 1774), *H. latus* (Linnaeus, 1758), *Lebia humeralis* Dejean, 1825, and *Ophonus rufibarbis* (Fabricius, 1792). These predominantly predatory taxa play a crucial role in regulating invertebrate populations and maintaining trophic balance in terrestrial ecosystems. The saprophagous component was represented by members of the family Silphidae, including *Necrodes littoralis* (Linnaeus, 1758), *Nicrophorus vespilloides* Herbst, 1783, *Silpha carinata* Herbst, 1783, and *Silpha obscura* Linnaeus, 1758, whereas Scarabaeidae comprised mainly coprophagous species: *Onthophagus coenobita* (Herbst, 1783), *O. fracticornis* (Preyssler, 1790), and *O. verticicornis* (Laicharting, 1791). Collectively, these functional groups contribute substantially to organic matter decomposition, nutrient cycling, soil fertility maintenance, and the ecological stability of urban ecosystems.

Of particular conservation significance is the occurrence of *Lucanus cervus* (Linnaeus, 1758) and *Oryctes nasicornis* (Linnaeus, 1758), both included in the third edition of the Red Book of the Republic of Moldova. The presence of these protected species demonstrates the capacity of urban green spaces to function as refugia for taxa of conservation concern and underscores their importance within regional biodiversity conservation strategies.

The findings confirm the ecological significance of La Izvor Park as a biodiversity reservoir within the urban landscape of Chișinău and enrich the existing faunistic knowledge on beetle communities associated with urban ecosystems in the Republic of Moldova. These results provide an important scientific basis for long-term urban biodiversity monitoring and for the development of sustainable management and conservation strategies for urban green infrastructure.

Acknowledgments: This study was supported by the research project 010701 "Evaluation of the structure and functioning of the animal world and aquatic ecosystems under the influence of biotic and abiotic factors in the context of ensuring ecological security and the well-being of the population.

Keywords: *coleopteran fauna, urban diversity, rare species.*

UDC: 576.89

ABOUT THE PHENOMENON OF HYPERPARASIS

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Hyperparasitism (superparasitism) is a form of life in which a parasite lives within another parasite of a different species, using it as a habitat and a source of food. This phenomenon was first described by Antoine van Leeuwenhoek in 1695.

The phenomenon of hyperparasitism operates at the level of altering the structure of polyparasitism; today, it is only partially understood, as little is known about the viral, bacterial, protozoan, helminthic, and arachnoentomological parasite load of each parasite species at every stage of development. This phenomenon can either aggravate or mitigate the situation of parasitic diseases in a human or animal population. As part of the structure of polyparasitism, it also has clear positive aspects, serving as supportive elements in the integrated fight against parasites and parasitic diseases. Biological, non-polluting methods for controlling parasites are known and used, utilizing the pathogenic action that typically occurs in hyperparasitism. In nature, there is no species whose populations do not exhibit the phenomenon of hyperparasitism. The host-parasite-hyperparasite coexistence affects each component individually, altering their morpho functional characteristics, and the hyperparasite's actions can become pathogenic to the host and can be utilized in the biological control of parasites.

The large number of species, their fertility and abundance in nature, as well as the presence of free-living life stages, explain the widespread distribution of helminths across various environments of the biosphere. Currently, over 5,000 species of parasitic nematodes, approximately 3.000 species of trematodes, over 1.000 species of monogeneans, approximately 2.000 species of cestodes, over 300 species of acanthocephalans, and approximately 100 species of gordiids are known. Cases involving three or four forms of hyperparasite localization are known. Interrelationships are established within a specific hierarchy. An example of the functioning of a hyperparasitic system is the system: pig - ascarids - salmonella - viruses, upon which another hyperparasitic system is superimposed: the migrating larvae of *Strongyloides ransomi*, which contain within their bodies certain species of staphylococci, streptococci, and enteropathogenic *Escherichia*.

Mixed and associative infestations pose a greater threat to human and animal health; these are caused by microparasitocenoses consisting of two or three species of parasites. For example, gastroenteritis and gastroenterocolitis, which cause diarrhea, are common among young livestock (lambs, piglets, calves). Gastroenterocolitis is caused by the young larvae and mature forms of *Strongyloides papillosus* (ruminants) and *Strongyloides ransomi* (pigs), which contain enteropathogenic *Escherichia*, staphylococci, streptococci, and other bacterial species. In more severe cases, pathogenic protozoa- cryptosporidia or eimeria of various species-are also involved.

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Keywords: *hyperparasitism, animals, parasites.*

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STRONGYLOIDOSIS IN ANIMALS AND HUMANS IN THE REPUBLIC OF MOLDOVA

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Strongyloidiasis is a common parasitic disease in cattle in the Republic of Moldova. The most common routes of infection are cutaneous and oral. This study is the first to investigate the possibility of intrauterine infection of young cattle with strongyloidiasis larvae. For the purpose of coproparasitological analysis, calves up to 3 days old were placed in individual pens. Fecal samples were collected individually from the rectum. Petri dishes containing the fecal samples were incubated for two days in a thermostat at a temperature of 20-22°C and then examined for the presence of strongylid larvae. Strongylid larvae were detected in 9 (5.3%) calves out of 169 examined, originating from various types of farms (farms, complexes, private households). Strongylid larvae were also detected in meconium. Our research conducted on young cattle from farms with various management practices (farms, complexes, private sector) and geographic areas in the Republic of Moldova established their infestation with *Strongyloides papillosus* larvae in 36.7-67.5% of cases, and in adult cattle in 21.1–26.0% of cases. Depending on the management practices used in various operations, calves are fed colostrum and milk from different cows during the first 10 days, which are practically not subject to parasitological screening for the presence of strongyloides larvae. As a result, parasites spread and the quantitative indices of infestation in livestock populations increase. In the Republic of Moldova, human strongyloidiasis (*Strongyloides stercoralis*) was officially recorded for the first time in 1960. Human strongyloidiasis is detected in most cases incidentally. A total of 1551 patients were examined, including 1094 residing in urban areas. Among patients with hepatobiliary and gastrointestinal disorders and eosinophilia of unclear origin, the incidence of strongyloidiasis was 0.28%, 0.63%, and 2.32%, respectively, with a higher prevalence also observed in this case among patients from rural areas (0.28%, 1.08%, and 2.60%, respectively). Examination of population groups with a presumed increased risk of infection yielded the following values: foreign students-2.5%, workers in the sewerage network and pumping station operations-1.8%, workers at biological municipal waste treatment plants-1.16%, and students at auxiliary schools-0.93%. Studies conducted in rural areas of the central region of the republic established an overall prevalence of 0.39%, with 0.64% among children and 0.32% among adults. The prevalence of infection varies by locality, ranging from 0 to 1.31%. The prevalence of strongyloidiasis in rural areas can also be explained by the population's close contact with domestic animals, particularly with their feces.

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Keywords: *Strongyloidiasis, animals, human, Moldova.*

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ANTIMICROBIAL RESISTANCE: A ONE HEALTH PERSPECTIVE ON HUMAN AND ANIMAL

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Even though bacterial adaptation to antimicrobials was documented as early as the mid-20th century, the steady pipeline of novel therapeutic agents initially obscured the long-term dangers of this phenomenon.

In the current medical landscape, however, a profound stagnation in drug development combined with pervasive over-prescription has transformed antimicrobial resistance into an unprecedented global emergency. While clinical mismanagement in human healthcare remains a major catalyst, recent epidemiological investigations have increasingly scrutinized agricultural practices and their subsequent repercussions on human health. Within livestock industries, antimicrobials are deployed not only for treatment and prevention but also, more controversially, as non-therapeutic additives designed to optimize feed conversion and accelerate biomass accumulation.

The scientific community is currently polarized regarding mitigation priorities. One faction asserts that agricultural contributions are negligible compared to human clinical misuse, advocating for interventions focused strictly on patient prescription habits. Conversely, another camp warns of the systemic hazards posed by unmonitored veterinary drug administration, emphasizing the risk of resistant strains penetrating the human population via food supply chains.

Quantifying the exact fraction of human resistance generated by animal reservoirs presents immense methodological hurdles. Yet, postponing regulatory policies until undeniable foodborne evidence materializes creates a dangerous scenario where future interventions might prove ineffective. To address these multi-layered challenges, this forum integrates diverse perspectives from both human and veterinary practitioners to dissect the systemic complexity of resistance dynamics.

Keywords: *AMR, contamination, one health.*

UDC: 595.787:634

MECHANISMS OF *ZEUZERA PYRINA*-INDUCED STRUCTURAL DEGRADATION IN TREES

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The aim of this study is to investigate the mechanisms by which the xylophagous insect *Zeuzera pyrina* L. (*Lepidoptera: Cossidae*) contributes to the degradation of woody tissues in host plants, focusing on both mechanical damage and secondary biological processes that lead to structural failure. The analysis is based on a synthesis of existing scientific literature in entomology, forestry, and agricultural pest management, with an emphasis on larval behavior, host interactions, and wood decay dynamics.

A female *Z. pyrina* can lay up to 1,000 eggs in 5–7 days, and the larval survival rate is approximately 30%, which means that under ideal conditions, over 200 larvae can colonize a single tree. However, in practice, larval density depends on several factors, including host availability, climatic conditions, predation pressure, and hatching success. Studies in walnut orchards have reported 16–24% of trees infested, with galleries up to 50 cm long, with an actual number of larvae ranging from a few to several dozen, and never reaching the hundreds. *Z. pyrina* larvae have a larval cycle of 271–289 days depending on the host species, allowing them to excavate extensive galleries in the wood during this period. The newly hatched larvae remain clustered for a few days, then disperse to feed on tender tissue and eventually penetrate thick wood, where they excavate galleries. The larvae enter through cracks in the bark, the bases of young branches, or branch nodes. There is no evidence that they strictly prefer the top or the side, but they are more frequently found in young branches and the upper part of the trunk. A single larva can damage a branch in a single season, but massive infestations lead to the death of trees within 2–5 years, depending on larval density and climatic conditions. Young trees, under 10 years old, are the most vulnerable because their wood is softer and sap flow is more intense, facilitating larval penetration. Mature trees are more resistant due to the difficulty larvae face in penetrating hardwood, but they can be compromised within 4–5 years if the infestation is massive (10-40 larvae/tree). However, it has been determined that the main trunk and the base of the skeletal branches are the critical points. Larval galleries in these areas disrupt the flow of water and nutrients, leading to the drying out of the entire tree, even if other branches remain intact.

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Keywords: *tree borer, Zeuzera pyrina, tree structural degradation, insect pest.*

UDC: 631.42:631.559

THE PARTICULARITIES OF THE EVOLUTION AND SUSTAINABLE MANAGEMENT OF SOILS IN NURSERY PLANTATIONS

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The specific features of watermelon plantations imply a trend of anthropogenic transformation and substitution of natural mechanisms with technogenic impacts at all levels of functioning of the soil ecosystem. Soil management in them involves complex measures of synergistic sustainability of physical, chemical and biological parameters within agrobiotechnologies based on the intensification of typogenetic processes by increasing bioenergetic resources and reducing technogenic inputs. Through this prism of ideas in the period 2024-2025 in our research, a model of complex agrobiotechnology was substantiated and tested based on and sustainability of bio-physico-chemical, physico-chemical and coprolitic mechanisms of soil aggregation and structuring by incorporating at a depth of 22-27 cm once a year the bioorganomineral preparation "NEOFERT-S" of humic origin (2t/ha) and plant residues at a depth of 14-16 cm. Monitoring the structural-aggregate state of the soils highlighted the increase in the content of 2-1 mm aggregates, which indicates the regeneration of aggregation processes, and the increase in the degree of hydrostability of 2-1 mm aggregates indicates an increase in the content of coprolites in their composition.

Management of biological parameters included the combined use of the bioorganomineral preparation of humic origin "NEOFERT-M" and the algal preparation Chlorella vulgaris, which resulted in an increase in the biological activity of soil microflora, manifested in an increase in the reserves of microbial biomass and enzymatic activity. The latter resulted in an increase in the activity of polyphenoloxidase and peroxidase. The ratio between them (Muromtzev coefficient) varies in the range of 0.8-0.97 and indicates the intensive implementation of the humification process, and the integrative index of the evolution of biological parameters is the fractional composition of humus manifested in the values Cah:Caf predominantly > 1. Their dynamics during the vegetation period clearly indicates two consecutive stages in the implementation of the humification process: a) formation of humic substances and b) polymerization-condensation. The interconnected evolution of physical and biological parameters led to the increase in the content of nutrient elements in the soil and the balancing of the ratio between them.

Keywords: *organic organic mineral preparations, algae preparation, humus.*

UDC: 597.851:591.16(478)

REPRODUCTION AND REPRODUCTIVE BEHAVIOR OF FEMALES *PELOPHYLAX ESCULENTA* COMPLEX (*AMPHIBIA*) IN THE CONDITIONS OF THE REPUBLIC OF MOLDOVA

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This scientific paper reflects a detailed study of the reproduction and reproductive behavior of amphibian females of the *Pelohylax esculenta* complex (*Pelohylax ridibundus, Pelohylax. lessonae, Pelohylax esculentus*) from the natural and anthropized ecosystems in the Center Area of the Republic of Moldova. This study has been finalized with the elucidation of very important biological and ecological particularities, which consists in the gradual arrival of the females in the breeding stations where the males are located, throughout the reproductive period. Observations, collection and obtaining of scientific data on the *Pelophylax esculenta* complex were carried out in the Central area of the Republic of Moldova: the "Codrii" Reserve and its southwestern bordering sectors (taken as a model area of natural ecosystems) and the Botanical Garden (Institute) (as a model area of aquatic habitats with varying degrees of anthropization). Following the assessments carried out in the ecosystems of the Central Forests during the research period, we established that the appearance of the first individuals of *Pelophylax ridibundus* and *Pelophylax lessonae* in the breeding stations takes place in April, when the average air temperature exceeds 12.5^0 C, and the water temperature exceeds $+10^0$ C. The prompt and efficient initiation of the breeding process is determined, first of all, by the establishment of favorable thermal conditions; therefore, this process in the specimens of the complex varies in time from year to year.

Unlike the species P. ridibundus and *P. lessonae*, the species *P. esculentus* initiates its reproduction process later, when the air temperature reaches values of $+15$ $+20^0$ C, and the water temperature of $+13^0$ C.

This reproductive feature of females represents, in fact, an indispensable component of a more ample original ecological and ethological mechanism, designed to ensure reproductive success and, at the same time, to solve the interspecific competition of amphibians for reproductive habitats.

Acknowledgments: The research was carried out in the framework of the subprogram: 010701 of Moldova State University.

Keywords: *Pelohylax esculenta complex, females, reproduction and reproductive behavior, Republic of Moldova.*

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PELOPHYLAX RIDIBUNDUS (AMPHIBIA: RANIDAE) AS PARATENIC HOST

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Amphibians are the most primitive terrestrial vertebrate animals, which has preserved the aquatic and terrestrial way of life, being vectors of various parasitic agents. In some cases, amphibians participate not only at the contamination of domestic and wild animals, but are an important factor in maintaining their circulation in the nature and actively participate in the formation of parasitic zoonoses. The paper presents data on the identification of the helminth fauna structure of *Pelophylax ridibundus* species and the determination of its role as intermediate and paratenic host for various groups of vertebrate helminths. 84 specimens of *Pelophylax ridibundus* (26 - males, 31 - females, 27 - juveniles) from the Dniester River, border area of Talmaza village, Ștefan Vodă district, were helminthologically investigated. As result of helminthological investigations, it was established that the structure of the helminth fauna of *Pelophylax ridibundus* species is characterized by 13 species of helminths *(Haematoloechus variegatus Rudolphi, 1819; Codonocephalus urniger Rudolphi, 1819; Opisthioglyphe ranae Froelich, 1791; Paralepoderma brumpti Buttner, 1951; Prosotocus confusus Looss, 1894; Tylodelphys excavata Rudolphi, 1803; Diplodiscus subclavatus Pallas, 1760; Parastrigea robusta Szidat, 1928, Strigea falconis Szidat, 1928; Cosmocerca ornata Dujardin, 1845; Oswaldocruzia filiformis Goeze, 1782; Icosiella neglecta Diesing, 1851; Spirocerca lupi Rudolphi, 1809),* from 13 genera, 11 families *(Omphalometridae, Haematoloechidae, Plagiorchiidae, Lecithodendriidae, Diplodiscidae, Diplostomatidae, Strigeidae, Cosmocercidae, Molineidae, Onchocercidae, Spirocercidae),* 6 orders *(Plagiorchiida, Echinostomida, Diplostomida, Ascaridida, Strongylida, Spirurida), 2 classes (Trematoda, Secernentea) and 2 phylums (Plathelminthes, Nematoda).*

Therefore, the results of helminthological research revealed that the amphibians species *Pelophylax ridibundus* from the Ranidae family in the natural ecosystems of lower Dniester River is infested with 13 species of helminthes (trematodes - 9, nematodes - 4), as well as the identification of the nematode species *Spirocerca lupi* show the role of amphibians in maintaining and forming the foci of parasitic agents specific to vertebrates.

So, it was determined the role of amphibian species *Pelophylax ridibundus* in maintaining and forming parasitic foci of *Spirocerca lupi*, which causes Spirocercosis in vertebrates, and for which the amphibians serve as a paratene hosts.

Acknowledgments: The research was carried out in the framework of the subprogram: 010701 of Moldova State University.

Keywords: *Pelophylax ridibundus, Spirocerca lupi, paratenic host.*

UDC: 597.851:576.89:[712.28:58](478)

HELMINTHIC FAUNA OF THE *PELOPHYLAX ESCULENTA* COMPLEX FROM THE BOTANICAL GARDEN, SUM

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The biotope is one of the main factors determining the level of infestation, demonstrated by many authors. The level of infestation of animals, to a large extent, also depends on the human factor. In urbanized areas, mainly geohelminths are established, with a monoxenic development cycle. For these reasons, it is very important to know the structure of the helminthic fauna in amphibians, especially in urban areas.

This work is based on data, collected since 2013 untill 2025 within urbanised areas of the city Chisinau, in the Republic of Moldova. The investigations on this group of amphibians were conducted in the laboratory of Parasitology and Helminthology of the Institute of Zoology of the SUM and the identification of above-mentioned species was performed by classical deductive methods. The complex amphibia Pelophylax esculenta (*Pelophylax ridibundus, P. lessonae, P. esculentus*) were dissected for complete helminthological analysis by Skrjeabin, 1928. For helminthological studies the amphibians have been captured in 4 water basins.

It was established the infestation of amphibia complex (*Pelophylax ridibundus, P. lessonae, P. esculentus*) by 14 helminth species that belong to 3 classes (*Trematoda* – 9 species, *Secernentea* – 4 species and *Palaeacanthocephala* – 1 species), 3 orders, 6 families and 13 genera.

As a result of helminthological investigations of the species *P. ridibunda*, it can be concluded that the highest degree of helminth infestation was established in specimens collected from lakes no. 1 and 2. In the species *P. lessonae* it was established that the highest degree of helminth infestation is in those collected from lake no. 1. At the same time, helminthological research of the collected *P. esculenta* species shows that the highest degree of helminth infestation was established in the specimens from lake no. 4.

It was revealed that the infestation level with helminths of *Pelophylax* complex depends on basins, on helminths species as well as on host species.

In species *Pelophylax ridibundus* the infestation with 14 helminth species was registered; in *Pelophylax lessonae* – with 12 species and in *Pelophylax esculenta* – with 8 helminth species.

Therefore, the higher degree of helminth infestation of amphibians collected from lakes no. 1, 2 and 3 are due to the presence of biodiversity (insects, oligochaetes, amphipods, copepods, gastropods, reptiles, birds, mammals), which serve as intermediate hosts in the development cycle of the detected helminths.

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Keywords: *amphibia, helminth fauna.*

UDC: 504.4:614.84

MANIFESTATION OF VEGETATION FIRES THROUGH THE PRISM OF DISASTER RISK MANAGEMENT

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The purpose of this research was to analyze the natural conditions for the occurrence of wildfire phenomena in order to identify eligible solutions for the supervision and operation of early warning systems in order to protect life, health and property from natural disasters related to weather and climate, the environment, as well as and to contribute to the sustainable development of the country. Wildfires were mapped and analyzed, the vulnerabilities and risks related to their production were established, eligible solutions were proposed regarding the adaptation of early warning systems to the national specifics.

The research will propose support for structures with competences in the field and risks management functions to provide expert services for mitigating the dangers of disasters.

The results of the study were consolidated in the Wildfire Risk Map. The classes of pronounced and medium risk are dominant. Among the administrative districts with a high risk of wildfires are: Orhei, Călărași, Orhei, Strașeni, Criuleni, Ialoveni and the municipality of Chișinău, as well as Leova, Cantemir and Basarabeasca. According to statistical data, on the territory of the Republic of Moldova, there is an increased average probability of wildfires.

Keywords: *disaster risk; early warning system; risk management, wildfires.*

UDC: 556.3:528.9

ON THE ISSUE OF GEOSTATISTICAL ACCURACY OF INTERPOLATORS IN THE PREPARATION OF HYDROGEOLOGICAL MAPS

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The aim of this work is to study the accuracy of various mathematical interpolators in compiling hydrogeological maps (groundwater levels, hydrodynamic parameters, hydrogeochemical, etc.). For this purpose, interpolators of the Surfer program (12 methods) were used. A well-studied area (2.4 x 2.0 km in size), located on the northern outskirts of the town of Cimislia (Moldova) was used as a natural model. The subject of mapping are groundwater levels in an interval from 0.8 to 3.0 m.

A total of 12 methods were tested: Kriging, Modified Shepard, Radial Basis Functions, Inverse Distance, Minimum Curvature, Polynomial Regression, Triangulation with Linear Interpolation, Nearest Neighbor, Natural Neighbor, Moving Average, Local Polynomials, and Data Metrics. Geostatistical analysis of the maps shows that all methods do not fully match the natural model. Significant differences in accuracy are observed for the moving average, inverse distance, local polynomials, and polynomial regression methods. The remaining methods have varying degrees of agreement with the natural groundwater level. For quantitative comparison of cartographic models, complex analysis of linear correlation coefficients, cartographic sections and residual values of functional relationships was applied.

The data analysis demonstrate that three methods are the least suitable: inverse distance, natural neighborhood, and moving average. The best methods are the following: modified Shepard's method, nearest neighbor, minimum curvature, kriging, and triangulation with linear interpolation. It is interesting to see how the methods we analyzed correlate with each other. A quantitative measure of statistical relationship can be expressed as a linear correlation. According to these data, the modified Shepard's method correlates strongly with the local polynomial method (r^2 = 0.680), kriging (r^2 = 0.657), natural neighborhood (r^2 = 0.60), triangulation with linear interpolation (r^2 = 0.544) and minimum curvature (r^2 = 0.432).

Acknowledgments: This study was supported by the research project 010902 “Complex geological - hydrogeological and geochemical studies on the development of underground natural gas storage facilities in the Central-Western part of the Republic of Moldova (theory, methodology and feasibility”, funded by Moldova State Program for 2024-2027.

Keywords: *groundwater, underground gas storage, Moldova.*

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ASSESSMENT AND OPTIMIZATION OF THE HYDROLOGICAL REGIME OF LAKE BELEU

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Lake Beleu is one of the most important natural aquatic ecosystems in the lower Prut River basin and plays a significant ecological role within the Lower Prut Biosphere Reserve. In recent years, concerns regarding the silting and potential drying of the lake have intensified due to climate change, hydrological alterations, and inadequate management of the hydraulic connection between the lake and the Prut River. The present study aimed to assess the influence of the hydrological regime of the Prut River on the hydrological state of Lake Beleu and to identify measures for optimizing the lake's hydrological balance.

The research was based on hydrological field investigations, topographic analysis, discharge measurements, water balance assessment, and mathematical modelling of lake filling and drying processes. Measurements were conducted at the inflow and outflow channels connecting the lake to the Prut River during different hydrothermal periods in 2024–2025.

The results demonstrated that the hydrological regime of Lake Beleu is strongly dependent on the hydrological regime of the Prut River. Significant seasonal decreases in inflow discharge and increased evaporation during summer and autumn periods negatively affect the lake water balance. Mathematical modelling showed that maintaining a minimum inflow discharge of approximately 2.0 m^3/s is essential to prevent negative water balance conditions and ecological degradation of the lake ecosystem.

The study highlights the necessity of implementing permanent hydrological monitoring, improving hydraulic infrastructure, and establishing an integrated hydrotechnical management system for the lake. The proposed measures would contribute to maintaining ecological stability, preventing excessive drying, and supporting the sustainable management of this valuable wetland ecosystem.

Keywords: *Beleu lake, hydrological regime, Prut river, water flow.*

UDC: 551.583:556.51(478)

ANALYSIS OF CLIMATE SCENARIOS FOR THE BOTNA BASIN

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Climate change represents one of the greatest challenges for the Republic of Moldova, affecting the environment, economy, and society. Due to its location in a temperate-continental climate zone, the country is increasingly exposed to extreme weather events such as droughts, heatwaves, torrential rains, and land degradation. The study highlights the impact of climate change on desertification processes and water resources, using high-resolution climate data provided by the WorldClim platform and CMIP6 climate models under the SSP2-4.5 scenario for the period 2021–2040.

The results indicate a continued warming trend, with increases in average seasonal temperatures, especially during summer and autumn. These changes are expected to intensify evapotranspiration, climate aridization, and drought risk, particularly in the southern and southeastern regions of the country. At the same time, an increase in the number of heat stress days and a reduction in soil water reserves are projected. Although seasonal precipitation may show slight increases, rainfall distribution is expected to become more uneven and concentrated in short, intense episodes, increasing the risk of soil erosion and flash floods.

Moldova's water resources are significantly affected by these processes, including the flow of small rivers such as the Botna River, which is highly vulnerable to climate change and anthropogenic pressure. In this context, adaptation and sustainable management measures are essential, including the modernization of hydrotechnical infrastructure, efficient water use, and the promotion of drought-resilient agricultural technologies. The study emphasizes the importance of climate monitoring and the implementation of environmental policies to ensure a sustainable future.

Keywords: *climate change, climate scenarios, botna basin, air temperature, precipations.*

UDC: 631.445.4:631.61(478)

AGROGENETIC PECULIARITIES OF THE EVOLUTIONARY PROCESSES OF THE STRUCTURAL-FUNCTIONAL ORGANIZATION OF ARABLE CHERNOZEMS IN THE PRUT AND DNIESTER AREA

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Under natural conditions, the structure of chernozems is constantly renewed through bio-physico-chemical, biogenic (microbiota activity), coprogenic (mesofauna activity) and root mechanisms.

The inclusion of chernozems in the agricultural circuit and their intensive use have led to the disruption of the specified mechanisms, with the implication of an agrogenic-natural trend of evolution of the structural-functional organization.

In this sense, our research has shown that the evolution of the aggregate structure of arable chernozems is determined by two groups of opposite processes: a) biopedogenic integration of abiotic and biotic matter with the formation of lumpy-grained chernozem aggregates and b) agrogenic metastructuring - a complex of processes of mechanical deterioration of the native structure (bio-pedogenic), redistribution of organo-mineral components and their association in pseudoaggregates with dimensions identical to those of bio-pedogenic, but with reduced mechanical and hydrological stability and less favorable properties (aggregate density, porosity) and water capacity.

The first and most widespread and common to all arable chernozems in the region stage of degradation of the chernozem structure is bouldering, materialized in structural formations > 10 mm.

The key factors that favor the bouldering of the chernozem structure are the mechanical damage of structural aggregates > 2 mm, accompanied by its accelerated dehumification as a result of the intensification of the mineralization process, the formation of structured mass and the alternation of its wetting-drying with the formation of aggregate formations > 10 mm.

The main factor that favors bouldering is dehumification materialized in the unidirectional reduction of humus reserves.

According to our research, under conditions of physical clay contents (< 0.01 mm) > 50% and illite-montmorillonite composition of the fraction < 0.005 mm, the risk of bouldering tends to zero when the humus content is > 6% (clayey soils) and > 8% (clayey soils).

Through this prism of ideas, more recent research has shown that in the arable chernozems of the region the maximum humus content is 4-5%, with those with humus content of 3-4% and < 3% being predominant. Consequently, the degree of bouldering in the chernozems of the region ranges from 10-15% (humus content 4-

5%) to 30-35% (humus content 3-4%) and > 35% (humus content < 3%).

When moistened, aggregates > 10 mm easily break apart, as a result, bouldering is accompanied by the dusting of the structure manifested in a 3-5-fold increase in the content of microagregates (< 0.25 mm), with the implication of the risk of crusting and compaction of the agrogenic layer.

Significant changes also occur in the 2-10 mm aggregates, manifested in the compaction of the 7-2 mm aggregates, the compactness of which increases by 0.12-0.37 g/cm3 as their diameter decreases. As a result, the aggregate porosity decreases and makes up 38-32%, decreasing with the decrease in the diameter of the aggregates. The composition of the aggregate porosity is dominated by pores < 10 μm occupied by physically bound water.

The self-reproduction of the mechanisms for the regeneration of the chernozem structure is limited by the small amounts of freshly formed humic substances as a result of the changes in the direction and intensity of the integral process of mineralization-humification of organic matter, caused by the unidirectional, including aggregate degradation, of chernozems. This implies the need to review the paradigm of the management of arable chernozems by practicing technologies based on the synergistic-controlled reproduction of the humification and aggregation-structuring processes.

Acknowledgments: This work was supported research subprograms 010801, 010102 funded by the Ministry of Education and Research, Republic of Moldova.

Keywords: *chernozems, soil structure degradation, dehumification, aggregate stability*.

UDC: 631.445.4:631.43(478)

HETEROGENEITY OF THE PHYSICAL STATE OF ARABLE CHERNOZOMS: AN EVOLUTIONARY APPROACH

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The evolution of chernozems within the current stage of anthropo-natural chernozem pedogenesis is primarily determined by the physical state of the soils.

In this context, our previous research has shown that physical degradation processes manifest themselves at all levels of structural-functional organization of its physical system and materialize in unfavorable changes in the structural-aggregate composition, compaction-settlement-slitting of the soil mass, changes in the quantitative and qualitative characteristics of the porous space, degradation of hydrophysical properties.

Their uneven realization in space led to the triggering of a new form of agrogenic degradation – the spatial heterogeneity of physical properties and regimes, this becoming one of the key forms of agrogenic degradation of arable chernozems.

Through this prism of ideas, we consider the heterogeneity of physical properties, manifested in the heterogeneity of pedogenetic and pedofunctional regimes, to be an integrating effect of anthropogenic impacts and the main factor that determines the meaning and significance of typogenetic and secondary processes, which are identical by virtue of the identity of the factors/technologies that influence them.

This process, over time, transfers the soil cover from a homogeneous state to an inhomogeneous state in which neighboring microspaces can be cardinally distinguished from each other by their basic physical properties.

The main forms of inhomogeneity of the physical state of arable chernozems determined by structural degradation are:

1. Inhomogeneity of the structural-aggregate process (aggregate formation);
2. Inhomogeneity of the state of aggregation, consolidation of the soil mass, aridification;
3. Redistribution of moisture and favoring seasonal overwetting.

Structural degradation entails the degradation of the humification process.

Acknowledgments: This work was supported research subprograms 010801, 010102 funded by the Ministry of Education and Research, Republic of Moldova.

Keywords: *physical properties and regimes, spatial heterogeneity, physical condition, physical degradation, arable chernozems.*

UDC: 631.431.1:635.21

EFFECT OF SOIL BULK DENSITY ON YIELD OF POTATO VARIETY SKARBNYTSIA

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The research objective was to investigate the effect of soil bulk density on the productivity of the early-ripening potato variety Skarbnytsia, taking into account its biological characteristics. The scientific research was conducted at a stationary field experiment of the Institute for Potato Research of the NAAS in the first field of a four-course crop rotation on an area of 1.5 hectares. The experimental design included nine treatments in which different types, rates, and methods of fertilizer application were studied. Analysis of the results obtained showed the effectiveness of using green manure biomass and organic fertilizers. According to three years of research, it was established that in all experimental treatments, soil bulk density for potato was rather high, ranging from 1.25–1.35 g/cm³ (optimal range 1.05–1.15 g/cm³).

The research established that, across all experimental treatments, the soil bulk density for potato was slightly higher than optimal, ranging from 1.25 to 1.35 g/cm³. The highest bulk density, 1.31–1.35 g/cm³, was observed in treatments where different rates of mineral fertilizers were applied and foliar fertilization was conducted, against a background of a double green manure fallow. The lowest soil bulk density, 1.25–1.28 g/cm³, was noted in treatments where green manure biomass was incorporated and 40 t/ha of manure was applied.

Yield indicators were to some extent dependent on soil bulk density. This trend is clearly observed in treatments with organic fertilizer application. At a soil bulk density of 1.25 g/cm³, maximum potato yield was achieved, amounting to 35.0–34.5 t/ha, respectively. However, quite high yield indicators are also observed at the highest soil bulk density values. This is primarily explained by the application of balanced rates of mineral fertilizers, as well as the use of foliar fertilization products. Accordingly, yields were 31.9–34.3 t/ha.

In treatments where only foliar fertilization was applied against a background of double green manure fallow, the bulk density indicator had no effect on potato yield. Thus, at bulk densities of 1.25 and 1.31 g/cm³, yields remained practically at the same level of 29.8 and 29.9 t/ha.

Therefore, the selection of soils with optimal bulk density, as well as balanced fertilization, will allow obtaining high potato tuber yields. It was established that maximum potato yield of 35.0 t/ha was achieved at a soil bulk density of 1.25 g/cm³.

Keywords: *potato, variety, bulk density, fertilization, yield.*

UDC: 528.8:632.125(478)

MONITORING DESERTICIFATION PROCESS IN MOLDOVA USING THE REMOTE SENSING

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This study examined approaches for monitoring aridization and desertification processes in the southern part of the Republic of Moldova, focusing on the Ialpug River Basin. In recent decades, desertification has increasingly been recognized as a global environmental threat, affecting not only traditionally arid and semi-arid regions, but also areas where climate variability, increasing drought frequency and duration, as well as unsustainable land use have intensified land degradation risks. Southern Moldova is recognized as particularly vulnerable due to increasing temperatures, irregular precipitation, recurrent droughts, high dependence on rain-fed agriculture and growing pressure on soil and water resources.

The research focuses on the use of remote sensing to assess spatial and temporal changes in land surface conditions. Freely available satellite data, such as Sentinel-2 mission, were used to analyse vegetation condition, land surface dynamics and potential degradation patterns. The main indicators applied included the Normalized Difference Vegetation Index (NDVI), land surface temperature, land cover change. These were complemented by climate-based indices, particularly the Standardized Precipitation Index (SPI) and the Standardized Precipitation Evapotranspiration Index (SPEI), calculated from the observed data. The combined use of remote sensing and climate indicators made it possible to assess the trends.

The results of the study showed that the aridization process is ongoing in the recent period in the Southern part of Moldova, being reviewed on the basis of remote sensing indicators, and validated by the SPI and SPEI indicator values. The findings confirmed the relevance of integrating satellite-based indicators with climate indices for land degradation monitoring and demonstrated the need to adapt land management and agricultural practices to current and future climate conditions.

Keywords: *remote sensing, desertification, Moldova, NDVI, SPI.*

UDC: 550.4:556.3(478)

ECOLOGICAL ASPECTS OF THE STUDY OF EQUILIBRIUM OF GROUNDWATER WITH ROCK MINERLAS

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The aim of this study is to identify the characteristics of groundwater-rock interactions by modeling secondary mineralization processes in drinking groundwater. The shallow aquifers of Chisinau and the confined Lower Sarmatian aquifer in north-central Moldova were selected as representative research objects. Equilibrium calculations were performed using the HydroGeo computer program. To determine the degree of equilibrium for individual minerals, we used the method for constructing mineral stability fields developed by R.M. Garrels and C.L. Christ, as well as the saturation index (Si).

Despite the high rate of water exchange and the short time of interaction between Chisinau shallow groundwater and the rock matrix, equilibrium with many carbonate minerals is nevertheless established. As a result of this interaction in the water-rock system, most of the elements released into solution are bound by newly formed secondary minerals, such as calcium, calcite, and dolomite. This circumstance allows the studied groundwater to be classified as belonging to the carbonate-forming geochemical type according to Shvartsev's classification. The observed equilibrium with calcite confirms the presence of an early stage of groundwater evolution, which is accompanied by relatively low mineralization values (less than 1 g/dm^3) due to the presence of hydraulic connections with surface water and precipitation. It is at these points that the equilibrium with carbonates shifts toward undersaturation. Given that the interaction of waters with aluminosilicates, which are widespread in this area, continues, carbonate formation processes play a significant role in the current stage of groundwater composition in Chisinau. Lower Sarmatian groundwater in north-central Moldova is primarily saturated with calcite and dolomite. A study of their interaction with rocks revealed that they are in equilibrium with muscovite, kaolinite, gibbsite, Ca-montmorillonite, Na-montmorillonite, and illite, but do not reach equilibrium with anorthite and analcime. This area is of great interest due to the widespread occurrence of soda-rich groundwater and the formation of unique secondary mineral formations.

Acknowledgments: This study was supported by the research project 010902 "Complex geological - hydrogeological and geochemical studies on the development of underground natural gas storage facilities in the Central-Western part of the Republic of Moldova (theory, methodology and feasibility", funded by Moldova State Program for 2024-2027.

Keywords: *groundwater, geochemical equilibrium, Moldova.*

UDC: 502:556.3(478)

ON THE HYDROGEOLOGICAL ECOLOGY OF MOLDOVAN UNDERGROUND GAS STORAGES

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The scientific argumentation for the creation of a large Moldavian underground gas storage (UGS) facility necessitated an assessment of its impact on groundwater. For this purpose, 3D modeling of the geological environment, mathematical statistics, and machine learning were used. A comprehensive study of the gas storage-aquifer-Prut River system was conducted.

For UGS location Ungheni (Moldova) area is selected. Groundwater occurs in Quaternary sediments and rocks of the Middle and Lower Sarmatian, Cretaceous, Silurian, and Cambrian periods. Only unconfined groundwater is suitable for water supply. Unconfined aquifers are without hydrodynamic pressure, while confined aquifers are highly pressured. There is a hydrodynamic connection between them, as well as with the Prut River.

The UGS facility will utilize depths ranging from 150 to 700 meters. The UGS has a specific impact on the geological environment, particularly groundwater. Both gas extraction and injection change the volume of fracture and pore space, intra-formational pressure, and the properties of the water itself. Geochemical interactions between host rocks, groundwater, organic matter, and dissolved gases are disrupted within the reservoirs. As a result of secondary migration, free gas will migrate in aquifers used for water supply. This also alters the groundwater regime and level, the water regime of soils, salinization, groundwater pollution, and increases the content of phytotoxic elements in water and air. Furthermore, during the construction and operation of UGS facilities, processes of gas diffusion and dissolution in water occur.

Measures are proposed to minimize the impact of the UGS facility on groundwater. Key measures include the creation of a groundwater monitoring network, modeling of ionic equilibrium in groundwater, and the development of a statistical model of groundwater behavior under the influence of the UGS.

Acknowledgments: This study was supported by the research project 010902 "Complex geological - hydrogeological and geochemical studies on the development of underground natural gas storage facilities in the Central-Western part of the Republic of Moldova (theory, methodology and feasibility", funded by Moldova State Program for 2024-2027.

Keywords: *groundwater, underground gas storage, Moldova.*

UDC: 631.147:602.6

VALORIZATION OF SOYBEAN AGRIFOOD WASTE AS A SUSTAINABLE RAW MATERIAL

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Soybean (*Glycine max* (L.) Merr.) stands as one of the world's most vital crops for food, feed, and industrial production, yet it generates considerable agricultural waste that remains vastly underutilized. This study investigated the lignocellulosic profile and protein content of soybean pods harvested from four distinctive genotypes—three commercial cultivars (Selena, Lela, and Black soybean) and one Experimental line 183—to evaluate their dual-purpose potential as sustainable protein sources and for bioremediation applications. The crop residues presented an average dry matter baseline of 91.67% ± 0.37% and a collective mean protein concentration of 5.50% ± 0.71%. Significant compositional variances were detected among the genotypes. The variety Lela exhibited the highest individual protein content at 6.39% ± 0.04%, positioning its pods as a highly viable substrate for value-added protein extraction. Conversely, the variety Selena demonstrated a significantly higher accumulation of fiber, yielding an average neutral detergent fiber (NDF) of 62.78% ± 0.33%, acid detergent fiber (ADF) of 43.86% ± 0.57%, and cellulose content of 33.49% ± 1.79%. Lignocellulose fractions showed similar content across the remaining samples, with Black soybean exhibiting the lowest recalcitrant lignin fraction (ADL) at 9.17% ± 0.04%, which may facilitate less energy-intensive biochemical processing. While all evaluated soybean pod samples serve as rich lignocellulosic reservoirs, specific genotypes like Selena show the most promise for heavy metal adsorption or bio-composite bioremediation frameworks due to elevated cell wall fractions, whereas Lela serves as an optimal candidate for biomass protein upcycling. Tailoring the upcycling pathway to the specific genotypic profile can drastically reduce agricultural waste and improve the economic sustainability of global soybean cultivation loops.

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Keywords: *Glycine max, agricultural by-products, lignocellulose, protein, biomass.*

UDC: 556.18:004.9:504.4

GIS DATA AND DIGITAL TOOLS FOR SURFACE WATER POLLUTION MANAGEMENT

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Surface water pollution is often managed through fragmented information: field notes, photographs, laboratory measurements, installation records and location data are stored separately, making it difficult to understand where problems are concentrated and how restoration measures change site conditions. The purpose was to integrate GIS data, digital monitoring records and nature-based floating treatment wetland installations into one operational view of polluted or vulnerable water bodies. The implemented approach combines georeferenced site records, water-body and locality information, installation type, deployment status, field observations, photographs, maintenance notes and selected water-quality or condition indicators in a web-based knowledge hub and installation map. Each location becomes a digital site profile linking the ecological problem, the installed or planned solution and follow-up monitoring.

The showcased records include floating wetland projects on the Raut and Bic river systems, where installations serve as ecological treatment measures and fixed reference points for inspection, plant development assessment and comparison over time. GIS visualization helps communicate the spatial distribution of projects, identify pollution-sensitive areas, prioritize future monitoring and support discussions with public authorities, communities and private water-body managers. The main result is a practical decision-support workflow that transforms individual restoration activities into mapped, updateable evidence. This improves transparency, supports maintenance planning and creates a stronger connection between field observations and water-management decisions. The article concludes that combining GIS data with simple digital monitoring tools makes surface water pollution more understandable, visible and actionable. The digital layer turns separate interventions into a scalable knowledge system for documenting actions, tracking change and guiding future nature-based remediation

Acknowledgments: This study was supported by the ZIUZEA SRL team.

Keywords: *surface water pollution; GIS; digital monitoring; water quality; floating wetland.*

UDC: 631.42:595.796:504.5

SOIL METAL POLLUTION SHAPES ANT BIOMARKER RESPONSES

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Soil contamination with metals and metalloids represents a long-term environmental pressure in industrially affected terrestrial ecosystems. This study aimed to evaluate whether cumulative soil contamination is associated with oxidative and neuroenzymatic biomarker responses in two ant taxa, *Lasius niger* and *Tetramorium cf. caespitum*, collected along a pollution gradient in the Copșa Mică–Micăsasa–Țapu area, Sibiu County, Romania. Eight sites from the historically impacted Copșa Mică area and one local low-contamination reference site from Țapu were investigated. Soil concentrations of potentially toxic elements were determined by ICP-MS, and cumulative contamination was integrated using a Pollution Load Index calculated for toxicologically relevant elements. In ants, antioxidant enzymes, reduced glutathione, lipid peroxidation, protein carbonyls and acetylcholinesterase activity were measured using spectrophotometric assays.

The soil analysis confirmed a non-uniform but clearly defined contamination gradient, with relevant exceedances for several elements, particularly arsenic, cadmium, zinc and lead. Both ant taxa showed significant site-dependent biomarker variation. Antioxidant enzymes, glutathione-related responses, oxidative damage markers and acetylcholinesterase activity were generally increased at polluted sites compared with the local reference site, with the strongest biological responses frequently observed at CM1 and CM5. *L. niger* showed broader antioxidant activation across several Copșa Mică sites, whereas *T. cf. caespitum* displayed a more localized but pronounced response pattern. Site-level correlation analysis indicated positive associations between the Pollution Load Index and all measured biomarkers in both taxa, supporting coordinated covariation between cumulative soil contamination, oxidative stress and neuroenzymatic modulation.

Overall, the findings indicate that chronic soil metal contamination reshapes redox and cholinergic biomarker profiles in ants. The combined assessment of soil chemistry and functional biomarkers may therefore provide a useful field-based approach for monitoring sublethal biological effects in industrially impacted terrestrial ecosystems.

Keywords: *ants; soil contamination; metal pollution; oxidative stress; acetylcholinesterase.*

UDC: 581.9(478-21)

FLORA OF SOME URBAN ECOSYSTEMS OF THE REPUBLIC OF MOLDOVA: COMPARATIVE ANALYSIS

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The flora of anthropized ecosystems is represented by both apophytic and anthropophytic species. In the case of urban ecosystems, the number of taxa is much lower, compared to the flora of natural ecosystems, where is no any impact.

The studies were conducted in the following urban ecosystems in the Republic of Moldova: Orhei, Telenești, Bălți, Cahul and Cimișlia, during the years 2015-2025. Only uncultivated synanthropic plants were included in the list of species. In order to have a clearer picture of the comparative analysis of the number of taxa, both the numerical and the percentage comparative analysis of them were performed.

The analysis of the taxonomic structure of the flora in the urban ecosystems studied highlighted the presence of 328 species, belonging to 269 genera, distributed in 73 families. The comparative analysis of the floristic spectrum of the studied urban ecosystems shows that the most representative, by *the number of species*, is the Cahul urban ecosystem, with 155 species (47% of the total species). With a practically identical number of species, the urban ecosystems were highlighted: Bălți – 151 species, Orhei and Telenești – 150 species each (46% for each). The poorest in species proved to be the Cimișlia urban ecosystem, represented by 118 species (36%). In some cases, the number of species is equal to *the number of genera*: in Cimișlia – 98 genera (36% of the total recorded genera) and in Telenești – 123 genera (46%). For the other urban ecosystems, a different ratio is recorded: for Bălți – 117 genera (43%), for Cahul – 133 genera (49%), for Orhei – 138 genera (51%). In terms of *the number of families*, the poorest is the Bălți urban ecosystem, with only 37 families (51% of the total families). For the other urban ecosystems, the number of families is practically equal: for Cimișlia – 41 families (56%), Cahul – 42 families (58%), Orhei – 44 families (60%) and Telenești – 45 families (62%).

Of those presented, the Bălți and Cimișlia urban ecosystems are more disadvantaged, from a taxonomic point of view, a primary factor being the impact of the anthropogenic factor.

Acknowledgments: This study was supported by the institutional project (*010801 (2024-2027): Increasing ecological security and resilience of geo-ecosystems to current environmental changes*), funded by (*State command*).

Keywords: *families, genera, species, comparative analises, urban ecosystem.*

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SAKER FALCON *(FALCO CHERRUG)* IN THE REPUBLIC OF MOLDOVA: STATUS AND TRENDS

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The Saker Falcon *(Falco cherrug)* is a diurnal bird of prey that formerly nested in tall trees in forest ecosystems. Currently, the species has largely abandoned forest habitats and is predominantly established in the southern part of the Republic of Moldova, using raven *(Corvus corax)* nests on high-voltage power line pylons. It is a partially migratory species; adults typically remain in the vicinity of their breeding territories, while younger individuals tend to disperse or migrate. In the Republic of Moldova, the species is most frequently recorded from late March until the first half of November, though some individuals have also been observed during winter.

The present study includes the analysis of more than 35 bibliographic sources published between 1959 and 2025, with records dating back to 1956. In older literature the species also appears as *Falco cherrug danubialis* or *Hierofalco cherrug danubialis.*

During the 1950s–1960s, the Saker Falcon was a relatively common species in the Republic of Moldova. Since 1962, it has been legally protected and was included in the Red Book of the Moldavian SSR (1978) as a rare species; however, after 1980 it has been considered very rare. The population underwent a marked decline over time: until 2005, 10–13 breeding pairs were reported, whereas at present no confirmed breeding pairs are known. The species benefits from both national and international protection, being included in the Bern Convention, the Bonn Convention, CITEX (Appendix II), the IUCN Red List, and the Red Books of the Republic of Moldova, Romania, and Ukraine.

Acknowledgments: The study was carried out within the framework of the project: PN-IV-PCB-RO-MD-2024-0274; 25.80013.5107.21ROMD "Cross-border assessment of population trends in bird species as bioindicators in relation to climate change and land use".

Keywords: *Saker Falcon, population status, Republic of Moldova.*

UDC: 628.35:543.3(478-21)

EVALUATION OF THE QUALITY OF THE EFFLUENT FROM THE BIOLOGICAL TREATMENT PLANT USING PHYSICO-CHEMICAL PARAMETERS, BĂLȚI MUNICIPALITY, REPUBLIC OF MOLDOVA

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The rivers of the Republic of Moldova are affected by very serious pollution, as a result of wastewater effluents generated by wastewater treatment plants. Wastewater treatment plants represent an important part of urban water infrastructure in reducing pollutants and protecting aquatic ecosystems. Currently, urban ecosystems are facing increasingly stringent requirements regarding the quality of effluents discharged into the outfall, which can lead to contamination of water bodies with various pollutants. Thus, the present study aimed to chemical evaluation of the effluent from the biological treatment plant, Bălți municipality, during the period 2023 - 2024. This system includes a wastewater treatment plant that uses the activated sludge process. The water samples were analyzed for 8 physicochemical parameters (pH, chemical oxygen demand, biochemical oxygen demand, suspended solids, ammonia nitrogen, nitrites, nitrates, total phosphorus). Sampling and laboratory testing were performed according to standard methods. The results were processed and compared with the permissible limit values for effluent discharge into the outfall. According to the results obtained, a low efficiency of ammonium nitrogen removal, representing a major nitrogen pollutant, was observed. On the other hand, in the case of ammonia nitrogen removal, the effluent is enriched with nitrites and nitrates, which are mainly due to the oxidation of nitrogen through the nitrification process. High levels of nitrates and nitrites in the effluent could indicate deficiencies in the denitrification process. This suggests that denitrification does not appear to have occurred properly, leading to higher levels in the effluent. Also, phosphorus is not completely removed, exceedances were observed in both the cold and warm seasons. The results showed good efficacy (approximately 90%) of the treatment in terms of organic matter, represented by the quality parameters of suspended matter, chemical and biochemical oxygen demand. However, the reduction of nutrients was limited, indicating the niche that requires improvements in the treatment process. Therefore, the major nitrogen and phosphorus loads discharged into the outfall, contribute significantly to the degradation of the entire aquatic ecosystem, especially through the abundant growth of aquatic plants.

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Keywords: *wastewater treatment plants, water quality parameter, denitrification, aquatic ecosystem.*

UDC: 598.2:502.1(478)

BIRDS FROM THE RED BOOK OF THE REPUBLIC OF MOLDOVA WITHIN THE "ORHEIUL VECHI" CULTURAL-NATURAL RESERVATION

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Rezervația Cultural-Naturală „Orheiul Vechi”, situată în valea cursului mijlociu al râului Răut, reprezintă un complex natural mozaicat, care include biotopuri forestiere, stepice, petrofite și de luncă, asigurând existența unui număr semnificativ de specii rare de păsări.

Pentru cercetări au fost aplicate metode standard: transecte de rută, observații vizuale, înregistrarea vocalizării și fotofixarea speciilor.

În perioada 2024–2026, pe teritoriul rezervației au fost înregistrate 22 de specii incluse în Cartea Roșie a Republicii Moldova. Dintre speciile asociate complexelor stâncoase și forestiere a fost semnalat Bubo bubo, înregistrată în zona pârâului Draghinici. Complexul faunistic forestier este reprezentat de porumbelul de scorbură Columba oenas, Dendrocopos medius, Dryocopus martius, Picus viridis și Ficedula hypoleuca, asociate în principal cu stejărișurile bătrâne din trupurile forestiere „Trebujeni” și „Țiganca”.

Dintre păsările spațiilor deschise au fost înregistrate Hieraaetus pennatus, Circus cyaneus și Circus pygargus. În habitatele de tranziție, unde pădurea se învecinează cu spațiile deschise, au fost observate Clanga clanga, Milvus migrans și Pernis apivorus. Milvus migrans cuibărește în valea Răutului (1–2 perechi), iar identificarea unei perechi de Pernis apivorus în valea „Morovaia” indică o probabilă cuibărire a speciei.

Biotopurile de luncă și zonele umede au o importanță deosebită pentru Ciconia ciconia, Ciconia nigra, Egretta alba, Porzana porzana, Cygnus olor. În perioada de iarnă, Egretta alba devine una dintre cele mai numeroase specii asociate ecosistemelor acvatice, iar Tadorna ferruginea a fost înregistrat în iarna anilor 2025–2026 în apropierea satului Paharniceni. De asemenea, în perioada rece a fost observat la vânătoare Haliaeetus albicilla.

Un reprezentant rar al biotopurilor stepice este Coracias garrulus, înregistrată în apropierea satelor Morovaia și Mașcăuți, lângă abrupturile argiloase și versanții deschiși.

Rezultatele obținute confirmă importanța Rezervației Cultural-Naturale „Orheiul Vechi” ca refugiu esențial pentru conservarea speciilor rare de păsări și a diversității avifaunistice din centrul Republicii Moldova.

Acknowledgments: *Studiul a fost realizat în cadrul monitorizării faunistice de lungă durată, desfășurate de Direcția Patrimoniu Natural și Biodiversitate a Rezervației Cultural-Naturale „Orheiul Vechi”.*

Keywords: *Păsări rare; Cartea Roșie; biotopuri; Rezervația „Orheiul Vechi”.*

UDC: 502.3:614.72(478)

ASPECTS CONCERNING ATMOSPHERIC AIR QUALITY IN SOME URBAN ECOSYSTEMS IN THE SOUTHERN REGION OF THE REPUBLIC OF MOLDOVA

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Air quality in the Southern Region of the Republic of Moldova is largely determined by road transport. Industrial activity is limited. In this region, agricultural products processing and processing enterprises predominate. Air quality is also determined by the activity of the Cuciurgan Thermal Power Plant and the Galati Steel Plant.

The Southern Region is crossed by some international traffic arteries, which connect the Cahul, Reni customs posts, Giurgiulesti International Port with the district centers in the area.

The Inspectorate for Environmental Protection is responsible for monitoring emissions from fixed sources. The latter systematically carries out checks on economic agents regarding the volume of emissions, the condition of capture filters, etc. For the year 2024, planned and unplanned controls were carried out in some urban ecosystems in the Southern Region.

At the moment, the Environmental Agency does not have permanent air quality monitoring stations in the Southern Region. For these reasons, it is more complicated to estimate the situation in this region using direct methods.

Acknowledgments: The research was carried out in Project 010801 - "Increasing environmental security and resilience of geo-systems to current environmental changes" from the State Program of the State University of Moldova.

Keywords: *urban ecosystem, air quality, southern region, emissions.*

UDC: 639.1.052:591.9(478)

ECOLOGICAL BASIS FOR SUSTAINABLE MANAGEMENT OF SEDENTARY GAME SPECIES IN MOLDOVA

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The sustainable management of game species requires comprehensive knowledge of their population dynamics, habitat requirements and ecological interactions. Sedentary game species represent an important component of hunting resources in the Republic of Moldova and contribute significantly to biodiversity conservation and ecosystem functioning. The aim of this study was to assess the biological and ecological characteristics of the main sedentary game species and to develop scientifically based recommendations for their sustainable management.

The research was conducted during 2021–2026 in hunting grounds located in different ecological regions of the Republic of Moldova. Population assessments were carried out using direct observations, transect counts, footprint surveys, camera trapping and habitat evaluations. The study focused primarily on European hare (*Lepus europaeus*), grey partridge (*Perdix perdix*), pheasant (*Phasianus colchicus*) and other resident game species. Data on abundance, spatial distribution, habitat preferences, reproductive performance and limiting factors were collected and analyzed.

The results revealed significant differences in population density and distribution among species and regions, mainly influenced by habitat quality, agricultural practices, predation pressure and anthropogenic disturbance. Habitat fragmentation and the reduction of suitable feeding and breeding areas were identified as major constraints affecting population viability. At the same time, biotechnical measures, supplementary feeding, predator management and habitat improvement demonstrated positive effects on local population stability and reproductive success.

The study highlights the necessity of integrating ecological monitoring, habitat management and adaptive harvest regulations into the national hunting management system. The proposed management framework contributes to the conservation of sedentary game species while ensuring their sustainable use as renewable wildlife resources in the Republic of Moldova.

Acknowledgments: The study was performed within the doctoral project „Sedentary game species – ecology, importance, sustainable management" funded by the Ministry of Education and Research.

Keywords: *sedentary game species, wildlife management, population ecology, sustainable hunting, Republic of Moldova.*

UDC: 581.55:502.1(478)

SYNTAXONOMIC CONSPECTUS OF THE VEGETATION OF THE DOBRUȘA LANDSCAPE RESERVE

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This study presents a synthesis of plant community diversity within the Dobrușa Landscape Reserve based on phytosociological investigations conducted between 2022 and 2026. The research is based on phytosociological relevés recorded according to the Braun-Blanquet approach and interpreted using contemporary principles of syntaxonomic classification in accordance with the provisions of the International Code of Phytosociological Nomenclature. Plant communities were arranged hierarchically into classes, orders, alliances, suballiances, associations, subassociations, and facies based on their floristic composition, structural characteristics, and ecological particularities. The syntaxonomic classification of the vegetation identified within the Dobrușa Landscape Reserve is presented below.

Cl. QUERCO-FAGETEA SYLVATICAE Br.-Bl. et Vlieger in Vlieger 1937

Ord. *Alnio-Fraxinetalia excelsioris* Passarge 1968

Al. *Fraxino-Quercion roboris* Passarge 1968

1. As. ***Sambuco nigrae-Quercetum roboris*** (Ger.Hofm. 1965) H.Passarge et Ger. Hofm. 1968
   - *equisetuosum telmateiae* facies nov.
2. As. ***Euonymo nanae-Quercetum roboris*** Pînzaru, Sfeclă et Cantemir 2025
   - *facies carpinosum betuli* Pînzaru, Sfeclă et Cantemir 2025

Ord. *Fagetalia sylvaticae* Luquet 1926

Al. *Carpinion betuli* Issler 1931

3. As. ***Carici pilosae-Carpinetum betuli*** Neuhäuslova et Nehäuslova-Novotná 1964
4. As. ***Dentario quinquefoliae-Carpinetum*** (Dobrescu et Kovács 1973) Täuber 1992
5. As. ***Stellario holosteae-Carpinetum betuli*** Oberd.1957
   - **subass. *typicum*** Oberd. 1957
   - ***allietosum ursini* subass.** nova
   - ***fraxinetosum excelsioris*** subass. nova

Ord. *Quercetalia pubescenti-petraeae* Klika 1933

Al. *Quercion petraeae* Issler

Suball. *Quercenion petraeae*

6. As. ***Melico uniflorae-Quercetum petraeae*** Gergely 1962
7. As. ***Poo nemoralis-Quercetum petraeae*** Morariu et al. 1970

Suball. *Tilio tomentosae-Quercenion petraeae* (Pînzaru et Cantemir 2023) Pînzaru, Sfeclă et Cantemir 2025

8. As. ***Tilio tomentosae-Quercetum petraeae*** Sârbu 1979 corr. Pînzaru, Sfeclă et Cantemir 2025

- *typicum* Sârbu 1979
- *cornetosum maris* (Sârbu 1979) Pînzaru, Sfeclă et Cantemir 2025

Cl. MOLINIO-ARRHENATHERETEA Tx. 1937

Ord. *Molinietalia caeruleae* Koch 1926

Al. *Filipendulion ulmariae* Segal ex Westhoff et Den Held 1969

9. As. ***Geranio pratensi-Cirsietum cani*** Pînzaru, Ioniță & Jardan 2019

The syntaxonomic diversity of the Dobrușa Landscape Reserve is represented by two vegetation classes, four orders, four alliances, two suballiances, and nine associations. This conspectus provides the first comprehensive syntaxonomic classification of the reserve's vegetation and establishes a scientific basis for its documentation, conservation, and future phytosociological and ecological research.

Keywords: *phytosociology; syntaxonomy; vegetation diversity; Dobrușa Landscape Reserve; Republic of Moldova.*

UDC: 598.2:712.253(478-25)

THE DIVERSITY OF BIRD SPECIES IN RISCANI FOREST PARK, CHISINAU CITY

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The Riscani Forest Park is located in the northeastern part of Chisinau, at the boundary between the Riscani and Ciocana sectors. Founded in 1970 and based on a natural forest massif, the park's vegetation is predominantly composed of deciduous species: field maple, oak, ash, elm, linden, pine, birch, and a variety of shrubs such as dogwood, common dogwood, rosehip, and privet. The total area of the park is 199.4 hectares, including three lakes covering a total of 3.5 hectares. Due to its complex vegetative structure and the presence of an aquatic ecosystem, the park provides favorable conditions for maintaining a relatively rich avifaunal diversity.

Studies were conducted between 2020 and 2025 along various routes ranging from 3 to 5 km, allowing for a comprehensive survey of the park. Systematic observations were carried out across six phenological aspects.

The ornithofauna diversity of Riscani Forest Park is represented by 80 bird species, accounting for 96% of the total avifauna of Chisinau. These species belong to 11 orders and 35 families. The largest share belongs to the order Passeriformes, constituting 38% of the park's avifauna, including: *Oriolus oriolus, Lanius collurio, Pica pica, Garrulus glandarius, Corvus frugilegus, Corvus corax, Parus major, Cyanistes caeruleus, Regulus regulus, Remiz pendulinus, Bombycilla garrulus, Aegithalos caudatus, Galerida cristata, Hirundo rustica, Delichon urbicum, Phylloscopus collybita, Phylloscopus sibilatrix, Acrocephalus arundinaceus, Acrocephalus scirpaceus, Hippolais icterina, Sylvia atricapilla, Sylvia borin, Sylvia curruca, Sitta europaea, Certhia familiaris, Troglodytes troglodytes, Muscicapa striata, Ficedula albicollis, Phoenicurus phoenicurus, Phoenicurus ochruros, Luscinia luscinia, Erithacus rubecula, Turdus merula, Turdus philomelos, Sturnus vulgaris, Passer domesticus, Motacilla alba, Motacilla flava, Fringilla coelebs, Coccothraustes coccothraustes, Pyrrhula pyrrhula, Chloris chloris, Spinus spinus, Carduelis carduelis, Linaria cannabina*, and *Emberiza hortulana*.

This is followed by *Gruiformes* (7%), while the smallest shares are held by *Galliformes* and *Cuculiformes* (1% each). This specific diversity is due to the variety of habitats (arboreal, shrubby, herbaceous, and aquatic) provided by the forest park. Habitat variety is also directly influenced by park management; sectors with less invasive intervention (standing deadwood and higher herbaceous cover) allow for a more stable and varied trophic web. The Riscani Forest Park ecosystem acts as an ecological corridor, allowing bird species to circulate and survive despite the fragmentation of surrounding natural habitats, contributing directly to the conservation of urban biodiversity.

Acknowledgements: The study was conducted within subprogram 010701 and the project "Red Book of the Republic of Moldova, 4th edition" (Contract No. 01-23p-096/03-05-2024), funded by the National Environmental Fund.

Keywords: *urban avifauna, diversity, habitat, Riscani Forest Park.*

UDC: 37.033:502:91

ENVIRONMENTAL EDUCATION THROUGH GEOGRAPHY IN VOCATIONAL EDUCATION

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The aim of this study is to examine the role of geography in environmental education and sustainable development within post-secondary vocational education. Environmental education, also called ecological education, has become an increasingly important component of contemporary education. Environmental issues, such as pollution and environmental degradation, overconsumption of natural resources and climate changes, demonstrate that the relationship between people and nature requires a responsible approach. During the present time, characterized by significant environmental problems and challenges, environmental education is not merely a choice, but a primary duty of the educational system. The method performed shows that geography lies centrally in the development of a coherent vision of the relationship between the natural environment, human activity and societal development.

Methods of analysis used: questionnaire; statistical, experimental, analytical.

Some educational systems widely adopt one of the following models: Environmental Education; Normative Education; Education for Sustainable Development. Geography is a core field of study in education for sustainable development, where its object is at the junction between natural, social and economic environments, and through their ability to distinguish future interrelationships. The revision of the geography curriculum should reflect the Council of Europe's prescription for crucial skills in lifelong learning. The view of Environmental Education perception of the students was based on a survey method (244 students of a sample at TUM College) that tested 28 questions to test the perceived values of environmental education. The findings indicate that students perceive geography as a highly valuable discipline with significant civic and scientific relevance, appreciated for its practical applicability in understanding contemporary environmental and social issues.

Conclusion: The study highlights a moderate level of development of environmental education competences, with the cognitive dimension prevailing over the practical and attitudinal dimensions. These findings underscore the need to promote students' active participation through practical, meaningful, and contextualized learning activities.

***Keywords**: environmental education, geography, ecological skills, curriculum, vocational education.*

UDC: 631.445.4:631.417.2(478)

THE CHERNOSIEMS OF THE LOWER NISTER PLAIN THROUGH THE PRISM OF AGROTECHNOLOGICAL AND AGROBIOCENOTICAL PEDOREGENERATIVE DEVELOPMENTS (CASE STUDY SRL „SCHIT-AGROMEX")

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In the composition of the soil cover of the Inner Dniester Plain, chernozems occupy about 70% and are represented by typical, moderately and weakly humiferous loamy and clayey loamy chernozems.

At the current stage, the evolution of the soils in the evaluated space is carried out in a phase of dynamic equilibrium characterized by a moderate energetic-functional level determined by the humus content (3-4%) below the optimal level (5-6%). As a result, they are characterized by extremely low intensity (0.015 - 0.02%/year) within a 5-year crop rotation manifested in a pronounced imbalance of the physical state of the soils and the current trend of climatic conditions.

This is one of the main factors that led to the establishment in the soils of a trend of reducing their fertility and the productive functions of the entire agroecosystem. As a result, a unidirectional trend of reducing the capacity for self-reproduction, self-organization and self-regulation of the soil ecosystem has been established in soils. Through this prism of ideas, agrotechnological and agrobiocenotic arrangements assume the evaluation of the reproductive potential of soils, namely through the prism of the meaning and intensity of chernozem typogenetic processes: a) formation-accumulation of humus and b) aggregation-structuring of the soil mass. To evaluate the degree of realization of the potential of the humification process in the present research, the degree of saturation of the physical clay function (< 0.01 mm) with humus, materialized in the aggregate instability index, was used. Their evaluation through the prism of the energy-functional concept of the chernozem process of soil formation showed that its realization is limited by the reduced humus content (3-4%) below the optimal level (5-6%).

The main factors limiting the expanded reproduction of humus reserves in the chernozems in the evaluated area are the reduced degree of structural hydrostability manifested in the deterioration of the structure upon wetting and the increased degree of exposure of the humus to mineralization processes, the disaggregation of the soil mass into microaggregates and elementary particles that clog the pores of the soils and the establishment of a defective, predominantly anaerobic, aerohydric regime in them, which leads to the disruption of the transformation-humification process of organic matter.

Keywords: *chernozems, humus content, structural aggregates, hydrostability.*

UDC: 631.445.4:551.583(478)

CONCEPTUAL-THEORETICAL AND APPLICATIVE FRAMEWORK FOR BROADENING THE CLIMATE RESILIENCE OF TYPICAL MODERATE-WEAKLY HUMIDIFYING CHERNOZIOMS FROM THE LOWER NISTER PLAIN

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The concept of expanded reproduction of climate resilience implies a complex approach based on measures to strengthen its natural capacity by reducing and even definitively excluding soil degradation processes and measures to rehabilitate chernozem typogenetic processes responsible for climate resilience within the framework of pedoregenerative agrotechnological and agrobiocenotic arrangements. This implies sustainable management of all components of the genetic-evolutionary chain "factors↔regimes↔elementary pedogenetic processes↔soil (resilience)" materialized in the interdependent and interdetermined interactive development of the process of transformation-humification of fresh organic matter and that of aggregation-structuring of the soil mass within complex agrobiotechnologies.

The theoretical conceptual framework of complex pedoregenerative agrobiotechnologies is provided by the Concept of "controlled humification" and the Concept of "genetically homogeneous restoration of the system of organic substances of arable chernozems".

Controlled humification involves the accelerated and directed transformation of plant residues into humic substances and the genetically homogeneous concept of restoring the system of organic substances involves the reproduction not only of the total amount of humus but also of its fractional and functional composition. In this sense, the management of the climate resilience of arable chernozems involves the differentiated implementation of complex agrobiotechnologies that include two interspersed technological components: a) soil improvement and b) soil regenerative.

The application-technological principles of complex soil regenerative agrobiotechnologies involve landscape adaptation; b) the priority role of biologization of agroecosystems in the rehabilitation of the soil genetic process; c) the supremacy of natural soil fertility in the establishment of bioproductivity and the regeneration of the soil genetic process; d) minimal work of permanent soil coverage with vegetation.

Keywords: *climate resilience, controlled humification, organic matter system.*

UDC: 631.46:631.445.4:634.8

VERTICAL STRATIFICATION OF SOIL MICROBIAL DIVERSITY IN IRRIGATED CHERNOZEM VINEYARD SOILS

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Soil microbial communities play an important role in nutrient cycling and organic matter transformation. However, the vertical organization of microbial communities within irrigated chernozem profiles remains insufficiently studied, particularly in perennial agroecosystems such as vineyards.

The aim of this study was to evaluate soil microbial diversity along a genetic profile of irrigated vineyard chernozem and to identify depth-related patterns.

Soil samples were collected from genetic horizons (0–160 cm) and analysed on nutrient and selective media (PDA, TSA, Pseudomonas Agar and Bacillus selective agar). Colony abundance and morphological diversity were assessed for each horizon.

Microbial abundance showed a pronounced depth-dependent pattern, decreasing from approximately 6.3×10^3 CFU g^{-1} in the surface horizon (0–34 cm) to 5.9×10^2 CFU g^{-1} at 140–160 cm depth. The upper horizon exhibited the highest microbial diversity and contained representatives of *Bacillus* spp., *Micrococcus* spp., presumptive *Pseudomonas* spp. and filamentous fungi, including *Penicillium* spp. and *Mucorales*. Morphological observations demonstrated a clear shift in microbial community structure with depth. The surface horizon was characterised by the highest taxonomic and morphological diversity, including bacterial colonies and filamentous fungi. In contrast, deeper horizons showed a progressive simplification of the microbial community, with a predominance of spore-forming bacteria, mainly representatives of the *Bacillus subtilis* and *B. pumilus* groups, and a marked reduction of fungal forms. This pattern may reflect adaptation of microbial communities to decreasing organic matter availability and more restrictive environmental conditions in subsoil horizons.

The results demonstrate pronounced vertical differentiation of microbial communities in irrigated chernozem vineyard soils. The shift from diverse surface communities to simplified subsoil communities dominated by spore-forming bacteria highlights the importance of soil profile structure for microbial biodiversity.

Acknowledgments: This study was supported by the research project *230102: Research regarding the evolution of irrigated chernozioms in horticultural plantations and pedoameliorative methods testing to prevent and/or combat their degradation* funded by the Ministry of Education and Research of the Republic of Moldova.

Keywords: *soil microbial communities; chernozem; irrigation; vineyard soils; soil profile.*

UDC: 551.583:636

MEASURES FOR ADAPTATION OF LIVESTOCK ECOSYSTEMS TO CLIMATE CHANGE

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The growing impact of climate change is threatening the EU's agri-food system, a cornerstone of Europe's food security, rural economy, and strategic autonomy. This complex sector covers 38% of the Union's territory, ensuring the protection of natural resources and ecosystems. With over 30 million employees in 2023 (including 8.5 million in agricultural production), the system generates 7% of the EU's gross value added. It is also the bloc's third-largest net exporter, with food and beverage exports totaling €48 billion in 2024.

Climate change, resource scarcity, and economic pressures are threatening the livestock sector globally. Implementing strict measures to adapt to and mitigate climate impacts is vital for the long-term sustainability of this industry.

Managing climate impact in animal husbandry involves mitigating greenhouse gas emissions and adapting infrastructure to temperature fluctuations and severe weather events. Responsible for 14.5% of global emissions, the animal husbandry sector is highly vulnerable to feed shortages and heat stress.

Climate change directly affects animal biology through heat stress, reduced production, reproductive problems, and excessive mortality, and indirectly affects food and water resources through forage degradation, water shortages, and new diseases and vectors, thereby reducing productivity and increasing operational costs on farms across the European continent.

This paper addresses the main measures for adapting the livestock ecosystem through the modernization of housing, nutrition management, genetic selection, and the transition to agro-silvo-pastoralism. The fundamental conclusion of the study on the adaptation of animal husbandry systems to climate change highlights the critical vulnerability of conventional animal husbandry in the context of global warming. The economic viability of the sector calls for an imminent transition to adaptive strategies focused on genetic resilience, nutritional optimization, and the technological upgrading of infrastructure.

***Acknowledgments*:** This study was supported by funding provided by the state budget through the 2026 research program of the National Institute for Economic Research "Costin C. Kiriţescu", Romanian Academy (PSS 1.8 Studies on the identification of risks associated with climate change and their effects on the management of animal genetic resources, coordinator Research Scientist III Ph.D. Mariana Sandu, Center for Studies and Research on Agroforestry Biodiversity "Acad. David Davidescu").

Keywords: *adaptation, climate change, livestock ecosystem.*

UDC: 634.8:911.2:338.48(478)

NATURAL FAVOURABILITY AND THE POTENTIAL OF VITICULTURE IN THE CENTRAL MOLDAVIAN PLATEAU

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Natural favourability for viticulture designates the predisposition of a territory to the development of the grape vine (*Vitis vinifera*), so that the grapes reach the necessary physiological and technological maturity. The evaluation of natural favourability is based on three major categories of criteria: climatic, edaphic and geomorphological. These do not function as independent entities, but as interconnected dimensions of the same natural system, and their analysis must capture how their interactions shape the behaviour of the vines.

Methods of analysis used: bibliographic; cartographic; field documentation.

In the specialized literature, this approach overlaps with the concept of *terroir*, which Seguin (1988, cited in Van Leeuwen & Seguin, 2006) describes as an "interactive ecosystem" in which the climate, the soil and the plant function as an inseparable whole. In viticulture, terroir explains how the natural environment gives the wine its own identity, impossible to reproduce elsewhere. An authentic expression of terroir occurs when the precocity of the variety is in harmony with the local climatic dynamics, so that full ripening occurs towards the end of the growing season. Another essential dimension of terroir is small-scale variability. Minimal differences in local conditions can generate distinct wine styles, even within the same vineyard. The OIV definition (2008) emphasizes that terroir includes not only the natural environment, but also the collective knowledge and viticultural practices that capitalize on the potential of the place. Thus, terroir is both a natural and a cultural concept, since the quality of wine depends on the way winegrowers interpret and manage the available resources. Contemporary vineyards are no longer perceived only as agricultural spaces, but as territories with cultural, landscape and economic value, capable of supporting tourism. Thus, natural favorability becomes a factor of tourist attractiveness, since areas with high wine-growing potential produce appreciated wines, which stimulate curiosity and the desire to visit. Vineyards can become not only production spaces, but also tourist destinations, and tourism contributes to the valorization of the territory's wine identity.

Conclusion: The Central Moldavian Plateau, within the borders of Romania and the Republic of Moldova, has numerous terroirs with a natural environment favourable to high-quality viticulture, combined with a millennial cultural tradition, and offers a major attraction for wine tourism.

***Keywords**: natural favourability, terroir, wine tourism, Central Moldavian Plateau.*

UDC: 616-036.22:614.7:502(478-21)

PREVALENCE OF DISEASES IN THE POPULATION OF CAHUL MUNICIPALITY AND ENVIRONMENTAL QUALITY ASPECTS

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Disease prevalence represents an essential indicator for assessing the health status of the population. Cahul Municipality, located in the southern part of the Republic of Moldova, faces various public health challenges determined by socio-economic, demographic, environmental, and lifestyle factors.

The aim of the study was to assess the prevalence of the main categories of diseases among the population of Cahul Municipality and to analyze several environmental factors that may influence public health. The research was based on the analysis of statistical and medico-demographic data available at the local and regional levels, as well as on the examination of trends in the distribution of different diseases within the population.

The study analyzed the main categories of chronic and non-communicable diseases, including cardiovascular, respiratory, endocrine, and digestive disorders, which represent some of the most common health problems among the population. Differences in disease prevalence according to demographic and territorial characteristics were also examined.

In addition, several general aspects of environmental quality were analyzed, including urban conditions, waste management, and the particularities of the population's living conditions. Statistical, comparative, and analytical methods were applied for data interpretation.

The results of the research contribute to a better understanding of the morbidity structure of the population of Cahul Municipality and may support the development of prevention measures and public health promotion strategies. The study is important from both scientific and practical perspectives, due to the possibility of applying the results in the development of local health policies and future research directions in the field of public health.

Acknowledgements: This study was carried out within the research subprogram 010801 "Enhancing ecological security and resilience of geo-ecosystems to current environmental changes".

Keywords: *disease prevalence, public health, environmental quality, Cahul Municipality, population health.*

UDC: 595.773.4:574.24

ECOLOGICAL AND MORPHOLOGICAL ADAPTATIONS OF HOVERFLIES SPECIES (*INSECTA: SYRPHIDAE*)

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The aim of this work was to summarize data on the morphological adaptations and ecological diversity of insects from the family *Syrphidae*, larvae and adults, as well as to substantiate their significance as important components of ecosystems.

An analytical review of literature sources was conducted, including identification keys and ecological databases (Syrph the Net) with includes data from the Republic of Moldova. Morphological traits (wing venation, eye structure, type of pubescence), larval trophic groups (predators, saprophages, phytophages, mycophages, myrmecophiles), and adaptive strategies of adults were examined.

It has been established that adult hoverflies possess a unique ability to hover and exhibit Batesian mimicry of stinging Hymenoptera. The larvae have colonized almost all types of terrestrial and freshwater habitats, excluding deep water bodies and caves. Key adaptations have been identified: aquatic saprophages, e.g., *Eristalis tenax*, possess a breathing tube (siphon). Predatory larvae of the subfamily *Syrphinae* exhibit a combination of phototaxis and geotaxis, allowing them to effectively control aphids (consuming up to 867 individuals during development). Additionally, there are phytophagous larvae, e.g., Merodon equestris, which damage narcissus bulbs.

The wide range of trophic strategies and the association of larvae with specific substrates make the family *Syrphidae* a model group for ecological research. Due to their sensitivity to anthropogenic pressure, hoverflies are recognized as effective bioindicators of the environment according to the *Syrphidae* the Net system. The presence of Eristalis species indicates organic pollution, whereas the occurrence of rare Brachypalpoides species indicates the presence of old-growth forests.

Acknowledgements: The research was supported by subprogram 010701.

Keywords*: Syrphidae, morphology, ecology, adaptations, mimicry, bioindicators.*

UDC: 712.25:502.3/.7:37.033

THE ROLE OF URBAN SCHOOL/THERAPEUTIC GARDENERS IN BIODIVERSITY CONSERVATION AND ECOLOGICAL EDUCATION

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In the context of accelerated urbanization, reduction of green spaces, pollution and habitat fragmentation, urban school/therapeutic gardens are taking on an important role in preserving biodiversity and promoting ecological education.

The purpose of this paper is to highlight the contribution of school and therapeutic gardens to supporting urban biodiversity, shaping ecological behaviors, and improving community well-being.

The methods used consisted of analyzing information on urban biodiversity, the role of vegetation in urban ecosystems, the functions of green spaces and the importance of educational and therapeutic activities carried out in gardens. The main threats to biodiversity were also monitored: urbanization, pollution, habitat loss, climate change, introduction of invasive species.

The results of the analysis show that school and therapeutic gardens can create favorable microhabitats for plants, pollinating insects, birds and other organisms, thus contributing to increasing biodiversity in the urban environment. School gardens offer students the opportunity to learn through practical activities about plants, soil, water, pollinators and the relationships between organisms, developing responsibility towards the environment. At the same time, they promote relaxation, reduce stress, stimulate attention and improve emotional state through direct contact with nature.

Conclusion: school and urban therapeutic gardens are effective tools for biodiversity conservation, ecological education and sustainable development of urban communities. By using local species, responsible resource management and involving students, teachers and the community, these spaces can contribute to environmental protection and the formation of an active ecological awareness.

Keywords: *urban biodiversity, school/therapeutic gardens, ecological education.*

UDC: 635.21:631.147:632.937

APPLICATION OF BIOLOGICAL PREPARATIONS IN ORGANIC TECHNOLOGY OF POTATO GROWING

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In today's context of intensified agricultural production, significant attention is being paid to the search for environmentally safe and cost-effective methods of plant protection. The traditional use of chemical pesticides ensures a high level of pest control but is accompanied by a number of negative consequences, including the accumulation of pesticide residues in crops and the environment, a decrease in soil biological activity, and the development of pathogen resistance. In this regard, there is growing interest in the use of biological products, which are an important element of environmentally friendly crop cultivation technologies.

The aim of the study is to investigate the effectiveness of biological products in potato cultivation under organic farming conditions.

Materials and methods: The research was conducted in the fields of the Institute of Potato Growing of the National Academy of Agrarian Sciences of Ukraine in 2024–2025. The soil is sod-podzolic sandy loam: the humus content in the arable layer is 1.4 %, nitrogen – 98.0 mg/kg, phosphorus – 72.0 mg/kg and potassium – 100.0 mg/kg. The soil solution has an acidic reaction (pH=5.2). The potato's predecessor is green manure. The experimental design included the application of biological products permitted in organic production: 1. Without the application of biofungicides and biostimulants (control); 2. Izabion (2.5 L/ha) + FitoHelp (1.0 L/ha); 3. Stim Pure AA Liquid (1.0 L/ha) + FitoHelp (1.0 L/ha). The effectiveness of these products was evaluated against a background of organic fertilization (manure 40 t/ha). Spraying of potato plants with biological preparations was carried out during the following stages of crop development: leaf closure in the row spacing (BBCH 35–39), and budding (BBCH 51–59). To control the Colorado potato beetle (Leptinotarsa decemlineata Say), in all variants of experiment, the plant treatment with the bioinsecticide Actofit at (0.3 L/ha).

Research results: The use of biological agents made it possible to reduce the spread of Alternaria leaf spot on potato leaves by 1.7–1.9 times and its development by 2.1–2.2 times compared to the control. The greatest reduction in the spread and development of Alternaria was observed in the treatment combining Izabion (2.5 L/ha) and FitoHelp (1.0 L/ha).

The reduction in the spread and development of diseases during the potato growing season had a positive effect on tuber yield. In particular, a significant increase in potato tuber yield was obtained, ranging from 4.6 to 4.8 t/ha. The maximum potato yield of 38.0 t/ha, or 4.8 t/ha more compared to the control, was obtained in the following treatments: Stim Pure AA Liquid (1.0 L/ha) + FitoHelp (1.0 L/ha).

The economic analysis showed that the additional application of biological products increases production costs, but, thanks to higher yields, reduces the cost of tubers and results in higher net profit and production profitability. The best economic results were achieved with the combination of Stim Pure AA Liquid (1.0 L/ha) + FitoHelp (1.0 L/ha), which yielded a net profit of 298,000 UAH/ha and a profitability rate of 97 %.

Conclusions: The results of the studies indicate that the use of biological agents helps reduce the development and prevalence of Alternaria leaf spot. This, in turn, leads to increased yields and greater economic efficiency in crop production.

Keywords: *potato, biological preparations, yield, profit, level of profitability, technical efficiency.*

UDC: 569.32:551.782.2(478)

PLIOPETAURISTA DEHNELI (PTEROMYINAE, MAMMALIA) FROM THE EARLY PLIOCENE LOCALITY PRIOZERNOE

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The species *Pliopetaurista dehneli* was described by Sulimski in 1964 from the Węże 2 locality in Poland. It is known from a number of Pliocene localities in Central and Eastern Europe. New species described from the Moskovei and Tatareshti localities in southern Moldova: *P. moldaviensis* Baranova et Konkova, 1974 and *P. tatareshensis* Lungu et Sushpanov, 1993, are apparently junior synonyms of *P. dehneli*. In Moldova, remains of *P. dehneli* are also known from the Musaid locality. Remains identified to the genus *Pliopetaurista* sp. are indicated from the Early Pliocene localities of Novaya Andryashevka and Budey. From the Early Pliocene locality of Priozernoe (biozone MN14b-15a), two finds have been assigned to the species *P. dehneli*: a fragment of the right maxilla with cheek teeth M2-M3 dex (Fig. 1: 1a-1b) and a fragment of the left maxilla with M1-M2 sin (Fig. 1: 2a-2b).

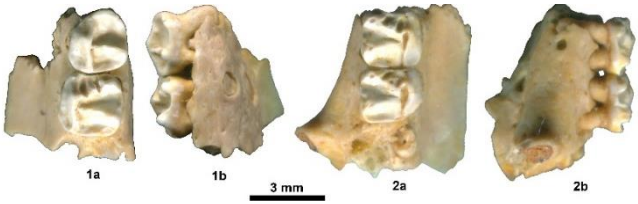


Figure 1. Maxilla fragments of Pliopetaurista dehneli:1 – right maxilla with M2-M3 dex; 2 – left maxilla with M1-M2 sin (a – occlusal view, b – lingual view)

The first specimen preserved the second molar M2 (L – 2.66 mm, W – 2.71 mm) and the third molar M3 (L – 2.70 mm, W – 2.50 mm). The second specimen retains the first molar M1 (L – 2.34, W – 2.63) and the second molar M2 (L – 2.50, W – 2.55). Both specimens are large in size and correspond to the maximum molar measurements for this species from Tatareshti and Węże 2.

Acknowledgments: This study was supported by the research project no. 010701 "Evaluation of the structure and functioning of animal world and aquatic ecosystems under the influence of biotic and abiotic factors in the context of ensuring ecological security and the well-being of the population", funded by the Ministry of Education and Research, and were performed within the doctoral project "Fossil fauna complexes and the evolution of vertebrate fauna in the early stages of the formation of the Dniester Valley (Pliocene-Early Pleistocene)".

Keywords: *Pteromyinae, Pliopetaurista dehneli, Early Pliocene, biozone MN 14b-15a, Priozernoe.*

Session E

CHEMISTRY, PHYSICS, MATHEMATICS AND IT APPLICATIONS IN BIOLOGY, AGRICULTURE AND MEDICINE

UDC: 615.22:004.65

CARDIOVASCULAR DRUG COVERAGE: A HARMONIZATION FRAMEWORK FOR BIOMEDICAL DATABASES

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Cardiovascular diseases remain a major cause of mortality worldwide, which highlights the need for reliable and harmonized pharmacological data. The purpose of this study was to develop and evaluate a methodological process for addressing differences in how multi-component cardiovascular drug products are represented across biomedical databases. Using the Anatomical Therapeutic Chemical (ATC) classification system, 657 cardiovascular drug entries from ATC class C at level 5 were systematically mapped across ChEMBL, PubChem, and DrugBank. Initial database coverage was compared, and a decomposition, mapping, and reconstruction procedure was applied to 234 combination-like entries to assess component-level representation.

Initial database coverage differed substantially: DrugBank covered 94.4% of entries (620/657), PubChem 51.9% (341/657), and ChEMBL 35.3% (232/657). Only 29.7% of entries (195/657) were present in all three databases. After component-level reconstruction, coverage increased substantially in PubChem (+198 entries; +58.1%) and ChEMBL (+164 entries; +70.7%), while the increase in DrugBank was limited (+11 entries; +1.8%). Paired-proportion testing showed statistically significant differences in coverage between databases (Cochran's $Q = 556.17$, $df = 2$, $p < 0.001$). Analysis by ATC level-2 drug groups showed higher reconstruction gains for antihypertensive combinations and diuretics, and lower gains for lipid-modifying agents.

These findings show that conventional parent-level comparison may underestimate database coverage for multi-component drug products. Component-aware harmonization provides a more accurate assessment of database content and supports the use of integrated multi-database approaches in cardiovascular pharmacoinformatics research

Acknowledgments: This study was supported by Doctoral School of Natural Sciences

Keywords: *cardiovascular drugs; ATC classification; biomedical databases; data harmonization; fixed-dose combinations; component-level mapping; ChEMBL; DrugBank; PubChem.*

UDC: 546.73:547.7:548.737

A NEW ONE-DIMENSIONAL COBALT(II) COORDINATION POLYMER INVOLVING PIVALATE AND PYRAZINE LIGANDS

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The development of coordination polymers is of considerable importance due to their tunable architectures and multifunctional properties, which make them promising materials for advanced technological applications. Constructed through the self-assembly of metal ions and multidentate organic ligands, these compounds can exhibit one- to three-dimensional architectures. A new one-dimensional (1D) coordination polymer, $\{[Co(Hpiv)(piv)_2(pyz)(H_2O)]\}_n$ (**1**) (where Hpiv = pivalic acid, pyz = pyrazine), has been synthesized under ultrasonic irradiation via the reaction between cobalt(II) pivalate and pyrazine in a methanol solution. X-ray structural analysis shows that **1** crystallizes in the monoclinic $P2_1/n$ space group with the unit cell parameters a = 18.318(4), b = 7.0630(9), c = 18.974(4) Å, β = 97.306(18)°, and V = 2434.9(8) Å^3. Structure **1** features a 1D coordination polymer chain where the Co(II) centers are linked by pyrazine ligands acting in a μ$_2$-bridging mode with a Co(II)···Co(II) separation of 7.063(2) Å (Fig. 1). The coordination environment of Co(II) ion is a distorted N_2O_4 octahedron comprising two nitrogen atoms from two symmetry-related pyz ligands, three oxygen atoms from three monodentate piv ligands, and one oxygen atom from a coordinated water molecule. The Co–O bond distances are in the range of 2.049(9)–2.178(8) Å and the Co–N bond distances are 2.124(9) and 2.134(9) Å, confirming Co(II) oxidation state. The water molecule participates in two hydrogen bonds (O1–H1A···O7): an intrachain bond of 2.683(11) Å and an interchain bond of 2.860(11) Å involving adjacent pivalate units. Additionally, a strong intramolecular hydrogen bond is established between two pivalate ligands (O3–H···O4 = 2.40(1) Å).

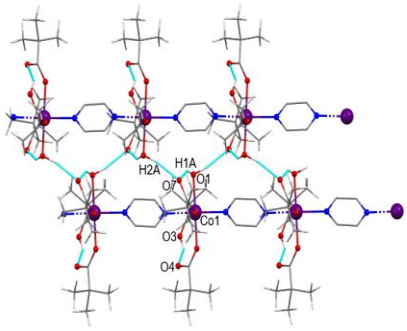


Figure 1. Structure of the 1D chains in 1.

Acknowledgments: This study was supported by the subprogram 011202 financed by the Ministry of Education and the project 25.80012.5007.87SE supported by the Moldovan National Agency for Research and Development (NARD).

Keywords: *cobalt, pyrazine, coordination polymer, X-ray diffraction.*

UDC: 547.9:582.684.1(478)

CHEMICAL PROFILE OF THE DRY EXTRACT OF HYPERICUM PERFORATUM FROM THE FLORA OF THE REPUBLIC OF MOLDOVA

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The concentration of chemical compounds in plant-derived extracts depends on the solvent used and the extraction method. Solvents commonly used in the extraction of medicinal plants include polar, moderately polar, and nonpolar solvents. Extraction methods include maceration, infusion, percolation, Soxhlet extraction, ultrasound- and microwave-assisted extractions. *Hypericum perforatum* L. has been traditionally used for centuries to treat wounds, burns, gastrointestinal disorders and in mild to moderate depression. The pharmacological potential of this plant is attributed to its rich phytochemical profile. The aim of this study was to obtain a dry extract from the aerial parts of the plant using the maceration method and to determine its chemical composition

The phenolic compounds were extracted using the fractional maceration method with agitation, employing ethanol 80% (ratio 1:20 w/v) as the solvent. The extract solution was concentrated using a rotary evaporator. The phenolic compounds were identified using HPLC, the total content of flavonoids, polyphenols, and hydroxycinnamic acids was determined using spectrophotometric methods.

The chemical compounds were identified using HPLC by comparing their retention times (tR) with those of standard substances analyzed under the same conditions. The following were identified: rutin (6.084), hyperoside (7.134), isoquercitrin (7.457), quercitrin (11.315), chlorogenic acid (3.846), and catechin (4.048). The total flavonoids (81.018 ± 0.953 mg RU/g extract, expressed as rutin equivalents), polyphenols (77.740 ± 2.348 mg AG/g extract, expressed as gallic acid equivalents), and hydroxycinnamic acids (58.161 ± 0.258 mg AC/g extract, expressed as caffeic acid equivalents) indicate a high content of phenolic compounds in the analyzed extract

Although the simplest method was used to extract phenolic compounds from the plant material *Hyperici herba*, the results of the chemical analysis indicate a high content of phenolic compounds in the dry extract. This extract can subsequently be used in preclinical studies to determine its anti-inflammatory and antioxidant activity *in vivo*.

Acknowledgments: This study was supported by the research project 25.80012.8007.04SE „In vivo evaluation of the anti-inflammatory activity of polyphenolic extracts from Hypericum perforatum L. and Agrimonia eupatoria L., derived from local raw materials", funded by ANCD.

Keywords: *Hypericum, dry extract, phenolic compounds.*

UDC: 547.9:582.739

THE PHYTOCHEMICAL PROFILE OF DRY EXTRACT OF TRIFOLIUM PRATENSE

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The plants from *Trifolium* species have known to be used as traditional medicine in several cultures. Some Trifolium plants can be used as an expectorant, analgesic, antioxidant and as anti-inflammatory. They can be used from human nutrition. *Trifolium pratense* contains isoflavonoids, flavonoids, coumarin derivatives, cyanogenic glycosides, volatile oil and saponins. The aim of this study was to obtain a dry extract from the aerial parts of T. pratense using the agitated fractional maceration method. Chemical analysis identified compounds belonging to the flavonoid class, while spectrophotometric methods were employed to determine the total content of flavonoids, polyphenols, and hydroxycinnamic acids.

Phenolic compounds were extracted from the plant material (*herba*) by fractional maceration with agitation, using 70% ethanol as the solvent, at a plant material-to-solvent ratio of 1:20. The extraction procedure was repeated four times, with each extraction cycle lasting 60 minutes. The total flavonoid content of the dry extract was determined using the aluminum chloride colorimetric method. Total polyphenols were quantified by the Folin–Ciocalteu method, and hydroxycinnamic acids were quantified by the Arnow reagent.

The total polyphenol content in the extract from the aerial parts of *T. pratense* (36.33 ± 2.16 mg CGA/g extract), expressed as chlorogenic acid equivalent, was determined. The total content of hydroxycinnamic acids, expressed as caffeic acid equivalent, was 38.39 ± 0.87 mg CA/g dry extract, and the flavonoid concentration reached 60.43 ± 1.16 mg RU/g dry extract (expressed as rutin equivalent). Using thin-layer chromatography, it was demonstrated that the dry extract obtained from *Trifolii herba* contains the following active compounds: rutin (Rf = 0.20), hyperoside (Rf = 0.47), isoquercitrin (Rf = 0.52), and caffeic acid (Rf = 0.93)

The results showed that *T. pratense* is rich in phenolic compounds, which could serve as a basis for biological studies aimed at evaluating the antibacterial and antioxidant activities of the dry extract obtained from plants grown under the climatic conditions of the Republic of Moldova.

Acknowledgments: *This study was supported by the research project 25.80012.8007.05SE „Optimization of extraction methods of phenolic compounds from plant products, with evaluation of antimicrobial and antioxidant actions”, funded by ANCD.*

Keywords: *Trifolium, dry extract, phenolic compounds.*

UDC: 546.655:546.56:548.734

A TRINUCLEAR HETEROMETALLIC {$CeCu_2$} CLUSTER CONTAINING ISOBUTYRATE AND TRIETHANOLAMINE LIGANDS

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Heterometallic 3d–4f coordination compounds have attracted considerable attention due to their remarkable structural diversity and ability to combine the properties of transition-metal and lanthanide ions within a single molecular system. A new coordination compound, $[CeCu_2(ib)(H_2tea)_3(NO_3)_2]NO_3 \cdot H_2O \cdot CH_3CN$ (**1**) (where Hib = isobutyric acid and H_3tea = triethanolamine), was synthesized via an ultrasonic method and characterized by elemental analysis, FT-IR spectroscopy, and ESI-MS-spectrometry. Single-crystal X-ray analysis revealed that **1** crystallizes in a triclinic space group *P*-1 with the following unit cell parameters: a = 10.9622(3), b = 11.0433(3), c = 17.4828(5) Å, α = 102.374(3), β = 103.003(3) and γ = 91.475(2)°. Its trinuclear molecular structure consists of one Ce^{III} and two Cu^{II} atoms bridged by one isobutyrate and three monodeprotonated H_2tea^- ligands, where one oxygen atom from an H_2tea^- ligand links all three metal centers in a μ_3-fashion (Fig. 1). The two Cu centers exhibit distinct coordination environments: Cu1 is hexacoordinated (NO_5 donor set) by an N and three O atoms from an H_2tea^- ligand, one O atom from the bridging isobutyrate, and one O atom from an adjacent H_2tea^- ligand; Cu2 atom is pentacoordinated (NO_4 donor set) by an N and two O donor atoms from an H_2tea– ligand, one O atom from the bridging isobutyrate, and one O atom from another H_2tea^- ligand. The Ce^{III} ion exhibits a coordination number of 10 with an NO_9 donor set, being surrounded by nine oxygen atoms and one nitrogen atom originating from two nitrate anions and chelating/bridging H_2tea^- ligands.

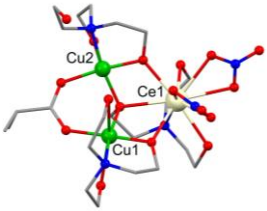


Figure 2.Structure of the cationic complex $[CeCu_2(ib)(NO_3)2(H_2tea)_3]^+$

Acknowledgments: The authors are grateful for the subprogram 011202 financed by the Ministry of Education and Research of R. Moldova and the bilateral project "MultiClust" (01DK25013 and 25.80013.5007.07GER) supported by the German Federal Ministry of Education and Research (BMBF).

Keywords: *copper(II), cerium(III), coordination compound, X-ray analysis.*

UDC: 621.383.5:621.315.592

EFFICIENCY ENGINEERING OF InGaN-BASED RED LIGHT-EMITTING DIODES

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The rapid progress of micro-light-emitting diode (micro-LED) technology has driven extensive research on full-color III-nitride optoelectronic devices. In comparison with conventional liquid crystal displays (LCDs) and organic light-emitting diodes (OLEDs), micro-LEDs provide higher brightness, improved energy efficiency, faster response speed, enhanced reliability, and longer operational lifetime, which makes them highly promising for next-generation display applications such as augmented reality (AR), virtual reality (VR), wearable electronics, and high-resolution microdisplays [C. Altinkaya et al. *Applied Physics Express* **18**, 061001 (2025)].

We present a numerical study of novel composite InGaN quantum-well structures for high-efficiency red light-emitting diodes. The proposed active regions consist of ultrathin, high-indium $In_{0.45}Ga_{0.55}N$ insertion layers embedded within InGaN quantum wells of varying composition and thickness, aimed at optimizing carrier confinement, transport, and radiative recombination. Five InGaN-based red LED structures with different quantum-well configurations were investigated and compared in terms of their current–voltage characteristics and internal quantum efficiency under electrical injection. The theoretical model is based on the self-consistent solution of the Schrödinger–Poisson system coupled with the drift–diffusion equations (see Ref. [V.P. Sirkeli et al. *Phys. Solid State* **67**, 655–663 (2025)]).

Our simulation shows that the performance of InGaN-based red light-emitting diodes strongly depends on the quantum well design. The optimized structure, featuring a graded quantum well with a thin $In_{0.45}Ga_{0.55}N$ insertion layer, demonstrates the best overall performance, achieving a peak internal quantum efficiency of 0.656, a reduced efficiency drop of 3.5% at 100 A/cm², and a wall-plug efficiency of 10.1%. It also maintains stable true-red emission with a limited wavelength shift from 636 nm to 622 nm under increasing current density. These improvements are attributed to enhanced carrier confinement and reduced polarization fields in the engineered active region. The results highlight the importance of quantum-well engineering for high-efficiency and spectrally stable InGaN-based red LEDs.

Acknowledgments: Authors acknowledge financial support from the Moldova Government (research program 011208).

Keywords: *light-emitting diodes, external quantum efficiency, InGaN*.

UDC: 004.056.55

APPLICATION OF A HASH FUNCTION BASED ON QUASIGROUPS IN ELECTRONIC DIGITAL SIGNATURES

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In modern information systems, hash functions play a vital role in ensuring data integrity and security. They are widely used in cryptographic protocols, authentication systems and digital signature mechanisms.

For a long time, functions from the MD and SHA families were used as standard hashing algorithms. However, advances in cryptanalysis and the increased computational power of modern systems have led to the discovery of vulnerabilities in some algorithms, including the possibility of constructing collisions. This necessitates the search for new approaches to the design of cryptographic hash functions.

One promising direction is the use of quasi-group transformations. Quasigroups possess a high degree of non-linearity and allow for the formation of complex data processing schemes, which enhances the algorithms' resistance to cryptanalysis.

The relevance of the research stems from the need to create more secure and efficient hashing methods capable of meeting modern requirements for data processing and protection.

In this work, a hash function based on quasi-groups was investigated and applied within the RSA digital signature algorithm.

A method for constructing hash values using chained hashing was implemented in the Python programming language. This hash function was integrated into the classic RSA digital signature algorithm in place of the standard SHA-256 function. The quasi-group hash function performs a pre-transformation of the original message m into a numerical digest of fixed length h = H(m).

The results demonstrate that hash functions based on quasi-groups can be successfully integrated into classical cryptographic schemes, such as RSA. This confirms the practical applicability of algebraic constructions in cryptography and their potential as alternative hashing mechanisms.

Acknowledgments: The Institutional Research Program of the Moldova State University for 2024-2027 years, subprogram 011303 has supported part of the research for this paper.

Keywords: *quasigroup, Latin square, encryption, one-way function, cryptology, RSA digital signature.*

UDC: 542.913:546.56:547.497

SYNTHESIS OF Cu (II) COORDINATION COMPOUNDS WITH A TIOSEMICARBAZONE CONTAINING MORPHOLINE MOIETY AND EVALUATION OF ANTIOXIDANT ACTIVITY

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Thiosemicarbazones are a class of organic compounds known for their versatile biological activities. It is well established that their biological properties can often be enhanced through complexation with transition metals. In the present work, the synthesis of an organic ligand containing a morpholine moiety and its subsequent complexation with various Cu(II) salts are described. The obtained compounds were further evaluated for their antioxidant activity.

The organic ligand (HL) was synthesized via a classical synthetic procedure. The 4-(2-aminoethyl)morpholine-thiosemicarbazida was condensed with 2-formylpyridine in the presence of acetic acid as a catalyst. Subsequently, the thiosemicarbazone (HL) was used as a ligand for the synthesis of coordination compounds with copper(II) nitrate, chloride, and bromide salts, which is demonstrated in figure bellow. The structure of the organic compounds was confirmed by NMR spectroscopy, while the structural features of the obtained complexes were investigated by FTIR spectroscopy.

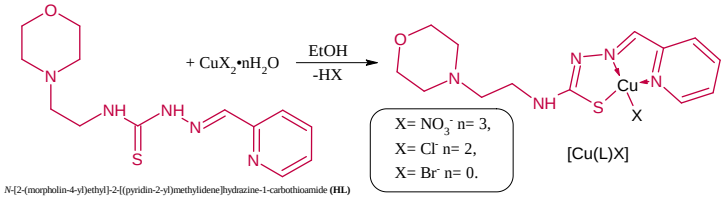


Figure 3. Synthesis scheme of Cu(II) coordination compounds with HL

The results of the antioxidant analysis demonstrated that the coordination compounds did not exhibit significant antioxidant activity. However, tiosemicarbazone (HL) showed pronounced antioxidant activity, with an IC_{50} value of 10.02 μM, which is approximately three times higher than that of the reference compound Trolox, whose IC_{50} value was determined to be 33.3 μM.

Acknowledgments: The experimental material presented in the article was developed within the national project "Synthesis and study of new materials based on complex combinations with polyfunctional ligands and with useful properties in medicine, biology and technology" (SSMCCLP) (code: 010602); details at: https://ichem.md/SSMCCLP.

Keywords: *coordination compounds, thiosemicarbazones, Cu (II), antioxidant activity.*

UDC: 619:616.379-008.64:004.891

VETERINARY DIGITAL BIOMARKER-BASED DSS FOR CONTINUOUS GLUCOSE MONITORING

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Diabetes mellitus (DM) is becoming an increasingly serious problem among veterinary patients, since it is one of the most common complex endocrine diseases with a progressively rising prevalence in veterinary patients. According to recent estimates based on surveys and published research articles, about 1.3% (1 in 300) of dogs and 1.2% (1 in 200) of cats in Europe, USA and UK will develop diabetes during their lifetime. Conventional diabetes management relies on intermittent blood glucose measurements, which provide limited information and increase stress in veterinary patients. This study aimed to develop a digital biomarker-based decision support system (DSS) algorithm integrated with a veterinary CGM platform to generate personalized recommendations for insulin administration, nutrition, and lifestyle management, based on the weighted contribution of predictor variables, as represented by the regression coefficients of the developed model. As input variables for conceptual DSS for CGM framework was included glucose level, insulin dosage, diabetes type, age, sex, meal carbohydrate intake, physical activity, sleep metrics, stress level, comorbidities, medications, and body temperature.

To calculate regression coefficients and data analysis of open-source veterinary diabetes datasets, was used linear regression method for prediction from JASP Machine Learning/Regression/Linear module that was trained to predict Insulin dose recommendation as target based on multiple factors. The developed regression model, based on datasets, identified several realistic factors significantly associated with insulin dose recommendations, including glucose concentration ($\beta = 0.867$, $p = 0.034$), low physical activity ($\beta = -1.584$, $p = 0.010$), diabetes type 1 ($\beta = 1.920$, $p = 0.005$), diabetes type 2 ($\beta = 1.329$, $p = 0.009$), and pancreatitis as a comorbidity ($\beta = 1.947$, $p = 0.002$).

The proposed algorithm of weighted contribution of predictor variables for digital biomarkers-based DSS for CGM systems addresses a significant gap in veterinary diabetes management and introduces a veterinary-specific DSS that provides actionable recommendations based on multiple data input streams. For more precise and better results more research and high-quality datasets need to be done. The system represents a first step toward personalized diabetes management in veterinary patients, improving glucose control, reducing stress, and enhancing quality of life.

Keywords: *continuous glucose monitoring, decision support system, diabetes mellitus, digital biomarkers, personalized veterinary medicine.*

UDC: 548.737:546.47

SYNTHESIS AND CRYSTAL STRUCTURE OF Zn(II) COORDINATION COMPOUND WITH PHENANTHROLINE

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Analysis of the Cambridge Structural Database and literature sources highlights the ability of transition metal cations to form stable coordination compounds with the 1,10-phenanthroline (phen) ligand. Due to the planar geometry and aromatic nature of this ligand, the resulting complexes can exhibit various supramolecular arrangements, stabilized by interactions between aromatic fragments. These structural features contribute to the formation of diverse crystal networks and provide compounds with significant potential in supramolecular chemistry and crystal engineering. A new coordination compound $[Zn(phen)_3](BF_4)_2 \cdot EtOH \cdot H_2O$ was obtained through the interaction of the phen ligand with salt $Zn(BF_4)_2 \cdot 6H_2O$, in the CH_3OH:C_2H_5OH solvent mixture. It crystallizes in the triclinic crystal system, with the *P*-1 space group, and has the following unit cell dimensions: *a*=11.3002(8)Å, *b*=12.8753(8)Å, *c*=14.4044(8)Å, α=82.350(5)°, β=75.946(6)°, γ=67.972(6)°. The Zn(II) cation is coordinated by three neutral phen molecules, which act as bidentate ligands through nitrogen donor atoms. The metal cation adopts a slightly distorted octahedral geometry, with an N_6 donor set provided by three phen ligands, Zn-N distances being in the range 2.153(3)-2.191(3) Å. Each phen ligand forms a chelate ring with the metal center, contributing to stability of the complex cation. The aromatic fragments favor the formation of supramolecular arrangements through π–π interactions, and intermolecular $[Zn(phen)_3]^{2+}$ cation – BF_4^- anion short contacts. These interactions contribute to the organization of the crystal packing and to the formation of a stable supramolecular network. X-ray data

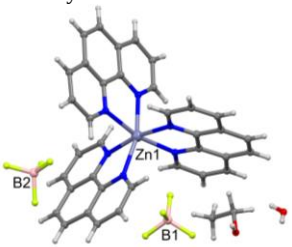


Fig. 1. Structure of $[Zn(phen)_3](BF4)_2 \cdot EtOH \cdot H_2O$

confirmed the structure of the obtained coordination compound, while IR spectroscopy confirmed the presence of the phen ligand and solvent molecules.

Funding: Subprogram 011202 ”Design and fabrication of intelligent materials with advanced magnetic, adsorption, luminescent and biologically active properties”, financed by the Ministry of Education and Research of R. Moldova.

Keywords: *1,10'-phenanthroline (phen), coordination compound, X-ray study.*

UDC: 004.415.53:004.8

AI-ASSISTED WEB APPLICATION TESTING: APPLICATIONS, RISKS, AND OPPORTUNITIES

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The adoption of artificial-intelligence (AI) tools in web-application testing has progressed over the past two years from isolated experimentation towards routine team practice, although its methodological maturity remains uneven. The present study offers a balanced synthesis of the ways in which such tools are, and may be, employed in web testing, drawing upon practitioner literature and reported industrial experience in order to establish correspondences between categories of testing task and the AI technologies appropriate to them.

Three levels of application are distinguished. The first concerns the support of manual testing, namely the derivation of test cases, checklists and boundary or negative tests from requirement specifications. The second concerns team-level assistants that generate application-programming-interface tests, page objects and locators, and that identify ambiguities in requirements through natural-language processing. The third concerns the orchestration of automated user-interface testing, comprising accessibility-tree exploration, conformance auditing against the Web Content Accessibility Guidelines, visual-regression checking and deterministic test execution.

The benefits reported in practice are appreciable but context dependent. Practitioner sources indicate reductions of approximately 30–50% in the effort required to author interface tests and gains of some 20% in automation coverage; these figures, however, derive from individual industrial accounts and have not been independently validated. The attendant risks are equally concrete, comprising output generated without regard to dependencies or preconditions, asymmetric inference costs, the silent loss of context, and self-healing mechanisms liable to conceal defects. Pressure towards rapid adoption is, moreover, in tension with confidentiality requirements that favor local, low-cost models.

Prompt engineering proves a determining factor: a structured Role–Context–Task–Format formulation, combined with few-shot exemplars, raises the quality of generated artefacts to a level comparable with that of experienced quality-assurance work. The study formulates prompt-engineering recommendations specific to web testing and advances the conclusion that AI extends, rather than replaces, engineering judgement. The resulting synthesis is intended as a reusable methodological nucleus for the doctoral thesis and for a supporting application.

Keywords: *web testing, artificial intelligence, test generation, prompt engineering, quality assurance.*

UDC: 547.972+615.281.9

SYNTHETIC DIBROMINATED TRICYCLIC FLAVONOIDS AS ANTIBACTERIAL AGENTS

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The increasing prevalence of antimicrobial resistance has reduced the effectiveness of current antibiotics, particularly against multidrug-resistant (MDR) pathogens. This study evaluated the antibacterial activity of synthetic dibrominated tricyclic 1,3-dithiolium flavonoids against clinically relevant bacteria, including *Staphylococcus aureus*, *Acinetobacter baumannii*, *Escherichia coli*, and *Neisseria gonorrhoeae*.

Methods: Antibacterial activity was determined by broth microdilution assays for minimum inhibitory concentration (MIC) and minimum bactericidal concentration (MBC) determination. Time-kill assays were performed to evaluate bactericidal kinetics, and fluorescence microscopy was used to investigate bacterial membrane integrity after treatment.

Results: Several compounds showed strong antibacterial activity, with MIC values as low as 0.12 µg/mL against *S. aureus* ATCC 25923 and 0.9 µg/mL against methicillin-resistant *S. aureus*. The lowest MBC value was 1.9 µg/mL, compared with 7.8 µg/mL for ampicillin. Moderate activity was observed against Gram-negative bacteria, with MIC values between 3.9 and 15.6 µg/mL. The lead compound was active against MDR *A. baumannii* (MIC 3.9 µg/mL) and *N. gonorrhoeae* (MIC 8 µg/mL). Time-kill assays demonstrated rapid bactericidal effects at 2×MIC, while fluorescence microscopy indicated disruption of bacterial membrane integrity.

Conclusions: Synthetic dibrominated tricyclic flavonoids demonstrated potent bactericidal activity, particularly against Gram-positive and MDR pathogens. Their membrane-targeting effects support further investigation of these compounds as potential antimicrobial agents.

Acknowledgments: This work was supported by a grant from the Ministry of Research, Innovation, and Digitization, CNCS/CCCDI-UEFISCDI, project number PN-IV-P7-7.1-PED-2024-1393, within PNCDI IV.

Keywords: *antimicrobial resistance; flavonoids; multidrug-resistant bacteria.*

UDC: 621.315.592:537.311.322

ELECTRONIC PROPERTIES OF $ZnSnN_2$ BY KELVIN PROBE AND PHOTOELECTRON YIELD SPECTROSCOPY

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Photoelectron Yield Spectroscopy (PYS) and Kelvin Probe (KP) measurements were used to investigate the surface electronic properties of $ZnSnN_2$ thin films. The films were prepared by magnetron sputtering from a [Zn]/[Sn] with 1:1 ratio alloyed target in N_2 ambient on SiO_2/Si(111) substrates at temperatures ranging from room temperature to 350 °C. Measurements were carried out on as-prepared films and on films post-deposition annealed at 350 °C in vacuum and Ar atmospheres

The ionization energy was obtained from the PYS spectra, while the work function was determined from Kelvin probe. The combination of these two quantities, together with the optical band gap, made it possible to estimate the positions of the valence band maximum, conduction band minimum, and Fermi level.

The as-prepared films showed almost no surface photovoltage response, indicating strong Fermi-level pinning, which can be attributed to surface states, defect-related levels, or a non-stoichiometric surface composition. The observed variations in ionization energy and work function with substrate temperature reveal that the electronic structure of $ZnSnN_2$ is highly sensitive to the growth conditions. Moreover, post-deposition annealing at 350 °C in vacuum or Ar caused a shift of the Fermi-level position, suggesting changes in surface composition, defect chemistry, and carrier concentration.

Overall, these results show that the combined use of PYS and Kelvin probe measurements is an effective approach for determining the band-edge positions and evaluating the band alignment of $ZnSnN_2$ thin films for future solar-cell applications.

***Acknowledgments*:** This study was supported by the research subproject *Abundant-element-based materials and structures for radiation detection and efficient energy conversion (#011207 DETCONV)* funded by Ministry of Education and Research of Republic of Moldova.

Keywords: *thin films, ternary nitrides, DC magnetron sputtering, Photoelectron Yield Spectroscopy, Kelvin probe*

UDC: 577.164.16:546.73

COBALAMIN AND COBINAMIDE: STRUCTURAL FEATURES AND REDOX MECCHANISMS OF COBALT CORRINOIDS

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Vitamin B_{12} (cobalamin) and its structural analogues, such as cobinamide, represent an important area of research in free radical chemistry. In general, the following generalities are characteristic of the forms of vitamin B_{12}.

Vitamin B_{12} (cobalamin) and its structural derivatives represent corrinic compounds with complex chemical and biochemical properties, determined mainly by the presence of the central cobalt atom and its ability to participate in redox transformations between the Co(I), Co(II) and Co(III) states.

The biological activity of cobalamin is closely related to its molecular structure, in particular to the presence of the lower axial ligand 5,6-dimethylbenzimidazole (DMB), which ensures recognition and interaction with B_{12}-dependent enzymes involved in essential processes of methylation and energy metabolism.

The biologically active forms of vitamin B_{12} (methylcobalamin and adenosylcobalamin) participate directly in fundamental metabolic reactions, while hydroxocobalamin and cyanocobalamin represent stable transport forms or metabolic precursors frequently used in supplementation and therapy.

Structural analogues of cobalamin, including pseudocobalamins and other modified corrinoids, although they retain the corrin core with cobalt, do not exhibit proper vitamin activity and may even interfere with the absorption and function of active vitamin B_{12}.

Cobinamide stands out as one of the most important analogues of cobalamin. The lack of the lower axial ligand DMB leads to the disappearance of coenzyme activity, but simultaneously determines the increase in the accessibility of the metal center and chemical reactivity.

The structural properties of cobinamide - the two axial positions available for coordination, the increased affinity for ligands and the more pronounced redox mobility - explain its easy participation in substitution and electron transfer reactions.

Compared to cobalamin, cobinamide exhibits superior chemical flexibility, which turns it into a valuable experimental model for studying the redox mechanisms of corrinoids and cobalt coordination compounds.

Comparative analysis of cobalamin and cobinamide demonstrates the direct relationship between molecular structure and biological or redox function of corrinoids. While cobalamin has predominantly physiological and metabolic roles, cobinamide is of major interest for fundamental research on free radical chemistry and oxidative processes.

Therefore, studying these compounds offers important insights into the bioinorganic mechanisms involved in redox homeostasis, in interactions with reactive oxygen and nitrogen species, and in the development of new biomedical and ecological applications based on corrinoids.

Acknowledgments: The results have been obtained in the framework of the project 25.80013.5107.20ROMD (REDOXCOB).

Keywords: *Vitamin B_{12}, cobalamin, cobinamide.*

UDC: 546.56:615.281.9

ANTIBACTERIAL MIXED-LIGAND CU(II) COMPLEXES WITH 4-PHENYLTHIOSEMICARBAZONE

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Mixed-ligand copper(II) complexes containing thiosemicarbazone ligands have attracted considerable attention due to their diverse biological properties, including antimicrobial activity. The investigation of their antibacterial activity against *Staphylococcus aureus* is particularly important because this Gram-positive pathogen is responsible for a wide range of community- and hospital-acquired infections and has developed resistance to many conventional antibiotics.

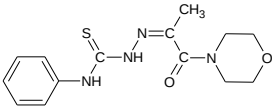


Fig. 1. The structure of HL.

A series of mixed-ligand copper(II) complexes was obtained by reacting the [CuLNO$_3$] with various *N*-heteroaromatic bases in ethanol using a 1:1 molar ratio: [CuL(Im)NO$_3$], [CuL(Py)NO$_3$], [CuL(β-Pic)NO$_3$], [CuL(γ-Pic)NO$_3$] and complexes were characterized by elemental analysis, FTIR spectroscopy, and molar conductivity studies.

The antibacterial properties were evaluated against *Staphylococcus aureus* (ATCC 25923). The activity was found to depend on the nature of the *N*-heteroaromatic base coordinated to the metal center and increased in the following order: β-Pic > Py > γ-Pic > Im. The highest antibacterial activity was observed for complex [CuL(β-Pic)NO$_3$], with MIC and MBC values of 1.953 μg mL^{-1} and 1.953 μg mL^{-1} respectively.

***Acknowledgments*:** This study was supported by the research project 010602 "Synthesis and Study of New Materials Based on Coordination Compounds with Polyfunctional Ligands and Useful Properties in Medicine, Biology, and Technology", funded by The Ministry of Education and Research of the Republic of Moldova.

Keywords: *copper(II) complex; antibacterial activity, N-heteroaromatic bases.*

UDC: 615.46:678.744

IN VITRO BEHAVIOR OF ELECTROSPUN PEO:CS MEMBRANES INCORPORATING CAFFEIC ACID

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Composite membranes obtained by electrospinning, based on chitosan (CS) and polyethylene oxide (PEO), are promising materials for biomedical applications, especially in the field of wound dressings, due to their biocompatibility and non-toxicity. However, the intrinsic antibacterial activity of chitosan is limited by its low solubility in water at physiological pH. To overcome this limitation, caffeic acid (CA), an antimicrobial agent with antioxidant properties, was incorporated into the matrix of electrospun fibers.

The need to study the *in vitro* behavior of these electrospun membranes derives from the importance of evaluating the structural stability and their ability to release bioactive compounds in a controlled manner.

To achieve the proposed goal, electrospun membranes of the PEO:CS were prepared, with and without the incorporation of caffeic acid (PEO:CS and PEO:CS_CA (1%)).

Their *in vitro* behavior was investigated by the following methods: determination of the degree of swelling and degradation, as well as the cumulative release profile of caffeic acid. Following the swelling analysis, for the PEO:CS electrospun membranes it was observed that in the first hour the swelling degree reached 100±0.00%**,** followed by a slight increase within the first 24 hours. After 48 hours, the swelling degree reached 156.00±1.41%**,** remaining stable thereafter. In the case of PEO:CS_CA (1%), after the first hour the swelling degree was 81.00±0.00%**,** but it continued to increase progressively, reaching 300±0.00% after 120 hours. Regarding the degradation behavior, it was noted that within the first 24 hours PEO:CS showed a degree of 46.50±6.36%**,** while PEO:CS_CA (1%) showed 31.25±4.42%**.** After 120 hours, degradation reached 56.25±4.42% for PEO:CS and 61.80±0.49% for PEO:CS_CA (1%). These findings confirm that the incorporation of caffeic acid into the polymeric matrix enhanced swelling and slightly accelerated degradation, through increasing matrix porosity and reducing intermolecular interactions between polymer chains. Further, the classical biphasic release profile of caffeic acid from the membrane was observed with the burst release in the first hour 39.07±4.14%, followed by a slow and cumulative release, reaching 70.35±7.45% after 120 hours.

In summary electrospun membranes analyzed exhibited rapid drug release, indicating a potential for inhibiting bacterial growth. The burst drug release behavior was mainly related to drug molecules loaded on the surface of the samples, while the subsequent sustained release phase is associated with the polymer matrix degradation.

Acknowledgments: This study was supported by the research project No. 010603.
Keywords: *electrospun membranes, caffeic acid, release profiles.*

UDC: 543.42/.51:547.913:582.929.4

QUANTITATIVE DETERMINATION OF TRITERPENIC ACIDS IN *MENTHA PIPERITA*. A COMPARATIVE STUDY OF NMR AND HPLC

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Mentha piperita is an aromatic crop from the *Lamiaceae* family, cultivated especially for its essential oils. This plant has been extensively used in traditional medicine and is a rich source of biologically active compounds. Among these compounds, triterpenic acids with proven anti-inflammatory, antioxidant, anticancer, and antimicrobial activities can be highlighted. In this study, we provide a method for the simultaneous quantitative determination of ursolic, oleanolic, and pomolic acids in 10 *Mentha piperita* varieties using 2D quantitative NMR spectroscopy, and the results were compared with those obtained by HPLC.

Plant extracts were obtained from the aerial parts by ultrasound-assisted extraction using 96% aqueous ethanol as the extraction solvent. Quantitative NMR determination included HSQC experiments using methyl 3,5-dinitrobenzoate as an internal standard. HPLC determinations were performed on an Agilent 1100 chromatographic system equipped with a UV detector set at 210 nm. An Agilent Zorbax PAH column packed with 3.5 μm particles (150 × 4.6 mm LT × ID) ensured satisfactory separation of pomolic, ursolic, and oleanolic acids in under 15 minutes using gradient elution with aqueous TFA–methanol mixtures. The method was validated for limits of detection and quantification, linearity, repeatability, recovery, and robustness. The determinations showed very close agreement between the results obtained by NMR and HPLC, with some differences reported, which can be attributed to chromatographic peak overlap with unresolved components.

The content of triterpenic acids reached the highest value in the crude extract of variety *Nistru 310,* obtained in the Republic of Moldova. These results confirm the validity of the NMR method for the quantitative estimation of triterpenic acid content in Mentha extracts for various biomedical and industrial applications and demonstrate the high potential for the exploitation of anti-inflammatory and antioxidant agents from Mentha-related products.

Acknowledgments: This study was supported by the research project 010601 „Chemical study of secondary metabolites from local natural sources and exploitation of their application potential based on the expansion of molecular diversity with multiple functionality (MetNatVal)", funded by the Ministry of Education and Research of the Republic of Moldova.

Keywords: *mentha, triterpenic acids, qNMR, HPLC.*

UDC: 616.314-073.75:614.876

EVALUATION OF DOSE FACTORS IN X-RAY PANORAMIC RADIOGRAPHY AND DENTAL TOMOGRAPHY INSTALLATIONS USED IN THE REPUBLIC OF MOLDOVA. PROPOSALS FOR DIAGNOSTIC REFERENCE LEVELS

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Radiation protection of patients in dentistry requires rigorous dose monitoring, especially given the frequent use of Cone Beam Computed Tomography (CBCT) compared to panoramic (2D) radiography.

Objective: This study evaluates the radiological performance and dose factors for 199 installations (45 models) from 14 European and Asian manufacturers represented in the Republic of Moldova.

Methodology: In 2025, independent measurements were conducted by an authorized medical physics service provider. Equipment performance was verified in accordance with international and European quality control standards. The metric used consisted of determining dose factors (normalized incident air Kerma) in correlation with exposure parameters (kV, mA, s). Exposure protocols were analyzed for four patient categories: child, adolescent, standard adult, and obese.

Results: Mean values for dose factors (Y1norm, Y2norm, Y3norm) were established for each category. The results indicate an increase in dose factors correlated with the patient's body mass.

Conclusions: The implementation of the methodology for establishing Diagnostic Reference Levels (DRLs) allows for dose optimization by enabling operators to adjust exposure parameters for each individual patient, thus ensuring compliance with the ALARA principle.

Acknowledgments: This study was supported and funded by the SRL ALARAD - Scientific and Technical Support Organization: Medical Physics Service Provider.

Keywords: *X-Ray, Kerma in air, DRL, Optimization.*

UDC: 37.018.43:004.771

DIGITAL ARTIFACT FOR AUTOMATIC GENERATION OF EVALUATIVE RESOURCES IN MOODLE

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În contextul transformărilor generate de revoluția digitală, sistemul educațional din Republica Moldova parcurge un amplu proces de modernizare. Cerințele societății bazate pe cunoaștere și evoluția accelerată a tehnologiilor informaționale determină reconfigurarea paradigmelor de predare, învățare și evaluare. Infrastructura educațională și resursele digitale existente necesită restructurare și aliniere la standardele internaționale ale educației digitale.

Direcțiile strategice sunt reflectate în documente precum Strategia Națională de Dezvoltare „Moldova Europeană – 2030" (HG nr. 653/2022) și Strategia „Educația – 2030", care susțin digitalizarea și inovarea educațională. În acest cadru, e-transformarea durabilă a Învățământului Profesional Tehnic devine esențială pentru dezvoltarea competențelor digitale și profesionale ale elevilor.

Problema cercetării derivă din necesitatea dezvoltării resurselor educaționale digitale sustenabile, capabile să asigure reutilizarea și extinderea ciclului de viață al conținuturilor didactice. În platforma Moodle, elaborarea testelor cu itemi randomizați implică procese complexe și consum ridicat de timp și competențe tehnice.

În acest context, automatizarea generării și organizării itemilor devine esențială pentru eficientizarea evaluării digitale. Soluția propusă constă în dezvoltarea unui artefact digital pentru optimizarea elaborării resurselor de e-testare.

Scopul lucrării este de a prezenta oportunitățile de automatizare a procesului de creare a băncii conținuturilor de itemi prin intermediul artefactului de planificare.

Lucrarea oferă o prezentare sintetică a unui artefact software și a fundamentelor teoretico-practice care au stat la baza proiectării și dezvoltării acestuia. Cercetarea, realizată în cadrul experimentului practic al tezei de doctor, vizează organizarea băncilor de conținut pentru itemi și elaborarea șabloanelor de e-teste cu itemi randomizați. De asemenea, sunt descrise funcționalitățile artefactului, mecanismul de funcționare și algoritmul implementat în codul sursă.

Studiul evidențiază schema funcțională, modelul informatic de funcționare și arhitectura de implementare a sistemului software. Integrarea soluției propuse răspunde necesității de optimizare a proceselor de evaluare digitală în contextul transformărilor generate de tehnologiile informaționale.

Prezentul studiu evidențiază faptul că procesul de creare și pregătire a materialelor necesare generării unui e-test contribuie semnificativ la reducerea timpului destinat planificării, elaborării și implementării evaluărilor digitale. Totodată, utilizarea artefactului propus diminuează necesitatea consultării extensive a resurselor bibliografice de specialitate privind metodologia dezvoltării resurselor educaționale digitale electronice.

Keywords: *artefact, planificator, platforma Moodle, Gift, banca categoriilor de itemi.*

UDC: 546.56:615.277.3

EFFECT OF S-METHYLATION ON BIOLOGICAL ACTIVITY OF COPPER(II) COMPLEXES

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To overcome selectivity and toxicity challenges of copper(II) thiosemicarbazone complexes, a transition to *S*-alkylated derivatives was proposed to enhance complex stability, solubility, and lipophilicity in physiological media. Six novel mixed-ligand coordination compounds, Cu(A)(L)NO3·nH2O, were successfully synthesized using salicylaldehyde 4-allyl-*S*-methylisothiosemicarbazone (HL) and various *N*-heteroaromatic bases: pyridine (1), 3-picoline (2), 4-picoline (3), 3,4-lutidine (4), imidazole (5), and 1,10-phenanthroline (6). The ligand structure was confirmed by NMR and FTIR spectroscopy; the resulting coordination compounds were comprehensively characterized by elemental analysis, FTIR, and molar conductivity measurements. *In vitro* anticancer activity and intracellular mechanisms were evaluated against HeLa, BxPC-3, and RD cancer cell lines, using MDCK cells as a normal control. Antiradical efficiency was assessed via $ABTS^{\bullet+}$ cation-radical assay relative to Trolox. All complexes exhibited pronounced dose-dependent antiproliferative activity (0.1–100 μM). The imidazole derivative [Cu(Im)(L)NO3]·H2O was the most potent, outperforming the reference drug doxorubicin 5-fold against HeLa cells (IC50 =2.1 μM vs. 10.0 μM) while exhibiting a remarkably high selectivity index (SI = 4.48). Comparative analysis revealed that *S*-alkylation of the thiosemicarbazone moiety is a key driver of biological efficacy: it enhanced cytotoxicity 3.3-fold and significantly improved the SI from 1.7 to 4.48. Additionally, all compounds significantly surpassed Trolox in antiradical assays, where S-methylation boosted antioxidant potency 1.5-fold. Thus, S-alkylation and the co-ligand nature critically modulate the biological profile, rendering S-methylisothiosemicarbazone complexes highly promising scaffolds for the development of selective anticancer agents with minimized side effects.

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Keywords: *copper(II) complexes, S-methylation, isothiosemicarbazone, cytotoxicity, antiradical activity.*

UDC: 547.792:632.4

A NEW TRIAZOLE COMPOUND WITH ANTIFUNGAL PROPERTIES AGAINST *FUSARIUM SOLANI*

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The fungus *Fusarium solani* is one of the most common soil-borne fungi that severely affects cereal and legume crops. The micromycete causes various rots and vascular diseases that lead to wilting and loss of plant vigor.

Aim of the study was to identify new triazole compounds that exhibit antifungal activity against the fungus *Fusarium solani*.

Materials and Methods: The compound 2-(2,4-dichlorophenyl)-3-(1H-1,2,4-triazol-1-yl)-2H-chromen-2-ol was used in the research, obtained from a solution composed of 2.56 g of triazolyl ketone - 1-(2,4-dichlorophenyl)-2-(1H-1,2,4-triazol-1-yl)ethanone and 1.34 g of salicylaldehyde dissolved in 30 mL of benzene to which piperidine/acetic acid was added in catalytic amounts. The structure of the synthesized compound was confirmed based on elemental analysis: $C_{17}H_{11}Cl_2N_3O_2$. This compound was supplemented in concentrations: 0.00125; 0.0025 and 0.005 in the PDA (Potato Dextrose Agar) nutrient medium. The mycelium of the mentioned fungus was placed on this medium and the diameter of the colonies was measured (2 perpendicular diameters, the average of which served as a biometric index) on days 6 and 7 of cultivation for all concentration variants studied and compared with the control variant (medium not supplemented with compound). The experiments were performed in 5 repetitions. The data were statistically processed in the STATISTICA 7 software package.

Results: It was found that on the 6-th day of cultivation, the increase in the antifungal activity of the researched compound compared to the control variant was 24.6-51.0%, and on the 7-th day – 19.8-44.6% for the concentration range 0.00125-0.005%, respectively.

Conclusion: The triazole compound 2-(2,4-dichlorophenyl)-3-(1H-1,2,4-triazol-1-yl)-2H-chromen-2-ol can be successfully used in the concentration range: 0.00125-0.005% as an inhibitor of the fungus *Fusarium solani*.

Acknowledgments: The research was carried out within the framework of the Subprogrammes 010601 "Chemical study of secondary metabolites from local natural sources and exploitation of their application potential based on the expansion of molecular diversity with multiple functionality" and 011102 "Extension and conservation of genetic diversity, improvement of gene pools of agricultural crops in the context of climate change", financed by the Ministry of Education and Research of Republic of Moldova.

Keywords: *cereals, Fusarium solani, triazole.*

UDC: 628.316.12:547.56

FENTON OXIDATION OF RESORCINOL IN AQUEOUS SOLUTION: EFFECT OF INITIAL SUBSTRATE CONCENTRATION

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Resorcinol (RS, 1,3-dihydroxybenzene) is a phenolic compound widely used in the chemical, pharmaceutical, and rubber industries, and is frequently detected in industrial wastewaters at concentrations posing significant risks to aquatic ecosystems and human health. Advanced oxidation processes (AOPs), particularly the Fenton reaction, have emerged as effective methods for the degradation of recalcitrant organic pollutants in aqueous media. The aim of this study was to investigate the influence of the initial resorcinol concentration on its degradation efficiency by the Fenton reagent, and to determine the optimal substrate concentration for the treatment process.

Experiments were conducted in batch mode using aqueous solutions of resorcinol at initial concentrations of [RS]0 = (2.27 – 9.08) ·10-4 M. Resorcinol was quantified spectrophotometrically at 275 nm (T80+ UV/Vis; R2 = 0.9995); COD was measured at 600 nm (R2 = 0.9998). Pseudo-first-order kinetics were applied; k (s-1) and $t_{1/2}$ (s) values were extracted from linear regression of $\ln(C_t/C_0)$ vs. time.

The residual RS concentration decreased over time for all initial concentrations tested, demonstrating that the Fenton process effectively degrades resorcinol under the applied conditions. The highest degradation efficiency (57.6% at 60 min; 91.2% after control adsorption) was achieved at the lowest initial concentration of RS, indicating that the Fenton reagent is most effective at lower substrate loadings. As initial concentration increased to 9.08 · 10-4 M, the degradation percentage decreased, although the absolute removal of RS mass increased. The COD values high across all tested concentrations (82–91%), suggesting effective conversion of organic matter to inorganic products. The optimal substrate concentration under the given Fenton conditions was found to be 2.27 · 10-4 M.

The study demonstrated that the initial substrate concentration significantly influences degradation and mineralization efficiency. The lowest tested concentration yielded the highest degradation rate under fixed Fenton reagent conditions. The results indicate that the Fenton oxidation process can be successfully applied for the treatment of resorcinol-containing wastewaters, with optimized substrate concentrations enhancing both pollutant removal and organic matter mineralization.

Acknowledgments: This study was supported by the research project No. 010603, *Advanced research in computational and ecological chemistry, identification of technological procedures for treatment, formation of water quality and quantity*, funded by NARD.

Keywords: *phenol, wastewaters, Fenton processes, Advanced oxidation processes.*

UDC: 577.216:004.9

A K-MER-BASED FRAMEWORK FOR SENSITIVE IDENTIFICATION AND QUANTIFICATION OF NOVEL TRANSCRIPT ISOFORMS

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Alternative splicing is one of the major sources of transcriptome complexity in eukaryotic organisms. However, accurate identification and quantification of highly similar transcript isoforms remain technically challenging, particularly in cases involving subtle nucleotide variation, alternative splice junctions, or incomplete transcript annotations. Conventional pseudo-alignment approaches frequently collapse similar transcripts into shared equivalence classes, limiting transcript-level resolution and complicating isoform-specific analysis.

Previously, we developed a k-mer-based strategy for expression analysis of transcript isoforms encoding identical protein products but differing by small synonymous nucleotide substitutions. The method was based on the identification of transcript-specific k-mer signatures generated after removal of k-mers shared between multiple isoforms. This approach demonstrated high sensitivity for distinguishing extremely similar transcript variants that are difficult to resolve using standard transcript quantification methods.

Building upon this concept, we propose the development of a computational framework for sensitive identification and quantification of previously unannotated transcript isoforms using k-mer analysis. In the proposed approach, RNA-seq reads are decomposed into k-mers and compared against a reference database of transcript-specific and shared k-mers derived from known transcriptomes. K-mers absent from the reference transcript annotation but consistently supported by sequencing reads are considered candidate markers of novel transcript structures. Additional emphasis is placed on k-mers spanning alternative splice junctions, exon-skipping events, intron retention regions, and local nucleotide variation.

The framework is currently under development and is intended for application to both short-read and long-read transcriptomic datasets. Preliminary observations suggest that the proposed strategy may provide improved sensitivity for distinguishing closely related transcript isoforms and detecting transcript structures that are difficult to identify using conventional alignment- or pseudo-alignment-based methods.

The proposed approach may contribute to more accurate transcriptome annotation and improved characterization of transcript diversity associated with alternative splicing.

Keywords: *alternative splicing, k-mers, novel isoforms, transcriptomics, RNA sequencing.*

UDC: 512.81:517.925

LIE ALGEBRA ADMITTED BY A TERNARY CUBIC DIFFERENTIAL SYSTEM OF THE DARBOUX TYPE

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Consider the ternary cubic differential system of the Darboux type

$$\dot{x}^j = a_\alpha^j x^\alpha + 3x^j R(x^1, x^2, x^3) \equiv P^j \quad (j = \overline{1,3}), \tag{1}$$

where $a_1^1 = g,\ a_2^2 = a_3^3 = q,$ the rest $a_\alpha^j = 0,$ if we denote $x^1 = x,\ x^2 = y,\ x^3 = z,$ then $R(x^1, x^2, x^3) = R(x, y, z) = ax^2 + by^2 + cz^2 + 2dxy + 2exz + 2fyz.$

Solving the determining equations of the system (1) were determined five Lie operators $X_i,\ (i = \overline{1,5})$ of the form $X_i = \xi_i^1 \frac{\partial}{\partial x} + \xi_i^2 \frac{\partial}{\partial y} + \xi_i^3 \frac{\partial}{\partial z},\ (i = \overline{1,5}).$

Theorem 1. *The Lie operators* X_1, X_2, X_3, X_4, X_5 *forms a five dimensional Lie algebra admitted by the ternary cubic differential system* (1).

$L_5 < X_1, X_2, X_3, X_4, X_5 >$

Using the operators X_1, X_2, X_3, X_4, X_5 we construct the operators

$$Y_1 = e(be - df)X_1 + e(be - df)X_3 + (cd - ef)b\left(be^2 g - defg + g + q\right)X_4 +$$

$$+(be - df)c\left(be^2 g - defg + g + q\right)X_5,\ Y_2 = X_2.$$

Remark 1. *The Lie operators* Y_1, Y_2 *forms a two-dimensional commutative Lie algebra admitted by the ternary cubic differential system* (1).

$L_2 < Y_1, Y_2 >$

We write the operators Y_1, Y_2 in the form $Y_i = \zeta_i^1 \frac{\partial}{\partial x} + \zeta_i^2 \frac{\partial}{\partial y} + \zeta_i^3 \frac{\partial}{\partial z}.$ Consider the non-zero determinant

$$\Delta = \begin{vmatrix} \zeta_1^1 & \zeta_1^2 & \zeta_1^3 \\ \zeta_2^1 & \zeta_2^2 & \zeta_2^3 \\ P^1 & P^2 & P^3 \end{vmatrix}.$$

Remark 2. $\mu = \frac{1}{\Delta}$ *is an integration factor for the Pfaffian equations*

$$(\zeta_i^3 P^2 - \zeta_i^2 P^3)dx + (\zeta_i^1 P^3 - \zeta_i^3 P^1)dy + (\zeta_i^2 P^1 - \zeta_i^1 P^2)dz = 0 \quad (i = 1, 2),$$

which define the general integral of the ternary cubic differential system (1).

Solving the Pfaffian equations were obtained two first integrals for the ternary cubic differential system (1).

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Keywords: *ternary diferential system of the Darboux type, Lie operators, Pfaffian equations.*

UDC: 577.34:530.145

UVC RADIATION EFFECTS ON LIVING CELLS RESPONSE - A QUANTUM-CLASSICAL PERSPECTIVE

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Quantum biophysics is a vibrant field at the intersection of quantum mechanics, molecular biology and biophysical modeling. This paper models the quantum nature of biomolecular interactions under UVC radiation, which lead to the covalent dimerization of adjacent pyrimidine nucleotides - specifically the formation of thymine dimers. DNA lesions trigger the cellular stress response. We also model the subsequent gene expression response through classical biophysics methods, utilizing a system of coupled differential equations.

The behavior of DNA or protein supramolecular structures under radiation opens new avenues for the inductive modification of these molecular conglomerates and for information processing. This radiation-driven control encompasses the synthesis or dimerization of biomolecules, intracellular mass migration, and intercellular signal interference. Here, we propose innovative methods for reorganizing biomolecular structures under radiation, where molecular dipoles are oriented toward fusion via Raman excitation. Furthermore, the interaction of a bimodal field with molecular electric dipoles—either inside an optical cavity or within the evanescent zone of a fiber or microsphere - unlocks new perspectives in biomolecular manipulation. This cooperative excitation of the electron subsystem of biomolecules within the near-field electromagnetic zone of optical structures can generate excited dipoles in the long-lived states of each molecular radical. A similar phenomenon can be observed during the generation of tautomeric states in DNA structures. To model these processes, we developed a master equation for the electronic and nuclear subsystems of molecular complexes; its solution describes the generation of molecular clusters in long-lived excited states. Finally, a stationary solution for the electric density matrix is proposed to demonstrate the stable excited states of dimers, trimers, tetramers, and multimers.

As an elementary unit of quantum information, we use the qubit, to describe two-state molecular systems, in which proton transfer in hydrogen bonds and conformational switching of nucleobases take place. For the description of quantum states and their evolution, we will use the Dirac formalism, bridging abstract quantum theory and classical biophysics.

Thus, the paper integrates three complementary approaches - the formalism of quantum states, modeling of radiation-matter interaction, and the dynamics of gene expression - into a unified framework of applied quantum biophysics.

Keywords: *quantum biophysics, modeling, qubits, Dirac formalism, UVC radiation, thymine dimerization, gene expression, differential equations, DNA damage.*

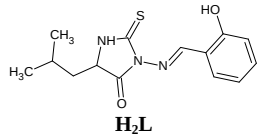
UDC: 546.56:577.121

SYNTHESIS OF Cu(II) COORDINATION COMPOUNDS BASED ON 3-{(E)-[(2-HYDROXYPHENYL)METHYLIDENE]AMINO}-5-(2-METHYLPROPYL)-2-SULFANYLIDENEIMIDAZOLIDIN-4-ONE WITH ANTIOXIDANT ACTIVITY

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Molecular design aimed at obtaining new bioactive agents often involves the integration of recognized pharmacophoric moieties, such as the imidazolidine-2,4-dione ring, into azomethine structures with antibacterial, antifungal, and chemotherapeutic properties [1-2]. In this context, the structural characterization and reactivity study of (E)-3-((2-hydroxybenzylidene)amino)-5-isobutyl-2-thioxoimidazolidin-4-one open valuable perspectives in the development of biometal coordination compounds capable of exhibiting enhanced biological activity and optimal selectivity against pathogens.

The synthesis of coordination combinations was carried out according to the methodology expressed in the literature, where the ethanolic solution of the Cu(II) salt is added to the alcoholic solutions of azomethine (H_2L) while stirring. The reaction products are green in color and are in powder form. The obtained samples were purified, and the functional groups were confirmed using FTIR spectroscopy. Then the research of antioxidant properties followed; the results are in the figure below.



H_2L

Compounds	IC_{50}, µM; ±SD
[Cu(L)Cl] (**1**)	29.50±0.87
[Cu(L)NO_3] (**2**)	100.00±3.00
[Cu(L)H_2O]ClO_4 (**3**)	15.06±0.45
H_2L	100.00±3.00
Trolox	33.3±0.99

Figure 1. Structural formula of 3-{(E)-[(2-hydroxyphenyl)methylidene]amino}-5-(2-methylpropyl)-2-sulfanylideneimidazolidin-4-one and results of antioxidant analysis of synthesis products

The investigation of the biological activity of the synthesized compounds, carried out by determining the IC_{50} values, demonstrated the existence of a direct correlation between the nature of the anion coordinated to the copper center and the antioxidant activity of the compounds. The free ligand (H_2L) showed the lowest activity, with the maximum value tested of 100 µM. Similarly, the [Cu(L)NO_3] (**2**) complex did not show significant improvements, exhibiting an antioxidant effect comparable to that of the basic ligand.

The [Cu(L)Cl] (**1**) complex demonstrated a moderate increase in biological activity, with an IC_{50} value of approximately 30 µM, close to that of the standard antioxidant Trolox (33.3 µM). The highest antioxidant activity was observed for the

$[Cu(L)H_2O]ClO_4$ (**3**) complex, which recorded an IC_{50} value of approximately 15 µM, exceeding the performance of the reference standard. The results obtained confirm that the choice of the anion and the copper salt significantly influences the biological properties of coordination compounds and represents an important factor for increasing their pharmacological potential.

Acknowledgments: The experimental material presented in the article was developed within the national project "Synthesis and study of new materials based on complex combinations with polyfunctional ligands and with useful properties in medicine, biology and technology" (SSMCCLP) (code: 010602); details at: https://ichem.md/SSMCCLP.

Keywords: *coordination compounds, Schiff bases, antioxidant activity.*

UDC: 634.11:632.951

PIPERIDINE AND TRIAZOLE FUNGICIDES MIXTURE IN POWDERY MILDEW CONTROL ON APPLE

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Apples are the primary perennial fruit crop in the Republic of Moldova in terms of yield. In 2025, the total apple harvest in Moldova amounted to 447,3 thousand tons. Obtaining high-quality crop is impossible without protection plants from diseases. Powdery mildew, caused by fungus *Podosphaera leucotricha* (Ellis & Everh.) E.S. Salmon) is among the most economically significant apple diseases.

Different classes of pesticides are used for the pathogens control. Triazole fungicides is one of the largest and most widely used groups of synthetic pesticides in the world. They account for approximately 25–30% of the global fungicide market and hold leading positions in the industrial orchard and grain crop segments. Resistance to tebuconazole, developed in fungi, can significantly reduce its efficacy in the control of the targeted diseases. For to reduce pathogens resistance in particular to triazole, the systemic piperidine contact fungicide fenpropidin is used. It accounts for 15–25% the morpholine-based preparations applied in the plant protection systems.

The aim of the work was to evaluate the biological effectiveness of the preparation Avedis, EC, active substances fenpropidine, 300 g/l + tebuconazole, 250 g/l, produced by LLC "Alfa Smart Agro," Republic of Moldova, and LLC "Plant for Formulation in Bila Tserkva," Ukraine, for the protection of apple trees against powdery mildew in the Republic of Moldova.

The experiments were carried out at the experimental plot of the MSU, IGFPP on the apple var. «Gala Delicious» during the 2025-year vegetation period. There were 3 variants, 3 repetitions, with 3 trees per repetition in the trials. The 0.4l/ha and 0,6 l/ha doses of the preparation were tested. Biological effectiveness of the preparation was calculated on the basis of the disease inensity.

It was found out that after the last application prior to harvesting the biological efficacy of Avedis EC in the powdery mildew control on apple trees was 80.4% and 85.2% at an application rates of 0.4 l/ha and 0.6 l/ha, respectively.

The results of field trials conducted in the Republic of Moldova under the agroclimatic conditions of 2025 show that Avedis EC preparation, containing fenpropidin and tebuconazole mixture is effective against apple powdery mildew.

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Keywords: *piperidine, triazole, powdery mildew control, apple.*

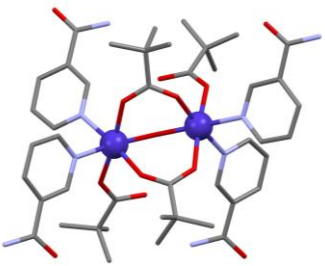
UDC: 546.73:548.737

SYNTHESIS AND CRYSTAL STRUCTURE OF A NEW MIXED-LIGAND COBALT(II) PIVALATE COMPLEX WITH NICOTINAMIDE

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Transition metal complexes containing mixed ligands have attracted considerable attention due to their diverse structural architectures and potential applications in catalysis, magnetism, bioinorganic chemistry, and materials science. Among transition metals, cobalt exhibits flexible coordination behavior and can adopt a variety of coordination geometries depending on the nature of the ligands.

As part of our studies on cobalt(II/III) cluster coordination chemistry, a new dinuclear complex, $[Co_2(\mu\text{-}H_2O)(piv)_4(nia)_4]\cdot 2MeCN$ (**1**), has been synthesized via the reaction of cobalt(II) pivalate (Hpiv = pivalic acid) and nicotinamide (nia) in an acetonitrile solution. Single-crystal X-ray diffraction analysis indicates that **1** crystallizes in the monoclinic space group $P2_1$ with the unit cell parameters a = 22.2351(3), b = 12.0053(2), c = 22.3644(4) Å, β = 111.904(2)°, and V = 5538.96 Å^3. The asymmetric unit comprises two crystallographically independent neutral dinuclear $[Co_2(\mu\text{-}H_2O)(piv)_4(nia)_4]$ complexes along with acetonitrile solvate molecules. In **1**, the two Co(II) atoms are bridged by an aqua ligand and two pivalates (Fig.). The remaining two pivalate ligands coordinate in a monodentate mode, while two nia ligands complete the coordination sphere of each Co(II) atom. Each nia ligand forms hydrogen bonds with the nia ligands of neighboring units, resulting in a 3D hydrogen-bonded network.



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Keywords: *cobalt, pivalate, nicotinamide, crystal structure, hydrogen-bonded network.*

UDC: 664.8:577.112

RESPONSE SURFACE OPTIMIZATION OF NADES-ULTRASOUND-ASSISTED EXTRACTION OF ANTIOXIDANT PROTEINS FROM ALMOND PRESSED CAKES

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Almond press cake, a by-product obtained during the oil extraction, is an important source of proteins, reaching up to 35% depending on the pressing conditions. Various strategies have been used to extract proteins from almond pressed cakes, including aqueous or enzyme-assisted aqueous extraction processes. To maximize the yield of phytochemical-rich extracts while minimizing costs, extraction processes can be optimized by adjusting key parameters such as the solvent-to-solid ratio, temperature, extraction time, and solvent composition. This study focused on optimizing antioxidant proteins extraction from almond press cakes through a NADES-based ultrasound-assisted extraction process using response surface methodology (RSM).

NADES were prepared by mixing betaine and urea at a 1:1 molar ratio, heated to 80 °C and stirred until a viscous clear solution was obtained. After cooling, the mixture was diluted to 30% with distilled water. Hexane-defatted almond pressed cakes were added to NADES and the protein extraction was carried out in an ultrasonic bath (37 kHz), followed by centrifugation, to recover the supernatant. The following extraction parameters were tested: the solid-liquid extraction ratio of 1:15, 1:30 and 1:45 (w/v); the temperature of 35 °C, 50 °C and 65 °C, and the extraction time of 15, 30 and 45 min. The extracts were analyzed for extraction yield (%) and their antioxidant potential using TEAC assay. Optimization of the extraction parameters was performed using RSM and a Box-Behnken experimental design with 20 runs, in order to maximize the extraction yield and antioxidant activity.

The experimental data showed that a solid-liquid extraction ratio of 1:45 combined with extraction temperatures of 50 °C and 65 °C enhanced polyphenol extraction and antioxidant activity, resulting in the highest polyphenol and TEAC values. The obtained data were subjected to mathematical design considering three parameters and two variables. In range extraction parameters for maximal yield (45.5%) and antioxidant activity (9.272 mM equiv/100g sample) were determined at 1:45 solid-liquid extraction ratio, 64.5 °C and 42.8 min. When considering minimal resource use for maximal yield (29.248%) and antioxidant activity (5.964 mM equiv/100g sample), the following values were identified as optimal: 1:28.5 extraction ratio, 48.88 °C and 15 min.

In conclusion, the NADES-assisted ultrasound extraction conditions were

optimized to maximize the recovery of proteins from almond press cakes while preserving their antioxidant activity. The obtained protein extracts will be further evaluated for their potential use in various food, nutraceutical, and biotechnological applications.

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Keywords: *by-products, almond pressed cake, NADES, protein extraction, optimization.*

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CHEMICAL SYNTHESIS OF AG NANOPARTICLES USING TANNIC ACID A STUDY OF THEIR STABILITY AND CHARACTERIZATION

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The aim of this study was to investigate the synthesis of silver nanoparticles (Ag-NPs) using tannic acid (C76H52O46) as a reducing agent and stabilizer, to study the stability of the synthesized silver nanoparticles, and to characterize them. The synthesis of AgNPs was carried out under various conditions, such as the concentration of C76H52O46 (0.50; 1.00; and 2.00 mM), the concentration of AgNPs (0.50; 1.00, and 2.00), synthesis temperature (50°C and 80°C), and stirring time (10 min; 20 min; 30 min; 60 min; and 80 min).

Stability study. The stability study of the silver nanoparticles was conducted over a period of 60 days, without the addition of any stabilizing agent, under conditions where sodium citrate ($Na_3C_6H_5O_7$) served as the reducing agent and tannic acid served as the stabilizing agent. The characterization of the synthesized silver nanoparticles was performed for various parameters such as UV-VIS absorption spectroscopy, FTIR spectroscopy, particle size, and zeta potential using a particle size analyzer.

The characteristic absorption peak of the silver colloidal solutions in the UV-VIS spectral range was located at wavelengths between 412 and 420 nm. The well-defined absorption peak with a narrow half-width indicates the formation of homogeneous spherical AgNPs. The average particle sizes of the synthesized AgNP samples ranged from 20.6 nm to 40.2 nm as the precursor concentration increased from 1.0 mM to 2.0 mM, respectively. The antimicrobial activity of silver nanoparticles at different concentrations (20 mg/L, 40 mg/L, and 60 mg/L) against bacterial strains was investigated and discussed.

In this study, a simple and versatile approach was developed for the synthesis of Ag-NPs with various molar concentrations ranging from 0.05 mM to 2.00 mM. Using this method, Ag-NP samples can be synthesized directly by stirring a mixture consisting of C76H52O46, AgNO3, and H2O at a specific temperature without the addition of other toxic agents, stabilizers, or co-precipitates. LS results showed that the average particle size ranges between (20 and 40) nm, and that the obtained Ag-NPs samples are stable; as the weight ratio between the reducing agent and AgNO3 increased, the average diameter of the Ag-NPs gradually increased, which was accompanied by a visible morphological transition from spherical shapes to more faceted structures.

Acknowledgments: This study was supported by the research „Design of supramolecular architectures based on metal-derivative phthalocyanines—functional nanoparticles with applications in medicine", funded by CDI from Romania.

Keywords: *tannic acid, silver nitrate, UV-VIS spectroscopy, FTIR, zeta potential.*

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MICROSCOPIC THEORY OF CHROMISM IN TMOs

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Chromic effects in transition metal oxides (TMOs) arise from strong coupling between electronic correlations, lattice distortions, carrier localization, and defect states. Depending on the material and external stimulus, the optical response can be governed either by a metal-insulator transition (MIT), as in vanadium oxides such as VO2 and V2O3, or by charge-carrier injection and the formation of localized polaron states, as in WO3, NiO, TiO2. In both cases, chromism is expressed through a redistribution of spectral weight in the dielectric function, leading to changes in absorption, reflectance, refractive index, and extinction coefficient in the VIS-NIR spectral ranges.

The optical response of TMOs is commonly described using phenomenological Drude-Lorentz or Lorentz-oscillator models. In these models, the metallic phase is represented by a Drude contribution, while interband, defect-related, and polaronic absorption bands are described by Lorentz oscillators. Such an approach successfully reproduces experimental optical and ellipsometric spectra, but provides limited microscopic interpretation of the individual spectral contributions.

In this work, chromism in TMOs is analyzed within the Green's function formalism using model Hamiltonians of the Hubbard-Holstein type. This approach accounts for electronic correlations, electron-phonon interaction, structural reconstruction, and localized polaron states. The dielectric function is evaluated within linear-response theory through the two-particle Green's function, allowing optical absorption to be connected with transitions involving band states, in-gap levels, polaronic states, and correlation-driven spectral-weight redistribution.

Although the resulting dielectric response has a Drude-Lorentz-like form, its spectral components acquire a clear microscopic meaning. For vanadium oxides, thermochromism is associated with a Peierls-Mott MIT and redistribution of spectral weight between Drude and interband contributions. For WO3 and NiO, chromism is mainly governed by small-polaron absorption. The proposed framework therefore links phenomenological optical modeling with microscopic mechanisms of chromism in TMOs.

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Keywords: *transition metal oxides, chromism, Drude–Lorentz model, Green's functions.*

The Conference was attended by 534 participants from 78 universities, institutes and research centers, representing 17 countries, including: Republic of Moldova (328), Romania (88), Ukraine (60), Serbia (18), Czech Republic (11), Russian Federation (9), Serbia (7), Turkey (3), Switzerland (2), Azerbaijan (16), Algeria (2), Sudan (3), Italy (1), France (1), Belarus (1) Georgia (1), Germany (1).

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