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Institute of Genetics, Physiology and Plant Protection
Scientific Association of Geneticists and Breeders of the Republic of Moldova

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(VIIth Edition)

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The International Symposium "*Advanced Biotechnologies - Achievements and Prospects*" keep on the series of scientific events that bring together all partners in the fields of applied biology, agriculture, and technologies related to natural sciences.

The first edition took place in 1998 with the title "*Genetic Engineering and Modern Biotechnology*", title maintained at the next 2 editions (1998 and 2002). Since 2013 the symposium has been carried out under the actual generic "*Advanced Biotechnologies - Achievements and Prospects*" (October 24-25, 2013 – IIIth Edition; October 3-4, 2016 – IVth Edition; October 21-22, 2019 – Vth Edition, October 3-4, 2022 – VIth Edition). Establishing and maintaining traditions, the symposium aims are to debate the latest outstanding results in plant biotechnologies and microbial biotechnology by bringing together scientists from different scientific centers.

The Symposium is organized within the subprogrammes, funded by the Ministry of Education and Research:

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011102 Increasing and conservation genetic diversity, agricultural crop breeding in the context of climate change,

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Scientific International Symposium
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INTEGRATIVE BIOTECHNOLOGICAL STUDY OF TOMATO AT SPOROPHYTE AND GAMETOPHYTE LEVELS TO INDIVIDUAL AND COMBINED BIOTIC AND ABIOTIC STRESS

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The response of a plant to combined stresses is very complex, leading to differential responses due to triggering of interactive, inhibiting or differential prioritizing of signaling pathways, which further conduct to modified agro-morphological traits, plant growth, and development. In order to study the reaction amidst individual or combined effects of biotic and abiotic stresses, it is important to understand the genetic variation among different genotypes and their responses to such stresses (alone or combined).

According to the proposal of this work, the impact of heat stress or water deficit was studied in the progeny of tomatoes derived from plants reinfected with viruses (Tobacco Mosaic Virus, TMV, or Tomato Aspermy Virus, TAV), represented by four cultivars – Flacara, Veneț, Mary Gratefully, Rufina, and the wild species *Solanum pimpinellifolium*. Based on a wide range of morphological and physiological parameters (germination rate, root size), a differentiated and specific response of the redox system was established (mobility of Reactive Oxygen Species, ROS, H_2O_2 content, peroxidase activity) in leaves and rootlets between genotypes, depending on phytosanitary status. Thus, a distinct ROS mobility pattern was identified in roots and stems of the offspring from virus-infected plants compared to control plants exposed to abiotic stress. Histochemical analysis revealed different ROS distribution patterns depending on stress type and genotype, expressing a more pronounced depressive effect for water deficit compared to high temperature. Offspring of plants infected with TAV or TMV showed significant increases in POX activity, predominantly dependent by stress (77%), followed by the virus-stress interaction (9%). The non-enzymatic antioxidant response, assessed on proline content, showed a significant increase under water stress, especially in the offspring of TAV-infected plants compared to the control or TMV variants.

The formation capacity and activity of the male gametophyte were significantly influenced by biotic and abiotic stress factors. Based on the ANOVA test, it was established that under viral pathogenesis conditions, the genotype was the main source of variation in pollen viability (45.0...70.0%), while the primary source of variation in pollen tube length was determined by viral agents (41.0...87.0%). The combined influence of abiotic and biotic factors manifested at the haploid level through specific responses, distinct in some cases from the responses observed at the sporophyte level. Thus, as a result of the combined influence of heat stress and viruses, stimulatory effects were recorded in 13.3...20.0% of cases, and inhibitory effect - in 80.0...86.0% of cases. According to the three-way ANOVA, temperature represent the main source of variability in the pollen viability (78.1…81.5%), while the variation in pollen tube length was largely dependent on temperature and factors interaction (75.6%). For reinfected variants, it was established the increasing by 1.8 to 2.2 times for the contribution of genotype as source of pollen parameters variation. The obtained data conclude that the male gametophyte represents a more expressive background of differential response to heat, water deficit alone or combined with viral infection, which allows for the selection of tomato genotypes with tolerance to the analyzed factors.

Keywords: tomato, heat stress, water deficit, virus infection, resistance, tolerance

Funding. 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 the Republic of Moldova.

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TESTING VECTORS WITH PHOSPHITOXIDOREDUCTASE GENE IN *Nicotiana tabacum*

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To reduce plant dependence on phosphorus fertilizers, the development of transgenic plant lines with genes encoding phosphite oxidoreductase is promising (López-Arredondo et al., 2012). Therefore, this study aimed to test the genetic constructs pB7WG2 and pTXDwt-BAR, the T-DNA of which contains a *ptx*D gene responsible for the oxidation of phosphite to phosphate. The genetic constructs pB7WG2 and pTXDwt-BAR were transformed into two strains of *Agrobacterium tumefaciens* GV3101 and C58. Four clones of *A. tumefaciens* were selected – GV4.1 and C9.1 with the pB7WG2 construct (containing the *ptx*D gene under the 35S promoter from the *Pseudomonas stutzeri* WM88 strain that encodes phosphite oxidoreductase), GV8.2 and C3.2 with the pTXDwt-BAR construct (containing, in addition to the *ptx*D gene, the *bar* selectable marker gene from *Streptomyces hygroscopicus*). Genetic constructs were kindly provided by prof. L.R.Herrera-Estrella.

Agrobacterium-mediated transformation of leaf discs of three *Nicotiana tabacum* varieties was performed: Petit Havana, Samsun, and Wisconsin. Selective media for the isolation of transformants carrying the *ptx*D gene had been established previously. In the selective medium based on MSR (MS with the addition of BAP and NAA) – MSR(Phi) – dihydrophosphate (Pi) was partially replaced with potassium dihydrophosphite (Phi) by partial removal of KH_2PO_4 and addition of phosphorous acid. This led to acidification of the MSR(Phi) medium to pH 3.3–4.9. When 1.9 g/l MES was added to the selective media, the pH stabilized at 5.6–5.7. It was found

that for the Petit Havana and Samsun varieties, the MSR(Phi) medium containing 50% phosphates and 50% phosphites was selective. For the Wisconsin variety, the medium containing 25% phosphates and 75% phosphites was selective.

As a result of the *Agrobacterium*-mediated transformation of tobacco leaf discs with suspensions of four selected *Agrobacterium* clones, genetic transformants of three *N. tabacum* varieties were obtained, which were confirmed by polymerase chain reaction analysis.

Thus, the constructs were tested, and their transforming activity was demonstrated. Thanks to the development of an optimized selective medium, it became possible to effectively screen transgenic dicotyledonous plants containing the *ptx*D gene. Using strain C58, more transformants were selected than with strain GV3101. The utilization of the *ptx*D gene as a selective marker is promising in genetic engineering to obtain plants modified for phosphorus metabolism.

Keywords: phosphite oxidoreductase gene *ptx*D, *Agrobacterium*-mediated genetic transformation, phosphites

Funding. This research was supported by two projects: “Study of Vital Activity Peculiarities of Biotechnological Plants after Genomic Modifications” (0123U100462) and “Innovative Biotechnological System for Phosphorus Nutrition of Wheat” (0120U103032), both of which were funded by the National Academy of Sciences of Ukraine.

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IDENTIFICATION AND ANALYSIS OF TANDEM REPEATS IN *Orobanche cumana* GENOME

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Microsatellites are short tandem repeats of 1-6 nucleotides found in virtually all eukaryotic and prokaryotic genomes, present in both coding and noncoding regions (Toth et al., 2000). Various families of repeats are dispersed throughout the genome with different frequencies and numbers of repeating units, depending on the genome/species and the proportion of repeats per genome for mono- and dinucleotide repeats increases according to a quadratic law proportional to the deviation in either direction from 50% GC (Katti et al., 2001). The evolutionary rate of change within microsatellites is considerably higher than in most other types of DNA, leading to the accumulation of population-specific mutations, which allows for detailed analysis of population structure (Zhivotovsky et al., 2003). The highly polymorphic microsatellites with dozens of alleles at each locus mainly differ in length due to variations in the number of repeats (Henderson et al., 1992). The main objective of this study is to identify and analyse tandem repeats in the genome of *O. cumana* Wallr.

The present study involved conducting a multilocus ISSR analysis on 336 *O. cumana* accessions, representing 33 populations from six countries: Serbia, Moldova, Romania, Bulgaria, Turkey, and China. Fourteen ISSR primers were tested. Of these, two dinucleotide primers ($(AG)_8T$ and $(GA)_8T$) were 3′ monoanchored; seven dinucleotide primers ($(AG)_8YC$, $(AG)_8YA$, $(GA)_8YC$, $(AC)_8YG$, $(CA)_6AC$, $(CT)_8TC$, $(CA)_6RG$) were 3′ dianchored; two trinucleotide primers ($(CAA)_5$ and $(CAG)_5$) were non-anchored; and $(CTC)_4RC$ was 3′ dianchored. Additionally, $(GACA)_4$, a non-anchored tetranucleotide primer, was used. The total genomic DNA extracted was subjected to ISSR-PCR as previously described by Duca et al. (2024). The amplification products were then analysed by agarose gel electrophoresis. Statistical analysis of the data was performed using the POPGENE 1.32 software and MS Excel.

Results revealed 358 microsatellites across the genome, averaging 28 per motif. Dinucleotides were the most numerous (256), accounting for 72% of the total, followed by trinucleotides (86; 24%) and tetranucleotides (16; 4%). These

microsatellites were divided into two classes based on the length of the repeat motifs: 150 (42%) were classified as the long, hypervariable class I (≥18 bp), while the remaining 208 (58%) were categorized as the variable class II (14-17 bp). The distribution of microsatellite motifs was not uniform; among dinucleotides, the most frequent were AG (27.65%), GA (17.60%), and CA (11.45%), followed by CT (8.10%) and AC (6.70%). For trinucleotides, CTC (8.66%) and CAG (8.38%) were the most abundant, with CAA (6.98%) also common. The GACA tetranucleotide was the least frequent, representing 4.47%. Frequency analysis based on motif type and number of repeats showed that dinucleotides were the most prevalent (0.202), followed closely by trinucleotides (0.200), and tetranucleotides (0.157). The most common dinucleotides were GA (0.253), AC (0.238), and AG (0.204), while CT (0.144) and CA (0.136) were less frequent. Among trinucleotides, CAG (0.225) was the most prevalent, followed by CAA (0.191) and CTC (0.183). The GACA tetranucleotide motif had the lowest frequency (0.157).

These microsatellite data for *O. cumana* enhance our understanding of genome evolution by revealing detailed patterns of polymorphism and mutation. Additionally, they represent a valuable resource for future studies on genetic diversity and evolutionary mechanisms.

Keywords: microsatellites, nucleotide, repeat motifs, genetic diversity

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SALT TOLERANCE OF MALE GAMETOPHYTE OF MAIZE

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The aim of this study was to investigate the salt tolerance of male gametophyte of maize hybrids and to determine the effects of salt stress at the haplod level.

Ten maize hybrids, the parental genotypes of which were different combinations of inbred lines P165, XL12, M11, A239, L1866, L459, P101, P502, Mo17, F2, and 1hybrid population of sweet corn were used as initial material for the study. Half of these genotypes were obtained using the gamete selection method. The diameter of pollen grains was measured in 10% NaCl solution using a microscope and an eyepiece micrometer. The data obtained were processed by a two-factor analysis of variance.

The dispersion analysis of the variability of the "pollen grain diameter" trait revealed reliable effects of both the "salt stress" factor and the interaction of the "genotype" and "salt stress" factors. The magnitude of the effect of the "salt stress" factor (η^2_p=0.512***) was approximately 6 times higher than the value of the effect of the interaction of factors (η^2_p=0.089***). The determination coefficient of the whole experimental model was at an average level (R^2=0.55***). Generally, for all genotypes, the indicators of the "pollen grain diameter" trait under stress conditions were lower than the values in the control variants by approximately 20 ocular micrometer units. However, such genotypes as (F2xCo125) x L1866 (three-line early-flowering hybrid) and N12 (complex hybrid combination obtained using the method of selecting large pollen grains) were characterized by a smaller difference in control and stress indicators (13 and 8 units, respectively), which is probably due to some potential for resistance to salt stress.

The analysis of the variability of the "smallest pollen grain diameter" trait was carried out and, depending on the effect of NaCl stress, reliable effects of such factors as "genotype" (η^2_p=0.24***), "salt stress" (η^2_p=0.69***), and the interaction "genotype x salt stress" (η^2_p=0.3***) were revealed. The magnitude of the stress factor effect is 2.5 times higher than other values. The determination coefficient of the entire experimental model was high (R^2=0.75***). According to the smallest difference between the control and stress indicators, 2 complex hybrid combinations

obtained using male gametophyte selection and the hybrid L1866 x ((L459xMK01) x L459) were distinguished. The variability of the "largest pollen grain diameter" trait reliably depended on the "genotype" (η^2_p=0.21**) and "salt stress" (η^2_p=0.7***) factors. The magnitude of the stress factor effect in this case was 3 times higher than the similar indicator of the "genotype" factor. The value of the determination coefficient of this experimental model was almost equal (R^2=0.74***) to the similar indicator in the previous model. The highest average values of this trait were noted in the N12 complex hybrid combination obtained using the gamete selection method, as well as in the hybrid population of sweet corn.

The efficiency of using quantitative traits of male gametophyte for screening maize genotypes for salt tolerance is shown. Hybrid genotypes were selected that demonstrated good potential for salinity resistance at the haploid level. This research also provided valuable starting material for the development of salt resistant maize inbred lines and hybrids

Keywords: maize, salinity, resistance, pollen

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DETERMINATION OF MAJOR FUNGAL PATHOGENS IN FRESH PLUM FRUITS

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Stanley, President and Super President are the leading plum varieties grown in the Republic of Moldova for export for fresh market consumption. To obtain competitive and healthy products, it is necessary to establish constant pathogen control at all stages of production to prevent disease outbreaks and fruit spoilage. Effective management of pathogenic fungi requires the use of timely and exact pathogen detection techniques and the implementation of conditions limited pathogen proliferation and development. In addition to phytosanitary assessment, it is important to identify and use pathogen-resistant varieties for cultivation. The aim of the study was to assess the susceptibility of plum fruits to some pathogenic fungi under high temperature conditions of the 2024 vegetative season.

Freshly picked fruits of aforementioned genotypes were tested to determine the fungal pathogens of *Alternaria*, *Fusarium, Penicillium, Monilinia* and *Botrytis* genera using nested-PCR assay. Molecular analysis was performed using primers designed based on specific sequences of each pathogen presented in GenBank collection. Total DNA was extracted from fruits using a CTAB protocol with modifications. PCR was performed in a 25 µl mix containing standard components specified for Taq DNA polymerase (Thermo Fisher Scientific). The amplification was carried out according to the protocol recommended for MiniAmp™ Thermal Cycler (96 wells, Thermo Fisher Scientific), taking into account that the melting temperatures of the primers are in the same range, in particular, 60°C. The products of amplification were analyzed by 1,5% agarose gel electrophoresis.

Monilinia is an important plant pathogen that affects different fruit crops including plum, which leads to significant losses both in the field and post-harvest. The results of molecular tests indicated that the fruits of the Stanley and President varieties were infected by *Monilinia* spp.

Pathogens of *Alternaria*, *Fusarium, Penicillium* and *Botrytis* genera are belonging to the group of well-studied mycotoxin-producing fungi, that can contaminate food

crops and pose health risks if ingested. Even their low levels in fruits can lead to mycotoxin contamination of products if storage and transportation conditions are unfulfilled. In this regard, the early detection and control of this pathogens is critical.

As a result of PCR analyses were found *Alternaria alternata* and *Botrytis cinerea* in fruits only of Stanley variety. In the study the set of primers to *Fusarium verticillioides, Fusarium equiseti, Fusarium proliferatum, Fusarium sporotrichioides, Fusarium nivale, Penicillium expansum* detection was used. Molecular analysis demonstrated the absence of mentioned *Fusarium* and *Penicillium* species in studied genotypes. In Super President variety (Moldavian selection) none of the pathogens were detected, thereby demonstrating low susceptibility to these fungal pathogens. In this study *Monilinia* spp. was the predominant pathogen in fresh plum fruits.

Keywords: pathogenic fungi, plum fruits, PCR

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BIOINFORMATICS ANALYSIS OF RESEARCH TRENDS ON THE ROLE OF FLAVONOIDS IN PLANT RESPONSE TO STRESS

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Flavonoids are secondary phenolic compounds that play key roles in numerous physiological and biochemical processes in plants, particularly in the response to biotic stress. In response to attacks of pathogens, insects, or other harmful organisms, plants activate complex metabolic pathways that lead to the biosynthesis of flavonoids with crucial defense functions. These compounds contribute to the induction of systemic acquired resistance (SAR) by acting as mobile signals or cofactors in plant-microorganism interactions. Additionally, flavonoids regulate reactive oxygen species (ROS) levels, helping to maintain cellular homeostasis and prevent tissue damage during infections. They also activate hormonal signaling pathways, particularly those involving salicylic acid, jasmonic acid, and ethylene, to coordinate defensive responses. Flavonoids can exert direct antimicrobial or insecticidal effects and indirectly modulate hormonal signaling and gene expression involved in defense mechanisms, influencing pathways essential for plant defense. This study **aimed** to investigate the role of flavonoids in plant responses to biotic stress by reviewing scientific publications and identifying key research trends. These insights could contribute to the development of strategies aimed at enhancing plant resilience. **Materials and methods.** The study was based on data retrieved from NCBI information databases, with a specific focus on articles indexed in PubMed Central (PMC). A bioinformatics approach was employed to analyze the evolution of research interest in flavonoids across three distinct time periods: 1995–2004, 2005–2014, and 2015–2024. In this context, the databases were queried using a curated list of keywords related to flavonoid biosynthesis and function, including: *genes and transcription factors*, *gene expression products, biosynthetic pathways, metabolic pathways.* **Results.** The quantitative analysis revealed a total of 274,135 scientific

articles. Among these, 3,303 were published between 1995 and 2004 (1.2%), 33,225 between 2005 and 2014 (12.1%), and 237,607 between 2015 and 2024 (86.7%). This distribution indicates a substantial and accelerating increase in the volume of research focused on flavonoids over the past three decades.

Tab. 1. Dynamics of the number of articles in PM Central NCBI by keywords

Keywords	1995-2004	2005-2014	2015-2024
Genes involved in flavonoid synthesis	1 351	12 401	81 210
Transcription factors in flavonoid synthesis	704	6 737	42 961
Flavonoid-associated gene expression products	477	4 794	32 442
Flavonoid synthesis pathways	474	5 768	50 407
Flavonoid-regulated/involved metabolic pathways	297	3 525	30 587
Total	**3 303**	**33225**	**237 607**

The analysis reveals a significant increase in research activity on flavonoid biosynthesis and their role in plant defense, with the number of publications rising by 6.5 to 8.7 times compared to the previous decade. In **conclusion,** the accelerating volume of research on flavonoids underscores their growing significance in plant defense against stress, highlighting their potential for enhancing plant resilience through targeted biosynthetic and regulatory pathways.

Funding. This research was supported by the project subprogram 011101: Genetic and biotechnological approaches to agroecosystem management under climate change funded by MER, Republic of Moldova and the project PN-IV-P8-8.3-ROMD-2023-0269: Comprehensive valorization of Helianthus annuus by-products for the development of new products with biomedical potential funded by MER, Romania.

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ASSESSING MOLECULAR POLYMORPHISM OF MAIZE COLLECTION SAMPLES USING iPBS MARKERS

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Molecular markers are a powerful tool in plant breeding as they give the opportunity for assessing genetic diversity, genotyping and selecting progenitors based on plant genome sequences that are much more stable under the influence of external factors compared to phenotypic traits. To be used effectively in breeding programs, molecular markers must satisfy several conditions: they must be polymorphic, abundant in plant genome, generate reproducible profiles and be heritable in generations. Molecular markers based on mobile genetic elements are described in a number of works as informative and highly reproducible and used for genetic studies of economic important crops.

Current paper presents the results of molecular genotyping of maize collection samples (Laboratory of Plant Genetic Resources of the Institute of Genetics, Physiology and Plant protection) based on inter-primer binding site of plant retrotransposon sequences (iPBS marker system). New inbred maize lines obtained based on synthetic populations were used as objects of the research. DNA was isolated from 5-day-old maize seedlings by the ISO 21570 (2005) method. A set of 20 single primers were tested. The reproducibility was assessed in three amplifications of the same DNA. For loci analysis, GelAnalyzer and POPGENE software were used. Based on the analysis of polymorphic profiles a conclusion on the informativeness of the used sequences was made. Several primers did not generate molecular profiles or amplified mostly monomorphic bands and were discarded from further analysis. Other primers generated bands in the range of 2400-200 base pairs. For the primers tested the polymorphism information content (PIC) varied in the range of 0.45-0.5 with 0.5 being the maximum value for dominant markers. The percentage of polymorphic loci for most primers was 97% with the mean number of amplicons per genotype generated being more than 10. The primers pb4, pb20 and pb21 generated the highest number of polymorphic bands in different maize genotypes. Additionally,

several specific bands were generated using these primers. These loci present a specific interest as they may be linked to certain valuable traits. However, the latter presumes a more detailed study involving sequencing. Combination of primers based on iPBS sequences generated specific and distinguishable patterns for maize genotypes.

Therefore, the markers tested were effective for discriminating different maize genotypes as well as characterizing the genomes of maize genotypes used in breeding programs. Using the selected primers, unique DNA profiles of corn genotypes were obtained, which can be used for certification of the existing gene pool and identification of collection samples received by the Gene Bank.

Keywords: maize, iPBS, molecular markers

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MOLECULAR DETECTION OF SEVERAL MICROBIAL SPOILAGE AGENTS IN MOLDOVAN WINE PRODUCED IN MICRO-WINERY

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Certain bacterial and fungal species produce a wide range of secondary metabolites, which contribute to either volatile acidity or off-odors in wines and therefore are considered undesirable microbiota by winemakers. Assessing the propagation of these species via conventional methods is challenging since they are able to enter a viable but non-culturable state and not all media support their growth. The limitations of traditional platting and enrichment assays enhanced developing the alternative molecular approaches based PCR assays. Current study focuses on PCR-detection and monitoring of two *Acetobacter* and *Brettanomyces/ Dekkera* species during wine production in the micro-winery of Technical University of Moldova.

Acetobacter aceti and *Acetobacter pasteurianus* belong to acetic acid bacteria (AAB), associated with wine spoilage. The timely detection of AAB, thought essential for their control, is however challenging due to the difficulties of their isolation. Thus, it would be advantageous to detect them using molecular methods at all stages of winemaking and storage. In this paper, we analyzed wines, musts and grapes of 13 varieties grown in different regions with Protected Geographical Indication of the Republic of Moldova for the presence of AAB, *A. aceti* and *A. pasteurianus* by real-time PCR and measured wine volatile acidity. Overall, the AAB content in mature wine explained 33.7% of the variance in the volatile acidity, while the *A. pasteurianus* content in mature wine alone explained 59.6% of the variability in the volatile acidity in the wine, and its content in the grapes, must and wine explained about 70% of the variance in the volatile acidity. This makes *A. pasteurianus* a good candidate to be a potential predictor of wine volatile acidity.

Brettanomyces bruxellensis yeasts cause wine spoilage by producing volatile phenol compounds with specific off-odors. In this study, wines produced in a micro-winery from the grapes of different varieties collected from three PGI regions of Moldova over three years were studied for the presence and infection level of *Brettanomyces* spoilage yeasts, using traditional microbiological and molecular methods. The results of *Brettanomyces* infection monitoring in mature wines might speak in favor of the hypothesis that grape berries can be a potential source of *B. bruxellensis* in wine. The contamination levels of mature wines with respective species fluctuated in accordance with the year of grape cultivation, being the highest during the 2023 vintage. This study shows the potential of applying sequencing analysis for tracking the source of *Brettanomyces* contamination in wineries.

Keywords: qPCR, Brettanomyces, Acetobacter, volatile acidity, phenolic compounds

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BIOINFORMATIC ANALYSIS OF GENOME ORGANIZATION: GENETIC, PHYSICAL, AND QTL MAPPING

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Genetic mapping emerged as an efficient tool for structural genomics (including genome sequence assembly), studies of meiosis and recombination, evolution of genome organization, comparative genomics, etc. Genome mapping is a part of various bioinformatics applications and a prerequisite for genome sequencing. The bioinformatic foundations of several genomic analyses belong to the field of discrete optimization: ordering of marker loci in genetic mapping, contig assembly, and scaffolding of fingerprinted genomic libraries, integrating multiple genetic and physical maps, etc. Different elements can be ordered in such an analysis (genes, molecular markers, fingerprinted clones). To address these problems we developed a wide algorithmic framework that includes: (i) diverse methods of selecting more trustable parts of the input data for ordering, assuming that less erroneous data should result in more reproducible local patterns; (ii) evolution-strategy heuristics for discrete optimization in multipoint ordering; (iii) tools for closing map gaps, linkage groups/contigs elongation, and end-to-end merging; (iv) tools for integrating heterogeneous mapping results (linkage maps of the target and related species, radiation-hybrid maps, and physical contigs.

Construction of high-quality genetic maps: New high-throughput DNA technologies resulted in a disproportion between the high number of scored markers and relatively small mapping populations. Hence, only a small part of the markers can be genuinely ordered in the map. The question is how to choose the most informative markers for building such a "skeleton" map. Our algorithms and software (*MultiPoint* package) allow to address the multilocus mapping problems based on: (a) tools for multilocus ordering; (b) map verification procedures; (c) taking into account complicated genetic situations caused "pseudo-linkage"; and (d) building consensus genetic maps by integration of mapping data on several populations.

Physical mapping as a basis for sequencing of big genomes: Physical mapping is based on cloning of DNA pieces into bacterial artificial chromosomes (BAC), resulting in BAC libraries of individual chromosomes and whole genomes. Fingerprinting of the BAC clones by molecular techniques allows assembly of the

clones into stretches of DNA (contigs) that can be further ordered and anchored to genetic maps. The result is a physical map, the basis for genome sequencing. The major obstacle hampering genome sequencing is the high genome complexity of many plant species, due to polyploidy, large genome size, and an excess of repetitive DNA, leading to misassemblies. Our analytical approach implemented in the Linear Topological Contig (LTC) software outcompeted the earlier developed FTP software and became a new standard for the cereal genetics community.

QTL mapping analysis: Low mapping accuracy is one of the obstacles in using QTL mapping for marker-assisted selection and positional cloning of genes corresponding to the mapped QTLs. We developed a "*multiple-approach*" of QTL analysis that includes multiple-trait, multiple-environment, and multiple-family models for multiple-interval QTL mapping (implemented in *MultiQTL* software). These combinations of methods proved very efficient, especially for increasing QTL detection power and mapping accuracy. One of the new interesting applications is "expression-QTL" mapping using microarray data. A spectrum of questions about the nature of quantitative variation, its "genetic architecture", can be addressed by this approach, e.g., the contribution of additive and non-additive effects to genetic variation and response to selection; role of overdominance, epistasis, coadaptation, pleiotropy, and developmental variation in QTL effects, and genetic basis of "reaction norm" (QTL-E interactions).

Consensus mapping analysis: Numerous mapping projects conducted on the crop species have generated an abundance of mapping data. The quality of maps broadly varies between populations, marker sets, and software used. Our trials to re-analyze some data sets on plants showed that the quality of certain published maps is surprisingly low. This problem calls for collaborative efforts to re-analyze the accumulated data and build reliable, dense multilocus maps fitting the challenges of physical mapping and breeding applications. The described analytical system enables joint re-analysis of multiple populations. Completion of this target should allow efficient utilization of mapping resources for: (a) comparative mapping within and across taxa; (b) integration of QTL mapping results; (c) efficient map-based cloning; (d) marker-assisted selection, etc.

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CONTROLLING RECOMBINATION IN PLANT BREEDING: NEW SOLUTIONS IN THE GENOMIC ERA

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Genetic novelties produced by recombination upon hybridization can be classified into three main types: (i) transgression for individual traits in the progeny exceeding the parental difference; (ii) formation of new trait combinations of the parental components; and (iii) new traits due to recombination in gene complexes with strong epistatic interactions. These forms of variability play a significant role in breeding programs aimed at developing new productive varieties adapted to various climatic conditions and resistant to biotic and abiotic stresses. In the majority of crops, recombination events tend to concentrate in the sub-telomeric regions, so that a high proportion of genes remain unseparated in meiosis. The practical importance of controlling recombination increases with the necessity of involving new genetic resources for crop breeding purposes. New genes are supposed to be introgressed from exotic germplasm, including wild relatives, implying additional challenges due to reduced recombination upon distant crosses and close linkage between the new beneficial and undesirable alleles. Realizing these limitations resulted in the declaration of the concept "manipulation of recombination" for improving the efficiency of plant breeding. The first general strategy was "exogenous induction" of recombination by applying abiotic and biotic environmental stresses and chemical or physical mutagens/recombinogens. In the last decade, the focus was shifted to "endogenous induction", based on genetic manipulations of the recombination controlling system.

Many genes are involved in the control of meiotic recombination in plants. Long-term studies in plant meiosis have discovered that, despite the earlier common view, mutations causing loss of function in some anti-recombination meiotic genes do not necessarily lead to a decline in viability or to sterility. The pioneering studies led by R. Mercier (at INRAE, France; and then at the Max Planck Institute for Plant Breeding Research, Germany) discovered that loss-of-function mutations of some genes (*FANCM*, *FIGL1*, *RECQ4A*, *TOP3*) may result in a few-fold increase in the rate of meiotic recombination in the Arabidopsis genome. The natural conclusion was that genetic manipulation of recombination in crops may become an efficient tool for modern breeding. And indeed, the recombinogenic effects of down-regulation

in antirecombination genes were tested and already confirmed on a few crops (peas, tomatoes, and rice). The next step is direct tests for a wide range of crops, including those with large genomes.

Some positive results on wheat were obtained in our ongoing studies with tetraploid wheat by testing the joint effect of the double mutant for *recq4A* and *recq4B* genes on crossover rates (CR) in the A and B genomes. The tests performed at different map resolutions (l = 1, 2, 5, 9 cM) showed a highly significant effect of the double mutant $recq4A^{m}$-$recq4B^{m}$ compared to the wild type $recq4A^{+}$-$recq4B^{+}$. The average values of $\delta=CR^{mm}$-CR^{++} over the tested intervals along the entire genome were always positive and exceeded the standard errors 4-7 fold, depending on the assayed resolution level (l = 1, 2, 5, 9 cM). In total, ΣCRs in the observed part of the genome map have increased in double mutant homozygotes by ~160-220 cM (implying 3.2-4.4 additional crossovers per genome). A promising, straightforward approach for manipulating recombination was recently proposed and tested on wheat: using virus-induced silencing of recombination-suppressing genes during meiosis in F_1 plants [Avi Levy's lab at Weizmann Institute, Israel].

The potential importance of manipulating recombination in plant breeding programs is difficult to overestimate. The advantage of using loss-of-function or sub-functional mutants of anti-recombination genes and their combinations may not be only in a few-fold increase of CO rates (like the effect observed in the aforementioned *Arabidopsis* studies). Much more important would be to induce CO exchanges in genomic regions where recombination is strongly suppressed, thereby increasing *the spectrum of genetic variation available for breeding*. Quite probably, the transferability of the exciting results obtained with *Arabidopsis* and supported by recent studies on a few crops may differ between plant species, between cereals (e.g., rice, barley, wheat) and even within a crop (e.g., between tetraploid and hexaploid wheats).

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ANALYSIS OF UKRAINIAN POTATO VARIETIES USING THE MOLECULAR MARKER YES-3A OF THE Ry_{sto} GENE FOR THE EXTREME RESISTANCE TO POTATO VIRUS Y

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Currently, the most economically important virus that affects potato production worldwide, reducing tuber yield and quality, is Potato virus Y (PVY). PVY is a primary cause of average annual yield losses of 20–30%, reaching 80% in case of a severe epiphytotic. Cultivation of PVY-resistant potato varieties is believed to be the most efficient solution to prevent yield losses caused by the virus. Three genes for extreme resistance to PVY, Ry_{adg}, Ry_{sto} and Ry_{chc}, are used in breeding programs around the world. The dominant *Ry* genes inhibit the virus replication in the infected cells and are effective against a wide spectrum of virus strains. The aim of this study was to screen a collection of Ukrainian potato varieties for the presence of a molecular marker of the gene Ry_{sto}.

We studied samples of 30 Ukrainian potato varieties derived from the collection of the Ustymivka experimental station of the Institute of Plant Production named after V.Ya. Yuriev, the National Academy of Agrarian Sciences of Ukraine. DNA was isolated with the silica-based kit NeoPrep_100 (Neogene LLC, Ukraine). For Ry_{sto} identification, the molecular marker YES3-A was used (Song and Schwarzscher, 2008). PCR was performed using PCR MIX 2x HOT (Neogene LLC, Ukraine). The amplification products were analyzed by agarose gel electrophoresis with ethidium bromide.

Norchief was used as a standard variety carrying the gene Ry_{sto}. PCR with the YES3-A primers and DNA of this variety produced a 341-bp amplicon (Song and Schwarzscher, 2008). For PCR, we modified the annealing temperature (58 °C

for the first 10 cycles and 53 °C for the next 30 cycles). The marker amplicon for Ry_{sto} was detected in the varieties Skarbnytsia, Resurs, Zaviya, Hurman, Slovianka, and Vernisazh. The frequency of the extreme resistance gene Ry_{sto} in the sample of Ukrainian varieties is 20%. In our previous studies of Ukrainian potato germplasm, we also detected varieties with Ry_{adg} or Ry_{chc} (Hadzalo et al. 2024).

Thus, the screening of the sample of Ukrainian varieties revealed six carriers of the molecular marker of the Ry_{sto} gene, which can be used as sources of extreme resistance to PVY in potato breeding.

Keywords: potato, resistance, *Solanum stoloniferum*, PVY, Ry_{sto}

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HPLC-BASED ANALYSIS OF FRACTIONS OF *Vitis amurensis* AND COMPREHENSIVE EVALUATION OF FRUIT QUALITY

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In this paper, 30 *Vitis amurensis* varieties were used as test material to determine the differences in soluble sugars and organic acids in different fruit varieties using HPLC technology, and to provide a basis for breeding *V. amurensis* in combination with the nutritional quality of the fruit. Anthrone sulfate colorimetric method, and acid-base titration method were used for the determination of *V. amurensis* varieties, and high-performance liquid chromatography (HPLC) was utilized to determine the soluble sugar and organic acid fractions and contents of the fruits, respectively. Among the 20 *V. amurensis* varieties, the highest total sugar content was rs1617, followed by 76042; the highest total acid content was 76060, and rs1605 had a lower content, which was significantly higher than the other varieties. The comprehensive evaluation score of fruit quality showed that rs1617, 76053 and 77017 were located in the top 3. Among the 20 *V. amurensis* varieties determined by HPLC, four organic acid fractions were detected under the condition of the same flow rate, and the average value of the content of each fraction was tartaric acid>malic acid>lactic acid>citric acid in descending order. 30 *V. amurensis* varieties of mature fruit soluble sugar and organic acid accumulation were dominated by tartaric acid and malic acid, respectively; rs1617 and 76053 fruit flavor is strong; fruit sweet, comprehensive traits are excellent, and it can be used as one of the alternative promotional varieties for the adjustment of industrial structure.

V. amurensis Rupr. is a perennial deciduous vine plant of the genus Vitis in the family Vitaceae, which is widely loved by the public as a berry fruit, and *V. amurensis* is the most cold-resistant species in the genus Vitis, especially in the northeastern group, with strong resistance and growth adaptability. *V. amurensis* is rich in nutritive values such as sugars and organic acids, and its grape skin contains a variety of biologically active substances such as anthocyanin glycosides, polyphenols, flavonoids, etc., which are antioxidant, scavenger of free radicals, anticarcinogenic,

anticancer, antiageing, as well as preventing cardiovascular diseases. Therefore, the study of nutrients in *V. amurensis* is of great value.

Sugar and acid are important nutrients in fruits, and the sugar-acid component and content are important bases for constituting the quality of the fruit and determining the fruit flavor. Much of the flavor of the fruit depends on the balance between the sweetness and acidity of the fruit, and the type of sugar-acid and its concentration regulation has been one of the important themes in the field of grape fruit quality research. The soluble sugars of grapes are mainly glucose and fructose, with the ratio of the two close to 1:1, and in most varieties of fruit, the content of sucrose is very small. Compared with soluble sugars, the content of organic acids in grape berries is relatively low, and the organic acids in fully ripe grape berries are mainly tartaric acid and malic acid, with low content of other kinds of acids. Sugar-acid fractions and contents vary between varieties, which determines the diversity of uses and processing specificity of grape berries.

Keywords: mountain grape; organic acid; soluble sugar; content

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MULTIDIMENSIONAL ANALYSIS OF VARIATION AND INTERDEPENDENCE AMONG BIOMORPHOLOGICAL TRAITS IN TOMATO UNDER CONTRASTING GROWING CONDITIONS

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This study aims to assess the variability of quantitative traits in tomato as influenced by seasonal growing conditions and the phytosanitary status of parental lines, using a multivariate approach that integrates principal component analysis (PCA), hierarchical clustering, correlation and multifactorial ANOVA. The analysis focused both on patterns of trait expression and on the annual variation in the number of significant correlations attributed to each trait, with the goal of identifying key features within the phenotypic network.

The investigation was conducted on two distinct sets of genotypes grown in open field conditions over consecutive years and included both commercial cultivars and interspecific recombinant lines, with both determinate and indeterminate growth habits, in progenies of virus-infected plants (Tomato Aspermy Virus and Tobacco Mosaic Virus). These conditions offered a robust framework for evaluating genotype-by-environment interactions and included an extensive range of approximately 20 vegetative and generative traits.

The results revealed substantial variability in the same trait expression across years, closely associated with fluctuations in temperature and precipitation, as confirmed by meteorological data, as well as the phytosanitary status of parental forms. In seasons marked by relative abiotic stress, the phenotypic correlation network became more constrained, with notable shifts in the direction of specific correlations - from positive to negative or vice versa. Within this context, PCA enabled the extraction of dominant axes of variation and the identification of traits with central influence in the overall system. The first two principal components accounted for 50–60% of the total variance, and loading analysis highlighted several consistent contributors across all years, including leaf length, number of flowers on the I and II clusters, and fruit set index.

A methodological innovation of this study lies in the quantification of the number of significant correlations per trait in each growing season. This approach facilitated the identification of structurally stable traits within the phenotypic network - those maintaining a consistent number of associations across years. Simultaneously, traits exhibiting interannual variability in connectivity were recognized as plastic and environmentally responsive.

Dendrograms of clustering analysis for each growing season revealed greater coherence among traits during abiotic stress years, while in more favourable seasons, trait groupings were more diffuse, reflecting broader phenotypic diversity. This structural shift may indicate an adaptive reorganization of the phenotypic network under environmental selection pressure. Two-way ANOVA further clarified trait control: some traits, such as total fruit number per plant or number of inflorescences, were mainly genetically determined, whereas others, like height of first inflorescence and leaf length, were influenced by both genotype and genotype-environment interaction. This classification supports aligning breeding strategies with specific goals - stability or plasticity - based on environmental targets. The multivariate approach provided a robust framework for interpreting biomorphological variability in tomato. Recognizing both consistently stable and context-sensitive traits offers valuable support for selecting resilient genotypes.

Keywords: tomato, multivariate methods, virus infection, genotype-environment interaction

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JUXTAPOSITION EFFECT ON CROSSING OVER IN MAIZE: FACTORS AND CONDITIONS

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When heterozygous chromosome regions alternate with heterozygous ones, the juxtaposition effect appears at the joints: crossovers are redistributed from homozygous regions to neighboring heterozygous ones. It is easier to observe an increase in the recombination frequency (RF) in heterozygous regions than a decrease in homozygous ones, since in the first case it is possible to measure the RF using morphological markers. In our work, alternation of homo- and heterozygous intervals was ensured by hybridization of two closely related maize lines, one of which (isogenic) differs from the other (original) by a marked fragment transferred from the 2-9m line. The fragments *ws3-lg1, lg1-gl2* (chromosome 2) and *c1-sh1*, *sh1-wx1* (chromosome 9) were transferred to genetic background of the MK01 and Ku123 lines. In hybrids of isogenic lines with the original ones, stimulation of crossovers was observed: the RF between markers increased by 1.5-3 times compared to the control - a complete heterozygote along the entire chromosome.

In further studies, some factors influencing the manifestation of this effect were revealed. First of all, this is the length of the heterozygous fragment. The farther the homo/hetero boundaries are from the edge markers, the lower RF, and at a sufficient distance RF decreases to the control level. For example, a fragment containing the marker pair *lg1-gl2* was transferred to the genetic background Ku123 and MK01. In the first case, introgression was accurate, and in the second case, a 7 Mb region to the left of the *lg1* locus was transferred along with the markers. As a result, the stimulation of crossovers was 2-2.5 in the first case and 1.4 in the second. This suggests that crossover redistribution has a limited range and fades with distance from the homo/hetero boundary.

Furthermore, crossovers can be recruited only from recombination-active regions, as was observed for the *sh1-wx1* interval. The right *wx1* locus is adjacent to the recombination-silent pericentromeric zone, and the accuracy of introgression near the *wx1* was not important: in one case, introgression was accurate, in the other case, an extra 7 Mb fragment on the right was captured. In both the cases, the stimulation of crossovers was 2.2-2.7.

Finally, the heterozygous interval must be continuous. When a short homozygous block of 6 Mb was introduced into the *ws3-gl2* heterozygous interval, the juxtaposition effect completely disappeared.

The juxtaposition effect is manifested in both male and female meiosis. As for the required level of polymorphism in heterozygous regions, in our experiments 0.5 SNP/kb was enough to manifest the effect.

It is unknown how widespread the juxtaposition effect is among plants. So far, it has been observed only in maize and Arabidopsis. These are very distant and dissimilar species: maize is a monocot outcrosser, *Arabidopsis* is a dicot self-pollinator, and they are separated by 140 million years of evolution. It is possible that the juxtaposition effect arose in them independently, but it is possible that it was inherited from a common ancestor. In this case, this effect could be preserved in many other species, which should be verified by further research.

Keywords: maize, crossing over, juxtaposition effect

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GENOMIC TECHNIQUES FOR SUSTAINABLE CROP IMPROVEMENT

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Crop improvement is a continuous process that involves the systematic development of new plant varieties with enhanced traits, like improved resistance to biotic and abiotic stresses, increased yields and better nutrition quality. This process is especially important in the context of climate change and a shift to sustainable farming practices. This ongoing effort combines traditional breeding techniques with modern biotechnological tools. The present work highlights some aspects of the application of new biotechnological tools to tomato breeding, particularly, the combination of transcriptomic analysis used to identify genes of interest and functional validation of these genes using new genomic techniques.

The purpose of this study was understanding the mechanisms that drive tomato response to phytoplasma infection.

The approach involved performing RNA-seq on tomato varieties with contrasting responses to phytoplasma infection. For this, the infection rate and phytoplasma load of the tomato plants of different varieties was measured by real-time PCR. Gene expression profiles of different tomato varieties were done by RNA sequencing of 3 individual plants of each variety. Some differentially expressed genes, found by RNA sequencing, were further tested by RT-qPCR. Possible approaches for functional analysis of some genes of interest are discussed.

This work emphasizes the potential of a transcriptomics approach in identifying genes associated with desirable traits and highlights the importance of their functional confirmation using new genomic techniques.

Keywords: Phytoplasma, tomato, RNA-seq, new genomic techniques

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CATALASE GENE ISOFORMS IN MICROSPOROGENESIS: EXPRESSION DYNAMICS IN FERTILE SUNFLOWER ANTHERS

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In the development of the male gametophyte in plants, redox signaling plays a crucial role, regulated by a complex network of antioxidant enzymes. This type of signaling involves tightly controlled accumulations of reactive oxygen species (ROS), particularly hydrogen peroxide (H_2O_2), which act as signaling molecules for cell-to-cell communication and the regulation of critical developmental stages. Alongside other enzymatic systems, such as ascorbate peroxidase, glutathione reductase, peroxiredoxins, thioredoxins, and the enzymes of the ascorbate–glutathione cycle, catalase contributes to the formation of compartment-specific H_2O_2-scavenging networks. Catalase, which is localized in peroxisomes, is responsible for the breakdown of H_2O_2 through a dismutation reaction, generating water and molecular oxygen. This reaction is essential for maintaining cellular redox homeostasis and for preventing the toxic accumulation of ROS. Under certain conditions, catalase can also participate in peroxidative reactions, thereby extending its role in the fine regulation of ROS levels.

In plants, catalase genes are typically organized into multigene families, with distinct isoforms exhibiting tissue-specific and developmental stage-specific expression patterns. Previous studies have shown that catalase isoforms may have differentiated functions depending on the developmental stage or environmental conditions.

In sunflower (Helianthus annuus), eight isoforms have been identified, corresponding to transcripts from at least four distinct genes (CATA1–CATA4), each regulated differently according to tissue type and developmental context. Such specificity suggests their functional differentiation in maintaining redox homeostasis during anther development.

In view of the increasing evidence on the role of H_2O_2 and the contribution of catalases to various physiological processes, it was of particular interest to investigate the expression of genes encoding different catalase isoforms during various stages of microsporogenesis in fertile sunflower anthers.

Plant material and gene expression analysis. Anthers from sunflower plants (inbred line SW501, Magroselect ASP, Soroca, Republic of Moldova) were used as biological material. Florets and anthers were examined cytologically and histologically to select specific microsporogenesis stages.

Total RNA was extracted from anthers at four stages using TRIzol reagent, following the manufacturer's instructions. cDNA synthesis was performed with RevertAid Reverse Transcriptase using random hexamers and oligo(dT)18 primers. Gene expression was assessed by RT-qPCR on a DT-96 Real-Time Cycler using Maxima SYBR Green/ROX Master Mix. Relative expression levels were calculated using the $2^{-\Delta\Delta CT}$ method, with actin (GenBank: AF282624.1) as the reference gene.

Differential expression patterns of catalase transcripts have been identified, which may reflect the specific involvement of these isoforms in distinct steps of pollen precursor formation.

Keywords: catalase, gene expression, microsporogenesis, oxidative stress, sunflower

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MULTIPLEX RT-PCR FOR CEREAL VIRUS SURVEILLANCE IN UKRAINE

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The aim of this study was to present recent advancements in the development of reverse transcription polymerase chain reaction (RT-PCR) multiplex assay for rapid and simultaneous detection of three economically important cereal viruses affecting Ukrainian crops: barley stripe mosaic virus (BSMV), barley yellow dwarf virus-PAV (BYDV-PAV), and barley yellow dwarf virus-MAV (BYDV-MAV). This diagnostic technique has been designed to enhance early warning systems, support phytosanitary surveillance, and improve crop management strategies. This multiplex assay specifically targets viruses commonly encountered in cereal crop fields across Ukraine, as confirmed by decades of regional virological research. The detection of multiple pathogens within a single reaction enables high-throughput and cost-effective screening, which is essential for strengthening Ukraine's food security through improved molecular diagnostics for cereal crops.

Materials and Methods. Virus-positive plant samples used for primer validation in the multiplex RT-PCR assay were confirmed via serological detection using the diagnostic kits from Loewe Biochemica GmbH (Germany) and Agdia Inc. (USA). RNA was extracted using RNeasy Plant Mini Kit (Qiagen, USA). The RT-PCR was performed in two steps. Specific primers were designed for the detection of BSMV, BYDV-PAV and BYDV-MAV. Multiplex PCR was conducted using several distinct sets of primers specific to individual cereal viruses. As a result, amplicons of different size corresponding to each target virus, as analyzed by 1.5% agarose gel electrophoresis with ethidium bromide (Invitrogen, USA) staining, have been obtained.

Results. As a result of the conducted research, a primer set was successfully developed for simultaneous detection of three economically important cereal viruses. The respective RT-PCR amplicon sizes obtained were 467 bp for BSMV, 842 bp for BYDV-PAV, and 787 bp for BYDV-MAV. PCR amplification was carried out in a 25-µL reaction volume containing DreamTaq Green PCR Master Mix (2X) (Thermo Scientific, USA) and 2 µL of cDNA template. Thermal cycling conditions included an initial denaturation at 94°C for 3 min, 35 amplification cycles (94°C for 30 s, 55°C for 30 s, and 72°C for 1 min), and a final extension at 72°C for 10 min.

Conclusions. The developed multiplex RT-PCR assay enables accurate and simultaneous detection of three harmful cereal viruses - BSMV, BYDV-PAV, and BYDV-MAV, which are common for Ukrainian agriecosystems. The successful design of virus-specific primers and optimization of the reaction conditions resulted in reproducible amplification of distinct target regions, thereby facilitating effective molecular detection. This diagnostic tool provides a robust platform for high-throughput screening and is well-suited for integration into phytosanitary programs and crop protection strategies. Its implementation can significantly strengthen Ukraine's capacity for early viral disease surveillance and contributes to global food security by enhancing molecular diagnostics' infrastructure in plant virology.

Keywords: BSMV, BYDV-PAV, BYDV-MAV, cereal viruses, multiplex RT-PCR

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ASSESSMENT OF THE ROLE OF SPONTANEOUS FLORA IN FRUIT ORCHARDS IN RESERVING FUNGAL PHYTOPATHOGENS

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Weed plants in agricultural fields represent not only competitors to cultivated crops but also serve as additional sources of nourishment and development sites for various pests. Furthermore, they act as reservoirs of phytopathogens of viral, bacterial, and fungal origin. The role of spontaneous flora in the spread of plant diseases is determined by its direct contact with cultivated plants or by short distances involved in the transmission of vector-borne infections. The variability of the mycopathogenic composition, as well as the susceptibility of agroecosystems to ecological succession, increases the necessity for identifying disease pathogens that persist in weed plants. The aim of this study was to assess the ability of segetal plants to act as reservoirs of fungal pathogens using the PCR method.

As part of the research on the properties of spontaneous flora to preserve and serve as sources of mycopathogens, four genotypes of weed plants growing in the IGFPP orchard were collected: *Capsella bursa-pastoris*, *Camelina sativa* agg., *Erysimum repandum*, and *Senecio vernalis*. For PCR analysis, primers were developed based on non-specific regions of genomic sequences of major fungal pathogens of fruit trees: *Monilinia* spp., which cause fruit rot and spoilage, as well as *Penicillium* spp., *Aspergillus* spp., and *Botrytis cinerea*, known producers of mycotoxins.

As a result of amplification product visualization, target sequences of *Penicillium chrysogenum* were identified in samples of *Capsella bursa-pastoris* and *Erysimum repandum*. In *Camelina sativa* agg. and *Senecio vernalis* samples, *Botrytis cinerea* was detected. *Penicillium expansum* sequences were found in *Capsella bursa-pastoris*. Genetic material of *Monilinia* spp. was recorded in *Capsella bursa-pastoris* and *Senecio vernalis*. Sequences of *Aspergillus* spp. were not identified in any of the analyzed samples.

The obtained results highlight the necessity of monitoring the capacity of segetal flora in orchards to preserve and spread mycopathogens, which pose a potential threat to crop yield and the phytosanitary state of agroecosystems. The findings also

demonstrate the ability to act as reservoirs not only for polyphagous fungi but also for specialized species such as *Botrytis cinerea* and *Monilinia*.

Keywords: segetal flora, *Monilinia* spp., *Penicillium* spp., *Aspergillus* spp., *B. cinerea*

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GROWTH-PROMOTING PROPERTIES AND WHOLE-GENOME ANALYSIS OF *Pseudomonas koreensis* CH-7

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In this study, a strain of *Pseudomonas koreensis* CH-7 was isolated from rhizosphere soil. This strain belongs to the fluorescent Pseudomonas complex and possesses growth-promoting properties such as nitrogen fixation, plant hormone production, and phosphorus solubilisation, while also being able to colonise plant roots effectively. Through morphological observation and biochemical characterisation analysis, combined with whole-genome sequencing, a high-quality genome draft (6,181,985 bp, GC content 60.36%) was obtained, with an N50 value of 10,299 bp for overlapping clusters and a BUSCO completeness of 98.13%.

Genome annotation revealed a total of 5,448 protein-coding genes, 19 rRNA genes, and 73 tRNA genes, with no plasmids detected. Additionally, 54 tandem repeat sequences, 2 prophages, 9 genomic islands, 2 insertion sequences, 447 antibiotic resistance genes, and 792 virulence-related genes were predicted. This study provides foundational phenotypic and genomic data for further research and applications of *P. koreensis* CH-7.

Keywords: *Pseudomonas koreensis*, growth-promoting, genome

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Section B

Bioengineering and Tissue Culture

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DEVELOPMENT OF AN EFFICIENT METHOD FOR MINI KIWI (*Actinidia arguta* Planch.) PROPAGATION IN GEORGIA USING HARDWOOD CUTTINGS

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Mini kiwi (*Actinidia arguta*) is an emerging high-value minor fruit crop with increasing global prominence and market demand, However, its commercial propagation remains a significant challenge due to the complexity of vegetative reproduction. This study aimed to establish a scientifically validated, efficient protocol for propagating mini kiwi via hardwood cuttings under Georgian agro-climatic conditions. The research was conducted between 2021 and 2023 at the LEPL Scientific-Research Center of Agriculture (SRCA), located in Jighaura Village, Mtskheta-Mtianeti, Georgia.

The study systematically evaluated the influence of different rooting hormone treatments - including indole-3-butyric acid (IBA; Dushefa-Biochemie) and powdered Kornevin (0.5% IBA) - alongside substrate composition and controlled environmental parameters on rooting success, survival rate, and shoot emergence in mini kiwi cuttings. Dormant hardwood cuttings were treated with five IBA concentrations (Control - water, 1,000 ppm, 2,000 ppm, 3,000 ppm, and 0.5% Kornevin powder) and planted into four distinct substrates: perlite with peat moss, coco coir with sand, vermiculite with peat moss, and commercial potting mix. Environmental conditions were optimized throughout the rooting period, maintaining a soil temperature of 18–22°C, relative humidity of 80–90%, a 12-hour photoperiod, and intermittent mist irrigation.

The results demonstrated that IBA treatment significantly enhanced rooting percentage, root length, and survival rate compared to the untreated control. Among the tested concentrations, 2000 ppm IBA combined with a perlite-peat moss substrate yielded the highest rooting performance - achieving a rooting percentage of 72.7%, mean root length of 7.1 cm, and survival rate of 87.7 %. Analysis of variance (ANOVA) confirmed statistically significant differences among treatments ($p < 0.001$), while post-hoc comparisons identified the perlite–peat moss mixture as the

most effective substrate for root development. Notably, shoot emergence was also maximized under these optimized conditions. These findings align with international studies and provide the first comprehensive, locally validated propagation protocol for mini kiwi in Georgia.

In conclusion, the application of 2000 ppm IBA and perlite + peat moss substrate is recommended for commercial-scale propagation of mini kiwi via hardwood cuttings in Georgia. This protocol will enable nurseries and growers to efficiently produce high-quality, genetically uniform planting material, supporting the expansion and sustainability of mini kiwi cultivation in the region. Further research should investigate seasonal and genotype-specific responses to optimize propagation strategies.

Keywords: *Actinidia arguta*, hardwood cuttings, indole-3-butyric acid (IBA), vegetative propagation, nursery technology, rooting efficiency

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ANALYSIS OF VARIANCE OF BIOMORPHOLOGICAL INDICES IN TRITICALE SC_1 - SC_2 SOMACLONES

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Genetic diversity can be estimated using morphological traits. The continuous development and availability of new genetic resources are essential for variety improvement, and phenotypic characterization can be used to differentiate genotypes.

Three hexaploid triticale genotypes served as study material: Ingen 35, Ingen 93 (standard), 188TR 5021 as a control and the somaclones SC_1–SC_2 obtained from all the variants investigated by *in vitro* culture and gamma-ray irradiation. The experiments were set up according to standard techniques under field conditions. Following biometric analyses, 7 quantitative characters were evaluated: number of fertile siblings, plant height, length of the main spike, length of the last internode, number of grains/spike, grain weight and 1000 grain mass.

The results revealed a significant contribution to the biomorphological indices conditioned by the SC_1- SC_2 generations and the effect of the action of the climatic conditions of the year. For the Ingen 35 genotype, the analysis of variance revealed significant differences in the traits plant height, main spike length, last internode length, number of grains/spike, grain weight and 1000 grain weight, indicating the presence of a significant stable genetic variability for both generations. Depending on the trait, for the SC_1 somaclones the influence power reached values from 12,69–60,91%. The highest values were recorded for the traits: length of the last internode (24,90%), length of the main spike (27,49%), and plant height (60,91%). In the SC_2 somaclones, the influence power ranged from 8,85 –34,28%, the values for the productivity traits were highlighted: grain weight (19,58%) and 1000 grain mass (34,24%). The values of the trait number of fertile siblings were insignificant compared to the control in both generations, this indicates that the genotype for this index had an identical response during the two years of study. The square root of the Ingen 93 genotype recorded statistically confirmed differences in most quantitative characters in both generations. The influence power ranged from 10,63-53,72% for the SC_1 somaclones, the highest values were attested for the index number of grains/ per spike, and for the SC_2 somaclones, the highest influence power was noted for the

main spike length character (42,72%). For the characters number of fertile siblings (SC_1) and length of the last internode (SC_2) insignificant values were recorded. The analysis of variance for the 188TR 5021 genotype revealed the effect of generations and year on the biomorphological indices. The results revealed significant differences at the 99,9% level for all characters of the SC_1 somaclones. The influence power reached values of 17,30-64,38%. The highest value was noted for the plant height trait (64,38%). Fisher test values for SC_2 somaclones attest to statistical support for the traits: plant height, main spike length, last internode length, grain weight and 1000 grain mass. The indices number of fertile siblings and number of grains being insignificant.

For the analyzed characters, significant differences were recorded for all characters depending on the year. These confirm the pronounced diversity of the climatic conditions of the two experimental years. Also, phenotypic distinctions were found between genotypes for most of the analyzed quantitative characters.

Keywords: somaclones, radiation, triticale, quantitative traits.

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BIOTECHNOLOGICAL APPLICATIONS OF SUNFLOWER POLLEN: FROM GENETIC ENGINEERING TO FUNCTIONAL BIOPRODUCTS

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Sunflower (*Helianthus annuus* L.) pollen has become in last the years a multifunctional biological resource with a large range of applications in modern biotechnology. Pollen, as a genetic information vector, has an essential role in plant breeding through methods such as haploid and double haploid production, cytoplasmic male sterility systems (CMS) and *in vitro* fertilization. These approaches facilitate the accelerated development of hybrid cultivars with the potential for increased yield, abiotic stress resistance and disease tolerance. The integration of pollen cryopreservation and pollen-mediated gene transfer further enhances its usefulness in germplasm conservation and genetic improvement. Beyond its agricultural importance, sunflower pollen demonstrates substantial potential in biotechnological production. Rich in proteins, essential fatty acids, flavonoids, phenolic acids and vitamins (A, C, E, B complex), it has antioxidant, anti-inflammatory, hepatoprotective and immunomodulatory properties. This study aims to explore the multifunctional potential of sunflower pollen, emphasizing its applications in genetic engineering, plant breeding, and the development of functional bioproducts with therapeutic and biotechnological relevance.

The chemical profile of sunflower pollen oil (extracted by the mini-Soxhlet method), determined by gas chromatography-mass spectrometry (GC-MS), revealed a large range of different compounds grouped according to their quantitative abundance. These bioactive constituents are classified into four main categories: trace level (<0.5%), low abundance (0.5-1.5%), moderate abundance (1.5-5%), and high abundance (>5%). Compounds present in trace quantities include *α-pinene, 3-pinanone, methyl hexanoate, acetophenone* and *cycloheptyl decyl adipate,* reflecting their minor but potentially functional roles. In the low-abundance group, a variety of esters, alcohols and hydrocarbons, such as *linalool, methyl octanoate,* vitamin E (*tocopherol*) and alkanes such as *heptacosane* and *hexacosane*, were identified, suggesting their involvement in antioxidant activity and structural integrity.

Compounds detected in moderate quantities, including *methyl palmitate, methyl dodecanoate,* and vitamin A (*retinol*), contribute significantly to the pollen's nutritional and bioactive profile. Notably, the major constituents (>5%) are represented by diterpenic and long-chain fatty acid esters, such as methyl *labda-8(20),12,14-trien-19-oate* and *α-methyl linolenate*, which are known for their antioxidant and anti-inflammatory properties. Overall, monocarboxylic acid esters constitute the predominant class (34-44%), followed by diterpenic esters (26-40%), dicarboxylic esters (0.2-0.6%), and various other compounds including ketones, vitamins, and monoterpenes. Compounds such as *methyl linolenate, linalool,* and *tocoferol* contribute not only to its therapeutic potential but also to its use in fragrances, natural preservatives, and drug delivery systems.

This complex composition highlights the multifunctional potential of sunflower pollen in pharmaceutical, nutraceutical, and biotechnological applications.

Keywords: sunflower, pollen, genetic engineering, bioactive compounds, pharmaceutical applications

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ESTABLISHMENT OF *IN VITRO* ASEPTIC CULTURE OF THE RARE SPECIES *Cercis occidentalis* Boiss. IN UKRAINE

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The optimisation of existing landscapes and the construction of new ones has long been carried out with the use of valuable ornamental woody plants. The source of increasing their range was and still is mobilisation, propagation, conservation and widespread introduction into the initial trial with further use in the urban phytoptimisation system. The presence of plants with high decorative properties is of particular value, in particular for landscaping populated areas. The representative of this group is a species of *Cercis occidentalis* Voss. from the family Fabaceae Lindl., which is rare in Ukraine, whose decorative properties are most evident during the flowering period, when even before the leaves appear, a mass of crimson-lilac flowers appears on the trees, collected in inflorescences of 8-16 pieces. The appearance of green, glossy, heart-shaped leaves against the background of a flowering tree and the formation of a tent-like crown shape further enhances its decorative effect.

Obtaining planting material for these plants often requires the use of vegetative propagation, as traditional methods are often either difficult to perform or not available at all. Therefore, it is *in vitro* technologies that have been very successful in producing large quantities of genetically homogeneous, virus-free planting material in a short time with a minimum number of plants of the source material. This is one of the most modern, high-tech and promising methods of plant propagation.

Successful establishment of in vitro aseptic culture propagation and preservation of plants in *in vitro* culture can be achieved by observing the correct selection of plant material, surface decontamination, composition of culture media, optimisation of cultivation conditions, which ensures the growth and development of plants introduced *in vitro*. Therefore, the aim of our research was to find out the peculiarities of introducing *C. occidentalis* plant material into in vitro culture and obtaining sterile, viable explants for further cultivation on nutrient media containing phytohormones.

Young green shoots of *C. occidentalis* with apical and lateral buds, from which microscopic shoots 0.8-10.0 mm long were isolated to obtain explants,

decontamination of which was carried out in two stages: pretreatment with neutral disinfectant VTS 885 ("IPAX CLEANOGEL", USA) with bactericidal and fungicidal properties and the main treatment with a 0.1 % aqueous solution of mercury dichloride ($HgCl_2$). The purpose of decontamination was not only to obtain explants free from harmful microorganisms, pathogens and viruses, but also to preserve their ability to morphogenesis. The study was carried out in a culture room at a temperature of 24±1°C, relative humidity of 70-75%, a photoperiod of 16 hours, and artificial light of 2-3 thousand lux.

The microscopic shoots obtained as a result of decontamination were planted on hormone-free culture medium according to Murashige & Skoog's prescription. Within eight to ten days, the effectiveness of the decontamination process was determined as a percentage of the number of uninfected objects to the initial number of explants that were sterilised. The percentage of viable explants was determined by the number of sterile explants that showed signs of growth within 10-12 days after planting on the culture medium.

Thus, the use of microscopic shoots of *C. occidentalis* with apical and lateral buds 0.8-10.0 mm long after decontamination with neutral disinfectant VTS 885 and 0.1 % aqueous mercury dichloride solution contributed to the production of 78±1.4 % of viable explants suitable for further cultivation on hormonal nutrient media to obtain the required amount of planting material.

Keywords: decorativeness, microclonal reproduction, in vitro introduction

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OPTIMIZATION OF MICROPROPAGATION PROCESSES OF STRAWBERRY VARIETY AROSA

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The aim of this work was to optimize the *in vitro* micropropagation processes of the Arosa garden strawberry variety in the Republic of Moldova. The studies were carried out in the laboratory and greenhouse of the institute in the period from 2023 to 2025 y. The initial approved mother plants were tested for the absence of the main viruses affecting strawberries according to the EPPO certification scheme. Meristems measuring 0.5-0.7 mm were used as explants. Sterilization at the isolation stage was carried out using Tabideze 56 and perhydrol 33 %. At the stages of isolation, micropropagation, and rooting, nutrient media based on macro-micro salts according to Murashige and Skoog (1962) were used, with the addition of benziladenina, gibberellic acid, indolilbutyric acid and vitamin C, agar-agar 6 g/l and sucrose 20 g/l. *In vitro* cultivation was carried out under illumination of 3000 lux and a photoperiod of 16 hours day - 8 hours night and a temperature of 23-25^0 C.

As a result of preliminary work, 8 source plants free of ArMV, RpRSV, SCV, SLRV, SVBV, SMYEV, SMV, and TBRV virus and virus-like diseases were selected. The best period for isolating meristems was in July. When sterilized in a 1% Tabideze 56 solution for 10 minutes, the survival rate of explants was 70 %. When sterilized in a 33 % perhydrol solution for 7 minutes, the survival rate was 80 %. At the stage of introduction into culture *in vitro* and in the following 2 - 4 months of proliferation, the most optimal medium was a medium with a half concentration of macro-micro salts according to Murashige, Skoog with the addition of BA-0.5 mg/l and IBA-0.1mg/l. At the stage of micropropagation, the concentration of macro-micro salts was full with BA 1 mg/l and IBA 0.5mg/l. In 5-6 months, 60-80 additional rosettes (bouquets) with well-developed microplants were obtained from a single explant. To stimulate rhizogenesis, BA was removed from the nutrient medium and the concentration of IBA was increased. The first roots appeared on day 9-10 and mass root formation occurred by day 20. The root formation rate ranged from 97 % to 100

% over the years. The best time for adaptation in non-sterile conditions in greenhouse was April. The survival rate was 87-90 %. After 40-50 days, the rooted rosettes were transplanted into a soil mixture.

As a result of optimizing all stages of micropropagation of the Arosa variety of garden strawberries, we have developed a complete technological process. We can propagate certified material for farmers in the country and neighboring countries who have a license from the CIV Italia variety holder in the required quantities for establishing a basic mother plant.

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FLOWERING PHENOLOGY IN TWO PLUM CULTIVARS

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The plum fruits serve as an excellent source of vitamins, minerals, fiber, and enzymes, possessing significant nutritional and medicinal properties. Consequently, examining the biological traits of specific varieties, particularly their phenology, holds scientific significance.

Numerous factors influence the flowering phenology of plants, and plums are no exception. Key factors include the timing, frequency, and duration of flowering. The phenology of a species encompasses not only the timing, frequency, and duration of reproduction but also the extent of reproductive synchrony with other plum cultivars. Synchrony among species can be beneficial, as the presence of one species may enhance fruit or seed set in another cultivar. It is now established that plums are self-incompatible, with entomophilous pollination being the predominant mode. However, the flower phenology of plums in semi-arid environments remains inadequately understood.

The objective of this study was to explore the flowering phenology of two plum cultivars (*Prunus domestica* L.) Stanley and Udlinionnaia, cultivated in lysimeters at the Institute of Genetics, Physiology, and Plant Protection during the 2024-2025. The date of the first flower appearance on the trees was recorded as the start of the flowering season, while the date of complete flower disappearance marked the end of this period. Ambient temperature and relative humidity during the flowering phase were also documented. Flower buds expected to open the following day were tagged the evening prior. The dehiscence of anthers was assessed by observing the presence of a yellow powdery mass of pollen on the anthers using a hand lens. The longevity of the flowers was measured by noting the time from opening until shedding.

The findings indicated that the flowering period of plums spanned 20-24 days across both observational years. The onset of anthesis in both cultivars occurred at 8:00 AM. The peak of anthesis was observed between 12:00 PM and 2:00 PM, continuing until 6:00 PM.

Both plum cultivars bloomed during the first to third decades of April. Flowering initiated when the minimum and maximum temperatures ranged around 10-12°C

and 24-26°C, respectively. The flowering process in plum begins with the sepals being gradually pushed backward by the expanding petals, which takes one day. On the following day, the petals emerge as a dome above the sepals. Subsequently, the outermost petal begins to straighten, followed in succession by the next petals. Gradually, they are pushed backward, revealing the stamen and pistil. The dehiscence of anthers first occurs in the inner circle of anthers after the flower has fully opened and continues for one day. The plum flower lasts for about 2 to 2.5 days, with no significant inter-varietal differences. After full opening, the flower remains open for approximately 2 to 3 days until the petals fall off.

The obtained data will be useful for determining the management strategy of plum pollination in conditions of changing climate and, as a result, frequent droughts.

Keywords: flowering phenology, plum, anthesis

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INFLUENCE OF DIFFERENT EXPLANTS ON LAVANDULA AND LAVANDIN MICROPROPAGATION

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To study the effect of three types of explants of two lavender and two lavandin varieties on growth and development parameters *in vitro* on nutrient medium without plant growth regulators.

In the study, the tops of microshoots and stem segments with one and two internodes were used for propagation of *Lavandula angustifolia* Mill. and *Lavandula x intermedia*. *L. angustifolia* varieties Hidcote blue and Mriya and hybrid varieties Platinum nico and Edelweiss were cultivated on hormone-free Murashige-Skoog medium at a temperature of $23^0 \pm 2$°C with a photoperiod of 16/8 at a light intensity of 3000 lux. The multiplication rate, regeneration potential, number of internodes, and height of microshoots were calculated after one month of cultivation. The multiplication rate was maximum in plants that regenerated on stem segments with two internodes. For lavender, this indicator was at the level of 1.3-1.5 shoots per explant, and for hybrid - 1.9-2.0. Compared to hybrid, lavender has shortened internodes, which affects the height of regenerated microshoots. For lavender, this indicator in our studies was 3.1-3.2 cm. Both lavender and lavandin with the maximum height of microshoots developed from apical explants in which apical dominance was maintained on medium without cytokinins. For both lavender varieties, this indicator was practically the same, while it differed significantly among lavandins – 3.5 cm for the Platinum nico variety and 10.6 cm for the Edelweiss variety, which is explained by the interaction of the variety's genetic characteristics and the source of the explants. The maximum length of the microshoots (10.6 ± 0.67 cm) was obtained for hybrid Edelweiss, which regenerated from apical explants. The greatest number of internodes formed on apical explants, and the number of internodes was almost the same for both lavender varieties and significantly different for lavandins – 3,8 for Edelweiss and 2.6 for Platinum nico. Moreover, the maximum number of internodes in Edelweiss was on stem segments with two internodes – 4.4. The regenerative potential for all the studied varieties was 100% on the apical explants. For lavender,

this indicator was 60% for single-node explants and 70% for double-node explants. For lavandin, the respective figures were 80% and 90%.

It was shown that it is possible to propagate certain lavender and lavandin varieties on a hormone-free medium. The results showed that the biometric parameters were slightly lower or like those obtained on hormonal media. The studied parameters were significantly influenced by both the initial explants and the varietal characteristics of lavender and lavandin. Correlation analysis revealed a high correlation (r = 0.862 and r = 0.784) between the lavender cultivar Platinum nico's multiplication coefficient and the number of internodes and plant height, regenerated from stem explants with one internode. For Hidcote Blue lavender variety, high correlations were observed between the multiplication coefficient (r = 0.710) and the number of nodes in the plants, that developed on stem explants with one internode and with plant height (r=0.915), regenerated on two-internode explants. The multiplication coefficient in lavandin Edelweiss and lavender Mriya had a high correlation with the number of internodes in plants propagated from explants with one internode (r = 0.887; r = 0.764), as well as with two (r = 0.982; r = 0.655).

Keywords: *Lavandula angustifolia* Mill.*; Lavandula x intermedia;* explants; *in vitro* cultivation

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SEXUAL DIMORPHISM OF POST-TRAUMA NON-MORPHOGENIC REGENERATIVE CAPACITY OF *Acer negundo* L.

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The introduction of new ornamental plants with year-round high aesthetic value and rich diversity - tolerant of adverse anthropogenic impacts and resistant to various biotic and abiotic stress factors - into green building practices is of particular and social importance. This is especially true in the context of increasing urbanization and the rapid reduction of available space in cities for creating squares, parks, other recreational areas, and for implementing garden therapy. Boxelder maple (*Acer negundo* L.) is a dioecious species, with male and female flowers borne on separate individuals. It was introduced to Ukraine from North America more than 200 years ago, has successfully acclimatized and naturalized, and is now considered invasive. However, androecious individuals of *A. negundo* do not pose a threat of expansion, are highly decorative, and can be used effectively in the landscaping of urbanized areas. Our research focused on the non-morphogenic regenerative capacity of both male and female *A. negundo* plants.

To assess post-trauma self-repair in the *A. negundo* plants under study, standardized notches (10–12 mm long, 1.5 mm wide) were made on one-year-old shoots from the previous year's growth at ten-day intervals from March to October. Creating the notch in the cambium was essential. Each wound was covered with transparent Scotch tape to prevent infection and desiccation. The regeneration coefficient was calculated using a modified 9-point scale to evaluate regeneration efficiency. Wound overgrowth was monitored every ten days using a magnifying glass. The regeneration coefficient was expressed in units of regeneration coefficient (urc), calculated according to Olga Opalko's equation.

The average regeneration coefficient index in *A. negundo* increased during the spring, starting from the third decade of March, when the indices gradually rose to 1.45 urc in androecious plants and 1.23 urc in gynoecious plants. By the third decade of May, the first peak of regeneration activity was observed, with regeneration

coefficients reaching 5.79 urc and 5.40 urc in androecious and gynoecious plants, respectively. Full wound healing occurred within 10 and 11 days, respectively. The second peak was recorded from the first decade of June to the second decade of July, during which the regeneration coefficients gradually increased and reached a maximum of 8.10 urc in androecious and 7.17 urc in gynoecious plants.

The intensity of non-morphogenetic post-trauma regeneration in the studied *A. negundo* plants varied throughout the years of investigation. It depended more on temperature fluctuations (r = 0.84–0.91) than on the amount of precipitation (r = -0.22 to -0.37) or the hydrothermal coefficient (r = -0.15 to -0.38). Nevertheless, the average indices of regeneration potential were rather higher for the androecious plants.

Because androecious *A. negundo* individuals cannot spread naturally, and male boxelder maple plants pose no risk of uncontrolled propagation while being highly acclimated to the natural and climatic conditions of Ukraine, they can be effectively used for landscaping urbanized areas and enhancing the productivity of urban ecosystems.

Keywords: androecious and gynoecious plants, boxelder maple trees, urban areas

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MULTISTEP DIAGNOSTICS OF ORSV AND CYMMV IN ORCHIDS DURING MICROPROPAGATION

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The aim. Odontoglossum ringspot virus (ORSV) and Cymbidium mosaic virus (CymMV) are among the most economically significant viruses affecting ornamental orchids. Their spread compromises the aesthetic and genetic value of collections and poses a challenge to biodiversity conservation. This study aimed to identify ORSV and CymMV in the orchid collection of M.M. Gryshko National Botanical Garden (NAS of Ukraine) and to investigate the genetic relatedness of Ukrainian isolates to those from other countries. The research emphasizes the relevance of a biotechnology-based multistep virus diagnostics system for ensuring plant health during propagation.

Materials and Methods. Symptomless *Cymbidium hybridum* plants were selected for *in vitro* propagation under aseptic conditions. Subsequently, leaf samples from greenhouse-cultivated plants exhibiting mosaic, chlorosis, and necrosis were collected for virus diagnostics. DAS-ELISA (Prime Diagnostics, Netherlands) was used as a primary screening tool. Total RNA was isolated using the RNeasy Plant Mini Kit (Qiagen), followed by RT with RevertAid Reverse Transcriptase (Thermo Scientific). PCR was performed with DreamTaq PCR Master Mix (2X) (Thermo Scientific) and specific primers targeting the coat protein genes of ORSV and CymMV. Amplicons were sequenced and subjected to phylogenetic analysis using MEGA X.

Results. The plant collection was screened by DAS-ELISA, identifying infected samples. RT-PCR confirmed the presence of ORSV and CymMV in symptomatic plants. Phylogenetic analysis demonstrated that the Ukrainian ORSV isolate is closely related to a South Korean isolate, whereas the CymMV isolate shares high sequence similarity with isolates from India and France.

Discussion. The data suggest that both viruses were likely introduced through international plant exchange, as the collection includes species obtained from countries such as India, China, France, South Korea, Singapore, and Brazil. Despite selecting

only symptom-free plants for micropropagation, ORSV and CymMV were later detected in greenhouse-grown orchids, indicating virus circulation and transmission during cultivation. Due to their mechanical spread, even one infected plant can lead to widespread contamination. Thus, strict sanitation, regular molecular testing, and vigilant monitoring with molecular methods are crucial for effective virus control.

Conclusions. This study shows that combining DAS-ELISA and RT-PCR enables efficient detection of ORSV and CymMV in orchids. Sequencing and phylogenetic analysis ensure accurate virus identification and origin tracing. Comprehensive diagnostics and routine monitoring at all propagation stages are vital for preventing virus spread in orchid collections.

Keywords: ORSV, CymMV, orchids, *in vitro* propagation, biodiversity protection

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THE EFFECT OF GLYCOSIDES ON THE ADAPTATION OF TOMATO POLLEN TO COMBINED STRESSES

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Stress factors (biotic, abiotic, or a combination of both) are known to significantly affect pollen performance during the development of reproductive organs. The use of biostimulants, such as glycosides, can help mitigate the negative effects of these adverse conditions. By enhancing the plant's adaptive and reproductive potential, biostimulants contribute to increased resistance and productivity. Given the limited information in the specialized literature regarding changes in male gametophyte characteristics under the combined influence of abiotic and biotic factors, as well as the effects of growth stimulants under such conditions, the aim of this study was to investigate the combined impact of viral pathogens and growth stimulants on the reactivity of tomato microgametes at supraoptimal temperatures.

The experiment was conducted using the tomato cultivars 'Rufina' and 'Elvira', along with the wild species *Solanum pimpinellifolium*. The plants were cultivated in the greenhouse and subsequently inoculated with either Tobacco Mosaic Virus (TMV) or Tomato Aspermy Virus (TAV). Following inoculation, they were treated with moldstim / veronicoside glycosides, obtained in the Natural Bioregulators Laboratory. Pollen samples underwent heat treatment in a thermostat at 40 °C for three hours. Microscopic analysis was then used to assess pollen viability and stress resistance, as well as the length and resistance of pollen tubes (PT). The study revealed specific responses indicating modifications in microgametophyte activity. Thus, in 16.7% of variants we established a stimulation of pollen viability by 4.0...12.1%, at the same time in most cases – 66.7% the complex action of factors inhibited the values of this character. In plants treated by pulverisation with glycoside, there was an increase in the length of pollen tubes in 44.4% of cases, which can be explained by the intensification of their growth rate, at the same time in 22.2% of the experimental variants, the pollen tubes were shorter compared to the control. Based on the results of the multifactorial dispersion analysis, the variability in pollen viability was primarily controlled by genotype, accounting for 11.3…27.3%, while

the effects of the glycoside and temperature contributed 10.0% and 11.5…24.6% to the variability, respectively. The modification of pollen tube length was largely dependent on genotype – with 19.9…33.5% and viruses – with 22.5…53.3%. Given that in cv. '*Rufina'*, thermal stress accounted for 61.3% of the variation in pollen viability and 18.3% of the variation in pollen tube length, exceeding the contribution of this factor by 1.8 to 3.1 times compared to the other genotypes, we can conclude that *this cultivar* exhibits significantly higher temperature sensitivity. The analyzed genotypes demonstrated a relatively high level of thermotolerance, with values in TMV/TAV (untreated) genotypes ranging from 58.1% to 74.3%. The application of glycosides increased these values by 5.5% to 13.9%, which can be attributed to the stimulatory effect of the glycosides.

Keywords: tomato, heat stress, virus infection, glycoside, resistance, tolerance

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Section C

Macrocompounds and Metabolic Processes

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PHENOTYPIC PLASTICITY AND ASSESSMENT OF PLANT RESISTANCE TO THE THERMAL STRESS

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The purpose. The concept of phenotypic plasticity is used to determine the level of an organism's adaptation to environmental conditions, enabling assessment of its biological performance. We aimed to determine the biological performance of different wheat genotypes based on the germination percentage of their seeds subjected to high or low temperature shock. The performance level was assessed based on the sum of the germination percentage after exposure of the seeds to high or low temperature shock.

Materials and methods. In our research, we used seeds of 28 winter wheat (*Triticum aestivum* L.) genotypes. Before exposure to high or negative temperature shock, the seeds were moistened by immersion in distilled water at +4°C for 36 hours; incubated at -7°C for 7 hours, or at +50°C for 30 minutes. After exposure to extreme temperature shock, we incubated the seeds for germination in the dark at 24°C, relative air humidity 70 %, for 7 days, subsequently determining the germination percentage. The data obtained were statistically analyzed, calculating the mean and standard deviation of data from three separate studies.

Summarized results. In response to the action of stress factors in plants, changes occur that generate functional and structural deformations, which, after the action of high doses, can lead to the degradation of the organism. The resistance of plants to the action of stress factors depends on the efficiency of different mechanisms, which are included in two large groups: avoidance (1) and tolerance (2) of the stress factor.

After the action of heat shock (HS) with different temperatures on the seeds of the Odesskaya 267 wheat variety, germination and root growth rate depended on the HS temperature, from this point of view, manifesting maximal biological plasticity in a restricted range of HS exposure temperature.

After exposing seeds of different wheat varieties to the same dose of HS, seed germination and seedling root growth rate of different wheat varieties were different, allowing the genotypes to be separated into three groups: with low, medium, and high biological plasticity.

Specific doses of HS or negative temperature shock (NTS) were evaluated, which allowed the separation of 28 wheat genotypes according to resistance to HS or NTS. Based on the percentage of seed germination, the genotypes were divided into groups with low, medium, and high resistance to HS or NTS.

Conclusions. 1. The primary resistance of wheat genotypes to the action of specific doses of HS or NTS correlates with their adaptive resistance to heat or frost. 2. Based on the primary resistance to HS or NTS of wheat genotypes, their phenotypic plasticity can be assessed, the value of which depends on the variation of environmental conditions.

Keywords: *Triticum aestivum*, heat shock, negative temperature shock, phenotypic plasticity

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STUDY OF THE EFFECT OF ALGAL PREPARATION ON THE GERMINATION OF CORN SEEDS (*Zea mays* L.)

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Corn (*Zea mays* L.) is one of the most widely cultivated agricultural plants worldwide, used in human nutrition, as animal feed and as a raw material in the agri-food industry. The growth of the world population determines an increase in the demand for corn for food and feed - a demand that needs to be satisfied. It is known that droughts and other unfavorable environmental factors have the effect of reducing corn yields, reducing grain size and, implicitly, decreasing the seed germination rate. In order to enhance the germination of corn seeds and accelerate the development of the crop, various stimulants are used. The most preferred, safe and environmentally friendly are algal biostimulants. These, based on the living biomass of green algae and cyanobacteria, stimulate seed germination, increase plant vigor and productivity and create favorable conditions for the development of soil biota, thus contributing to the qualitative improvement of soils involved in agriculture.

Thus, we aimed to evaluate the influence of the preparation "ALGE EN-1" on the germination of corn seeds (Strain 458) preventively treated with the insecticide Acetamiprid. The preparation "ALGE EN-1" is a product obtained from green soil algae, in a living state, having an intense green color. It is 100% organic, non-toxic to humans, animals and the environment and is accessible for application in sustainable agriculture.

Experiments were carried out in laboratory conditions, at a temperature of 19–20°C, with natural lighting. Two variants were tested: Variant 1 (control) – seeds were sprayed with distilled water; Variant 2 – seeds were sprayed intensively with the preparation "ALGE EN-1". In each variant, 100 seeds were used, in three repetitions. After treatment, the seeds were sown in peat cassettes, at a depth of 5 cm. The samples were subsequently moistened with distilled water in equal amounts, to maintain the optimal humidity necessary for germination. During the experiment, the

following were analyzed: germination capacity, relative root elongation and seedling height (15 days after planting).

As a result of the research, it was found that treating corn seeds with the investigated algal preparation has the effect of stimulating their germination capacity. Thus, the germination capacity values in the control variant were 88.66±0.33%, and in the variant treated with "ALGE EN-1" - 90.33±0.32%. Preventive treatment of seeds with the investigated preparation did not show a major effect on the relative elongation of the root, reaching 92.42±4.30% in variant 2, but the roots of the treated plants were much thicker and more branched. In the variant with the treatment of seeds with the algal preparation, an increase in the aerial part of the seedlings was also found. Thus, in variant 1, the height of the aerial part of the corn was 10.10±1.00 cm, and in the variant treated with the "ALGE EN-1" preparation - 11.80±1.05 cm. It is important to note that, in the treated variant, the leaves had a much more intense green color than those in the control group, a greater width and increased vigor. These effects are due to the action of the live algae, as well as the bioactive compounds and metabolites released by them into the treatment solution.

In conclusion, as a result of the research conducted, we find that the preparation "ALGE EN-1" has a biostimulating effect on the germination of corn seeds and creates favorable conditions for its application in open field cultivation conditions.

Keywords: ALGAE EN-1, corn, seed germination

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STUDY OF THE BIOSTIMULATORY EFFECT OF WASTEWATER GENERATED FROM *Spirulina platensis* CULTIVATION ON THE GERMINATION OF *Sorghum bicolor* X *Sorghum sudanense* SEEDS MAINTAINED UNDER COLLECTION CONDITIONS

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The cultivation of spirulina has gained increasing interest due to its nutritional value and applicability in various fields. The global production of spirulina is approximately 1.5 million tons of dry biomass, and to supply these quantities, the cyanobacteria are cultivated industrially, thus accumulating large amounts of wastewater (mainly consisting of the culture liquid). It is worth noting that these wastewaters are rich in nutrients, biologically active substances and other compounds, which can be exploited including by using them in the treatment of seeds of various plants. Of particular interest among cultivated plants with increased resistance to drought is sorghum. Sorghum is the fifth most important cereal an important source of micronutrients and macronutrients essential for human nutrition. Of great interest is the identification and evaluation of the effect of inexpensive algal and cyanobacterial biopreparations on the germination of sorghum seeds, especially those maintained under collection conditions, in order to preserve the gene pool and fortify the plants in order to increase the germination rate and accelerate their growth. It is important to highlight that, in many cases, the high cost of cyanobacterial biomass results in relatively expensive end products. It is important to highlight that, in many cases, the high cost of cyanobacterial biomass results in relatively expensive end products.

Thus, we aimed to analyze the effect of wastewater (culture liquid) resulting from the cultivation of the cyanobacterium *Spirulina platensis* on the germination of sorghum seeds maintained under collection conditions for two years, with the aim of capitalizing on these waters and creating the premises for obtaining inexpensive and accessible biopreparations applicable in sustainable agriculture.

In the research, were used seeds *Sorghum bicolor* × *Sorghum sudanense*, provided by Dr. Victor Ţîţei. The waste water from the cultivation of spirulina was obtained

by centrifuging the suspension on the 20th day of cultivation. The biostimulator was prepared by thermal activation of the waste water. In the experiments, solutions with concentrations of 1, 2 and 4 % were used, obtained by diluting the culture liquid with distilled water. The researched seeds, in number of 100 for each experimental batch, were treated with the biostimulator for 1, 2 and 4 hours, and as a control, the seeds exposed to distilled water for the same time intervals served. To study the germination process, the seeds were placed in Petri dishes, on filter paper moistened with distilled water, at a temperature of 22 °C. During the experiments, the germination capacity of the seeds was analyzed.

Thus, on the first day after seed treatment, in the variants with biostimulator, the germination capacity recorded values between 6–22 %, and in the control ones – 4–8%. On the second day, in the variants treated with biostimulator, 34–58 % of the seeds germinated, and in the control variant – 42-44 %. On the third day, in the treated variants, 44–60% germinated, and in the control ones – 44–54 %. On the fourth day, in the treated variants, 56–60% germinated, and in the control ones – 54–56 %. The most favorable time for seed treatment with biostimulator was 2–4 hours, which led to obtaining the highest values of germination capacity. Thus, we find that wastewater generated from the cultivation of the cyanobacterium *S. platensis* creates favorable conditions for being utilized as biostimulators in the germination of *Sorghum bicolor* × *Sorghum sudanense* seeds maintained under collection conditions.

Keywords: wastewater, *Spirulina platensis*, seeds, sorghum

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WATER USE EFFICIENCY OF SOYBEAN AND WALNUT ACCORDING PHOTOSYNTHETIC PARAMETERS OF PLANT LEAVES

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The purpose of this investigation was to evaluate photosynthetic parameters of different cultures (soybean, walnut) with a view of this cultures water use efficiency.

The objects of study were plants of soybean and walnut in field conditions. The soybean variety Laduta has been approved for all zones of the Republic of Moldova since 2018 and was planted at the fields of the Institutute of Genetics, Phisiology and Plant Protection of Moldova State University. The walnut variety Pescanski was grown since 2014 in the walnut orchard of the village Rediul de Sus (Falesti district, Republic of Moldova) has been approved for all zones of the Republic of Moldova since 2018. A portable LCpro-SD system (ADC BioScientific Ltd, UK) was used to measure the photosynthetic parameters of plant leaves (photosynthetic assimilation rate, transpiration rate, stomatal conductance of H_2O, leaf chamber and leaf surface temperature). Water use efficiency was evaluated from instantaneous measurements of photosynthesis and transpiration intensity.

It has been shown that water use efficiency at the leaf level of soybean and walnut plants is significantly higher than water use efficiency at the community level. Water use efficiency at the leaf level decreases as leaf temperature increases.

Keywords: walnut, soybean, photosynthesis, transpiration, leaf temperature

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PHENOLIC COMPONENTS OF PLANT EXTRACTS AND THEIR RELATIONSHIPS WITH ANTIOXIDANT CAPACITY

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The purpose of this study was to evaluate the content of several phenolic components in extracts used as natural plant growth regulators and to determine their impact on the antioxidant capacity of these extracts. Dry extracts from the above-ground parts of the plants *Veronica spicata* L., *Veronica officinalis* L., *Veronica spuria* L., *Verbascum densiflorum* Bertol., *Linaria genistifolia* (L.) Mill. and *Juniperus sabina* L. were obtained and investigated.

The total polyphenolic content (GAE – gallic acid equivalent), total flavonoid content (QE – quercetin equivalent), total phenolic acid (CAE – caffeic acid equivalent), and Trolox equivalent antioxidant capacity (TEAC) by two methods of radical scavenging DPPH (2,2-diphenyl-1-picrylhydrazyl) and ABTS (2,2'-azino-bis(3-ethylbenzothiazoline-6-sulfonic acid) were determined.

The highest content of total polyphenolic components and total flavonoids was in extract from *V. densiflorum*, respectively 78.27±3.51 mg GAE/g and 91.98±1.31 mg QE/g. According to the decrease in total flavonoid content (mg QE/g), extracts can be arranged as follows: *V. densiflorum* > *J. sabina* (79.36±0.17) > *V. officinalis* (74.98±0.98) > *V. spicata* (69.01±1.95) > *L. genistifolia* (16.11±0.42) > *V. spuria* (3.93±0.77). Extract from *V. spuria* also contained the least amount of total polyphenols (13.33±2.02 mg GAE/g) and phenolic acids (3.86±0.15 mg CAE/g). Despite this, the extract from *V. spuria* shows growth regulating activity, which is probably not initiated only by the phenolic components.

The antioxidant capacity determined by ABTS method had the high positive correlation with content of flavonoids in extracts (r = 0.7291). All extracts, except *V. spuria,* demonstrated by ABTS method the antioxidant capacity in limits 108.44-114.35 mg TEAC/g. DPPH antioxidant capacity changed from 6.88 to 8.13 mg TEAC/g. No significant relationship was found between the antioxidant capacity evaluated by DPPH method and the studied phenolic components. However, the main contribution to the antioxidant activity of the studied plant extracts was made by flavonoid components.

Keywords: plant extract, polyphenol, flavonoid, acid phenolic, antioxidant activity, DPPH, ABTS

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ASSESSING DROUGHT TOLERANCE THROUGH PHYSIOLOGICAL RESPONSES IN DIFFERENT WHEAT VARIETIES

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In the Republic of Moldova, droughts frequently occur and adversely affect the cultivation of agricultural crops, notably winter wheat (*Triticum aestivum* L.), which plays a vital role in the country's economy. Water stress significantly impacts plants during early ontogenetic stages, delaying germination and causing physiological and biochemical imbalances. In this context, breeding drought-tolerant cultivars is essential to maintain crop productivity and facilitate adaptation to changing climatic conditions. The selection of appropriate genetic material constitutes the initial phase of an effective breeding program, followed by genotype evaluation at various developmental stages. Laboratory assays employing polyethylene glycol (PEG 6000) are routinely used to simulate water stress during early plant development.

Materials and methods. This study evaluated the response of four common winter wheat varieties (Meleag, Moldova 614, Moldova 5, and Bijuteria Zâmbrenilor) to water stress induced during germination and early growth stages. A 15% PEG 6000 solution was used to simulate drought conditions.

Seeds were disinfected with a 2.0% sodium hypochlorite solution for 20 minutes, then placed on filter paper moistened either with distilled water (control) or PEG 6000 solution (osmotic stress treatment). Germination was carried out under controlled conditions (22 ºC, 16-hour photoperiod) for 10 days, using a completely randomized experimental design with four replicates of 25 seedlings each.

The following parameters were analyzed: vigor index, dry biomass, photosynthetic pigment content, polyphenol levels, and proline concentration. Data were processed using one-way analysis of variance (ANOVA) to identify statistically significant differences among cultivars.

Summarized results. Water stress simulated with PEG 6000 significantly reduced the growth vigor index, dry biomass, water retention, and photosynthetic pigment content. These adverse effects were observed in all tested cultivars, although the intensity of responses varied among genotypes.

Biochemical analysis revealed a marked accumulation of proline and polyphenolic compounds as an adaptive response to osmotic stress, indicating activation of physiological and metabolic mechanisms conferring tolerance to water deficit. Notably, the winter wheat variety Bijuteria Zâmbrenilor exhibited consistently high biochemical parameter values under both control and stress conditions, suggesting potentially greater metabolic resilience. For instance, proline levels in this variety were significantly higher than in others, reflecting the effectiveness of its osmoprotective mechanism.

Conclusions. 1) An inverse relationship was found between the vigor index and PEG 6000-induced stress, indicating that higher seed vigor is associated with lower susceptibility to water stress during early developmental stages. 2) Comparative metabolite analysis revealed consistent changes under osmotic stress that persisted even in control conditions, suggesting potential metabolic stability in certain genotypes. 3) The winter wheat variety Bijuteria Zâmbrenilor demonstrated the most robust biochemical response to drought, evidenced by high accumulation of proline and polyphenols in both control and treated samples, indicating the presence of an effective adaptive mechanism.

Keywords: winter wheat, seedlings, water stress, PEG 6000, proline, phenol, vigor index, dry biomass, photosynthetic pigments

Funding. This research was supported by subprogram 011101 „Genetic and biotechnological approaches to the management of agroecosystems under climate change conditions", funded by the Ministry of Education and Research of the Republic of Moldova.

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DYNAMICS OF PHOTOSYNTHETIC SUBSTANCES IN *Panicum virgatum* L. PLANTS DEPENDING ON THE STAGE OF DEVELOPMENT AND THE METHOD OF SOWING

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Plants are ideal models for studying metabolic diversity and the pathways of its formation. Analysis of the dynamics of metabolic processes, in particular the accumulation of biologically active compounds depending on the place of growth (including soil and weather conditions) and the area of nutrition, allows us to determine their adaptive potential and select the most optimal conditions for growing, preserving, and using phytodiversity for the needs of society. Studying the degree of influence of climatic conditions or cultivation conditions on the content of nutrients and antioxidants in plants contributes to the development of new approaches to increasing their adaptive potential. *Panicum virgatum* L. (Poaceae) is a promising new crop with C_4 photosynthesis, characterized by high ecological plasticity. The plant is native to North America. Recently, it has been widely studied in various regions of the world and used in a number of industries (phytopower, landscaping, phytoremediation, fodder production, etc.) due to its high adaptive potential. Research on the response of switchgrass plants to stressful environmental conditions, namely the accumulation of chlorophylls and carotenoids, can serve as an indicator of adaptation to stress factors (temperature, moisture, salinity, etc.).

Over many years, the M. M. Gryshko National Botanical Garden of the National Academy of Sciences of Ukraine has created a valuable introduction and genetic fund of *P. virgatum* plants, which includes more than 40 taxa. As part of the research tasks on scientific and applied topics of the Department of Cultural Flora of the NBG, the dynamics of the accumulation of photosynthetic substances (chlorophyll *a* and *b*, carotenoids) in the above-ground phytomass of plants was analyzed depending on the phase of development and feeding area. The content of photosynthetic substances in plant extracts was determined using a Unico UV 2800 spectrophotometer, with identification at wavelengths of 662 nm for chlorophyll *a* (Chl *a*), 644 nm for

chlorophyll *b* (Chl *b*), and 440 nm for carotenoids. The content of photosynthetic pigments in plants was assessed depending on the method of placement in crops (row spacing 24 cm; 45 cm; 70 cm). In all variants of the experiment, an increase in Chl *a* content was recorded from the regrowth phase (from 0.97 to 1.13 mg/g) to the flowering phase (from 1.25 to 1.28 mg/g), which indicates the activation of growth processes in plants. A 30-40% decrease in Chl a content during the fruiting phase (from 0.83 to 0.87 mg/g), depending on the sowing method, may be associated with the redistribution of metabolic components and their reorientation toward the formation and maturation of viable seeds. There were also fluctuations in Chl *b* values depending on the phase of development and the method of plant placement, namely, with an increase in row spacing, the Chl *b* content increases from the regrowth phase (from 0.16 to 0.19 mg/g) to the flowering phase (from 0.24 to 0.28 mg/g). A decrease in Chl b values was observed in the fruiting phase from 0.18 mg/g to 0.23 mg/g depending on the plant placement scheme. The ratio of Chl a/Chl b was within the range of 1.0-2.5, which indicates the ability of plants to adapt to both shading conditions and increased light levels. The increase in carotenoid content from the regrowth phase (from 0.55 to 0.58 mg/g) to the end of fruiting (from 0.62 to 0.56 mg/g) confirms that carotenoids perform a protective function- they protect chlorophylls from photosaturation and photooxidation. The highest pigment content and optimal ratio between them was observed in wide-row crops with 70 cm row spacing, which indicates better conditions for production processes in plants.

Thus, the results obtained regarding the dynamics of photosynthetic substances in plants allow for a deeper understanding of the mechanisms of their adaptation to growing conditions and may contribute to the development of effective strategies to increase their resilience. *P. virgatum* is a promising perennial crop with high energy potential, capable of becoming one of the important plants for the development of the bioeconomy, thanks to its ecological plasticity, productivity, and ability to grow in different climatic conditions.

Keywords: *Panicum virgatum*, chlorophylls, carotenoids, plant resistance

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IMPACT OF TEMPERATURE AND BIOREGULATOR ON STARCH USED FOR CORN SEEDS GERMINATION

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Corn (*Zea mays* L.) is one of the principal cereals crops whose early growth is very sensitive to environmental conditions. The germination process is crucial for the successful cultivation of maize. Among the various factors affecting germination, temperature plays a fundamental role. The ability of seeds to mobilize efficiently their starch reserves during germination helps in root and seedling development. The purpose of this work was to study the effect of two abiotic factors – temperatures and treatment with a natural bioregulator, extract from *Juniperus sabina* (JS) on starch mobilization during corm seeds germination and its relationship with other bio-morphological features.

The object of the study was seeds of the Porumbeni 455 (P455) corn hybrid belongs to the FAO 450 group and has dent grain. Corn seeds were germinated in six variants: a) control (optimal conditions); b) preliminary treatment with *Juniperus sabina* 0.0001%; c) cold test, seeds germinated at 10°C for 7 days and under optimal conditions - 4 days; d) cold test of seeds preliminary treated by JS) seeds treated at 50°C for 30 minutes, germinated under optimal conditions; g) heat test of seeds pre-treated with JS. Starch content was determined polarimetrically before and after germination. Starch utilization was determined by the difference between the initial starch content of intact seeds and germinated seeds. Biomass distribution was assessed by measuring initial seed weight, residual seed weight after germination, root and epicotyl biomass, and biomass loss due to respiration.

Initial starch content in corn seed of the P455 hybrid averaged 59.06±0.66%. Temperature and bioregulator treatments significantly influence to starch used and biomass allocation. Starch used varied among treatments, with the highest reduction observed in seeds pre-treated with JS in cold test (4.58%) and the least in control seeds (1.45%). Biomass utilized during germination was relatively uniform (0.036 - 0.043 g per one seed, across treatments). Allocation differed: cold conditions favored

epicotyls development, while standard and heat treatments favored roots biomass. An average, 37–47% of consumed seed biomass was allocated to root development and 9–19% to epicotyls, depending on treatment. Metabolic efficiency ranged from 1.2766 (JS) to 1.4133 (heat test). A moderate positive correlation (r = 0.31) was observed between the amount of starch mobilized during germination and the metabolic efficiency of seeds. Starch consumption during germination has a high positive relationship with epicotyl biomass (r = 0.8664) and its vigor (r = 0.8408). The effect of non-optimal temperature and JS treatment led to starch mobilization, biomass distribution, and changes in metabolic efficiency during corn seed germination. The natural bioregulator JS improved starch utilization and epicotyl growth under the influence of temperature factors.

Keywords: corn seed, non-optimal temperature, bioregulator JS, germination, starch mobilization

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ADVANCED ANALYTICAL APPROACHES FOR THE DETECTION OF TROPANE ALKALOID CONTAMINATION IN HERBAL TEAS – INSIGHTS FROM THE "ConTrAl" PROJECT

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Herbal teas are widely consumed for their health benefits and relaxing properties; however, numerous studies and data highlight their susceptibility to contamination with toxic compounds. Secondary metabolites, such as tropane alkaloids (TAs), are found in various species from the Solanaceae family (e.g., *Atropa belladonna* L., *Hyoscyamus niger* L., *Mandragora officinarum* L., *Datura stramonium* L.), Brassicaceae (e.g., *Brassica* sp.), Erythroxylaceae (e.g., *Erythroxylum* sp.), and Convolvulaceae (*Convolvulus arvensis* L.), among others. Over 200 TAs have been identified to date, including atropine, hyoscyamine, scopolamine, and cocaine, among others. Exposure to TAs, especially in high doses, can result in severe toxic effects in humans. The most common cause of unintentional TAs ingestion is through plant-based food products, including herbal teas, which may become contaminated during harvesting when TA-producing weeds are accidentally included. The ConTrAl project aims to develop and implement advanced analytical tools to detect TAs contamination in herbal teas and enhance consumer safety.

The methods used include DNA barcoding combined with high-resolution melting (Bar-HRM) to specifically identify the presence of TA-producing plant species in complex herbal teas. Additionally, liquid chromatography-tandem mass

spectrometry (LC-MS/MS) is employed to assess TAs in contaminant (TA-producing) plants and commercial herbal teas.

The expected results of ConTrAl include providing a novel integrated analytical solution to quickly and reliably detect species containing toxic TAs as contaminants in herbal teas and assess the quality of these teas concerning TAs contamination. ConTrAl will deliver a substantial dataset on TAs occurrence in herbal teas from the Romanian market, supporting improved exposure assessments and risk characterization for public health authorities. Integrating DNA-based methods with targeted chemical analyses represents a robust and scalable approach to quality control of herbal teas. The results of ConTrAl will assist in developing new standards for preventing and monitoring toxic plant contamination in herbal teas.

Keywords: contamination, herbal teas, quality control, tropane alkaloids, safety

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THE ROLE OF GENOMIC METHYLATION PROFILING IN PERSONALIZED DIETARY INTERVENTIONS

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DNA methylation plays a fundamental role in gene expression regulation, neurochemical balance, detoxification, and immune homeostasis. Advances in nutrigenomics have allowed for the evaluation of methylation capacity that combine genetic (SNP) testing and biochemical markers. This study aims to explore the relevance and applicability of methylation testing in clinical nutritional practice. The study included 4 adult patients (3 male, 1 female) with overlapping clinical symptoms at Clinical Nutrition of Mitogenix Innovations, Romania, by an authorized dietitian, reporting fatigue, weight loss, digestive issues, sleep disturbances. Each had a FACIT-Fatigue score >35. Their genomic data revealed shared SNPs (MTHFR C677T, MTRR A66G, COMT V158M, CBS A360A, BHMT-08) and biochemical anomalies including elevated homocysteine, low glutathione, and altered SAM/SAH ratios. Based on these patterns, targeted dietary and nutraceutical interventions were proposed. All patients exhibited polymorphisms in key methylation-related genes: MTHFR C677T: One patient (female) was homozygous (T/T) while others were heterozygous (C/T), indicating universally reduced methylation efficiency. MTRR A66G: 3/4 were homozygous (G/G), which impairs methylcobalamin regeneration. BHMT-08 mutation and CBS A360A overactivity were present in most cases (3/1), suggesting a tendency toward disrupted homocysteine clearance and accelerated transsulfuration. COMT V158M: while two patients (1 female, 1 male) were homozygous (Met/Met), suggesting decreased catecholamine degradation and increased stress sensitivity, 1 male, was Val/Val, indicative of more rapid catecholamine clearance and potentially lower susceptibility to mood dysregulation. CBS A360A was normal only in one patient (female), while the others exhibited overactive variants, linked to glutathione depletion and detoxification imbalances. 4/4 demonstrated low SAM/SAH ratios, elevated homocysteine levels, and reduced glutathione. The patients share a common epigenetic and metabolic background, characterized by mutations in genes involved in methylation and detoxification. Differences between patients (e.g., CBS activity or COMT status) may justify specific adaptations in supplementation and dietary

intervention. The integration of genetic methylation panels into functional medicine emphasizes the importance of SNP interpretation in tailoring nutritional protocols. This improved patient outcomes following nutrient-targeted methylation support in individuals with fatigue, digestive issues and mood disorders.

Keywords: genomic methylation, personalized nutrition, epigenetics, detoxification

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INFLUENCE OF THE APPLICATION OF BIORATIONAL PLANT PROTECTION PRODUCTS ON LEAF CHLOROPHYLLS, CAROTENOIDS CONTENT AND PRODUCTIVITY OF CUCUMBER PLANTS

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Challenges related to adaptability to the unfavorable climatic conditions and to the efficiency of the use of organic plant protection substances have a fundamental as well as a practical significance. The application of treatments of plant protection products has impact first to control diseases and combat the attack of pests but at the same time they could affects the physiological state and the productivity of crops.

The purpose of the study was to investigate the impact of natural products monopotassium phosphate, dipotassium phosphate and Neem oil applied alone or alternately on total chlorophylls, carotenoids contents in leaves and their effects on cucumber fruit yield. A greenhouse experiment was carried out on cucumber cultivar Iulian. This cucumber variety has moderate susceptibility to the powdery mildew pathogen S*phaerotheca fuliginea*. The applied treatments were as follows: 1. Control, untreated plants; 2. Monopotassium phosphate 1%; 3. Dipotassium phosphate 1%; 4. Neem oil 0,5%; 5. Monopotassium phosphate 1%+Neem oil 0,5%; 6. Dipotassium phosphate 1%+Neem oil 0,5%. During vegetation there were four treatments with these ecological products. The chlorophyll and carotenoids content in leaves was determined according to the method accepted in speciality of literature. The data were analyzed using Statistic Program 7.

Experimental results revealed that highest biological efficiency was registered in treatment with integrated use of dipotasium phosphate (1%) and emulsion of Neem oil (0,5%). Foliar application of these compounds contributed to accumulation in leaves of total chlorophylls (by 16,2%). Data analysis of carotenoids content in leaves revealed that the separate application of monopotassium phosphate contributed to a decrease of carotenoids in cucumber leaves. The alternate application of dipotasium phosphate and emulsion of Neem oil increase this index by 9,4%. In the rest of the variants no significant changes in the carotenoids content were established compared to the control. Experimental data established that the application of potassium phosphates in combination with emulsion of Neem oil treatments led to an increase

in cucumber yield. The integrated use of these two organic products contributed not only to a reduction of plant infection with powdery mildew, but also to an increase in productivity by 12,9% compared to untreated plants. Thus, the treatments with these mineral salts contributed to a certain extent to the improvement photosynthetic pigments status, which undoubtedly had positive repercussions on the better plants development and increased the productivity of cucumber plants.

In summary, the study results demonstrated that integrated application of dipotassium phosphate and emulsion of Neem oil was the most effective among the tested biorational products not for controlling powdery mildew disease, but also to increase the pigments contents in leaves with beneficial consequences on productivity of cucumber plants compared to individual treatments. Further study is necessary to verify the results on a larger scale in biotechnology for organic cucumber production.

Keywords: carotenoids, biorational products, cucumber, productivity

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Section D

Biotechnology for Environment and Plant Protection

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MOLECULAR DIAGNOSIS OF PHYTOPLASMA PRESENCE IN PLUM ORCHARDS

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Plums are a fruit culture of national economic importance, however, the productivity of these fruit crops is threatened by numerous pathogens, including phytoplasmas. Phytoplasmas are wall-less microorganisms that colonize the phloem and affect the tree growth systemically. Main symptoms of phytoplasma infection at plums include stunted growth, yellowing and reddening of leaves, and reduced fruit yield. The spread of phytoplasmas is facilitated by insect vectors and perennial plants. Monitoring the presence of phytoplasma allows to control its spread within the region.

The aim of the research was the molecular analysis of the presence or absence of pathogens from the genus '*Candidatus* Phytoplasma' including the species '*Ca*. P. solani' in local plum.

Molecular detection of phytoplasma was carried out on different plum genotypes collected from experimental plots of IGPPP, MSU in 2024. Samples for analysis were collected in spring during the first ten days of April, and in autumn — during the second ten days of October 2024. DNA was isolated using SDS method from thin sections of plum branches and leaves. Molecular analysis was performed using nested-PCR techniques with ribosomal primers P1\P7 specific for '*Ca*. P. spp' and 16Sr396 F\R for phytoplasma species '*Ca*. P. solani'. Results were visualized after electrophoresis in 1.5 % agarose gel under UV light.

Initially, a molecular analysis was conducted to determine the presence or absence of phytoplasma in plums of three groups: Stanley (4 years old), President (4 years old), and Stanley (10 years old). For the analysis, 15 branches were collected from the Stanley and President trees (both 4 years old), and 20 branches from the Stanley trees (10 years old). No phytoplasma presence was detected in the analyzed genotypes of plum. The same result was obtained in October. Taking into account these negative results on the Stanley and President genotypes, other genotypes such as Angelina, Superpresident and Udlinionnaia were included in the analysis. For the tests, 12–15 leaves were collected from individual plum trees. The molecular analysis

confirmed the absence of phytoplasma in all studied plum genotypes. Additionally, to confirm phytoplasma presence in the IGPPP fields, tomatoes were taken for analysis. The results confirmed a widespread infection in tomato. So, despite the high level of phytoplasma infection observed in the tomato field, the presence of phytoplasma was not detected in plum trees either in spring or after the fruit harvest. Thus, phytoplasma infection does not currently present a real threat to plums orchards in Moldova. Nevertheless, future monitoring phytoplasma spread is essential for effective control and accurate epidemiological assessment of phytoplasmosis in the region.

Keywords: '*Candidatus* Phytoplasma spp', '*Ca*. P. solani', *nested*-PCR, plums

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BACTERIAL STRAINS WITH HIGH BIOTECHNOLOGIC POTENTIAL FOR AGRICULTURE

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Agriculture in the Republic of Moldova, while critically important, faces numerous challenges - including arable soil degradation, environmental pollution, and inefficient management practices - that negatively impact the economy, environment, and human health. Among these challenges, plant diseases caused by various fungi (e.g., *Fusarium*, *Alternaria*, *Botrytis*) and bacteria (e.g., *Agrobacterium*, *Erwinia*, *Corynebacterium*, *Xanthomonas*) significantly reduce crop yields and product quality.

Biotechnological solutions such as antimicrobial agents and plant growth-promoting microorganisms offer promising, sustainable, and environmentally friendly alternatives that are also safe for human health.

The objective of this study was to identify bacterial strains with strong antibacterial activity against phytopathogenic bacteria, as well as plant growth-promoting properties.

Six bacterial strains were selected for the study: *Bacillus cereus* var. *fluorescens* CNMN-BB-07, *B. velezensis* CNMN-BB-13, *B. velezensis* CNMN-BB-31, *Pseudomonas fluorescens* CNMN-PsB-01, *P. fluorescens* CNMN-PsB-02, and *P. fluorescens* CNMN-PsB-12, all stored in the NCNM collection. The phytopathogenic strains *Agrobacterium tumefaciens* CNMN-AB-01, *Corynebacterium michiganense* CNMN-CrB-01, and *Erwinia carotovora* CNMN-BE-01 were used as test cultures to assess antibacterial activity via the disc diffusion method.

The *Bacillus* strains demonstrated antibacterial activity against all three phytopathogens. The effectiveness varied depending on both the bacterial strain and the specific pathogen tested. The largest inhibition zones were recorded for *B. cereus* var. *fluorescens* CNMN-BB-07 and *B. velezensis* CNMN-BB-31, measuring 18.0–21.3 mm against *E. carotovora* CNMN-BE-01 and 21.7–24.0 mm against *A.*

tumefaciens CNMN-AB-01. In contrast, the *Pseudomonas* strains did not exhibit any antibacterial activity against the tested phytopathogens.

Plant growth-promoting activity was evaluated under laboratory conditions through vegetation experiments with winter wheat and maize. Seed pretreatment with suspensions of *Bacillus* strains resulted in up to a 1.3-fold increase in seedling dry mass, whereas pretreatment with *Pseudomonas* strains was less effective, yielding up to a 1.2-fold increase.

As a result, *Bacillus cereus* var. *fluorescens* CNMN-BB-07 and *B. velezensis* CNMN-BB-31 were identified as the most promising strains due to their dual ability to suppress phytopathogenic activity and promote the growth of winter wheat and maize. Further research is needed to determine the most effective application strategies under field conditions.

Keywords: bacteria, antimicrobial activity, biocontrol, plant growth-promoting microorganisms

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THE ROLE OF BIOFACTORS IN REGULATING THE DENSITY OF SOME PESTS OF VEGETABLE CROPS

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Solutions to the problems caused by pests and pathogens of agricultural crops must be based on the recognition of the idea of coexistence and compromise, once a pest or pathogen has reached acceptable conditions, it cannot be completely eradicated. A clear example is the penetration, many years ago, of pests such as the Colorado potato beetle (*Leptinotarsa decemlineata*), the American whitefly (*Hyphantria cunea*), the bacterial fire blight of perennial seed crops (*Erwinia amylovora*) and others, which populated large areas in a relatively short time. As is known in nature, all species and genera that have secure access to a food substrate, among the associated forms in the same habitat, create a practically stable biological balance.

In vegetable crops, the decisive biofactor in regulating the number of harmful organisms is the fauna of predators and parasites. Predators influence the population regulation from the beginning of the resumption of the vegetative process since there is an almost parallel development between these predator-prey forms. Thus, in our assessments in protected land, the population size of the spider mite (*Tetranychus urticae*) was reduced, practically, to the level of the economic threshold of harmfulness by many species of acariphagous that feed on eggs, larvae and adults. The most important role in this chain was played by *Chrysopa carnea*, *Stethorus punctillium*, *Scimnus frontalis*, *Scolothrips acariphagus*, *Phytoseiulus persimilis*, *Amblyseius cucumeris* and *A. mckenziei*. Aphids were the target, mostly of *Coccinella septempunctata*, *Hippodamia variegata*, *Aphidoletes aphidimyza*, *Syrphus balteatus*, as well as *Chrysopa vulgaris*, *C. carnea*, which at the larval and adult stages can reduce their population density to or below the damage threshold.

Another biofactor, which had a significant involvement in the reduction of the pest population, were parasites. The most common species were *Aphidius matricariae*, *Lysiphlebus fabarum*, *Ephedrus persicae*, which parasitize in the larval and imago stages. Among the parasites of pests from the order Lepidoptera on vegetable crops, *Trichogramma evanescens* was present, in the larval stage the parasites *Apanteles*

glomeratus. The mealbyg species in greenhouses are regulated by the parasite *Aphelinus mali*, and the greenhouse whitefly by *Encarsia formosa*. The plant bug *Macrolophus pygmeus* successfully regulates the tomato mining moth *Tuta absoluta*. And the tomato mining fly *Liriomysia trifolii* is regulated by the parasite *Dyglyphus isae.*

All these biological agents in different situations, provide a different reduction of pest populations by 5-10 to 70-80%. For some of these promising species of biological agents, artificial reproduction methods are required for release and colonization in agrocenoses, ensuring control of the development of populations of certain pest species.

Thus, in the multiplication activity under laboratory conditions, two species of predatory bedbugs, such as *Orius majusculus* and *Amphiareus obscuriceps*, are involved, with the assessment of the optimal food substrate, the specific features of storage and release in agrocenoses, their colonization and survival in adverse environmental conditions.

Keywords: biofactor, predators, parasites, vegetable crops, multiplication

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EFFECT OF NEEM OIL ON THE VIABILITY OF PREIMAGINAL STAGES OF THE WAX MOTH

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Neem compounds, derived from the *Azadirachta indica* plant, especially the fruits and seeds, have a wide range of actions, as they can affect insects, mites, nematodes, fungi and bacteria. Thus, the neem compound, limonoid (azadirachtin) is one, which has been shown to be effective against insects by modifying vital functions in such a way that the insect is unable to feed, mate or undergo metamorphosis. It is also known to inhibit the biosynthesis of the hormone ecdysone that regulates the formation of chitin during moulting in insects. Another extract is neem oil, which has a historical background, is easily accessible and completely safe for fauna and the environment. Neem oil can easily disrupt the life cycle of an insect at any ontogenetic stage egg, larva, adult, without harming beneficial species.

The purpose of our research was to evaluate the action of neem oil on the viability of the ontogenetic stages of the wax moth, as a result of contact with the surface treated with an alcoholic solution of the oil of different concentrations and the possibility of subsequent application of the procedure for sterilization of natural populations of Lepidoptera pests by means of pheromone traps. The biological material served as the wax moth, as a test object, from the laboratory culture of the larval stage, V instar and one-day imago. 2-hole lantern bottles were used for the application of the alcoholic solution of neem oil in the variants of 5; 10; 25 and 50%, as a chemical standard the 10% pyriproxyfen solution and the untreated control. The internal surface of the lantern bottles was processed with the given solutions. Larvae and adults separately were subjected to active contact with the processed surface for 5 min. in three repetitions of 10 individuals each. The expression of the effect of the action of the active substances on spermatogenesis and oogenesis of the individuals subjected to contact was analyzed according to the morphological aspect of the pupae, adults, the shape and numerical content of the eggs, as well as the viability at the embryonic and larval stages, expressing the degree of induced sterility and the decrease in the degree of reproduction.

It is obvious that the impact of the contact of the individuals with the processed substrate on variants with different concentrations manifested an action directly proportional to the maximum concentration - minimum egg, expressed by the obvious decrease in the number of eggs in the egg. Thus, in the variant with the maximum concentration, practically the females develop a minimum egg and with 90-100% sterility of the eggs. The formation of chitin during the molting of V-instar larvae into pupae was manifested by the deformation of the pupae as a result of the incomplete formation of chitinous tissue. This indicates some changes at the cellular-molecular, functional level, which determine the viability and reproductive potential of adults. A deeper disclosure of the mechanism of the decrease in the reproductive potential of adults, as a result of the contact of larvae and adults with surfaces treated with an alcoholic solution of neem oil and pyriproxyfen, could be expressed by the effect at different ontogenetic stages in F1; F2; F5; which would indicate changes manifested at different molecular, cellular or organ levels. Given the fact that in Lepidoptera species the process of oogenesis and spermatogenesis occurs at the prepupa and pupa stages, it would confirm or deny the action at the cellular or molecular level of azadirachtin and pyriproxyfen.

Keywords: *Azadirachta indica*, pyriproxyfen, stages, reproduction

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WILD POPULATIONS AS A BASIC GENE POOL AND A SELECTIVE POPULATION FOR THE BREEDING OF ELDERBERRY (*Sambucus nigra* L.)

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The aim of the study was to evaluate the economic value of selected genotypes from wild populations of black elder (*Sambucus nigra* L.) widespread in various locations in Slovak Rebublic with selected cultivated varieties.

Materials and methods. In the experiment, we used a GPS system to locate 125 genotypes of black elderberry in wild populations at 56 locations at altitudes ranging from 98.15 to 712.32 m above sea level, which we evaluated on site. We evaluated the plant parts of selected genotypes and varieties in field and laboratory conditions for 41 quantitative and 14 qualitative traits on trees, buds, bark, leaves, flowers, fruits, and seeds.

Results. In natural stands, we identified significant differences in crown shape and plant habit among the evaluated genotypes. For most genotypes, we observed a hemispherical or irregular shape of the shrubs. For the tree form, we identified a spherical to ellipsoidal crown shape. The bark of the branches and trunks was characterized by a light grey, brownish grey, pale brown to dark brown colour, smooth on the inner surface and corky on the outside, deeply wrinkled, with distinct papillae of air holes. By evaluating the characteristics of the leaves, we determined the average length of the leaf blade to be in the range of 106.6–303.8 mm, leaf width 71.0–221.6 mm, leaf petiole length 22.6–72.8 mm, and leaf petiole thickness 1.43–5.09 mm. Based on morphometric analysis, we determined the average fresh weight of inflorescences in the collection of evaluated wild-growing genotypes to be in the range of 0.91–34.81 g, the length of inflorescences in fresh condition was 101.0–230.2 mm, the length of inflorescence peduncles was 42.2–116.0 mm, the weight of fruit clusters was 4.51–111.19 g, the diameter of drupes was 4.43–6.39 mm, number of ripe drupes 37.0–928.0, number of berries 543.30–715.40 berries, weight of the cluster 0.63–9.99 g. Technological analysis revealed a juice yield in the range

of 77.60–87.20%. The results of the sensory evaluation of elderberries confirmed the importance and potential of black elderberries for the commercial market, not only because of their taste, texture, and aroma, but especially because of the high colour intensity of elderberry juice. All the experimental data and knowledge about genotypes obtained were used for cataloguing, which also allows the selection of significant genotypes for various uses.

Conclusions. The results and findings obtained from addressing this issue expand the currently known theoretical and practical knowledge about the variability of economically important traits of basic plant parts of genotypes from wild populations in Slovak Rebublic. The results confirmed that genotypes can be detected in wild populations that meet or even exceed the parameters of economically important traits used in black elderberry varieties, which can significantly improve the breeding process. When studying the characteristics of a collection of genotypes from wild populations, we identified many genotypes with atypical characteristics in the number of petals in flowers, the number of stamens, the number of lobes on the stigma, leaf shape, fruit colour, and other traits that can be used as genetic resources for potential practical applications.

Keywords: black elderberry, *Sambucus nigra* L., inflorescence weight, fruit weight, number of ripe drupes, juice yield

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PHYTOSTIMULATION ASSESSMENT OF BACTERIA STRAINS ON THE GERMINATION OF EGGPLANT SEEDS AND SHOOTS GROWTH

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Plant growth-promoting bacteria can naturally enhance growth and increase plant mass by fixing atmospheric nitrogen, synthesizing phytohormones and siderophores, and stimulating the absorption of nutrients by plants. Such bacteria interact directly with plant roots and increase the resistance of the latter to adverse environmental conditions.

The application of microbial exometabolites in pre-sowing practice of seeds, holds significant promise for sustainable agriculture. These compounds, synthesized by beneficial saprophytic microorganisms, can enhance nutrient uptake, promote stress tolerance, and improve plant health, reducing the need for synthetic fertilizers and pesticides.

To ensure food security and healthy nutrition, it is necessary for the population to have access to as many different agricultural crops as possible. One such crop is eggplant. The aim of these studies was to determine the germination of seeds and the development of *Solanum melongena* cultivar Classic F1 shoots. Eggplant seeds were bacterized in various solutions of exometabolites (suspension with cells of strain and supernatant) of the strains *Bacillus velezensis* CNMN-BB-16, *Micrococcus yunnanensis* CNMN-BM-19 and *Actinomadura* sp. 36; for four hours. Incubation of seeds and growth into shoots was carried out using the blotter method (each experiment had 10 seeds), for 14 days at 26.5±0.1°C. The total length of the eggplant shoots was registered and the effect of phytostimulation was noted by the difference of average length of shoots in comparison with control sample. The experiment was repeated twice.

According to the results, there were no ungerminated seeds left in the control and experimental samples. Studying the results of phytostimulating activity of *Bacillus velezensis* CNMN-BB-16 strain, a slight phytostimulating effect was noted.

Thus, the suspension of exometabolites at a concentration of 3 % contributed to an increase in the length of shoots by 3.23 % more in comparison with the control, and very slightly 3 % supernatant – only by 0.4 % more than in the control. In the case of the *Micrococcus yunnanensis* CNMN-BM-19 strain, the results of phytostimulation were more significant. Thus, the supernatant solution at a concentration of 2 % and 3 % stimulated the growth of eggplant shoots by 9.02 % and 12.38 %, respectively.

Exometabolites of the *Actinomadura* sp. 36 strain affected the growth of eggplant shoots differently. Phytostimulation in the case of using a suspension was noted only at a concentration of 2 %, by 6.33 % more. As for the use of the supernatant solution at a concentration of 2 %, phytostimulation was only by 2.29 % higher than in the control. However, a 3 % suspension of the solution showed more significant results – by 11.04 % higher than in the control sample.

Thus, promising bacterial strains were discovered, the exometabolites of which can be used as phytostimulators for the growth and development of eggplant crop.

Keywords: phytostimulation, eggplant, exometabolites, bacteria strains

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HEAVY METAL CONTENT AND SOIL ACIDITY IN THE MOST TRAFFIC-LOADED AREAS OF UZHHOROD, UKRAINE

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Due to its role in filtering pollutants, supporting vegetation, and maintaining microbial communities, urban soil cover serves as an important environmental indicator. Soils are subjected to significant anthropogenic pressure under urbanization, especially from motor vehicles. Heavy metals (HMs), such as lead (Pb), zinc (Zn), copper (Cu), and manganese (Mn), pose the most serious threat. These metals enter the soil through exhaust emissions, tire and brake wear, and stormwater runoff. These elements are hazardous due to their toxicity and ability to accumulate in living organisms.

Soil acidity is a critical factor that influences the bioavailability of metals. As acidity increases (i.e., as pH decreases), the solubility of heavy metals (HMs) rises, facilitating their entry into trophic chains. Therefore, a comprehensive assessment of urban soil environmental conditions must include analysis of pH levels and toxic element content.

This study aimed to determine the pH levels and heavy metal concentrations in the soil along Uzhhorod's most congested streets and compare them with those in a relatively clean control area: the Botanical Garden of Uzhhorod National University. Soil samples were collected from seven locations, including Mytna Street, Sobranetska Street, Svobody Avenue, Mynaiska Street, and Zankovetska Street, as well as from control points within the Botanical Garden, at a depth of 0–20 cm. pH was measured using the potentiometric method, while heavy metals were determined via atomic

absorption spectrophotometry. A statistical analysis was conducted using a Student's t-test at a significance level of $P < 0.05$.

The results showed that the soils under study exhibited slightly acidic reactions (pH 5.91–6.36). The control sample had the lowest acidity. Concentrations of heavy metals in samples from traffic zones exceeded those in the control area by 1.5 to 3.5 times. The highest lead levels (over 9 mg/kg) were found on Mytna Street and Svobody Avenue. The highest zinc concentration (24.7 mg/kg) was also recorded on Mytna Street. The least contamination was observed at the control site in the Botanical Garden (Shakhta sector).

The most polluted sites were those with heavy traffic and intersections. The data indicate the formation of local contamination hotspots that require the attention of environmental authorities. Regular monitoring of urban soils is essential for maintaining ecological balance and protecting public health.

Keywords: heavy metals, soil acidity, soil pollution, motor vehicles, urban soils

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ASSESSMENT OF THE DISTRIBUTION AREA AND POPULATION DENSITY OF THE WESTERN CORN ROOTWORM

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Corn cultivation in the Republic of Moldova occupies a predominant position (up to 50%) in the structure of cereal and fodder crops, having major economic importance. However, it faces significant challenges, especially due to climate change and pest invasions. The lack of crop rotation and the cultivation of corn as a monoculture have led to significant problems with pests that previously had no significant biological impact on this crop. This is also the case with the western corn rootworm *Diabrotica virgifera virgifera* Le Conte (DVV). Adults feed on the silk threads of the cobs, which affects pollination. The larvae feed on the roots of the plants, affecting their stability and ability to absorb water and nutrients. Larvae also are carriers of fungal, bacterial and viral diseases, which can lead to wilting and drying of plants, causing high production losses (up to 90%).

In order to optimize the methods of combating the western corn rootworm, a series of objectives were established: monitoring the population activity and determining the distribution area of this invasive pest, in the conditions of the Republic of Moldova. Evaluation of the effectiveness of nature-identical substances in monitoring pest populations and evaluation of the phytosanitary status of plants in different areas affected by the quarantine insect pest DVV, is needed.

Pheromone traps equipped with sticky inserts and variants of capsules impregnated with synthetic sex pheromone and capsules impregnated with a combination of synthetic sex pheromone and a plant extract-based attractant, as well as the standard commercial sex pheromone trap, were used as materials. Scientific research was carried out on the territory of the Republic of Moldova, in the open corn fields of Dubăsarii Vechi village, Criuleni district and Zaim village, Causeni district, in the period between 25.06.2024 -06.09.2024. The pest was observed visually and using pheromone signaling traps, once a week. Sticky inserts were changed once they were filled up with captured males. In addition to monitoring the pest, visual inspections were also carried out to analyze the percentage of affected plants.

Research showed that pheromone traps containing capsules with added plant extract captured a total of 1,100 males, with 27.3% more than the traps containing capsules containing only the sex pheromone and traps with the standard variant, which captured 900 and 864 males, respectively. Throughout the monitoring period, the variant with the addition of plant extract demonstrated superior efficiency in capturing males of *Diabrotica virgifera virgifera*. The average density of 4.4 individuals per plant did not exceed the economic damage threshold. However, it is essential to continue monitoring research on this pest to assess the population expansion throughout the RM and the degree of infestation of affected corn fields.

Keywords: *Diabrotica virgifera virgifera,* western corn rootworm, monitoring, synthetic sexual pheromone, plant extract

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INFLUENCE OF THE MEDIUM COMPOSITION ON BIOSYNTHETIC PROPERTIES OF *Lactococcus lactis*

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Lactic acid bacteria (LAB) are one of the most important groups of bacteria in the food industry, contribute to typical flavor and texture of dairy food. Also, they produce various secondary metabolites that contribute to antimicrobial activities, making them promising agents against large number of pathogenic, non-pathogenic or food spoilage microorganisms and expanding the directions of their implementation.

Maintaining the viability of deposited strains and their technological properties is an important task for every microbial collection. Efficient maintenance of strains viability and biological activity by periodic subculturing depends on cultivation medium used. Composition of culture medium has an important role for bacteria and can affect the growth of microorganism, their productivity and technological properties.

The aim of the research was to study changes in the antibacterial properties of *Lactococcus lactis* strains after cultivation on different culture media based on hydrolyzed milk and yeast extract. The antibacterial activities were tested on *Bacillus* spp. such as *Bacillus subtilis, Bacillus subtilis* var. *mesentericus, Bacillus cereus var. fluorescens, Pseudomonas fluorescens*, *Micrococcus yunnanensis, Rhodotorula mucilaginosa*. To assess the inhibitory activity agar well diffusion method was followed.

Determination of the antibacterial activity of LAB strains showed different sensitivity.

Mostly strains showed moderate inhibitory effects. *B.subtilis* CNMN-BB-06, *B. subtilis* CNMN-BB-09, *P. fluorescens* CNMN-PsB-02, *P. fluorescens* CNMN-PsB-11, *P. fluorescens* CNMN-PsB-12 were the most sensitive to the action of produced exometabolites, inhibition zones varying between 16 – 26 mm, depending on the strain.

B. subtilis CNMN-BB-10 was sensitive only to exometabolites synthesized by *L. lactis* bv. *diacetylactis* CNMN-LB-14 with inhibition zones 12.7±0.7 mm.

L. lactis bv. *diacetylactis* CNMN-LB-14 showed the ability to inhibit growth of majority test bacteria. It was also noticed that LAB studied strains have the capacity to prevent the growth of *M. yunnanensis*, but did not affect on the *R. mucilaginosa.*

It was found that several LAB strains after cultivation in the growth medium supplemented with yeast extract and sucrose, showed the higher sensitivity against tested *Bacillus* and *Pseudomonas* compared to the initial one. The highest antagonistic activity was demonstrated by *L. lactis* CNMN-LB-09 strain increased by 49% against *P. fluorescens* CNMN-PsB-02 and *L. lactis* bv. *diacetylactis* CNMN-LB-14 by 44% against *B. subtilis* CNMN-BB-09. Cultivation of some strains in nutrient medium based on yeast extract showed stimulation effect increasing antibacterial activity of LAB strains against *B. cereus* var. *fluorescens* CNMN-BB-07.

Keywords: *Lactococcus lactis*, nutrient medium, inhibition zone

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CLIMATE PARAMETER MONITORING A DECISIVE FACTOR FOR PRECISION AGRICULTURE

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Against the background of progress in improving productivity and plant resistance to biotic and abiotic factors, the implementation of new varieties, and advanced agricultural techniques, the level of harvests remains comparatively low, with large fluctuations both at the producer (farmer) level and at the branch level. This phenomenon has become particularly pronounced in the last two decades, which indicates the presence of climate change and the significant importance of climate factors in the formation of harvests. In order to carry out a more in-depth analysis of the impact of climate change on the productivity of agricultural crops, within the project (C2014) 9130,,Equipment for investigating the functional state, adaptive capacity and resistance of plants to drought, salinization, and nutritional imbalance", financially supported by the Horizon 2020 program, the Institute of Genetics, Physiology and Plant Protection was equipped with high-performance equipment, a meteorological station that automatically monitors the climate and agrophysical parameters of the soil throughout the year on land without plants, and in field conditions only during the vegetation period of agricultural crops.

Meteorological data are recorded and maintained in the database where they can be accessed at any time, up to a minimum interval of 15 minutes. Thus, databases of climatic parameters are created (max, min and averages of: temperature °C, relative air humidity %, wind direction gr, speed wind speed m/sec and km/h, solar and active radiation W/m2 and Mj/m2, atmospheric deposition mm), soil moisture on soil profiles, 10-100 cm, temperature and electrolyte concentration in the soil surface layers (0-30cm). Soil moisture monitoring is carried out by means of probes with access tubes and equipment with PR2 sensors, at different depths on the soil profile: 0-10; 20; 30; 40; 60; 100 cm.

The humidity measuring equipment consists of a polycarbonate rod with electronic sensors (in pairs of stainless steel rings) arranged at fixed intervals along the length of the sensor set. (SDI-12 Profile Probes). The SM150T sensor is equipped with with resistant constructions and can be buried in the soil for a long time. Being

connected to the CP2 logger it records the soil moisture in dynamics with an accuracy of ± 3%, and the temperature sensor embedded in the soil with an accuracy of ± 0.5°C. The WET-2 Delta-T sensor connected to the CP2 logger has the ability to calculate the pore water conductivity (ECp) and the water conductivity (EC) available to the plant roots. The equipment is convenient and efficient for expressly checking the soil salinity, providing important information to take appropriate remedial measures. Data readings of maximum, minimum and average climate values (temperature °C, relative air humidity %, wind direction degrees, wind speed m/sec and km/h, solar and active radiation W/m2 and Mj/m2 , atmospheric deposition mm) under stationary conditions are carried out in an automated mode by the CP–1 type logger, and the agrophysical parameters of the soil (humidity at the surface and on the soil profiles up to a depth of 100 cm, temperature at two depths, soil solution conductivity) by the CP–2 type logger, according to the programmed time intervals (sales@delta-t.co.uk). Monitoring of agrometeorological and agrophysical parameters of the soil under field conditions can be carried out systematically, during the entire vegetation period at highlighted time intervals, according to the same measurement method with the HH2 data reading and storage device (www.deltalink-cloud.com). Subsequently, the initially displayed and analyzed readings are stored in memory and then downloaded to the computer. The information obtained and stored in databases can be transmitted to the Excel operational system or other calculation packages that perform a directed analysis with graphical representation of the results.

Keywords: climate, parameter, monitoring, agriculture

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DROUGHT - LIMITING FACTOR IN SUSTAINABLE DEVELOPMENT OF AGRICULTURE

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Currently, there is increasing discussion about the phenomenon of global warming, greenhouse gas emissions, drought, as well as the catastrophic consequences of these disturbances on the environment and agriculture. The predominance of the agricultural sector conditions the dependence of the national economy on climatic conditions. According to the international classification of arid territories, the Republic of Moldova is characterized as a subhumid - dry geographical area, with a hydrothermal coefficient of 0.50 - 0.65. The last two decades are characterized by a more severe recrudescence of drought conditions.

The insufficiency or lack of long-term precipitation against the background of high temperatures leads to the intensification of the drought phenomenon, with frequent manifestations in the central and southern areas. The consequences of droughts have an unfavorable socioeconomic character and, on the environment, causing soil degradation, decreased productivity of agricultural crops, reduction of aquatic resources, etc. The insufficiency of soil water in dry years reaches levels at which annual crops are completely compromised.

The abolition of the previous crop and the cultivation of the soil according to old practices in conditions of atmospheric and pedological drought often result in additional moisture losses, thus contributing to the drying of the soil and the worsening of the conditions for plant growth and development. The argument is that in the conditions of the years (2020-2025), with extreme temperatures, no successful cases of reseeding of recultivated areas have been highlighted. In the absence of recommendations appropriate to the situation, the efforts and good intentions of farmers have led to additional expenses, thus turning the agricultural sector into an area of increased risk for business. Limited water resources and the high cost of irrigation are obvious reasons that emphasize the need to develop recommendations to minimize water consumption for irrigation, increasing its efficiency in the formation of an agricultural production unit. At the present stage, the improvement of irrigation technologies for various crops, are of undeniable importance and opportunity. The decline in the level of crops, including as a result of incorrect watering on irrigated

lands, the frequency and intensity of droughts in recent years have a negative effect on food security and the national economy. In the context of the above, irrigation in accordance with the requirements of plants is one of the most effective ways to optimize soil moisture and the formation of crops in conditions of underwater security. Along with the positive effects expressed by crop growth, in the process of long-term exploitation, chernozems under irrigated conditions are subject to a number of negative consequences, such as: solonetization (accumulation of sodium); salinization (accumulation of salts); destructuring and secondary compaction; increase in the level of the underground layer (triage); intensification of dehumidification processes (loss of humus), etc. These negative processes were detected in the 1970s-1990s. Irrigation of ordinary chernozems with mineralized water from the Ialpug, Taraclia water basin led to moderate and sometimes strong soil salinization. The affected area was about 3000 ha. As a result, the productive capacity of the soil decreased by 30-50%. Currently, the area of irrigated soils has decreased from 310 thousand ha. to 25-30 thousand ha, or 10 times, and the productivity of irrigated crops is quite modest. Carrying out scientific investigations in the direction of improving irrigation technologies, their action on soil fertility, plant productivity and economic efficiency would boost the development of irrigation and obtaining guaranteed harvests.

Keywords: agriculture, factor, recommendations, climatic conditions

Funding. The research was carried out within the framework of Subprogram 011102 „Expansion and conservation of genetic diversity, improvement of agricultural crop gene pools in the context of climate change", funded by the Ministry of Education and Research of the Republic of Moldova.

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PRODUCTIVITY OF THE PLUM PLANTATION DURING THE FRUITING PERIOD ACCORDING TO THE CULTIVATED ASSORTMENT

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The plum is considered a fruit species with long traditions of cultivation in the Republic of Moldova, having a particularly important role in the life of the local population, as its fruits have constantly been a financial source. In this study, the development and productivity of plum trees in an intensive cropping system during the fruiting period were characterized. The research was carried out during 2024 in the enterprise SRL „Agrofields", plantation founded in the spring of 2018, with 6 plum varieties: Piteșteanca (control), Cacanska Najbolia, Empresso, Stanley, Blue Free and President. The trees were grafted on the Myrobalan seedling rootstock, tree spacing 5.0x3.0 m, with improved pyramid-shaped crown.

During the research, trunk diameter and growth, average fruit weight, productivity of a tree, plantation, and yield per unit area of trunk cross-section were studied. To achieve the research objectives, biological, stationary field and laboratory methods commonly used in plum crop studies were applied.

At the end of the growing season of 2024, the trunk diameter of the trees of the varieties under study increased, registering values between 87.8 mm and 113.4 mm, which corresponds to an increase of 8.3 - 9.9 mm, largely influenced by the plum production accumulated in the crown of the trees, as well as the biological characteristics of the varieties.

The study carried out on the ripening period shows that this phenophase started at 103 days after flowering for the earliest variety (Piteștean) and ended at 152 days for the President variety. Fruits of the Empresso variety are characterized by a flowering-ripening period of 126 days, Cacanska Najbolia and Stanley varieties of 127 days, and for the Blue Free variety this period was 137 days.

In the spring of 2024, the varieties included in the study set different quantities of fruit, from 370 to 773 pcs/pom. The lowest value was registered in trees of the Piteștean variety - 370 fruits and the highest in Cacanska Najbolia - 751 fruits and Stanley - 773 fruits. The President, Blue Free and Empresso varieties registered 397, 442 and, respectively, 447 fruits, in the crown.

The lowest average fruit weight was registered for Stanley (38.0) and the highest for President (54.7 g). The varieties Piteștean, Blue Free, Cacanska Najbolia and Empresso had average values of 47.3 g, 49.7 g, 50.6 g and, respectively, 51.9 g.

The lowest yield was registered by the variety Piteștean - 17.5 kg/pom, equivalent to 11.7 t/ha. The President, Blue Free and Empresso varieties had average yields: 21.7 kg/pom (14.5 t/ha), 22.0 kg/pom (14.7 t/ha) and 23.2 kg/pom (15.5 t/ha). Stanley yielded 30.0 kg/pom (20.0 t/ha) and Cacanska Najbolia produced 35.0 kg/pom (25.4 t/ha).

The lowest value of tree productivity per unit area of trunk cross-section area was recorded for Blue Free - 0.26 kg/cm², while higher indices were obtained for Cacanska Najbolia - 0.38 kg/cm² and Stanley - 0.40 kg/cm². The varieties Piteștean, President and Empresso were in the average group with 0.29 kg/cm², 0.30 kg/cm² and, respectively, 0.32 kg/cm².

For a more balanced distribution of production over the harvest period, it is recommended to supplement the assortment with 1-2 early varieties, end of July - beginning of August.

Keywords: plum; varieties; diameter increment; crop yield

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BIOCHEMICAL AND RHIZOSPHERIC FEATURES OF AESCULUS HIPPOCASTANUM IN URBAN SITES

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In recent decades, changes in environmental conditions in urban agglomerations and the intensive spread of the invasive pest *Cameraria ohridella* have led to a significant weakening of the condition of *Aesculus hippocastanum* L. (horse chestnut), affecting their health and viability (Thomas, Peter A., et al., 2019). Important factors in adaptation to biotic and abiotic stresses are the seasonal dynamics of secondary metabolites and the supply of mineral elements to trees. Changes in the chemical composition of *A. hippocastanum* leaves can also affect the rhizosphere environment, in particular through the release of allelopathically active substances and the transformation of the soil microbiota structure. The study of these relationships is important for understanding the ecological role of the species and developing approaches to preserving its phytocenotic stability under conditions of increasing anthropogenic pressure.

The aim of the study was to determine the characteristics of the biochemical adaptation of *A. hippocastanum* L. to urban conditions by analysing the mineral composition, rhizosphere microbiota activity and allelopathic potential.

The objects of the study were the leaves and rhizosphere soil of *A. hippocastanum* from the exhibition site of the M. M. Hryshko National Botanical Garden of the National Academy of Sciences of Ukraine. Samples were collected during three vegetation phases (June, July, September 2023–2024). The agrochemical properties of the soil, the content of macro- and microelements (ICAP 6300 DUO), laccase activity, the content of secondary metabolites in leaves and soil (phenols, flavonoids, tannins, saponins, triterpenoids), biotests were carried out with watercress and radish, and the number of functional groups of microorganisms in the soil was assessed. Statistical analysis was performed using methods of variance analysis (ANOVA, Tukey test, $P < 0.05$).

During the growing season, seasonal variability in the content of macro- and microelements in leaves and soil was recorded. In particular, the highest levels of titanium, barium and zinc were found in the soil under the plants, while the maximum concentration of silicon was recorded in the leaves. It was found that chestnut demonstrates effective regulation of mineral nutrition, which is reflected

in the growth of concentrations of Ca, Si, Zn, Fe, S and other elements in the leaves against the background of their decrease in the soil. The seasonal decrease in the level of brassinosteroids indicates a weakening of hormonal protection against the *C. ohridella* pest. A deterioration in the biochemical state of the soil has been shown: a decrease in humus levels, laccase activity, as well as changes in the structure of the microbiocenosis with the dominance of fungi in autumn and a decrease in the number of ammonifiers and nitrogen-consuming bacteria. At the same time, an increase in the number of actinomycetes and nitrogen-fixing microorganisms was noted, which play a compensatory role in maintaining nitrogen nutrition. The high level of soil phytotoxicity and the content of secondary metabolites (especially tannins and flavonoids) in the leaves indicate the active participation of allelopathic mechanisms in the formation of resistance.

Thus, *A. hippocastanum* shows signs of biochemical resistance to urban conditions, as evidenced by enzyme activity, high metabolite content, and the ability to alter the composition of the microbiota. The results obtained can be used to assess the ecological status of urbanised areas and to develop approaches to greening.

Keywords: *Aesculus hippocastanum*, mineral nutrition, secondary metabolites, microbial community, *Cameraria ohridella*

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DESIGN OF BIOENGINEERING COMPLEXES FOR BIOLOGICAL PROTECTION OF PLANTS

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The work is devoted to the design of bioengineering complexes for biological plant protection, which is currently one of the components of the greening of agriculture. The purpose of the work was to develop a project structure for specialized agricultural bioengineering complexes for the biologization of agricultural production. The object of research is bioengineering complexes in the production of biological plant protection products. The subject of the research is the synergy of knowledge regarding the design of specialized agricultural bioengineering complexes. Research methods are systemic and synergistic approaches.

The work is based on the scientific foundations of the design of bioengineering complexes depending on their purpose, the agroecological foundations of the functioning of bioengineering complexes depending on the conditions of a specific agricultural enterprise and agricultural landscape and the information and technical support of the production of entomophages.

Known scientific works on the chosen research direction are devoted to determining the basic principles of designing bioengineering complexes, developing technological complexes production of entomophages, fermentation complexes production of biological preparations, using innovative approaches for managing the production of entomophages, application of ontological engineering to the design of bioengineering complexes in the production of entomophages; introduction of intelligent information processing algorithms based on fuzzy logic, neural networks and cognitive analysis into the processes of managing the production of entomophages; adaptation of bioengineering complexes to the conditions of a specific agricultural enterprise.

A project structure for specialized agricultural bioengineering complexes has been developed, which includes: intelligent systems for managing the production of entomophages, intelligent systems for managing biological plant protection, cyber-physical systems for managing the production and use of biological plant protection products and decision support systems based on ontologys. Intelligent systems allow for the formalization of loosely structured dependencies, make decisions under

uncertainty; cyber-physical systems – to carry out information communications using the Internet; ontologys – to systematize knowledge using modern software tools. The main directions of designing support systems for decision-making based on ontologys are quality control and consumption norm of biological plant protection products. The results of the work represent a comprehensive approach to the process of designing specialized agricultural bioengineering complexes using modern data processing tools and the experience of interdisciplinary specialists (agronomists, engineers, biotechnologists). The proposed approach contributes to increasing the efficiency of plant biological protection management processes by implementing knowledge digitization and automated information processing based on computer-integrated information technologies.

Keywords: Biological plant protection, design, specialized agricultural bioengineering complexes

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DIGITAL TECHNOLOGY FOR COMPARATIVE ANALYSIS OF PROTEIN ELECTROPHORETIC SPECTRA IN MAIZE BREEDING AND GENETIC RESEARCH

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Successful interpretation of research results in biology depends largely on the design of the experimental scheme. A fundamental guiding principle in this context is the widely accepted "principle of the single difference." Accordingly, testing of a working hypothesis is conducted by comparing the experimental variant with a control. In genetic and breeding studies, this experimental approach - regardless of the experimentation level - is considered standard. This is clearly illustrated by the long-term analysis of data from studies on plant protein polymorphism (specifically, for the endosperm storage protein zein in maize). According to literary data, in the methodology of interpreting electrophoretic (EP) spectra of zein from various maize genotypes, the primary tool for express assessment of the presence or absence of zein molecular forms (ZMFs) in the studied samples is their visual comparison, along with quantitative calculation of EP zone components and their relative electrophoretic mobility (rf).

In recent years, new methodological developments have emerged that expand the possibilities for interpreting zein polymorphism data. The use of an updated version of the "FOREZ-2" software has enabled the development of a digital technology for comparative analysis of protein EP spectra from contrasting maize genotypes.

The main idea of this technical approach is the automatic reciprocal synthesis of two EP spectra from the parental lines, followed by detection of the corresponding protein markers in the digital spectrum of the hybrid combination. The following procedure was tested to implement this concept:

1) inclusion in the FOREZ-2 database of the calculated formulas for the EP spectra of the two compared genotypes: the control line and the test line;

2) automatic synthesis of two versions of EP spectra for hybrid combinations of these genotypes - according to the principle of direct (D) and reverse (R) modeling;

3) as a result of the automatic reciprocal synthesis of the two parental line formulas, two hybrid EP matrices are displayed:

- the direct matrix (D), where markers indicating the elimination of ZMFs from the control line in the test line's EP spectrum are automatically highlighted, and

- the reverse matrix (R), where markers indicating enrichment of the zein protein profile in the test line are automatically displayed, i.e., the appearance of new ZMFs for the control line, reflecting the genetic differences of the test line from the control line.

The effectiveness of this digital EP spectrum processing technique was successfully demonstrated between 2020 and 2024 for *Zea mays L.* in studies involving gene and genome mutations, somaclonal lines, and self-pollinated lines from several heterotic groups of maize.

The range of obtained results allows for the recommendation of this digital technology as an optimal tool for interpreting zein EP spectra in maize breeding and genetic research.

Keywords: maize, polymorphism, zein, electrophoresis, reciprocal synthesis

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GREEN BIOTECHNOLOGY FOR THE VALORIZATION OF SUNFLOWER RAY FLORETS AS SOURCE OF PHENOLIC COMPOUNDS WITH ANTIOXIDANT PROPERTIES

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In recent years, management of waste from sunflower (*Helianthus annuus* L.) plant processing (ray and disk florets, pollen, stem, leaves) is important for the environment protection. The valorization of agricultural waste and isolation of the bioactive compounds using ultrasound- and/or microwave-assisted extraction techniques present great interest, being green biotechnologies with several advantages for solving the environmental issues, over the traditional used methods.

The aim of the present study was to optimize a lab biotechnology for a high extraction yield of phenolic compounds with antioxidant activity from sunflower ray florets, in view of their valorization as nutraceutical ingredients.

The biological material was represented by sunflower ray florets harvested from Bacioi fields, Republic of Moldova, dried and ground to a powder. The powder was subjected to ultrasound-assisted extraction in ethanol, in a sonication bath at low frequency and high intensity, to enhance disruption of cellulosic walls and cell membranes in a short time, with low energy consumption. After filtration, the extracts were analyzed for total phenolic content by Folin-Ciocalteu method, to calculate the extraction yield, and their antioxidant activity by TEAC assay. The experimental design based on Design Expert software and response surface methodology was carried out on 20 extract variants obtained by varying the extraction parameters (independent variables): time, temperature, extraction ratio and ethanol concentration. The statistical analysis was conducted on the response variables: extraction yield and antioxidant activity.

Based on the experimental data, the results' representation as box plots, contour plots and 3D graphs for the variable parameters and their interactions led to the following observations: (i) the extraction yield significantly increased at higher ethanol concentrations and temperature; (ii) a high antioxidant activity was favored by lower extraction ratio and temperature, and their cumulative effect. Then, the parameters of ultrasound-assisted extraction were optimized to obtain cumulated high yield of phenolic compounds and strong antioxidant activity. The solution indicated the use of minimum temperature, in concentrated solutions and an average solvent concentration. HPLC analysis of the optimized sunflower extract showed high quantities of caffeic acid and quercetin, known as good antioxidant agents.

In conclusion, the optimized green biotechnology applied to sunflower ray florets presented a high potential to be transferred to the economy. The obtained phenolics could be further used as valuable ingredients for the formulation of novel nutraceuticals.

Keywords: sunflower, ray florets, phenolics, antioxidant activity, nutraceuticals

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RIZOPLAN AND TRICHODERMIN SC FOR THE CONTROL OF *Venturia inaequalis* Wint.

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Apple variety Reinette Simirenko is one of the most widely cultivated apples in the Republic of Moldova. There are 45,000 tons of Reinette Simirenko apples produced in the country each year. Fungal diseases are the reason of the essential losses of the apple fruits. Preparations on the basis of the natural enemies of the pathogens can be used as the alternative to the chemical pesticides.

Purpose of the research was to determine the biological efficacy of the microbiological preparations Rizoplan and Trichodermin, SC, elaborated on the basis of the antagonistic bacteria and fungi, respectively, in the control of the pathogen *Venturia inaequalis* Wint in the apple crop.

Materials and methods: Biological preparations Rizoplan and Trichodermin, SC, in the consumption rates of 7 l/ha and 10 l/ha were used for the apple trees treatment against *Venturia inaequalis* Wint. Preparation Luna Sensation SC 500 with the consumption rate 0.35 l/ha was used as the chemical control. Studies were conducted in 2024 at the experimental orchard of the Institute of Genetics, Physiology and Plant Protection of the MSU, on the apple variety" Reinette Simirenko".

Results: The first evidence of the untreated apple trees revealed that the frequency of leaf attack with *Venturia inaequalis* Wint was 18.3 % at 6.3 % disease development intensity. In the variant where the biological fungicide Trichodermin SC was used at the consumption rate of 7 l/ha, the frequency of attack was 7.3 % and the disease development intensity was 1.3%. With increasing the consumption rate up to 10 l/ha the attack frequency and disease development intensity decreased and became 5.6 % and 0.9 %, respectively. Treatment with Rizoplan at consumption rate 7 l/ha leaded to the attack frequency 8.0 % and 1.1 % disease development intensity. With increasing the consumption rate up to 10 l/ha the attack frequency and disease development intensity decreased and amounted 6.3 % and 1 %, respectively. In the variants with treatment with Rizoplan and Trichodermin SC mixture in the consumption rate 7.0 l/ha the frequency of attack and intensity of disease development intensity were at 7% and 1.2 % respectively. With increasing the consumption rate of the preparation

mixture up to 10 l/ha the frequency of attack and intensity of disease development were 5.3 % and 0.7 % respectively. The standard Luna Sensation SC 500 with the consumption rate 0.35 l/ha leaded to the 7.6 % frequency of attack and 0.8 % intensity of disease development. Biological efficacy of Rizoplan was 82.5 % and 84.1 % at the 7 l/ha and the 10 l/ha consumption rates, respectively. Biological efficacy of Trichodermin SC was 79.3 % and 85.7 % at the 7 l/ha and 10 l/ha consumption rates, respectively. Biological efficacy of the Rizoplan and Trichodermin SC mixture at the consumption rate 7.0 l/ha and 10 l/ha was 81.5 % and 88.8 %, respectively. Efficacy of the Luna Sensation SC 500 0.35 l/ha consumption rate was 87.3 %.

Conclusions: The mixture of Rizoplan and Trichodermin SC at the consumption rate 10 l/ha with biological efficacy 88.8% was the most effective in *Venturia inaequalis* Wint control on the apple variety Reinette Simirenko and could be recommended for protection against the pathogen.

Keywords: biological efficacy, Rizoplan, Reinette Simirenko, Trichodermin SC, *Venturia inaequalis* Wint.

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RESISTANCE AGAINST WEAT STREAK MOSAIC VIRUS: INVESTIGATION OF THE *Wsm2* GENE PRESENCE IN WHEAT IN UKRAINE

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Wheat streak mosaic virus (WSMV) is the species type of the genus *Tritimovirus* within the family *Potyviridae* and recognized as an economically important viral pathogen that threatens wheat production around the globe. Marker-assisted selection (MAS) is a valuable tool in European wheat breeding programs aimed at developing resistance to various viruses. MAS leverages molecular markers linked to specific genes that confer disease resistance, allowing breeders to select for these traits more efficiently than traditional methods. *Wsm2* gene known has provided strong resistance to WSMV (Seifers et al., 2006; Lu et al., 2012); leading to low WSMV incidence in field conditions (McKelvy et al., 2021). WSMV resistance conferred by *Wsm2* is controlled by a single dominant allele located on chromosome arm 3BS (Lu et al., 2011).

MAS can be effectively used in wheat breeding programs to incorporate the *Wsm2* gene into new wheat varieties. This approach accelerates the breeding process by allowing breeders to select for the *Wsm2* gene using molecular markers rather than relying solely on time-consuming and labor-intensive phenotypic evaluations in the field. Using these molecular markers, breeders can screen large populations of wheat plants and select those carrying the desired resistance genes, even at the seedling stage, before the development of visible disease symptoms.

The goal of this study was to screening of wheat varieties on the presence of WSMV resistance gene *Wsm2*. For this study, 45 wheat Ukrainian and foreign varieties were selected in different regions of Ukraine. Genomic DNA was extracted

from wheat leaves using GeneJet Plant Genomic DNA Purification Mini Kit K0791 (Thermo Fisher Scientific, USA). Specific primer pair barc102 (Lu et al., 2012) for detection of *Wsm2* gene for WSMV resistance was used in PCR. Amplification was performed with touchdown program using DreamTaq™ Green PCR Master Mix (Thermo Fisher Scientific, USA).

PCR results shown presence of a 219 bp DNA-fragment of the *Wsm2* gene in one Ukrainian wheat variety MIP Vyshyvanka. These results will be useful will help wheat breeders to accelerate the breeding process of transferring *Wsm2* to adapted cultivars and in wheat breeding programs in Ukraine.

Keywords: wheat resistance, *wsm2* gene, wheat streak mosaic virus, wheat

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SOME FEATURES OF PHENOLOGY OF THE OAK LACE BUG *Corythucha arcuata* (HEMIPTERA: TINGIDAE)

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The oak lace bug *Corythucha arcuata* (Say, 1832) (Hemiptera: Tingidae) is a dangerous invasive species of the true bug originating from North America and thought to have been introduced to Europe through Italy in 2000. It sucks the sap of oak leaves, strongly affecting chlorophyll activity. Due to this nutrition, in the second half of the vegetation season, the colour of the oak leaves' turns from green to reddish. It was first recorded in the Republic of Moldova by Derjanschi V., Mocreac (Stahi) N. and Iordosopol E.in 2018. The aim of this work is to clarify some aspects of the phenology of *C. arcuata* in the central part of the Republic of Moldova.

The material for the study was a sample of 25 oak (*Quercus robur* L.) leaves in each station containing *C. arcuata*, collected weekly, from the third decade of May to the second decade of September, in four locations in and around Chisinau: "Dendrariu"park (47.02943, 28.81203), petrol station next to Dacia Blvd. (46.971934, 28.878504), Valea Crucii STA (46.97468, 28.86331), Botanical Garden (Institute) "Alexandru Ciubotaru" (46.97640, 28.87797). Leaves were collected at eye level, then brought to the laboratory and examined according to five criteria: average number of eggs per leaf, average number of eggs per clutch, average number of clutches per leaf, average number of nymphs per leaf and average number of adults per leaf.

In "Dendrariu" park, the average number of eggs per leaf peaked in the second decade of June at 193.7 eggs/leaf. The average number of nymphs per leaf had two peaks, the first in the second decade of June with 209 nymphs/leaf and the second - in the third decade of August with 678 nymphs/leaf. At the petrol station average number of nymphs per leaf had three peaks: the second decade of June with 318 nymphs/leaf, the third decade of July with 445 nymphs/leaf and the first decade of September with 358 nymphs/leaf. In the Botanical Garden, one peak of average number of nymphs per leaf was observed in the third decade of August - 864 nymphs/leaf. When data from all of the locations were combined, the following results were obtained: the average number of nymphs per leaf had three peaks – in the second decade of June

with 263.5 nymphs/leaf, in the third decade of July with 295.5 nymphs/leaf and in the third decade of August with 473.3 nymphs/leaf. Based on three sharp peaks in the average number of eggs per leaf in the second decade of June, second decade of July and second decade of September, three generations of *C. arcuata* can be clearly distinguished. This fact is consistent with Romanian and Ukrainian data, where *C. arcuata* is also presented in three generations.

In the changing climatic conditions of the Republic of Moldova, this pest is multiplying in huge numbers and will pose a serious threat to oak trees in the years to come. It can present a hazard to fruit trees as well. It develops in three generations, as in Romania and Ukraine. Further research on *C. arcuata* are vitally needed.

Keywords: oak lace bug, *C. arcuata*, oaks, invasive, leaves

Funding. 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 of the Republic of Moldova.

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DOSE-DEPENDENT GERMINATION RESPONSE IN HIGH-VIABILITY BEECH SEEDS EXPOSED TO X-RAYS

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The objective of the research was to evaluate the germination of highly viable *Fagus sylvatica* L. seeds to different doses of X-ray irradiation.

The experiment was conducted during 2024-2025 at the Institute of Genetics, Physiology and Plant Protection, Moldova State University, using *F. sylvatica* seeds (population PF-23) with high viability (97 %) collected in autumn 2023. To assess the seeds' potential to germinate, the 2,3,5-triphenyltetrazolium chloride (TTC) test, which indicates seed viability, was used. Seeds were irradiated with X-rays at doses of 25-300 Gy using the RS-2400 device, and then stratified at +4 ± 1 °C for 150 days. Germination traits (overall germination, mean daily germination – MDG, mean germination time – MGT and germination rate index – GRI) were recorded weekly, and analysed by one-way ANOVA and Multiple Range Tests (Tukey HSD, LSD) using Statgraphics Plus 5.0.

As a result of the experiment, it was established that X-ray irradiation at a dose of 25 Gy promoted earlier germination of *F. sylvatica* seeds from the high-viability PF-23 population compared to the control. The peak of germination was advanced by 21 days, and the overall germination increased by 6.67 % (reaching 74.00 %). MDG values at this dose reached 1.48 compared to 1.35 in the control, and GRI was 1.99 (control – 1.80), indicating high activity and uniformity of the process. Doses of 50-100 Gy had a moderate stimulating effect (overall germination was 71.67-72.67 %) without statistically significant differences from the control. MDG values for these doses reached 1.43-1.45, and GRI ranged between 1.86 and 1.89. The 125 Gy dose resulted in the highest germination – 77.33 % (+10.00 % compared to control), as well as the highest MDG (1.55) and GRI (2.00). However, a 7-day delay in the peak germination activity compared to control and high variability between replicates indicate an unstable response at this dose.

An inhibitory effect was observed at 200 and 300 Gy, where germination dropped to 59.00% and 58.67%, respectively. A significant delay in the onset of germination was recorded, with the mean germination time (MGT) increasing to 121.98-123.19 days and the germination rate (MDG ≤ 1.17, GRI ≤ 1.46) decreasing.

The germination response to X-ray exposure followed a hormetic pattern typically observed in high-viability seeds, characterized by initial stimulation at low doses, a temporary decline, and a secondary increase at intermediate doses, indicating a complex dose-dependent balance between activation and stress-induced inhibition mechanisms.

Thus, the observed germination dynamics of the high-viability beech seed population during stratification under X-ray exposure at doses ranging from 25 to 300 Gy reflect a complex response to radiation, involving stimulatory or inhibitory effects, requiring careful dose optimisation and extensive understanding of biochemical processes occurring in seeds to ensure consistent and predictable germination outcomes.

Keywords: *Fagus sylvatica*, seeds, high-viability, X-ray, germination traits

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THE ROLE OF THE FLATID CICAD (*Metcalfa pruniosa* Say) IN THE URBAN LANDSCAPE

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In the Republic of Moldova, the urbanization process is slow and often uneven, generating increased pressure on green spaces, urban infrastructure and local ecosystems.

Landscapes contribute to improving the quality of life by exercising essential social functions, ensuring an appropriate setting for public and private outdoor recreation, enhancing the aesthetic value of localities, living and working spaces, and, in certain cases, having cultural, historical or scientific importance. The urban landscape, as a key element of the quality of life and ecological balance in cities, is becoming increasingly vulnerable to disruptive anthropogenic and environmental factors. One of these factors, with a growing impact in recent years, is the emergence and spread of invasive species. Among these, *Metcalfa pruinosa* Say, an invasive species of planthoppers originating from North America, has proven to have a high capacity for adaptation and dissemination in European urban ecosystems, including those in the Republic of Moldova. The presence of this pest in public gardens, parks, street alignments and urban green areas raises questions about the capacity of authorities and communities to effectively manage such an ecological risk. The mass development of a given species in urban cenoses can cause massive migrations into cenoses of agricultural and forestry crops. In world practice, species of parasites from the Embolemidae family are known, specializing in parasitizing cicada nymphs from the Fulgoridae and Achlidae families. Representatives from the Dryinidae family are noted as parasites of cicadas from the Cicadellidae, Cixiidae and Delphacidae families. The egg stage of cicadas is parasitized by representatives from the Platystasiini subfamily (Platygastridae) and the Eurytomidae family. In the Republic of Moldova, these families of parasites are practically not studied.

The purpose of the work was to analyze the impact of the presence of the invasive species *M. pruinosa* on the urban landscape, with an emphasis on the importance of preserving its structure and functions. Leaf samples of different plant species served

as materials. 3 stations were investigated: urban, dendro-urban and agricultural. The area analyzed for the presence of *M. pruniosa* was 10x10m, by highlighting the plants (trees, shrubs and herbs) that populate the stations.

As a result of collecting leaf samples from cherry saplings in station one, a population of 85% of the saplings with larvae of different ages was established. Following the visualization of *M. pruniosa* colonies, exuviate and nymphs of the last instar of the cicada parasitized by *Dryinus victorovi* N. were found, which flew in the second decade of June of the following year. From some capsules of the *D. victorovi* species in April, the secondary parasite from the Pteromalidae family.

Predators present in the colonies were represented by dipteran larvae from the families Syrphidae and Pipinculidae, adults of the asian lady beetle *Harmonia axyridis* and larvae of the neuropterian lacewing *Chrysopa ciliata*.

Thus, the species *M. pruniosa* poses a danger to the urban landscape and requires in-depth research into both bioecological aspects and trophic relationships with useful species.

Keywords: Landscapes, planthoppers, parasites, predators, invasive

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ASSESSMENT OF THE DISTRIBUTION AND INFESTATION IMPACT OF *Zeuzera pyrina* IN WALNUT ORCHARDS IN THE REPUBLIC OF MOLDOVA

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Purpose. In the context of the rapid expansion of walnut (*Juglans regia* L.) plantations in the Republic of Moldova, the *pest Zeuzera pyrina* L. (Lepidoptera: Cossidae), known as the branch borer, is an emerging and poorly documented threat.

This study aims to assess the distribution and impact of *Z. pyrina* larvae on trees in two commercial plantations, in order to support the development of effective alternative integrated pest management and monitoring strategies.

Materials and methods. Monitoring was carried out in two plantations (Fernor variety) of 1 ha: station I - Bubuieci village, Chisinău municipality, aged 17 years, and station II - Sadova village, Călărasi district, aged 10 years. Delta pheromonal traps were used to monitor adult activity, placed in the tree canopy at a height of 1.5-2.0 meters above ground level. Traps were checked weekly, and the number of captured males was recorded. In parallel, a systematic visual inspection was carried out to identify symptoms of infestation (presence of holes, galleries, branch and trunk breaks).

Results. In station I, male flight activity was recorded from July 27, with an initial number of 1 male/trap, increasing to 3 males/trap in the following decade. This dynamic suggests the beginning of the flight period and a moderate population density. In station II, the infestation was severe: 30% of the trees were 33% affected, with symptoms manifested by active galleries and mechanical damage to branches. Holes of 2-5 cm indicate intense larval activity with vertical migration on the trunk and branches of varying thickness. Recurrent colonization is observed, which may occur annually or even within the same generation.

There is a possible correlation between the age of the plantation and the level of infestation, with younger plantations (Station II) being more vulnerable due to a less lignified tissue structure, facilitating larval penetration. It is also hypothesized that the absence of phytosanitary measures constantly contributes to the increased level of attack.

Conclusions. In station I, a high density of male flight was noted, and in station II, pronounced structural damage was noted. The continued expansion of the species requires the urgent application of integrated pest control methods. Pheromone traps are an essential tool for the early detection and assessment of the distribution of this dangerous pest, but their use is not sufficient in the absence of other complementary measures.

Keywords: walnut, *Zeuzera pyrina* L., pheromone, plant pest

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NATURAL REGULATORS OF APPLE WORM (*Cydia pomonella* L., TORTRICIDAE) IN WALNUT

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In the Republic of Moldova, about 67 species of natural regulators of the apple worm *Cydia pomonella* L. from 8 taxon orders, from 25 families, have been identified at the moment. As for the complex of natural regulators of the apple worm in walnut culture, it is poorly studied.

The purpose of the investigation was to highlight the complex of natural regulators of the apple worm in walnut culture. The materials used were individuals captured in the adhesive plates of pheromone traps. Individuals belonging to taxa from 5 orders, 6 families, diagnosed from a total of 17 survey data, 51 adhesive plates from pheromone traps of the apple maggot were analyzed. It was observed that male butterflies of generation one (G1) lasted from the first decade of May to the first decade of July, and the second generation (G2), or rather the generation entering hibernation (Gh), lasted from the first decade of July to the first decade of July of the following year. Therefore, the phenological calendar of the apple worm on walnut was not made, but from our observations on the capture of males in pheromone traps we could find that the phenological calendar made for apple is similar for the walnut crop. In our case, the first butterflies captured in the adhesive plates of the pheromone traps were noted at the beginning of the second decade of May in the number of 6.3 individuals per trap on average, and the last butterflies in the middle of the second decade of August up to 9 individuals per trap. Based on the phenological calendar, the egg stage of both the first generation (G_1) and the hibernating generation (G_h) lasted from the first decade of May to the third decade of September, and the larval stage from the third decade of May to the third decade of June of the following year. After analyzing 100 collected and split walnut fruits, a 40% attack was observed. Of these, half (20%) had larvae inside, which indicates a fairly large population of the walnut apple worm per 100 fruits. Analysis of the adhesive plates revealed species of larval and pupal parasites from the Tachinidae family (genus *Phania, Cylindromia, Tachina, Blondelia, Phorocera, Voria, Pollenia*) present in an average of 3 individuals per

plate and present in all samples. These polyphagous parasite species enter the hosts by two methods: they lay their eggs on the larvae during the passage from one fruit to another and they lay their eggs on the plant organs, which are subsequently used by the pests and attack the larval stages, but the flight takes place at the pupal stage of the apple maggot larvae. In small numbers there were other species of parasites such as: the oophage *Trichogramma evanescens* (Trichogramatidae) in the first decade of June, and the larviphage *Copidosoma truncatellum* (Encyrtidae) at the beginning of the first decade of August. Predators were represented by the species *Chrysopa carnea* and *C. perla* (Chrysopidae), *Panorpa communis* (Panorpidae, Mecoptera) and representatives of the order Aranea. Walnut cultivation requires a more extensive study of the complex of arthropods useful to walnut and it is necessary to use the trap belt method for both the first and second generations, which go into hibernation. As a result, the regulatory complex of the apple worm in walnut culture was established, consisting of 10 species of parasites and more than 3 species of predators of the immobile stages of the apple worm in walnut.

Keywords: walnut, phenological calendar, parasites, predators

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MULTIPLICATION AND APPLICATION OF THE ENTOMOPHAGIC *TRICHOGRAMMA* IN THE CONTROL OF THE PEST COMPLEX

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In the Republic of Moldova, the areas cultivated with agricultural crops are vast. Annual and perennial crops are attacked by various pest species, but the most economically important belong to the complex of cutworms, moths, and whiteflies. Most of these species are polyphagous, attacking over 120 species of cultivated and spontaneous plants, causing significant damage. Annually, crop losses range from 15–80%. The flight of butterflies from the overwintering generation begins when the sum of temperatures reaches 260–270°C and continues throughout the summer (2–3 generations). The widespread use of the entomophagous *Trichogramma* spp. in plant protection is linked to its quality in mass rearing and field application. It is reared on the laboratory host, the grain moth (*Sitotroga cerealella* Ol.). For the multiplication of *Trichogramma* sp., the host *S. cerealella* is reared.

The technology of rearing *S. cerealella* includes several operations: preparation of barley – thermally processed at 95°C; then allowed to dry (2–3 days), after which it is infested with larvae of the grain moth (*S. cerealella* Ol.), applying one gram of moth eggs per kg of barley; the barley is mixed and moistened after 3–4 days; for host rearing, optimal conditions are 25–27 °C and 80–85% relative humidity; butterflies are collected daily; butterflies are placed in a collector and eggs are collected daily, which are used for *Trichogramma* rearing.

The grain moth eggs are glued with water to the inner surface of glass containers (3-liter jars, glass cylinders, vivarium's), then the parasite:host ratio is set to 1:20, meaning one *Trichogramma* female is given 20–30 moth eggs to parasitize; after 9 days, *Trichogramma* individuals hatch from the parasitized eggs. Before starting experiments with this entomophage, biological indices are determined. For example, biological indices of *T. evanescens* (collected from sweet corn crops) were: female prolificacy ranged from 20.4–24.0 eggs per female, emergence rate of individuals 82.0–86.0%, female ratio 52.7–56.0%, static quality criterion 8.9–11.5, parasitism rate 80.0–84.0%, female progeny-bearing rate 80.0–84.0%, and female lifespan 2.2–2.9 days. Before field release, pheromone traps are installed to monitor pests,

and depending on pest density, *Trichogramma* is released. The effectiveness of field releases depends on the rearing procedures, specific species, and biotic and abiotic factors.

Controlling pest insect species densities in modern concepts of biological plant protection is one of the key links in trophic chains and networks, ensuring high environmental quality, enabling the production of ecological agro-food products, reducing or eliminating chemical treatments, and preserving beneficial fauna.

Keywords: *Trichogramma,* entomophagy*,* plant pest

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THE IMPACT OF THERMAL REGIME ON THE BIOTECHNOLOGICAL PROCESS OF REPRODUCTION OF THE SPECIES *Plodia interpunctella* Hbn.

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The species *Plodia interpunctella* (Hübner), is part of the Pyralidae family (Lepidoptera). It is an important economic pest of stored food products and dried fruits, causing annual losses of up to 10%. It has a complete biological development cycle (egg, larva, pupa, imago). This species represents a relevant experimental model in the context of biological protection. In order to multiply the entomophagous. *Bracon hebetor*, it is essential to use an appropriate host species, which allows the rapid obtaining of an optimal number of fertile females, ensuring a complete ontogenetic development. The aim of the research was to evaluate the ontogenetic development of the species Plodia interpunctella in controlled thermal regimes, in order to determine the feasibility of using it as a host species in the multiplication of the entomophagous *B. hebetor*. In the experiments, carried out under controlled laboratory conditions, the biological parameters of the ontogenetic development cycle of the species Plodia interpunctella were evaluated. The experimental variants were mounted in a "NITEH" type climatic chamber, equipped with a system for regulating temperature and relative air humidity. During the experiments, the humidity was maintained constantly in the range of 65–70%. Five distinct thermal regimes were tested in the study, in order to observe the influence of temperature on the development of the species. The first thermal regime assumed a temperature range between 9 and 12°C, followed by the second interval, of 15–18 °C. The third thermal regime was established between 20 and 21°C, and the fourth between 25 and 27°C. The last regime was the one with the highest temperature, varying between 30 and 35 °C. The biological material used for the maintenance and propagation of the Plodia interpunctella species was collected from cereal product storage areas, and was subsequently transferred to controlled laboratory conditions. The imago stages were maintained on an artificial nutrient substrate composed of corn flour and glycerin, which provided the necessary support for the complete development of the insects throughout the entire ontogenetic cycle. During the experiments, the imago

was maintained in glass containers with a volume of 3 liters and fed with a sucrose solution at a concentration of 7%, used as an energy source to support physiological and reproductive activity. Experimental analysis of the influence of thermal factors at low temperatures (9–12 °C) has shown that larvae gradually enter diapause, and at 15–18 °C - the duration of the ontogenetic cycle lasts a long period of time (up to 60–65 days). At a temperature of 20–21 °C, development is moderately accelerated - up to 40–55 days, and at 30–35 °C, larval hatching is completely inhibited due to major mortality. The optimal thermal regime for the complete development of the species Plodia interpunctella was identified at 25–27 °C, where the ontogenetic cycle completes in 22–25 days. In comparison, the species Galleria mellonella, another host for the entomophagous Bracon hebetor, requires about 40–45 days to develop an ontogenetic cycle, under the same thermal conditions. In conclusion - it has been demonstrated that the species Plodia interpunctella presents an optimal potential to be used as a host species for the multiplication of the entomophagous *B. hebetor.*

Keywords: *Plodia interpunctella,* eggs, larvae, imago, female, male, temperature

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NOVEL TRIZOLE DERIVATES AND CHITOSAN REVEAL SYNERGY IN SUPPRESSING *FUSARIUM spp*.

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Constantly changing climate conditions not only have a direct adverse impact on crop productivity, but also affect fungal microbiome. Studies report that global heating and alteration in precipitation patterns induce modifications in metabolism of both pathogenic and non-pathogenic fungi associated with economic important plants. These changes include areal spread, increased pathogenity, mycotoxigenity, host-range widening and imply developing new preparation for suppressing pathogenic fungi. Moreover, since currently synthetic fungicides are the most effective remedy against fungal pathogens, including *Fusarium*, it is important to reduce their negative impact on environment and biodiversity.

The aim of this study was evaluating the effect of tomato treatment with seventeen triazole derivatives in combination with fungal chitosan on *Fusarium* propagation in plants during early stages of vegetation. Several novel triazole derivatives were obtained in the Laboratory of Organic Synthesis, Institute of Chemistry of Moldova State University. Three trial groups of tomato seeds were primed with chitosan, triazole derivatives in different concentrations, triazole-chitosan compound and grown in infected soil in nursery. Control groups – tomato seeds treated with distilled water and Topaz (Syngenta ©). *Fusarium* propagation was assessed using PCR assay based on fungal DNA in plant tissue accumulated during the trial time.

It was observed that tomato plants treated with triazole derivatives had a more developed root system and stems compared to water-treated plants. In most cases, the length of roots exceeded the respective values for stems. Therefore, it could be stated that the compounds testes reveal selective stimulatory effect on tomato vegetative organs, while treated plants did not show any symptoms of fusariosis. One of the triazole derivatives in combination with fungal chitosan had a more significant inhibitory effect on *Fusarium spp*. propagation in tomato plants compared to the same substance in higher concentrations and chitosan itself.

Conclusions. Several novel triazole derivatives manifest synergy with chitosan in both stimulating tomato growth and suppressing *Fusarium spp*. This interaction permits reducing significantly the triazole content for plant treatment without losing its benefic stimulatory and antifungal properties while reducing environment contamination with synthetic pesticides and growth promoters.

Keywords: triazole, chitosan, *Fusarium*, tomato, PCR

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BIOLOGICAL APPROACH OF APPLE TREES PROTECTION FROM POWDERY MILDEW IN TERMS OF WESTERN FOREST-STEPPE OF UKRAINE

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The purpose: Powdery mildew (*Podosphaera leucotricha* Salm) is one of the spread apple-tree diseases in terms of Western Ukrainian Foreststeppe. So, the work's aim was to study the complex apple tree protection systems effectiveness against powdery mildew.

Materials and Method: The work conducted during 2023-2024 in the apple orchard of the Ukrainian Science Research Plant Quarantine Station Institute of Plant Protection NAAS as per generally approved methods on the apple trees plantings of 2014 the Idared variety planting. The fungicides efficiency determined according to the official methods through 7 days.

Summarized results. There were 3 biological complex systems in combinations with microelements study for apple-trees plantations protection from powdery mildew.

The first system of biological protection included treatment at phenophase "bud separation" with biological preparation Fluorescin BT at rate 2.0 l/ha and chelated S, Zn; at phenophase "fruit forming" – Bactofit BT (4,0 l/ha) + Mg, Mn, Fe, Co; at phenophase "fruit growing" (walnut-size fruit) – Biogibervit BT (3.0 l/ha); at phenophase "fruit growing" (July second ten-days) – Trichopsin BT (5.0 l/ha) + Ca; at phenophase "fruit ripening" – Fluorescin BT (1.5 l/ha). The present protection system allowed to decrease the powdery mildew on 67.6% as per researches results.

The second biological protection system based upon the next spraying during phenophase "rose bud" mix Bactofit BT at rate 4.0 l/ha and Trychipsin BT at rate 5.0 l/ha + B, Mo; "fruit growth" (hazel fruit size) – Biohybervit BT (3.0 l/ha) + Mg, Mn, Fe, Co; "fruit growth" (first July's ten-days) – Fluorescin BT (1.5 l/ha); "fruit growth" (first August's ten-days) – a mixture of Trichopsin BT (3.0 l/ha) and Biospectre BT (3.0 l/ha) + Ca; "fruit ripening" – Fluorescin BT (1.5 l/ha). The

efficiency of proposed protection system consisted of 64.9 %. It is the lowest among all studied systems.

The following biological protection system included treatment during the phenophase “bud separation” with chelated S, Zn; in the phenophase “rose bud” – with a mixture of Ampelomycin BT (4.0 l/ha) and Bactofit BT (3.0 l/ha) + B, Mo; at the phenophase “fruit formation” – a mixture of Phytosporin BT (5.0 l/ha) and Fluorescin BT (1,0 l/ha) + Mg, Mn, Fe, Co; in the phenophase “growth fruit” (walnut – sized fruit) – Biohybervit BT (3.0 l/ha); at the phenophase “fruit growth” (second July’s ten-days) – Biospectre BT (6.0 l/ha) + Ca; in the phenophase “fruit maturation” – a mixture of Trichopsin BT (3.0 l/ha) and Fluorescin BT (1.0 l/ha). The current protection system allowed to decrease the powdery mildew on 75.7 %. It was the highest indicator among all researched protection systems.

A chemical system used as a reference. It was based upon five spraying by chemical pesticides. The present protection system against powdery mildew technical efficiency consisted of 86.5 %.

Conclusions. The investigations results showed that the studied biological complex in combination with microelements allowed to decrease powdery mildew development on 64.9-75.7%.

Keywords: apple tree, powdery mildew, biological protection, technical efficiency

Funding. The work completed within the framework of the topic 11.00.03.05 A. „Development of scientifically based technologies for environmentally friendly systems improving in fruit plantations protection in organic farming with BT preparations usage”.

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FIRST RECORD OF THE INVASIVE LEAFHOPPER *Hauptidia maroccana* Melichar IN THE REPUBLIC OF MOLDOVA AND ITS TROPHICAL LINKS

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Fourteen species of leafhoppers in the genus *Hauptidia* have been described and reported most of them associated with herbaceous plants. Among them, only *Hauptidia maroccana* Melichar is a species adapted to greenhouse conditions and with a tendency towards open field conditions. The species is polyphagous and has hosts representing eight botanical families. *H. maroccana* has been recorded in more than ten European countries. In Africa in more than 4 countries. In Asia it has been found in two countries, in Russia in the Siberian part and in the Middle East only in Jordan, where it wreaks havoc on cucumbers, peppers, eggplants, tomatoes, and some ornamental crops. To date, the presence of this species has not been reported in the Republic of Moldova.

The purpose of the investigation was to study some bio ecological aspects of the maroccan leafhopper *H. marocana* and its relationship with the nectariferous plant *Lobullaria maritima* L. The material used was leaves of greenhouse plants (tomatoes, cucumbers, sweet peppers), indoor flower crops and other herbaceous crops. Two yellow adhesive traps measuring 24x12 cm were used to detect the species in greenhouses. The images of eggs, nymphs of different ages and adults were taken with an Optika stereoscopic microscope. The diagnosis of the species was made according to new guides for the genus *Hauptidia* and by preparing the genitals in temporary preparations.

As a result, in the fall of 2023, based on observations made in station one (47.005°N, 28.858°E), enormous quantities of adult leafhopper specimens were detected, which were identified as representatives of the species *H. maroccana*. In the cold conditions of the room at ground level of +5 °C, it was first observed on ornamental plants of *Pelargonium inquinans* (Geraniaceae). The presence of the species was confirmed on other host plants, including *Philodendron hederaceum* (Araceae), *Kalanchoe blossfeldiana* (Crassulaceae) and *Lobularia maritima*

(Brassicaceae) in a closed space. Subsequently, in the conditions of 2024, it was observed throughout the entire vegetation period on intensively improved *L. maritima* and on *Malva* sp. (Malvaceae) in open space with impressive quantities, and in November it migrated again indoors where it was located on *L. maritima* at a height of 22.40 meters from the soil surface. In the same year, during the vegetation period of the intercalated lobullaria in the plum crop, its presence was observed in quite large quantities of over 43 individuals per plot. In the winter of 2025 it was again observed indoors developing at the same level from the soil surface and producing generations on calanhoe and hibiscus at temperatures of +10-15°C and humidity of 70%. In order to study other trophic links of the species, two yellow adhesive traps were installed in the second decade of June in greenhouses. As a result, leafhopper was found in single specimens in the greenhouse with tomatoes and peppers. The species' ability to colonize a wide range of host plants poses a potential phytosanitary risk to spontaneous flora and crops under greenhouse conditions.

Keywords: leafhopper, host plants, phytosanitary risk

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CORRELATION ANALYSIS BETWEEN MORPHO-PHYSIOLOGICAL TRAITS OF CORN UNDER THE INFLUENCE OF TEMPERATURES

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Analysis of the correlation coefficients between morpho-physiological traits of corn germination under normal conditions and under the influence of non-optimal temperatures may become a good criterion for selection of high-yielding and climate-resistant genotype. The aim of this study was to identify traits sensitive to temperature fluctuations by correlation analysis of corn bio-morphological traits in the initial growth phase under different temperature conditions. The Porumbeni 465 (P465) corn hybrid was germinated under normal conditions (control) and under non-optimal temperatures of +10°C (cold test) and +50°C (heat test). Changes in the length and biomass of root/shoot, their vigor, metabolic efficiency of seed germination, and their relationships were determined.

The overall germination of corn seeds decreased under cold and heat tests compared to the control by 4 and 18%, respectively. Seed germination under cold conditions did not significantly affect the growth of roots and shoots, the length of which did not differ statistically. After the heat test, the length of roots ($p \leq 0.001$) and shoots ($p \leq 0.01$) was significantly greater compared to the control seeds and seeds after the cold test ($p \leq 0.001$). Root/shoot vigor did not modify significantly under the influence of the suboptimal temperature of +10°C. The heat test induced root vigor ($p \leq 0.001$) compared to the control and cold test, as well as shoot vigor ($p \leq 0.05$) compared to the cold test.

No strong positive correlations were found between overall germination and other studied traits. Root vigor of control seeds had the high correlation coefficients with root length (0.9940) and biomass spent on root growth (0.9224), which were also maintained during the cold test (0.8299 and 0.8559) and the heat test (0.9996 and 0.9260). Similarly, the shoot vigor of control seeds was strongly correlated with shoot length (0.9935) and biomass spent on shoot growth (0.8341), which changed but remained high under the cold test (0.9904 and 0.9843) and the heat

test (0.9959 and 0.8066). The metabolic efficiency of control seeds germination had a weak positive correlation with root/shoot vigor (0.3398), which increased in the cold test (root vigor- metabolic efficiency r=0.6657) and in the heat test (root vigor - metabolic efficiency r=0.8242; shoot vigor - metabolic efficiency r=0.7855). The increased relationship between root/shoot vigor and metabolic efficiency in corn seeds reflected a more effective mobilization of stored energy and reserve substances for root/shoot growth during germination and early development.

Despite the fact that the overall germination of seeds of the P465 hybrid decreased under the influence of non-optimal temperatures, the physiological activity of germinated seeds increased significantly. Based on the changes in correlation links between morpho-physiological traits, it can be concluded that the Porumbeni 465 hybrid is quite resistant to the influence of both low and high temperatures.

Keywords: corn, root, shoot, length, biomass, vigor, non-optimal temperature, correlation

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CELL SELECTION OF DROUGHT-RESISTANT TOMATO PLANTS

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One of the most important areas of modern biotechnology, which has already found wide practical application, is cell selection, as a method of creating new plant forms by isolating mutant cells and somaclonal variations. Cell selection is based on the screening of cell populations resistant to a selective factor and the regeneration of plants from them.

In the context of current climate change, cellular mechanisms of drought tolerance are important for in vitro cultivated cells and whole plants, and selection at the cellular level represents a real prospect for obtaining drought-resistant forms of cultivated plants. Under simulated drought conditions, the selected lines are characterized by an increase in total bound water, an increase in photosynthetic and osmotic potentials, and an increase in cell membrane stability due to antioxidant activity. The latter correlates with an increase in plant resistance to salinity, freezing, and drought, and, accordingly, is a convenient marker of systemic resistence.

Materials and methods. Immature embryos, cotyledon nodes with meristematic activity, and hypocotyls of tomato plants of the Lagidny, Khoriv, Borivsky, and Bobrytsky varieties, 1,2 – 1,5 mm long, optimal for callus induction, were used as explants. For the cultivation of isolated tissues, agarized MS medium with various concentrations of growth regulators was used. Superoxide dismutase and peroxidase activities were determined spectrophotometrically by the rate of NADH oxidation in the presence of nitro-blue tetrazolium and phenazine methosulfate, and using acetate buffer, respectively.

Results and discussion. To induce morphogenesis, callus aged 5 – 7 weeks was transferred to MS medium with the addition of 1 mg/l kinetin, 0,5 mg/l IAA, and 0,1 mg/l GA. Green leaf-like structures, initials, developed from dense areas of callus, and after 2 – 3 weeks, regenerated plants were formed. Cultures showing

rhizogenesis and necrosis were discarded, and callus without signs of regeneration was transferred to a fresh medium. After the regenerants reached a height of 1,5 – 2 cm, they were transferred to a ½ MS medium without phyto-regulators.

The cell selection schemes included several sequential actions with a selective agent at different concentrations at the stages of induction – proliferation or proliferation – morphogenesis of callus cultures. Callus lines cultivated on media without the addition of selective agents served as controls. The exposure time on the selective medium was at least three weeks. After the first passage of tomato callus, the hydrogen peroxide content of the control variant and experimental varieties was determined. After the first passage of tomato calluses, the hydrogen peroxide content of the control variant and experimental varieties was determined. An increase in its content compared to the control was established in the following order: Control → Lagidny → Bobritsky → Borivsky → Khoriv. The functioning of the antioxidant system of plants *in vitro* culture is a marker of their systemic resistance and adaptation to changed conditions caused by environmental stress factors.

Conclusions. Using the stepwise selection method *in vitro* culture, a line of tomato plants with increased drought-resistance was obtained.

An increase in the hydrogen peroxide content in tomato calluses and stimulation of the activity of the antioxidant enzymes superoxide dismutase and peroxidase were detected.

Keywords: *Lycopersicon esculentum* Mill., *in vitro* cell selection, MS, growth regulators

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SCREENING OF WHEAT VARIETIES ON THE *WSM1* GENE CONFERRING RESISTANCE TO WHEAT STREAK MOSAIC VIRUS IN UKRAINE

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Wheat streak mosaic virus (WSMV) is the most harmful and widespread virus of cereals in all wheat grown areas in the world. WSMV can cause significant yield losses of wheat – up to 60 % and in some cases – up to 100 %.

Plant resistance genes (R genes) primarily function through a "gene-for-gene" interaction, where specific R genes in plants recognize corresponding avirulence (Avr) genes in pathogens. This recognition triggers a plant defense response, often a hypersensitive response (HR) and/or initiation of signal transduction pathways that restricts pathogen growth and spread. Four genes for WSMV resistance named as *Wsm1, Wsm2, Wsm3*, and *c2652* have been identified in wheat to date (Haley et al., 2002; Sharp et al., 2002; Divis et al., 2006; Haber et al., 2006). *Wsm1* gene derived from *Thinopyrum intermedium and* initially mapped to a translocated segment on wheat chromosome 4DL. Mechanism of *wsm1*-mediated resistance in wheat likely involves virus replication suppression or movement restriction**,** but the exact mode is still under study. *Wsm1* provides broad resistance of wheat against WSMV comparing to the *wsm2* and *wsm3* that provides strong resistance but temperature-sensitive and moderate resistance, respectively. Effective molecular markers closely linked to the target genes are the key for the success of MAS on traits such as WSMV resistance and widely used in wheat breading programs.

The goal of this study was to screening of wheat varieties on the presence of WSMV resistance gene *wsm1* using PCR-based marker.

For this study, 52 wheat varieties were selected in different regions of Ukraine. Genomic DNA was extracted from wheat leaves using GeneJet Plant Genomic DNA Purification Mini Kit K0791 (Thermo Fisher Scientific, USA). For polymerase chain reaction, specific primer pair STSJ15, developed by Talbert et al. (1996) for detection of *wsm1* gene for WSMV resistance was used in PCR: left primer GTAGCAGGGGAAGCTGAAGA) and right primer CCGAGCTCACACGCTAATTT. PCR amplification was performed following standard procedure with annealing 30s at 56°C using DreamTaq™ Green PCR Master Mix (Thermo Fisher Scientific, USA). PCR results shown presence of a 500 bp DNA-fragment of the *wsm1* gene in 17 wheat varieties. Thus, our investigation revealed 17 *wsm1*-positive wheat varieties. These results will be useful to provide these wheat varieties containing *wsm1* as potentially resistant to WSMV in wheat breeding programs in Ukraine.

Keywords: wheat streak mosaic virus, resistance, *Wsm1* gene, wheat, Ukraine

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NEW ALIEN PREDATORY BUG IN THE PLUM ORCHARD OF THE REPUBLIC OF MOLDOVA

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During the development of an environmentally safe system of plum orchard protection based on low level of use of chemical plant protection products (one treatment with fungicide and insecticide per season); sowing of turf grasses and nectar-bearing plants; use of methyl salicylate to attract beneficial insects and mites, an alien predatory bug - *Amphiareus obscuriceps* was detected.

The laboratory colony of bugs was maintained at 25 ± 1°C and a long (16:8 h) daylight period. The ability of the predator to feed and develop on various food substrates was studied.

It's been established that predators feed on the eggs of dangerous pests of plum (*Tetranychus urticae* and *T. viennenzis*), cereals (*Sitotroga cerealella* and nymphs of *Schizaphis graminum*), vegetable (*Aleyrodes proletella*) and legumes (*Acanthoscelides obtectus*) crops. Whiteflies living on wild grasses (*Aleyrodes singularis*) and psocids (family Trogiidae) are also food for bugs (Figure). Eggs of *T. urticae*, *S. cerealella*, *A. obtectus*, *psocids* and nymphs of *S. graminum* provided full development of predators. The diet comprising eggs of the *S. cerealella* or the *Galleria mellonella*, in conjunction with a 5% honey solution, ensures the full *A. obscuriceps* development accompanied by low mortality (less than 10% at the immature stages of development), fertility (67-78% of fertile pairs) and high lifespan (93-98 days) of adult bugs.

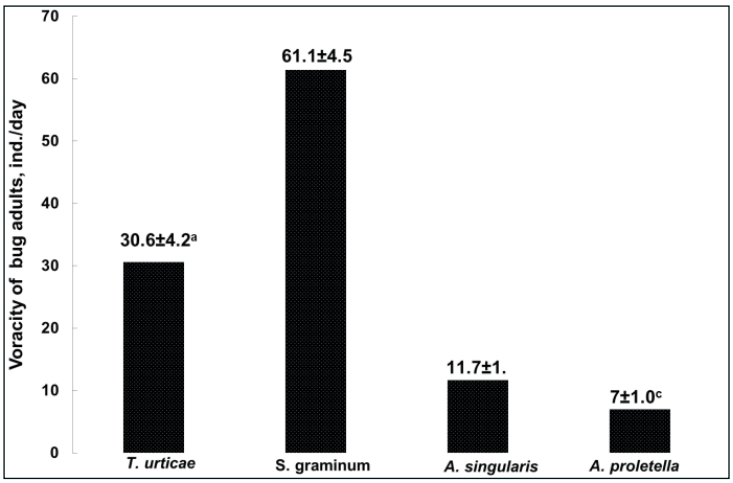

Fig. Voracity of *A. obscuriceps* adults feeding on various arthropods

The obtained data indicate the ongoing process of natural expansion of *A. obscuriceps* range. The use of biorational methods of plum orchard protection contributed to the penetration and colonization of the orchard by alien predatory bug. In the future, in the absence of negative impact of *A. obscuriceps* on native beneficial entomoacarifauna, mass breeding and release of the predator into various agro-biocenoses is possible. The increasing biodiversity by introducing a new entomophage will contribute to the stability of such agro-systems.

Keywords: *Amphiareus obscuriceps,* laboratory colony, food

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POPULATION DYNAMICS OF *Agrotis segetum* IN THE CONTEXT OF CLIMATE CHANGE

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The species *Agrotis segetum* Den. et Schiff. (Lepidoptera: Noctuidae), commonly known as the "turnip moth," is a particularly aggressive pest within the agroecosystems of Central and Eastern Europe.

The larvae of this species cause significant damage to a wide range of crops, especially during the early stages of plant development, by attacking the plants at the collar or root level.

In recent decades, extreme climatic phenomena and global warming trends have led to clear changes in the bioecology and behavior of many pest insect species. In the case of *A. segetum*, these changes are reflected in earlier adult emergence, prolonged activity periods, overlapping generations, and the northward and upward expansion of its distribution range.

The present study aims to investigate how climate change influences the population dynamics of *A. segetum* in the Republic of Moldova, in order to provide updated insights for the phytosanitary management of this species under current climatic conditions.

Materia lsand Methods. The monitoring of *A. segetum* populations was carried out during the vegetation seasons of 2022–2024 in the central region of the Republic of Moldova.

The following tools and techniques were used: light traps and pheromone traps (Delta type), direct field observations of larval damage, and the collection of meteorological data (daily average temperature, number of days with temperatures ≥25 °C, and precipitation amount).

To interpret the data, statistical correlation methods were applied to analyze the relationships between climatic parameters and the weekly dynamics of moth captures.

Results and Discussion. The analysis of the obtained data revealed a clear trend of adult flight periods shifting to earlier months compared to historical records. In years with warmer springs (e.g., 2023), the first captures were recorded 2–3 weeks earlier than the multiannual average.

In addition, the following were observed: increased activity during June-July, with pronounced flight peaks during dry periods; a positive correlation between daily average temperatures above 22 °C and the number of adults captured. These changes indicate a high ecological adaptability of the species, as well as an increased risk to crops, especially in the absence of well-implemented warning systems.

Conclusions. The presented data confirm that climate change has a direct influence on the behavior and development of the pest *Agrotis segetum*. Adapting phytosanitary management to new climatic conditions is essential for protecting agricultural production and reducing the negative impact on the environment.Future studies should include a predictive component, based on phenological modeling and regional climate scenarios, in order to anticipate the evolution of this species in the coming decades.

Keywords: *Agrotis segetum,* pest population, pheromone trap

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ASSESSMENT OF THE PRODUCTIVITY OF PLUM AND APPLE TREES, DEPENDING ON GROWING CONDITIONS AND GENOTYPE

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Lack of precipitation, long periods of drought and heat have a negative impact on the metabolism of fruit plants and, consequently, on the productivity and stability of the harvest of various fruit crops. In the Republic of Moldova, plum is one of the main fruit crops, occupying the second place after apple and the first place among stone fruit species. A distinctive feature of plum is its resistance to adverse environmental factors, which is confirmed by the cultivated areas in most regions of the country, characterized by constant temperature changes, excess or lack of precipitation. At the same time, under stress conditions (drought) the adaptability of the crop in general, and of varieties in particular, decreases. Apple tolerates drought better than other fruit crops due to its deeper root system. However, some varieties have a superficial (shallow) root system, in which case they are more demanding on moisture than other varieties.

Based on the above, the aim was to evaluate the productivity of plum and apple trees under conditions of insufficient humidity, which would allow the subsequent development of procedures to strengthen the functionality of the production system in fruit trees in the context of climate change.

The object of study was plum trees of two late varieties: Stanley (of foreign selection) and Udlinionnaia (of local selection), as well as two winter apple varieties: Granny Smith and Golden Spur from the lysimeters of the Institute of Genetics, Physiology and Plant Protection of the State University of Moldova. The research was carried out according to the scheme: a) experimental variant: plants grown under non-irrigated conditions; b) control variant: plants grown under irrigated conditions (soil humidity – 70%).

The average amount of fruit per tree was determined by weighing.

It was found that the growing conditions influence the productivity of the trees and the quality of the harvest. Regarding the average quantity of plum fruits obtained

from a single tree, we mention that the Udlinionnaia variety from the variant with plants grown under non-irrigated conditions recorded a decrease in yield by 22.6%, compared to the control. This law also applies to the Stanley variety, as well as apple varieties. Thus, in the case of the Stanley variety of foreign selection, a decrease in yield was recorded by 15%, which represents a decrease of 7.6% compared to the Udlinionnaia variety of local origin. The Golden Spur apple variety grown under non-irrigated conditions recorded a decrease in yield by 35.28%, compared to the control, and the Granny Smith variety – approximately by 36%.

Thus, we can conclude that plum and apple trees grown under non-irrigated conditions were distinguished by lower yields, compared to trees grown under optimal conditions (with irrigation). Studying the peculiarities of plant growth and development under unfavorable conditions represents a cardinal moment in understanding the mechanisms of plant tolerance to drought, which could serve as a basis for developing procedures for directed management of the functional state and optimization of the production process.

Keywords: productivity, fruit quality, plum fruit, apple fruit, growing conditions

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ECOTOXICOLOGICAL ASSESSMENT OF SOIL AFTER LONG-TERM EXPOSURE TO MONTMORILLONITE HYDROGELS

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The environmental safety of polymer materials intended for use in agricultural soils requires a comprehensive evaluation that extends beyond their primary functional attributes. This study evaluated the potential long-term ecotoxicological effects of four different montmorillonite (MMT) hydrogel formulations - identified as M0 (0% MMT), M1 (0.25% MMT), M2 (0.5% MMT), and M3 (1% MMT) - after their partial degradation in soil over various periods. Each formulation was prepared using different doses of MMT, sodium alginate, acrylic acid, polyethylene oxide, and potassium persulfate and then subjected to electron beam irradiation at an intensity of 12.5 kGy. Following the soil burial method for the hydrogel formulations, soil samples were collected after 100, 200, and 300 days, and aqueous extracts were prepared. The resulting extracts were tested at five dilution levels via seed germination assays utilizing *Raphanus sativus* and *C. sativus* seeds. Germination Index and Global Index of Germination (GI) values were then computed. Based on studied literature, a GI ≥ 80% indicates non-phytotoxicity, 50–80% suggests moderate phytotoxicity, and a GI < 50% signifies considerable toxicity. At the 100-day mark, all formulations exhibited GI values exceeding 90% across both plant species and all dilutions, thus confirming the absence of phytotoxic effects. However, by 200 days, the GI values for all samples decreased below the 80% threshold, with formulation M1 at 100% extract displaying the most pronounced effect, registering GI values of 59.36% for radish and 63.63% for *C. sativus* seeds. Conversely, at 300 days, GI values showed an increase, surpassing 90% for formulation M3, which suggests a restoration of biocompatibility over time. These findings indicate that while temporary ecotoxic effects may manifest during intermediate stages of degradation, the tested materials - particularly M3 - do not pose substantial long-term environmental risks. The consistent recovery in GI values at 300 days demonstrates the environmental compatibility of these materials for use in soil - plant systems.

Keywords: hydrogel, ecotoxicity, seed germination, soil extract, montmorillonite

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A BRIEF OVERVIEW OF AN INITIAL MONITORING TRIAL ON TOMATO LEAF MINER IN GREENHOUSES

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The South American tomato pinworm, known also as tomato leafminer is currently considered one of the most devastating invasive pests of tomato plants worldwide, causing serious damage to tomato production. This pest can infest host plants at all stages of development, with larvae creating mines and feeding on leaves, stems and fruits, and can cause crop losses of up to 80–100%, without timely control measures. All farmers are interested in combating the occurrence of this small invasive pest both in open fields and in greenhouses. Tomatoes are the most widely grown crops in protected areas and are widely consumed vegetables in the world.

One of the main methods of controlling this pest is the use of chemical insecticides. Frequent treatments can lead to the emergence of resistance to these pesticides, affecting beneficial insect populations and polluting the environment. Combating this pest must be carried out from the moment the pest appears, with optimal application of pesticides. One of the widely used ecological monitoring methods is the use of delta traps with sex pheromone dispensers, which is constantly evolving.

In July 2024, standard sex pheromone traps were placed in the experimental greenhouses cultivated with tomato plants of the Institute of Genetics, Physiology and Plant Protection, MSU to detect the emergence of the tomato leafminer pest. When the first moth was captured, Delta traps with sticky plates and dispensers were installed in 3 variants: 1st variant – a standard comercial dispenser, variant for comparison, 2nd variant – dispenser with the synthetic sex pheromone and 3rd variant – mixture of synthetic sex pheromone with a plant-extracted compound. The number of pests captured in the experimental traps was recorded once a week from july to october. Sticky plates were changed when was necessary.

With the appearance of the pest, a linear increase in the number of captures in pheromone traps was observed at each observation. In all the variants exposed in the

greenhouses, a smaller number of pests were captured than in previous years because a chemical treatment was performed to control the population density and maintain it at an acceptable level, without compromising the development of tomato plants.

Analysis of the accumulated data revealed that the addition of the plant-extracted compound led to a significant increase in catches in pheromone traps of variant 3, with a share of 40% of the total catches per season, compared to the standard variants and the variants with synthetic sex pheromones, which captured a lower percentage of moths, 29% and 31% of the total, respectively. The results of the research conducted highlight the positive effect of adding a plant-extracted compound to synthetic sex pheromones for monitoring the pest *Tuta absoluta* with Delta pheromone traps and require further studies in this direction.

Keywords: South American Tomato Pinworm, *Tuta absoluta*, monitoring, Delta traps

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MEDICINAL HERBS AS IMPORTANT INGREDIENTS FOR INNOVATIVE CEREAL PRODUCTS

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The aim of this study was to develop functional breakfast cereals with addition of two functional herbs *Alchemilla xanthochlora* L. (Lady's mantle) and *Vaccinium myrtillus* L. (Bilberry) to improve their nutritional, antioxidative and sensory values.

The cereals were formulated with varying herb concentrations (5, 10 and 15%), and analyzed for proximate composition, bioactive compound content, oxidative stability, and consumer acceptability.

Results showed a significant increase in dry matter, ash, and fat content with herbal enrichment. For example, 15 % of bilberries yielded the highest dry matter (95.65 %), fat content (2.48 %), and ash (1.28 %), compared to the control (94.25, 1.50, and 1.01%, respectively). Bioactive compound analysis revealed that total polyphenols, phenolic acids, and flavonoids increased dose-dependently, peaking at 3.62 mg GAE/g (GAE – gallic acid equivalent), 2.10 mg GAE/g, and 2.85 mg QE/g (QE – quercetin equivalent) in the 15% bilberry sample. However, antioxidant activity, while moderate across all formulations, did not differ significantly ($p = 0.339$), suggesting limitations in assay sensitivity. Oxidative stability, as measured by induction time, improved from 0.73 h in control to 1.70 h in the 15 % bilberry sample. Sensory evaluation indicated that lower concentrations (5–10 %) of herbs were well tolerated, while 15 % inclusions, though nutritionally superior, led to sensory decline due to intensified taste and aroma. Radar plots and sensory scores confirmed overall acceptability above 6.0 on a 9-point scale, especially for *Alchemilla* 10 %, which achieved the highest preference among panelists.

These results indicate that inclusion of herbs in cereals helps to improve nutritional and functional properties, with no reduction in consumer acceptability at the best levels of inclusion.

Keywords: innovative foods, medicinal herbs, breakfast cereals, polyphenols, sensory evaluation

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SPECIAL FEATURES OF INTEGRATED PROTECTION OF SUNFLOWERS IN CLIMATE CHANGE CONDITIONS

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The importance of the theme is determined by the value of the sunflower as a strategic oilseed plant, particularly valuable from a strategic, economic and food point of view. Development and application of integrated sunflower protection systems with the broad application of biological means of protection, especially microbiological preparations that will be the basis for regulating the density of populations of harmful organisms in conventional and organic agriculture.The ecological substantiation of the development and application of the integrated sunflower protection system advances objectives such as: Determining the phytosanitary status of sunflower and the impact caused by harmful organisms at different stages of development, to establish the biological diversity of biological agents that participate in regulating the density of harmful organism populations.

As a perspective, we can highlight the methods of identifying phytosanitary agents and biological agents useful in the future, such as the analysis of the phytosanitary status of agricultural agrophytocenosis. The research from 2025 was conducted in a 3-year repetition on the same land located in the southern part of the Republic of Moldova, Iujnoe village, Cahul district. The experiment was conducted on a plot within the field with an average quality of 80 points, the soil type being ordinary chernozem with a loamy texture. The experimental design includes three variants in three repetitions, the conventional protection system, the ecological protection system and the control were used as variants. As a repetition, three of the most famous sunflower hybrids on the market were evaluated, which are cultivated using three different technologies, namely: repetition 1 Express technology, hybrid P64LE25, repetition 2 Clearfield technology, hybrid P64LP130 and repetition 3 classic technology, hybrid LG5377. Throughout the growing season, records will be kept on the development of diseases and the appearance of pests, and at the end of the period, the harvest will be determined. In the conventional version for integrated protection, the fungicide Unical EC will be used, 1: l /ha (tebuconazole 250 g/l) applied in two treatments in the 6-leaf phase and at budding. In the organic version,

the organic fungicide Trichodermin, 1% suspension, will be administered, also applied in two treatments in the respective phases plus seed treatment.

The most intensive manifestation of diseases caused by the phytopathogenic agents *Botrytis cinerea*, *Plasmophara halstedi* is expected, a limiting factor for the harvest. Despite the strong phytopathological background and the increase in the number of attacked plants, it is expected that the effectiveness of the administered preparations will be observed. It is expected to determine the high efficacy of the fungicide Unical EC, 1 l/ha (tebuconazole 250 g/l) in the conventional sunflower protection system against the background of 4-year monoculture. Ecological protection of sunflowers is expected to become increasingly difficult with the practice of monoculture, but not impossible if the number of treatments during the growing season is increased.

Keywords: *sunflower, organic agriculture, phytosanitary status, Botrytis cinerea, Plasmopara halstedii*

Funding. The research was carried out within the doctoral program on 411.09. Plant Protection" with the topic: "Integrated protection of sunflower in conventional and organic agriculture", and within the Subprogram 011102 „Expansion and conservation of genetic diversity, improvement of gene pools of agricultural crops in the context of climate change", funded by the Ministry of Education and Research of the Republic of Moldova.

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THE BEHAVIOR OF APPLES TREATED WITH THE ETHYLENE BIOSYNTHESIS INHIBITOR 1-MCP IN THE POST-HARVEST PERIOD

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Stable and high-quality apple harvests must be accompanied by the use of progressive methods of fruit preservation in the post-harvest period, which ensure fruit resistance to disorders caused by fungal diseases due to the application of growth regulators based on 1-methylcyclopropene.

The apple fruits studied were of the Gala Dark Baron variety, grown on the M9 rootstock, in the intensive culture system. To determine the effectiveness of treatment with ethylene biosynthesis inhibitors, the following experimental scheme was developed: 1. Control, no treatment; 2. Fitomag, 0.44 g/m^3; 3. Grand Fresh, 60 g/m^3; 4. Grand Fresh, 68 g/m^3. The fruits of the control and treated variants were placed in rooms with a normal atmosphere (CO_2 - 0.03%; O_2 - 21%). Storage temperature 0...+1 ^{0}C and humidity 92-95 %. The storage period was 150 days.

The firmness of apples in the control variant during the storage period decreased from 9.5 to 6.2 kg/cm^2, and in the variants treated with the ethylene biosynthesis inhibitor, it was 7.2 kg/cm^2. After five months of fruit storage, the firmness of apples in the control variant decreased by 34.8%, and in the variants treated with the ethylene biosynthesis inhibitor by 24.2-28.4%.

During the storage period of apples, the maximum intensity of ethylene emission was recorded in the control variant 3.4-13.7 ppm. Post-harvest treatment of fruits with Fitomag and Grand Fresh products reduced the intensity of ethylene emission to 1.8-2.7 ppm.

Treatment of apple fruits with Fitomag and Grand Fresh products contributed to maintaining the firmness of the fruits and reducing the intensity of ethylene release, both during storage and during the “shelf life” period.

The DA-Meter index allows determining the ripening of fruits based on the degradation of chlorophyll content, which decreases with the intensification of the process of ethylene emission from the apple. If in the case of the control variant the ripening index of apples was 0.44, then in the variants treated with the growth regulators Fitomag and Grand Fresh, it was 0.49-0.54.

Higher natural loss of fruits was observed after 5 months of storage in the control

variant - 3.8 %. Treatment of fruits with preparations based on 1-MCP (Fitomag and Grand Fresh) reduced the studied parameter, constituting 1.7-2.6 %. The difference between the variants treated with the ethylene biosynthesis inhibitor Grand Fresh, constituted 0.9 % in favor of the dose of 68 g/m^3.

The share of fruits damaged by *Botrytis cinerea* during storage in the Fitomag variant at a dose of 0.44 g/m^3 was 1.2 %, and when using the Grand Fresh growth regulator at a dose of 68 mg/m^3, such fruits were not detected. Keeping these apples for 7 days at room temperature (+18–22 ^{0}C) led to a slight increase in the share of fruits affected by fungal diseases, but not as in the control variant.

Treating fruits with products based on the ethylene biosynthesis inhibitor 1-MCP before placing in storage influenced the firmness of apple pulp, the share of ethylene emitted by fruits and increased the values of the DA-Meter index, increased the yield of standard fruits, decreased the degree of natural perishability, *Botrytis cinerea* diseases and extended the "shelf life" period of apples compared to the control variant.

Keywords: inhibition, ethylene, firmness, ripening, DA-Meter, physiological diseases

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THE BEHAVIOUR OF DIFFERENT ROOTSTOCK BIOTYPES FROM THE GENEVA GROUP DURING THE GROWTH AND FRUIT-BEARING PERIOD IN THE APPLE PLANTATION

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In the last 20 years, sustainable fruit growing has seen major changes in the implementation of new rootstocks from the Geneva group, characterized by stable growth, high, constant and quality yields, wide branch insertion angles, resistance to replanting diseases and insect infestation.

To study the behavior of trees of the Gala Nikangie variety grafted on M9, G11, G41 rootstocks and the Fuji King Grofn variety on the G11 biotype, on a replanted plot in the northern part of the country, an experiment was set up to analyze the development of variety/rootstock associations under the influence of the phenomenon of "soil fatigue". Planting distance 3.5 x 0.8 m.

The height of the trees during 2023 depending on the variety/rootstock association studied recorded values from 233 cm (Gala Nikangie/G11) to 348 cm (Fuji King Grofn/G11). The Gala Nikangie/M9 and Gala Nikangie/G41 associations had average tree height, constituting 251 and, respectively, 272 cm. A smaller crown width was obtained in the trees from the Gala Nikangie/M9 association – 112 cm, compared to Gala Nikangie/G11 (123 cm) and Gala Nikangie/G41 (126 cm). The Fuji King Grofn variety on the G11 biotype recorded an increase in crown width by 43.1 % compared to Gala Nikangie/G11.

The trunk circumference length in the associations studied ranged from 9.1 cm to 11.2 cm. The trees in the Fuji King Grofn/G11 association recorded a higher value of this index (11.2 cm), being 23 % more developed tree trunks compared to those in the control variant (Gala Nikangie/M9). The Gala Nikangie/G41 association recorded an increase of 18.6 % compared to the control variant, and Gala Nikangie/G11 had an insignificant increase, constituting 4.4 %.

The vegetative macrostructure of apple trees is correlated with the variety/rootstock association, a higher value being obtained in the Fuji King Grofn variety with the G11 rootstock (3814 cm), recording an increase of 278.1 % compared to the control variant, which recorded a total branch length of 1371 cm/tree. The Gala

Nikangie/G11 and Gala Nikangie/G41 associations recorded average values of 1683 cm/tree and 1752 cm/tree, respectively.

The number of fruits tied in the crown of the trees in the second year after planting the orchard varied from 13 pcs. (Fuji King Grofn/G11) to 31 pcs. (Gala Nikangie/G11). The associations Gala Nikangie/M9, and Gala Nikangie/G41, formed an average number of fruits, i.e. 20 and, respectively, 24 pcs/tree.

The average weight of a fruit varied insignificantly in the Gala Nikangie variety grafted on the G11, G41 and G41 biotypes, constituting 168 g, 171 g and, respectively, 180 g. The biological peculiarities of the variety influenced the value of the studied index, registering an increase of 30.4% for the Fuji King Grofn variety compared to Gala Nikangie, both grafted on the G11 rootstock.

Fruit production per unit area for the associations taken into the research was 10.4-18.9 t/ha. The association Gala Nikangie/G11 (18.9 t/ha) had a more pronounced influence on fruit production, followed by Gala Nikangie/G41 (15.4 t/ha), Gala Nikangie/M9 (12.0 t/ha) and Fuji King Grofn/G11 (10.4 t/ha) was in last place.

Keywords: apple, variety, rootstock, fruiting, harvest

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FREQUENCY OF HERBACEOUS PLANT SPECIES WITHIN BALTI URBAN ECOSYSTEM

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Balti urban ecosystem, is located in the Steppe Plain of the Lower Cubolta, which is part of the Steppe Balti District (VII). Previous studies indicate that it's flora obviously differs from the typical spontaneous zonal flora of the steppes.

In Balti urban ecosystem, research was conducted in 13 stations during the vegetation period using the linear transect method.

The purpose of the research was to assess biocenosis indices, such as the frequency and constancy of herbaceous plant species, in order to determine which species have greater plasticity and capacity to adapt to the conditions of the urboecosystem. *Species frequency* represents the ratio, between the number of sites where the species is recorded and the total number of sites analyzed. To assess the frequency of the species, there were sufficient qualitative data on its presence or absence in the resort. *Species constancy* represents an indicator that is assessed through the values of the frequency.

Depending on the frequency range, herbaceous species within Bălți urban ecosystem were classified into the following categories: Euconstant – with frequency values of 75 – 100 % – 16 species, (11 %). The most frequently encountered are the ruderal and segetal – ruderal species (*Bromus arvensis* L., *Polygonum aviculare* L., *Chenopodium album* L., etc.); Constant – whose frequency values of 50 – 75 % – 12 species, (8 %). The following species were included in this category: *Cychorium intybus* L., *Ambrosia artemisiifolia* L., etc.; Accessories – species with frequency of 25 - 50%, known as companions of the urbanization process. Were reported 37 species (25 %): spontaneous (*Trifolium fragiferum* L., *Butomus umbellatus* L., etc.) and ruderal (*Caucalis platycarpos* L., *Plantago lanceolata* L., etc.); Accidental species – with frequency of 0 – 25 % – are often species that accidentally ended up on the territory of the city were recorded. This category includes 85 accidental species (56 %): segetal-ruderal, ruderal, and spontaneous species (*Ajuga genevensis* L., *Salvia nemorosa* L., *Urtica dioica* L., etc.), the latter being at an advantage.

Keywords: Balti urban ecosystem, frequency, herbaceous species, segetal-ruderal, ruderal

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STUDYING THE POSSIBILITIES OF USING PHYSIOLOGICAL METHODS TO ASSESS HEAT RESISTANCE IN MAIZE BREEDING

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Maize is one of the most important food and forage crops in the world and in the Republic of Moldova. However, the high sensitivity of this crop to elevated temperatures, especially at critical stages of development (flowering, grain filling), leads to significant yield losses. As a weighty argument in favor of the formulated statement, it is necessary to cite the results of studies demonstrating a decrease in maize yield with an increase in temperature, for example, by 7.4 % for each degree Celsius.

Analyzing the advantages of physiological methods, the breeder's attention is focused on: a) the possibility of early diagnostics in order to reduce the timing of the breeding cycle; b) the objectivity of the measured physiological indicators, reducing the subjectivity of the phenotyping assessment; c) the high throughput of a number of physiological methods, allowing for the analysis of a large number of samples in a short time, which is important for mass screening in breeding; d) they contribute to a deeper understanding of the mechanisms of resistance by identifying specific physiological and biochemical changes underlying heat resistance, which determines the effectiveness of targeted breeding, e) and also reduce the need for long and expensive field trials under high-temperature stress conditions.

In this regard, the purpose of this study is to select methods for assessing the heat resistance of maize, which will allow achieving the main methodological goal - to expand the possibilities of searching for optimal tools for creating new maize hybrids characterized by tolerance to high temperatures.

Genotypes contrasting in FAO groups 100-499 from the maize collection of the National Center for Research and Seed Production of the Republic of Moldova were used as the object of this study. The methods used for heat tolerance assessment were grouped by specific evaluation parameters related to either vegetative or generative plant organs: statolitic starch; free proline content; cell membrane electrical conductivity; protoplasm viscosity of leaf mesophyll cells; stomata opening temperature; water retention capacity; leaf blade thickness; pollen viability and cytological characteristics.

In the experimental part, at the first stage of the research, an analysis of the selected methods for assessing the heat resistance of maize was carried out. At the second stage, the optimal method was selected, taking into account the requirements of the breeding process, allowing for screening of heat-resistant forms. It was found that the most acceptable object for express diagnostics of the resistance of the studied genotypes to heat is pollen. This generative organ demonstrated the adequacy of interpreting the results of its cytological genotyping. At the third stage, it was pollen that was used to modify the selected method of express diagnostics of maize genotype resistance to high temperatures. The results obtained determine the basic basis for the subsequent development of an algorithm for improving the methodology for creating maize hybrids adapted to heat conditions.

Keywords: maize, physiological methods, breeding, heat resistance, pollen

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THE CHALLENGES OF RESEARCHING CONSERVATION AGRICULTURE

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Adapting agriculture to climate change is a task that must be addressed in the coming years. The adaptation of agriculture to climate change should be seen as a challenge, and for survival, we need new agricultural systems. Old, intensive systems, which have also contributed to climate change, will be replaced by new agricultural systems with a high potential for adaptation and mitigation of climate change. This transformation is not easy; new agricultural systems must first be researched and evaluated.

Conservation agriculture, a farming system based on three principles - keeping the soil permanently covered with residues or cover crops, minimal mechanical disturbance of the soil (i.e., no-tillage), and crop diversity with at least three crops through associations and rotations - is slowly making its way into Moldovan agriculture, but at a very slow pace. The main problem is the lack of local knowledge and advanced experience. In 2022, at the "Porumbeni" Institute of Plant Breeding, short-term experiments were established to better understand the challenges of conservation agriculture research.

The experiments were set up in the field after harvesting winter wheat by drilling cover crops. In the conventional agriculture variant, soil was tilled according to recommended practices, while in the conservation agriculture variants, cover crops were drilled in mixtures and monocultures. In total, there were 7 experimental variants. In spring 2023, a hybrid corn (Porumbeni 391) was planted across all variants, with a planting density of 62,000 viable seeds per hectare. Planting was performed directly into crop residues and cover crops. During the growing season, observations and studies were conducted.

The highest water retention in the soil was observed in the conservation agriculture variant, where the soil was permanently covered with plant residues, and no cover crops were grown. Corn yield obtained in the tested variants can be considered the main indicator. The highest grain yield per hectare was obtained in the traditional agriculture variant, where the soil was tilled with a plow and disk harrows. The grain yield reached 5.41 t/ha. The lowest yield was recorded in the conservation agriculture variant, where winter vetch was used as a cover crop and

terminated after corn planting, with a yield of 2.50 t/ha. At first glance, the results seem clear, but we must note that in the variant where 2.5 t/ha of corn was harvested, an additional 10.5 t/ha of dry biomass of winter vetch was also produced.

Several issues have been identified that need to be addressed in the research of conservation agriculture. The most important are: cover crop management, selection of adapted hybrids, soil surface leveling, uniform distribution of plant residues, fertilizer application, and, not least, weed control.

Keywords: conservation agriculture, climate change adaptation, corn, cover crops

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SEASONAL ACTIVITY OF *Halyomorpha halys* IN THE CONDITIONS OF THE REPUBLIC OF MOLDOVA

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Halyomorpha halys (Stal), also known as the brown marmorated stink bug, is a dangerous invasive species characterized by high fecundity, a wide range of host plants, and strong adaptability. The expansion of *H. halys* across Europe and Asia has drawn scientific attention to its ecology and monitoring methods. The diurnal and seasonal activity of this pest is of great importance for developing early detection and control systems.

The data for this analysis were based on field observations conducted during 2023–2024 in the central and southern regions of the Republic of Moldova. Pheromone and light traps were used. Sampling was conducted weekly from April to October. Temperature parameters and day length were considered when analyzing seasonal dynamics.

Field observations revealed well-defined seasonal peaks in *H. halys* activity:

April – May: During this period, overwintered adult individuals emerge from shelters. The bugs actively move onto host plants for feeding. The pest is most commonly found on early-flowering ornamental and woody plants (lilac, maple, ash). The activity threshold is around 13 °C, and a sustained increase in daily mean temperature promotes adult activity.

June – July: The beginning of reproductive activity. Massive egg-laying is observed, especially in orchards, vineyards, and soybean fields. From late June, first-instar nymphs begin to appear. An increase in numbers is recorded on sticky panels and in pheromone traps. During this period, the average daily temperature exceeds 20 °C, which accelerates nymph development and contributes to the formation of a second generation.

August – September: The second and most intense activity peak. The highest numbers of adults, IV–V instar nymphs, and egg masses are observed. A third generation is formed. Pheromone traps capture the highest number of insects throughout the growing season. This stage is especially dangerous for crops (apple,

pear, grapevine), on which the bugs feed actively. Expansion to new areas is also possible during this time. The thermal conditions (25–30 °C) are favorable for rapid development.

October – November: Activity declines, but adult individuals are still captured in traps. The insects begin actively searching for overwintering sites, concentrating near buildings, warehouses, under bark, and in wood cracks. Light traps capture them in the evening hours. As the temperature drops below 10 °C, activity nearly ceases.

Thus, the seasonal dynamics of *H. halys* in the conditions of the Republic of Moldova are characterized by two main peaks: in June–July (reproductive phase) and in August–September (maximum density). Understanding these patterns allows for effective planning of pheromone monitoring and biological and chemical control measures.

Taking seasonal activity into account helps optimize population monitoring and enhances the effectiveness of control measures. This topic remains open for further research into the pest's diurnal activity, as knowledge of behavioral chronotypes supports more precise timing for placing pheromone and light traps, as well as for planning preventive treatments.

Keywords: seasonal activity, population, *Halyomorpha halys*, monitoring, peak activity

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EFFECT OF ESSENTIAL OILS ON THE FIRE BLIGHT DEVELOPMENT IN THE IMMATURE FRUITS

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Fire blight of rosaceous plants caused by the bacterium *Erwinia amylovora* is one of the economically most important diseases of the pome cultures. Chemical treatments demonstrate high effectiveness against fire blight, but are harmful to the ecosystems and forbidden in time of blossoming. Natural antibacterials represent the alternative to conventional plant protection practice and are under the active investigation. Essential oils, synthesized in aromatic plants have been shown to present significant inhibitory effects on bacteria, fungi, and viruses.

The aim of the present study was to evaluate the ability of the essential oils to inhibit *E. amylovora* growth in the immature fruit tissues.

Materials and methods. The immature fruits were inoculated with suspension of *E. amylovora*, treated with essential oil emulsions of *Mentha* spp., *Origanum vulgaris* L. sp. *nirtum*, *Monarda fistulosa* L., *Satureja montana* L., *Lavandula angustifolia* L. prepared using Tween 80. Immature fruits treated with essential oil emulsions were incubated in the humid chamber at 28^0C. Fruits, treated with sterile distilled water and with bacteria only, were used as the controls. Symptoms were recorded at 1, 2, 3, 5, 6 and 7 days after inoculation. The assessment of the degree of *E. amylovora* infection on the immature pear fruits was carried out according to the following scale: 0 – absence of the necrosis; 1– necrotic spots on the 5% of the fruit's surface; 2– necrotic spots on the 25% of the fruit's surface; 3 – necrotic spots on the 50% of the fruit's surface; 4 – necrotic spots on the 75-100% of the fruit's surface/ ooze formation.

Results and conclusions. Immature fruits infected with suspension of *E. amylovora* displayed the first symptoms of the fire blight, ooze formation and light necrosis, one day after inoculation. The degree of *E. amylovora* infection on the immature pear fruits inoculated with pathogenic bacteria and treated with essential oil emulsions on the seventh day of the experiment was the following: *M. piperita* — 2, *M. longifolia* — 2, *M. spicata* — 2, *M. piperita UsIgen* — 1, *O. vulgaris* sp. *nirtum*

— 1, *Monarda fistulosa* — 2, *S. montana* — 2 and *L, angustifolia* — 1. Thus, all essential oil emulsions used in the assays were able to inhibit *E. amylovora* growth in the immature fruits tissues. The most effective were essential oil emulsions of *O. vulgaris* sp. *nirtum*, *M. piperita UsIgen* and *L. angustifolia*.

The conducted experiments confirmed the inhibitory effect of essential oils on the fire blight pathogen. For the successful application of the essential oils as natural antibacterials in the plant protection practice against fire plight disease it is needed to determine the optimal ratio of their biological and economical effectiveness.

Keywords: fire blight, essential oil, antimicrobial activity

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EFFECTS OF DROUGHT AND HIGH TEMPERATURE ON SOME MORPHOLOGICAL TRAITS IN TRITICALE

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Triticosecale Wittmack, a hybrid of wheat and rye, is considered more tolerant to drought and high temperatures than wheat. Its high biomass production across diverse climatic conditions is attributed to a high rate of carbon assimilation due to stomatal physiology, as well as a low respiration rate.

In the context of climate change, the present study aims to identify sources of drought and heat tolerance in local triticale genotypes, based on morphological traits.

The study included the triticale genotypes Costel (C) and Ingen 54 (I), both known for their favorable biochemical and baking qualities, as well as the hybrids resulting from their reciprocal crosses (C × I and I × C). Pre-germinated seeds were placed between two sheets of filter paper in Petri dishes. Two experimental sets were prepared, with treatments including distilled water (control) and an aqueous solution of PEG 6000 (18 % w/v) to simulate humidity restriction (*HR*). All variants were kept in the dark at 22°C for five days. After this period, one set was subjected to a temperature of 43 °C for two hours, followed by a two-day recovery period at 22 °C to restore physiological processes.

Phenotypic variability was recorded for the traits: *Germination Potential* (*GP*), *Root Length* (*RL*), *Shoot Length* (*SL*), *Root Dry Mass* (*RDM*), and *Shoot Dry Mass* (*SDM*) at five and seven days of cultivation. The phenotypic response to water and heat stress was assessed using the *Plant Vigor Index* (*PVI*), while the *Tolerance Index* (*TI*) was used to evaluate trait-specific stress tolerance.

In the Control group, *GP* ranged from 53.3 % to 73.3 %. Under *HR* and combined *HR + T* treatments, *GP* declined in the Costel parent (-27.4 % and -16.7 %), as well as in the hybrids C × I (-54.0 % and -16.0 %) and I × C (-23.6 % and -15.7 %), indicating moderate tolerance along with varying degrees of susceptibility. The Ingen 54 parent exhibited susceptibility to *HR* (-48.4 %), high temperature (-39.4 %), and the combined stress (-43.9 %). In both hybrids, the RL/SL ratio (1.6–1.7) was inherited in an intermediate manner.

The *HR* treatment significantly increased *RL* only in *Costel*, while *SL* was significantly reduced across all genotypes. Overall *PVI* results indicated low susceptibility in *Costel* and the I × C hybrid, but high susceptibility in *Ingen 54* and the C × I hybrid.

Under heat stress, the reciprocal hybrids demonstrated high *TI* values for *RL* and *RDM*. All four genotypes exhibited high *TI* values for *SDM*. Tolerance to high temperature for *SL* (25.5 –60.7 %) and *SDM* (24.8 %–63.6 %) was inherited by the hybrids from the *Ingen 54* parent.

In response to the combined *HR* + *T* stress treatment, *Ingen 54* and both reciprocal hybrids exhibited increased *TI* values for all studied traits compared to *HR* alone. However, when compared to the response to heat stress alone, the combined abiotic stress resulted in decreased *TI* values for all traits in *Ingen 54* and the I × C hybrid. Priming, induced by moderate drought (PEG 18 %), and appeared to enhance the phenotypic response under combined *HR* + *T* stress in most of the examined traits.

Keywords: plant vigor index, reciprocal hybrids, tolerance index, *Triticosecale* Wittmack

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APPLICATION OF BACTERIAL-FUNGAL SUSPENSION FOR PLANTS PROTECTION FROM PESTS IN GREENHOUSES

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Especially dangerous pests in all types of greenhouses include the common spider mite, several types of aphids, greenhouse whitefly, and thrips. All of them are polyphagous characterized by a high potential for reproduction that cause significant harm. The use of chemical pesticides in greenhouses is significantly limited. Therefore, in greenhouse olericulture, protective measures are often supplemented with biological methods of pest control. To protect plants from pests in greenhouses, hyphomycetes of the genus *Lecanicillium* (syn. *Verticillium*) and the bacterium *Bacillus thuringiensis (Bt)* are commonly used.

A key focus of biological protection is the development and use of mixed, complex biological preparations. These agents enhance biological efficiency, expand the spectrum of action, and increase multifunctionality.

The aim of this research was to evaluate the biological efficacy of working suspensions of the hyphomycete *Lecanicillium lecanii* R. Zare & W. Gams (2001), strain 2T20, the bacterium *Bacillus thuringiensis* var. *thuringiensis*, and their mixtures in suppressing populations of melon aphids and red spider mites on cucumber plants under greenhouse conditions.

The strains were cultivated in liquid nutrient media on a shaker at 200 rpm. The hyphomycete *L. lecanii* was grown in a sucrose-molasses medium for 96 hours at 24 °C. For pest control applications, the resulting suspension was diluted with water to a concentration of 3.5%, corresponding to a titer of 3×10^7conidia/ml. The bacterium *B thuringiensis* var. *thuringiensis* was cultivated in a polysaccharide nutrient medium for 48 hours at 30 °C. To prepare the working solution, the suspension was diluted with water to a final concentration of 5 %.

To obtain a bacterial-fungal mixture, the required volumes of each suspension were combined and diluted with water to the desired final volume. Pest mortality was assessed 7–12 days after plant treatment.

The biological efficacy of an aqueous suspension of *L. lecanii* at a concentration of 3.5 % in reducing melon aphid populations was 89.9 %, and 92.7 % in reducing

spider mite populations. The bacterial suspension of *B. thuringiensis* at a concentration of 5.0 % reduced aphid numbers by 89.1 % and spider mite numbers by 91.1 %. The biological efficacy of the combined suspension of the fungus *L. lecanii* (3.5 %) and the bacterium *B. thuringiensis* (5.0 %) was 91.7 % against melon aphids and 93.8 % against spider mites. The study showed that the combined use of two biological plant protection agents, i.e. *L. lecanii* (contact action) and *B. thuringiensis* var. *thuringiensis* (intestinal action) resulted in higher pest mortality in melon aphids and spider mites under greenhouse conditions compared to the use of each agent separately.

For active growth of hyphomycete *L.lecanii* and reduction of pest population in greenhouse conditions it is necessary to maintain relative air humidity not less than 85%.

Keywords: mixture of suspensions, sucking pests, greenhouse, *Aphis gossypii, Tetranychus urticae, Lecanicillium lecanii, Bacillus thuringiensis*

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BACTERIA STRAINS WITH THE POTENTIAL TO SYNTHESIZE SUBSTANCES WITH ENHANCED ANTIMICROBIAL ACTIVITY

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It is known that bacteria, in particular *Bacillus* spp. are capable of producing in the medium various secondary metabolites, diverse in function and structure, such as peptide antibiotics like gramicidins, bacitracins and tyrocidins that possess pronounced antimicrobial activity. Therefore, the search for pathways to stimulate the synthesis of exometabolites produced by bacterial strains with pronounced antimicrobial activity becomes significant and attracts much more attention. The given study aimed to fortify the ability of microorganisms to synthesize bioactive substances with antimicrobial effect with the use of iron oxide nanoparticles (NPs) as stimulators.

Three strains of *Bacillus* spp. bacteria deposited in the National Collection of Nonpathogenic Microorganisms as objects of biotechnological interest were used in this research: *B. subtilis* CNMN-BB-10, *B. velezensis* CNMN-BB-12 and *B. velezensis* CNMN-BB-16. Cultivation was carried out on NB medium at +30 ºC for 48 hours by continuous shaking at 180 rpm. Fe_3O_4 NPs (IONPs) were used as stimulators, added in the medium at concentrations of 5, 10 and 15 mg/L. After 48 hours of incubation, the biomass was separated from the culture liquid by centrifugation to obtain cell free supernatant (CFS), then antimicrobial activity was determined by well plate method, on bacteria strains *Agrobacterium tumefaciens* CNMN-AB-01, *Corynebacterium michiganense* CNMN-CrB-01, *Erwinia carotovora* CNMN-BE-01 and *Xanthomonas campestris* CNMN-BX-01; and fungi *Fusarium oxysporum*, *F. solani*, *F. graminearum*, *Aspergillus fumigatus* and *A. flavus*. For well method, a quantity of 100 µL CFS was poured into wells of 8 mm diameter in Petri plates with medium already containing inoculated bacterial or fungal strains. After, 48 hours of bacteria incubation and 3-5 days of fungi incubation, the diameter of the growth inhibition zones was measured.

The results obtained after cultivation of *B. subtilis* CNMN-BB-10, *B. velezensis* CNMN-BB-12 and *B. velezensis* CNMN-BB-16 in the presence of IONPs, demonstrate increased antimicrobial activity at all studied concentrations. Of the bacterial strains the most sensitive was *A. tumefaciens* CNMN-AB-01, where the zones of inhibition of its growth and development exceeded the control sample by 25-36 %, and the growth and development of *E. carotovora* CNMN-BE-01 and *X. campestris* CNMN-BX-01, was inhibited by more than 17-22 %, in comparison with control. In contrast, growth and development of fungal strains of *Fusarium* spp. was totally inhibited in the presence of IONPs, in comparison with area of about 20 mm produced by the control. Growing the bacteria on media supplemented with 5 and 10 mg/L IONPs, also leads to the growth of *Aspergillus fumigatus* and *A. flavus* strains being stopped, and with their increase the inhibition is manifested in areas between 21-30 mm, depending on the strain.

Thus, it was established that iron oxide NPs, supplemented in the culture medium of some bacterial strains, stimulate the biosynthesis processes of bioactive substances in the medium with enhanced antibacterial and antifungal activity, and as a result the obtained products can be used with biotechnological and medical applications.

Keywords: bacteria, antibacterial and antifungal activity, iron oxid nanoparticles

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PATHOGEN IDENTIFICATION AND SCREENING OF CONTROL AGENTS FOR BASAL STEM ROT OF *Schisandra chinensis*

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Schisandra chinensis (Turcz.) Baill., a perennial deciduous woody vine belonging to the family *Schisandraceae*, is widely distributed in northeastern China, particularly in Jilin, Liaoning, and Heilongjiang provinces. Its dried fruits are commonly used in traditional Chinese medicine, especially for the treatment of respiratory system diseases. In recent years, a new disease affecting *S. chinensis* has been observed in the Jilin production area. The disease is characterized by drying and rotting of the basal stem near the ground, eventually leading to wilting and death of the entire plant. This symptom is distinct from previously reported root rot and has been preliminarily designated as "basal stem rot of *S. chinensis*".To date, there have been few reports domestically or internationally regarding this disease and its causal pathogen, and effective control strategies remain limited. In this study, typical diseased samples were collected from Jilin City, Jilin Province. The pathogen was isolated and purified using tissue isolation and culture techniques. Its pathogenicity was confirmed, and morphological characteristics and molecular methods were employed for identification. In addition, the biological characteristics of the pathogen were studied, and effective fungicides were screened.The results showed that the isolate WWZ-P1 formed circular colonies with regular edges on PDA medium. The colony surface was dense and covered with felt-like aerial mycelia, displaying a concentric color pattern from the center outward: pinkish-white, peach-pink, and white. The reverse side of the colony appeared rose-red at the center and bright red at the margins. According to Koch's postulates, the pathogen re-isolated from inoculated, diseased plants was identical to the original isolate, confirming its pathogenicity. Based on morphological and molecular identification, the pathogen was identified as *Fusarium acuminatum*. Biological studies revealed that the optimal growth of the pathogen occurred at 25 °C under a 12 h light/12 h dark photoperiod. It grew well in the pH range of 7.0-9.0. The most suitable culture medium was oatmeal agar (OA), with soluble starch as the optimal carbon source and sodium nitrate as the optimal nitrogen source. Fungicide

screening showed that all ten tested fungicides exhibited varying degrees of inhibitory effects against the pathogen. Among them, 25% tebuconazole wettable powder and 50% carbendazim wettable powder exhibited significant antifungal activity at a concentration of 300 mg/L, with inhibition rates of 89.2% and 94.5%, respectively, indicating their potential as preferred fungicides for controlling basal stem rot of *S. chinensis*.

Keywords: *Schisandra chinensis*, basal stem rot, *Fusarium acuminatum*, fungicide

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AUTOMATIC MONITORING SYSTEM FOR PHYTOSANITARY RISK ASSESSMENT IN APPLES ORCHARDS

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Efficient pest monitoring is essential for sustainable apple orchard management. Pest development is a function of interactions among the components of the agricultural system. Canopy microclimate determines the rate of pest development. This study aims to evaluate opportunities to use the online system EcoBioNet for pest risk analysis. We evaluate the use of automated pheromone traps equipped with digital cameras and AI-based image recognition software for monitoring codling moth (*Cydia pomonella*), a key pest in apple production. EcoBioNet is a GIS tool designed to solve multiple-criteria classification, optimization of forecasting and pest control systems and pest risk analysis in integrated plant protection. EcoBioNet include 4G digital pheromone trap and the system for identifying harmful organisms. The system works online and allows the construction of development graphs of harmful and beneficial organisms, system for monitoring and evaluating weather conditions, phenology forecasting system and BioClass GIS system for decision support and risk assessment.

Interactions among microclimate components on codling moth (*Carpocapsa pomonella L* using GIS technologies was studied. GIS technology was used to identify zones with different risk of developing harmful organisms and to develop disease and pest forecasting models and methods. For modeling, maps of the sum of active and effective temperatures were constructed by the Kriging interpolation method. The precision of beginning of the continuous flight of apple coddling moth (*Cydia pomonella* L.) and the calendar date for the first and second treatment in the orchards with a high and medium density of the pest were calculated. The accuracy of the forecast model for different sectors was 1 – 3 days.

On the other hand, the treatments are only justified once the population of an insect pest reaches a certain level. The EcoBioNet system was used to identify pest economic damage thresholds in space. The system enables real-time detection,

population density assessment, and flight dynamics analysis directly in the field. Field tests demonstrated comparable accuracy to traditional "Delta" traps, with significantly reduced labor and time input.

The results confirmed that the EcoBioNet system can be used for the online agro-ecological classification of the territory at household, region, country level and to provide farmers' consultation centers and forecasting stations with precise information for pest risk analysis. Information from pest models can be used to simulate and predict the intensity and potential pest threat. For decisions support, an online version of the Phenology Forecast and Solutions module was developed and is located on http://www.ecobionet.com.

Keywords: pests, *Cydia pomonella*, risk assessment, models, image recognition, decision making

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BIOTECHNOLOGICAL APPROACHES TO COMBAT FOLIAR PHYTOPATOGENS OF VINE

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Against the background of climate change and the change in the phytosanitary status of vines, there is an increase in epidemiological indicators and the impact of phytopathogens, which determines the application of modern biotechnological achievements to combat them. Particularly serious are the losses caused by *Uncinula necator, Plasmopara viticola* and *Botrytis cinerea,* which attack not only European varieties, but also hybrid ones. Starting from the aggravation of phytosanitary problems, the purpose of this article is to promote biotechnological achievements aimed at maintaining the quantity and quality of wine and grape products.

The materials and methods consist of the identification of biological products to combat biological agents will allow the improvement of integrated protection programs in conventional and organic farming systems. Methodological procedures and systemic approaches have been applied, as a tool of complexity management and as one of the essential paradigms of the future. Testing under laboratory conditions and in the field of experiment was carried out in 4 randomized trials, respectively, in accordance with the general requirements of experiments of this kind.

The histological analysis of the entities that populate the foliar apparatus of hybrid varieties and the determination of the biodiversity and taxa found in the foci of development of vine leaf pathogens, were the basis for highlighting and identifying a wide range of epiphytic microorganisms. Starting from the needs of reducing biotic and abiotic stresses associated with leaf surface, epiphytic microorganisms are oriented towards the establishment of microhabitats capable of protecting host plants.

To survive abiotic stress on the leaf surface, many microbes form biofilms composed of extracellular polysaccharides for cell aggregation and are resistant to drying, antimicrobials and reactive oxygen species, which are important for plant protection. The physical proximity of different microbial species in a stressful environment supports a high rate of horizontal gene transfer, especially for the exchange of plasmids and genes. Particularly important is the secretion of enzymes such as chitinases, esterases and lipases, which can release nutrients from the cuticle

and increase the permeability of the epidermis. Epiphytic microorganisms produce siderophores containing iron chelates to increase iron absorption, which is the basis for combating fungal and bacterial pathogens.

In order to apply the capacities of epiphytic communities, it becomes necessary to highlight the similarities between epiphytic and phytopathogenic adaptations manifested in the production of plant hormones, the production of surfactants and the suppression of defenses, which cause the environment around pathogens to change, reducing penetration capacities and behaving as epiphytes during early leaf colonization.

In conclusion, we mention that the application of the capacities of the epiphyte communities requires the development of research models of the interactions between microorganisms and the host plant, as well as the opening of the paths of biotechnological achievements oriented to the biological control of phytopathogenic agents and the strengthening of plant health.

Keywords: biological preparation, biotechnology, epiphytic microorganisms, plant health

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IMPROVING SPONTANEOUS FERMENTATION: MICROBIAL AND SENSORY EVALUATION OF FORTIFIED PIED-DE-CUVE IN FETEASCA NEAGRA WINES

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The "pied-de-cuve" (PdC) method, which involves initiating fermentation with must that has already begun spontaneous fermentation, holds great potential for capturing the complexity and typicity of the local microbial terroir. However, spontaneous fermentation can sometimes lead to the development of off-flavors, compromising wine quality. This study aimed to evaluate the effectiveness of a fortified PdC technique - where wine is added during PdC preparation, in enhancing fermentation stability and aromatic quality. Using the Feteasca Neagra grape variety, two PdC approaches were compared: a spontaneously fermented PdC (Group P) and a fortified PdC (Group F), alongside a control group (Group C) inoculated with commercial dry yeast.

High-throughput sequencing (NGS) was employed to investigate the microbial succession in both PdC experimental groups. The results revealed that the spontaneous PdC group (P) contained a higher proportion of non-*Saccharomyces* yeasts and unclassified microorganisms during fermentation. In some samples, *S. cerevisiae* was present in insufficient quantities, which likely contributed to the emergence of aroma defects. In contrast, the fortified PdC group (F) showed greater microbial stability: the addition of wine early in the process helped suppress potentially spoilage-associated microbes and allowed *S. cerevisiae* to rapidly dominate the fermentation. This led to a more controlled microbial community structure and a more consistent fermentation process.

These findings demonstrate the profound impact of PdC preparation methods on microbial dynamics and provide valuable insights into the relationship between microbial ecology and wine quality. In summary, the fortified PdC approach represents an effective alternative to spontaneous fermentation, combining the benefits of indigenous microbiota with improved fermentation control, ultimately enhancing the aromatic profile and sensory appeal of the final wine.

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ANALYSIS OF SEASONAL POPULATION DYNAMICS OF *Halyomorpha halys* ON VARIOUS ORNAMENTAL PLANT SPECIES

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Invasive pest *Halyomorpha halys* (brown marmorated stink bug) poses a serious threat to both agricultural and ornamental plants in the Republic of Moldova. This species is native to China, Japan, and the Korean Peninsula. In Europe, Halyomorpha halys was first detected in 2004. In 2019, the invasive species was recorded for the first time in the Republic of Moldova. In recent decades, *Halyomorpha halys* has become a significant pest of globally important fruits and vegetables. This species is one of the most challenging pests to control due to its high mobility and polyphagous feeding behavior, which enables it to rapidly colonize new territories. Even small populations can cause considerable damage to crops. In recent years, active spread of this pest has been observed within urbanized areas, where ornamental plants play a significant role in supporting its life cycle.

The aim of this study is to determine the seasonal population dynamics of *H. halys* on various ornamental plant species in the urban environment of Chisinău.

Materials and Methods. Monitoring was carried out during the 2024 growing season (April–October) on the territory of the Institute of Genetics, Physiology and Plant Protection. Four widespread ornamental plant species were selected: lilac (*Syringa vulgaris*), tree ailanthus (*Ailanthus*), hibiscus (*Hibiscus syriacus*), and sea buckthorn (*Hippophae rhamnoides*). Pest population counts were conducted twice a week using visual observations, recording the number of adults, nymphs, and egg masses.

Results and Discussion. The results showed that the highest number of adults was observed in July on ailanthus (an average of 15.4 individuals per plant), while the peak abundance of nymphs was recorded in June and August on lilac and hibiscus. The lowest pest activity was noted on sea buckthorn throughout the entire observation period. Air temperature had a significant influence on pest activity: when the temperature dropped below +18 °C, the number of insects on plant surfaces sharply decreased.

Egg masses were most often found on the underside of syringa and hibiscus leaves. The average number of eggs per mass was 26–28. Despite the high number of adults on ailanthus, the level of reproductive activity was lower (average number of egg masses per plant – 1.3).

Conclusions. Seasonal monitoring of *Halyomorpha halys* on ornamental plants has demonstrated the importance of continuous population surveillance throughout the entire vegetation period. The identified plant species preferences and seasonal fluctuations in population density will contribute to the development of more effective strategies for controlling and protecting plants from this invasive pest. Thus, ornamental plants, especially lilac and ailanthus, play an important role in sustaining and reproducing *H. halys* populations in urban environments. The data obtained emphasize the necessity of including ornamental plantations in phytosanitary monitoring systems, particularly in urbanized areas.

Keywords: *Halyomorpha halys*, seasonal dynamics, ornamental plants, invasive species, population monitoring

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NEW POTATO VARIETIES FOR IDENTIFYING POTATO WART PATHOTYPES IN UKRAINE

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Wart is the most dangerous quarantine disease for potato. It is caused by intercellular obligate pathogen *Synchytrium endobioticum* (Schilb.) Perc. Potato wart determines in 31 countries throughout the world as per data of European and Mediterranean Plant Protection Organization (EPPO). Present disease harms potato in many countries. New aggressive pathotypes determined in these countries. There are more than 40 aggressive pathotypes of wart causative agent as per data of Van de Vossenberg B. T. L. H. et al. The most spread pathotypes in Europe are: *S. endobioticum* 1(D1) – Dalem or common; aggressive 2(G1)-Gissuble (Germany), 6(O1)-Olpe (Germany) and 18(T1)-Tranroda (Poland).

The following pathotypes recorded in Ukraine: common (Dalem) pathotypes (D1), it is spread in Chernivtsi region and 4 aggressive: 11(M)-Mizhirrya, 13(R2)-Rachiv, 18(Ya)-Yasynnya spread in Zakarpattia region and 22(B) Bystrytsya, spread in Ivano-Frankivsk region. Ukrainian and European potato test-assortment uses for identifying Ukrainian potato wart pathotypes. The identifying Ukrainian potato wart causative agents defeating *Synchytrium endobioticum* (Schilb.) Perc conducted in laboratory terms on following cultivars: Deodora, Tomensa, Eisterling, Producent, Combi, Saphir, Delcora, Miriam, Caroline, Ulma and additional assortments Asche Saemling, Desiree, Talent, Universal, Gievont, Blank, Baltyk, Irga, Nicola, Gavin, Evora, Spunta, Otolia, Megusta.

There were determined sensitive to defeating potato all wart European pathotypes causative agents in laboratory terms. Among them were:Deodara, Tomensa and Eisterling.There were determined defeating in cultivars Producent, Combi, Saphir, Delcora, Miriam- basic test-assortment and Asche Samling, Desiree, Talent, Universal, Gievont, Blanik, Baltik, Irga, Evora, Spunta, Otolia during infecting zoospores of 11 (Mizhirya) pathotype.

2assortment) and Asche Samling, Desiree, Talent, Universal, Gievont, Blanik,

Baltik, Irga, Evora, Spunta, Otolia from additional test-assortment during 13 (Rachiv) pathotype infecting.

The basic test-assortment reaction to 18 (Yasynnya) aggressive pathotype was the same as 11 (Mizhirrya) pathotype, excluding cultivar Delcora. There were defeated all cultivars from additional test-assortment, excluding Otolia and Megusta.

The 22 (Bystrytsya) patyhotype defeating reaction was the same as defeating reaction of 13 (Bystrytsya) pathotype excluding cultivar Asche Samling, Desiree and Talent. Testing cultivars of potato Karolin, Ulme and Megusta were not defeated any potato wart pathotypes.

So, European potato test-assortment complicate the accurate bordering of Ukrainian pathotypes. Cultivars Combi, Saphir, Miriam, Giewont, Blanik, Irga, Evora and Spunta, because they give the same reaction on pathotypes defeating. So for identifying our Ukrainian pathotypes renew the basic test-assortment of new cultivars Cardyma, Acoustic and Evroviva. Cultivar Cardyma defeated only 18(Ya) Yasynnia pathotype: cultivar Evroviva defeated 13(R)-Rachiv and 18 (Ya) Yasynnia pathotypes. Cultivar Acoustic defeated only 22(B) - *Bystrytsia* aggressive pathotype. New cultivars showed different reaction on our Ukrainian potato wart causative agents defeating and proposed as test-assortment-differentiators for pathotypes identification and new wart causative agents isolates determination.

Keywords: wart, potato, evaluation. pathotypes, identification

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Section E

Conservation and Utilization of Genetic Resources

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AGRICULTURAL PLANT GENOTYPES - AN EFFICIENT METHOD OF CAPTURING CARBON FROM THE ATMOSPHERE

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Based on greenhouse gas inventory calculations, it was found that currently the amount of CO_2 in the atmosphere has exceeded 430 ppm, which leads to the disruption of the balance of climatic factors on the planet. Thus, the imbalance of climatic factors is a continuous phenomenon, which unfolds very rapidly over time, and certain genotypes of living organisms will fail to adapt to the new habitat conditions. The present study aimed to use the light saturation curve method for photosynthesis to determine grapevine genotypes that have an increased coefficient of carbon capture from the atmosphere.

For the purpose of this study, grapevine genotypes of intraspecific origin from the group: *Vitis vinifera* L. ssp. *sativa* D.C. were trained, such as: Muscat de Alexandria, Sauvignon, Cabernet-Sauvignon, etc. and genotypes of interspecific origin *Vitis vinifera* L. ssp. *sativa* D.C. x *Muscadinia rotundifolia* Michx., such as: Ametist, Alexandrina, Augustina, etc. Determination of the capacity to capture CO_2 from the atmosphere was carried out using the light saturation curve method for photosynthesis, using the PTM-48A phytomonitor. The intensity of physiological indicators was determined as: photosynthesis, stomatal conductance, real assimilation, total respiration, photorespiration, transpiration, etc. The time period for estimating the activity of physiological factors was 72 consecutive hours.

Land used for forestry, agriculture, recreation, etc. is an efficient and profitable way to reduce carbon emissions from the atmosphere. Therefore, the efficiency of carbon capture on these lands depends on the capture potential of the plant genotype used, thus requiring the creation of plant genotypes that have an increased potential to capture CO_2 from the atmosphere.

Analyzing the intensity of photosynthesis, using the light saturation curve method for photosynthesis, in grapevine genotypes of intraspecific origin *Vitis vinifera* L. ssp. *sativa* D.C., it was found that the Sauvignon variety has an average intensity of photosynthesis of 2.2 micromol(CO_2)/m^2*s; Muscat de Alexandria – 1.7 micromol(CO_2)/m^2*s etc.

The interspecific rhizogenic grapevine genotypes *Vitis vinifera* L. ssp. *sativa* D.C. x *Muscadinia rotundifolia* Michx. have a photosynthesis intensity as follows: BC_3-580 – 4.3 micromol (CO_2)/m^2*s; Augustina – 3.8 micromol (CO_2)/m^2*s; Ametist – 4.8 micromol (CO_2)/m^2*s; Alexandrina – 3.1 micromol (CO_2)/m^2*s. Also, these genotypes are cultivated on their own roots in a biological regime and have increased adaptability to climatic factors. At the same time, they have a carbon capture coefficient from the atmosphere twice as high compared to the intraspecific genotypes *Vitis vinifera* L. ssp. *sativa* D.C.

In conclusion, we find that the average annual temperature for the period 2002-2024 is 10.8°C, compared to the average annual temperature, the norm calculated on the territory of the Republic of Moldova, is increasing by 1.33°C. The interspecific rhizogenic genotypes of grapevine *V. vinifera* L. ssp. *sativa* D.C. x *M. rotundifolia* Michx.: Ametist, Alexandrina, Augustina, etc. present a double coefficient of carbon capture from the atmosphere in relation to the intraspecific genotypes, as well as an increased adaptability to climatic factors.

Keywords: genotypes; saturation curve; photosynthesis; carbon footprint

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THE OIL CONTENT OF GRAPEVINE SEEDS

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Every year, wineries accumulate impressive quantities of pomace, which, after separating the fractions, extract the seeds for further processing for various purposes. By-products, resulting from the processing of grapes, constitute approximately 20% of the total processed mass, consisting of bunches, berry skins, seeds and various sediments from must and wine. This is the raw material for the production of grape seed oil, feed products, food products, abrasive materials, oenotannin, etc.

This work aimed to quantitatively compare the oil content in the seeds of genotypes of intraspecific and interspecific origin of grapevine, as well as in relation to the color of the berries.

The object of the study was the seeds collected from intraspecific grapevine genotypes, such as: Fetească neagră, Fetească regală, Merlot, Sauvignon, as well as interspecific rhizogenic grapevine genotypes, such as: Ametist, Alexandrina, Tethys, etc. The studied seeds were extracted from fresh berries. The amount of oil (%) and the weight of the seeds (mg) were determined. The determination of the oil content in grapevine seeds was carried out by the NMR (nuclear magnetic resonance) relaxometer method, comparing the amplitude of the echo signal from the seeds with that from a set of calibration standards. The selection of the standards is determined by the natural biochemical composition of the seeds.

Grape seed oil is a compound very rich in antioxidants, especially vitamin E and essential fatty acids, such as linoleic acid, which contribute to maintaining the activity of the cardiovascular, circulatory and immune systems. Grape seeds contain oils ranging from 9.9 to 20.6 % of the dry mass.

Determining the oil content of grapevine seeds from intraspecific genotypes with yellow-green berries, it was found that they contain approximately 13.8-13.7 % oil (Fetesca regală, Sauvigon), while seeds from interspecific genotypes with yellow-green berries have 13.45-14.46 % oil (Alexandrina, Sarmis, etc.).

Grapevine seeds from intraspecific genotypes with blue-violet berries contain 13.5 % oil (Fetească regală) and 16.6 % oil (Merlot), while seeds from interspecific genotypes with blue-violet berries contain 11 % oil (Ametist) and 15.35 % oil (Sor).

Considering the average weight of the seeds included in the study, we observed that grapevine seeds of intraspecific origin weigh on average 30.4 mg and the average amount of oil is 14.4 %. Grapevine seeds of interspecific origin weigh on average 33 mg and the average amount of oil is 13.9%.

Taking into account the berry color of the of the studied grapevine genotypes, it was found that grapevine seeds of genotypes with yellowish-green berries contain an average of 14.4 % oil, and seeds of grapevine genotypes with blue-violet berries contain an average of 13.54 % oil.

Grapevine seeds, taking into account the fact that they contain valuable derivatives of oily substances, so necessary to maintain the activity of the human body, demonstrate that they can serve as raw material for obtaining and using these seed oils. A greater amount of oil can be extracted from grape seeds extracted from the grapevine before the fermentation process begins than from seeds extracted after the grapevine fermentation process has occured.

Keywords: genotype, seeds, oil, grapevine, relaxometery

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Marssonina juglandis (Lieh.) ON RESISTANT AND SENSITIVE FORMS OF WALNUT

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Ukraine takes 7th place in the globally volume of walnut cultivation. The annual production consisted of more than 87.2 thousand tones from 1994 through 2022. The walnut's yield increase often stops by number of diseases. Blotch (also known as Walnut brown spot) is one of the dangerous diseases. This disease affects all walnut trees in all cultivated regions. It causes significant damage to plantings. The disease is caused by a fungus *Ophiognomonia leptostyla* (Fr.) Sogonov (*Marssonina juglandis* P. Magn.). The pathogen affects leaves, young shoots and fruits. Blotch is a very harmful disease for fruits. Young defeated nut fruits deform and fall prematurely. The yield may decrease on 30-50% during severe disease development. The **goal** of our research was to study the pathogen development dynamics on various resistant forms of walnut, which will optimize measures to protect the crop from a dangerous disease.

Methods. The researches conducted on Walnut plantations of Ukrainian Science Research Plant Quarantine Station IPP during 2023-2024. The disease spread and development records conducted using generally accepted methods.

Research results. The first blotch's signs were recorded in the first ten days of June in the form of separate spots on sensitive walnut's forms. The leaves defeating consisted of 0.9%. The disease development was consisted of 0.2%.The fruit defeating was not observed on trees. The walnut's plants observation conducted on the areas of UkrSRPQS IPP. No sign of leaves and fruits blotches were recorded on nut's resistant forms. The defeating and disease development on walnut's sensitive forms consisted of: on leaves — 3.7% and 1.4% respectively, during the next record. It was conducted at second ten-days of July. The leaf damage reached only 0.2%, and the disease development — 0.05%; fruit damage was not recorded for this period in resistant walnut forms. The first signs of damage on the resistant forms of walnuts fruits by blotch were recorded in the third August ten-days — the damage level was 1.0%, and the disease development — 0.2%. At the same time, on susceptible forms

of culture, fruit damage reached 5.5%, with disease development at the level of 2.2%. The whole walnut's plant intensity reached 57.9% and disease development 23.1%, in the first September ten-days and during the last recording day. These indicators were significantly less: the defeating consisted of 16.5%, the disease development was 7.4% on resistant forms.

Conclusions. The disease development dynamics observation showed a significant difference in defeating resistant and susceptible forms of walnut; the damage intensity of sensitive forms was 57.9%, while resistant forms were only 16.5%. The walnut's resistant forms growing allow to reduce the plants defeating intensity on 3.5 times, and disease development in 3.1 times.

Keywords: walnut, brown spot, development, resistance, susceptible forms

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CULTURE OF THE CLARY SAGE (*Salvia sclarea* L.) IN THE REPUBLIC OF MOLDOVA

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Salvia sclarea L. is a species with a special value due to the multiple uses of its essential oil. This crop, at a European level, is planted on extensive areas. In the past, the Republic of Moldova was a major producer of essential oils. Only 15-17 % was made up of clary sage oil, which was produced in 20 specialized agricultural farms, equipped with technical and material resources and specialists in the field. The clary sage varieties cultivated in the MSSR during the 1960s-1970s were created outside our country.

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 research included inbred lines, hybrids of various types/complexity and varieties. The experiments were carried in accordance with internationally accepted methods for this crop. 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 creation of clary sage varieties using modern methods, including the development of male-sterile inbred lines, began in the Republic of Moldova in 1978. In recent years, the diversification of the initial breeding material for clary sage has continued, using for this purpose various methods of hybridization - simple, double, trilinear. The hybrid genotypes created are the result of multiple researches over several generations of hybrids and served as the basis for the development of clary sage varieties. The created varieties were implemented in various agricultural units. According to the results obtained, it was found that clary sage varieties accumulate a higher content of essential oils in dry years compared to the years with normal atmospheric precipitation. 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 formation and adherence to cultivation technology.

Inbred lines with valuable breeding traits were developed and selected for inclusion in various hybrid combinations. Based on the research conducted, several lines with an essential oil content of over 1.5% have been identified: AP 97-11 S6– 2.250 %; AP 30-11 S6– 1.912 %; AP 32-11 S6– 1.719 %; NC 98-11 S6– 1.810 %; NC 11-11 S6– 1.753 %; NC 38-11 S6– 1.646 %; NC 98-11 S6– 1.810 %, etc. These represent exceptional material for creating hybrids of varying complexity. Hybrids with high essential oil content were identified, confirming theier ability to withstand drought conditions.

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

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ENVIRONMENTAL MONITORING THROUGH *Phragmites australis*: HEAVY METAL ANALYSIS IN ECOTONAL AREAS

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Phragmites australis (Cav.) Trin. ex Steud. also known as common reed, plays an essential role in Romania`s ecotonal areas. These plants contribute significantly to soil stabilization and erosion prevention due to their extensive root system. They are also efficient water filters and purifiers by retaining nutrients and pollutants.

Additionally, *P. australis* provides habitat and food for a variety of animal and plant species, thereby supporting local biodiversity. However, in some cases, it can become invasive and negatively affect local ecosystems, requiring management measures to maintain ecological balance.

The accumulation of heavy metals in *P. australis* in ecotonal areas in Romania can be attributed to several factors:

Industrial and urban pollution: Industrial and urban activities release heavy metals into the environment, which end up in the soil and water. *P. australis* can absorb these metals through its roots.

Intensive agriculture: The use of fertilizers and pesticides in agriculture can contribute to heavy metal contamination of soil and water in ecotonal areas.

Atmospheric deposition: Heavy metals can be dispersed over long distances via airborne and by their deposition on soil and water, becoming available to plants as *P. australis*.

The physicochemical characteristics of the sediment and water influence the mobility, bioavailability and absorption of heavy metals by reeds.

P. australis has the ability to bioaccumulate heavy metals, which makes it useful in phytoremediation processes, but also vulnerable to contamination in polluted environments.

Keywords: *Phragmites australis*, heavy metals

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MOBILIZATION AND USE OF GENETIC RESOURCES OF PLANTS OF THE GENUS *Astragalus* IN THE CONDITIONS OF UKRAINE

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Mobilization and comprehensive study of the genetic diversity of autochthonous and introduced plant species of flora is one of the key challenges of biological science. This will allow not only to preserve valuable phytoresources, but also to outline promising directions for their use to improve the well-being of society and restore disturbed ecosystems. The genus *Astragalus* L. is represented in Ukraine by about 60 species, of which 18 are listed in the Red Book of Ukraine (2009). Some species have a conservation status at the European level (*A. cicer, A. glycyphyllos)*. A number of species (*A. cicer, A. gummifer, A. sinicus*) are used in sideration and phytoremediation systems to restore agroecosystems degraded due to climate change and anthropogenic impacts. Thanks to their deep root system and in symbiosis with nitrogen-fixing bacteria, plants enrich the soil with nitrogen, increase its biological activity, contribute to improving soil structure, accumulating organic matter, reducing erosion processes.

As a result of comprehensive introduction research, for the first time for the conditions of Ukraine, a collection of the genus *Astragalus* was formed of 23 species from three genetic centers: European-Siberian – 60.9 %, Near East – 30.5 %, and Mediterranean – 8.7 %. The assessment of the introduction potential allowed us to recognize 6 species as the most promising for introduction into culture in the conditions of the Forest-Steppe of Ukraine: *A. cicer, A. falcatus, A. galegiformis, A. glycyphyllos, A. monspessulanus, A. ponticus*. Each of the studied representatives was distinguished by its qualitative and quantitative phytochemical composition. It was established that the highest dry matter in all studied introducers accumulates in the fruiting phase (24.37–35.79 %) with the maximum observed in *A. falcatus*; during budding – minimum indicator (17.35–20.05 %). The total sugar content increases significantly in the flowering phase: the highest in *A. glycyphyllos* (20.00

%), and the lowest in *A. galegiformis* (3.27 %). The protein content in plants of the genus *Astragalus* during this period was 14.00–24.42 %, and ascorbic acid rangered 102.44–398.45 mg%, highest content beed established in *A. ponticus*. Studying the dynamics of biologically active compounds can serve as a biochemical mechanism of plant response to stressful conditions, and also allows us to determine the prospects for their use as valuable raw materials for the production of phytopreparations, feed additives, and antioxidants in the food and pharmaceutical industries. In addition to their biochemical value, these species have an important agrobiological and ecological function due to symbiotic nitrogen fixation, which enriches the soil with nitrogen and increases its fertility. The powerful root system of the rhizome (*A. cicer*) and caudex (the rest of the representatives) prevents erosion processes, which makes them promising for stabilizing eroded landscapes and recultivating degraded lands. Therefore, in view of the above, autochthonous and introduced plants of the genus *Astragalus* collected in the collection fund are a valuable genetic resource for preserving biodiversity, creating phytoraw materials, biostimulants, restoring soil fertility and ecosystem stability.

Keywords: *Astragalus*, biologically active compounds, phytoremediation, genetic resources

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THE MAIN INDICATORS IN THE IMPROVEMENT OF F_1 HYBRIDS *Lavandula angustifolia* Mill.

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Lavandula angustifolia Mill. is the most well-known and extensively studied aromatic species for essential oil production. The main criterion for improving lavender hybrids is the high content of essential oil extracted from fresh inflorescences. Currently, this product is highly valued and widely used in aromatherapy, perfumery, cosmetics, and other fields. The objective of this research was to obtain F_1 lavender hybrids that are resistant to frost and overwintering, with a high content of premium-quality essential oil.

The study evaluated 308 F_1 lavender hybrids in their second year of vegetation, derived from four maternal forms: Fr. 1, Fr. 5, Fr. 8, and Cr. 13, as well as 280 F_1 hybrids in their third year of vegetation, originating from the local variety Aroma Unica. The experiments were conducted on the experimental field of the Institute of Genetics, Physiology, and Plant Protection of Moldova State University. Frost and overwintering resistance were assessed in early spring using recommended methods, graded on a scale from 1 to 5 points. During the vegetation period, phenological observations and biometric evaluations were carried out. At full flowering stage, the essential oil content was determined by hydrodistillation using Ginsberg apparatus.

Frost and overwintering resistance results for second-year hybrids: 218 hybrids – high resistance (5 points), 50 hybrids – above-average resistance (4 points), 29 hybrids – medium resistance (3 points). For third-year hybrids: 171 hybrids – high resistance (5 points), 85 hybrids – above-average resistance (4 points), 24 hybrids – medium resistance (3 points). The essential oil content of 42 second-year hybrids ranged from 2.308% to 5.556 % (dry matter), including: 5 genotypes with 2.308 – 2.661 %, 27 genotypes with 3.015 – 3.992 %, 8 genotypes with 4.034–4.539 %, 2 hybrids with 5.15 – 5.556 %. In the third year of vegetation, 130 hybrid genotypes were tested for essential oil content: 21 hybrids showed 4.023 – 4.923 %, 7 hybrids ranged from 5.099% to 5.608 %. To confirm chemical composition, three hybrids (140-3AU, 61-3AU, and 4Cr.13-2-106) with high essential oil content

were analyzed by gas chromatography–mass spectrometry (GC-MS). Between 25 and 32 components were identified, with a detection rate of 99.46% – 99.97 %. Key compounds influencing oil quality and characteristic aroma included: Linalyl acetate (30.46–31.75 %), Linalool (42.46 – 47.05 %), Lavandulyl acetate (0.42 – 1.98 %).

The results of this study confirmed that the selected lavender hybrids are resistant to frost and overwintering, while accumulating a high content of essential oil. The essential oil analyzed meets the European Pharmacopoeia standards, making it suitable for perfumery, aromatherapy, phytotherapy, and other applications. In total, 10 second-year hybrids and 20 third-year hybrids with high essential oil content were selected.

Keywords: lavender, hybrids, essential oil, chemical composition

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REPRODUCTION OF SEEDING MATERIAL FROM AERIAL BULBS IN GARLIC CULTURE

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Although the pedoclimatic conditions allow for the successful cultivation of garlic, local production does not cover the needs of domestic consumption in the Republic of Moldova. The low yields (2.5-3.5 t/ha) are caused by the lack of certified planting material and practical recommendations for obtaining it. In the absence of seedlings, garlic from the marketing network is used for planting, often imported from other geographical areas, which does not ensure obtaining economically advantageous production. Since garlic is a plant prone to physiological degeneration, maintaining varietal properties and cultural qualities requires a planned renewal of seedlings every 3-4 years. One of the effective methods for obtaining healthy and high-yielding planting material is in situ reproduction of garlic from aerial bulbs. In order to increase the level of harvests, research was carried out aimed at determining the optimal nutrition area, improving the conditions for plant growth and development along with improving the technology for obtaining seedlings for local varieties of garlic, placing particular emphasis on increasing productivity and production quality.

Investigations on the optimization of the nutrient surface and the consumption of aerial bulbs for the establishment of the seed crop were carried out with the Bereket variety. The aerial bulbs were calibrated in four fractions with sizes: smaller than 1 cm, 1.0-1.4 cm, 1.5-1.9 cm and larger than 2.0 cm, obtaining bulbs with the corresponding average weight: 0.7, 1.75, 3.0 and 6.0 g. Planting was carried out, in the first decade of October, using the two-row strip scheme (20+50 cm), by placing the aerial bulbs in a row at distances of 3, 4, 6, 8 and 10 cm.

Knowledge of the agrobiological and technological peculiarities of varieties when propagating seedlings by planting aerial bulbs allows creating better conditions for plant growth and development. Optimization of technological parameters leads to a reduction in the consumption of seed material and does not require harvesting after the first year of vegetation. The sowing rate of aerial bulbs depends on their size and density per unit area. Depending on the mass of aerial bulbs and the planting density, it is easy to determine the required amount of material for propagation.

In the experiments conducted, their quantity was approximately 130-140 kg/ha, which provides a density of 600-650 thousand plants per hectare. If aerial bulbs are planted in late September - early October, they take root, and the next year the plants form 3-4 leaves and monodentate bulbs, which can be harvested or left in the soil. In the second year of vegetation, plants obtained from monodentate bulbs form bulbs with superior qualities as planting material.

The conducted research reports the influence of the nutrient surface and the planting norms of aerial bulbs on the growth and development of garlic plants. Reducing the nutritient surface of plants contributes to an increase in the consumption of planting material. The height, size of leaves and bulbs depend largely on the distance between plants in the row. Although the mass of bulbs increases proportionally with the increase in the nutrient surface of plants, reducing the number of plants per unit area leads to a decrease in the harvest. The maximum yield between the consumption of aerial bulbs per unit area, the quality of monodentate bulbs and the level of garlic harvest is obtained in the case of optimal densities. Increasing the nutrition surface of plants, although contributing to an increase in the mass of monodentate bulbs, leads to a decrease in the yield and reproduction coefficient.

Keywords: agriculture, garlic, peculiarities, varieties

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SOME TECHNOLOGICAL FEATURES IN ESTABLISHING GARLIC CROP CULTURES

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Although it occupies relatively small areas, garlic is one of the most widespread vegetable species used in food, which is why it is cultivated everywhere for fresh consumption, as well as in various culinary aspects and the canning industry. Two forms of garlic are found in culture, with and without flower stalks (arrows).

Garlic has modest heat requirements and can be planted in autumn or early spring. The optimal growth and development temperatures are between 16 and 26 ºC. However, during the vegetation period, the plants withstand minimum temperatures of up to minus -7 ºC and those that do not exceed + 34ºC. After planting, well-rooted plants withstand winter temperatures of up to – 25 ºC, returning to vegetation when spring temperatures exceed 3 - 4 ºC. If the bulbs have been stored for a long time at temperatures of +20-24 ºC and planted in late spring, the plants do not form bulbs.

Having a poorly developed root system, garlic has special requirements for soil moisture and reacts negatively to its large fluctuations. Garlic plants need moisture to form sufficiently large bulbs, but abundant watering and excessive soil moisture should be avoided. It is preferable to establish garlic crops in the fall, in the period September-October until the danger of soil frost appears, or in early spring, in March, at the first possibility of going out into the field. In the spring crop, yields decrease by 25-30 %. When establishing a garlic crop, it should be avoided to place it after potatoes, tomatoes, onions, soybeans, beans, or peas, because after these crops the probability of nematode attack increases. Depending on the cultivation period, soil preparation works for autumn garlic planting include shredding and removing plant residues from the previous crop and discing. If organic fertilizers (fermented manure) are available, they are applied under the basic plowing, which should be carried out at a depth of 28-30 cm, so that the fertilizers are incorporated as evenly as possible into the soil layer where the roots will develop.

The application of mineral fertilizers is carried out based on soil analysis. In their absence, as a guide, it is recommended to apply: 150-200 kg/ha ammonium nitrate, 200-300 kg/ha simple superphosphate, 120-150 kg/ha potassium salt, with

incorporation into the soil by chiseling to a depth of 15-20. In the fall, before planting, the land is loosened to a depth of 7-8 cm, then the trenches are opened and the beds are formed for planting the bulbs.

When establishing garlic crops in the spring, the work includes loosening the soil surface (8-10 cm), basic fertilization, followed by herbicides, so as to ensure maximum weed control. It is important to note that the use of pre-emergent herbicides supplemented by those applied in the initial stages of vegetation provides effective weed control, ensuring optimal development of the crop plants.

Of particular importance when establishing garlic crops is the preparation of the planting material. The bulbs are sorted into 2-3 fractions. Bulbs can be planted mechanically or manually, taking into account the following technological aspects: on unshaped land, manual planting is carried out in strips of 5 rows, at a distance of 20 cm between rows and 60 cm between strips. Planting is done in rows located at a distance of 35 cm, and in the row the bulbs are planted depending on their size at a distance of 7-15 cm from each other.

Keywords: culture, garlic, establishment, technological peculiarities

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YIELD PERFORMANCE AND GENOTYPE × PLOIDY INTERACTIONS IN DIPLOID AND TETRAPLOID MAIZE LINES

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Maize (*Zea mays* L.) remains one of the most important cereal crops worldwide, serving as a key component in food, feed, and industrial systems. Among its many agronomic traits, yield is the main criterion determining the success of a genotype under diverse environmental and genetic contexts. In this study, a polyfactorial experimental approach was employed to evaluate the yield performance of diploid and tetraploid maize lines, with the objective of understanding the extent to which genotype, ploidy level, and environmental conditions contribute to variation in productivity.

The analysis revealed that genotypic differences were the most significant contributors to yield variability, underscoring the critical role of genetic background in determining grain production. The incorporation of tetraploid lines allowed for the assessment of ploidy effects, which proved to be significant for yield, indicating that polyploidization can alter biomass partitioning and grain development pathways in maize. However, the response to ploidy level was not uniform across all genetic backgrounds, as evidenced by the significant Genotype × Ploidy interaction, which suggests that the impact of chromosome doubling on yield is highly genotype-dependent.

Environmental influence, modeled through year-to-year variation, had a moderate but noticeable effect on yield performance. The significance of Genotype × Year and Year × Ploidy interactions reflects the importance of genotype stability and the differential sensitivity of diploid and tetraploid lines to climatic and edaphic fluctuations. These findings are particularly relevant in the context of climate variability, where genotype selection must consider not only productivity potential but also environmental resilience.

Furthermore, the analysis of residual variance – ranging from 28 % to 40 % of total variation - points to the presence of uncontrolled environmental or experimental

factors, suggesting a need for more refined trial management and experimental precision. Nonetheless, these results demonstrate that the integration of polyploid genotypes into breeding programs presents valuable opportunities to expand the genetic base, explore novel allelic interactions, and enhance yield potential.

In conclusion, this study emphasizes the strategic relevance of ploidy manipulation in maize improvement efforts. By systematically evaluating how ploidy interacts with genetic and environmental variables, breeders can develop more targeted approaches to achieve yield stability and adaptability. Such approaches are essential to meet the growing global demand for maize under conditions of increasing environmental stress and limited agricultural inputs.

Keywords: maize, diploid, tetraploid, yield, variance

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STORAGE POTENTIAL OF PEPPER SAMPLES – AN INDICATOR OF THEIR LONGEVITY DURING *EX SITU* CONSERVATION

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The main task of plant gene banks in the *ex situ* conservation of germplasm is to preserve the viability of seed material, since storage causes aging processes in seeds, leading to a loss of viability and genetic uniformity. It is therefore important to assess the storage potential (SP) of collection samples before they are placed in storage. This comprehensive indicator is used in various gene banks around the world, allowing conclusions to be drawn about the longevity of samples in storage and their classification according to SP. To determine the SP of seeds, an accelerated aging (AA) test is used, which is carried out under conditions of elevated temperature and humidity for a short period of time. After the AA test, the seeds can be characterised according to their morphophysiological and biochemical parameters. This test allows samples unsuitable for long-term storage to be identified and recommendations to be made on seed reproduction times and the need to restore the viability of valuable collection samples.

The aim of the study was to determine the storage potential of pepper collection samples before their placement in *ex situ* conservation in a plant gene bank.

AA test was carried out at a temperature of 45 °C, relative air humidity of 90-100 %, and an aging time of 72 hours. Four collection samples of pepper were tested: Vlad, Camber, Alexandru, and Capstar from the active collection of the gene bank. Various morphophysiological parameters of the seeds were determined: germination energy (GE) and germination (G) of seeds, root length (RL) of seeds, raw biomass (RB) of roots, and electrical conductivity (EC) of solutions with seeds. Control - seeds from the same reproduction.

The GE of pepper seeds after aging decreased compared to the control by 4.0–28.2 %, depending on the genotype. The decrease in seed germination after the test for different pepper genotypes ranged from 20.0–39.9 % compared to the control, indicating the genotypic specificity of the tested samples. After the test, changes in

other parameters (root length, raw root biomass, electrical conductivity of solutions) were also observed. The RL of pepper seeds decreased after the test compared to the control by an average of 2.4–7.5 mm, and the RB of seeds decreased by 50.0–90.0 mg. After AA test, the EC of solutions with pepper seeds changed differently in different genotypes compared to the control. After 48 hours of swelling exposure of normal and aged seeds in the Camber and Alexandru genotypes, the EC of seeds increased slightly, only 1.1 times compared to the control. In the other two pepper genotypes, Vlad and Capstar, a decrease in EC was observed compared to the control, by 1.3 and 1.5 times. Based on the combination of the studied morphophysiological parameters of pepper seeds and seedlings, the following genotypes had the highest storage potential: Vlad, Alexandru, and Capstar.

The use of tests on the AA capacity of seeds and EC of solutions with normal and aged pepper seeds allows determining the SP of each specific genotype and grading genotypes according to this indicator, which characterises the ability of samples to be preserved *ex situ* in a plant gene bank.

Keywords: storage potential, pepper, gene bank, accelerated aging

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RESULTS OF THE STUDY OF SOME QUANTITATIVE CHARACTERS OF HYBRIDS OF DIFFERENT TYPES OF *Salvia scalarea* L.

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To create hybrids of different varieties of *Salvia sclarea* L., with high productivity, resistant to drought, frost and wintering, initial breeding material was used with a pronounced variability in key quantitative traits that directly influence productivity: plant height, inflorescence length, number of first and second degree branches of the inflorescence. The biological material used in the research consisted of 25 simple, triple, double, stepped and complex F_7 - F_8 hybrids of sage, in the second year of vegetation. The studied biomorphological traits were included: plant height, inflorescence length, number of first and second degree branches of the inflorescence. The essential oil content was determined by hydrodistillation in Ginsberg apparatus.

Under the weather conditions of 2024, the evaluated hybrids developed floral stems ranging from 99.9 cm to 141.5 cm. The tallest plants were attested to the double hybrid combination [(V-24-86 809 S_3 x 0-33 S_6)F_7 x (S-1122 528S_3 x S.s.Tien-Shan/sud)B_5)]F_7 and the stepped hybrid [M-69 655 S_9 x (K-36 x 0-41)F_2 x 0-19)F_1 x L-15)F_7]F_7, which recorded 141 cm each. The length of the inflorescence varied between 51.9 and 74.7 cm. The panicle height in the plant is within the limits of 49 – 59%. The largest inflorescences were recorded in the plants of the complex hybrid [(M-44 S_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, and the inflorescence length/plant height ratio was 54.9%, as well as in the stepwise hybrid combination [(K-36 x 0- 41)F_2 x 0-19)F_1 x 0-22)B_4 x L-15)F_6 x Cr.p.99 S_{11})]F_7 with a panicle length of 70.2 cm and the inflorescence share of the plant height – 55.0%. The best correlation between plant height and inflorescence length was observed in triple hybrid [(S-1122 60 S_{10} x (M-69 429-82 S_3 x 0-40S_5)F_7)]F_7 – 59.8%. The plant inflorescences had a total of 37.4 – 64.6 branches, including 13.0 – 21.0 first-degree branches and 28.2 – 45.0 second-degree branches. The highest number of branches was recorded by the complex 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 and the step hybrid combination [(K-36 x 0- 41)F_2 x 0-19)F_1 x 0-22) B_4 x L-15)F_6 x Cr.p. 99 S_{11})]F_7 – 60.2 and 64.6 branches, respectively.

The content of essential oil in inflorescences ranged from 0.673 to 2.834 % (dry matter). Seven hybrids were selected that stood out with a very high essential oil content of 1.424 – 2.834% (dry matter). Exceptional in this character was the hybrid [(0-57 S_5 x 0-21)F_2 x Dacia 50 I an)]F_8. In 2020, this hybrid synthesized and accumulated 2.163 % (dry matter) essential oil, in 2022 this important index was 1.889% (dry matter), and in the reference year it had the value of 2.834% (dry matter).

The research carried out resulted in the selection of hybrids with a high content of 1.424 – 2.834 % essential oil, recalculated to dry matter. These hybrids present a valuable genetic material for the creation of *Salvia sclarea* L varieties.

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

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ANALYTICAL SOLUTIONS FOR MONITORING VULNERABLE MAPs IN FOOD SUPPLEMENTS

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The study aims to establish optimal integrated analytical solutions for identifying the presence of vulnerable medicinal and aromatic plants (MAPs) in food supplements, thereby enabling the assessment of their compliance and quality. These analytical approaches are essential for promoting the sustainable use of biodiversity by verifying the identity, authenticity, and traceability of food supplements derived from such MAPs.

MAPs and their derived products are an essential source of bioactive compounds with therapeutic potential. The use of food supplements, as a complementary approach to synthetic drugs, is steadily increasing and plays a significant role in supporting human health and well-being. In this context, the World Health Organization has reported a growing global demand for MAPs, which has led to the overexploitation and degradation of natural habitats for several plant species, such as *Gentiana lutea* L. and *Rhodiola rosea* L. The overharvesting of MAPs with special conservation status, particularly when used as raw materials in food supplements, poses a significant threat to the survival of these species. To address and monitor these concerns, there is an urgent need for reliable and cost-effective methods to identify and authenticate plant species in complex formulations. A relevant example of such a vulnerable species is *G. lutea*, which is included in various food supplements due to its content of triterpenoids, flavonoids, secoiridoids, and iridoids, all of which are biologically significant for human health. This species is

globally protected, with its collection, use, and market sales regulated by specific legislation.

To identify the presence of such protected species in food supplements (and also to test their authenticity), a variety of phytochemical methods can be used, either alone or in combination: UV-Vis spectrophotometry, Thin Layer Chromatography (TLC), High-Performance Liquid Chromatography (HPLC), Gas Chromatography with Mass Spectrometry (GC-MS). UV-Vis spectrophotometry is a common and inexpensive method for identifying specific classes of phytochemical compounds, providing preliminary data. TLC is a cost-effective and reliable technique for detecting the presence of a targeted species, offering several advantages: simplicity, speed, flexibility, and multiple detection methods capabilities. HPLC is a standard analytical method used for the quality control of MAPs-based food supplements, primarily for identifying and quantifying marker compounds. GC-MS is used to analyze volatile oils and to assess the fatty acid profile of fixed oils. Our results strongly suggest that combining DNA barcoding techniques with phytochemical methods provides a thorough evaluation of the quality of botanical preparations.

Keywords: food supplements, vulnerable species, analytical solutions, biodiversity

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IMPACT OF GAMMA RAY-INDUCED MUTAGENESIS ON OIL ACCUMULATION IN FLAX SEEDS

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The research aims to develop new linseed/flax (*Linum usitatissimum* L.) cultivars through the application of physical mutagenesis using γ-rays, with the goal of inducing useful genetic variability for breeding purposes. The main objective is to select mutant lines exhibiting high oil content, a key trait for both industrial and nutritional applications. Flaxseed is an alternative to marine products. It is one of the richest sources of the plant-based omega (ω)-3 fatty acid, alpha-linolenic acid (ALA).

The biological material employed in this study consisted of the control linseed variety *Dichl 8* and three mutant lines derived from the M_5 generation. At the initial stage, flax seeds were irradiated with gamma rays at three distinct doses (400, 500 and 600 Gy), using the RXM-γ-20 facility equipped with a cobalt-60 (^{60}Co) radioactive source. Following irradiation, the plant material was cultivated and advanced to the M_5 generation, at which point a comparative evaluation of oil content (%) was carried out between the mutant lines and the control cultivar. Oil content was determined using a non-destructive method based on nuclear magnetic resonance (NMR) spectroscopy, a technique recognized for its precision, speed and analytical efficiency in evaluating the chemical composition of oilseed samples.

Oil content (%) analysis in mutant flax plants (*Dichl 8*, M_5) revealed significant variations as a function of irradiation dose. According to the literature, the oil content of linseed (flax) seeds typically ranges between 35 and 45%, although even higher values have been reported. The 600 Gy dose resulted in the highest average oil content (39.16 % ± 1.12, SD = 1.94, CV = 4.95 %), suggesting a high potential, albeit with increased variability. The mutant treated with 400 Gy exhibited a value close to the control (37.83 % ± 0.31) and the lowest variability (SD = 0.54, CV = 1.42 %), indicating genetic stability. In contrast, the 500 Gy dose led to the lowest oil content (35.23 % ± 0.91, SD = 1.58, CV = 4.50 %), suggesting a possible inhibitory

effect. The control variety *Dichl 8* recorded an average oil content of 38.26 % ± 0.89, with SD = 1.54 and CV = 4.03%. These values establish it as a reference point for evaluating the effects of different irradiation doses on oil content in the mutant lines. Overall, 600 Gy enhanced oil accumulation, 400 Gy balanced stability and yield, while 500 Gy had a negative impact.

Conclusion. Gamma irradiation induced a dose-dependent response in flax oil biosynthesis, with 600 Gy being the most effective for selecting high-oil genotypes.

Keywords: flax, gamma rays, mutagenesis, oil content

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REGISTRATION OF "NİHATBEY" CHICKPEA (*Cicer arietinum* L.) VARIETY

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Chickpea production has always been important in the history of civilization. Today, chickpea is the most cultivated food legume in Türkiye and the third most cultivated in the world. The first breeding research on food legumes was started in the 1970s in Türkiye. Since then, research studies have continued. Currently, the Transitional Zone Agricultural Research Institute undertakes the Transitional Zone Chickpea Breeding Research project. Through the project, Nihatbey chickpea cultivar was registered on behalf of Transitional Zone Agricultural Research Institute in 2020. The pedigree history goes back to hybridization performed in 2004 between Flip 97-90C and Flip 97-125C. That combination had been bulked from 2005 to 2009 for the segregating population. In 2009, selection was performed in F_5, and Nihatbey was selected as the thirteenth plant. In the next year, the selected plant was sown in a single plant row together with other selected plants, and it was selected again. In the following years, microyield trials between 2011-2015, and macro yield trials between 2015-2017 were established, and the line was evaluated. As a result, the line coming from the selected thirteenth single plant has been evaluated as high-yielding. Then, it was sent to Variety Registration and Seed Certification Center for registration. Over the next two years, Variety Registration and Seed Certification Center established special experiments to measure agricultural values of candidate varieties, and Nihatbey was registered according to the results of these experiments in 2020. In 2023, the rights of Nihatbey production and sales were given to Altat Tarım by an official tender.

Keywords: chickpea, breeding, variety, *Ascochyta rabiei*

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THE EVALUATION OF THE QUALITY INDICES OF STEM BIOMASS OF *Coriandrum sativum* AND PROSPECTS FOR ITS USE IN MOLDOVA

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Lignocellulosic biomass is a promising, renewable and safe resource for the production of various biofuels, and is of growing global interest. *Coriandrum sativum* (coriander), an annual herb of the *Apiaceae* family native to the Mediterranean Basin, is cultivated worldwide for its medicinal, culinary, aromatic and spice uses. In the Republic of Moldova, it is primarily grown for its seeds, which are rich in volatile oils, vitamins, minerals, antioxidants, fiber and trace elements. However, seed harvesting leaves behind substantial stem residues in the field (7.5-9.0 t/ha).

This study aimed to evaluate the quality of coriander stem biomass and its potential as a substrate for renewable energy production.

Coriandrum sativum was grown in monoculture at the Botanical Garden, Chisinau. After seed harvesting, stems were cut manually, field-dried, and then ground using a 1 mm mesh knife mill. Biomass samples were oven-dried at 85°C before analysis. Total carbon, hydrogen, nitrogen and sulfur contents were determined by dry combustion using a Vario Macro CHNS analyzer at the State Agrarian University of Moldova. The ash content was determined at 550°C in a muffle furnace, and the calorific value was assessed using an automatic calorimeter. The cell wall content in the dry stems was assessed via near-infrared spectroscopy (PERTEN DA 7200). The theoretical ethanol potential was calculated using the equations of Goff et al. (2010), and the biochemical methane potential – according to Dandikas et al. (2015).

Results showed that the coriander stem biomass had a moisture content of 10.12 %, ash content of 4.60%, carbon 44.35%, hydrogen 6.04%, nitrogen 0.42%, and sulfur 0.09%. The gross calorific value ranged from 18.2 to 19.6 MJ/kg, with an average of 18.93 MJ/kg, and a net calorific value of 17.06 MJ/kg. The resulting solid biofuel pellets had a bulk density of 560-580 kg/m³ and 93 % mechanical durability. Biochemical composition of coriander stem biomass included 58.3 % acid detergent fiber (ADF),

83.1 % neutral detergent fiber (NDF), 11.7 % acid detergent lignin (ADL), 466 g/kg cellulose, and 248 g/kg hemicellulose. Theoretical ethanol yields were estimated at 348.33 L/t from hexose sugars and 170.11 L/t from pentose sugars. With a high C/N ratio of 94 and a biochemical methane potential of 160 L/kg organic dry matter, coriander stem biomass is also suitable as a co-substrate for biogas production.

The coriander stem biomass exhibited optimal quality indices to serve as feedstock for the production of pellets and cellulosic bioethanol and as co-substrate in biogas generators.

Keywords: agricultural residues, biochemical methane potential, bioethanol, *Coriandrum sativum,* pellets

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INTERSPECIFICAL RHIZOGENIC GRAPEVINES FOR MODERN VITICULTURE

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In modern viticulture, one of the most important aspects of existing plantations is their productivity. Another equally important aspect is the stability and quality of the harvest obtained. These aspects can be different from year to year, and can vary considerably depending on climatic conditions, the degree of nutrient supply and the timely performance of agrotechnical works. But one thing that remains relatively stable and makes a difference over time is the performance of the varieties used. This most often determines the grape harvest.

In order to provide the current viticulture sector with high-quality raw material and stable production, after numerous trials and crosses carried out in recent decades, rhizogenic interspecific varieties have been created and approved. Compared to local varieties belonging to the *Vitis vinifera* species, rhizogenic interspecific varieties represent hybrids obtained from crossing with the endemic American species *Muscadinia rotundifolia*.

Rhizogenic interspecific varieties can be obtained by cuttings without the need of grafting (vegetative propagation) of shoot fragments. These, due to their increased rhizogenesis capacity, are much more reliable over time than grafted cuttings, are more resistant to environmental factors and have a longer lifespan.

As study material, 8 already homologated rhizogenic interspecific genotypes served - Nistreană, Alexandrina, Malena, Augustina, Ametist, Sarmys, Thetys and Algumax. Three interspecific hybrids that are still in the performance study stage – BC_3- 508, BC_3- 536, BC_3- 502 but were also involved in crosses 19 genotypes of the *Vitis vinifera* species. The crosses were carried out on 5 maternal forms and as paternal form (pollen source) were trained 30 forms belonging to both the *V. vinifera* and *M. rotundifolia* species. No castration was performed, due to the functional female grapevine genotypes used. For the first time in recent years of study, crosses were carried out on fourth-generation interspecific hybrids – BC_4.

The study methods used were - the method of directed interspecific hybridization, the method of sensory analysis of uvological characters, the DUS

test (distinctiveness-universality-stability), as well as the method of determining the performance of varieties following diurnal phytomonitoring.

As a result of previous years of crossings, approximately 150 plants are being studied as a result of crosses from the study year 2023, around 100 plants from 2024, and in the current year, after conducting directed crosses, about 80 inflorescences pollinated with pollen from the high-performance varieties from the institute's collection were obtained. These plants, after a long process of testing and verification under production conditions, could later become interspecific hybrids approved for cultivation on republic's territory.

In conclusion, we can say that following a long selection process, rhizogenic interspecific varieties with high-performing characteristics and resistance to biotic and abiotic factors were created and approved. Other new interspecific varieties of table and wine grapes are to be tested and approved later, and the limit of vine cultivation due to this varieties may been extended on all the territory of the Republic of Moldova.

Keywords: viticulture, interspecifical rhizogenic genotypes, hybrids, harvest

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THE BIOCHEMICAL COMPOSITION OF GREEN BIOMASS OF *Vicia* SPECIES IN MOLDOVA

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Fabaceae species are agriculturally valuable for their nitrogen-fixing ability, which improves soil quality, contribute substantial quantities of organic matter for the circular economy and provide a source of protein-rich food and forage. In the spontaneous flora of Bessarabia, the Fabaceae family is represented by 146 species of 35 genera, including 19 species of the genus *Vicia* L.

The primary objectives of this study were to evaluate the biochemical composition of the green biomass of *Vicia hirsuta* (L.) Gray*, Vicia sativa* L. and *Vicia tenuifolia* Roth, and to assess their potential use as forages or as substrates for biomethane production.

The local ecotypes of *Vicia hirsuta*, *Vicia sativa* and *Vicia tenuifolia* were collected from the local flora and grown in monoculture plots at the Botanical Garden MSU, Chisinau. The green biomass samples were harvested at the flowering stage. Biochemical analyses were performed at the Research and Development Institute for Grassland, Brasov, Romania. The following parameters were determined: crude protein, crude fiber, crude ash, total soluble sugars, ADF, NDF and ADL. Other indices such as hemicellulose, cellulose, digestible dry matter, digestible energy, metabolizable energy, net energy for lactation and relative feed value were calculated according to standard procedures. The carbon content of the substrates was estimated according to Badger et al. (1979), and the biochemical methane potential – following the method of Dandikas et al. (2015).

The harvested green biomass of the studied *Vicia* species consisted of 50.8-66.7 % leaves and flowers, with dry matter concentrations ranging from 179.6 to 266.0 g/kg. The biochemical composition of the dry matter was as follows: 17.9-19.8 % CP, 9.9-11.0 % CA, 32.2-35.6 % CF, 34.5-39.3 % ADF, 51.0-60.6 % NDF, 5.0-6.5

% ADL, 29.5-32.8 % Cel, 16.5-21.3 % HC and 0.6-8.3 % TSS. The digestibility and energy values of the forage were: 593-620 g/kg DDM, 90-113 RFV, 11.57-12.24 MJ/kg DE, 9.50-10.05 MJ/kg ME and 5.51-6.05 MJ/kg NEl.

The biomass substrates intended for anaerobic digestion and biomethane production were characterized by a carbon content of 492.8-502.2 g/kg, nitrogen content of 27.5-33.0 g/kg, a C/N ratio of 14.8-18.3, ADL content of 50-65 g/kg and hemicellulose levels of 165-213 g/kg. The calculated biochemical methane potential ranged from 289 to 308 L/kg of dry matter, or from 320 to 343 L/kg of organic dry matter.

In conclusion, the studied *Vicia* species exhibited favorable crude protein content, digestibility and energy value, making them suitable as livestock forage. Additionally, the optimal carbon-to-nitrogen ratio of the biomass makes it a promising substrate for biogas production. These local ecotypes may also serve as valuable genetic material for breeding new legume cultivars.

Keywords: biochemical composition, biochemical methane potential, green biomass, nutritive and energy value, *Vicia* species

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RARE HABITATS IN THE TERRITORY OF GRANITE QUARRIES OF CENTRAL POLISSIA

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The establishment of mining facilities leads to alterations in the landscape diversity of a territory. Initially, natural habitats are replaced by anthropogenically transformed ecosystems, often devoid of natural vegetation. During the active extraction of minerals, natural habitats may begin to regenerate in certain parts of the mining operation. This regeneration occurs under varying intensities of anthropogenic pressure, on diverse soil types, and exposed rock outcrops. From this point until the cessation of mining, some of these newly formed habitats may qualify for inclusion in international or national lists of rare habitats. While rare habitats may possess varying direct economic or recreational potential, they invariably provide a greater volume of ecosystem services. This fact necessitates careful consideration during the formulation of reclamation plans for areas disturbed by mining activities.

Research Aim and Objectives. This study aims to investigate the phytocenotic diversity of vegetation within granite quarries in the Central Polissia region and to identify the presence of rare habitats therein. In pursuit of this aim, the following objectives were set:

- To classify plant community descriptions collected from the granite quarry sites in Central Polissia.
- To establish a list of habitats to which the identified plant community syntaxa belong.
- To determine the rarity status of these habitats in accordance with Annex 4 of the Bern Convention Resolution.

Methodology. For this research, we utilized standard geobotanical descriptions collected over a 20-year period (from 2004 to 2024) using a route-expeditionary method. The study encompassed 11 active and abandoned granite quarries within the Central Polissia region. During geobotanical surveys, general characteristics of environmental conditions were recorded, and the projective cover of higher vascular plants was determined using a modified five-point scale, based on the seven-point Braun-Blanquet scale. The scale modification was as follows: 5 points: over 75 %

cover, 4 points: 50–75 %, 3 points: 25–50 %, 2 points: 5–25 %, 1 point: less than 5% (combining categories "1", "+" and "r" of the classic Braun-Blanquet scale).

The collected geobotanical database was structured using "Turboveg for Windows 2.0" software. To determine ecological factor indicators, the natural dynamics indicator, and the integral indicator of anthropogenic transformation, we applied synphytoindication methodology. Environmental factors were assessed using the unified Didukh–Pliuta scale, implemented in a corresponding database. Anthropogenic pressure was evaluated based on the "EcoDBase 5d" database using the 18-point Didukh–Khomyak scale. The natural dynamics indicator was determined using a 21-point scale from Khomyak I.V.'s original methodology. Calculations of synphytoindication indicators were performed using the "Simagrl 1.12" software tool.

Standardized geobotanical descriptions were integrated and processed using "Turboveg for Windows" software. Subsequently, these data were exported to "JUICE 7.1.29" in XML table format. The resulting phytocenotic tables were saved in WCT (JUICE Table format WCT). After verification for duplicate taxa, similar geobotanical descriptions were identified using color coding for subsequent merging. The identification of formed phytocenoses was based on blocks of diagnostic species, in accordance with the taxonomic system presented in the "Prodromus of Ukrainian Vegetation". Nomenclature for higher vascular plant species adhered to "Vascular plants of Ukraine. A nomenclatural checklist".

The determination of habitat rarity status, as per Resolution 4 of the Bern Convention, was based on the principles and criteria outlined in the monograph "National Catalogue of Biotopes of Ukraine".

Results. The vegetation of the studied granite quarry territories in Central Polissia belongs to 19 classes, 31 orders, 50 alliances, and 84 associations according to the Braun-Blanquet system. Specifically, it includes the following classes: *Lemnetea* (associations *Riccietum fluitantis, Lemnetum minoris, Spirodeletum polyrhizae, Lemno-Spirodeletum polyrhizae*), *Potamogetea* (associations *Ranunculetum fluitantis Ceratophylletum demersi, Ceratophylletum submersi, Numpharo lutei-Nymphaetum albae, Potametum natantis, Potametum lucentis*), *Phragmiti-Magnocaricetea* (associations *Glycerietum, Sagitario-Sparganietum emersi, Eleocharitetum palustris, Butomo-Sagittarietum sagittifoliae, Alopecuro-Alismatetum plantaginis-aquaticae, Phragmitetum australis, Typhetum angustifoliae, Typhetum latifoliae, Iridetum pseudocaori, Schoenoplectetum lacustris, Glycerietum maximae, Caricetum elatae, Carici acutae-Glycerietum maximae*), *Molinio-Arrhenatheretea* (associations *Agrostio vinealis-Calamagrostietum epigeioris, Agrostietum vinealis-tenuis, Poo angustifoliae-Arrhenatheretum elatiori, Bromopsidetum inermis, Potentillo argenteae-Poetum angustifoliae, Achillea submiefolium-Dactyletum glomeratae, Festucetum pratensis, Poëtum pratensis, Lolietum perennis, Juncetum effusi, Holcetum lanati Issler, Scirpetum sylvatici, Lysimachio-Filipenduletum, Veronico-Euphorbietum*), *Calluno-Ulicetea* (associations *Calluno-Genistetum*), *Nardetea strictae* (associations *Calluno-*

Nardetum), *Sedo-Scleranthetetea* (associations *Sedo acri-Dianthetum hypanicii* та *Thymo pulegioidis-Sedetum sexangularis*), *Epilobietea angustifolii* (associations *Rubo-Chamaenerietum angustifolii, Rubetum idaei, Calamagrostietum epigii*), *Robinietea* (associations *Cheledonio-Pinetum sylvestris, Cheledonio-Aceratum negundi, Cheledonio-Robinietum, Geo-Aceretum platanoidis, Salicetum capreae*), *Vaccinio-Piceetea* (associations *Cladonio-Pinetum, Dicrano-Pinetum), Salicetea purpurea (associations Salicetum albae, Salici-Populetum, Populetum nigro-albae*), *Alnetea glutinosae* (associations *Ribeso nigri-Alnetum*), *Franguletea* (associations *Salicetum pentandro-cinereae*), *Stellarietea mediae* (associations *Centaureo-Aperetum spicae-venti*, *Violo arvensis-Centaureetum cyani*, *Aphano-Matricarietum*, *Apero spicae-venti-Papaveretum rhoeadis, Echinochloo-Setarietum, Portulacetum oleraceae, Brometum tectorum, Hordeetum murini*), *Artemisietea vulgaris* (associations *Agropyretum repentis, Poo compressae-Tussilaginetum farfarae, Arctietum lappae, Arctio-Artemisietum vulgaris, Leonuro-Arctietum, Echio-Verbascetum, Berteroëtum incanae, Dauco-Picridetum hieracioidis, Onopordetum acanthii, Potentilo-Artemisietum absintii, Tanaceto-Artemisietum vulgaris*), *Polygono arenastri-Poëtea annuae* (associations *Polygonetum arenastri, Poetum annuae*), *Plantagenetea majoris* (associations *Agrostio tenuis-Poetum annuae, Prunello-Plantaginetum, Juncetum tenuis, Potentilletum reptantis, Potentilletum anserinae*), *Galio-Urticetea* (associations *Calystegio-Angelicetum archangelicae, Elytrigio repentis-Aegopodietum podagrariae*), *Bidentetea tripartiti* (associations *Polygonetum hydropiperis, Bidentetum tripartitae, Rumici maritimi-Ranunculetum scelerati*).

Ten rare habitats, listed in Resolution 4 of the Bern Convention, were identified within the territory: C1.32 Free-floating vegetation of eutrophic waterbodies, C1.33 Rooted submerged vegetation of eutrophic waterbodies, C2.34 Eutrophic vegetation of slow-flowing rivers, D5.2 Beds of large sedges normally without freestanding water, E1.71 *Nardus stricta* swards, E2.2 Low and medium altitude hay meadows, E3.4 Moist or wet eutropic and mesotrophic grassland, F4.2 Dry heaths, F9.1 Riverine scrub, G1.11 Riverine *Salix* woodland.

A comparison of phytocenotic diversity before mining operations and in abandoned or reclaimed quarries often reveals paradoxical findings. Changes in microrelief and the exposure of various rock types create conditions conducive to the formation of a greater diversity of plant ecosystems. Among these newly formed ecosystems, rare habitats with high potential for providing ecosystem services are occasionally found.

Conclusions. The vegetation of granite quarry territories in Central Polissia encompasses 19 classes, 31 orders, 50 alliances, and 84 associations according to the Braun-Blanquet system. Our analysis identified 10 rare habitats listed in Resolution 4 of the Bern Convention. A comparison with analogous sites indicates that, in the long term, mining activities can paradoxically lead to an increase in habitat diversity, including its rare components.

Keywords: ecosystem, vegetation restoration, mining, phytocenosis

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SOIL ACIDITY AND VEGETATION CHANGES FOLLOWING STRIKE UAV IMPACTS

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All ecosystems on Earth are subject to anthropogenic pressure, making it crucial to assess its impact on natural dynamics. The concept of hemeroby has evolved into the evaluation of anthropogenic influence through the degree of anthropotolerance, which enabled the development of an improved 18-point scale. Given the complexity of directly measuring the energetic parameters of ecosystems, the use of synphytoindication methods based on species distribution patterns along tolerance gradients is considered a promising approach. This is especially relevant in the context of the armed conflict in Ukraine, which, in addition to human and economic losses, has caused large-scale environmental degradation, destruction of natural ecosystems, and a reduction in their ecosystem services. Military activities involve a combination of anthropogenic factors – shelling, landmines, and the movement of heavy machinery – each of which affects specific habitat components in different ways, requiring scientific analysis, impact assessment, and the development of effective restoration strategies.

This study explores the projected dynamics of vegetation self-regeneration in areas where UAV explosions have altered soil acidity. In such sites, active soil pH ranges from 6.62 to 7.41 (mean 7.14), and exchangeable pH from 6.68 to 7.28 (mean 7.02), likely due to carbonate bedrock exposure in craters. These conditions support early autogenic succession dominated by herbaceous, ruderal, and segetal vegetation. According to the Brown-Blanke system (EcoDBase 5g), these communities span 8 classes, 9 orders, 10 alliances, and 11 associations, with high levels of synanthropization and the dominance of anthropotolerant species.

Stellarietea mediae vegetation occurs where the humus layer is partly preserved, while *Poo compressae–Tussilaginetum farfarae* (*Artemisietea vulgaris*) develops in deep craters. The most widespread is *Agropyretum repentis*, forming on disturbed soils in various post-agricultural or military-impacted environments. Once established, vegetation dynamics are driven more by biotic and abiotic interactions than by the initial explosion. However, thermobaric munitions can destroy soil seed banks, necessitating human-assisted reintroduction of native flora. Elevated nitrogen compounds may also shift succession toward nitrophilous communities. Though self-regeneration is effective, explosion-induced soil changes promote invasive species, potentially destabilizing ecosystems. Therefore, controlling invasives is vital for restoring war-impacted natural landscapes.

Elevated nitrate and ammonium levels may drive vegetation toward nitrophilous phytocoenoses. Although self-regeneration is an efficient restoration strategy, altered soil conditions and niche destruction post-explosion facilitate invasive species colonization. Their establishment can destabilize ecosystems and lead to a catastrophic climax.

Hence, managing invasive species during post-disturbance regeneration is a key priority for the ecological rehabilitation of war-affected landscapes.

Keywords: anthropogenic pressure, synphytoindication, soil pH, vegetation succession, ecosystem restoration

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HIGH-THROUGHPUT PHENOTYPING (HTP) IN TABLE GRAPE BREEDING

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Morphology is one of the most important characteristics of the grapevine plant and its organs, which is considered one of the most important tools for grapevine breeders and grapevine propagation specialists. Therefore, high-throughput phenotyping becomes a permanent tool for grape breeding programmes, especially for the morphometric characters assessment.

The purpose of this work was to identify the key directions for the development of a highly productive phenotyping for table grape varieties breeding. Selections and varieties breeded at National Scientific Center "V.Ye. Tairov Institute of Viticulture and Winemaking" with the original shape of the bunch and berries were used.

Results. Grape breeders throughout the history of grape breeding are constantly trying to create new varieties with interesting and visually attractive forms of berries, not only the typical for grapevine forms (what is meant is spherical or round, ovoid and elliptical ones). These breeding programs utilize both traditional cross-breeding methods, and modern molecular techniques (DNA markers etc.) to obtain desirable traits. Researchers are exploring various indexes of berry shape and color, including size, length-width ratio, and overall morphology peculiarities, to meet the demands of markets and buyers.

High-throughput phenotyping method means a group of advanced imaging techniques which are being employed to rapidly assess berry shape and other traits in large breeding populations, clonal selection processes and in different types of grapevine collections.

Based on the peculiarities of the available breeding material for table varieties at the National Scientific Center "V. Ye. Tairov Institute of Viticulture and Winemaking"

and the spectrum of the institute scientific researches, promising directions for the highly productive phenotyping are:

1) use of the methods of the berry signs fixation for rapid assessment of berry shape and other characters in large breeding populations;

2) studies of grape berry shape, color and size variation (analyzing the shape diversity of grapevine accessions using elliptic Fourier descriptors (EFD), which quantify shape characteristics;

3) environmental factors influence on berry shape (temperature and precipitation during vegetation season, that influence processes of breeding and selection);

4) analysis of berry shape, color and size traits inheritance.

Conclusions

High-throughput phenotyping can help identify grapevine populations, selections and varieties with desirable berry traits at an early stage of the breeding (earlier than 3-4 years), which allows conduct early screening of grapevine plants with improved bunch and berry characteristics and significantly increases the effectiveness of the grape breeding programmes.

Keywords: grapevine breeding, grape berry shape, high-throughput phenotyping, environmental factors, morphology peculiarities

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CHARACTERISTICS OF THE NEW VARIETY OF WINTER TRITICALE FANICA

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One of the promising crops at present is winter triticale - a crop with high potential and nutritional value. This crop is one of the great achievements of man in the field of plant breeding. The growing interest in the cultivation of triticale is caused by its high productivity, winter hardiness, quality of grain and green mass, low susceptibility to a number of diseases, the possibility of cultivation on poor soils. The strategic goal, in the process of further increasing the production of high-quality food and feed grain, is the creation of new high-yielding varieties of grain crops, in particular winter triticale.

The main task of triticale breeding at the present stage in the conditions of Moldova is the creation of mid-season and highly productive varieties with high grain quality, resistant to biotic and abiotic environmental factors. When creating a new variety, the important task of increasing yields by increasing the grain content of the ear and increasing the productive tillering of plants was solved. The best varieties of winter triticale, wheat and rye were involved in the crossing, which allowed to enrich the genetic basis of the breeding material, giving it a complex of biological and economically valuable traits and properties. Currently, the following varieties are approved in the Republic of Moldova: Ingen 93, 33, 35, 40, 54, Costel, and the FĂNICA variety is being tested in PVTC.

The FANICA variety was obtained by hybridizing 3 genera (common wheat, rye and triticale) - F_4 (Podoima x Talovscaia 12) x Ingen 93 and then, starting with F_2, individual selection was carried out from hybrid populations and they were tested in breeding, control and competitive nurseries. The variety belongs to the *Erythrospermum* variety (the spike and awns are white, the grain is red). The spike is cylindrical, 13.0–14.0 cm long and has a density of 31–34 spikelets per 10 cm of spike length. The kernel is large (the weight 1000 kernels is 48–51 g), contains 16.0–16.5% protein, 18–19% gluten. The number of grains in an spike varies from 69 to 76, in a spikelet 2-3 grains.

The vegetation period is 276–280 days. The FANICA variety belongs to the group of mid-early varieties, earing and flowering occurs 2–4 days earlier than the standard Ingen 93 variety. Plant height is 113–120 cm, productive tillering is 2.8–3.0 stems. High resistance to lodging and shedding. It is resistant to drought, frost and diseases (powdery mildew, yellow and brown rust, fusarium, septoria, etc.). The variety is productive, the potential yield is 8.9 t / ha, which is 1.0 t / ha more than the control variety (Ingen 93). It is recommended to sow in the first decade of october with a seeding rate of 4.5 - 5.0 million grains per hectare. Responds well to the application of mineral fertilizers. Less demanding of soil conditions than wheat.

A variety for grain feed use with good grain quality and high protein content. It has good biochemical and baking qualities. The new triticale variety can be used as a source material for the creation of new triticale varieties and for cultivation in all areas of Moldova.

Keywords: triticale, variety, resistance, grains, protein, gluten.

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INFLUENCE OF TEMPERATURE ON COMMON WHEAT – *Fusarium avenaceum* INTERACTIONS

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The fungus *Fusarium avenaceum* is a fast-growing micromycete, with a thin, light mycelium, yellowish, pink in color of varying intensity. In 2021, *F. avenaceum* isolates were recorded on common winter wheat with a much higher frequency in our conditions (11.8 %), compared to previous years. Along with direct economic losses, for cereal growers, especially wheat and barley, the pathogen also poses a food safety concern because it is also an active producer of mycotoxins in grains, such as moniliformin, eniatins, bovericin (Ponts et al., 2020). In our previous research, the specificity of the reaction of peroxidases to fungal isolates was found, which denotes its pronounced intraspecific polymorphism (Lupascu et al., 2023).

The aim of the present research was to establish the cumulative effect of the *F. avenaceum* fungus and temperature on the variability and heritability of growth organs and development of common wheat under *in vitro* conditions.

Material and methods. Four common winter wheat genotypes – Moldova 66, L Cub.101/Bas., L Bas./M30, L Sel./Accent and 4 culture filtrates (CF1, CF2, CF3, CF4) of the *F. avenaceum* fungus as objects of study they served. Culture filtrates were prepared based on Cszapek liquid medium.Wheat grains were treated for 18 hours with CF, after which they were rinsed with distilled water and placed in Petri dishes on filter paper moistened with water, the seedlings being grown for 6 days under different thermal conditions. In variant I, the temperature was constant: 18-19 °C for 6 days, in variant II the seedlings were maintained on day 2 at a temperature of 8-9 °C for 6 hours. The experiment was performed in 3 repetitions. The data were statistically processed through variance, factorial analyzes in the STATISTICA 7 software package.

Results and discussion. In the thermal variant I, 9 cases of inhibition of growth and development organs were found, and in variant II – 29. Only in L Cubani 101/ Bas. were no significant inhibitions of growth and development organs recorded in both thermal conditions. Factorial analysis demonstrated that in the source of

variation of germination, radicle length, stem length, seedling length, the genotype share at temperature I constituted 60.6; 60.8; 87.3; 75.2; 77.1%, and of the isolate – 24.3; 18.8; 5.9; 12.7; 14.8%, respectively.

At temperature II, the genotype share was 69; 8.2; 61; 26.7; 32.8%, and the isolate share was 16.4; 69.5; 18.9; 51.1; 43.4%, respectively, of the mentioned characters. The heritability coefficient (h^2) coefficient varied within the limits of 0.64 ... 0.89 at temperature I, and 0.16 ... 0.79 – at II. The lowest h^2 values (0.16) at conditions II were recorded for the most sensitive growth organ – the embryonic radicle.

Conclusions. The data indicate that against the background of thermal alternation, the role of the isolate factor of the pathogen *F. avenaceum* has considerably increased, which denotes the high polymorphism of the isolates, the virulence phenotype of which is amplified against the background of unfavorable abiotic factors, what to consider in *in vitro* research.

Keywords: common wheat, fungus, *Fusarium avenaceum,* heritability

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GENETIC SOURCES OF NEW GERMPLASM FOR TOMATO BREEDING FOR FRUIT QUALITY

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High productivity and fruit quality can contribute to the increase of tomato production efficiency in the Republic of Moldova. Currently, the quality of tomato fruit remains one of the priority indicators for widespread consumption. This confirms the steady growth of consumer interest in tomato forms with a high content not only of lycopene and β-carotene, but also of anthocyanins, which are more powerful antioxidants. When searching for genetic sources of these traits, it is necessary to take into account the nature of manifestation of a number of other, no less valuable traits - weight, shape, diameter, color, strength and elasticity of fruit skin, content of dry matter, sugars, titratable acidity, organoleptic taste assessment (sour, sweet), aroma, pulp texture and others. Thin skin, cracking and rapid softening of fruits is one of the problems difficult to eliminate for tomato forms with the indicated set of traits. On this basis, the aim of the research was to search for and identify genetic sources of the indicated breeding-valuable traits for their subsequent use in the creation of lines, varieties and heterotic hybrids of tomato with increased elasticity of the fruit skin in the period of filling and ripening, simultaneously combining increased resistance to cracking and long-term preservation of fruit marketability under stress conditions.

As experimental material, 50 samples of old local forms of tomato, 125 marker mutant genotypes and more than 50 varieties of domestic and foreign selection were tested and described. Evaluation and identification of the sources of new germplasm was carried out considering the nature of manifestation and the degree of phenotypic expression of the complex of fruit traits affecting its quality within the population of each genotype at different stages of plant development.

High heterogeneity within the tomato (*Solanum lycopersicum* L.) gene pool has been revealed, both with respect to the color range and intensity of fruit coloration, and shape, size, surface and density of fruit skin. Taking into account the color range and intensity of fruit color, the collection samples are divided into 13 groups: 1 – red, intensely red, carrot-red; 2 – intensely orange, orange, light orange; 3 – lemon, yellow, dirty yellow; 4 – pale pink, pink, dark pink; 5 – purple, light violet, violet turning to black; 6 – white; 7 – dark green, green, yellow-green; 8 – intensely green

with black shoulders; 9 – burgundy transitioning to black; 10 – brown-black; 11 – red with pink stripes, red with yellow stripes; 12 – pink with yellow stripes, pink with white stripes; 13 – green with yellow stripes and green with brown stripes. Higher diversity within the collection of mutant forms, carriers of a large number of marker genes: *o, at, ep, gs, gf, hp, t, u, ug, Ip, l, r, sh, y*, controlling the manifestation of these traits. The content of lycopene and *β*-carotene in fruits is controlled by genes *B,* B^c*,* B^{og}*, Del.* Fleshiness and high firmness of fruits are imparted by *pat* and *pat-2* genes, which contribute to high fruit formation under conditions different from optimal. High heterogeneity was also found in the traits of fruit shape and surface structure controlled by another group of genes – *Ol, o, obl, el, n, n-2*. The collection samples systematized into groups and according to the shape of their fruits: rounded, flat-rounded, flat, pear-shaped, plum-shaped, cylindrical, heart-shaped and ellipsoid. Within each of these groups, the genotypes also differ in fruit surface texture - smooth, semi- and heavily ribbed.

Thus, as a result, genotypes (36.4% of the studied ones) with stable manifestation of fruit traits and with very low coefficient of their variability (C_V) from 0.4 to 9.7% were identified. The original combination of a complex of valuable fruit traits in one genome and their stable manifestation during the entire vegetation of plants indicates their importance as sources of new germplasm for use in breeding programs to improve existing and obtain new productive tomato varieties and hybrids with high marketability and fruit quality.

Keywords: tomato, breeding, genetic source, traits, fruit quality

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DEVELOPMENT OF SOYBEAN GENOTYPES WITH ENHANCED TOLERANCE TO THERMAL AND WATER STRESS UNDER CLIMATE CHANGE CONDITIONS

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The aim of this study is to develop soybean genotypes with high tolerance to extreme climatic conditions, particularly thermal and water stress, to ensure the stability of agricultural production in the context of intensifying climate change. The research was conducted in 2024 - a year that provided an ideal framework for evaluating genotype adaptability - characterized by elevated temperatures (2–3 °C above the multiannual average in June and July) and insufficient precipitation during key vegetative stages. These conditions revealed the vulnerability of conventional cultivars, particularly during critical developmental phases. In this context, the genetic improvement of soybean through the selection of stress-tolerant genotypes represents a strategic priority for sustainable agriculture in the Republic of Moldova.

The study was conducted at the Institute of Genetics, Physiology and Plant Protection of Moldova State University. The biological material consisted of 20 soybean genotypes from the 8th to 10th generations, developed through gamma ray-induced mutagenesis (100–250 Gy) and controlled crossbreeding, aiming to ensure broad genetic diversity. The genotypes were evaluated in the breeding program's control field on the institute's experimental plots. During the vegetation period (May–August), detailed agrometeorological data were collected - including daily maximum temperatures, soil moisture deficits, and isolated torrential rains - which were correlated with the phenological and productive behavior of the genotypes. The parameters analyzed included the duration of the vegetation period, plant height, fertility index, yield per plant, 1000-seed weight, as well as tolerance to abiotic stress and disease resistance.

Among the genotypes tested, Z3M$_{10}$100, Z1M$_{9}$250, L.4, and L.86 demonstrated outstanding adaptability under thermo-hydric stress conditions. Their short vegetation period (105–115 days) enabled them to complete pollination and seed filling before the onset of severe summer heatwaves. These lines successfully completed their

biological cycles while maintaining stable productivity. Yield per plant ranged from 8.2 g to 11.8 g, and 1000-seed weight varied between 149.1 g and 155.1 g. Furthermore, they exhibited phenotypic stability, resistance to key foliar diseases, and high agronomic potential, which recommends them as high-potential varieties for expanded cultivation.

The climatic extremes observed during the 2024 growing season served as an effective selection filter for identifying resilient soybean genotypes. The integration of modern breeding methods - mutagenesis and hybridization - proved successful in generating lines with enhanced tolerance to abiotic stress. Genotypes $Z3M_{10}100$, $Z1M_{9}250$, L.4, and L.86 stood out for their robust agronomic performance, offering viable solutions for soybean cultivation under increasingly unpredictable climate conditions. These findings underscore the importance of continued research and the incorporation of new genetic resources to support sustainable agricultural systems.

Keywords: soybean, climate change, mutagenesis, hybridization, agricultural adaptation

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EVALUATION OF THE GROWTH AND PRODUCTIVITY OF NEW STRAWBERRY VARIETIES IN OPEN FIELD

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The aim of this study was to examine the agrobiological indicators of growth and fruiting of new Italian strawberry varieties, which are actively imported due to the limited availability of domestic cultivars. The goal was to identify the most productive, visually appealing, and resilient varieties suitable for commercial use. An experimental plantation was established in mid-July 2022 in the village of Cunicea, Floresti district, using "frigo" seedlings of the Aprica, Lycia, Sibilla, Arosa, and Marmolada varieties, all from the CIV Italia selection.

The study revealed that the varieties differed significantly in growth vigor and vegetative shoot formation. The largest vegetative mass and the strongest root system were developed by the Aprica variety, which had superior indicators such as bush height, leaf area and gross weight among the studied varieties. The other varieties were in the following descending order in terms of bush development capacity: Sibilla - Arosa - Marmolada - Lycia. The Sibilla variety was characterized by the formation of the smallest number of stolons per bush. In the first year of fruiting, the highest yield per unit area was recorded in the Arosa variety, at 27.6 t/ha. The Lycia variety had the lowest yield, producing 20.4 t/ha - approximately 26% less than Arosa.

In the second year of fruiting, average fruit weight decreased across all varieties. For Marmolada, it dropped by 7.8% to 17.1 g. Despite this, yield per hectare increased by 0.3–1.6 t/ha due to more flower stalks per plant. Over two years, Arosa had the highest total yield (55.9 t/ha), followed by Sibylla, Marmolada, Aprica, and Lycia. In the first year, fruit size was largest, averaging 21.3–27.3 g. Although berries were smaller in the second year, yield slightly increased due to more fruits per plant. Dry matter content ranged from 10.3% (Aprica) to 12.5% (Marmolada). Pulp density peaked at 0.83 g/cm² in Arosa. Vitamin C content ranged from 29.9 to 37.0 mg/100 g, with higher values in later-ripening varieties. Thus, an extensive agrobiological study of 5 varieties of Italian-selected strawberries allows us to recommend for production the early-ripening Aprica variety, the mid-ripening Sibylla variety, and the late-ripening Arosa variety, which, according to

a set of technological, biochemical and commercial characteristics, presented the best results in the studies conducted.

Keywords: strawberries, cultivars, growth indicators, productivity

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EXPLORING THE EFFECT OF X-RAYS ON SEED GERMINATION OF SPECIES OF THE GENUS *Cuphea* P. Browne

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The genus *Cuphea* P. Browne (*Lythraceae* J. St.- Hill.) comprises 240-260 herbaceous plant species, annual or perennial, widespread in temperate, subtropical and tropical regions of the American continent. Their importance is very varied, but of particular interest is the ability of plants to synthesize and store in seeds technical oils (16 - 42%), the composition of which is determined by medium-chain fatty acids: caprylic (C8:0), capric (C10:0), lauric (C12:0), myristic (C14:0) - compounds of high economic value. The domestication of *Cuphea* species in temperate climate zones requires the use of special methods that would contribute to their improvement and valorization as well as to the obtaining of new genotypes with high performance under introduction conditions. An effective method that provides the possibility to achieve this desideratum is induced mutagenesis. It offers good prospects for the domestication of promising underutilized wild species, for agricultural or horticultural uses as well as for improving adaptation of recently introduced crops to unsuitable environments.

This research aims to explore the biological response of *Cuphea* species following X-ray irradiation. The study material consisted of seed samples of the plant species *Cuphea lanceolata* Ait. (MDI 02161, MDI 02167) and *Cuphea lutea* Rose (MDI 02234). Fifty seeds of each genotype were treated with X-rays at different doses: 100 Gy, 200 Gy, 300 Gy, 400 Gy, 500 Gy and 700 Gy. Irradiated seeds were germinated in Petri dishes on filter paper and periodically moistened with distilled water. The effect of the action of the mutagenic factor on seed germination varied depending on the dose and the species evaluated. In *C. lanceolata* Ait. (MDI 02161) this parameter was decreased at 400 and 700 Gy after which germination decreased to 76.7 and 70.0% respectively. In sample MDI 02167 this parameter decreased by

6.7% (700 Gy) relative to the control. *C. lutea* Rose plants proved to be the most radiosensitive. Germination of seeds of this species decreased by 33.3% at a dose of 200 Gy, and at an irradiation of 500 Gy the level of this parameter reduced by 38.3% compared to the control. Irradiated seedlings emerged later than the control with a slower growth rhythm. Seed irradiation with 300 Gy significantly inhibited seedling sprouting, leading to chlorophyllene mutations and slowed plant growth. Seedling survival rate decreased with increasing radiation dose. Radiation doses of 300 Gy and higher are considered lethal, leading to extremely low or no plant survival.

Keywords: Cuphea, medium-chain fatty acids, X-ray, irradiation, germination

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ASSESSMENT OF CONSERVATION STATUS OF FERTILIZED GRASSLANDS THROUGH CHARACTERIZATION OF ENVIRONMENTAL VARIABLES AND SOIL FAUNA, FROM BUCEGI MOUNTAINS, ROMANIA

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The mountain grasslands are very important from ecological and pastoral points of view. Maintaining functionally diverse invertebrate communities in grasslands may have positive effects on ecosystem functionality. Soil mites (Mesostigmata) are one of the most abundant invertebrates groups. They are considering valuable bioindicators, recording a spatial variability that change over time and influenced by climatic conditions. Biotic and abiotic factors exert regulatory effects on their populations. Many researchers studied the influence of grazing intensity, fertilization and different abiotic factors on the mite communities. In Romania, these studies have been focused on qualitative and quantitative data or on the influence of heavy metal pollution and other climatic factors on their communities. None of these studies took into consideration chemical and organically fertilized experimental grasslands and their relationship with mite fauna. Considering all these aspects, we proposed to investigate some ecological aspects (including the dispersion rate) of soil mite fauna from five experimental grasslands, in correlation with abiotic factors.

The study was accomplished in 2017. In total, 250 soil samples were analyzed, revealing the presence of 30 species, with 1163 individuals. The fauna sampling was sampled with a MacFadyen soil core at a 10 cm depth. The mites were extracted with Berlese–Tullgren method, using natural light and heat. Taxonomic identification and

counting were conducted using Zeiss stereo-microscope and Axio Scope A1 Zeiss microscope. All statistical procedures were implemented in R 4.0.2. Each experimental plot was defined by characteristically environmental conditions, vegetation cover, soil moisture content and soil temperature differing significantly among the experimental grasslands. On the other hand, each experimental plot was characterized by the specific indicator species, numerical abundance and species richness. Analysing the dispersal rates of mite communities between the plots, we demonstrated that between the experimental grasslands dominated by the accessory and accidental species, the mobility of these invertebrate communities was higher. This study demonstrates the importance of knowing the ecology of the mite communities, as important tools for environment assessment.

Keywords: environment, fertilized, grassland, invertebrates, soil

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IMPROVEMENT OF FOOD SORGHUM IN THE REPUBLIC OF MOLDOVA

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Globally, including in the Republic of Moldova, in recent years, the intensity of the use of natural resources has been increasing at an accelerated pace, the reserves of which are increasingly being reduced due to the negative impact of climate change.These trends enormously affect the potential for cultivating agricultural plants, considerably reducing their productivity and quality, especially through the drastic increase in temperatures, the accelerated desertification of agricultural areas, and the increase in years with increasingly severe and longer droughts.In these circumstances, the exceptional importance of sorghum, which is called the "camel of agriculture", becomes increasingly evident, this plant having the highest resistance to drought and using water resources most efficiently compared to all other widely distributed agricultural crops. Due to these particularities, grain sorghum crops are currently spread in more than 100 countries, being cultivated on an area of 49 million hectares annually. In the structure of crops, sorghum ranks 5th in the world after wheat, rice, corn and barley. Sorghum grain provides food for many millions of people in Africa, Asia and Latin America. In recent years, sorghum grain has been increasingly used by patients with genetic gluten intolerance. There are between 140 and 400 million such people in the world. The paper includes the results obtained in breeding sorghum for grain.

The object of study was the grain sorghum hybrid SASM 3 and the Avantaj variety. The research was conducted in the Plant Resistance Genetics laboratory. The newly created genotypes were obtained through individual selections and self-pollination from the hybrid sorghum population MK 14, MSL 21.

The hybrid SASM 3 ensures the yield of grains at the level of corn, but having grains with glassy endosperm (similar to rice and respectively called soriz by combining the words *Sorghum oryzoydum*) products similar to those processed from rice grains can be successfully obtained: whole and broken groats, semolina, flour, starch, beer, combined feeds, etc. The yield of groats, semolina and flour from soriz

reaches 75 – 82 %, while from rice it is 53 – 63 % and respectively 1.5 - 1.7 % - of wheat semolina. The protein content in these products is 9.4 - 10.6 % (in rice 6.5 - 8.5 %), starch 82 – 88 %, fats 0.2 -0.5 %.

The Avantaj grain sorghum variety is semi-early. The plant height is 120-160 cm. The central stem consists of 9-10 nodes. The panicle peduncle is well developed from the sheath of the last leaf – flag and reaches a length of 32-35 cm. The panicle is compact, cylindrically elongated with medium glume pubescence, light yellow in the ripening phase. The grain is oval in shape, light yellow with glassy endosperm. The mass of 1000 grains varies from 28-31 g and can be used for the production of groats, semolina and gluten-free flour. Productivity was an average of 6.4 t/ha of grains, exceeding the control by 0.27 t/ha. The grains contain: 9.8 % protein, 63 % starch and 1.8 % fat. It is attacked by diseases and pests at the level of the control, resistant to plant fall and grain shaking.

The grain sorghum hybrid SASM 3 and the Avantaj variety are of interest both for the grain harvest, the high content of nutrients, proteins, sorghum seeds can be commonly consumed in flour or semolina.

Keywords: sorghum, varieties, traits, resistance

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WINE YEAST S*accharomyces cerevisiae* RESEARCH IN UKRAINE

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Data from molecular genetic studies of the yeast component of the terroir microbiome indicate that the basis of wine quality is the genus, species composition and strains of *Saccharomyces cerevisiae* yeast, which determines the feasibility of research and preservation of their genetic resources. The aim of the work was to expand the composition of wine yeast *Saccharomyces cerevisiae* collection and their phylogenetic studies in relation to the ecological conditions of vineyards. The object of the research was the plots of grape plantations and strains of wine yeast. For phylogenetic analysis, 64 strains of *Saccharomyces cerevisiae* isolated on 36 wine grape varieties during the ripening period were used. For the analysis of nucleotide sequences and the construction of a dendrogram, version 5.2 of the MEGA phylogenetic analysis program and nucleotide sequences of the ITS1_5.8S_ ITS2 region of ribosomal DNA of strains deposited in the NARO GeneBank (https:// www.gene.affrc.go.jp/databases-micro_search_en.php) were used. To study the ecological conditions of vineyards, topographic and soil maps, soil survey materials, meteorological observation data, and the VIN-CAD-UKR software product (Registration number 4830, February 4, 2020, Bulletin No. 57) were used.

The collection of wine yeast strains isolated in the wine-growing regions of

Ukraine currently consists of strains isolated in the 60s - 70s (32 samples), strains isolated in Odessa and Mykolaiv regions in the 2000s - 2020s (42 samples) and Transcarpathian region in 2024 (12 samples).

The difference between the ecological conditions of vineyards located in the Odessa and Mykolaiv regions and between the Tairov and Izmail territorial communities of the Odessa region is shown, which was caused by the different characteristics of the soil cover and microclimatic conditions of the territory, which, probably, can lead to changes in the genetic diversity of wine yeast.

The assessment of the wine yeast strains genetic diversity showed that the main factors are the geographical location of the site (environmental conditions), its size, the year of isolation and the variety from which the strains were isolated. Our data provide some support for the assumption that yeast terroir is associated with the stable diversity of S. cerevisiae in time and space, rather than with the long-term preservation of specific local strains in a particular region or winery.

Phylogenetic analysis of 64 wine yeast strains isolated on 36 wine varieties (ITS1-5.8S-ITS2 region), which belong to the species Saccharomyces cerevisiae, demonstrated that the clustering of samples is mainly influenced by the year of isolation, i.e. agroclimatic factors as a component of environmental conditions and to a lesser extent – the varietal composition of grape plantations.

Key words: terroir, environmental conditions, *Saccharomyces cerevisiae* strains, sequencing, phylogenetic analysis

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GRAPEVINE PROTECTION: NEW CONDITIONS, NEW TECHNOLOGIES

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Due to climate change, there has recently been an increase in the resistance of pathogens (downy mildew, powdery mildew agents) to frequently used pesticides, changes in the biophenology of grape berry moth, which requires technological changes in protection systems.

For vineyards in Ukraine mildew (*Plasmopara viticola*) is one of the most widespread and harmful diseases of grapevine. But recently, due to arid vegetation conditions, powdery mildew (*Uncinula necator* Burril.) has become of great importance. Among the pests, grapevine berry moth deserves special attention. Therefore, controlling their distribution and abundance is an important part of the technology of growing grapes, including table ones.

The aim of this work was to study the effectiveness of vineyards protecting from harmful organisms using innovative preparations from Syngenta.

To achieve the goal, in particular, we conducted monitoring of the most harmful grape diseases (downy mildew, powdery mildew) and study of the biophenology of grape berry moth and its harmfulness.

Field research was conducted in 2024 on the demonstration plot "Conveyor of table grape varieties" (20 table and 3 wine varieties breeded at the NSC "Tairov Institute of Viticulture and Winemaking") with a total area of 2.5 ha (0.5 – control, 1 ha – standard, 1 ha – new scheme. Planting year 2012-2014, formation – horizontal border on the middle trunk, rootstock – B x R Kober 5 BB. Planting scheme of the vineyard – 3 x 1.5 m, non-irrigated.

An OPV-2000 tractor sprayer was used, the working solution consumption rate was 400 – 1000 l/ha. The studied treatment scheme included 10 preparates and Izabion - a growth stimulator and organic fertilizer/

The results of the research show that the effectiveness of the system against pathogens in variant using the Syngenta protection scheme exceeded the effectiveness of the protection scheme in the reference variant. On average, for the studied diseases (downy mildew, powdery mildew, bunch rot), the effectiveness was 95.1% versus 88.3% for the reference.

Regarding pests, the highest biological effectiveness in protecting aganist grapevine berry moth was also obtained when using the Syngenta protection scheme (96.2% versus 85.6 % for the reference.).

Thus, experimental data indicate the high effectiveness of the protection system with Syngenta preparations against a complex of grapevine pests and diseases in the extreme weather conditions and epiphytotic development of grapevine powdery mildew, as well as grapevine berry moth *Lobesia botrana* protection.

Conclusion. Protection system using Syngenta preparations makes it possible to effectively protect the grape crop from harmful organisms

Keywords: treatment, grape berry moth, powdery mildew, downy mildew, bunch rot

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Ailanthus altissima (Mill.) SWINGLE: ECOLOGY, ECOSYSTEM SERVICES, DEGREE OF INVASION

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Ailanthus altissima (Mill.) Swingle (Tree of heaven), native to Asia, it was widely planted in cities around the world because of its ability to grow in adverse conditions (even in cement cracks), it is extremely tolerant of acidic, compacted, or nutrient poor conditions of the soil, it is very tolerant to drought and flood Gbut not very tolerant to shaded conditions.

Most reproduction is asexual, via cloning forming dense clonal thickets but also producing very high number of seeds (300,000 seeds per year by a female adult tree) mainly dispersed by wind. Its biology and ecological preferences and reproduction make this species frequent invader in disturbed areas such as: urban areas, forest edges, savannas, open forests, canopy gaps, communication corridors (roadsides, railways, freeways, or walkways), in rural areas along fencerows, woodland edges, or rocky and forest openings, and in heritage areas such as archaeological monuments.

The ecosystem services are multiple and complex and based on literature survey and expert opinion and regarding the categories of ecosystem services based on the CICES, our paper presents the positive and negative impacts on provisioning, regulation & maintenance, cultural, biodiversity & human health.

In our days, *A. altissima* is one of the most invasive weeds in temperate climates of the world (North and South Americas, Europe, Australia and North and South Africa). It was first introduced into America in 1748 by a Pennsylvania gardener. In Romania is first mentioned in 1866 in Transylvania (cultivated in gardens) and introduced and naturalized in the Bucharest city and surrounding in 1898. In EPPO Global Database, the species is reported as present in Republic of Moldova but no other details.

The exact costs are unknown. However, it is widely accepted that prevention would be highly cost effective. The management of this invasive species can be considered from the perspectives of public (policy-maker, public lands manager) and

private (forest owner, timber operation manager, goods importer, forest recreationist) decision- makers.

Future researches are highly needed. We identified the need for more studies regarding: biodiversity, habitats, ecosystem services and human conceptions in our biogeographic areas and in more cities; outside cities areas where *A. altissima* invades in mass mainly cliff habitats which comprise the richest endemic flora of Romania, the most appropriate measures that should be taken for diminishing/eradicating *A. altissima* where/if is needed.

Keywords: *Ailanthus altissima*, biology, ecology, ecosystem services, invasion

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INITIAL OBSERVATIONS ON *Campanula romanica*: DNA BARCODING AND POLLEN MORPHOLOGY

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Campanula romanica Săvul. is species endemic to the Dobrogea region of southeastern Romania, belonging to section *Rotundifoliae* within the *Campanulaceae* family. It is morphologically distinguished by several features, such as a short, hairy basal stem, numerous shortly petiolate stem leaves, a very small corolla (8–10 mm), and an elongated obconic-cylindrical capsule.

The taxonomic complexity and polyphyly of genus *Campanula* complicate species boundaries, especially in local endemics such as *C. romanica*. Despite its close relation to taxa such as *C. bulgarica*, *C. balcanica*, and *C. rotundifolia*, the taxonomic and phylogenetic position of *C. romanica* is still incompletely resolved, primarily due to the lack of molecular data and complex evolutionary histories within the genus.

The aim of this study was to explore the phylogeny and micromorphological traits of *C. romanica* as a preliminary step toward clarifying its taxonomic status. The findings are based on 12 field-collected samples of *C. romanica*. DNA was extracted from dried leaf material and subsequently amplified using standard barcode markers: nuclear ITS, and plastid matK and rbcLa. PCR products were Sanger sequenced. Pollen grains were examined using scanning electron microscopy (SEM) and the diameter was measured for multiple grains per sample.

While PCR was generally successful, the resulting sequences were of insufficient quality, exhibiting background noise and ambiguous base calling across all markers. These issues hindered reliable alignment and phylogenetic inference, reflecting the technical challenges inherent to molecular work on endemic, non-model species. Improving sample preservation and DNA extraction protocols will be essential for future investigations.

SEM revealed that *C. romanica* produces pollen grains with a diameter of 22-

25 μm, falling within the lower size range for the genus. The smaller pollen grain size in *C. romanica* may be associated with its floral miniaturization and could reflect an evolutionary adaptation.

Although the barcoding component of this study was compromised by sequence quality, the palynological data offer preliminary insight into micromorphological differentiation in *C. romanica*.

Given the exploratory nature of this study, the limited number of samples, and the restricted geographic coverage, the findings should be interpreted as preliminary. In order to provide a clearer understanding of the taxonomic and phylogenetic placement of *C. romanica*, it is essential that future research expands both the sample size and geographic coverage and performs comparative analyses with closely related species.

Keywords: *Campanula romanica*, endemic species, DNA barcoding, SEM, pollen morphology

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STUDIES OF THE COMPORTMENT OF NEW INTRODUCED WALNUT VARIETIES WITHIN REPUBLIC OF MOLDOVA

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Crop and successful of walnut (*Juglans regia* L.) market depend on varieties, its characteristic of fruit bearing type, agro-technical measures, environmental factors, etc. In present for nut domain of Rep Moldova there are important to implement for temporary testation of varieties production with lateral bearing, especially with late flowering period of pistillate flowers.

Pomological studies (including IBPGR descriptor) were dedicated to comparative appreciation of comportment of local and introduced mainly protandrous varieties Chandler, Lara, Fernor, Fernette, Tulare, Franquette, which are good pollinators for most local Moldovan protogynous one. Experimental orchards there are established in the conditions of Central, partially North and South Pomological zones of the Republic of Moldova.

More promising results were noticed for Chandler variety with good resistance to late spring frosts and compatibility with local varieties (Pecianskii, Kisiniovskii, Skinosskii, Calarasskii etc.). Chandler, as well as Tulare is moderately vigorous and semiupright. Harvest time is for mid to late season. The whitest shell color and high index of kernel/endocarp relation: 45-47% of kernel were noticed at north pomological zone especially for Chandler variety. At the same time crispness rating of kernels of Chandler was almost the same in all studied zones. Until now a significant marketing defect there not noticed whin the conditions of our country. Most of the studied varieties had a moderate kernel fill and shriveling score. Embryological approaches regarding introduced varieties shows following results. The most favorable morphophysiological state of embryo sac (E.S.) for fertilization coming in 2-3 days after the differentiation of 7-cells stage. This moment coincides approximately with the 4-5 day of total opening of stigma. Three days before the total opening of stigma, as well as on the first and the 6th days mass germination of pollen in stigma tissues were not observed. In the last case the pollen tube reaches the E.S. on the 9th day, when the elements of E.S. are already hypertrophied and fusioned. For the most local and introduced varieties with the medium pistillate

flowering period the most favorable stage for pollination is reached on the third day of flowering. In this case efficient receptivity of stigma totally corresponds to morphophysiological preparation of female gametophyte for fertilization. Data of E.S. dynamic differentiation within studied introduced protandrous varieties make us to conclude that in the climate conditions of the Rep. of Moldova Chandler, Hartley, Fernor, Fernette with partial coverage of female and male flowering period and female flowers, as well as the early protandrous variety Lara have the most chances for occurrence double fertilization and for the following normal development of the embryo as a principal and more valuable part of walnut fruit.

Key words: walnut, introduction, varieties, adaptability, Republic of Moldova

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VALUABLE SAMPLES OF THE UKRAINIAN GENE POOL – LOCAL FORMS OF VEGETABLE PLANTS

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Breeding improvement of plants is a complex process of reconstructing useful indicators and traits of interest to the researcher, bringing them to the maximum level in production technologies in terms of productivity, quality, disease resistance and a number of other parameters. One of the effective directions in the enrichment of genetic diversity for use in breeding practice is the involvement of local plant forms in working collections. The first stage of research in this direction is their search and mobilization in order to expand the resource base for subsequent involvement in the selection process.

An important task is also the search for samples of unknown origin, but grown for a long time in the territory of a certain region, adapted to local soil and climatic conditions. These are potential sources of valuable biochemical composition, commercial taste, resistance to abiotic stressors, unpretentiousness to growing conditions, etc. Therefore, research on the collection and evaluation of the source material of rare species of vegetable plants is an important direction.

Dill (*Anethum graveolens* L.) is a valuable green vegetable plant. According to the results of the assessment of genetic resources of local origin from the Chernihiv region (Ukraine), 2 dill samples were isolated, which underwent scientific and technical expertise and were registered in the National Center for Plant Genetic Resources of Ukraine: Chernigivsky (Certificate No. 002413) and Perebudivsky (Certificate No. 002415).

The local form of fragrant dill Chernihiv was selected in Chernihiv in 2015, the local form Perebudivsky - in the village of Perebudova, Nezhinsky district in 1993. from discovery to 2019. Signs of identification of samples that determine their difference: local form Chernigivsky: yield of green mass, color of leaves, slight wax coating, arrangement of leaves in a rosette; local form Perebudivsky: yield of green mass, the presence of a blue tint, broadly rhombic leaf shape, strong wax coating. Elements of novelty for which samples are applied for registration: local form Chernigivsky: a combination of green mass yield - 15.0 t/ha with the number of days to economic suitability - 36, the number of leaves - 7 pieces; economic suitability

period 12 days, resistance to powdery mildew - 7 b., drought resistance - 7 b., cold resistance 9 b., resistance to stemming 7 b., seed plant height 88 cm; local form Perebudivsky: a combination of green mass yield - 16.2 t/ha with the number of days to economic suitability - 32, the number of leaves - 7 pieces; period of economic suitability 14 days, resistance to powdery mildew - 7 b., drought resistance - 7 b., cold resistance 9 b., resistance to stemming 7 b., seed plant height 102 cm, distinctive features: “the presence of a blue tint of leaves”, “the shape of the leaves is broadly rhombic”, “the presence of a strong wax coating”.

In the natural lands of the Nezhinsky district, a wild-growing form of sorrel (*Rumex acetosa* L.) was isolated, named after the place of growth Fendykovo-Kotsyubynivsky. Valuable as a source of early maturity (25 days), green mass yield (20.2 t/ha), winter hardiness, drought resistance; the length of the leaf blade is 10 cm, the width is 2.5-3.5 cm; with a dark green leaf color (Certificate No. 002228).

Thus, as a result of the assessment of genetic resources of local origin according to a complex of economically valuable indicators and traits, 2 samples of fragrant dill and a wild form of sour sorrel from Chernihiv region (Ukraine) were identified, which passed scientific and technical examination and were registered in the National Center for Plant Genetic Resources of Ukraine.

These samples are involved in the breeding process to create competitive varieties of fragrant dill and sour sorrel adapted to local conditions.

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CONSERVATION, ENRICHMENT AND USE OF NEW PHYTOGENETIC RESOURCES IN UKRAINE

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The problem of ensuring one's own food, biological, ecological, and energy security is relevant for many countries. An important task is to develop fundamental and applied principles for the mobilization, preservation, enrichment, and rational use of new phytogenetic resources of the world's flora (Biological…, 2024). Introduction, acclimatization, and plant breeding are important scientific areas that result in significant changes in the plant diversity of cultural phytocenoses (Introduction…, 2020).

Of the approximately 400000 known plant species of the world's flora, the number of agricultural crops is over 7000. Among them, over 650 are of paramount importance for the development of civilization. According to FAO estimates, 75% of the biodiversity of agricultural crops has been lost over almost a 100-year period (Fundamental…, 2022). Seed banks play an important role in preserving the genetic diversity of cultivated plants. In total, about 7.5 million samples of agricultural crops are stored in world gene banks (Fundamental…, 2024). The National Center for Plant Genetic Resources of Ukraine stores about 155 thousand samples belonging to 550 agricultural crops (https://yuriev.com.ua, Report of the National Center for Plant Genetic Resources, 2024). The State Register of Plant Varieties of Ukraine includes 15205 varieties (2025).

An important way to preserve the phytogenetic diversity of introduced and autochthonous plants ex situ is to maintain them in collection and seed funds of botanical gardens, arboretums and other specialized institutions. According to our estimates, the total number of samples in the botanical collections of Ukraine is about 40 thousand taxa.

The purpose of the work is to develop breeding-genetic, ecological-biological, physiological-biochemical foundations the mobilization, preservation, enrichment and effective use of new phytogenetic resources of useful plants through introduction, acclimatization, adaptation and biotechnology.

The M.M. Gryshko National Botanical Garden NAS of Ukraine (NBG) has a large introduction-genetic fund of plants (over 17.2 thousand taxa), on the basis of which about 500 varieties have been bred. The Department of Cultural Flora of the

NBG has a phytogenetic fund of economically valuable plants, which includes over 2500 taxa (including over 50 rare ones). On their basis, about 140 original varieties have been created. A component of this gene pool, namely the "Collection Fund of Energy and Aromatic Plants of the NBG" (about 1770 taxa), is included in the List of Scientific Objects constituting the National Heritage.

Scientific and practical foundations for the introduction into culture and use of new and non-traditional phytogenetic resources in bioenergy of Ukraine (680 taxa, including 34 original varieties) have been developed. The gene pool of bioenergy plants consists of a collection of plants for solid biofuels and biogas (315 samples), oilseeds (215), sugar plants (150 taxa).

Thus, we have developed scientific and practical principles for the mobilization, preservation, enrichment and effective use of new phytogenetic resources of introduced and autochthonous plants with a complex of useful traits. We have worked out the genetic and breeding, biotechnological, physiological and biochemical and energy aspects of increasing the efficiency of the process of introduction, acclimatization, adaptation of plants, resistance, productivity and qualitative and quantitative characteristics of new crops and genotypes. A significant contribution has been made to the development of the formation of new phytogenetic resources of niche cultures, which is a relevant direction in modern plant breeding.

Keywords: new phytogenetic resources, conservation, enrichment, use

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TRENDS IN ACCESS AND BENEFIT-SHARING REGULATIONS FOR PLANT GENETIC RESOURCES

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The ongoing decline in biodiversity, compounded by climate change, pollution, and genetic erosion, poses a critical threat to global food security and human well-being. In response, the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) has emphasized the urgent need for transformative change - systemic shifts in values, structures, and practices - to address the root causes of biodiversity loss and achieve the 2050 Vision for Biodiversity. Plant genetic resources (PGRs), a key element in ensuring crop improvement and food security, are increasingly endangered by anthropogenic pressures and environmental stressors. The loss of genetic diversity undermines efforts to develop resilient crop varieties needed to adapt to changing climates. Current conservation efforts remain fragmented and underfunded, despite the existence of international frameworks such as the Convention on Biological Diversity, the Nagoya Protocol, and the International Treaty on Plant Genetic Resources for Food and Agriculture. The European Strategy for PGRs (ECPGR, 2021) highlights significant gaps and calls for enhanced ex situ, in situ, and on-farm conservation, robust data management systems, stakeholder engagement, and coordinated legal and policy measures. Ensuring the long-term availability and sustainable use of PGRs requires active conservation, improved documentation, and strengthened research infrastructure supported by national and international collaboration.

Along with the evolution of the global conservation system, the 'concept' of genetic resources has evolved as well. Initially, the focus was strongly on the use of germplasm as the raw material for plant breeding, a resource that was freely available. The term germplasm gradually started to also embrace the associated knowledge as well as information derived from germplasm through basic and applied research, and breeding. Simultaneously, the status and recognition of the role of cultivators/ custodians of the genetic resource became part of this framework, and the concept of benefit sharing resulting from the use of the acquired resources was added to the legal arrangements to obtain these.

Legal frameworks like the Convention on Biological Diversity (CBD), Nagoya

Protocol, and the International Treaty on Plant Genetic Resources for Food and Agriculture (ITPGRFA) now govern access and benefit-sharing (ABS) of PGRs. Under the CBD/Nagoya Protocol, countries are free to establish specific national legislations that regulate germplasm access and benefit sharing to be negotiated bilaterally. The ITPGRFA attempted to ease this situation by establishing a globally harmonized multilateral system (MLS). Unfortunately, the MLS is (still) restricted to a limited number of food and forage crops, with very few vegetable crops. Crop improvement depends on access to agrobiodiversity to source new genetic variations for breeding. Fair, transparent, and non-bureaucratic rules and regulations that provide legal certainty concerning the access to and use of germplasm in breeding and research are, therefore, a predisposition for food security.

Keywords: plant genetic resources, International Treaty, Convention on Biological Diversity, Nagoya Protocol

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CREATION OF WINTER DURUM WHEAT VARIETIES IN THE REPUBLIC OF MOLDOVA

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Durum wheat for commercial production and human consumption is the second most important species of Triticum after common wheat. Research was carried out on the improvement of winter durum wheat, which was aimed at studying the characteristics and properties of this crop (resistance to frost, drought, lodging and the main diseases), which significantly influence the plasticity of the variety and the stability of the harvest. We used the methods of hybridization - interspecific and intraspecific. At the first stage, we studied the collection of winter durum wheat and common wheat. As a result, parental forms were selected, as a result of which we obtained a large number of hybrid combinations. We began individual selection of plants in the second generation and expanded it at all stages. The best forms selected in the improvement process were studied in various experiences (control selection, competition and in the variety testing sectors of the Republic of Moldova). Studying new lines in the experience of control and competition allowed us to select some of them, which are not inferior to the most superior varieties of common wheat, in terms of productivity and resistance to biotic and abiotic factors of the environment. Thus, short-stem durum wheat varieties were created (Auriu 273, Hordeiforme 335, Hordeiforme 333, Leucurum 2224, Hordeiforme 339), with a productivity potential of up to 6 t/ha. The grains of these forms have high glassiness (94-96%), a high protein content (13.2-15%) and gluten (24-28%). Due to their high productivity qualities and resistance to biotic and abiotic factors, three varieties (Hordeiforme 333, Auriu 273 and Hordeiforme 335) were approved in Moldova in 1998, 2000 and 2008.

The newest varieties in our breeding program are the varieties: Hordeiforme 340, Auriu 1, Auriu 2, Auriu 5, Hordeiforme 3, Leucurum 1, Sofidurum and al. All varieties created by us are varieties with an average height resistant to falling. According to the mass of 1000 grains, the varieties Auriu 5, Auriu 4 and al are distinguished. The hectoliter weight is an element of assessing the quality of the grains. According to this

character, all varieties exceed the control variety and the highest is in the varieties: Sofidurum, Auriu 273 and Auriu 4. The most important quality characteristics are glassiness, protein and gluten content in the grains. Valuable genotypes have been identified according to these characters. According to the protein content and glassiness of the grains, the following varieties were noted: Sofidurum, Hordeiforme 340 and Hordeiforme 335. According to the gluten content, the varieties: Auriu 5, Auriu 273 and others. In favorable years, the average productivity of these varieties varied between 3.5 and 7.5 t/ha, and in unfavorable years between 1 and 2t/ha. Due to the high results according to the studied characters at the State Commission for Testing Plant Varieties, the varieties: Hordeiforme 340 in 2016, Auriu 2 – 2020 and Sofidurum – 2021 were approved, and the Nastea variety is being tested for the second year, which in recent years has achieved higher productivity than the control variety and was more resistant to environmental conditions.

Keywords: winter durum wheat, productivity, resistance, glassiness, gluten

Funding. The research was carried out within the subprogram 011102 „Expansion and conservation of genetic diversity, improvement of agricultural crop genotypes in the context of climate change", funded by Ministry of Education and Research of the Republic of Moldova.

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THE POTENTIAL FOR COLLECTING GERMPLASM FROM RARE SPECIES CONSERVED *EX SITU* IN THE COLLECTIONS OF THE "AL. CIUBOTARU" NATIONAL BOTANICAL GARDEN (INSTITUTE)

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Botanical Gardens represent living archives of plant biodiversity originating from various phytogeographic regions of the Earth, but, according to *"International Agenda for Botanic Gardens in Conservationun*" (2012), a central role of these is the *ex situ* conservation of native flora in *ex vivo* collections, germplasm collections and herbarium collections. *Ex situ* conservation has several purposes, including the saving of the germplasm of the threatened species, by storing genetic material in germplasm collections (seeds, spores, etc.). This conservation method is cost-effective due to small storage space and has the following benefits: seeds of many species can be preserved for the long term; provides researchers with easy access to genetic diversity (seeds of the same species collected from different centers of origin); serves as a support for threatened plant populations, contributing with material for reintroduction, repopulation and restoration; provides the opportunity for research into conservation biology; contributes to ecological education in the field of conservation; brings local input to the *International Seed Exchange (Index Seminum)* between Botanic Gardens and Research Institutions.

Within the *"*Al. Ciubotaru*"* National Botanical Garden (Institute) (NBGI) the flora of the Republic of Moldova is represented by a number of species, which are framed and maintained in collections and micro-exhibitions such as: Exhibition of the Vegetation of Moldova; Collection of Ornamental Plants; Collection of Medicinal Plants; Collection of Aromatic Plants. These representatives of the native flora, preserved *ex situ* in the GBNI, represent a potential for collecting genetic material. This opportunity eliminates or reduces the pressure exerted by wild collection on threatened species, with degraded habitats and with fruiting phases compromised by various limiting factors.

During 2024-2025, 30 seed samples of the following species were collected

from the collections and exhibitions of NBGI, for the conservation in the germplasm collection "*Rare Plants of the Republic of Moldova*" (PRRM): *Adonis vernalis* L.; *Alnus glutinosa* (L.) Gaertn.; *Alnus incana* (L.) Moench; *Amygdalus nana* L.; *Anemonoides sylvestris* (L.) Galasso, Banfi & Soldano; *Asparagus officinalis* L.; Aurinia saxatilis Desv.; *Cephalanthera damasonium* (Mill.) Druce; *Clematis integrifolia* L.; *Convallaria majalis* L.; *Crambe tataria* Sebeók; *Dictamnus gymnostylis* Steven; *Digitalis lanata* Ehrh.; *Dryopteris fi lix-mas* (L.) Schott; *Galanthus nivalis* L.; *Helichrysum arenarium* (L.) Moench; *Iris pumila* L.; *Leucojum aestivum* L.; *Lunaria annua* L.; *Padus avium* Mill.; *Phyllitis scolopendrium* (L.) Newm.; *Pontechium maculatum* (L.) Böhle & Hilger; *Potentilla astracanica* Jacq.; *Pulsatilla montana* Rchb.; *Pulsatilla ucrainica* (Ugrinsky) Wissjul.; *Serratula coronata* L.

In conclusion, we can mention that the "Al. Ciubotaru" National Botanical Garden (Institute) holds a vast collection of threatened species of native flora, which can be exploited as germplasm sources in the conservation process.

Keywords: *ex situ* conservation, rare species, NBGI, Republic of Moldova.

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NEW FINDINGS OF *Serratula lycopifolia* (Vill.) A. Kern. AND *Trifolium pannonicum* Jacq. – RARE SPECIES IN THE FLORA OF THE REPUBLIC OF MOLDOVA

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The study was conducted within the field expeditions during which were collected seeds of rare plants, in the forest near the village of Vădeni, Soroca district, where new growth sites of two rare species, included in the 3rd edition of the Red Book (2015), were identified: *Serratula lycopifolia* (Vill.) A. Kerner and *Trifolium pannonicum* Jacq. The species inhabit the glades of mixed stands, dominated by the *Quercus petreae* (Matt.) Liebl. and *Q. robur* L., which is approximately 80 years old, light gray soil type, on a plateau an at an altitude of 320 m. Collected specimens of the identified species were herbariumized and deposited in the Herbarium of the "Al. Ciubotaru" National Botanical Garden (Institute).

***Serratula lycopifolia* (Vill.) A. Kerner** is a rare species of Community interest, protected by the Habitats Directive (2011). In the Republic of Moldova, according to Ioniță et all. (2024), it is identified only in three locations: Gordinești and Fetești, Edineț district and Colosova, Grigoropol district. Its distribution area includes Central and Eastern Europe, the Balkan Peninsula, Western Siberia. *Serratula lycopifolia* is one of the 6 species the restoration and repopulation activities for which were planned within the framework of the Project 20.80009.7007.22 "*Research and conservation of vascular flora and macromycobiota in the Republic of Moldova*" (2020-2023).

The highlighted location in the forest glades near the village of Vădeni represents a new growth point. The population is composed of three subpopulations at a distance of about 250 m from each other, and consists of about 30 mature specimens, and about 15 juvenile specimens, on an area of about 2.2 ha, which grow solitary and in small groups.

***Trifolium pannonicum* Jacq.**, a rare species for the flora of the Republic of Moldova, grows on the edge of oak and cherry forests in the north-west of the country: Briceni, Edineț, Rîșcani, Dondușeni districts, and the growth point in the

Vădeni forest would be its most South-Eastern growth point. The species' range includes Central and Eastern Europe, and the Balkan Peninsula.

The population we highlighted was not previously known and represents isolated specimens or small groups of 3-5 phytoindividuals, spread over approximately 200 m^2.

For *ex situ* conservation, germplasm of the two species was collected, as well as of other rare species from this habitat, such as: *Fritillaria montana* Hoppe ex W.D.J.Koch (included in the Red Book of the Republic of Moldova ed. 2015); *Asparagus officinalis* L.; *Asparagus tenuifolius* Lam.; *Clematis integrifolia* L.; *Iris aphylla* L. (species protected by the Law on the Fund of State Protected Natural Areas). Potential for further collections of rare species such as: *Lilium martagon* L.; *Veratrum nigrum* L.; *Potentilla alba* Moench. was identified.

The biological characteristics and ecological requirements of both species, together with the existing threats to their populations and habitats, determine the need to protect breeding sites as well as monitor the population status.

Keywords: *Serratula lycopifolia*; *Trifolium pannonicum*; rare species; new location; Republic of Moldova

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ASSESSMENT OF VASCULAR FLORA DIVERSITY IN THE ‘’DOBRUSA” LANDSCAPE RESERVE

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This study provides an overview on the vascular flora of the ‘’Dobruşa’’ landscape Reserve, based on the field research conducted between 2009 and 2025. The survey involved systematic collection and herbarium processing of cormophyte species, followed by taxonomic identification.

As a result of the research, 544 taxa were identified, belonging to 289 genera, 71 families, 4 classes, and 3 phyla. The phylum *PTERIDOPHYTA* is represented by a single class – Polypodiopsida (comprising 2 families, 2 genera, and 3 taxa). The phylum *PINOPHYTA* is represented by the class Pinopsida (comprising 1 family, 1 genus, and 2 taxa). The phylum *MAGNOLIOPHYTA* includes two classes: Magnoliopsida (represented by 56 families, 241 genera, and 452 taxa) and Liliopsida (represented by 12 families, 45 genera, and 87 taxa).

The most representative families are: Asteraceae (82 species from 40 genera); Fabaceae (40 species from 18 genera); Lamiaceae (37 species from 18 genera); Poaceae (36 species from 20 genera); Apiaceae (26 species from 19 genera); Rosaceae (26 species from 13 genera) and Brassicaceae (23 species from 18 genera). The other botanical families have under 20 species.

The most representative genera are: *Carex* L. with 14 species; *Veronica* L. with 13 species; *Trifolium* L. and *Galium* L., each with 9 species; *Viola* L. with 8 species; followed by *Bromus* L. and *Centaurea* L., each with 7 species; *Vicia* L. and *Lathyrus* L. with 6 species each. The remaining genera are represented by between one and five species.

In terms of biological forms, hemicryptophytes are clearly predominant, with 240 species (44 %), followed by phanerophytes with 103 species (19 %) and geophytes with 75 species (14 %). This distribution reflects an adaptation to a temperate continental climate with moderate seasonal variation. Regarding chorological elements, the flora is dominated by Eurasian species (236 species; 43%) and European species (80 species; 15 %), indicating a well-adapted native flora.

The analysis of the ecological moisture index confirms the predominance of habitats typical of hilly areas with fresh to slightly arid soils, accounting for

approximately 84 % of the flora: 44 % (240 species) are mesophilous and 40 % (218 species) are xeromesophilous.

The flora of the ‘’Dobruşa’’ protected area reflects a well-established and stable forest ecosystem with a high conservation value potential.

Keywords: taxonomic composition, vascular plant, ‘’Dobruşa’’ landscape reserve

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CONSERVATION OF GERMPLASM OF RARE SPECIES FROM THE "DOBRUSA" LANDSCAPE RESERVE

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In a constantly moving and developing world, measures to save and conserve genetic resources are becoming imperative. The collection and storage of plant germplasm is a modern system for biodiversity conservation, which allows the storage of a large number of samples in a relatively small space. The stability of plant biodiversity is ensured by the synergy of *in situ* and *ex situ* conservation strategies.

In 2024, within the National Botanical Garden (Institute) "Al. Ciubotaru", the germplasm collection "*Rare Plants of the Republic of Moldova*" (PRRM) was established, which has a primary role in ensuring the *ex situ* conservation of rare species of native flora. This collection presents, in essence, a scientific basis for a subsequent assessment of the preservation of quality indices, as well as the regeneration-multiplication-repopulation of species at high risk of endangerment.

Protected areas are selected as target points for the collection of biological material from *in situ* conditions, where rare species are widespread, including the "Dobrușa" landscape reserve.

Within the PRRM germplasm collection, seeds of species that represent rare taxa protected by the state are preserved through: *The Red Book of the Republic of Moldova* (1); *The Law on the Fund of State Protected Natural Areas* (2); *The Law on the Plant Kingdom* (3). Germplasm collections on the territory of the Dobrușa Landscape Reserve were carried out in 2024-2025, through field trips. The collections were sustainable and conscious, aligned with the principles of nature conservation.

During the reference period, germplasm of the following species were collected and preserved: *Cephalanthera damasonium* (Mill.) Druce (1, 2); *Epipactis helleborine* (L.) Crantz (2); *Epipactis purpurata* Smith (1, 2); *Fritillaria montana* Hoppe ex W.D.J.Koch (2, 3); *Galanthus nivalis* L. (1, 2, 3); *Lilium martagon* L. (2); *Lunaria annua* L. (2); *Scopolia carniolica* Jacq. (1, 2, 3); *Staphylea pinnata* L. (2).

In conclusion, we can state that the "Dobrușa" landscape reserve has potential

for collecting germplasm of rare native species, specific to forest coenoses. *Ex situ* conservation of species with high conservation value in germplasm collections ensures their long-term protection.

Keywords: rare plants, *ex situ* conservation, germplasm, Dobruşa protected area

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GENETIC VARIABILITY OF POLYPHENOLS CONTENT IN SOYBEAN SEEDS

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Soybean is the main source of complete protein for the needs of feed production and human nutrition on our planet. In this regard, its area and gross yield are growing rapidly and now amount to 137 million hectares and more than 370 million tons, respectively. The intensive spread of soybean in the world is due not only to the high content of protein and oil in the seeds, but also to the presence of a complex of functional compounds that have a significant beneficial effect on human health. Among them, polyphenols, a group of natural compounds that include one or more phenolic groups, occupy a special position. It is known that they have a high preventive effect on human health, especially protecting against such diseases as cancer, diabetes, cardiovascular, osteoporosis, and kidney diseases. These compounds are synthesized only in plants and are characterized by high antioxidant properties.

The purpose. Polyphenols include a significant number of functional compounds, but the most common are flavonoids. Our objective was to study their variability in the seeds of collection and breeding soybean samples during the implementation of our breeding program.

Materials and methods. The study involved a significant number of varieties from different countries of the world, which differed in the duration of the growing season, productivity elements, resistance to diseases and drought, and seed coat color. The study also involved breeding lines of hybrid origin, which were evaluated in competitive and preliminary nurseries. The amount of flavonoids was assessed by binding them with aluminum chloride [Evaluation of biochemical indicators of soybean breeding material that characterize seed quality. Odessa, Plant Breeding and Genetics Institute, 2025].

Results. The amount of flavonoids in 17 soybean varieties of Ukrainian breeding varied within 77.4–375.3 μg/g. The Smolyanka variety, which has black seeds, was characterized by a very high concentration of these compounds (375.3 μg/g). In yellow-seeded varieties, their content was 77.4–175.6 μg/g. In this study, the

Smolyanka variety, which was distinguished by the black color of its seeds, clearly stood out in terms of flavonoid content. The amount of flavonoids was also assessed in a set of 12 breeding lines with different seed colors obtained by crossing the Kobra collection variety, which has black seeds, with the Yug 30 variety of Ukrainian origin and the K-4937 collection sample. The recombinant lines were characterized by different levels of color intensity, from light brown to completely black. This made it possible to differentiate the amount of flavonoids depending on the color of the seed coat. In black-seeded lines (5 pcs.), the total amount of these compounds varied within 257–291 μg/g, in light-brown (2 pcs.) – 180.8–227.7, in red-brown (2 pcs.) – 212.3–219.7, and in brown (1 pc.) – 165.1 μg/g. In the yellow-seeded line of this hybrid combination, the amount of flavonoids was only 84.4 μg/g.

Conclusions. Significant genetic variability of flavonoid content in soybean seeds has been revealed. Biosynthesis of pigments in the seed coat leads to significant accumulation of polyphenols. Environmental conditions also affect their quantity

Keywords: soybean, polyphenols, flavonoids, varieties

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MORPHOLOGICAL PARTICULARITIES OF NEW TOMATO LINES *Solanum lycopersicum* L. OBTAINED *IN VITRO*

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One of the main tasks of amelioration was grandiose blending in the same variety of high productivity and resistance to stress factors (drought). As a result of distant hybridization, the breeder is also interested in highlighting the spectrum of genetic variability, which increases the efficiency of selecting genotypes with high productivity and increased resistance to environmental stress factors. From the literature data it has been demonstrated that the prolonged action of high temperatures 30-35 °C on tomatoes during fruit setting leads to plant sterility. The most sensitive phase of tomato development at high temperatures is from the beginning of flowering to fruit setting. The purpose of the research is to obtain new tomato genotypes with valuable characters, useful for the breeding process.

As sources of initial research material, 10 high-performance tomato lines L.20, L.25, L.47, L.55, L.63, L.64, L.317 created in the Plant Resistance Genetics laboratory and three varieties as controls Peto-86, Novinca Pridnestrovia and Elvira were used. The evaluation of the lines was carried out according to the most valuable indices of the phenophase phases that determine the vegetation period (single flowering, mass flowering, single fruiting, single ripening, mass ripening), morphological characters (average fruit mass, fruit shape, pericarp and mesocarp thickness, pedicel length).

The results obtained reveal that the early tomato lines L.63 and L.317 exhibit a shorter precocity period compared to the control variety Peto-86 of 11 and 7 days. Investigations carried out on the medium-early tomato lines L.47 and L.55 demonstrated the longevity of the maturity period reduced by 11 and 10 days compared to the control variant Novinca Pridnestrovia. For the medium-late lines L.20, L.25 the precocity share constituted reduced values compared to the control variety Elvira by 10 and 7 days. Based on the experimental data obtained, it results that in the perspective tomato lines the plant height character varies within the limits of values 45.1-77.4 cm, the control forms 55.4-67.5 cm. In most lines obtained *in*

vitro, the descendants of the populations constitute maternal-type genotypes, with a tendency towards the characters of the mother plant, at the same time another series of genotypes is made up of paternal-type descendants, in which most morphological characters predominate from the father plant and a source of genotypes that predominate intermediate characters inherited from both parents. This mode of inheritance of the plant height character occupies an intermediate position and plays the main role both in the evolution of plants and in the improvement of a certain character, which is defined as an attribute of an individual in a population by which it differs from other individuals in another population or taxon, any morphological, physiological or biochemical peculiarity of an individual or group of individuals, which is determined by a gene or a group of genes in interaction with environmental conditions. Analyzing the preliminary results, it was concluded that the high-performing tomato lines obtained *in vitro* with various types of precocity demonstrated a shorter fruit maturity period compared to the control varieties.

Keywords: tomatoes, lines, *in vitro*, characters, genotypes

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VARIABILITY OF QUANTITATIVE CHARACTERS IN TOMATO VARIETIES OBTAINED *IN VITRO*

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Through classical hybridizations, effective capabilities in the activity of plant regeneration have been transferred by crossing spontaneous species with cultured species, through embryonic callus culture. Hybridization between various genetically stable species, varying according to the degree of kinship between them, with the transmission of genetic information that determines some economically valuable characters from spontaneous species to cultivated species. In this way, the emergence of biotechnologies, especially *in vitro* culture, has produced a true revolution in the process of improving vegetable crops and other agricultural species. As a result of distance hybridization, interest for the breeder also presents the spectrum of genetic variability, which increases the efficiency of genotypes selection with high productivity and increased resistance to environmental stressors. One of the main tasks of amelioration was grandiose blending in the same variety of high productivity and resistance to stress factors (drought).

The purpose of the work: Obtaining high-performance tomato forms based on a complex of valuable characters: productivity, quality, precocity and resistance to adverse climatic conditions. The research was conducted in the laboratory Genetics of Plant Resistance. The object of study is 9 high-performance tomato varieties, created through interspecific crosses and the application of *in vitro* culture. *Iulihirsutian, Iuliperuan, Anatolie, CeriDani, Jacota, Flacara* and *Mia* approved in the Republic of Moldova, control forms were cultivated *Peto 86, Elvira, Novinca Pridnestrovia.*

As a result of distant hybridization, the highlighting of the spectrum of genetic hereditary variability is also of interest to breeders, which increases the efficiency of selection of genotypes with high productivity and increased resistance to environmental stress factors. According to investigations carried out through the application of *in vitro* culture, a harmonization of recombinant genes occurred, possessing some precious qualities, which allow the creation of high-performance varieties with increased productivity, fruits with high taste qualities, distinct

technological qualities and increased resistance to drought, low positive temperatures and diseases. *Iulihirsutian variety*, vegetation period 117 days. Fruits with high taste qualities. General harvest of 58.5 t/ha, commodity 55.3 t/ha. The variety is productive, drought-resistant. *The Iuliperuan* variety, the vegetation period is 114-120 days, medium early variety. It is productive, with high taste properties, drought resistant. It differs from the standard Elvira variety by its resistance to diseases, viruses. Variety *Anatolie*, vegetation period is 125-130 days. General harvest 43.7-47.3 t/ha. Variety *CeriDani*, vegetation period 85-90 days. General yield 38.6-42.0 t/ha. The variety is characterized by increased resistance to drought and low positive temperatures. *Jacota* variety, vegetation period 110-114 days, early variety. General harvest of 57.6-60.2 t/ha and commodity - 57.6-60.2 t/ha. The share of commodity fruits is 96.3%. The variety is productive, drought-resistant. *Flacăra* variety, vegetation period 81-108 days, medium early variety. Fruits with high taste qualities. General yield of 48.9-52.4 t/ha and commodity 44.3-49.9 t/ha. Commodity fruit quality 88.4-97.3%. The variety is productive, drought-resistant. Mia variety, vegetation period 89-105 days, medium early variety. General yield of 50.2-55.8 t/ha. and commodity – 44.4.9-53.7 t/ha. Fruit quality commodity 88.4-96.2%. The variety is productive, drought-resistant.

Keywords: tomatoes, varieties, *in vitro*, characters, resistance

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ANALYSIS OF THE SECALOINDOLINE A GENE OF THE WILD RYE SPECIES *Secale sylvestre*

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The wild rye *Secale sylvestre* Host, is an annual self-pollinating species whose area ranges from Eastern Europe to the Central Asia. This species can be a source of useful genes for enriching the cultivated wheat genome with genes for resistance to biotic and abiotic factors and genes determining grain quality and nutrition value. The purpose of our study was to characterize the gene encoding secaloindoline a in *S. sylvestre*. Secaloindolines are rye proteins corresponding to wheat puroindolines. These small cysteine-rich basic proteins determine grain hardness level and show antimicrobial properties mainly due to the presence of the tryptophan-rich domain.

We analyzed a *S. sylvestre* sample collected from the natural population growing in the Odessa region, Ukraine. DNA was isolated from a single seed suing the silica-based procedure. For obtaining amplicons different primers (Massa et al, 2006, Lillemo et al, 2006, and Liu et al, 2017) were tested. PCR was carried out using PCR mix MIX 2x HOT (Neogene, Ukraine). PCR products were analyzed by agarose electrophoresis and isolated amplicons were sequenced using the forward and reverse primers. Sequencing chromatograms were analyzed using a Chromas v.2.6.6 software. The sequences were aligned using MEGA 11 with the puroindoline a sequence (the allele *Pina-D1a*) DQ363911.1 of the common wheat cultivar Chinese Spring (CS) and the *S. cereale* secaloindoline a sequence DQ269850.1 (Massa et al, 2006) from the NCBI database as the reference sequences. The nucleotide positions are given in relation to the beginning of the coding sequence.

We succeeded in obtaining secaloindoline a amplicons of *S. sylvestre* only with the primers *Sina-F1* and *Sina-F1* (Liu et al, 2017). Sequencing from both primers yielded the coding sequence of the secaloindoline a gene, from position 19 to 438. The *S. sylvestre* sequence showed high similarity to *S. cereale* sequence, except for several positions. Differences from both the CS and *S. cereale* sequences were observed at nucleotide positions 46, 65, 284, 289, and 423. At position 147 the wild

rye showed the same nucleotide as the wheat CS, in contrast to the sequence of the cultivated rye. Among the *S. sylvestre*-unique nucleotide substitutions, three resulted in radical amino acid substitutions and two led to conservative ones, in comparison with both wheat and *S. cereale* amino acid sequences. Of special interest are two amino acid differences in the region of the tryptophan-rich domain, which may result in changed properties regarding antimicrobial activity and grain hardness level.

Thus, the secaloindoline a gene sequence of the wild rye species *S. sylvestre* has been reported for the first time. Differences from that of the cultivated rye were specified.

Keywords: rye, secaloindoline a gene, puroindoline, amino acid substitution

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USE OF MAP'S WITH CONSERVATION STATUS IN FOOD SUPPLEMENTS: CHALLENGES & SOLUTIONS

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This study aims to identify the challenges associated with the use of medicinal and aromatic plant species (MAPs), found under special protection and conservation status, in food supplements and to propose solutions for their sustainable use.

According to TRAFFIC, an estimated 50,000 to 70,000 medicinal and aromatic plant species are harvested from the wild. In Europe, approximately 150 of the 1,500 MAP species in trade are considered threatened due to unsustainable harvesting practices. Notable examples include *Adonis vernalis* L., *Arctostaphylos uva-ursi* (L.) Spreng., *Gentiana lutea* L., and *Arnica montana* L. *G. lutea* is listed under Regulation (EC) No 338/97 on the protection of wild fauna and flora, as well as Directive 92/43/EEC on the conservation of natural habitats and wild fauna and flora. In Romania, the species is classified as "vulnerable" and is subject to strict conservation and restoration measures, including a ban on wild harvesting. Despite these legal protections, we identified 39 food supplements containing *Gentiana* spp., as notified by the IBA, including 6 products that specifically list *G. lutea*. In many cases, the species was not clearly specified on the label. Some products claim that the raw material was sourced from controlled areas in Romania; however, it remains unclear whether the plants were harvested from the wild or cultivated. To date, we have found no verifiable evidence of cultivated populations of *G. lutea* in Romania. *A. montana* is included in the CE Directive 92/43 EEC (Habitats Directive), which lists plant and animal species of Community interest whose collection from nature and

exploitation are likely to be subject to management measures. Although *A. montana* was once common in mountain meadows, a rapid decline has been observed due to habitat fragmentation, degradation of meadows, and overcollection. As a result, the species is considered one of the most endangered meadow species in Central Europe.

Overharvesting from the natural habitats of species like those mentioned earlier can cause their endangerment and even extinction. Additionally, the lack of traceability hinders conservation efforts, including the establishment of appropriate collection quotas. To reduce pressure on these species in their natural habitats, various strategies could be considered: development of traditional cultures for the endangered species; development of *in vitro* cultivation techniques for biomass and bioactive compounds production, as well as for establishing conventional cultures; identification of new sources of bioactive compounds, either by using other species with similar phytochemical profiles that are not under conservation concern or whose cultivation is simpler and more cost-effective; improvement of legislation related to the traceability of MAPs; development of new analytical methods to detect the presence of these species with special status in food supplements.

Keywords: vulnerable species, MAPs, food supplements, sustainable capitalization

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THE DISINFECTANTS IMPACT ON PROCESS OF CULTURE *IN VITRO* INPUT POTATO WART CULTIVAR-DIFFERENTIATORS

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Potato (*Solanum tuberosum* L.) is one of important agricultural crops throughout the world. It plays key role in providing agricultural safety and economical stability in many countries, especially in Ukraine. However, phytopahtological threats make large problems for this crop effective growing. Potato wart is especially dangerous (*Synchytrium endobioticum*). This disease spread comes to serious economic losses through the yield loss, export decrease, and the necessity of constant phytosanitary monitoring.

The creation of resistant varieties is one of the promising direction with potato wart struggle. They create with biotechnological approaches, in particular microclonal reproduction. So the successful plants introduction to culture *in vitro* depends on the effective contamination control, an important step is to choose the optimal disinfectants that ensure the disinfection of plant material without damaging its morphophysiological state.

The purpose. The main aim was to study different desinfecting matters (especially 0.4% - solution of silver nitrate; hydrogen peroxide solution; 0,1% of sulema) for input into the culture *in vitro* potato cultivars-differentiators to wart with plant material optimization purpose and explants' survival percentage and regeneration increase.

Methods. Apical meristem separation work, plant micrograftage conducted in aseptic terms of laminar-box under binocular magnifying glass with 20-fold magnification in combination with heat therapy method. Tubers were previously kept at a temperature of 37-38 °C in a thermostat (heat therapy) to inhibit bacterial and fungal infection for 5-7 days. The tubers' experimental initial material selected from visually healthy bushes with free-symptoms disease. The generally approved biotechnological techniques *used* during input in culture in vitro.

The tubers sprouts with length 1.5-2.0 cm for input in culture in vitro. The following desinfecting reagents compared for tubers cover sterilization:

- 0.4 % silver nitrate solution, 45 – 60 seconds

- 15 % hydrogen peroxide solution, 3 min;
- 0.1 % sulema, 10 min.

The modified Murashige and Skoog (MS) by Institute for potato study NAAS used for sprouts input into in culture *in vitro* and for plant regeneration from explants. The media was sterilized by autoclaving at a temperature of 120° C and pressure of 1 ATM for 20 minutes.

Plants grew in a cultivation room at 16-hour photoperiod with a lighting intensity of 2000-2500 Lux, at a temperature of 22-25 °C and an air humidity of 60-80 %.

The material for research was potato wart differentiator cultivars (Basis, Dyvo).

Results. There are 9 cultivar- differentiators for potato wart in culture *in vitro* laboratory of agricultural crops biotechnology UkrSRPQS IPP in collection for present time.

The plant material of cultivars Basis, Dyvo sterilization optimization modes conducted for the receiving potato aseptic plants *in vitro*. The tuberous sprouts surface was the most effective with the following reagents: 0.4 % silver nitrate solution (during 45-60 seconds) and 0.1 % sulema solution (during 10 minutes). Apexes of 64.7-90.2 % were viable and they started to develop in culture *in vitro.* So the regeneration percent consisted of 59.1-84.9 %.

Plants with development point (5) were received in researchers variants with 0.1 % sulema solution. Plants with (2 and 3) points received in variant with 0.4 % - silver nitrate solution. Plants with (1) development point was determined in variant with15% hydrogen peroxide (see table).

Table. Disinfectants impact on potato tuber seedlings regeneration (UkrSRPQS IPP)

Researches' variants	**Number of apexes introduced in *in vitro culture,* %**	**Regeneration percentage, %**	**Plants with a development score, (1-5)**
Cultivar Basis			
Hydrogen peroxide, 15%, 3 min	43.2	37.4	1
Sulema, 0.1%, 10 min	**90.2**	**84.9**	**5**
Silver nitrate solution, 0.4% 45–60 sec.	**72.8**	**62.5**	2
Cultivar Dyvo			
Hydrogen peroxide, 15%, 3 min	38.1	22.1	2
Sulema, 0.1%, 10 min	**91.4**	**74.2**	**5**
Silver nitrate solution, 0.4%, 45–60 sec.	**64.7**	**59.1**	**3**

Conclusions. The tuberous sprout cover desinfection was the most effective during the plant material sterilization of cultivars (Basis, Dyvo) for receiving aseptic potato plants *in vitro*. The following reagents were used 0.4 % silver nitrate solution (for 45-60 seconds) and 0.1 % Sulema solution (for 10 minutes). At the same time, 64.7 – 90.2 % of apexes were viable and began to develop in culture *in vitro*, and the percentage of plant regeneration was 69.1 - 84.9 %.

Keywords: potato wart, culivar-differentiators, culture *in vitro*, meristem culture, nutrient medium, growth stimulators, morphogenesis

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PRELIMINARY STUDIES ON SEED BIOLOGY AND *IN VITRO* GERMINATION OF THE SPECIES *Cephalanthera damasonium* (Mill.) DRUCE WITH A VIEW TO *EX SITU* CONSERVATION

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Cephalanthera damasonium (Mill.) Druce is a rare species for the flora of the Republic of Moldova, categorized as vulnerable in the Red Book (2015), grows sporadically in beech, sessile oak and pedunculate oak forests with cherry. The distribution area of the species includes North Africa, Europe, the Caucasus and Asia Minor. Due to the difficulties of natural regeneration, which depends on the specific presence of mycorrhiza and appropriate habitat conditions, studies on *in vitro* germination and multiplication become crucial for *ex situ* conservation strategies and reintroduction into the natural environment. Previous studies have demonstrated that *in vitro* germination of orchid seeds is influenced by several factors: the physiological state of the seeds, sterilization treatments, the type and composition of the nutrient medium, as well as incubation conditions. For the genus *Cephalanthera*, the specialized literature is relatively limited, but there are reports on the success of germination in MS-type media (Murashige & Skoog) with minimal hormonal adjustments.

The study used mature seeds of *Cephalanthera damasonium* (Mill.) Druce, collected from natural populations (Landscape Reserve "Dobrusa"), for the purpose of assessing germination capacity under *in vitro* conditions. The seeds of the studied species are very small in size (m_{1000} ≃0.01 mg), and usually do not have a well-developed endosperm. Each seed represents an embryo surrounded by a transparent coverage. The structure is adapted for anemochorous dispersal. The biomorphometric parameters of the seeds, determined with the Levenhuk Med D40 Microscope, are the following: length – 146.332±6.947 μm; width – 25.288±3.964 μm; embryo perimeter – 83.666±3.115; embryo area – 523.830±10.186 μm².

For their asepsis, two sterilizing agents were applied: mercuric chloride (0.01 %) and sodium hypochlorite (ACE, 7 %). After sterilization, the seeds were inoculated on Murashige & Skoog (MS) media in two variants: MS + 0.5 mg/L

BAP and MS (without phytohormones). The protocol with $HgCl_2$ 0.01 % showed the lowest contamination rate (below 10 %), compared to the protocol with sodium hypochlorite (~25 %). In addition, seeds treated with $HgCl_2$ demonstrated a survival rate of approximately 70 %, and in combination with MS + BAP medium, they showed clear beginnings of germination and differentiation of protocorms. Sodium hypochlorite, although more easily accessible and less toxic, partially affected the viability of the seeds and did not completely prevent the development of fungi, especially in samples collected from areas with soils rich in mycorrhizal spores.

The results obtained are consistent with those reported for other terrestrial orchids, where mercuric chloride was effective in low doses. Although no clear germination processes have been observed so far, the seeds remain viable in the environment, and the protocorms have not visibly differentiated. Observations will continue to monitor the evolution over time.

The proposed protocol can be successfully used in the initiation of sterile cultures of Cephalanthera damasonium, representing an essential step towards the ex situ conservation and artificial propagation of this rare species.

Keywords: *Cephalanthera damasonium*, seeds, gemination, *in vitro,* mercuric chloride

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THE BIOCHEMICAL COMPOSITION AND THE ECONOMIC VALUE OF THE SILAGE FROM *Silphium integrifolium*

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Silphium integrifolium Michx. (Asteraceae family), commonly known as rosinweed, is a tall (up to 200 cm), long-lived perennial prairie species native to eastern North America. It is studied in various research centers for its potential as an oilseed, forage, honey and technical crop. The goal of this study was to evaluate the silage quality of *S. integrifolium* grown under the climatic conditions of Moldova and its value as forage for ruminants and substrate for biomethane production.

An introduced ecotype of *S. integrifolium* was cultivated in the experimental plots of the "Alexandru Ciubotaru" National Botanical Garden (Institute). Green biomass was harvested at the early flowering stage from three-year-old plants. Whole plants were chopped and ensiled in sealed containers. After 45 days, silage samples were analyzed for sensory, fermentation and nutrient characteristics according to standard laboratory procedures and the Moldovan Standard SM 108. Biochemical composition was determined using near-infrared spectroscopy (PERTEN DA 7200) at the Institute for Grassland, Braşov. Analyzed parameters included: crude protein, crude fiber, crude ash, total soluble sugars, acid detergent fiber, neutral detergent fiber and acid detergent lignin. Hemicellulose, cellulose, digestible dry matter, digestible energy, metabolizable energy, net energy for lactation and relative feed

value were calculated using standard methods. The carbon content was estimated using the methods described by Badger et al. (1979), and the biochemical methane potential – according to Dandikas et al. (2015).

Results showed that the silage had a pH of 4.54, and contained 8.1 g/kg acetic acid, 32.4 g/kg lactic acid and 0.03 g/kg butyric acid. The silage dry matter nutrients 12.6 % CP, 10.6 % ash, 35.5 % CF, 37.9 % ADF, 58.3 % NDF, 4.6 % ADL, 33.0 % Cel, 20.4 % HC and 2.3 % TSS, with 594 g/kg DDM, 11.76 MJ/kg DE, 9.66 MJ/kg ME, and 5.79 MJ/kg NEl. The C/N ratio of substrate was 24.6, and the biochemical methane potential reached 297 L/kg DM or 332 L/kg ODM.

Silphium integrifolium silage exhibits favorable biochemical properties, making it a promising alternative fermented feed for ruminants and viable substrate for biomethane production.

Keywords: biochemical composition, biochemical methane potential, nutritive value, silage, *Silphium integrifolium*

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