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

Scientific International Symposium

"Advanced Biotechnologies - Achievements and Prospects"

(VIth Edition)

ABSTRACT BOOK

3 -4 October, 2022
Chisinau, Republic of Moldova

CZU 082
A 23

Abstract book includes materials presented as oral communications or posters at the Scientific International Symposium "*Advanced Biotechnologies - Achievements and Prospects*" (VIth Edition), held on 3-4 October, 2022 in Chisinau, Republic of Moldova.

INTERNATIONAL SCIENTIFIC COMMITTEE

ANDRONIC Larisa, doctor habilitatus, associated professor, IGPPP, Republic of Moldova
BRINDZA Ján, doctor, associated professor, Slovak University of Agriculture in Nitra, Slovak Republic
CERIT Ibrahim, doctor, Eastern Mediterranean Agricultural Research Institute, Adana, Turkey
CLIFTON-BROWN John, professor, Department of Agronomy and Plant Breeding I, Germany
DUCA Maria, academician, professor, MSU, Chisinau, Republic of Moldova
ENACHE Madalin, doctor, Institute of Biology, Bucharest, Romania
KHUDAYEV Faig, associated professor, Research Institute of Crop Husbandry, Baku, Azerbaijan Republic
MULYUKINA Nina, corresponding member, National Scientific Center, The Institute for Wine and Winemaking „V.E.Tairov", Odessa, Ukraine
SISCANU Gheorghe, academician, professor, IGPPP, Chisinau, Republic of Moldova
TABARA Valeriu, academician, professor, The Academy of Agricultural and Forestry Sciences „Gheorghe Ionescu-Sisesti", Bucharest, Romania

ORGANIZING COMMITTEE

ANDRONIC Larisa, doctor habilitatus, associated professor
BALMUS Zinaida, doctor, associated professor
BOTNARI Vasile, doctor habilitatus, associated professor
BUJOREANU Nicolae, doctor habilitatus, associated professor
COTENCO Eugenia, doctor, associated professor
DASCALIUC Alexandru, doctor habilitatus, professor
DUCA Maria, academician, professor
GANEA Anatolie, doctor, associated professor
LUPASCU Galina, doctor habilitatus, professor
NASTAS Tudor, doctor habilitatus, associated professor
SMEREA Svetlana, doctor, associated professor
TODIRAS Vladimir, doctor habilitatus, associated professor
VOLOSCIUC Leonid, doctor habilitatus, professor

SYMPOSIUM SECRETARIAT

SMEREA Svetlana, doctor, associated professor
BATCO Mihail, doctor, associated professor
IVANOVA Raisa, doctor, associated professor
GRAJDIERU Cristina, PhD student

The Symposium is organized within the State Programs (2020-2023) funded by the National Agency for Research and Development, research projects:

20.80009.5107.03. *Efficient use of plant genetic resources and advanced biotechnologies to increase the adaptability of crop plants to climate change*

20.80009.5107.07. *Reducing the consequences of climate change by creating, implementing varieties of medicinal and aromatic plants drought, frost, winter, disease resistant, which ensures sustainable development of agriculture and guarantees high quality raw material predestined to the perfumery, cosmetics, pharmaceuticals and food industry*

20.80009.5107.11. *Long-term ex situ conservation of plant genetic resources in the Gene Bank using the methods of molecular biology for plant germplasm health testing*

20.80009.5107.18. *Targeted formation of quality and immune system in fruits of late varieties of plum intended for long-term storage*

20.80009.5107.19. *Strengthening capacities for the forecasting and control of harmful organisms and phytosanitary risk analysis in integrated plant protection*

20.80009.5107.27. *Elaboration of the alternative methods based on environmentally friendly means and procedures for harmful arthropods control in different agricultural crops*

20.80009.7007.04. *Biotechnologies and genetical processes for evaluation, conservation and exploitation of agrobiodiversity*

20.80009.7007.07. *Determining the parameters that characterize the resistance of plants with the different level of organization to the action of extreme temperatures in order to reduce the effects of climate change*

20.80009.7007.16. *The synergism between natural factors and microbiological, environmentally friendly, means of regulating of the population's density of harmful organisms for the crops protection in conventional and organic farming*

CONTENT

PREFACE

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 1996 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). 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.

During the decades, the objectives of biotechnologies, as a means of obtaining and implementing innovations, have been reviewed. Following the development of fundamental scientific concepts, biotechnological tools have found applicability in solving of the most diverse areas of genetic engineering, cell and tissue culture, molecular diagnostics, microbial and medical tasks. In particular, the importance of biotechnologies in maintaining of genetic identity, preserving germplasm, controlling the use of genetically modified organisms use and sustainable employment of biodiversity is summarized.

The symposium "*Advanced Biotechnologies-Achievements and Perspectives*" addresses topics related to various subjects: experimental mutagenesis, anther culture, genetics of quantitative traits, cytoplasmic sterility, gametic selection, etc. Particular objectives are focused to the traditional breeding methods, which ensure the efficient transmission of genes, combining and multiple improvement of the characters of interest. As evidence of the success of the genetic and breeding methods, the varieties of cereal crops, vegetables, legumes, medicinal and aromatic plants obtained within the specialized research institutes were exhibited. The improvement of adaptive capacity of crop plants, strengthen resistance and reduce susceptibility to climate change is pointed out. The topics related to the applicability of biotechnological methods in the identification of valuable genotypes, the expansion of genetic diversity through *in vitro* cultures, the micropropagation and multiplication of rare plants, the preservation and valorization of biodiversity are discussed. The elucidation of the physiological, biochemical and structural mechanisms in the ontogenesis of plants under optimal conditions and ecological stress are underline as important subjects. Of major interest is the development of the concepts of the functionality of agroecosystems through precision technologies and effective means of overcoming environmental stress in order to promote and implement the biodiversity conservation strategy. The objectives of creating a resilient agri-food system integrated in the circular economy through biotechnological tools in complex value chains oriented towards reducing the impact of climate change, the efficient utilization of natural resources, the use of innovative products friendly to the environment is stated.

The symposium proceeding materials include 118 abstracts discussed in the form of oral communication/poster related to the symposium thematic areas: molecular and cell biology; bioengineering and tissue culture; macrocompounds and metabolic processes; biotechnology for environment and plant protection; conservation and utilization of genetic resources.

About 200 representatives of the national and international academic community, professors, scientific researchers from 9 universities, 25 research institutions contribute this year to the symposium progress.

The Symposium Chair
Larisa ANDRONIC

CZU:633.15:631.527 ttps://doi.org/10.53040/abap6.2022.01

ALGORITHM FOR CREATING ELECTROPHORETIC PASSPORTS OF MAIZE HYBRIDS

ADAMCIUC A., BATIRU G., COMAROVA Galina, BOUNEGRU S., ROTARI E.
State Agrarian University of Moldova, Chisinau, Republic of Moldova
e-mail: grigore.batiru@gmail.com

One of the topical issues of seed production in the Republic of Moldova is the timely export of hybrid maize seeds and ensuring their quality. In this regard, it is necessary to involve the latest methods of express diagnostics of hybrid purity of these seeds and their passportization in order to be able to carry out their objective and adequate certification. The project "*Creating the catalog of electrophoretic passports of parental forms and maize hybrids approved in the Republic of Moldova for export*" currently being developed under State Program 2020-2023, provides for the effective use of software for storing and synthesizing electrophoretic spectra based on the codominance principle.

Therefore, the purpose of this work was to create a new version of the FOREZ-2 Program adapted to the modern level of operating systems and new requirements for the creation of model electrophoretic passports of storage proteins of maize hybrids and their parental forms.

For the required modifications, the FOREZ program, developed in 2003 to work in the Windows XP environment, was used in the initial program database for the required modifications.

New generation maize hybrids and their parental forms, selected according to the principle of the greatest commercial demand in the Republic of Moldova and abroad, were used to test the newly created modified version of the FOREZ-2 Program. Sampling was carried out in accordance with the recommendations of ISO 9001 and a number of classical sampling methods that ensure reproducibility and reliability.

The method of electrophoresis in polyacrylamide gel (in accordance with the national standard SM-2003) was used to obtain electrophoretic spectra of the maize seeds storage protein (zein). Stained gels with electrophoretic (EP) tracks formed the basis for parameterization of the obtained peptide subunits spectra.

Formula calculation of the obtained electrophoretic spectra was carried out on the basis of determining the value of the relative electrophoretic mobility (rf), which was calculated according to the "internal standard" unified by the EF component with rf_{st}=60.

When compiling the formulas of the analyzed electrophoretic spectra, the following was performed:

1) binarization of intensity: the present band - designation (1) or absent band-designation (0);

2) determination of the band (peptide subunits) borders: rf_{in} & rf_{fin}

3) formation of a text file with a list of EF band boundaries [rf_{in} – rf_{fin}] for each genotype.

The new version of the FOREZ-2 Program is designed to work on the Windows 10 operating system in both 32-bit and 64-bit versions. To create the program, the Visual Studio 2019 software development environment was installed and configured. The developed version of the FOREZ-2 software and its verification testing on 27 maize genotypes demonstrated the ability to process binary electrophoretic spectra of low resolution (1 - 0.5 mm) and high resolution (band detection accuracy of 0.1 mm) according to the following algorithm:

Step 1. Sequential input of the names of maize initial parental lines, corresponding to the certified hybrid, in the category "*Parent forms*", with the subsequent possibility of editing and deleting (if necessary).

Step 2. Introduction of the range of indicators "relative electrophoretic mobility - (rf)" of each of the peptide subunits that make up the electrophoretic spectrum of the maize parent line. It is provided for the possibility of editing or, if necessary, deleting erroneous information.

Step 3. Entering the name of the maize hybrid and its formula, using its parental forms entered earlier, in the category "*Hybrids*".

Step 4. Synthesis of electrophoretic spectra of single cross, single modified cross, three-way cross, double cross hybrids. Automatic assembly of these hybrid spectra is carried out from the spectra available in the database, collected according to the «FOREZ-2» Program algorithm (steps 1-2).

Step 5. Creation of the final computer matrices, in graphical and tabular forms, as a basis for further development of maize hybrids and their parental forms passports with indicating hybridity protein markers

Thus, the step-by-step execution of the presented algorithm makes it possible to automatically identify on the obtained computer matrices:

a) quantitative specifics of zein polymorphism for each studied genotype used in heterosis maize breeding;

b) quantitative specifics of marking by binary intensity of molecular forms of zein of maize hybrids certified by protein electrophoresis.

In order to expand the effectiveness of using the «FOREZ-2» Software for creating electrophoretic passports of certified hybrids, there was also introduced a new processing element for the created database according to the «FOREZ-2» Program, namely: a digital indicator of the «area/width» for every zone of peptide subunits obtained on electrophoregrams.

The specificity of the digital expression of this indicator is that each analyzed electrophoretic spectrum is binarized: along the common axis of the analyzed EF spectrum (conventionally denoted by the total rf length of 100 mm and the intensity of any zone equal to 1), there are zones of peptide subunits (ZPS), which are present a set of different number of bands (molecular forms of zein - MFZ). Therefore, the area index (S_{rf}) coincides with the specific rf (width) range for the respective area under assessment, denoted by the difference between rf_{in} (upper limit of the ZPS) and rf_{fin} (lower limit of the ZPS). Therefore, the area of each analyzed EF zone (S_{rf}) can be expressed in mm: $S_{rf} = [(rf_{in} – rf_{fin})$ in mm].

The new version of the «FOREZ-2» Program made possible to effectively use the discussed indicator to automatically determine:

- the «total area» of the entire set of electrophoretic zones characterizing the protein profile of the studied sample;
- the «area» of each discussed marker zone and «area» of their total set for the corresponding EF spectrum;
- the «area percentage » of marker molecular forms of zein (MFZ) of the total area of the MFZ of the electrophoretic hybrid protein profile, which expands the possibilities for express diagnostics of the hybridity level of certified hybrid maize seeds lots.

Thus, the developed algorithm for the creating of electrophoretic passports based on the modified version of the «FOREZ-2» Program should be considered as a successful experimental tool for modeling the electrophoretic passports of storage proteins in maize hybrids and their parental forms.

This research was funded by the National Agency for Research and Development of the Republic of Moldova under State Program 2020-2023, project code 20.80009.5107.21.

CZU:632.4:631.53.02:633.853.73 https://doi.org/10.53040/abap6.2022.02

MOLECULAR IDENTIFICATION OF *Fusarium spp.* PATHOGENS IN SESAME SEEDS

BELOUSOVA Galina*, MOGILDA A.**
Institute of Genetics, Physiology and Plant Protection, Chisinau, Republic of Moldova
**https://orcid.org/0000-0002-9977-1248, **https://orcid.org/0000-0001-9159-6038,*
e-mail: belousovagalina@mail.ru

Sesame (*Sesamum indicum* L.*)* is one of the oldest oilseed crops cultivated worldwide due to its unique seed qualities. About 65% of the world sesame yield is used for cooking oil production. Sesame seeds are rich in proteins, sulphur, amino acids, minerals and vitamins. Genus *Sesamum* L. belongs to the plant family *Pedaliaceae Lindl.*, which comprises about 38 species. The only domesticated species *Sesamum indicum* L. (2n = 26) is cultivated in many states in tropical and temperate regions. *Sesamum indicum* L. is considered to originate from South Africa.

Fungal pathogens are associated with sesame yield losses. The fungal disease fusariosis is considered a significant threat. The causal agents are associated with root system and transmitted via soil, blocking the xylem elements. The first case of fusariosis was reported in 1950 in USA [1]. The causal agents induce cell destruction and block the vessel elements with gum, which subsequently detains water and plant alimentation. This further induces plant withering and death [2].

Recently, as a result of sesame's genome sequencing and developing different molecular assays, marker assisted selection for such agronomical traits like seed yield, high oil content and quality, drought tolerance, waterlogging tolerance, disease resistance became possible. The fungus usually affects the roots causing chlorosis, stem necrosis and defoliation. As a result, mature plants wither completely [3]. Therefore, seed screening for fungal pathogens is an important step in preventing disease dissemination and helps increasing crop productivity. **The purpose** of this study was identifying the *Fusarium* spp. infection in twelve sesame genotypes (Biolsadovski, Zaltsadovski, Lider, Manchurskii uluchshenyi, Kubanets 57, Donskoi belosemiannyi, Liana, Natasha, Margo, Solnechnyi, Gusar, Serebristyi) using molecular methods.

Keywords: *Sesamum indicum* L., *Fusarium spp.*, *seeds, nested PCR*

Materials and Method: Sesame seeds (*Sesamum indicum* L.) from the collection of Institute of Genetics, Physiology and Plant Protection (yield 2021) were used in the study. Intact symptomless seeds were selected for pathogen identification. Total DNA was extracted from 40 mg samples of seed material using 5% SDS extraction buffer. DNA purification was performed using phenol-chloroform protocol. DNA samples were tested using nested PCR with a set of primers to *Fusarium spp.* Primers were designed based on tef1α (translation-elongation factor 1α) gene sequence. Twelve sesame genotypes: Biolsadovski, Zaltsadovski, Lider, Manchurskii uluchshenyi, Kubanets 57, Donskoi belosemiannyi, Liana, Natasha, Margo, Solnechnyi, Gusar, Serebristyi were tested. Nested-PCR was performed in 20 µl mix containing 1×PCR buffer, 0.1 mM dNTP, 0.2

µl of forward and reverse primer, 1 unit of Taq DNA-polymerase and about 50 ng of DNA template. PCR was performed in two rounds. In the first round, forward CTACCAGTGCGGTGGTATCG and reverse ATGGTGATACCACGCTCACG primers were used (pair 1). In the second round, forward CCATCGAGAAGTTCGAGAAGGTT and reverse CCCAGGCGTACTTGAAGGAA primers (pair 2) were used. Amplification was performed in Bioer thermal cycler. PCR protocol included initial denaturation at 94° C for 4 min, followed by 30 cycles that comprised denaturation at 94° C for 1 min, annealing at 61° C for 1 min, elongation at 72° C for 1 min. The annealing temperature in the second round was 60° C. Amplification was concluded with a terminal elongation at 72° C for 7 min. Amplicons were separated in 1.5% agarose gel electrophoresis with 1xTBE buffer stained with intercalating agent ethidium bromide and visualized under UV light.

Results. The analysis revealed that eleven of the screened genotypes were positive for *Fusarium spp.* Pathogenic *Fusarium spp.* was not identified only in the seeds of Serebristyi genotype. Then, the species-specific discrimination was performed between the following *Fusarium* species: *F. nivale, F. avenaceum, F. culmorum, F. equiseti, F. sporotrichioides, F. verticillioides, F. oxysporum. None of these pathogens was identified. Considering that Fusarium spp. comprises a large and heterogeneous group of fungi, the primer set was insufficient to perform the specific identification.*

Conclusions. The performed analysis based on molecular identification of pathogens using nested-PCR of sesame seed DNA revealed the *Fusarium ssp.* infestation in eleven of the twelve analyzed samples. The seed infection rate was 92%. *Fusarim spp.* usually infects plants in fields. In the yield samples we stated the infection that was accumulated both during plant vegetation and storage.

Acknowledgment. Current study was funded by State Program grant 20.80009.5107.11 "Long-term *ex situ* conservation of plant genetic resources in Gene Bank using molecular methods for assessing germplasm viability" financed by the National Agency for Research and Development.

References:

1. Armstrong J.K., Armstrong G.M., A. *Fusarium* wilts of sesame In United States, Phytopathology, 1950, 40, p. 785.
2. Ara A., Akram A., Ajmal M., Akhund S., Nayyar B.G., Seerat W., Chaudhry S.M., Histopatho-logical studies of sesame (*Sesamum indicum*) seedlings infected with fusarium oxysporum. Plant Pathol. Quar. 2017, 7, pp. 82–90. DOI: 10.5943/ppq/7/1/10.
3. Li Dong-hua, Wang Lin-hai, Zhang Yan-xin, Lv Hai-xia, Qi Xiao-qiong, Wei Wenliang, Zhang Xiu-rong, Pathogenic variation and molecular characterization of *Fusarium* species isolated from wilted sesame in China, African Journal of Microbiology Research, 2012, 6, pp. 149-154. DOI: 10.5897/AJMR11.1081.

CZU:633.88:58.08 ttps://doi.org/10.53040/abap6.2022.03

ADAPTIVE AND DIAGNOSTIC MICROSCOPIC STRUCTURES FOR *Cassia occidentalis* (L.) LINK SPECIES

CALALB Tatiana

Departement of Pharmacognozy and pharmaceutical botany, Nicolae Testemitanu SUMPh

https://orcid.org/0000-0002-8303-3670, e-mail: tatiana.calalb@usmf.md

The species *C. occidentalis* with the common name Coffee senna was added to the Collection of Medicinal and Aromatic plants of the Institute of Genetics, Physiology and Plant Protection (IGPhPP) in 2018. The pedo-climatic conditions in R. Moldova differ from those in the native center (tropical and subtropical regions of America) for the formation of the species. Therefore, it was **proposed** to determine the structural diagnostic parameters and potential adaptability of the species *C. occidentalis* to the action of unfavorable environmental factors for the possibility of cultivation and valorization of this species for medicinal purposes in R. Moldova.

Keywords: *C. occidentalis, microscopy, adaptation, diagnostic*

Materials and Method. The microscopic study was carried out on plant organs, collected during the mass flowering period from the Collection of Medicinal and Aromatic plants of IGPhPP during the growing season of 2020-2021. Classical techniques were applied to obtain cross-sections and surface preparations from fresh botanical material, dried and clarified in hydrochloride solution, then analysed under a Mikos microscope coupled with computer software. Selective chemical staining reagents were used to identify the chemical nature of the structures [2].

Results of microscopy: Root. Anatomical structure was investigated on cross-sections of the main root. In parenchyma cells of secondary structure, polygonal crystals were noted in the sheath of vascular bundles. The root anatomy data in *C. occidentalis* are largely in agreement with those described in other work [3], except for the type of vascular bundle. We describe it as tetrarchy, which is in agreement with the description by Nassar (2013), but disagrees with Begum (2014), who mentions it as diarthric. The roots give a reddish colouration when tested for anthraquinone. **Stem.** Anatomical structure was investigated on the middle internode of the main stem. On the cross-section it is circular and is represented by secondary anatomical structure, covered by a thick layer of cuticle. Paracytic stomata are present. Rarely non-glandular unicellular trichomes and with moderate frequency multicellular glandular trichomes were found. In epidermis, cortical cells, and parenchymatous cells of pith abundant druses and less frequently prismatic crystals were observed. In literature [1] only prismatic one has been mentioned. **Leaf.** The rachis is cordate on cross-section, with a groove protruding inward and 2 prominent notches on the adaxial side, surrounded on the outside by a uniserrate epidermis with the paracytic and anysocytic stomata. Rarely, non-glandular, slender, uni- and multicellular trichomes are observed. Also, the glandular trichomes with multicellular and brownish gland are mentioned. Data on the presence of different types of trichomes in Coffee senna leaf are contradictory [1, 4]. Some anatomical studies describe only multicellular glandular trichomes, while another studies mention only the presence of unicellular non-glandular one. Some authors [3] describe the presence of both uni- and multicellular non-glandular trichomes, although the latter with a rare frequency. There are 2 ridge bundles with druse crystals in their sheath, which is in harmony with the anatomical results by other researches [3, 4]. In dorsoventral mesophyll type of the leaflets is characteristic palisade tissue on the adaxial side and the spongy tissue on the abaxial ones. It is an amphistomatous leaf, but stomata are more numerous on the abaxial than on the adaxial. Note that the paracytic stomata were found on both types of epidermis, but the anisocytic type only on the abaxial one. These data are consistent with those reported already [3] and differ from those described in another paper [4], which indicate the presence of 3 types of stomata (paracytic, anisocytic and tetracyclic) on the both leaf epidermises. Epidermises develop non-glandular unicellular trichomes with rarely frequency, but more on the abaxial epidermis, particularly along the nerves and in the basal part of the leaflet. Multicellular glands were observed on the both epidermises, but frequently on the abaxial one. Leaf anatomy with regard to *S. occidentalis* is generally consistent with a study [3], except for calcium oxalate crystals, mentioned as solitary and druses. We indicate the presence of druse crystals throughout the mesophyll and polygonal-type crystals in the sheath of vascular bundles. Leaves give a lower expression of the staining gradient for anthraquinone testing compared to fruits, seeds and roots. **Flower.** Study of flower anatomy was carried out on sepals and petals. The sepal epidermises contain paracytic stomata of rounded shape protruding from the level of the epidermis, from which radially arranged folds can be seen. On the petal upper epidermis there are mamelon protuberances, especially along the veins. The folding of the epidermis surfaces is radial around the rounded paracytic stomata. On the base of the petals a few small and thin non-glandular trichomes are developed. Between the epidermis is the parenchyma, frequently with lipid-containing globules (red staining with sudan III). Sepals and petals give a reddish stain when tested for anthraquinones. **Fruit pericarp.** There is 3 histological zones on the cross section of the pericarp in the middle area of the pod: exocarp, consisting only of a layer of tangentially elongated outer epidermal cells, with thickened and slightly lignified cell walls, compact, rarely separated by paracytic stomata and very rarely by non-glandular trichomes, covered by a relatively thick cuticle; mesocarp of parenchymal cells, irregular in shape, in some of which are druses; the mesocarp is perforated by collateral vascular bundles, surrounded by the fibrous sheath of the sclerenchyma; endocarp, represented by the inner uniseriate epidermis. **Seed.** The seed consists of the seed coat and the embryo. The cross-section of the seed coat shows: the outer layer consists of the thick waxy cuticle, then follows the epidermis, consisting of thick-walled, tangentially elongated cells with a very compact arrangement, followed by several layers of osteosclereids, and last is the inner layer represented by the parenchyma, consisting of thin-walled, tangentially elongated cells. The embryo includes 2 cotyledons, extending parallel to the long axis, consisting of the radical, hypocotyl, epicotyl and plumule. The cotyledons are covered by epidermis, and the internal mesophyll consists of parenchymatous cells with gelatinous contents and small intercellular spaces, which is in agreement with the paper [4]. Thus, when evaluating microscopic data from the literature, we find that in many respects there is confusion [1, 3, 4]. However, most of the microscopic characters highlighted in the present study for *C. occidentalis* species are in agreement with the data in the edited scientific articles, only on some specific aspects (trichome type, stomata, calcium oxalate crystals and their distribution mode, vascular bundle type) are in disagreement.

Conclusions. 1. The identified specific anatomical structures with diagnostic role in Coffee senna are: type of trichomes and of type of stomata, their frequency and mod of distribution on the aerial part of the plants; type of oxalate calcium crystals and their location in the plant organs.

2. Frequently of different types of trichomes (uni- and multicellular non-glandular and glandular trichomes), abundant distribution of calcium oxalate crystals (druses and solitary), and compact packing of epidermis cells with thick cuticle on the aerial part of plant and form the adaptive structure potential of the *C. occidentalis* plant for unfavorable climate conditions.

Acknowledgment. This paper was supported by and is part of the scientific research project – research and innovation, State Program 2020-2023: "Reducing the consequences of climate change by creating and implementing varieties of medicinal and aromatic plants with high productivity, resistant to drought, wintering, disease, which ensures the sustainable development of agriculture, guarantees high quality products, predestined for the perfumery, cosmetics, pharmaceuticals, aliments", Code: 20.80009.5107.07.

References:

1. Begum A., Rahman O., Begum M. Stomatal and trichome diversity in Senna Mill. from Bangladesh. Bangladesh J. Plant Taxon, 2014, vol. 21(1), pp 43-51, Doi: 10.3329/BJPT.V21I1.19264

2. Calalb T., Nistreanu A. Botanica farmaceutică: Compendiu pentru lucrări de laborator, Print-Caro SRL., Chișinău, R. Moldova, 2021, ISBN 978-995-82-222-0.
3. Nassar M. A., Ramadan H., Ibrahim H. Anatomical structures of vegetative and reproductive organs of *S. occidentalis* (Caesalpiniaceae). Turk J Bot. 2013, vol. 37, pp. 542-552, doi:10.3906/bot-1111-26
4. Suma M., Tanuja N. Kasamarda (Cassia occidentalis Linn.), Macro/microscopic profile. Journal of Biological and Scientific Opinion, 2(1). 2014, pp 83-85. Doi: 10.7897/2321-6328.02118

CZU:631.52+575.17 https://doi.org/10.53040/abap6.2022.04

TYPES OF LINKAGE OF GENETIC MARKERS TO THE TARGET GENE AND CHROMOSOME LOCI

CHESNOKOV Yu.V.
Agrophysical Research Institute, St.-Petersburg, Russian Federation
https://orcid.org/0000-0002-1134-0292, e-mail: yuv_chesnokov@agrophys.ru

Keywords: *genetic markers, linkage, genotype-environment, resources, genes, mutations*

Genetic markers in various forms of their manifestation, both at the phenotypic and at the biochemical or molecular levels, are a tool for establishing genetic linkage, including when building genetic maps and/or assessing genetic diversity, including the “genotype-environment” interaction [1]. In general, today there are three main areas of application of genetic markers. First, markers can provide a new, expanded and enhanced picture of the genetic diversity that exists between and within species. This information is of particular interest for the management of plant genetic resources (PGR) and for the implementation of the rational use of PGR in breeding programs. Secondly, markers make it possible to construct genetic maps that allow one to localize and identify loci of quantitative and/or qualitative traits, as well as to establish the effects of the action or interaction of loci of these traits. And finally, thirdly, markers make it possible to establish „marker-trait“ associations and carry out associative mapping, which gives an undoubted advantage due to the effective screening of natural and artificial breeding populations that are of practical interest for breeding.

Along with classes and categories, genetic markers can be divided into three types depending on the nature of the genetic linkage to the target gene or chromosomal locus. If there are identified markers that are physically located next to the gene of interest to the researcher or even directly in the desired gene, it becomes possible to carry out the so-called marker-assisted selection (MAS), i.e. select identified marker variants (alleles) in order to select the necessary unidentified variants of the desired gene. Based on the relationship of a genetic marker with the QTL or gene of interest to the researcher, three main types or varieties of polymorphic genetic markers can be distinguished [3]. (I) Direct markers (direct, D) mark loci encoding various kinds of functional genes or mutations. Such markers, if molecular, are located directly in the desired gene. In this case, we can speak of gene assisted selection (GAS). This is the most favorable situation for MAS, since the inheritance of marker alleles is directly related to the alleles of the desired gene or QTL. However, this type of marker is the rarest (in the physical sense, it is not common enough in the genome) and therefore it is the most difficult to find. An exception is morphological and biochemical markers, and only if they are genes of direct interest to the researcher, and not genetic markers linked to other genes that the researcher needs. (II) Markers of disequilibrium linkage (linkage disequilibrium, LD). They mark chromosomal loci or genes that are in a population in linkage disequilibrium with a functional gene or mutation (morphological markers), the biochemical product of a marker gene (biochemical markers), or with a DNA marker (molecular markers). In fact, linkage disequilibrium is the tendency of some combinations of alleles to be inherited together. In a population, LD can be found if the markers and desired genes are physically very close to each other and/or when lines or breeds have crossed in recent generations. A special case is quasi-coupling. It can also be attributed to non-equilibrium linkage and is equally applied in breeding practice. Selection using an LD marker variety may be referred to as LD marker assisted selection (LD-MAS). (III) Linkage equilibrium markers (LE). They mark loci that are in a population in equilibrium linkage with a functional gene or mutation (morphological markers), the biochemical product of a marker gene (biochemical markers), or with a DNA marker (molecular markers). In this case, linkage is a random event and the genetic marker is not in linkage disequilibrium with the gene of interest to the researcher in the entire population. Selection using this variety of markers can be called LE marker assisted selection (LE-MAS). This is the most difficult situation for application in genetics and practical breeding. At the same time, LE markers can be easily identified based on genome-wide analysis. For this, certain breeding crosses or specially created families (lines) that are strictly related to each other, for example, mapping populations, are usually used. Such a genome scan requires only saturated marker maps with an interval between molecular markers from 15 to 50 cM, depending on the marker informativity and the economic cost of genotyping [4]. This is usually sufficient to identify the majority of QTLs with a medium or main effect of the action. However, a distance of 15–50 cm is insufficient for the marker and the desired gene to be in linkage disequilibrium. LD markers must be located in the vicinity of the gene of interest for a valid, population-wide, linkage disequilibrium between the marker and an existing QTL or gene (usually 1 to 5 cM, up to a maximum of 10 cM in plants, depending on the LD limits, which, in *in turn*, depend on the structure of the population and its history). LD markers can be identified through the use of candidate genes or precise mapping techniques [2].

D-markers (i.e., polymorphisms determined by functional genes or mutations) are the most difficult to find, because their causality or conditioning is difficult to verify or establish. As a result, only a limited number of examples of the detection of D markers are known to date, with the exception of traits encoded by a single gene. As a rule, such traits are genetically very simple. For example, many traits of disease resistance in plants, or traits related to timing of flowering, are controlled by one or two to three genes. At the same time, most economically valuable traits are quantitative. They are determined by a genetic complex that includes not one or three, but many genes (the so-called QTLs), which, moreover, is often influenced by the environment. If a certain molecular D-marker is used to screen genetic samples that contain a gene labeled with this D-marker that the researcher needs, then due to the degeneracy of the genetic code, mutations and/or recombination, such a molecular D-marker may “not work” on the DNA of the desired sample with the desired gene. The use of LD markers is more preferable, since they do not have a rigid “binding” to the genes or QTLs they mark, which are numerous and, moreover, mutually replaceable and complementary. Simply put, if during the screening of genetic breeding material any LD marker turns out to be unsuitable or “does not work” like a D-marker, then it can be easily replaced or replenished with another LD marker or markers located nearby, which cannot be done in case of a molecular D-marker.

All three varieties of markers differ not only in the methods of their determination, but also in how and where they are used in genetic breeding programs. It should be noted that the above types of markers are predominantly molecular markers. However, phenotypic and biochemical genetic markers can also act as the indicated types of markers, but only in those cases if they meet the above requirements for this type of markers. While LD markers and, to a lesser extent, D markers allow genotypic selection in the entire population due to the strong relationship between genotype and phenotype, LE markers from line to line must belong to different phases of genetic linkage between markers and QTLs. or genes (table). Thus, the ease and possibility of using markers in genetic breeding research is inversely proportional to the ease of their detection, and this correlation increases from D markers to LD markers and further to LE markers.

References

1. Chesnokov Yu.V. Molecular genetic markers and their use in pre-breeding studies. St. Petersburg, AFI. 2013. 116 p. (in Russian).
2. Chesnokov Yu.V., Kosolapov V.M. Plant genetic resources and acceleration of the breeding process. Moscow: Ugresh Printing House LLC, 2016. 172 p. (in Russian).
3. Dekkers J.C. Commercial application of marker- and gene-assisted selection in livestock: strategies and lessons. J. Animal Sci. 2004. v. 82: pp. E313-E328 DOI: 10.2527/2004.8213_supplE313x.
4. Darvasi A., Soller M. Optimum spacing of genetic markers for determining linkage between marker loci and quantitative trait loci. Theor. Appl. Genet. 1994. v. 89. pp. 351-357 DOI: 10.1007/BF00225166.

CZU:633.15:631.524:581.15 https://doi.org/10.53040/abap6.2022.05

MALE GAMETOPHYTE OF SWEET AND WAXY CORN HYBRIDS UNDER DROUGHT AND SALT STRESS CONDITIONS

CLIMENCO Oxana
Institute of Genetics, Physiology and Plant Protection,
Chisinau, Republic of Moldova
https://orcid.org/0000-0001-5223-6208
e-mail: climenco_2010@mail.ru

The purpose of this study involved to evaluate the genotypes of sweet corn and its hybrids with waxy corn at the haploid level of the male gametophyte under conditions of osmotic and salt stresses.

Keywords: *sweet maize, waxy maize, osmotic stress, salinity, pollen*

Material and method. Two hybrid populations of sweet corn (genotype 15 and genotype 18), as well as hybrids of sweet and waxy corn (genotype 14 - backcross hybrid ((sugary x waxy) x sugary), genotype 16 - F_2 hybrid (sugary x waxy), genotype 17 - backcross hybrid ((sugary x waxy) x waxy) were used as initial material. For evaluation of pollen grains osmotic solutions (5 variants with pressure values 2.92-10.5 MPa) and NaCl solutions (2 variants with pressure values 2,.23-3.84 MPa) were used. The values of the trait "pollen grain diameter" (in eyepiece micrometer units) were determined using the ocular micrometer MOB-1-15x). The experiments were carried out according to the schemes of one- and two-factor analysis of variance. Statistical processing (ANOVA) of data was performed using STATISTICA 7 program.

Results. In a two-factor experiment (5 genotypes), a significant dependence of the variability of the trait "pollen grain diameter" on the factors "genotype" (η^2 = 11.62% **) and "stress" (η^2 = 8.53% **) was revealed. The determination coefficient of the whole model was R^2=0.4741**. Effect size of factors «genotype» and «stresses» were 0.1304**, (observed power=0.9335 (alpha= 0,.05) and 0.099**, (observed power =0.9051 (alpha =0.05), correspondingly. Under conditions of a lower level of exposure to stress factors, genotype 18 and genotype 17 were characterized by the best indicators of the trait "pollen grain diameter". The average indicator of the studied trait for all genotypes was significantly higher under the influence of the stress factor "drought". There was no significant difference between this parameter and control.

In backcross hybrids and the F_2 hybrid (genotypes 14.17 and 16) two-factor analysis of variance also showed the significant dependence of the variability of "pollen grain diameter" trait on the factors "genotype" (η^2 = 7.23% ***) and "stress" (η^2 = 20,.4%

). The value of dependence from the factor "genotype" proved to be 2,8 times less than that from the factor "stress". The determination coefficient of the whole model was R^2=0.5528. Effect size of factor «genotype» was 0.0943***, (observed power =0.9394 (alpha =0.05)) and «stresses» - 0.2271***, (observed power =0.9997 (alpha =0.05)). According to the average indicator of the studied trait, genotype 17 turned out to be the best in all variants of the experiment. Under stressful conditions, genotypes 14, 17, 16 had the values significantly lower than the control.

Study of the effects of stress factors on the male gametophyte in each of the backcross hybrids and the F_2 hybrid (one-way analysis of variance) showed that in genotype 14, in all variants of stress treatment, no significant differences were found with the control. This is probably due to the resistance to drought and salinity (in the studied range of stress) of this hybrid at the level of the male gametophyte.

In genotype 16, a significant effect of stress factors on the variability of the trait "pollen grain diameter" was noted - effect size = 0.3162*** (observed power=0.9816 (alpha=0.05)). The coefficient of determination of the whole experimental model was R^2=0.5623***. The mean values of the studied trait were significantly lower than the control values only under salt stress. Under the action of osmotic stress, the difference in values was insignificant, which indicates a certain potential for drought resistance in this genotype.

For genotype 17 effect size = 0.2377** (observed power = 0.8929 (alpha=0.05)) of factor «stresses» proved to be smaller compare to the same value for genotype 16. The value of the coefficient of determination of the whole experimental model was also lower than that of genotype 16 and amounted to R^2=0.4875**. The average values of the trait "pollen grain diameter" in all variants of stress treatment were significantly lower than the control. However, it should be noted that no significant difference was found between the average values of the studied trait under conditions of osmotic stress and the average values under the action of salt stress. This genotype has the same level of response to both stresses.

Conclusions. Effect size of factor «genotype» proved to be medium and effect size of factor «stresses» variated from small value to large one. Genotype 14 was characterized by the highest resistance to both stresses, but a good potential for drought resistance at the haploid level of the male gametophyte was noted in genotype 16. The highest indicators of the "pollen grain diameter" trait in the control were noted in genotype 17, which is promising for gamete selection for this trait.

Acknowledgment. Research was carried out within the project of the State Program 20.80009.5107.03 «Efficient use of plant genetic resources and advanced biotechnologies to increase the adaptability of crop plants to climate change», financed by the National Agency for Research and Development.

CZU:633.15:581.1 https://doi.org/10.53040/abap6.2022.06

EVALUATION OF THE EFFECTS OF OSMOTIC AND SALIN STRESSES ON MALE GAMETOPHYTE OF MAIZE

CLIMENCO Oxana
Institute of Genetics, Physiology and Plant Protection,
Chisinau, Republic of Moldova
e-mail: climenco_2010@mail.ru

Purpose. to evaluate the variability of trait «diameter of pollen grain» under osmotic and salin stresses and to select genotypes with the highest values of this trait for using in further breeding programs.

Keywords: *maize, osmotic stress, salinity, male gametophyte*

Material and Methods. As the initial material, inbred lines L1866, P343, P346, Co125, A285, L276, Mo17, B73, 4nW23 (9 genotypes) and 22 hybrid combinations with maternal genotypes (simple hybrids of inbred lines Mo17, Rf7, A285, W23, N6, L276, P165, XL12), and with paternal genotypes (L459xP502) xP101, (A239xMK159) x MK159, (L459xMK390) x (P165xB73), (MK01xW47) were used. Pollen grains were studied in osmotic solutions (2.92-10.,5 MPa) and NaCl solutions (2.23-3.84 MPa). The values of the trait «pollen grain diameter» (in eyepiece micrometer units) were determined using the ocular micrometer MOB-1-15x). Statistical processing (ANOVA) of data was performed using the programs Statgraphics 5.1. and STATISTICA 7. The values of LSD (least significant difference) were calculated for two-factor analysis of variance.

Results. The variability of the character ”diameter of the pollen grain” depended significantly on the factors ”genotype” (lines- η^2 =39.84%***; hybrids- η^2=11.97%***), ”stresses” (lines - η^2 =18.4%***; hybrids - η^2 =27.72%***), and from the interaction of factors ”genotype” and ”stresses” (lines - η^2 =7.05%**; hybrids- η^2 =14.64%***). The variability of male gametophyte trait of inbred lines proved to be mostly genotype depending (the part of variability determined by factor “genotype” was in three times higher than similar parameter in hybrids). The variability of pollen grain diameter in hybrids depended more from stress factors. Reliably the highest average values for all variants of the experiment were found in lines B73, Co125 and P346. At the same time, the lowest similar indicators were recorded for the A285, L1866 and Mo17 lines. The overall average indicator of the “pollen grain diameter” trait according to the experience of the lines was higher than that of hybrids.

It should be noted that under stress conditions, the values of the studied trait of the male gametophyte in the lines were significantly lower than the control, with the exception of the indicator of the B73 line under the action of osmotic stress (157.3 mic. un. - control and 165 mic.un - stress, $LSD_{0.05}$=3.9). The average values of the sign "pollen grain diameter" under osmotic stress in the lines L1866 and P343 were very slightly inferior to the control, but with a significant difference. L1866: control- 154.3 mic.un. and stress- 148.3 mic.un. ($LSD_{0.05}$= 3.9) and P343: control-157 mic.un. and stress- 151 mic.un ($LSD_{0.05}$=3.9). Under conditions of salt stress, only the B73 line can be distinguished, in which the difference between the mean values in the control and under stress was significant, but its value was less than 10 mic.un. (control -157.3, stress-148.6 mic. un. $LSD_{0.05}$=3.9). Under the action of osmotic and salt stresses the average indicator of the studied trait in the lines was higher than that of hybrids.

The lines L1866, L276, 4nw23, were selected after the average relative high values of the pollen grain diameter in conditions of drought and salinity -145.9 mic.un.; 145.2 mic.un.; 185.5 mic.un., corresponding. After drought resistance, l1866 lines were highlighted (average value of pollen grain diameter in osmotic solution -148.3 mic. un.), P343 (151.1 mic.un.), B73 (165.0 mic.un), 4nW23 (183.6 mic.un.). Both inbred lines and hybrid combinations were characterized by the higher average value of the character "pollen grain diameter" under osmotic stress conditions. High values of the studied character (in all variants of experience) were found in hybrids with maternal genotypes – combinations of lines A285xW23 (145.8 mic.un.), XL12xN6 (151.7 mic. un.), A285xN6 (151.1 mic.un.).

Under salinization conditions the average values of the "pollen grain diameter " character of the selected maternal genotypes decreased A285xW23 (141.1 mic.un.), XL12xN6 (144.6 mic.un.), A285xN6 (141 mic.un.), L276xP165 (143 mic.un.). But under osmotic stress the mean values of the studied character were higher compared to similar values under salinization conditions (A285xW23 (154.7 mic.un), XL12xN6 (148.6 mic.un.), A285xN6 (146.1 mic.un.), L276xP165 (156.5 mic.un.). Maternal genotypes can be used for the selection schemes of drought-resistant hybrids.

Conclusions: Genotypes (L1866, L276, N6, B73, A285) have been identified at the male gametophyte level, which can be used to obtain drought and salinity resistant hybrids. Inbred lines were charactered by the highest value of the dependence of the variability of the character "pollen grain diameter" from the factor "genotype" , but hybrids had the highest value of the dependence of the variability of the studied character from the factor "abiotic stresses"**.**

Acknowledgment. Research was carried out within the project of the State Program 20.80009.5107.03 «Efficient use of plant genetic resources and advanced biotechnologies to increase the adaptability of crop plants to climate change», financed by the National Agency for Research and Development.

CZU:575.1/.2:633.11:632.4 https://doi.org/10.53040/abap6.2022.07

MOLECULAR DIAGNOSIS OF FUNGAL PATHOGENS IN WINTER WHEAT VARIETIES WITH DIFFERENT RESISTANCE

CUZNETOVA Irina
Institute of Genetics, Physiology and Plant Protection,
Chisinau, Republic of Moldova
e-mail: mamakuza@mail.ru

Pathogens of the genera *Fusarium*, *Alternaria*, *Aspergillus* and *Penicillium* are represented by numerous fungi species that are ubiquitous. Many of them are obligate or facultative pests of agricultural plants causing enormous economic losses. The range of host plants affected by these species is very wide, and the damage caused is very significant. Pathogens can destroy from 50 to 90% of grain and vegetable crops. Sources of infection are seed material, soil, dead remains of diseased plants, agricultural machinery and equipment. Fungi infect plants in fields and greenhouses, provoking the fall of leaves and ovaries, growth stagnation, drying of crops. In addition, fungi of the genera *Alternaria*, *Penicillium* and *Fusarium* are able to infect harvested crops in storage, which leads to a change in the organoleptic properties of products, loss of marketable quality and decay. Most fungi of these genera are producers of mycotoxins, secondary metabolites that bring a serious danger to human health. *Mycotoxins* have varying degrees of toxicity, some of them are capable of provoking not only toxicosis and allergic reactions, but also necrotic lesions of organs and tissues, oncogenic processes in animals and humans. That is why these substances are under the strong control of the phytosanitary services of the European Union countries, and their permissible concentrations in food products are strictly regulated [1]. Thus, the timely detection of pathogenic fungi on agricultural crops makes it possible to use adequate methods to manage them, which will not only preserve the yield and productivity of cultivated plants, but also have a positive effect on the ecological state of soils and groundwater making it possible to limit the use of excess amounts of fungicides and other chemicals. **This work is dedicated** to the identification of fungal pathogens of these genera in winter wheat crops from the moment of tillering to the full maturation of seeds. The main research method is nested-PCR using species-specific primers.

Keywords: *fungal phytopathogens, wheat, molecular diagnosis, species-specific primers, resistance*

Materials and Method. Objects of study: plants of three varieties of winter wheat (Moldova 66, Moldova 614, Kuyalnik) at the stage of tillering and flowering and wheat seeds of these varieties. Sampling was carried out on the experimental fields of the Institute of Genetics, Physiology and Plant Protection from March to July 2021.

DNA isolation: total DNA was isolated from 1 gram of plant material of each wheat variety (root neck, middle part of leaves at the tillering stage, ears at the end of flowering stage) and seeds of winter wheat of each variety (24-25 grains) using the ISO method [2]. DNA was then used as template for PCR analysis. Visually healthy seeds without any defects were selected for the sample. Samples of the isolated DNA of each variant were purified according to the protocol and prepared for nested-PCR reactions.

Amplification: For the analysis of fungi, nested-PCR was carried out with two pairs of species-specific primers, which made it possible to determine the species diversity of Fusarium spp., Penicillium spp., *Aspergillus parasiticus* and *Alternaria alternate*. The tested types of fungi are the most common in our region. Also, *Penicillium spp., Aspergillus parasiticus* and *Alternaria alternata* were previously determined by nested-PCR in the total DNA of the seeds of the disease-resistant variety Kuyalnik.

The polymerase chain reaction was carried out in 25 µl mix containing 66 mM Tris-HCl (pH 8.4), 16 mM $(NH_4)_2SO_4$, 2.5 mM $MgCl_2$, 0.1% Tween 20, 7% glycerol, 100 µl-1 BSA, 0.2 mM of each dNTP, 1.25 units of Taq DNA polymerase (Thermo Fisher Scientific), 5 pM of forward and reverse primers, and 10 ng of DNA.

Conditions for the polymerase chain reaction: First round: 3 min denaturation at 95°C followed by 30 cycles including denaturation (1 min, 95°C), annealing (1 min, 60°C), elongation (1 min, 72°C), and 1 cycle of final elongation (7 min, 72°C). Second round: 30 cycles, including denaturation (1 min, 95°C), annealing (1 min, 60°C), elongation (1 min, 72°C), and 1 cycle final elongation (7 min, 72°C). The products of amplification were separated by gel electrophoresis in 1.5% agarose gel with the addition of ethidium bromide at a final concentration of 5 µg/ml, using a molecular marker GeneRuler 100 bp DNA Ladder (Thermo Fisher Scientific). Visualization was carried out in UV light, at a wavelength of 312 nm in the presence of ethidium bromide.

Results. *Alternaria alternata* was found in all DNA samples isolated from all organs of all studied wheat varieties at all stages of plant development.

The highest diversity of fungal pathogens was found in the root necks of all studied wheat varieties (*P. expansum, P. chrysogenum, F. verticillioides, F. equiseti, F. avenaceum*) at the tillering stage.

Fusarium nivale (*Microdochium nivale*) was found only in the DNA samples of leaves of the Kuyalnik variety at this stage of vegetation. However, later on, this pathogen took a dominant position in the crops, since it was already present in all DNA samples of the ear of the studied wheat varieties at the stage of the end of flowering and at the stage full maturation of seeds.

At the end of flowering *P. expansum* was determined only in the DNA samples of the ear of varieties M-614 and Kuyalnik. In the DNA samples of the leaves of all wheat varieties at this stage of vegetation, only *Alternaria alternata* was found, none of the studied species of the genera *Fusarium* and *Penicillium* was found.

At the stage of full maturation, the seeds of the studied wheat genotypes showed a lower diversity of fungal pathogens (only *F. nivale* was found in all the studied varieties of winter wheat) compared to previous years of research. *F. equiseti* and *F. avenaceum* were found in the seeds of varieties M-66 and Kuyalnik in an insignificant amount (the signal disappears when diluted 1: 10000). P. expansum was determined only in DNA samples of seeds of varieties M-614 and Kuyalnik. *F. oxysporum, F. sporotrichioides, F. verticillioides, F. solani, P. brevicompactum* were not found in these seeds, that allows to consider the seeds of these wheat varieties as suitable for long-term storage.

The most harmful species of Fusarium (*F. culmorum*, *F. graminearum*) have not been found at all.

Conclusions: Monitoring the situation with the spread of fungal pathogens in winter wheat crops during the growing season allows to pre-determine the algorithm of actions for treating crops with fungicides.

The nested-PCR method used in the work makes it possible to timely identify the species of a fungal pathogen and assess its potential harmfulness as a mycotoxin producer.

The moderate content of fungal pathogens in the seeds of the studied varieties of winter wheat harvest of 2021 allows to use them for long-term storage.

Acknowledgements. Research was carried out within the Project of the State Program 20.80009.5107.11 „Long-term *ex situ* conservation of plant genetic resources in the Gene Bank using the methods of molecular biology for plant germplasm health testing", financed by the National Agency for Research and Development of the Republic of Moldova.

References:

1. GenBank https://www.ncbi.nlm.nih.gov/genbank
2. ISO 21571:2005(en) Foodstuffs — Methods of analysis for the detection of genetically modified organisms and derived products — Nucleic acid extraction [Online]. URL: https://www.iso.org/obp/ui/#iso:std:iso:21571:ed-1:v1:en

CZU:575.86:582.916.26(497.2) https://doi.org/10.53040/abap6.2022.08

THE STUDY OF ISSR-MARKERS POLYMORPHISM IN BROOMRAPE POPULATIONS FROM BULGARIA

DUCA Maria*, BIVOL Ina**
Moldova State University, Chisinau, Republic of Moldova
**https://orcid.org/0000-0002-2666-6180, ** https://orcid.org/0000-0002-6052-1540*
e-mail: bivolinga@yahoo.com

The genetic diversity of 4 broomrape populations of Debovo, Selanovtsi, Radnevo and Rosenova from Bulgaria was evaluated using inter simple sequence repeat (ISSR) markers. Analysis of genetic structure of populations revealed the average observed number of alleles (Na=1.4581) and effective number of alleles (Ne=1.2179). The average calculated value of Nei's gene diversity (H=0.1368), Shannon's Information index (I=0.2132), number of polymorphic loci (NPL=62.75) and percentage of polymorphic loci (PPL=45.81) indicated a medium level of genetic variation exists among the broomrape accessions in the studying populations. The highest level of diversity was found in population from Debovo, followed by Radnevo, Rosenova and Selanovtsi. Based on clustering method, a Ward's tree was constructed and grouped the entire genotypes into 3 major clusters. PCA analysis revealed that first principal component extracted maximum variation (F1=27.27%) than second principal component (F2=17.39%). Both of the methods (AHC and PCA) distributed the 48 broomrape accessions in three groups and presented similar grouping of the genotypes. AMOVA test demonstrated the higher genetic diferences among populations (53%) and lower level (47%) within the populations. The total genetic diversity (Ht=0.2700) and genetic diversity within populations (Hs=0.1525) were no significantly that reflect low population heterozygosity. It was revealed a great genetic differentiation (Gst=0.4354) with intermediate gene flow (Nm=0.6485) among the broomrape populations. All results showed that there is medium level of diversity within populations and large differentiation among populations that suggest the important role of genetic drift in genetic structure differentiation among broomrape populations.

Genetic relatedness and population structure are essential condition for wider natural distribution, stronger environmental adaptability, survivability and evolutionary potential of a species in changing environmental conditions [1]. Evaluation of genetic diversity of the parasitic species *O. cumana* is important tool in germplasm characterization and this information may be highly relevant to contribute for the development of sustainable control strategies of pathogen and breeding programs of sunflower resistance to broomrape.

This investigation aimed to detect and characterize the genetic variability and similarity in *O. cumana* populations collected from naturally *Orobanche*-infested fields in different regions of Bulgaria using ISSR molecular markers.

Keywords: *Orobanche cumana, ISSR markers, polymorphism, population*

Materials and Method. Four broomrape populations were collected from infected sunflower (*Helianthus annuus* L.) fields in different regions of Bulgaria. Two broomrape populations analysed from Debovo and Selanovtsi were classified as race G, and the other two were belonged to race H. Total DNA of 48 accessions was extracted using Thermo Scientific GeneJET Plant Genomic DNA Purification Mini Kit#K0791 according to the manufacturer's protocol (Thermo Fisher Scientific, USA). Thirteen different ISSR primers were used in this study. The DNA amplified fragment analysis was carried out with the Photo-Capt V.15.02 program. A dendrogram based on the Euclidean genetic dissimilarity matrix by Ward's method (AHC) as well as principal component analysis (PCA) were performed using software package XLSTAT 2014 V.2014.5.03. AMOVA (Analysis of molecular variance) test as implemented in GenAlex 6.501 was used to show the intra- and interpopulation genetic differences of Bulgarian broomrape. Descriptive population genetic statistics (Na, Ne, H, I, NPL, PPL, Ht, Hs, Gst and Nm values) were computed by POPGENE V.1.32 software.

Results. The obtained results from evaluation of the genetic diversity with ISSR markers within the four studied broomrape populations by the statistical parameters demonstrated that the largest observed number of alleles (Na=1.5620) and effective number of alleles (Ne=1.2767), the highest value of Nei's gene diversity (H=0.1741) and Shannon's Information index (I=0.2698), and also largest number of polymorphic loci (NPL=77) and the highest percentage of polymorphic loci (PPL=56.20) were found in population from Debovo, followed by Radnevo, Rosenova. The lowest values were observed for population from Selanovtsi (1.4015, 1.1845, 0.1167, 0.1829, 55 and 40.15, respectively). Thus, these data revealed that among the broomrape accessions in the studying populations exists medium level of genetic variation. According the analysis of the population genetic structure, the total genetic diversity (Ht=0.2700) differed not significantly from the genetic diversity within populations (Hs=0.1525) that reflecting low population heterozygosity. The genetic differentiation among the studied populations was great (Gst=0.4354) according to Gst degree classification on Buso [2], indicating that nearly 44% of the total genetic variation occurred among, rather than within 4 broomrape populations. Broomrape populations had a gene flow value smaller than 1 (Nm=0.6485), concluding that the sampled populations were subject to genetic drift [Slatkin, 1987]. AMOVA analysis revealed that 53% of genetic variability was due to differences among populations and 47% was due to differences within populations ($P<0.001$). Genetic relationships among broomrape populations were further investigated by AHC and PCA, and as it turns out, the results of both methods were comparable and grouped the 48 broomrape accessions into three main groups. The first group consisted population from Debovo, the second group included populations from Selanovtsi and Radnevo, and third contained all accessions of population from Rosenova. However, the obtained groups showed that the genetic diversity of the four populations had a weak relationship with their geographical distribution and racial status.

Conclusions. Analyzing available data on organization of the populations using AMOVA method and Popgen software helped to draw out a conclusion that the higher genetic diversity among populations can be due to low of gene flow resulting from the self-pollination which was also confirmed by another study performed with *O. cumana* populations from Spain, Romania, Bulgaria, and Turkey via RAPD analysis [4]. It was also found that the genetic relationships between populations do not accord with their geographical distribution and racial status.

Acknowledgment. This study was funded by the project of the State Program 20.80009.5107.01 - Genetico-molecular and biotechnological studies of the sunflower in the context of sustainable management of agricultural ecosystems, financed by the National Agency for Research and Development of the Republic of Moldova.

References:

1. Liu F., Shi H-Z., Guo Q-S., Lv F., Yu Y-B., Lv L-L., Shen W-B., Zhao W-H., Zhang M-M. Analysis of the genetic diversity and population structure of *Perinereis aibuhitensis* in China using TRAP and AFLP markers, Biochem. Syst. Ecol. 2015, 59, p. 194-203. DOI: 10.1016/j.bse.2015.01.002.
2. Buso G.S.C., Rangel P.H., Ferreira M.E. Analysis of genetic variability of South American wild rice populations (*Oryza glumaepatula*) with isozymes and RAPD markers, Mol. Ecol. 1998, vol. 7, no. 1, p. 107-117. DOI: 10.1046/j.1365-294x.1998.00321.x.
3. Slatkin M. Gene flow and the geographic structure of natural populations, Science, New Series. 1987, vol. 236, no. 4803, p. 787-792. DOI: 10.2307/1699930.
4. Gagne G., Roeckel-Drevet P., Grezes-Besset B., Shindrova P., Ivanov P., Grand-Ravel C., Vear F., Tourvieille de Labrouhe D., Charmet G., Nicolas P. Study of the variability and evolution of *Orobanche cumana* populations infesting sunflower in different European countries, Theor. Appl. Genet. 1998, vol. 96, no. 8, p. 1216-1222. DOI: 10.1007/s001220050859.

CZU:633.854.78:581.151:543.9 https://doi.org/10.53040/abap6.2022.09

GENOTYPING OF BROOMRAPE POPULATIONS WITH DIFFERENT GEOGRAPHICAL ORIGIN

DUCA Maria*, MUTU Ana**, CLAPCO Steliana***
Moldova State University, Chisinau, Republic of Moldova
** https://orcid.org/0000-0002-5855-5194, ** https://orcid.org/0000-0001-8603-142X,*
**** https://orcid.org/0000-0001-7147-2740*
e-mail: mduca2000@yahoo.com

Broomrape (*Orobanche cumana* Wallr.) is a holoparasitic angiosperm found in the wild and crop plants mainly in the Eastern Europe and Central Asia. Genetic variation is an important force in explaining the evolution process of races and emergence of a new more virulent forms of the pathogen.

An efficient technique in molecular genetics, which is widely applied in genetic diversity studies, is SSR-PCR using simple sequence repeats (microsatellites, SSR). The study of the allelic diversity with SSR markers and the genetic relationships between individuals of different *O. cumana* populations, will contribute essential to the determination and characterization of the population genetic structure, followed by development of strategies to control and improve the resistance of the host plant to the parasite. In this study, the analyses of allelic diversity within different populations of *Orobanche cumana* Wallr., has been carried out using simple sequence repeats (microsatellites) markers.

Keywords: *Orobanche cumana Wallr., molecular profiles, allelic diversity, alleles frequency, SSR*

Materials and Method. The experimental material included 33 *O. cumana* populations that were collected from infected sunflower fields from different countries: China, Turkey, Serbia, Romania, Bulgaria and Republic of Moldova. Seeds of *O. cumana* were germinated on sunflower roots in the greenhouse [Rotarenco, 2012; Vranceanu et al., 1980]. Fresh tissue samples from each population were collected and stored at -80°C until DNA extraction (GeneJET Plant Genomic DNA Purification Mini Kit #K0791). SSR-PCR was performed according to follow program: 95°C – 3 min; 35 cycles: 95°C – 30 sec, 57°C – 45 sec, 72°C – 1 min; 72°C – 5 min. PCR reaction (15 µl) included: 60 ng DNA, 200 µM of each type of dNTP, 0.4 µM SSR primer, 1.0 U/µL DreamTaq Green DNA Polymerase, 2.5 mM $MgCl_2$ (*Thermo Scientific*) Vertical electrophoresis in 8% polyacrylamide gel was carried out as described in the scientific literature [Sambrook et al., 2001]. Genotyping was performed based on 13 SSR primers (Simple Sequence Repeats) [Pineda-Martos et al., 2013]. Statistical processing was carried out with Photo-Capt (version 15.02), Microsoft Excel Office 2010 and XLSTAT (version 2014).

Results. Based on genotyping with microsatellite markers the differences of the molecular profiles, number and frequency of alleles at the same locus was highlighted among populations. The broomrape genotypes were characterized by a high degree of allelic polymorphism of the microsatellite sequences, showing a total of 2-23 different profiles (mono-, bi-, tri-, tetra-allelic profiles etc.) per marker and 1-6 molecular profiles per population. Compared to other populations, those from Bulgaria and Serbia are more homogeneous, resulting in 1-4 profiles per population. Overall, genotyping with the SSR markers generated the greatest number of molecular profiles within the populations belonging to the Republic of Moldova (70), Turkey (45) and China (45).

All 13 markers were polymorphic, revealing a total of 98 alleles for 33 populations, and varied widely in their numbers of alleles, from three to 13 alleles, with a mean of 7.54 alleles per locus. The average number of alleles per population for each country varied from lower values of 3.63 and 3.67 revealed in the case of populations from Serbia and, respectively, Bulgaria, to higher values, such as 3.82 - Republic of Moldova, 4.02 - Turkey, 4.07 - Romania and 4.72 - China.

The investigated broomrape populations belonging to different races, the most virulent biotypes being predominant. So, the majority of populations were classified as race G and H, exception was only Serbian populations identified as race ≤E. In present research it has been established that *O. cumana* populations belonging to race H (regardless of the country) were characterized by the highest number of molecular profiles (97), followed by race G (72) and ≤E (59). At the same time, in the case of populations belonging to race ≤E, a smaller average number of alleles (3.65), comparative to those from the race G (3.92) and H (3.90), was determined.

Alleles frequency is also an important measure of genetic variation. The SSR marker system revealed 3 types of alleles for the majority of populations – rare (with a frequency <0.05), frequent (>0.05<0.5) and abundant (>0.5) [Cole, 2005]. So, the 13 codominant markers identified a total number of 98 alleles, most of them being frequent, with a frequency ranging from 0.05 to 0.5 within each population. The Serbian populations were characterized by the presence of all 3 types of alleles with relatively constant frequency at the interpopulational level, suggesting a small differentiation between populations from this country. Overall, 10 common alleles (with a frequency between 0.17-1.00) for all populations and, respectively, for all races have been also detected. These alleles can be considered as a basic genetic background for the panel of 33 populations. The allelic variants specific (frequency: 0.05-0.5) for Turkish, Chinese, Serbian and Romanian broomrape populations was detected, which is of particular interest and can be used as a molecular tool in genotyping and differentiation of *O. cumana* populations. Also, from 1 to 5 allelic variants specific for the race E, G and H were identified. The presence of a greater number of common alleles was established in individuals belonging to race G and H, that can be due by more recent appearance of race H (2014) derived from race G (2006) and existence of a strong gene flow between them, comparative to race E (1950).

Conclusions: Based on the molecular profiles generated by the microsatellite markers allelic variations among populations and races was highlighted. The broomrape populations from Bulgaria and Serbia are more homogeneous, resulting in 1-4 profiles per population. The average number of alleles per population for Serbian (3.63) and Bulgarian (3.67) populations was also lower, comparative to other populations, indicating a less allelic diversity. The highest number of molecular profiles and alleles were observed in the case of populations from the Republic of Moldova (70 respectively, 3.82), Turkey (45 respectively, 4.02) and China (45 respectively, 4.72). According to the obtained results we can conclude that these populations are more heterogeneous, characterized by a higher degree of genetic variations.

Acknowledgment.This study was funded by the research project of the State Program 20.80009.5107.01 – *Genetico-molecular and biotechnological studies of the sunflower in the context of sustainable management of agricultural ecosystems,* financed by the National Agency for Research and Development of the Republic of Moldova.

References:

1. Cole, C. T. Allelic and population variation of microsatellite loci in aspen (*Populus tremuloides*), New Phytologist. 2005, vol. 167, no.1, p. 155-164. doi: 10.1111/j.1469-8137.2005.01423.x.
2. Pineda-Martos, R., Velasco, L. et al. Genetic diversity of sunflower broomrape (*Orobanche cumana*) populations from Spain assessed using SSR markers, Weed Research. 2013, vol. 53, no. 4, p. 279-289. DOI: 10.1111/wre.12022.
3. Rotarenco, V. Aspecte morfo-fiziologice și genetice de interacțiune gazdă-parazit (*Helianthus annuus* L. – *Orobanche cumana* Wallr., Autoref. tezei de doctor în șt. biol., Chișinău, 2010, 26 p.
4. Sambrook, J., Russell, D. Molecular cloning, A laboratory manual, vol. I-III, Cold Spring Harbor Laboratory Press., New York, 2001.
5. Vranceanu, A. V., Tudor, V. A. et al. Virulence groups of *Orobanche cumana* Wallr., differential hosts and resistance sources and genes in sunflower. In: Proc. of the 9th Int. Sunflower Conf., Torremolinos, Spain, 8-13 June 1980, p. 74-82.

CZU:633.11:632.938.1 https://doi.org/10.53040/abap6.2022.10

ANALYSIS OF THE COMPOSITION OF *Fusarium* PATHOGENS IN THREE TRITICALE VARIETIES

IGNATOVA Zoia
Institute of Genetics, Physiology and Plant Protection,
Chisinau, Republic of Moldova
https://orcid.org/0000-0003-1171-5928, e-mail: zoianciki@mail.ru

One of the main tasks of modern agriculture is to ensure the productive security of people by increasing the yield of agricultural crops, breeding for resistance to unfavorable environmental factors and diseases, and minimizing the risk of mycotoxins entering food and animal feed, which are synthesized by many fungal phytopathogens [2, 3].

Triticale as a wheat-rye amphidiploid is resistant to most pathogens. However, in recent years there has been more and more data on the expansion of the spectrum of fungal pathogens on triticale plants [1].

Some parasitic species of fungi of the genus *Fusarium*, which affect the generative organs of cereal crops, are producers of the most dangerous mycotoxins. They not only infect grain during the growing season, but also continue to develop on grain under certain conditions during storage, contaminating it with mycotoxins. The most harmful representatives of this genus in terms of the toxicity of their secondary metabolites are *F. equiseti, F. avenaceum, F. nivale, F. oxysporum, F. sporotrichioides, F. verticillioides, F. culmorum.* They produce mycotoxins such as deoxynivalenol (DON), zearalenone, T-2 / HT-2 toxins, ochratoxin, fumonisin, etc., which have a negative impact on human health. So, PCR diagnostics of plant samples for the presence of some harmful fungal pathogens during the growing season can be a preventive measure against the contamination of the final product (grain) with mycotoxins. It allows timely treatment of crops with fungicides and rejection of infected seeds.

The aim of the present study was to analyze the composition of pathogens from the genus *Fusarium* in plants of three varieties of triticale at different stages of vegetation.

Keywords: *triticale, genus Fusarium, molecular diagnosis, nested-PCR*

Materials and Method. Triticale plants of the three varieties created in IGPPP (Ingen 40, Ingen 54, and Ingen 93), grown on the experimental plots in 2021, were tested. Plant material from different tissues was taken for the molecular analysis at the different phases of vegetation: root neck and leaves at the tillering stage; grain with spike scales at the stage of early milky-wax ripeness; the mature seeds.

DNA was extracted according to the CTAB protocol (https://www.iso.org) with some modifications.

Analysis of plant DNA for the presence of pathogenic fungi synthesizing toxic metabolites was carried out using the nested-PCR. Specific primers designed in the

Laboratory of Molecular Genetics of IGPPP were used for species identification of pathogens *F. equiseti, F. avenaceum, F. nivale, F. oxysporum, F. sporotrichioides, F. verticillioides, F. culmorum.* PCR analysis was carried out in two rounds (nested-PCR). The 25 µl reaction mixture contained: 66 mM Tris-HCl (pH-8.4), 16 mM $(NH_4)_2SO_4$, 2.5 mM $MgCl_2$, 0.1% Tween 20,7% glycerol, 100 µg/ml BSA, 0.2 mM each of dNTPs, 2 units of Taq polymerase, 5 pM of each primer, and 20 ng of DNA. In both rounds, the following program was used: denaturation at 95°C (1 min), annealing at 60°C (1 min.), elongation at 72°C (1 min.). The number of cycles in both rounds was 30.

The amplification products were analyzed by electrophoresis in 1.5% agarose gel stained with ethidium bromide and visualized in ultraviolet (312 nm). A 100 bp DNA Ladder from Thermo Fisher Scientific was used as a molecular marker.

Results. Nested-PCR analysis on the total DNA from triticale samples for the presence of a number of pathogens from genus Fusarium showed that *F. sporotrichioides* was most often identified at the stages of tillering (root neck and leaves) and milky-wax ripeness (grains with spike scales). It was present in the DNA of all three triticale varieties at these stages. However, this species was not found in samples of the mature seeds. *F. nivale* was detected in DNA samples of varieties Ingen 40 and Ingen 54 at all stages of the development. Analysis for *F. avenaceum* showed its presence in DNA samples of root necks of triticale varieties Ingen 40 and Ingen 93 and mature seeds of variety Ingen 40. *F culmorum* was identified only in seeds of variety Ingen 93 at the stage of full ripeness.

Molecular diagnostics for the *F. equis*eti presence was carried out using primer pairs synthesized on the basis of different regions of the genome of this pathogen to compare the reliability of the results.

The primers were designed based on the nucleotide sequences of the beta-tubulin gene and the translation elongation factor presented in the GenBank database (https://www.ncbi.nlm.nih.gov/genbank/). Electropherograms in both cases showed the synthesis of fragments of a specific length only in the variety Ingen 93 in leaves at the tillering stage and in mature seeds. This confirms the possibility of using primers designed from different regions of the genome for molecular diagnostics *F. equis*eti.

Conclusions. Molecular analysis of DNA samples from all three analyzed varieties of triticale at the stages of tillering (root necks and leaves) and milky-wax ripeness (seeds) demonstrated approximately the same degree of pathogen loading. At the same time, the smallest number of studied pathogens was diagnosed in variety Ingen 54. *F. sporotrichioides* was found at the stages of tillering and milky-wax ripeness, but was absent in mature seeds.

The most sensitive to pathogens *F. avenaceum* and *F. nivale* was variety Ingen 40, and to pathogens *F. culmorum* and *F. equiseti* Ingen 93.

The possibility of identifying the *F. equiseti* pathogen with primers designed from different regions (genes) of the genome of this species was shown.

Pathogens *F. verticillioides* and *F. oxysporum* were not found in all studied DNA samples.

Acknowledgements. Research was carried out within the Project of the State Program 20.80009.5107.11 „Long-term *ex situ* conservation of plant genetic resources in the Gene Bank using the methods of molecular biology for plant germplasm health testing", financed by the National Agency for Research and Development of the Republic of Moldova.

Plant material for the molecular analysis of infection in triticale was kindly provided by the Laboratory of Applied Genetics under the direction of Dr. hab. Galina Lupascu.

References:

1. Arseniuk E., Góral T. Triticale biotic stresses – known and novel foes. In:Triticale Book, Agri-Food Canada Part II, 2015, p. 83-110.
2. Fisher, M.C., Hawkins, N.J., Sanglard, D., Gurr, S.J. Worldwide emergence of resistance to antifungal drugs challenges human health and food security. Science. 2018, vol. 360, no. 6390, p. 739–742. DOI: 10.1126/science.aap7999.
3. Fones, H.N., Bebber, D.P., Chaloner, T.M.; Kay, W.T., Steinberg, G., Gurr, S.J. Threats to global food security from emerging fungal and oomycete crop pathogens. Nat. Food. 2020, vol. 1, p. 332–342. DOI:10.1038/s43016-020-0075-0.

CZU: 633.15:631.527.5 https://doi.org/10.53040/abap6.2022.11

JUXTAPOSITION OF HETEROZYGOUS AND HOMOZYGOUS REGIONS AND CROSSING OVER IN MAIZE

MIHAILOV M.
Institute of Genetics, Physiology and Plant Protection,
Chisinau, Republic of Moldova
https://orcid.org/0000-0003-1204-410X, e-mail: mihailov-me@mail.ru

It is believed that the function of crossing over is the reshuffling of genetic material in sexually reproducing species. However, the rarity of crossover events (usually 1-2 per chromosome) can cause difficulties for their use in breeding. Therefore, much attention is paid to the study of the factors regulating frequency and location of crossovers. One of long-studied factors is heterozygosity. A very remarkable phenomenon was discovered in the analysis of cis-effects, when the relationship between polymorphism in some regions and the recombination rate in neighboring ones was studied. In Arabidopsis F_2 plants, when a homozygous region is adjacent to a heterozygous one (which is called juxtaposition by the authors), the frequency of crossovers decreases in homozygous region and increases in neighboring heterozygous ones [4]. There is a redistribution of crossovers, or in authors' terms, remodelling. One of the authors assumes for this phenomenon an adaptive sense for self-pollinators, as Arabidopsis, and wished that similar studies be carried out on other plants, including outcrosses [3]. Note that we have already observed the effect of juxtaposition in the maze F_2 generation (outcross), although we did not interpret it as remodelling [2]. Research on maize has continued since then, and here we present the main results.

Keywords: *crossing over, meiosis, maize*

Materials and method. The initial material included inbred maize lines MK01, Ku123 and a multiple marked line 2-9m, carrying on chromosome 2 mutant markers *ws3* (white sheath), *lg1* (liguleless), *gl2* (glossy) with coordinates 2, 13 and 31 cM, and on chromosome 9 - *c1* (colorless aleurone), *sh1* (shrunken endosperm) and *wx1* (waxy endosperm) with coordinates 16, 20 and 48 cM. In the course of backcrossing, markers from the 2-9m line were transferred to the genetic background of lines MK01 and Ku123 and the isogenic lines were obtained: M(*c,sh,R*)$_7$, M(*sh,wx*)$_7$, M(*lg,gl*)$_6$, M(*R*)$_7$, K(*c,sh,R*)$_7$, K(*sh,wx*)$_5$, K(*lg,gl*)$_6$, K(*R*)$_7$, M(*ws,lg*)$_7$, M(ws,*gl*)$_7$, M(*lg,gl*)$_7$, M(*gl*)$_7$. The initial letters M and K mean MK01 and Ku123, the transferred mutations are given in brackets (without numbers for brevity), the subscript means the number of backcrossing. The dominant allele *R1* from chromosome 10 was transferred with the *c1* allele, so that the anthocyan kernel color appeared and segregation for *c1* could be observed.

In 2017-2021 the recombination rate between marker loci was estimated in three groups of hybrids: 1) K(*R*)$_7$×M(*ws,lg*)$_7$, Ku123×M(*lg,gl*)$_6$, K(*R*)$_7$×M(*lg,gl*)$_7$, MK01×K(*lg,gl*)$_6$, K(*R*)$_7$×M(*ws,gl*)$_7$, K(*R*)$_7$×M(*c,sh,R*)$_7$, M(*R*)$_7$×K(*c,sh,R*)$_7$, M(*sh,wx*)$_7$×Ku123, MK01×K(*sh,wx*)$_5$; 2) MK01×M(*ws,lg*)$_7$, MK01×M(*lg,gl*)$_6$, MK01×M(*lg,gl*)$_7$, Ku123×K(*lg,gl*)$_6$, M(*R*)$_7$×M(*c,sh,R*)$_7$, K(*R*)$_7$×K(*c,sh,R*)$_7$, MK01×M(*sh,wx*)$_7$, Ku123×K(*sh,wx*)$_5$; 3) MK01×M(*ws,gl*)$_7$, M(*gl*)$_7$×M(*ws,lg*)$_7$.

The recombination rate was estimated by F_2 or BC data, in the first case, the values for male and female meiosis were averaged. In each variant, from 7 to 14 plants were tested, the average family size was 250 individuals.

Results. The recombination rate in the marked interval significantly depends on the genetic status of the rest chromosome. When the rest of the chromosome is homozygous (the second group of hybrids), recombination is near doubled compared to the completely heterozygous state (first group): from 11.3 to 22.4% in *ws3-lg1* (by 2.0 times), from 17.8 to 31.7% in *lg1-gl2* (by 1.8 times), from 5.4 to 10.1% in *c1-sh1* (by 1.9 times) and from 15.0 to 35.7% in *sh1-wx1* (by 2.4 times), in all cases $p<0.001$. The term "heterozygous" is used here somewhat conditionally: we call a genome fragment as heterozygous if it is represented by material of different origin in homologous chromosomes. The amplification factors observed here (1.8-2.4) are higher than in the experiment on F_2 (1.05-1.8), which is apparently caused by the expansion of the homozygous regions adjacent to the marked interval.

The third group includes hybrids in which the marked interval, being in homozygous environment, contains a homozygous region within itself. These are MK01×M(*ws, gl*)$_7$ and M(*gl*)$_7$×M(*ws,lg*)$_7$ hybrids. The recombination rate in *ws3-gl2* was 30.0 and 29.2%, which is near to 29.6% observed in the heterozygous hybrid K(*R*)$_7$×M(*ws, gl*). In the second hybrid, the recombination rate in *ws3-lg1* and *lg1-gl2* was 11.2 and 20.8%, which is close to the values observed in the first group of hybrids. Thus, the effect of external homozygous background appears only in entire heterozygous regions. Further, the alternation of homo- and heterozygous regions should not be too fractional: in the M(*gl*)$_7$×M(*ws*, *lg*)$_7$ hybrid, the internal homozygous region is located between the *lg1* and *gl2* loci, and the *ws3-lg1* region remained fully heterozygous. But the homozygous region bordering it (no more than 6 Mb, with the most probable length 2 Mb) is presumably too short for the juxtaposition to have effect. The results for F_2 show that the homozygous region to the left of the *lg1* locus (expected mean length 3 Mb) does not yet provide a significant increase in recombination in the adjacent *lg1-gl2* region, while the homozygous region of 10 Mb to the left of the *sh1* locus already leads to a noticeable effect in *sh1-wx1*. As for the heterozygous regions, in all cases they were at least 6 Mb (including expected exit beyond the border markers). Thus, the threshold length of neighboring homo- and heterozygous regions, above which remodeling becomes noticeable, lies approximately between 3 and 6 Mb. Thus, Ziolkovsky's opinion that the effect of juxtaposition only appears on the megabase scale is confirmed [3].

We also noticed the juxtaposition effect when analyzing data of 23 maize hybrids, where crossover events between SNP markers were recorded [1]. Comparison of different hybrids is complicated by structural differences, so we chose chromosomes 2 and 10, where structural differences were minimal. In some hybrids, there are large regions (5 Mb or more) where there are no SNP and parental sequences are identical due to common origin. The intensity of crossing over in these regions (measured by recombination between terminal SNPs) was lower than the average, but increased in neighboring heterozygous ones. But this is only when both regions did not fall into the pericentromeric zone of suppressed crossing over. This pattern manifested as a statistical trend, which should be expected when comparing heterogeneous material. However, this can be indirect confirmation of a new genetic phenomenon, the mechanism of which has yet to be discovered.

Conclusions. The intensity of crossing over in a heterozygous region of maize chromosome increases if neighboring region has homozygous state. This effect is well explained by the redistribution of crossovers from homozygous regions to heterozygous ones. This effect is manifested when the size of alternating homo- and heterozygous regions is at least a few Mb. When the homozygous region spreads to the rest of the chromosome, the increase of recombination rate becomes, on average, twofold.

Acknowledgment. Research was carried out within the project of the State Program 20.80009.5107.03 “Efficient use of plant genetic resources and advanced biotechnologies to increase the adaptability of crop plants to climate change”, financed by the National Agency for Research and Development.

References:

1. Bauer E., Falque M. et al. Intraspecific variation of recombination rate in maize. Genome Biology, 2013, 14:R103. DOI: 10.1186/gb-2013-14-9-r103.
2. Mikhailov M.E., Chernov A.A. The effect of heterozygosity for marker loci on recombination fraction in adjacent chromosomal regions in maize. Rus. J. Genet. 2004, vol. 40, no 7, p. 751-755. DOI: 1023/B:RUGE.0000036524.76567.cc.
3. Ziolkowski P.A. Why do plants need the ZMM crossover pathway? A snapshot of meiotic recombination from the perspective of interhomolog polymorphism. Plant reproduction, published online 12 July 2022. DOI: 10.1007/s00497-022-00446-3.
4. Ziolkowski P.A., Berchowitz L.E. et al. Juxtaposition of heterozygous and homozygous regions causes reciprocal crossover remodeling via interference during *Arabidopsis* meiosis. eLife. 2015, vol. 4, e03708. DOI:10.7554/eLife.03708.

CZU: 633.15:631.527.5 https://doi.org/10.53040/abap6.2022.12

REMODELLING OF CROSSING OVER AS A CAUSE OF JUXTAPOSITION EFFECT IN MAIZE

MIHAILOV M.
Institute of Genetics, Physiology and Plant Protection,
Chisinau, Republic of Moldova
https://orcid.org/0000-0003-1204-410X, e-mail: mihailov-me@mail.ru

When studying the relationship of heterozygosity with recombination, it was noted that in mosaic genotypes, where homozygous and heterozygous regions alternate, local homozygosity is accompanied by an increased frequency of crossovers in neighboring heterozygous regions of chromosomes. This effect was first noticed in maize using morphological markers [2], and then confirmed in an experiment on Arabidopsis [3,4], where, due to use of molecular markers, it was shown that this effect (called the juxtaposition effect by the authors) is explained by the redistribution of crossovers from homozygous regions into neighboring heterozygous ones (remodelling in the author's terms). We decided to test whether this explanation also applies to maize by analyzing primary data from Bauer et al. [1], where dense SNP mapping was used to construct recombination landscapes for 23 maize hybrids, and the families of DH lines obtained from each F_1 hybrid served as mapping generations.

Keywords: *crossing over, maize, heterozygosity*

Materials and method. The material analyzed here from [1] is not similar to the material from [2], since in this case different F_1 hybrids were studied, rather than mosaic genotypes obtained by combining two parental genomes. However, in the hybrids analyzed, there are extensive homozygous regions, where no SNP polymorphism was noted. We will assume, together with the authors, that in these cases there is an identity of sequences in the parents due to a common origin. We decided to pay attention to these regions, and to consider other regions represented in homologous chromosomes by material of different origin as heterozygous, not taking into account differences between them in SNP density.

Comparison of different hybrids is complicated by structural differences due to translocations, inversions, and more complex chromosome rearrangements. Therefore, chromosomes 8 and 10 were selected for analysis, where structural differences are minimal. In these chromosomes, we found homozygous segments no less than 5 Mb long, determined their recombination length by edge markers, and compared it with the frequency of recombination between the same markers in other hybrids, where this segment is represented by material of different origin, as well as with the frequency of recombination in adjacent heterozygous regions.

Results. In all hybrids, a total of 72 homozygous regions over 5 Mb were found: 46 in chromosome 8 and 26 in chromosome 10. Most of these homozygous regions (32 in chromosome 8 and 15 in chromosome 10) are located in the pericentromeric zone with suppressed crossing over, where recombination rate was close to zero in both homozygote and heterozygote. For the remaining 25 regions, we determined the recombination length and compared it with the average recombination length in those hybrids where the same regions were heterozygous.

In the homozygous state, recombination turned out to be reduced on average, by 3.7 cM in absolute terms, and by 32% in relative terms. The maximum decrease was observed in the interval 103–133 Mb of chromosome 8, where the recombination frequency in the SFF7 hybrid dropped to zero compared to the average value 19 cM in the other hybrids. However, a decrease in the recombination frequency was observed not in all homozygous segments, but in 9 out of 14 in chromosome 8 and in 10 out of 11 in chromosome 10. This is probably due to the fact that among the 23 different hybrids there should be other genetic differences regulating crossing over excepting local homozygosity. For example, the SFF13 hybrid exhibits an atypically high intensity of crossing over on the chromosome 8 (recombination length 173 cM versus the average value of 135 cM for other hybrids). It is this situation that includes three cases of increased recombination frequency in homozygous segments of the SFF13 hybrid.

We also checked whether there is a redistribution of crossovers from homozygous regions to neighboring heterozygous ones. Of the 25 studied long homozygous regions, 14 were selected with the strongest effect, where the recombination frequency decreased by 4 cM or more. Checking the adjacent regions showed that the recombination frequency in them is indeed increased relative to the average value in the other hybrids. In all the cases studied, there was a redistribution of crossovers from the homozygous region to neighboring heterozygous one, although not always in both directions. There was no redistribution of crossovers to the pericentromeric zone with suppressed crossing over, as well as through the centromere to the other arm of the chromosome.

The total recombination length of the 13 regions examined is equal, in mean, 76.4 cM in the homozygous state and 187.1 cM in the homozygous state. The regions adjacent to them, in which a redistribution of crossovers was observed, have a total length of 375.7 cM and 255.4 cM, respectively. Thus, on a chromosomal scale, the frequency of crossovers exhibits homeostasis, and the local redistribution of crossovers does not lead to a significant change in their overall frequency.

The most expressed case of redistribution of crossovers from the homozygous region refers to two segments of the chromosome 8 with physical coordinates 74-101 Mb and 103-133 Mb in the SFF7 hybrid. These segments, homozygous in SFF7 and separated by a small heterozygous region, have zero recombination length in this hybrid, while in the heterozygous state the same segments have an average recombination length of 6.2 cM and 19.0 cM. On the contrary, the segment with coordinates 133-163 Mb located to the right has a recombination length of 39.5 cm in SFF7 against an average length of 17.3 cm in those hybrids where it is also in the heterozygous state.

Thus, the statistical analysis of 23 hybrids gives reason to believe that the juxtaposition effect found by us in maize is explained by the same reason as in Arabidopsis - the redistribution of crossovers from homozygous regions to neighboring heterozygous ones [3, 4].

Conclusions. When comparing the recombination landscapes of 23 maize hybrids, the effect of increasing the frequency of recombination in heterozygous regions of maize chromosomes located in the neighborhood of homozygous ones was confirmed as a statistical trend. This trend is accompanied by a reverse trend towards a decrease in the frequency of recombination in homozygous regions adjacent to heterozygous ones, which may indicate that maize has the same crossover remodeling in mosaic genotypes as in Arabidopsis. In maize, the redistribution of crossovers occurs only within the same arm of the chromosome and does not affect the pericentromeric regions with suppressed crossing over.

Acknowledgment. Research was carried out within the project of the State Program 20.80009.5107.03 “Efficient use of plant genetic resources and advanced biotechnologies to increase the adaptability of crop plants to climate change”, financed by the National Agency for Research and Development.

References:

1. Bauer E., Falque M. et al. Intraspecific variation of recombination rate in maize. Genome Biology, 2013, 14:R103. DOI: 10.1186/gb-2013-14-9-r103
2. Mikhailov M.E., Chernov A.A. The effect of heterozygosity for marker loci on recombination fraction in adjacent chromosomal regions in maize. Rus. J. Genet. 2004, vol. 40, no 7, p. 751-755. DOI: 1023/B:RUGE.0000036524.76567.cc
3. Ziolkowski P.A. Why do plants need the ZMM crossover pathway? A snapshot of meiotic recombination from the perspective of interhomolog polymorphism. Plant reproduction, published online 12 July 2022. DOI: 10.1007/s00497-022-00446-3
4. Ziolkowski P.A., Berchowitz L.E. et al. Juxtaposition of heterozygous and homozygous regions causes reciprocal crossover remodeling via interference during *Arabidopsis* meiosis. eLife. 2015, vol. 4, e03708. DOI:10.7554/eLife.03708

CZU:635.64:632.95:581.1 https://doi.org/10.53040/abap6.2022.13

EFFECTS OF ABIOTIC STRESS FACTORS ON FUNCTIONAL PARAMETERS OF TOMATO POLLEN UNDER VIRAL INFECTION

SALTANOVICI Tatiana*, ANDRONIC Larisa**, ANTOCI Ludmila, DONCILA Ana***
Institute of Genetics, Physiology and Plant Protection, Chisinau, Republic of Moldova
**https://orcid.org/0000-0002-1122-7433, **https://orcid.org/0000-0002-2761-9917, ***https://orcid.org/0000-0002-9674-0403, e-mail: tatiana.saltanovici@igfpp.md*

Studies carried out in the last 25 years have shown that abiotic and biotic stresses have a negative impact on the male gametophyte quality and activity, including the ability to form pollen and its germination, as well as the functionality of the pollen tubes [1; 3; 4]. The information about these processes is of particular interest not only through the influence on pollination and fertilization, but also for the application in the screening of valuable genotypes using of gametic methods. Considering the fact that, in many plant species, more than half of their genome is expressed at the pollen level, the male gametophyte can become a reliable system for evaluating the degree of interaction of the genotype with environmental factors [2]. The information regarding the associated action of viral phytopathogens and abiotic factors on the male gametophyte is quite limited in the specialized literature. **The purpose** of this research was to determine the reaction of the male gametophyte of tomato genotypes infected with viruses and their descendants to the action of high temperatures and hydric deficit.

Keywords: *tomato, virus, pollen, variability, selection*

Materials and Method. The investigations were realized on F_1 hybrid combinations of tomatoes, virus infected and its descendants. The plants were grown in solarium conditions and were inoculated at the 4-5 leaf stage with Tobacco Mosaic Virus (TMV) or Tomato Aspermy Virus (TAV). To obtain pollen, the flowers were collected from plants infected with TMV or TAV, their descendants and the control variants. For each variant, a half of the pollen was subjected to heat treatment (43^{o}C for 3 hours) and then grown on a nutrient medium. Other half was used for determination of the resistance of the male gametophyte to water deficit by growing of the pollen grains on the nutrient medium with the selective concentration of sucrose. The pollen viability and the length of the pollen tubes (LPT) were determined by microscopic study. The obtained data were statistically processed using the program *Statgraphics Plus* 5.1.

Results. The infection of plants with VMT and the action of abiotic factors resulted in the decrease of pollen viability values by 27.4...29.5% and the reduction of the length of pollen tubes by 23.4%, while in plants (TAV) the length of the pollen tubes increased by 11.2% compared to the control, that can be explained by the specific effect of viral background. At the same time, the researches established a differentiated reaction of pollen grains to the associated action of stress factors. In these conditions, in 20% of the analysed genotypes, the values of pollen viability increase compared to the control, although in the other forms, the neutral reaction or the inhibition of this processes was recorded. Also, differences were established according to the length of the pollen tubes. About half of the genotypes showed increased values of this character, and shorter pollen tubes were formed in 40% of the genotypes. According to the obtained results, 13% of TAV genotypes showed the stimulating effect of pollen viability in heat treatment, and the most genotypes presented decrease values of this index. The frequency of the pollen tubes with larger or smaller lenth compared to the control was equal and constituted 46.6%.

The statistical processing of the obtained data by the ANOVA test established a major contribution of temperature (69.3...69.7%) in the variability of pollen viability, the role of genotype and viruses was significantly lower and constituted - 8.8 and 9, 0% ($P<0.001$), while the variation of the length of pollen tubes was mostly determined by the impact of viral pathogens - 54.5...64.3%.

Based on the dominance degree, it was found that the values of these indicators varied from negative to positive overdominance; positive dominance and overdominance been recorded in 45.0% of cases, which reveals the dominant manifestation of the parental form with higher values.

In stress condition, for the descendants of plants infected with viral pathogens was attested the reduction of pollen viability and the length of the pollen tubes by 1.4...1.8 and 1.3.. .1.7 times respectively to the control. The variation of these characters in the TMV progenies was determined by temperature - 81.0...87.5%, although in the genotypes obtained from TAV plants the variability was mostly dependent by the genotype. The analysis of the distribution histograms based on the length of the pollen tubes in condition of water deficit revealed the formation of short or medium-lenth pollen tubes in most cases of the offspring.

According to the structure of the variation spectra of pollen viability under high temperature conditions in TMV/TAV descendants (for each separate genotype) it was revealed the decisive role of the thermal factor with a contribution 42.4/97.2% respectively, although the outcome effect of viral agents was low. In most infected plants, as well as in TMV/TAV progeny, water deficit represented the main source of pollen tube length variability - 50.2...97.0%. Thus, the obtained data can be used to characterize the sensitivity of each genotype to the action of the stress factors and can be applied in the descrition of genotype reaction to the action of the thermal or water deficit factors. So, the resistance level of the genotypes was determined summing up the experimental results,. Thus, the highest values of this character (90.0 and 78.4%) were highlighted in the varieties Mary Gratefully and Tomis in the control variants. The thermoresistance of the pollen was lower compared to the control by 8.3-13.1% and the resistance level of the pollen tubes was lower by 1.4...1.5 times in the TMV/TAV progenies. Among the TMV descendants, a high resistance was demonstrated by the spontaneous forms and cv. Mihaela. The varieties Tomis, Mihaela and Rufina (TAV) also showed high values of heat resistance. In conditions of water deficit, the resistance level of pollen in the offspring was lower compared to the control by 5.4-6.8%.

Conclusions. The TMV/TAV infected plants and their progenies showed different reactions (stimulation, neutral and inhibition) at male gametophyte level, according to the pollen viability and the length of pollen tube.

The action of high temperature/water deficit on the male gametophyte in infected genotypes and their descendants causes differentiated changes in pollen indeces, which are determined by genotype (5.6...19.7%), temperature (36.8...81.5%) or water stress (55.4...82.1%).

The structure of the variation spectra of the male gametophyte indices for each genotype under abiotic stress conditions revealed the possibility of applying the results of gametic selection methods in the prognosis of the reaction of genotypes to the high temperature and water deficit factors based on a complex genetic and statistical analysis.

Acknowledgment. The research was carried out within the project of the State Program 20.80009.7007.04 "Biotechnologies and genetical processes for evaluation, conservation and exploitation of agrobiodiversity", financed by the National Agency for Research and Development.

References:

1. Harth J., Winsor J., Weakland D. et al. Effects of virus infection on pollen production and pollen performance: Implications for the spread of resistance alleles. In: *Am J Bot*. 2016, 103(3), p. 577-583. DOI: 10.3732/ajb.1500165.
2. Johnson M., Harper J., Palanivel R. A Fruitful journey: pollen tube navigation from germination to fertilization. In: *Annual Review of Plant Biology*. 2019, 70(1), p. 809-837. DOI: 10.1146/annurev-arplant-050718-100133.
3. Razzaq M., Rauf M. Khurshid et al. Pollen viability an index of abiotic stresses tolerance and methods for the improved pollen viability. In: Pakistan Journal of Agricultural Research. 2019, 32 (4), p. 609-624. DOI: http://dx.doi.org/10.17582/journal.pjar/2019/32.4.609.624.
4. Тоцкий И., Лях В. Гаметофитный отбор на жаростойкость у подсолнечника культурного. В: *Вісник Донецького національного університету. Сер. А: Природничі науки*. 2014, № 2, с. 156-160.

CZU:635.64:632.9(478) https://doi.org/10.53040/abap6.2022.14

STOLBUR HAZARD CHECK IN EGGLANTS IN MOLDOVA

ZAMORZAEVA Irina*, BAHSIEV Aighiuni**, FOCSA Nina
Institute of Genetics, Physiology and Plant Protection,
Chisinau, Republic of Moldova
** https://orcid.org/0000-0002-6302-2069, **https://orcid.org/0000-0002-1915-7652,*
e-mail: izamorz@gmail.com

Phytoplasmas are wall-less phloem colonized bacteria causing serious damage to agricultural production worldwide [Namba, 2019]. As it is currently known, about half of the targets of phytoplasma diseases of vegetable crops belongs to the *Solanaceae* family [Kumari *et al.*, 2019]. A quarter of solanaceous plants affected by phytoplasmas are eggplans. The presence of phytoplasmas from a number of groups has been found in eggplants in different regions of the world. However, '*Candidatus* Phytoplasma solani' (16SrXII group), causative agent of stolbur, is the only phytoplasma that infects this crop in Eastern Europe [Ember *et. al.*, 2011]. '*Ca*. P. solani' has a wide range spectrum of host plants, including cultivated and wild species [CABI]. Native plants as reservoirs and many hemipteran insects as vectors contribute to a rapid expansion of infection in the field, which can lead to disease outbreaks in the region. Thus, monitoring the presence of '*Ca*. P. solani' in native crops and weeds, as well as insects, is important to control and reduce the spread of the disease. Our previous research by molecular diagnostic methods allowed to find '*Ca*. P. solani' infection in plants of the moldavian varieties of tomato and pepper and in potential insect vectors of phytoplasma from order Hemiptera.

The aim of the present study was to test '*Ca.* P. solani' presence in eggplants of moldavian breeding and some concomitant weeds to estimate the hazard of the stolbur spread.

Keywords: *stolbur, eggplant, weeds, molecular diagnostics*

Materials and Method. '*Ca.* P. solani' was tested on eggplant (main host) and weeds (intermediate host) in September 2021, at the end of the growing season when the maximum load of plants with infection was expected. The total sample size was 68 randomly selected eggplants: 40 plants of four genotypes were grown in a greenhouse and 28 plants of two genotypes were grown in the field. In addition, some species of wild herbal plants collected near the experimental plots (open ground) were tested for the presence of '*Ca.* P. solani'. The molecular diagnosis of the infection was made on plant material (fruits or leaves in the case of eggplants; stems or leaves in the case of weeds). In all cases, DNA was isolated from organs containing phloem, which is colonized by phytoplasma during plant infection. Then nested PCR analysis with specific to '*Ca.* P. solani' chaperonin primer pairs was carried out on template DNA isolated from a common probe of plants of each genotype. The probe volume consisted of 9-16 plants of the same genotype. Total DNA was extracted using the DNA zol Kit, the K-acetate method or by boiling of plant material in an alkaline solution. The choice of a method depended on plant species and organs. The high quality of the isolated DNA in each sample was confirmed by PCR with primers designed based on conservative plant 18S ribosomal RNA gene sequence to avoid false negative results.

Results. The main result of the present study is the absence of '*Ca.* P. solani' infection in eggplants analyzed by molecular diagnostics at the end of the growing season of 2021. Given that stolbur leads to inhibition rather than earlier death of infected plants, we can assume the lack of stolbur in eggplants during the entire growing season. Moreover, the visual observations did not reveal the appearance of symptomatic 'stolbur' plants with abnormal flowers, petal proliferation, spoon-like leaves or partial drying and lignification of fruits. Thus, the result of the molecular diagnostics of '*Ca.* P. solani' infection in eggplants is consistent with visual observations that were carried out in conditions of open and cover ground.

As a rule, the disease control in the greenhouse is more successful than in the field due to more effective application of herbicides and insecticides and fewer insect vectors under cover. A little surprising was the absence of a stolbur in the field. It can be assumed that the growing season of 2021 was generally unfavorable for the spread of phytoplasma in plants, in contrast to several previous years, in which we found the presence of stolbur phytoplasma in tomato and pepper plants. To answer this assumption, a number of molecular diagnostics of phytoplasma were carried out on some weeds – the potential reservoirs of stolbur infection in the field. The presence of 'Ca. P. solani' has been found in two intermediate host species, Convolvulus arvense and Solanum nigrum. Thus, the presence of stolbur causative agent in open ground in 2021 was confirmed.

Conclusions: As a result of molecular diagnostics and visual observations on eggplants growing in 2021 in open and cover ground conditions, the presence of 'stolbur' plants was not detected. At the same time, the causative agent of stolbur '*Ca.* P. solani' was present in open ground this year, it was found in plants of two weed species near the eggplant field, *Convolvulus arvense* and *Solanum nigrum.* Thus, stolbur is not currently a big hazard in eggplants in Moldova. However, periodic monitoring of the presence of '*Ca.* P. solani' in local crops, including eggplant, is essential to control the spread and possible outbreaks of the disease.

Acknowledgements. Research was carried out within the Project of the State Program 20.80009.5107.11 „Long-term *ex situ* conservation of plant genetic resources in the Gene Bank using the methods of molecular biology for plant germplasm health testing", financed by the National Agency for Research and Development of the Republic of Moldova.

References:

1. CABI: Invasive Species Compendium. Candidatus Phytoplasms solani (Stolbur Phytoplasma). https://www.cabi.org/isc/datasheet/108243/htm.
2. Ember I., Acs Z., Munyaneza J.E., Crosslin J.M., Kolber M. Survey and molecular detection of phytoplasmas associated with potato in Romania and southern Russia, Eur. J. Plant. Pathol. 2011, vol. 130, no. 3, p. 367-377. DOI: 10.1007/s10658-011-9759-5.
3. Kumari S., Nagendran K., Rai A.B., Singh B., Rao G.P., Bertaccini A. Global Status of Phytoplasma Diseases in Vegetable Crops, Front. Microbiol. 2019, vol. 10, no 1349, p. 1-15. DOI: 10.3389/fmicb.2019.01349.
4. Namba S. Molecular and biological properties of phytoplasmas, Proc. Jpn. Acad., Ser. B. 2019, vol. 95, no. 7, p. 401-418. DOI: 10.2183/pjab.95,028.

CZU:633.11:631.527:57.085.2 https://doi.org/10.53040/abap6.2022.15

VARIABILITY OF BIOMORPHOLOGICAL AND QUANTITATIVE CHARACTERISTICS OF SC_1 SOMACLONES OF TRITICALE INDUCED BY GAMMA RAYS AND *IN VITRO* CULTURE

CIOBANU Renata
Institute of Genetics, Physiology and Plant Protection,
Chisinau, Republic of Moldova
e-mail: renata.ciobanu@igfpp.md

Somaclonal variation is a frequent phenomenon in plants regenerated by *in vitro* culture and is of high interest because it offers the possibility to expand the spectrum as well as the value of the gene pool. Studying the degree of variability of regenerants of different plant species, it has been found that they can differ from their original forms in chromosome number, morphological and biochemical characters. Very frequently these variations are unique and cannot be obtained in a different way. Therefore, the observed variations can serve as initial material for the creation and selection of new plant species [1]. Somaclones, obtained by *in vitro* culture, possess a wide spectrum of variation in morphological and biochemical characters, therefore, callus culture is effectively used to induce variability by obtaining somaclones of agronomic interest [3]. From literature data, there are known advantages of somaclonal variation and mutagenesis. The combination of these methods leads to a widening of the spectrum of induced variability with even greater frequency. Research on the induction of genetic variability *in vitro* by gamma radiation has shown changes in the process of callusogenesis, morphogenesis and the frequency of occurrence of mutations in different plants. In most cases, somaclonal variation in different plant species has been determined by morphological and physiological characters [2].

Keywords: *variability, triticale somaclone, in vitro culture, gamma rays*

Materials and method. Three genotypes of triticale were used as study material: Ingen 35, Ingen 93(standard), 188TR5021 as control and SC_0 somaclones obtained from all the variants investigated. SC_0 somaclones and control genotypes were sown in the greenhouse. Phenological observations were performed, quantitative characters of SC_1 somaclones of triticale were assessed and examined. The vegetation period, including the phases and stages of vegetation was carried out according to the Zadocks scale. Estimation of the mean value (x) for quantitative characters (plant height, number of productive tilluss and internodes per plant, length of main ear and last of internode, number of grains, weight of grains per plant) was performed using the STATGRAPHICS Plus 5.0 software suite.

Results. The result of biomorphological evaluations showed significant variation in the mean value of agro-morphological characters in triticale somaclones at the level of 95-99.9% and depended on genotype, factors taken in the study and index analysed.

The mean values of the plant height trait varied for somaclones obtained by in vitro culture and was genotype dependent. Therefore, for genotypes Ingen 93 (*in vitro*) and Ingen 35 (*in vitro*) higher mean values were found than the control (by 13.49 - 13.89%). The maximum value of the plant height characteristic (116.33 cm) was shown by the genotype Ingen 93 (*in vitro*), with differences being significant at the 99.9% level.

The gamma irradiated variants had lower mean values than the control for all genotypes by 9.98 - 31.36%. The lowest values were recorded for genotype 188 TR (RAD) constituting 79.38 cm. These somaclones stood out by the height of the plant, obtaining dwarf and semi-dwarf somaclones. The coefficient of variation reached low and medium values (4.57 - 15.68%), indicating that the plant height character is stable.

The mean values of the number of productive tilluss per plant trait also decreased by 18.06 - 79.17% compared to the control for genotypes Ingen 93 (*in vitro*) and 188 TR (*in vitro*). The lowest mean value of the productive tillus per plant (0.5) was assessed for genotype 188TR (*in vitro*), being significant at the 99.9% level. For the character number of productive tillus per plant, the coefficient of variation is high (39.97 - 114.47%), showing a strong variation.

As a result of the analysis of the data obtained for the main ear length character, specific reaction for each genotype was evidenced. Higher mean values of 9.37-13.29% were found for genotypes Ingen 93 (*in vitro*, RAD) and Ingen 35 (*in vitro*), the differences being significant at 99.9% level compared to the control, and for genotype 188 TR (RAD) the mean was reduced by 8.39% compared to the control, significant at 95% level. The coefficient of variation of this index was 8.11 - 14.54%, which corresponds to a low to medium level of variability.

Similarly, in the variants exposed to gamma irradiation and obtained *in vitro*, higher values of the last internode length trait were observed by 4.33 - 17.80% compared to the control for genotypes Ingen 93 (RAD, *in vitro*) and Ingen 35 (*in vitro*), being significant at the 99.9% level.

The number of grains per main ear in treatment variants showed 23.97% higher mean values compared to the control for genotype Ingen 93 (in vitro), significant (95%). The effect of gamma radiation was also significant on the number of grains per main ear trait. Significant differences (99 - 99.9%) were attested, 44.88 - 79.04% lower than the control for genotype Ingen 35 (RAD) and 188TR (RAD, *in vitro*). The variability assessment of the character number of grains per main ear showed a high variation (24.00 - 86.71%).

The mean value for the grain weight in treatment variants showed significant differences between variants at the level of 95 -99% in all genotypes compared to the control. Lower mean values of 21.38 -79.17% compared to the control were established for genotypes Ingen 35 (RAD), Ingen 93 (RAD) and 188 TR (RAD, *in vitro*). The coefficient of variation reached high values (31.47 -1-2.07%), indicating a high variability of this character.

Conclusions.

1.*In vitro* culture and gamma irradiation induced significant variations at the level of 95 - 99.9% of the mean values in 6 characters compared to the control, thus changing the mean in dependence of genotype and index studied.

2.The assessment of variability showed low and average values for most of the characters investigated. The coefficient of variation for the characters: number of productive tills, number of grains per ear and grain weight reached high values, indicating a high variability for these characters.

3.As a result of the evaluation of somaclones (SC_1) of triticale, the forms of interest according to biomorphological characters were selected. The somaclone (SC_1) of genotype Ingen 35 (RAD) was highlighted, according to the mean values compared to the control, being determined by 3 biomorphological characters: plant height, length of main ear, length of last internode.

Acknowledgment. Research was carried out within the project of the State Program 20.80009.5107.03 “Efficient use of plant genetic resources and advanced biotechnologies to increase the adaptability of crop plants to climate change”, financed by the National Agency for Research and Development.

References:

1. Michael W. B., Adeyemi O. A., Johannes V. S., Somaclonal variation in plants: causes and detection methods, In: Plant Growth Regulation, 2011, vol. 63, p.147–173.
2. Mushtaq Ah. K., Rakesh Ch. V., Assessment of the effects of gamma radiations on various morphological and agronomic traits of common wheat (*Triticum aestivum L.)* var. WH-147, In: European Journal of Experimental Biology, 2015, 5(7):6-11.
3. Padmaja G., Reddy V.D., and Reddy, G.M., Somaclonal variation from regenerants of mature embryo calli of triticale, In: Indian J. Exp. Biol., 1993, vol. 31, no. 3, pp. 238–241..Fan Zhu, Triticale: Nutritional composition and food uses, In: Food Chemistry, Vol. 241, p. 468-479.

CZU:634.739.3:631.53:581.143 https://doi.org/10.53040/abap6.2022.16

PROPAGATION OF *Vaccinium macrocarpon* CULTIVARS BY CONVENTIONAL TECHNIQUES AND TISSUE CULTURE

CHITAN Raisa*, CIORCHINA Nina**
"Alexandru Ciubotaru" National Botanical Garden (Institute),
Chisinau, Republic of Moldova,
** https://orcid.org/0000-0003-2519-901X, **https://orcid.org/0000-0002-5792-5587*
e-mail:chitan.rodica@yahoo.com

The **purpose** of the research was to carry out the vegetative propagation of *Vaccinium macrocarpon* by semi-lignified cuttings, experimenting with several rhizogenesis stimulators, obtained at the Institute of Genetics, Physiology and Plant Protection. At the same time, comparison was made between the efficiency of vegetative propagation and *in vitro* micropropagation of this plant.

Keywords: *rhizogenesis, stimulators, cuttings, substrate*

Materials and Method. The research was carried out in the Embryology and Biotechnology Laboratory of the "Alexandru Ciubotaru" National Botanical Garden (Institute). The vegetative propagation of two cultivars of *Vaccinium macrocarpon* Aiton ('Pilgrim' and 'Early Black') was conducted. The cuttings were taken in July, during the period of active growth of the donor plants.

American cranberry – ***Vaccinium macrocarpon*** is a shrub about 20-30 cm tall, with alternate, elliptical and evergreen leaves. The campanulate flowers consist of 4 petals, white or pale pink, the fruits are spherical, red when ripe. The fruits have many health benefits, due to the high content of protein, provitamin A, vitamins B_1, B_2, C, (retinol, ascorbic acid, tocopherol, niacin, pyridoxine), minerals (potassium, phosphorus, calcium), tannins (antibacterial substances and antimycotics), fibres, flavonoids (substances with antioxidant effect), saponins, phenols and essential fatty acids Omega 3, 6 and 9, oils and sugars. Therefore, they have an energizing effect, help relieving stress, anxiety and depression, boosting mental health and improving memory.

Results. For the vegetative propagation of American cranberry plants (*V. macrocarpon*), fragments of well-developed shoots, 7-8 cm long, were excised; the leaves were removed in the lower part of the cuttings. The cuttings were soaked for 24 hours in the following solutions: Ecostim – 0.01%; Moldstim – 0.01%; Linaroside – 0.01%; Genistifomiozide – 0.01%; Verbascoside – 0.01%. For the control variant, the cuttings were soaked for the same time in distilled water. The cuttings were placed in a cool room, without air currents, in the dark. After 24 hours, the cuttings were planted (about 1/3 of the shoot) in containers with inert, previously sterilized substrate. The moderately moistened substrate consisted of a mixture of sand and perlite in a ratio of 1:1. In order to maintain the atmospheric humidity necessary to prevent dehydration of the cuttings, the containers in which the cuttings were planted were covered with transparent film in which small holes were made (for ventilation) and were frequently sprayed with deionized water using a vaporizer. The seedlings were uncovered for ventilation daily (initially, for a few minutes and gradually prolonging this time to a few hours). For the initiation and development of rhizogenesis, it is important to maintain the light intensity and the temperature within the limits necessary for the optimal development of this crop (21°C- 25°C). Rhizogenesis occurred in the lower part of the cuttings, after about a month from their planting. After that, for a more efficient development, the cuttings were transplanted into pots, on acidic peat with pH 3.5-5.0, which proved to be the most optimal substrate for these plants.

The best results were obtained with the cuttings soaked in a solution of Genistifomiozide – 0.01% and Linaroside – 0.01%, the percentage of rooting of the cuttings of the ‘Early Black’ cultivar was 60%. The percentage of rooting of the ‘Pilgrim’ cultivar was 40%, for the cuttings processed with Genistifomiozide (0.01%) and Linaroside (0.01%) solution.

The cuttings soaked in Ecostim solution – 0.01%; Moldstim – 0.01%; Verbascoside – 0.01% had a rooting percentage of about 20-25%, for both cultivars. However, placing the cuttings in the solutions of these rhizogenesis stimulators had a beneficial effect on the rooting process of the semi-lignified cuttings, because in the control variant (the cuttings placed in distilled water) not a single cutting took root.

At the same time, also in july, cuttings were taken from the same donor plants to initiate the tissue culture of the *V. macrocarpon* cultivars (‘Pilgrim’ and ‘Early Black’). For the microcloning of American cranberry plants, we used WPM growth medium, gelled with agar and supplemented with zeatin: WPM – 100%, zeatin – 0.5 mg/l, sucrose – 30 g/l, agar – 5 g/l, pH 5.0. Most of the *V. macrocarpon* plantlets formed 3-6 microclones per inoculum, the microshoots being vigorous, well developed, 8-10 cm long, transferred to rhizogenic nutrient media, these mini-cuttings had a rooting success of about 100%. It was found that the most optimal growth medium to trigger the rhizogenesis process was liquid WPM, supplemented with IBA (indole-3-butyric acid) – 0.5 mg/l, pH 5.0, about 95-100% of the mini-shoots placed in this growth medium formed a well-developed root system. Therefore, being placed in a rhizogenic growth medium, the mini-cuttings of *V. macrocarpon*, within 2-3 months, reached a height of 14-16 cm, forming 2-3 shoots each, so, from one explant we can obtain 5-7 mini-cuttings for a new culture cycle. Even if we take into account the fact that zeatin is a rather expensive cytokinin, we can skip the microcloning, placing the mini-cuttings obtained after the inoculation process on a rhizogenic growth medium, we get about 5-7 mini-cuttings from one inoculum. Thus, it was found that the possibility of producing planting material by tissue culture is incomparably higher as compared with vegetative propagation by cuttings, considering the fact that the percentage of adaptation to *ex vitro* conditions of mini-cuttings of *V. macrocarpon* is 80-90%.

Therefore, the conducted research allows us to conclude that rhizogenesis stimulators have a beneficial action on vegetative propagation, however the given species shows better results in tissue culture as compared with vegetative propagation, and biotechnological methods allow obtaining high multiplication rates.

Conclusions.

1. The studied rhizogenesis stimulators had a beneficial effect on vegetative propagation, the highest rooting yield was obtained in the cuttings treated with Genistifomiozide solution – 0.01% and Linaroside – 0.01%.
2. The propagation of *V. macrocarpon* by tissue culture is more profitable and faster as compared with vegetative propagation; besides, the methods of micropropagation allow obtaining high multiplication rates.

Acknowledgment. The research was carried out within the project 20.80009.7007.19. "The introduction and development of technologies for propagation and cultivation of new species of woody plants by conventional techniques and tissue culture", financed by the National Agency for Research and Development.

References:

1. Chiţan Raisa, Cuzmina Elvira. Micropropagarea speciilor V*accinium vitis-idaea* L. şi *Vaccinium macrocarpon* Aiton. Mat. Conf. „Instruire prin cercetare pentru o societate prosperă". Chişinău, Moldova, 20 martie 2021, p. 195-203.
2. Ciorchină Nina, Lozinschii Mariana, Cutcovschi-Muştuc Alina, Trofim Mariana, Tabara Maria. Înmulţirea soiurilor de mur fără spini prin vitrocultură. Mat. Conf. Naţionale cu participarea internaţională "Ştiinţa în Nordul Republicii Moldova: realizări, probleme, perspective". Bălţi, Moldova, 2019, p. p. 324-330.
3. Trofim M., Ciorchină N., Tabăra M. Pests and diseases of *in vitro* cultures of blackberry. International Scientific Symposium, Chișinău, 2017, p.116.

CZU:633.16:631.52:57.084 https://doi.org/10.53040/abap6.2022.17

INTERGENERATIONAL ANALYSIS OF VIRUS AND GAMMA RAYS EFFECT ON AGRONOMIC TRAITS IN BARLEY REGENERANTS

GRIGOROV Tatiana*, ANDRONIC Larisa**, SMEREA Svetlana***, TEMNICOV E.
Institute of Genetics, Physiology and Plant Protection, Chisinau, Republic of Moldova
https://orcid.org/0000-0003-1906-4322, https://orcid.org/0000-0002-2761-9917, ***https://orcid.org/0000-0002-1978-0452, e-mail: tatiana.grigorov@igfpp.md*

Our previous research established that viral infection alone or in combination with gamma radiation generate useful phenotypic variation of some quantitative traits and can be used to enhance genetic variability in barley regenerants (R_0) [2]. According to data from the literature phenotypic variation of plant traits can be result of genetic and epigenetic changes under different biotic and abiotic stress factors including gamma rays and viruses [1, 3, 5]. One of major epigenetic modification is DNA methylation that modifies gene expression and is easier passed through generations. In the same time, it is important to highlight that epigenetic modifications show instability and are influenced by the environment, and some epigenetic changes may result in heritable phenotypic variation whereas others are not [1, 5]. In the context of the above, it is purpose to evaluate effect of barley stripe mosaic virus (BSMV) and gamma rays on agronomic trait in barley offspring (R_1) compared to the regenerants R_0.

Keywords: *intergenerational effect, regenerants, barley stripe mosaic virus, gamma rays, quantitative traits*

Materials and Method. The two-rowed spring barley cultivars (*Hordeum vulgare* L., 2n = 14): Sonor, Galactic, Unirea were used in the experiments. The donor plants were obtained from irradiated seeds with gamma rays (at doses of 100, 150 and 250 Gy), from ^{60}Co source. The dose delivery rate was 0.16 Gy/sec. Barley plants from both irradiated and untreated seeds were mechanically inoculated with a BSMV extract. All plants were tested for the presence of virus infection by negative contrast electron microscopy.

The studied barley regenerants (R_0) were obtained from immature embryos-derived calluses via somatic embryogenesis and organogenesis on optimized MS medium (Murashige-Skoog, 1962). The R_0 were transferred into soil in pots covered with glass cups and acclimatized under the controlled conditions of light and temperature. Then, somaclones were grown under solarium conditions to obtain seeds. The seeds of R_0 were planted in the field conditions to obtain R_1 progeny. The plants from each variant were randomly selected for the measurements of four traits: plant height (PH), apical internode length (AIL), kernel per spike (NKS) and productive tillers per plant (NPT). The differences among the means value were compared using *Student's* t *test. T*he dispersion analysis was performed based on the Anova test. The statistical analysis of data was carried out using the software package Statgraphics Plus (version 5.0).

Results. Comparative analysis of the same genotype shows similar quotas of traits with significant deviations of average value from the control in R_0 regenerants compared to descendents R_1, except for Sonor and Unirea genotypes. These genotypes exhibit the lower number of traits with significant deviations of mean value from the control in R_1 generation, for BSMV and BSMV + gamma ray variants (0-25 %) or higher rate of quantitative characters for BSMV + gamma ray, cv. Unirea (100 %). BSMV and gamma radiation influenced the average values of quantitative traits for evaluated cultivars according to the genotype, studied traits, applied factors and generation. In case of Sonor genotype, gamma radiation (250 Gy) increased the average value of PH and AIL traits by 10.97 - 14.78 % over the control in R_1 generation ($P \leq 0.001$), although it did not significantly influence these parameters in R_0 generation. At the same time, for R_1 descendents of Galactic and Unirea varieties were established lower values of these characters by 13.10 - 46.29 % ($P \leq 0.05$ - 0.001) for gamma irradiated variants (100 - 250 Gy), comparing with control, except cv. Unirea (PH trait, no significant differences).

BSMV alone or in association with gamma rays (150 - 250 Gy) reduced average value of PH (by 6.83 %) and AIL (by 11.32 - 12.28 %) traits in R_1 generation, only for Unirea genotype (signification $P \leq 0.05$; 0.01). While, descendants (R_1) of Sonor and Galactic genotypes exhibited the higher value of PH (by 2.3 – 7.15 %) and AIL (by 9.90 – 11.32%) with significant deviations ($P \leq 0.05$) from the control for BSMV variant, contrarily to R_0 generation. It is important to note that R_1 offspring of Unirea and Galactic varieties from gamma irradiated (100 - 250 Gy), BSMV and BSMV + gamma ray (250 Gy) variants showed the same tendency for lower mean value than the control of PH and AIL traits compared to the R_0 regenerants. The short plant height and apical internodes length are accompanied by the lodging resistance in barley, and play a very important role in grain yield formation. Regarding to the traits direct associated with the yield (NPT and NKS), gamma radiation (250 Gy) and BSMV (only for cv. Unirea, NPT) caused a significantly ($P \leq 0.01$; 0.001) reduction of average value (by 22.00 - 35.23 %) compared with control variant of NPT (cv. Galactic, Unirea) and NKS (Unirea) characters in R_1 descendants contrarily with R_0 regenerants, except cv. Sonor (no significant differences). Also, these genotypes, only for NPT trait, indicated the same tendency of mean value in R_0 - R_1 regenerants, irradiated (lower mean value than the control) and BSMV (higher over the control) variants.

The analysis of variance established significant variation of quantitative parameters, according to the *genotype, trait, generation* as well as the interaction of genotype and studied factors. The *genotype* was mainly responsible for variation of studied characters (14.99 to 38.84%), followed by the interaction of *genotype* x *dose of radiation* (5.20 to 10.40%), *virus* x *radiation* (2.54%) and *genotype* x *virus* (2.35%). It is necessary to note that the contribution of the studied factors on variation of characters related to the plant architecture in the offspring (R_1) had the unequivocally impact (*dose of radiation* and *virus* x *radiation*) or a greater impact (*genotype* x *dose of radiation*) compared to the R_0 regenerants.

Conclusions: The obtained results confirm the significant (95 - 99.9%) influence of gamma radiation (100-250 %) and viral infection on variation of architectural and productivity traits of descendants R_1 and suggest about intergenerational effect of these factors, according to the genotype. In the context of these, it is need to evaluate the next generation (R_2) of barley regenerants.

Acknowledgment. The research was carried out within the project 20.80009.7007.04 “Biotechnologies and genetical processes for evaluation, conservation and exploitation of agrobiodiversity”, financed by the National Agency for Research and Development.

References:

1. Baulcombe, D., Dean, C. Epigenetic regulation in plant responses to the environment. In: *Cold Spring Harb. Perspect. Biol*. 2014, vol.6. no 9, p.1-19. doi: 10.1101/cshperspect. a019471.
2. Grigorov, T., Smerea, S., Andronic, L. Variabilitatea caracterelor agro morfologice la somaclonele de orz (SC_0) indusă de radiaţia gama şi infecţia virală. In: *Realizări științifice in ameliorare și tehnologii inovative la culturile cerealiere în contextul schimbărilor climaterice*. Conferința Științifico-Practică cu participare internațională, *Pașcani,* 4-5 septembrie 2020. Chișinău, pp. 153-161. ISBN 978-9975-56-177-8.
3. Laanen P. et al. Changes in DNA methylation in *Arabidopsis thaliana* plants exposed over multiple generations to gamma radiation. In: *Frontiers in Plant Science*. 2021, vol 12, p 1-17. doi: 10.3389/fpls.2021.611783.
4. Sun M., et al. DNA Methylation in plant responses and adaption to abiotic stresses. In: *Int. J. Mol. Sci.* 2022, vol.23 no.13, p.1-15. doi: 10.3390/ijms231369104.
5. Thiebaut, F., Hemerly, A. S., Ferreira, P. C. G. A role for epigenetic regulation in the adaptation and stress responses of non-model plants. In: *Front. Plant Sci*. 2019, vol.10, no. 246, p.-1-7. doi: 10.3389/fpls.2019.00246.

CZU:635.21:631.811.98:57.085.2 https://doi.org/10.53040/abap6.2022.18

THE IMPACT OF GROWING REGULATORS ON CULTIVAR –DIFFERENTIATORS TO POTATO WART IN CULTURE *IN VITRO*

SKOREIKO Alla*, ANDRIYCHUK Tetyana**, BILYK R.***,
SAFRONOVA Tamara#
Ukrainian Science – Research Plant Quarantine Station IPP NAAS,
https://orcid.org/0000-0001-6336-0773, https://orcid.org/0000-0002-7718-7964,*
****https://orcid.org/0000-0003-1674-826X, #https://orcid.org/0000-0002-2648-6200*
e-mail:askoreiko50@gmail.com

Purpose is to study growing regulators impact on productivity potato cultivar differentiators to wart *in vitro* culture.

Keywords: *potato wart, cultivar- differentiators, plants in vitro, productivity, growing regulators*

Introduction. Potato wart causative agent *Synchytrium endobioticum* (Schilb.) Perc. is intercellular parasite. It defeats all plants bodies, besides roots. It was determined in 38 countries throughout the world. The yield loss may cause 50-100 % during the susceptible potato varieties growing. The growing of potato not clean crop on defeated plots mat cause appearing new more aggressive causative agent pathotype. As per literary sources, it is necessary to use the non-viral cultivar differentiators for potato wart pathotypes differentiators. This differentiation provides in field terms of disease spread sources. The defeating material usage by other infections may cause inaccuracy during the diagnostics. The feed material for elite reproduction and cultivar differentiators to potato wart pathotypes were on the level with material from clones chose and treated material by biotechnological methods, e.g. meristem cultivation. The growing regulators add to *in vitro* medium seriously increase potato plant state. They impact on cells destruction and growing spreading, resistant to stress, trophism, transpiration. They provide functional unity of plant body, regular sequence of individual development phases.

Materials and method. Plants grow in terms of cultivation room at 16 hours photoperiod, with light intensity 2000-2500lx, temperature 22-24^{0}C and air humidity 60-80%. The experiment conducted through the adding different concentrations into Murashige and Skoog nutritious medium of growing regulators Epin- maxi (MS-control; MS+Epin Maxi+0,012г/л; MS+Epin-Maxi 0,025 g/l) and Poteitin (MS-control:

MS+0,15мг/л; MS+0,3 mg/l) on cultivar- differentiators of different group of ripeness (Schedryk - early, Slovyanka – is mid-ripe) for process optimization of potato propogation and productivity in *in vitro* cultivation. The cutting conducted for every variety in quantity 25 plants. The experiment repeatability was three times. The determination productivity of potato tubes' plants conducted on 80 th day of cultivation. "Epin- maxi" is active matter 2,4 – eppibrassinolid. The Epin usage favours the plants resistance to diseases and pests, Plants easily survive the following (stress) conditions, e.g. draught, salinity, enough high or low temperature, lack of nutrition. "Poteitin" is a specialized potato growing regulators. The natural phytohormones in combination with 2,6 dimethylhylpyrydin – 1 oxide with accinic acid and biogenic elements are preparations' active matters. The preparation increases germination energy and field emergence, yield. It decreases the plants diseases favours the plant cell division, increases area of leaves surface and chlorophyll content. It decreases the phytotoxic action of pesticides and the phytotoxic action of pesticides; increases quality of growing production, plants resistance to material and anthropogenic stress factors; activizes resistancev genes and plant immunity.

Results. The growing regulators Epin-Max and Poteitin impact study on productivity of cultivar differentiators *in vitro* culture showed that present stimulators have seriously less impact on average weight, weight and quantity of microtubers for plant. The optimal indexes determined. There were following adds into nutrition medium Epin- Max 0,025 g/l and Poteitin, 0.3 mg/l. The microtubers` average weight are 58.8 and 65.5 mg, respectively, in comparison with control (135.4 mg), for variety Schedryk. The weight of microtubers on 1 plant are 64.9 and 78.0 mg in control (100.2 mg) and microtubers' quantity on one plant is 0,4 and 0.5 pcs in control (0.6 pcs). The increase of microtuber average weight increases on 71.8 and 84.2 mg in comparison with control (141.3 mg) for cultivar Slovyanka in variants with Epin- maxi 0,025g/l and Poteytin 0.3 mg/l. The microtubers weight on one plant was on 70.3 and 76.8 mg in control (108.9 mg) and microtubers quantity on one plant on 0.3 and 0.4 pcs in control (0.6 pcs).

Conclusions. The following optimal indexes of potato cultivar-differentiators *in vitro* culture received during the additions MS+Epin –Max 0.025 g/l and MS+Poteitin 0.3 mg/ l usage.

CZU:601:635.64:573.6 https://doi.org/10.53040/abap6.2022.19

EXPRESSION OF QUANTITATIVE TRAITS IN SOMACLONES (SC_1) OBTAINED FROM DIFFERENT TYPES OF VIRUS-INFECTED TOMATO PLANT EXPLANTS

SMEREA Svetlana

Institute of Genetics, Physiology and Plant Protection,
Chisinau, Republic of Moldova
https://orcid.org/0000-0002-1978-0452; email: svetlana.smerea@igfpp.md

It is known that biotechnological processes based on the possibilities of *in vitro* cultivation of plants offer new opportunities for the diversification of genetic variability, which allows the complex use of classical and modern methods in plant breeding. The plants regenerated by callus cultures are distinguished from the original forms by various qualitative and quantitative traits, including those of important economic interest. Research for identification of factors that induce somaclonal variations attests the dependence of their occurrence on the genetic heterogeneity of the somatic cells of the initial explants, the genetic and epigenetic variability generated by the *in vitro* culture conditions and genotype [1, 3]. The use of phytopathogenic viruses based on different cytopathic systems in combination with other sources of variation is of major importance for obtaining and selecting genotypes with valuable properties, including increased defensive potential to viral agents [2, 4].

Keywords: *quantitative traits, somaclone, viral infections, tomato*

Purpose. Study of the expression of quantitative traits in tomato somaclones (SC_1) obtained from various types of virus-infected plant explants.

Materials and Method. Initial forms and SC_1 somaclones of different cytopathic origin were included in study for 5 tomato genotypes: *Solanum lycopersicum* L.: Elvira variety (sensitive to virus); genotypes with Tobacco Mosaic Virus resistance genes - Craigella TM1 (Tm-1/Tm-1), Craigella TM2 ($Tm\text{-}2^2/Tm\text{-}2^2$), Rufina ($Tm\text{-}1+Tm\text{-}2^2$) and the spontaneous (tolerant to virus) form *Solanum pimpinellifolium* L. (SP). SC_0 primary somaclones were obtained *in vitro* by callus cultures from explants of leaves (lf), sepals (sep) and immature embryos (ime) taken from healthy plants and infected with Tobacco Mosaic Virus (TMV) or Tomato Aspermy Virus (TAV). SC_1 somaclones were obtained by self-pollination (1st generation by seeds) from plants tested negative for the presence of viral particles and cultivated under field conditions according to the standard agrotechnical techniques. Biometric analyzes targeted 20 SC_1 somaclones based on 17 plant traits (the number of nodes on the main stem, the flowers/fruits number on the I, II and III clusters, the rate of fruit set, the leafsing – the length and width of the leaf, number of large, small, medium and segments, segment length and width) and 7 fruit indices (weight, shape – length/width ratio, pericarp thickness, mesocarp diameter, number of lodges).

At the same time, the specific characters of the type of plant growth were evaluated: for the somaclones with determined growth (Craigella TM1, Elvira) - the plant's waist, the number of inflorescences on the main axis, the height of the I cluster formation, and for those with indeterminate growth (Craigella TM2, Rufina, SP) respectively – the length of the inflorescence and the length of the internodes between the 1st and 4th inflorescence. For each variant, 15 plants per repetition were evaluated. The data were processed statistically with STATGRAPHICS Plus2.1 software package, by applying the Anova and Student test.

Results. The somaclones of 5 tomato genotypes of different cytopathic origin (obtained from immature embryos, leaf or sepals fragments) showed significant variations in quantitative traits according to the plant parameters, leaf apparatus and fruit indices, depending on the source of variation: genotype, virus or explant.

In SC_1 somaclones of Craigella TM1 genotype, significant differences could be seen for 13 of the 17 analyzed traits, compared to the initial form. All 8 analyzed somaclones differ from the original form by at least 2 traits (for ex. SC_1-32 TAV lf) and at most by 10 (in the case of SC_1-29 TAV lf). The study of the fruit parameters shows significant differences compared to the initial form, according to at least 1 parameter (SC_1-33 TAV lf) and maximum by 4 (SC_1-25 TAV sep and SC_1-34 TMV sep). The study of the interaction of the factors, viral infection – type of explant, shows statistically confirmed differences between almost all somaclones of TAV and TMV group, according to at least one trait and a maximum of 3. Exception was for SC_1-25 TAV sep / SC_1-34 TMV sep, which do not recorded significant differences according to the biomorphological traits of the plant. At the same time, there are significant differences between all somaclones with the same origin of viral infection (TAV group) and different types of explants (leaf-sepals), but also within the group derived from leaves, but not between those derived from sepals. In the case of the Elvira genotype, somaclones derived from leaf explants obtained in the TMV and TAV groups were analyzed compared to the control (not infected donor plant). Significant differences were attested for 14 of the 17 analyzed traits at the plant level, compared to the initial form. All 3 analyzed somaclones differ significantly by at least 6 traits (for ex. SC_1-1 Control lf) and maximum by 12 - in the case of SC_1-2 TMV lf. Based on the analysis of the fruit parameters, we found that the somaclones differ significantly from the initial form after 4 indices, and between them - respectively after at least 2, depending on the nature of the viral agent in the donor explants. The study of the impact of viral infection compared to *in vitro* culture allowed establishing statistically differences between all the somaclones of Elvira, originating from the TAV, TMV and control groups, according to at least 5 traits and a maximum of 9. Based on the analysis of variance (Anova test) it was established that the percentage contribution of the viral agent varies according to the analyzed traits, was 65.19% for the length of the leaf segment and respectively 60.3% - the width of the leaf, 51.5% - the number of small segments of the leaves and 36.7% - plant height. The evaluation of the quantitative trait in 5 somaclones of Craigella TM2 genotype, derived from the Control (ime), TAV (lf, sep) and TMV (lf) shows significant variations both from the initial form and within the groups/variants, as a rule, according to the indications of the foliar apparatus. The somaclones derived from the SP spontaneous genotype from explants of immature embryos – control group (SC_1-46 control ime) and leaves – TMV group (SC_1-52 TAV lf) showed significant variations according to all fruit parameters, while the somaclone obtained from leaves explants – the TMV group (SC_1-54 TMV lf) differs only in the thickness of the pericarp in the direction of reducing the average value by about 2 times compared to the initial form. At the same time, all 3 somaclones differ significantly from each other according to 4-5 parameters of the fruit. It should be noted that, in parallel with the analysis of statistical differences according to the average values of the analyzed quantitative traits, the somaclones were notified according to the degree of expression in conformity with UPOV descriptor for carrying out tests for distinctiveness, uniformity, stability (https://www.upov.int/edocs/tgdocs/en/tg044_11_rev_ 2.pdf). Thus, some parameters, although they do not have confirmed statistical support, are found in another plant/fruit characterization group of the analyzed somaclones, which shows an increased agronomic value.

Conclusions: Somaclones obtained from various types of explants derived from plants infected with viruses, differ according to a series of quantitative traits of the plant and the fruit, both compared to the initial form and within the variant/group, confirming the importance of the complex use of the culture *in vitro* with viral infections in the induction and diversification of somaclonal variations.

Acknowledgment. Research was carried out within the project of the State Program 20.80009.7007.04 "Biotechnologies and genetical processes for evaluation, conservation and exploitation of agrobiodiversity", financed by the National Agency for Research and Development.

References:

1. Bairu, M.W., Aremu, A.O., Staden, J.V. Somaclonal variation in plants: causes and detection method. *Plant Growth Regulation.* 2011, vol. 63, no. 2, p. 147-173. DOI: 10.1007/s10725-010-9554-x.
2. Marii, L.I., Andronic, L.I., Smerea, S.V., Erhan I.F. Assessment of the response reactions of tomatoes depending on the phytosanitary status in condition of infection with viral agents. *Vegetable crops of Russia*. 2021, no. 1, p. 125-129. (In Russ.). DOI: 10.18619/2072-9146-2021-1-125-129.
3. Miguel, C., Marum, L. An epigenetic view of plant cells cultured *in vitro*: somaclonal variation and beyond. *Journal of Experimental Botany.* 2011, vol. 62, no. 11, p. 3713-3725. DOI: 10.1093/jxb/err155.
4. Shcherbatenko, I., Oleshchenko, L. Somaclonal variation as a source of tomato spotted wilt virus-resistance in plants. In: Cooper I., Kühne, T., Polishchuk V.P. (eds.) Virus Diseases and Crop Biosecurity. NATO Security through Science Series. Springer, Dordrecht. 2006, p. 133–144. DOI: 10.1007/978-1-4020-5298-9_12.

CZU:633.88:581.43 https://doi.org/10.53040/abap6.2022.20

CHARACTERISTICS OF THE HAIRY ROOTS OF THE MEDICINAL PLANT *Spilanthes acmella* MURR.

TIMINA O.O. [1], TIMIN O.Y. [2], STEPANOVA A.Y. [3], SOLOVEVA A.I. [3]
[1] Shevchenko State University, Tiraspol, Republic of Moldova; [2]Research Institute of Ecology and Natural Resources, Bendery, Republic of Moldova; [3] Timiryazev Institute of Plant Physiology, RAS, Moscow, Russian Federation
e-mail:otimina@mail.ru, e-mail:step_ann@mail.ru

One of the well-known and widely sought-after members of the Compositae family is spilanthes or oilcress (*S. acmella*). Plants have a pleasant, piquant taste and aroma. It is used as a spice. But its main application is in medicine. It is known that the flowers and root part of the plant are a rich source of active substances with a pronounced pharmacological effect of a wide spectrum: analgesic, anti-inflammatory, antioxidant, antimalarial, antibacterial, and with a number of other physiologically significant effects. The rich composition of bioactive components prevents the formation of wrinkles, so *S. acmella* can also be used in cosmetology. The secondary metabolites of *S. acmella* are diverse forms of aliphatic alkylamides and triterpenoids. Metabolites of the plant also contain β-sitosterol, similar in structure to cholesterol. The center of origin of this plant is not fully understood, and at the moment it is believed that this is South America. Spilanthes grows in the tropical or subtropical zone, its seeds slowly germinate, and the vegetative plant reproduction is weak. In the wild, in places of natural range, it is classified as a species of the endangered category, i.e. a species in a dangerous state. At the same time, the plant is in demand as a medicinal raw material. Currently, innovative biotechnologies are used to obtain a number of drugs, cost-effective for in vitro conditions, which allow to consistently obtaining the target product regardless of the season and region of cultivation. Moreover, such biotechnologies are most effectively carried out on the basis of transformed cultures of hairy roots. The **purpose** of this work was to characterize the obtained and steadily growing hairy roots of spilanthes. The objectives of the research included the identification of ***rol*** genes in the resulting transformants, as well as the amino acid composition of the resulting root crops.

Keywords: *Spilanthes acmella**,** hairy roots**,** Agrobacterium rhizogenes, transformation*

Materials and Method. The method of obtaining the transformed material was described earlier using wild strains of *Agrobacterium rhizogenes* without additional "genetic ballast" such as a reporter gene and an antibiotic resistance gene with all possible negative consequences [1, 3]. At the same time, using only wild strains of *A. rhizogenes*, it is possible to avoid introducing genetic "ballast" into the recipient's cell. The resulting root material was maintained on a liquid hormone-free, well-known media of Murashige and Skoog (MS). The amino acid composition was determined by the staff of the Institute of Physiology and Sanocreatology, Chisinau, Moldova on the AAA 339TM device (amino acid analyzer). The content of amino acids in the dry product was taken into account. ***Rol*** genes were identified in hairy root transformants using PCR analysis as described earlier [2].

Results. The ability of rhizobia *A.rhizogenes* to cause not only an infectious process when penetrating into the plant, but also to perform transformation is well known**.** When rhizobia enter the plant, it is able to carry out the transfer of a DNA fragment called T-DNA from a large plasmid ***Ri*** (inducing the root) to the genome of a plant cell. The appearance of hairy roots depends on the expression of several genes that induce the formation of roots (***rol A, B, C*** and ***D***). As it turned out, four ***rol*** genes ***A, B, C, D*** were embedded in the genome of the spilantes root culture. PCR analysis confirmed the absence of agro bacterial contamination in the resulting material, hairy roots grow stably on agarized and liquid hormone-free media. The optimal composition of macronutrients in the nutrient media and the mode of cultivation of culture, giving a greater increase, have been clarified. Since *S. acmella* is a source of alkylamides, the biosynthesis of which depends on the available pool of acyl fragments of non-alkaline fatty acids and the pool of amino acid amine fragments, it is important to know the composition of amino acids in hairy roots for possible improvement of the yield of the target product. The amino acid composition of the resulting culture was quite diverse and was represented by essential and non-essential amino acids, immunoactive, proteinogenic and a number of others. In a culture with four insertions, the content of non-essential, immunoactive and proteinogenic amino acids prevailed over such as essential, glycogenic, ketogenic and sulfur-containing amino acids. In the protein product of spilantes hairy roots, tryptophan and seventeen other amino acids were completely absent: taurine, phosphoethanolamine, hydroxyproline, asparagine, glutamine, citrulline, homocysteine, cystetionine, β-аланин, ethanolamine, ornithine, 1-methylhistidine, 3-methylhistidine, as well as cysteine, α-aminobutyric, β-aminobutyric and α-aminoadipinic acids. Urea was also completely absent, which is the finite product of protein's metabolism. The results obtained most likely confirm the complex interactions of ***rol*** genes, which determine not only the growth and mass of the root culture, but also the yield of the target product.

Conclusions. Hairy roots of *S. acmella* are deposited in the collection fund of genetically transformed plant roots at the Institute of Plant Physiology named after K.A. Timiryazev, Russian Academy of Sciences, Moscow and at The Transdnistria State University, Tiraspol, Moldova. Culture may be of interest for obtaining targeted biopharming products, as well as possible use in the food industry for obtaining functional products and in cosmetology.

References:

1. Тимина О.О., Тимин О.Ю., Чупрун А.А. Этапы получения бородатых корней лекарственного растения *Spilantes acmella* Murr масляного кресса или индейского крессона.// Конференция памяти кандидата биологических наук, доцента Л. Л. Попа : 25 июня 2020 г. = The conference dedicated to Associate Professor L. L. Popa : June 25, 2020: Материалы / ответственный редактор: Филипенко С. И – Тирасполь: Eco-TIRAS, 2020 (Tipogr. «Arconteh»). С.144 – 152.
2. Stepanova A.Y., Solov´eva A.I., Malunova M.V., Salamaikina S.A., Panov Y. M., Lelishentsev A.A. Hairy roots *Scutelaria* spp., (*Lamiaceae*) as promising producers of antiviral flavones. In: *Molecules*. 2021; 26, x. https://doi.org/10.3390/xxxxx
3. Timina O., Timin O., Alecsandrova T. Hairy roots of pea mutants with a modified morph leaf type. *BIO Web of Conferences.* 2020; 24. 00086/https://doi.org/10.1051/bioconf/20202400086

CZU:633.416:631.5(479.24) https://doi.org/10.53040/abap6.2022.21

EFFECT OF NANO-GRO PHYSIOLOGICAL ACTIVE HEIGHT SUBSTANCE ON HEIGHT OF FODER BEET, GROWTH AND PRODUCTIVITY

ZAMANOVA Rahmina

Research Institute of Crop Husbandry, Baku, Azerbaijan

ID-3WYEXJ2, e-mail: rehmine.zamanova@gmail.com

The soil and climatic conditions of Azerbaijan, located in nine climatic zones, allow to plant fodder beet several times in a row in all zones and get a rich harvest.

Fodder beet is a very demanding plant and gives high yields when planted in fertile soils.

The article examines the importance of growth regulators, which are important in the life of agricultural crops, and the effect of Nano-Gro (made in USA) growth substance on fodder beet as the first application of nanotechnology to agriculture in our country. Living organisms contain substances in such small doses that even when they are not present in sufficient amounts in the diet, serious diseases can sometimes result in death. These substances are not nutrients, but they contain microelements that affect the physiologically active points in the meristem of all plants and regulate their vital functions, either accelerating or weakening plant growth. World research also shows that seeds, twigs and seedlings are soaked with all nutrients, fertilized and sprinkled with green mass. Nano-Gro, a growth regulator used in the study, contains Fe, Al, Ni, Mn, Mg, Ag sulfate compounds and sucrose, and weighs 0.05 grams.

The **purpose** was study of the application of different fertilizer norms and the effect of various norms and proportions of physiological active Nano-Gro substances on fodder beet yields and biometric indicators. Field experiments were laid out in the territory of Absheron Subsidiary Farm (fodder) of the Research Institute of Crop husbandry in 2014-2016. A 2-factor field experiment was carried out using the “Semi-sugar white beet” variety. Field experiments were laid out in 4 replications, 6 options, 2 schemes, the sowing norm was 14 kg per hectare in the sowin area of 70 x 30 cm. The predecessor was a mixed sowing of legumes and cereals.

Keywords: *fodder beet, manure, root, fertilizer, productivity*

Materials and Method. 1. Fodder beet, 2. Organic and mineral fertilizers; $N_{60}P_{45}$ K_{90} + 20 t manure (background -1), ($N_{160}P_{90}$ K_{210} + 20 t manure 20t (background-2); 3. Nano-Gro physiologically active growth-Before planting, 2 and 4 Nano-Gro granules are dissolved in 1 liter of water in Nano-Gro bags and in a separate plastic bowl for 30 and 60 seconds soaked and sprinkled.

Results. In our study, despite the fact that the seeds were soaked for 30 and 60 seconds and the study was prepared in 6 options, we purposefully explain the 4 most important options, taking into account that the study schemes are repeated twice in 30 and 60 seconds, as there is not much difference in field seedlings. The purpose of the study was not to study the optimal fertilizer norms, but to determine the effect of physiologically active Nano-Gro physiologically active growth on the size, development, productivity and product quality of feed beets against the background of mineral and organic fertilizers.

Root mass: During research in 2015, root mass was 1054 q in 1st Control option, but only fertilizer, complex of various foodstuffs – root mass was 1283g in the 2nd background (N_{160} P_{90} K_{210} + 20 t manure) variant that was more (21.07%) than Control option. In 6th options, either using fertilizer (2nd background), or using 4 granules of Nano-Gro, root mass was 1553 g.

When compared with options, it seems that root mass increased 21.7% by using fertilizer production (2015), but it increased by 21.04% from the effect of physicochemical active substance.

In 2016, the root mass was 606 g in the first options of Control (0), in 2nd option (in the complex application of various nutrients (N_{160} P_{90} K_{210} + 20 t manure)- 2nd background) it was 1072 g which it was (28.7%) higher than the Control. In the 6th variant either using the Fertilizer- 2nd background, or using 4 granules of Nano-Gro root mass was 1182 g that increased 20.7 % more than background.

When compared with options, it seems that root mass increased by 76.8 % by using fertilizer (2016), but it increased by 11,1 % from the effect of physicochemical actives substance.

Generally, when comparing two years, the root mass was (2015) 1553g in the 6 th variant (both Fertilizer 2nd background and 4 granules of Nano-Gro), (2016) 1192 g. For two years, the average mass of a root was 1372 g. The biggest root mass was 1553g in 2015.

Root diameter**:** During our study, the diameter of the root in 2015 was 9.8 cm in the 1st (0) control, in the second option (in the complex application of different nutrients (N_{160} P_{90} K_{210}+20 t manure) –2nd background) was 15.4 cm, which it was (57.2%) more than Control which there was (57.2%) increase of diameter of the root relative to controls. In the 6th variant either using the Fertilizer- 2nd background, or using 4 granules of Nano-Gro root diameter was 16,1 cm which it increased by 4.4% more than background. In 2016, the root diameter was 8.8 cm in the first version of Control (0), in 2nd option (in the complex application of various nutrients (N_{160} P_{90} K_{210} + 20 t manure)- 2nd background) it was 15.23cm which it was 43.9% than the Control. In the 6th option either using the Fertilizer- 2nd background, or using 4 granules of Nano-Gro root mass was 17.3cm which it increased by 13.5 % more than background.

The length of root: During our study in 2015, the length of the root was 16.9 cm in the 1st (0) control option, in the second option (in the complex application of different nutrients (N_{160} P_{90} K_{210} + 20 t manure) – 2nd background) was 23.5 cm, which it was (39.05%) more than Control option. In the 6th variant either using the Fertilizer- 2nd background, or using 4 granules of Nano-Gro root length was 16.1 cm, and it increased 7.6% more than background.

In 2016, the root length was 15.7 cm in the first option of Control (0), in 2nd option (in the complex application of various nutrients (N_{160} P_{90} K_{210} + 20 t manure)-2nd background) it was 23.4 cm, and it was 49.04% than the Control. In the 6th option it was 25.8cm, and it was 10.2 % increase more than background.

When compared with options, it seems that root mass increased 49.04 % by using fertilizer production (2016), but it increased 10.2% by the effect of physicochemical active substance.

Generally, when comparing two years, the root length was (2015) 25.3cm (both Fertilizer 2nd background and 4 granules of Nano-Gro), (2016) 25.8cm. For two years, the average diameter of root was 25.55cm; the biggest root diameter was 25.8 cm in 2016.

Root productivity: During our research in 2015, root productivity was 410 c/ha in Control option, in 2nd option (in the complex application of various nutrients (N_{160} P_{90} K_{210} + 20 t manure)- 2nd background) it was 623c/ha, and it was 42.3 % more than Control option. In 6^{th} option it was 765 c/ha, and it was 33.9 % more growth than background.

In 2016, the root productivity was 433 c/ha in the first option of Control (0), in 2nd option (in the complex application of various nutrients (N_{160} P_{90} K_{210} + 20 t manure) - 2nd background) it was 768 c/ha, and it was 77.3% more than the Control. In the 6th option it was 852 c/ha, and it was 10.9% growth more than background.

When compared with options (2016) it seems that in our research the increase was 77.3 % by applying fertilizers N_{160} P_{90} K_{210} + 20 t manure in the second option.

CZU:581.19 https://doi.org/10.53040/abap6.2022.22

PLANT SECONDARY METABOLITES: NEW INFORMATION ABOUT OF ITS ROLE FOR THE PLANT

BALASHOVA I.[1*], KHARCHENKO V.[1], MOLCHANOVA A.[1], MASCHENKO N.[2**]
[1] *Federal State Budgetary Scientific Institution "Federal Scientific Vegetable Center" (FSBSI FSVC), Moscow region, Russian Federation*; [2] *Institute of Genetics, Physiology and Plant Protection, Chisinau, Republic of Moldova*,
**https://orcid.org/0000-0001-7986-2241, ***https://orcid.org/0000-0003-1869-4357,*
e-mail: balashova56@mail.ru

Plant secondary metabolites (PSM) are usually defined as plant products play secondary role in the plant development and survive. But modern molecular investigations convince us, that it isn't true. Their role in the plant is more spacious and deep. Study genetic determinants of the fruit size in tomato, we came to a conclusion, that loci controlling the fruit shape and weight are involved in phytohormone signaling pathways and processes of primary and secondary metabolism. The development and weight of the tomato fruit is closely related to the amount of primary and secondary metabolites. Modification the expression of genes associated with primary and secondary metabolism can change the organoleptic composition and weight of tomato fruits by adjusting the harvest index and distribution of carbohydrates, which will ultimately improve the biochemical composition of tomato fruits. Many of PSM show effects outside their functional role in the plant. Of all anticancer medicine compounds developed since the 1940s, 75% were based on natural molecules and 49% are still natural products containing secondary metabolites. In earlier investigations we show, that PSM of steroid glycoside class, depending on the concentration, have the protective effect against of plant pathogens, such as fungi and viruses.

The goal of studies is determine the role of exogenously applied secondary metabolites in the regulation the development of plants.

Object of studies were PSM and plants. **PSM:** linaroside (the sum of glicosides from *Linaria vulgaris* Mill.), trigonelloside (the sum of furostanolic steroidal glicosides from *Trigonella foenum-graecum* L.), and moldstim (the preparation based on furostanolic glycosides from seeds of *Capsicum annuum*) were obtained from IGPPP. Materials of studies were water solutions of PSM, which were used for seeds treatment. **Plants:** 3 varieties from Apiaceae family (*Coriandrum sativum* L., v. Jubilar; *Anethum graveolens* L., v. Rusich and *Apium graveolens* L., v. Elixir) and 2 varieties of Japanese cabbage from Brassicaceae family (Salad Misuna – typical Japanese variety and Salut Jubileiu – new variety from FSVC). Materials of studies were seeds and above parts of plants.

Keywords: *tomato, secondary metabolites, genes associated, treatment, linaroside, moldstim*

Matherial and Method. seed treatment with water solutions of PSM, plants cultivation at the multi-circle hydroponic installation (MHI), analytical methods (determination of dry matter content, sum of antioxidants and polyphenols), biometry, statistical methods: dispersion analysis (Microsoft Excel, 2010).

Results. Plant cultivation at the multi-circle hydroponic installations is modern and progressive method of plant cultivation, which allows increase green vegetable yields significantly. But such method of greens cultivation need in some conditions: growing without of pesticides and permanent control the quality of greens. We show earlier, that PSM linaroside and moldstim can increase resistance and productivity of plants from Apiaceae family (carrot and parsnip). So, we decided use them as plant resistance inducers applied in seed treatment. It has been shown, that **PSM linaroside** (c=0,001%) could to increase the seed germination, the height and the mass above part of plants, when they applied for seed treatment. But their effect was specific for each crop. *C. sativum* L. reacted with increasing the height of plants and enlarging the weight of above part. *Anethum graveolens* L. demonstrated increasing the seed germination. *Apium graveolens* L. improved all characteristics of plants (tab.1).

Table 1. Change in seed germination and biometric parameters of plants Apiaceae-family after seed treatment with water solutions of plant secondary metabolites. MHI. FSBSI. FSVC. 2021

Plants	Treatment variants	Parameters					
		Seed germination,%		Height of the plant, cm		Weight of the above part, g	
Coriandrum sativum L. (v. Jubilar)	St-dist. water	92,5	+/- to St	36,5	+/- to St	85	+/- to St
	Linaroside	91,3	- 1,2	**43,0**	**+ 6,5**	**100**	**+15**
	Moldstim	100,0	+ 7,5	36,5	0	71	-14
Anethum graveolens L. (v. Rusich)	St-dist. water	10,0	St	34,5	St	80	St
	Linaroside	**41,3**	**+ 31,3**	36,8	+ 2,3	59	- 21
	Moldstim	11,3	+ 1,3	35,5	+ 1,0	61	-19
Apium graveolens L. (v. Elixir)	St-dist. water	32,5	St	37,0	St	51	St
	Linaroside	**60,0**	**+ 27,5**	**42,8**	**+ 5,8**	**115**	**+64**
	Moldstim	32,5	0	36,0	- 1,0	44	-7
		LSD_{05}	11,6	LSD_{05}	2,7	LSD_{05}	14

As to biochemical parameters, they changed differently depended on the crop. The dry matter content increased significantly in above part of *C. sativum* and *A. graveolens*, but it wasn't change in above part of *A. graveolens* after seed treatment with linaroside. The content sum of antioxidants and the content of polyphenols were changed in above part of *C. sativum*. These parameters weren't changed in the other crops.

Table 2. Change biometric and biochemical parameters in plants of Apiaceae-family after seed treatment with water solutions of plant secondary metabolites. MHI. FSBSI. FSVC. 2022

Plants	Treatment variants	Parameters					
		Content of dry matter, %		Content the sum of antioxidants, mg-ecv. GA/g d.m.		Content of poly-phenols, mg-ecv. GA/g d.m.	
Coriandrum sativum L. (v. Jubilar)	St-dist. water	9,98	St	24,26	St	9,41	St
	Linaroside	**10,82**	**0,84**	**26,09**	**1,83**	**10,62**	**1,21**
	Moldstim	8,9	-1,08	21,28	-2,98	9,15	-0,36
Anethum graveolens L. (v. Rusich)	St-dist. water	7,48	St	17,53	St	13,09	St
	Linaroside	**8,44**	**0,96**	15,91	-1,62	13,03	-0,06
	Moldstim	**8,95**	**1,47**	16,54	-0,99	12,80	-0,29
Apium graveolens L. (v. Elixir)	St-dist. water	8,73	St	17,56	St	9,08	St
	Linaroside	8,41	-0,32	17,46	-0,10	9,18	0,10
	Moldstim	8,87	0,14	17,53	-0,03	9,15	0,07
		LSD_{05}	0,59	LSD_{05}	1,71	LSD_{05}	0,81

PSM linaroside, moldstim and trigonelloside (c=0,005%) rose weight of plants Japanese cabbage, increasing the number of lives in rosette; glycosides linaroside and trigonelloside (c=0,005%) increased the sum of antioxidants in leaves of plants (tab.3).

Table 3. Change biochemical parameters in plants of Brassicaceae-family after seed treatment with water solutions of plant secondary metabolites. MHI. FSBSI. FSVC. 2021

Plants	Treatment variants	Parameters					
		Weight of the above part, g	Number of leaves	Content of dry matter, %		Content the sum of antioxidants, mg-ecv. GA/g d.m.	
Brassica rapa L. *subsp. nipposinica* (*v. Salad Mizuna*)	St-dist. water	93,0 - St	31,0 - St	6,54	St	1,38	St
	Moldstim	88,6	39,6	5,73	-0,81	1,35	-0,03
	Linaroside	98,6	40,4	6,11	-0,43	**1,72**	**+0,34**
	Trigonelloside	78,8	41,2	**7,32**	**+0,78**	**1,79**	**+0,41**

Brassica rapa L. *subsp. nipposinica* (*v. Salut Jubileiu*)	St-dist. Water	96,8- St	32,6 - St	6,69	St	1,84	St
	Moldstim	**165**	**44,4**	6,22	-0,47	**2,13**	**+0,29**
	Linaroside	**134**	**44,4**	6,72	+0,03	**2,07**	**+0,23**
	Trigonelloside	**134**	**44,8**	6,64	-0,05	**2,32**	**+0,48**
	LSD_{05}	36,4	11,1	LSD_{05}	0,39	LSD_{05}	0,23

Conclusion: PSM linaroside, trigonelloside can to increase the content sum of antioxidants and polyphenols in plants of Apiaceae and Brassicaceae-families. These PSM stimulate seed germination, growth of plants and increase the weight of plants, raising its productivity and yields. But modulating effect is depended on the species of a plant.

CZU:[57.045+581.1]:633.15 https://doi.org/10.53040/abap6.2022.23

INFLUENCE OF SUPRAOPTIMAL TEMPERATURES ON MAIZE AT THE INITIAL STAGES OF GROWTH

BOROVSKAIA Ala*, LUTCAN Elena, IVANOVA Raisa**
Institute of Genetics, Physiology and Plant Protection,
Chisinau, Republic of Moldova
**https://orcid.org/ 0000-0002-7225-0186, **https://orcid.org/0000-0002-2554-2039,*
e-mail: allaborovskaia@gmail.com

Purpose of this work was to study the resistance to supraoptimal temperatures of various maize hybrids by evaluating some changes in seed germination and mobilization of reserve substances.

Introduction. The initial stages of plant growth is the more influenced by abiotic factors, in special by high temperatures. Supraoptimal temperatures delay seed germination and reduce the growth rate of embryonic roots and shoots. [5]. Taking into account that the number of studies on germination characteristics and mobilization of reserve substances of maize seeds in correlation with their tolerance to non-optimal temperature is very limited, research on the primary resistance to supraoptimal temperatures of maize lines used in the Republic was initiated [3].

Keywords: *heat shock, maize seed, germination, vigor, metabolic efficiency*

Materials and Method. The experiments were carried out in 2022 year in laboratory conditions. Maize seeds of hybrids Porumbeni 383 (P383) and BEMO 203 (B203), which differ by maturation period and size of seeds, were contributed by the „Porumbeni" Institute of Crop Science (Republic of Moldova). Previously soaked with water for 24 hours, the maize seeds were exposed to heat shock at temperatures of 48°C 50°C and 52°C for 30 min. Germination of treated and intact seeds (control) was performed according to the standard method described by the international rules [2]. After7 days of germination, the modification of followed bio-morphological traits were determined: germination capacity; lengths of roots and shoots; vigour index [4]; dry biomass of separated components (seeds, roots, shoots) and metabolic efficiency [1].

Results. The germination capacities of maize seeds exposed to heat shock reduced with increasing temperature. However, the tested hybrids reacted differently to elevated temperatures. At 50°C the germination capacity of B203 seeds decreased by 16%, and that of P383 by 21%. Heat shock at 52°C led to a diminution of seed germination by 21% and 32%, respectively in hybrid B203 and P383.

The physiological response, evaluated through the growth of embryonic roots and shoots of the two hybrids also differed at different temperatures. The roots length of germinated seeds after heat shock at 48°C did not change significantly in comparison with intact seeds of both hybrids. An increase in temperature to 50-52°C led to inhibition of roots growth. The roots length of both hybrids decreased by 25-35% compared to intact seeds. It is necessary to mention that the roots length of intact seeds of tested hybrids differed significantly ($p \leq 0.001$). The root length of hybrid B203 was 14.00±0.31 cm and that of P383 – 6.81±0.25 cm. After heat shock at 50°C and 52°C, the lengths of roots were shorter by 3.85-5.2 cm in B203 hybrid and 1.75-1.93 cm in P383 hybrid; and had the statistically significant differences at $p \leq 0.001$ for hybrid B203 and $p \leq 0.05$ for hybrid P383 between intact and treated seeds.

Concerning the shoots of tested hybrids, their lengths of germinated intact seeds did not differ; the shoot length was 6.28±0.13 cm and 6.03±0.12 cm, respectively for hybrids B203 and P383. It was shown that the shoots were less affected by high temperature than the roots of treated seeds. However, after heat shock at 52°C the germinated seeds had the shoots, the length of which were statistically significant shorter from intact seeds by 2.38 cm ($p \leq 0.001$) for hybrid B203 and 0.89 cm ($p \leq 0.05$) for hybrid P383.

The initial vigor of intact seeds in hybrid B203 was equal to 542.37, and in P383 – 431.81. Seeds of B203 hybrid treated at 48°C lost 5% in vigor and P383 hybrid about 30%. A subsequent increase in temperatures to 52°C led to a decrease in the vigor index of both hybrids, approximately two times. Therefore, the vigor of B203 seeds remained 1.5 times higher than that of P383 seeds.

During the germination, the seeds of both hybrids consumed for growth of roots and shoots only 46-54% of reserve substances mobilized from the endosperm. The remaining mobilized reserve substances were used to provide energy for physiological processes. The ratio between the weights of reserve substances utilized for the growth of roots/shoots and spent for energy supply changed depending on the degree of heat treatment of seeds and characterized the metabolic efficiency of hybrids. In limits of experimental temperatures (48-52°C) the metabolic efficiency of treated seeds in relation to the intact ones decreased in direct proportion. The equations for reducing metabolic efficiency from 48 to 52°C were determined. The degradation coefficient of metabolic efficiency for hybrid B203 was 0.0137 and for hybrid P383 - 0.3826. These data showed that the rate of degradation of the P383 hybrid was significantly higher than that of B203 under the influence of supraoptimal temperatures.

Conclusions. The effect of supraoptimal temperatures on such bio-morphological traits as germination, length of roots and shoots, dry weight of biomass, vigor and metabolic efficiency of maize seeds of two different hybrids was studied. The significant changes in physiological processes of seeds germination were established within the temperature range of 48-52°C. Taking into account the obtained data about modification of total germination, vigor and metabolic efficiency with an increase in temperature by two degree (from 48 to 50°C; from 50 to 52°C) it can be concluded that the maize seeds of P383 hybrid are more vulnerable to the influence of supraoptimal temperatures than the seeds of the P203 hybrid.

Acknowledgment. The authors gratefully acknowledge colleagues from the „Porumbeni" Institute of Crop Science, who kindly provided us with the maize seeds.

Research was carried out within the State Program no. 20.80009.7007.07 "Determining the parameters that characterize the resistance of plants with the different level of organization to the action of extreme temperatures in order to reduce the effects of climate change", financed by the National Agency for Research and Development.

References:

1. Dascaliuc A., Jelev N., Ralea T., et al. Mobilization of reserve substances of seeds for germination and growth of seedlings in wheat varieties with different frost resistance. *Buletinul AȘM. Științele vieții*. 2020, no. 2 (341), p. 54-66.
2. ISTA (International Seed Testing Association). International rules for seed testing. Chapter 5: The germination test. 2017 (1), 2017. DOI: https://doi.org/10.15258/istarules.2017.05.
3. Ivanova R., Borovskaia, A., Mașcenco, N. Impactul temperaturii supraoptimale și genistifoliozidei asupra mobilizării substanțelor de rezervă la porumb. In: Genetica, ameliorarea, producerea de semințe și tehnologia de cultivare a porumbului: materialele conf. şt.-pract. cu participare intern. online, dedicată a 100 ani de la naşterea d-lui Tihon Cealîc, doct. hab., mem.-cor. al AŞM, Pascani, 9-10 sept. 2021. Chișinău, 2021, p.122-130.
4. Kerecki S., Jovicic-Petrovic J., Kljujev I., et al. Biopriming: a sustainable support for crop establishment. In: Agrosym-2021, the XII International Scientific Agricultural Symposium, Jahorina, Bosnia-Hercegovina 2021, p. 188-194. http://agrosym.ues.rs.ba/article/showpdf/BOOK_OF_PROCEEDINGS_2021_FINAL.pdf
5. Sikder. S.; Hasan, M. A.; Hossain, M. S. Germination characteristics and mobilization of seed reserves in maize varieties as influenced by temperature regimes. J. Agric. Rural Dev. 2009, vol.7, no. 1-2, p. 51–56. https://doi.org/10.3329/jard.v7i1.4421

CZU:633.522:631.41 https://doi.org/10.53040/abap6.2022.24

BITUMINOUS ROCK - ALGINITE AS A NATURAL SOURCE OF SILICON FOR IMPROVING GROWTH, PRODUCTION AND QUALITY OF HEMP (*Cannabis sativa* L.)

BRINDZA Ján[1]*, HORČINOVÁ SEDLÁČKOVÁ Vladimíra[1**]
[1]Slovak University of Agriculture in Nitra, Institute of Plant and Environmental Sciences, Slovak Republic;
**https://orcid.org/0000-0001-8388-8233, **https://orcid.org/ 0000-0002-5844,*
e-mail: jan.brindza@uniag.sk

There is extensive knowledge in the scientific literature about the importance of silicon for plants (Epstein 1999, Nielsen 2014) and human health (Jugdaohsingh, 2007), which unequivocally proves its irreplaceability for plants as well as for human health. Despite this, siliceous fertilizers are not used in many countries of the world, and the silicon content is not determined in human clinical biochemistry. It is also generally known that the mass of the Earth consists mostly of iron (32.1%), oxygen (30.1%) and silicon (15.1%) (Morgan and Anders, 1980). The aim of the work is to verify the influence of selected products created from natural bituminous rock - alginite on hemp plants. The mentioned experiments were carried out to find out the influence of silicon sources on production and quality characteristics. Alginite is also a source of active silicon. It also contains phosphorus, potassium, and trace elements necessary for normal plant development (Brindza et al., 2021). Therefore, it became the object of study in the presented work.

Keywords: *bituminous rock, alginite, natural source of silicon, effects on plants*

Materials and Method. For 6 years, the collective of the Institute of Plant and Environmental Sciences at the Slovak University of Agriculture in Nitra has been providing research from the study of unknown properties of alginite, the development of new alginite products and the determination of their effects on germination, emergence, growth, development, biomass production and the quality of plant parts. In this work, we present only informative results from some experiments from the study of the influence of alginite products on hemp plants (*Cannabis sativa* L.) - variety Finola:

a) **E1** for plant growth and biomass production

b) **E2** to accumulate cannabinoids (CBD) in inflorescences

Experimental variants: Application of alginite in the form of a suspension solution to leaves of 20g/litre of water (Variant 1), 30g/litre (Variant 2) and 60 g/litre (Variant 3), control variant (CV) without alginite application.

Results.

In the experiment, the application of alginite in the form of a suspension solution to plants showed an increase in plant height compared to the control variant (Figure 1). With increasing alginite dose, plant height increased proportionally, ranging from 117.8 cm (Variant 1 – 20g/litre) to 125.0 cm (Variant 3 – 60g/litre).

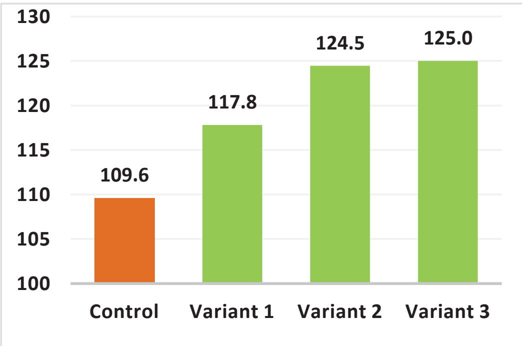

Figure 1. The effect of the application of different doses of suspension alginite (Variant 1 - Variant 3) on the height of plants (mm) of hemp (*Cannabis sativa* L.).

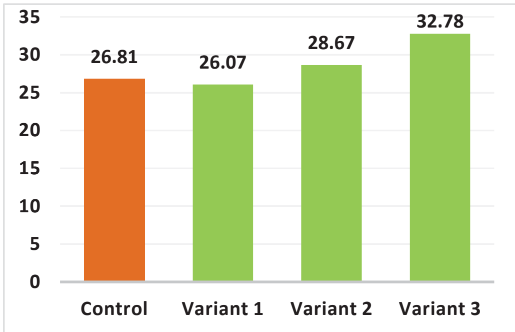

Figure 2. The effect of the application of different doses of suspension alginite (Variant 1 - Variant 3) on the weight of plants in the dry state (g) of hemp (*Cannabis sativa* L.)

In experiment 2, the application of alginite in the form of a suspension solution to plants showed a different effect on the weight of plants in the dry state (g) compared to the control variant (Figure 2). An increase in the weight of the plants in the dry state was manifested only after the application of a dose of alginite of 60g/litre of water (Variant 3).

Table 1 Statistical evidence between the determined content of CBD cannabinoids in samples of hemp (*Cannabis sativa*) inflorescences obtained after applying different doses of suspension alginite to the plants (by LSD test at the significance level α = 0.05)

	Tested variants	Average content of CBD mg.kg^{-1}	Homogen-ity
1	**CV -** Control variant without alginite application	2699.78	a
2	**Variant 1 –** application of alginite 20g/litre of water to plants	2882.77	ab
3	**Variant 2 –** application of alginite 30g/litre of water to plants	3295.11	d

	Tested variants	Average content of CBD mg.kg^{-1}	Homogenity
4	**Variant 3 –** application of alginite 60g/litre of water to plants	3190.75	bc

The application of alginite in the form of a suspension solution to plants was also manifested by an increase in the content of cannabinoids (CBD) in the inflorescences of hemp, ranging from 2882.77 (Variant 1) to 3295.11 mg.kg^{-1} (Variant 2) compared to the control variant. The application of a dose of suspension alginite of 60g/litre of water has already shown a reduced content of cannabinoids.

Conclusions: Many positive but also negative effects of alginite as a bituminous rock on the quality of water, soil, biomass formation and the quality of plant parts have already been confirmed by many authors. Many authors therefore consider alginite as a natural fertilizer. We cannot agree with this, because alginite contains a very low nitrogen content, which must be added to the soil when applying alginite even at high doses. Based on previous findings from the study of the "mysterious properties" of alginite, our research team is convinced that the very positive effects of natural alginite and technologically modified alginite products on plants are due to the synergistic effect of the complex chemical composition of alginite. Several components are prioritized in this complex, namely the content of more than 50 microelements, higher silicon content, favourable content of "unknown" organic matter and many other specific physico-chemical and mechanical properties of alginite. For this reason, the application of alginite in a suspension form also had a very positive effect on hemp plants in the increased biomass production, the content of cannabinoids, but also the content of other biologically active substances and thus also antioxidant activity and other morphological and qualitative characteristics.

Acknowledgment. The authors of the publication would like to thank all the workers who actively participated in the preparation, establishment, and evaluation of the experiments.

References:

1. Brindza, J., Vozár, Ľuboš, Miko, M., Gažo, J., Kovár, P., Horčinová Sedláčková, V., Grygorieva, O. Unique Effects of Alginite as a Bituminous Rock on Soil, Water, Plants and Animal Organisms – Review. *Agrobiodiversity for Improving Nutrition, Health and Life Quality*, 2021, Vol. *5,* No. 1, p. 169-184. DOI: 10.15414/ainhlq.2021.0016
2. Epstein, E. Silicon. *Ann. Rev. Plant Physiol. Plant Mol. Biol.,* 1999, Vol. 50, p. 641–664. DOI: 10.1146/annurev.arplant.50.1.641

3. Jugdaohsingh, R. Silicon and bone health. *J. Nutr. Health Aging.,* 2007, Vol. 11, p. 99–110.
4. Morgan, J. W., Anders, E. Chemical composition of Earth, Venus, and Mercury. *Proceedings of the National Academy of Sciences*, 1980, Vol. 77, No. 12, p. 6973–77. DOI: 10.1073/pnas.77.12.6973.
5. Nielsen, F. H. Update on the possible nutritional importance of silicon. *J. Trace Elem. Med. Biol.,* 2014, Vol. 28, p. 379–382. DOI: 10.1016/j.jtemb.2014.06.024

CZU:631.15.017.1:633.15 https://doi.org/10.53040/abap6.2022.25

EFFICIENCY OF REGLALG IN INCREASING MAIZE TOLERANCE TO SUPEROPTIMAL TEMPERATURES

CAUS Maria[1*], DASCALIUC A.[1**], BOROZAN P[2***]
[1]*Institute of Genetics, Physiology and Plant Protection, Chisinau, Republic of Moldova;*
[2] *Public Institution „Porumbeni" Institute of Phytotechnics, Pascani, Republic of Moldova*
**https://orcid.org/0000-0001-7914-3482, **https://orcid.org/0000-0003-3210-6144*
****https://orcid.org/0000-0002-4142-2918*
e-mail: mcaus2021@yahoo.com

Maize (*Zea mays* L.) a strategic cereal crop, ranks third in the world in terms of sown area, after wheat and rice. Maize products are utilized in a range of branches, including feed, food and processing industry, medicine etc. In recent years, humanity has been facing the effects of climate change on the planet and the unpredictable climatological anomalies related to it. Among extreme climatic factors, the thermal stresses conditions had a serious impact on the growth, development and productivity of maize. NASA study results show that climate change could affect corn production as early as 2030, which is expected to fall by 24% [1]. In this regard, the use of various methods to increase plant resistance to heat stress is one of the most important tasks for both agriculture and scientific researches. One of the ways that are widespread in terms of increasing resistance to stress factors is the preliminary processing of seeds with natural growth regulators, to activate the initial stages of germination, growth rate and formation of a powerful root system that could subsequently affect favorably the whole course of plants ontogenesis.

The purpose of the study consisted in studying the influence of preliminary processing maize seeds with bioregulator Reglalg on germination and growth parameters of seedlings, depending on the action of high temperatures.

Keywords: *seeds, maize, hybrids, Reglalg, heat stress*, *growth parameters*

Materials and Method. In the studies were used seeds of different maize hybrids that differ after their resistance to high and cold temperatures, with average thermotolerance, which after the action of the high temperature, germinates more than 50%. Experiments were performed under laboratory-controlled conditions at 25°C, in the dark and air humidity of 60-70%. The seeds of the maize hybrid sensitive to high temperatures, Por. 427 were treated with H_2O (control) or Reglalg (experimental) and then were exposed to the action of various high temperatures (HT). The working concentration of the Reglalg preparation used for the processing of maize seeds was established experimentally as a result of several laboratory experiments, followed by the determination of the germination percentage and the morpho-physiological parameters of the seedlings.

Seedlings of all experiments were collected after 5 days for biometric assessments, including measurement of epicotyls height, radicle length, and their fresh biomass. The results were statistically analyzed using the “Statistics 7” software package for computers. The obtained results are means of 3 measurements of samples resulting from 3 different experiments.

Results. Preliminary experiments under laboratory-controlled conditions at 25°C with utilization of seeds of Por. 427, sensitive to high temperature (HT), which were exposed to the action of various high temperature the thermotolerance degree of this hybrid was established. Also, for seeds this hybrid the concentrations of Reglalg preparation, having the best effect on germination and growth parameters were demonstrated. Obtained results on the influence of HT on the germination and growth of the maize hybrid seedlings (Por. 427) sensitive to HT showed, that with the increase in the values of high temperatures, the % of seed germination on 1st day decreases, being 86,7% in the control, and 78, 56, 36 and 1.6%, respectively, in the variants with HT of 44, 47, 50 and 53°C, respectively. On the next, 2nd, 3rd and 4th days, the germination rate gradually increases, amounting to 98% in the control, and 96, 90, 81 and 71% at HT of 44, 47, 50 and 53°C, respectively. Testing the effect of high temperature of 50°C for 30 minutes on the germination and growth of seedlings of various maize hybrids (Por. 180, Bemo 203, Por. 374 and Por. 427), which differ in resistance to high temperatures and cold, causes a decrease in both % seed germination, and % germination energy in all hybrids studied. For the hybrid with increased resistance to high temperatures (Por. 374), according to the authors of obtaining these hybrids, we observed the lowest germination %, compared to the other hybrids. But biometric determinations showed that HT of 50°C for 30 min does not affect the length of the radicle and epicotyl of the Por 374 hybrid. At the same time, HT causes a decrease in the growth of radicles and epicotyls by 1,1 and, respectively, 1,4 times in the hybrid Por. 427, sensitive to high temperatures. HT also affects the biometric indices of maize hybrids with different cold resistance – Por. 180 and Bemo 203. The level of inhibition of radicle and epicotyl growth is higher in the cold sensitive hybrid - Bemo 203, being by 1,4 and 1,6 times higher, respectively, compared to the control.

Analysis of the effect of seed pre-treatment of maize hybrids differing in their resistance to HT (Por. 374 and Por. 427) with the optimal dose (1/200) of Reglalg on seed germination and growth parameters under the influence of super-optimal temperature of 50°C with the duration of 30 min showed that HT reduces the percentage of seed germination in both hybrids studied, as well as in the controls (53% - Por. 374; 75% - Por. 427), as well as in the variants with the application of Reglalg (62% - Por. 374; 87% - Por. 427). As demonstrate the data obtained the percentage of germination in the variants with Reglalg and HT is higher than in the controls.

The results obtained with the use of Reglalg for seed treatment of resistant (Por.374) and sensitive (Por.427) maize hybrids to HT before their subjection to super- optimal temperature of 50°C for 30 minutes showed a positive effect of the preparation in increasing growth rates of seedlings, including the length of radicles, eight epicotyls and their fresh biomass, compared with the controls. The maximum length of both radicles and coleoptiles was obtained for seedlings of maize hybrid resistant to HT (Por.374), grown from seeds pretreated with Reglalg preparation and application of 50°C temperature. With these treatments, the length of the radicles was significantly longer - by 14%, and epicotyls - by 12%, compared with the controls.

Conclusions.

- Laboratory experiments with the application of the preparation Reglalg for the treatment of seeds of various maize hybrids before exposure to the action of high temperatures have shown that Reglalg exerted a beneficial action on the physiological state of maize seedlings in the juvenile stage of ontogenesis, increasing germination rate and morpho- physiological parameters.
- The results obtained regarding the germination percentage, root length, epicotyl height and their fresh biomass are informative indicators reflecting the effectiveness of the use of Reglalg in seed pretreatment, which increases the maize resistance under the action of super optimal temperatures.
- Reglalg preparation can be used as a plant growth stimulator for seed germination and seedling development during early stages of ontogenesis under high temperature action.

Acknowledgment. Research was carried out within the project of the State Program 20.80009.7007.07 “Determining the parameters that characterize the resistance of plants with different levels of organization to the action of extreme temperatures in order to reduce the effects of climate change”, funded by the National Agency for Research and Development.

References:

1. Jägermeyr J., Muller C., Ruane A.C. et al. Climate impacts on global agriculture emerge earlier in new generation of climate and crop models. Nature Food, 2021, vol. 2, p. 873-885. https://doi.org/10.1038/s43016-021-00400-y.

CZU:581.5:581.1 https://doi.org/10.53040/abap6.2022.26

IDENTIFICATION OF MECHANISMS OF PLANT RESISTANCE TO STRESS FACTORS

DASCALIUC A.
Institute of Genetics, Physiology and Plant Protection,
Chisinau, Republic of Moldova
https://orcid.org/0000-0003-3210-6144, e-mail: dascaliuca@yahoo.com

The resistance of biological systems to the action of stress factors depends on the combined influence of the mechanisms that determine resistance through avoidance (reduction of the received dose) and the functional one, which influences the effectiveness of preventing and eliminating damage caused by stress. The relative contribution of the different mechanisms on the total resistance is variable depending on the specifics of the evolutionary adaptations of the species and on the transformations induced during the ontogenesis of the individual by environmental factors. It is important to note that the individual adaptations during ontogenesis involve changes in both mechanisms leading to increased resistance due to avoidance and functional adaptations. The level of resistance induced in ontogenesis depends on several factors, among which we mention the genetic characteristics of the organism, the dose, and specificity of the abiotic or/and biotic stress factor, the application of preparations that influence adaptation, protection, and other processes induced in response to the action of the stress factor. Recently, a specific group was separated from plant growth regulators, called biostimulators. They include compositions of components, substances, and microorganisms, which, being applied to plants or soil, improve vigor, yield, quality, and resistance to environmental abiotic stress factors. In this presentation, we include some results that describe the biological effects of the biostimulator Reglalg. The obtained results suggest that the preparation activity is reflected in the plants' resistance to abiotic and biotic stress factors. As in the case of growth stimulators and growth inhibitors, experimental data suggest that some mechanisms of action of biostimulators and plant protection preparations against biotic stress factors are congruent. Therefore their separation may lead to a decrease in the effectiveness of the practical use of both groups of preparations in agriculture.

Keywords: *system approach, stress resistance, biostimulators*

Materials and Method. The research included several species of field, horticultural, and forest plants. The different genotypes of the mentioned groups of plants we studied in laboratory and field conditions. At the initial stages of germination and plant growth, we examined the biostimulator Reglalg impact on seed germination and growth, vigor, and plant resistance to the action of high temperatures and frost. Also, in laboratory and field conditions, we determined the influence of biostimulator Reglalg, trophic and physical factors on plants' growth rate, vigor, and viability. The assessment of the physiological state of the plants and the specificity of the genotypes provided by determining the rate of seed germination and plant growth, the duration of the vegetation period, the content of chlorophyll pigments, the daily and seasonal activity of photosynthesis, the productivity of the plants.

Results.Due to adaptation processes, plant resistance during ontogenesis changes. For this reason, it is necessary to synchronize their physiological state to compare different genotypes by their resistance to a specific stress factor. The mentioned requirement is fulfilled most simply by involving in the research the seeds of different genotypes that naturally are in a synchronized state and can be easily prepared for uniform germination. The resistance of seed embryos in this state characterizes the primary resistance of the given genotype. Research conducted with different wheat genotypes has shown that their primary resistance to the action of high temperatures, or frost, differs. Under the influence of the conditions specific to autumn, winter, and spring, thanks to the adaptation processes, the resistance of the plants obtained from them increases progressively, reaching the maximum value during the winter after fulfilling the second hardening phase. During the action of above zero temperatures in the early spring, the resistance of the plants to frost decreases rapidly; however, it remains higher compared to the value of primary resistance. Our research demonstrated that genotypes characterized by higher primary frost resistance also had higher frost resistance after the first and second hardening phases. The sum of primary and adaptive resistance determines the value of the total resistance of the genotype achieved at the specific hardening phase. From the above, it follows the argumentation of the proposal to distribute wheat genotypes according to frost resistance based on the data on their distribution based on their primary resistance. It is necessary to emphasize that the method of determining the primary resistance is faster and less expensive than that of the total resistance after the first or second phase of hardening.

The treatment of wheat seeds with the biostimulator Reglalg ensures the increase of their primary resistance to frost and the action of high temperatures. Plants from wheat seeds treated before sowing with biostimulator Reglalg adapt faster to sub-zero temperatures. Still, the maximum level of resistance and the distribution of genotypes after frost resistance remain intangible. From this, it follows that the beneficial effect of the biostimulator on the state of wheat plants during wintering, independent of the activation of adaptive processes characteristic of each genotype. In the spring, after the winters characterized by near-zero temperatures but with a lot of snow, the wheat plants obtained from the seeds that we treated with the biostimulator Reglalg were less attacked by snow rot; they initiated the vegetation processes earlier in the spring, and later passed to the stage of autumn maturation and desiccation. Similar effects of stimulation on the processes of adaptation to stress factors and seedlings growth we induced by the treatment of acorns with the biostimulator Reglalg and also under the influence of external physical factors (temperature and light) on pedunculated oak seedlings. Under the specific effect of light, temperature, and preparation Reglalg, pedunculate oak plants' vigor and adaptive capacity have increased. The plants obtained by the traditional method, at the age of two years, reached a height of 19 cm, while those obtained under the influence of the mentioned factors reached a height of 95 cm. In the leaves of the experimental plants, in the 2nd year of cultivation, the chlorophyll content was 22% higher than that in the control plants' leaves, the photosynthetic activity being higher throughout the all vegetation period. Likewise, the leaves of the experimental plants tended to be more resistant to the action of high temperatures and the infection of the leaves with powdery mildew compared to those of the plants of the control variant. Together, the mentioned data demonstrate that the resistance of plants to the action of extreme temperatures and biotic stress factors depends on the vigor of the plants, and to optimize the procedures for the use of biostimulators in agriculture we must take into consideration the level of plants vigor. This value of this parameter influences the plants' resistance to abiotic and of biotic stress factors.

Conclusions.

1. The resistance of biological systems to stress factors can be divided into two additive components: the primary (initial) resistance and the one obtained due to the adaptations that occur during ontogenesis. Their sum determines the biosystem's total resistance to stress factors.
2. To distribute related genotypes according to their resistance to stress factors, we must induce them to an identical physiological state before testing.
3. Because the physiological state of plant seeds during ripening and desiccation is synchronized naturally, the seeds well prepared for germination can be used to determine the primary and adaptive resistance of the genotype, as well as the influence of physical factors and biostimulators on the adaptation processes of plants to biotic and abiotic stress factors.

Acknowledgment. The research was carried out within the project of the State Program 20.80009.7007.07, "Determining the parameters that characterize the resistance of plants with different levels of the organization to the action of extreme temperatures to reduce the effects of climate change", financed by the National Agency for Research and Development.

CZU:582.632.2:581.165 https://doi.org/10.53040/abap6.2022.27

EFFECT OF BIOREGULATORS ON SEED GERMINATION AND ADAPTATION OF BEECH SEEDLING

ELISOVETCAIA Dina[1*], IVANOVA Raisa[1**], MASCENCO Natalia[1***], BRINDZA Ján[2#]
[1]Institute of Genetics, Physiology and Plant Protection, Chisinau, Republic of Moldova,
[2]Slovak University of Agriculture in Nitra, Institute of Plant and Environmental Sciences, Slovak
**https://orcid.org/0000-0003-0521-6428,* **https://orcid.org/0000-0002-2554-2039,
****https://orcid.org/0000-003-1869-4357, [#]https://orcid.org/0000-0001-8388-823,*
e-mail: elisovetcaia.dina@gmail.com

In the Republic of Moldova, European beech *Fagus sylvatica* L. grows on the eastern border of its range, so even small climate changes can significantly affect the number of beech forests. Since the late 80s of the last century, an increase in the amount of direct and global solar radiation has been noted, accompanied by a decrease in the number of days without sun. The air temperature in the Republic of Moldova regularly breaks records and the average of annual temperature exceeds by at least 1.0-1.5°C (http://old.meteo.md/newru/last_season.htm). The absence of significant precipitation in early spring contributes to the drying of the upper layers of the soil, which creates not quite favorable conditions for the germination of beech seeds in natural conditions. The summer months are characterized by even more extreme conditions – the number of days with a maximum air temperature of ≥30ºC significantly increases with a significant deficit of precipitation. Taking into account the climate change, it seems relevant to identify some measures to improve the adaptive capacity of beech, especially from local populations.

Purpose. The purpose of our work was to study the effect of the bioregulators such as genistifolioside and capsicoside on the germination of beech seeds originated from Cioresti, the Republic of Moldova, as well as on the adaptation and survival of seedlings in solarium conditions.

Keywords: *Fagus sylvatica, seed germination, seedlings adaptation, capsicoside, genistifolioside*

Materials and Method. The experiments were carried out in the Laboratory of Natural Bioregulators of the Institute of Genetics, Physiology and Plant Protection, Republic of Moldova during 2022. The seeds of European beech *Fagus sylvatica* L. (Fagaceae) were collected in the autumn of 2021 from beech stand in the Cioresti, Republic of Moldova.

The initial viability of seeds was determined by two tests using the 2.3.5-triphenyltetrazolium chloride (2.3.5-TTC) solution [3] and hydrogen peroxide (HP) solution

[4]. The germination test (four replicates of 100 seeds each) was carried out in accordance with the recommendations of the International Seed Testing Association [2].

The seeds of Cioresti origin before stratification were treated with bioregulators – 0.01% solutions of capsicoside and genistifolioside for 22-24 hours. Distilled water was used as a control, and 0.01% solution of gibberellic acid was used as a standard. Seed stratification was carried out at moisture content of 30% and temperature of +4±1°C until germination. The appearance of roots at least 3 mm long was defined as germination. Seed germination was evaluated on the 56th and 114th day of stratification. Germinated seeds were sown in peat with pH=5.5 in solarium with drip irrigation and uncontrolled temperatures. During the growing season, seedlings were treated every three weeks with 0.01% solutions of the bioregulators capsicoside and genistifolioside, starting from the phase of 2-4 true leaves.

The data analysis was performed in Excel and Statgraphics Plus 5.0 programs. Values were presented as the mean of four replicates by standard deviation. The relationship between particular parameters was examined using Pearson's correlation coefficient.

Results. The viability of freshly harvested seeds, determined by tetrazolium (TTC) and peroxide (HP) tests, averaged 81.5 and 81.0%, respectively. The value obtained by the two tests correlate well with each other, the Pearson correlation coefficient was 0.9084.

It was determined that on the 56th day of stratification, the number of germinated seeds in the variant with capsicoside treatment was significantly lower than in the other variants and amounted to 42.0% versus 44.0 in gibberellin, 44.8 in control and 55.3% in genistifolioside ($LSD_{0.05}$= 8.74, $p>0.05$). On the 114th day of stratification, the largest number of germinated seeds was also noted in the batch of seeds treated with genistifolioside – 82.8%. However, in the batch of seeds treated with capsicoside the number of germinated seed increased to 80.5% and was significantly higher than in the control – 73.8 and the standard – 76.8% ($LSD_{0.05}$= 1.35, $p<0.05$). Data on the overall germination of Cioresti seeds during stratification had a good correlation with their viability determined by rapid tests. The germination of seeds treated with capsicoside after two months of stratification was somewhat delayed compared to other variants, by the end of the third month of stratification, the number of germinated seeds reached to the level of genistifolioside, and significantly exceeded the control and standard. Previously, we found that the bioregulators such as genistifolioside and capsicoside at a concentration of 0.01% increase the rate of seed germination and seedlings adaptation of beech from Slovakia [1].

Germinated seeds from Cioresti were sown in solarium conditions. The first seedlings were observed on 9 days after sowing in all variants. After two weeks the largest number of seedlings was observed in the genistifolioside variant – 41.5±3.5%, the smallest was in the control – 21.0±2.2%. The seedlings appearance in the capsicoside variant was at the level of the standard and amounted to 32.5±4.3 and 31.8±3.9 %, respectively. The rate of seedlings appearance during the first three weeks in batches treated with genistifolioside and capsicoside was 1.5-2.0 time higher than in control batch. The total adapted seedlings were 82.79±4.32 and 81.41±3.75%, respectively treated with genistifolioside and capsicoside, which was significantly higher than in the control (72.63±4.75%) and at the standard batch (80.23±4.25%).

It is necessary to note that in the solarium, since the second decade of June 2022, the daytime temperature significantly exceeded the optimum for the development of beech seedlings and reached to +35...+40^{o}C. In the control and gibberellic acid variants, 6.70 and 5.65% of the seedlings, respectively, died. At the same time, in the variants treated with bioregulators, all seedlings survived.

The average height of seedlings, which were foliar treated with bioregulators, reached to 15.5-16.1 cm, which slightly exceeded the control (15.0 cm) and was not significantly lower than in the variant with gibberellin treatment – 16.3 cm ($LSD_{0.05}$=2.2, $p>0.05$).

Conclusions: Pre-treatment of European beech seeds with natural growth regulators capsicoside and genistifolioside at a concentration of 0.01% significantly increased the overall germination of seeds and their adaptation. The foliar treatment contributed to the survival of *Fagus sylvatica* seedlings in non-optimal conditions of growth.

Acknowledgment. The research was carried out within the project of the State Program 20.80009.7007.07, “Determining the parameters that characterize the resistance of plants with different levels of the organization to the action of extreme temperatures to reduce the effects of climate change”, financed by the National Agency for Research and Development.

References:

1. Elisovetcaia, D., Ivanova, R., Mascenco, N., Brindza, J. Improvement of seed germination and seedling resistance of beech (*Fagus sylvatica*) by growth regulators. *AGROFOR International Journal*, 2022, vol. 7(1), p. 90-97. DOI: doi.org/10.7251/AGRENG2201090E.
2. ISTA (International Seed Testing Association). International Rules for Seed Testing, Edition 2006/1, Bassersdorf, Switzerland.
3. Kerkez I., Pavlovic S., Lucic A., Devetakovic J., Sijacic/Nikolic M., Popovic V. Different methods for beech seed quality testing. Sustainable forestry. Collection 77-78, Institute of Forestry, Belgrade, 2018, p. 1-10.
4. Sharma S., Sibi G. Seed germination and maturation under the influence of hydrogen peroxide-a review. Journal of Critical Reviews, 2020, vol. 7, is. 1, p. 6-10. ISSN- 2394-5125 http://old.meteo.md/newru/ last_season.htm

CZU:631.415:581.43 https://doi.org/10.53040/abap6.2022.28

EFFECT OF HUMIC ACIDS ON THE BIOELECTRIC POTENTIAL DIFFERENCE GENERATION IN THE ROOT ENVIRONMENT

GASIEVA Zalina*, GALUSHKO Al.**, KULESHOVA Tatiana***

Agrophysical Research Institute, St.-Petersburg, Russian Federation

** https://orcid.org/0000-0003-0126-0181, ** https://orcid.org/0000-0002-0387-7997*

**** https://orcid.org/0000-0003-3802-2494*

e-mail: melkii844@gmail.com, www.piter.ru@bk.ru

Bioelectrochemical systems (BES) based on electroactive processes in the root environment of plants and accompanying microorganisms are a new promising environmentally friendly technology for generating renewable energy [2]. The productivity of BES depends on the composition of the root environment, intensity of oxidation-reduction reactions and the diffusion of potential-forming ions. The formation of a bioelectric potential difference in a root-inhabited environment is due to the transport and separation of charged particles in the process of biochemical reactions accompanying the vital activity of plants and microorganisms surrounding them. Although the possibility of practical use of bioenergy resources has already been shown in many studies, the nature of electrogenesis is still the subject of research.

Humic acids (HA) are the main organic constituents of the soil, which are formed during the decomposition of plant and animal residues under the action of microorganisms and abiotic environmental factors. HA can play the role of a redox mediator. The addition of HA can increase electron transfer rates between halogenated and nitroaromatic compounds and between reduced sulfur and nitrogen containing compounds, respectively which are attributed to quinine moieties in HA [1]. Currently, HA has been proved to serve as the nontoxic electron-carrying mediator between anaerobic or facultative bacteria and Fe(III) or electrode [4]. HA resulted in increase of power density and coulombic efficiency in microbial fuel cell, which ranged from 7.5% to 67.4% and 24% to 92.6%, respectively [1].

Investigations concerning use of HAs as mediators are, however, still limited underlining the need of extensive assessment of the efficiency of available HAs as mediators and exploring their applicability for power production in BES. **The purpose** of this work was to identify the effect of HAs on the potential difference formation in the BES based on the electrogenic properties of the root environment when growing agriculturally significant plant products.

Keywords: *bioelectrochemical system, lettuce, bioelectrogenesis, peat soil, artificial light culture*

Materials and Method. As a phytoobject was chosen lettuce (*Lactuca sativa* L.) variety Typhoon (Sortsemovoshch LLC, Russia), which are widely distributed in the protected ground area. Plants were grown at the ARI biopolygon under conditions of intensive artificial lightculture [5]. HPS-400 lamp were used as light sources. The irradiation value was set equal to 70-75 W/m^2 PAR, the duration of the light period was 14 hours per day. The air temperature was maintained within +20-22°C during the day and +18-20°C at night, relative air humidity was 65-70%. The universal peat soil Agrobalt-C (Pindstrup LLC, Russia) was used as a root environment. 1 g of such soil contains 0.35 g HA. Soil moisture at the level of 60-70% of the total moisture capacity and the amount of micro- and macroelements necessary for obtaining high-quality plant products was maintained by adding Knop's solution [5].

BES was a container for growing plants with a volume of 90*70*70 mm^3, filled with peat soil, in which electrode systems based on graphite felt were introduced and lettuce were planted in the amount of 2 pieces [3]. The measured characteristic reflecting the bioelectrical activity in the root environment was the bioelectric potential (BEP) – the potential difference measured between the electrodes, one of which is located at the root collar, and the other at a distance of 30 mm from it. The upper electrode was electronegative with respect to the lower one. BEP values were automatically recorded every 15 minutes using the Arduino hardware platform.

To identify the role of HA in the generation of potential difference in the root environment, the following variants were studied: 1) BES-C – control containing only the original peat soil without plants, the total amount of HA is 3 g, 2) BES-P – based on peat soil and 2 lettuce plants, 3) BES-HA – with a 2-fold increase in the content of HA, 4) BES-HAu – with a 2-fold increase in the content of HA in the 0,5 volume region of the upper electrode, 5) BES-HAl – with a 2-fold increase in the content of HA in the 0,5 volume region of the lower electrode. Vegetation experiment lasted 30 days and was carried out with 2-fold repetition of the studied options. Statistical data processing was carried out using the Excel 2010 program.

Results. The average value of BEP when growing lettuce was 360±19 mV for BES-C, 405±2 mV for BES-P, 395±14 mV for BES-HA, 418±29 mV for BES-HAu, 387±4mV for BES-HAl. The average plant weight in BES was 71±19 g for BES-P, 53±2 g for BES-HA, 77±3 g for BES-HAu, 82±12 g for BES-HAl. The maximum value of BEP – 530 mV was typical for BES-P, which did not contain additionally added HA. At the same time, for this variant, a rather large spread of values of ~60 mV was noted during the growing season. Whereas for the BES-HAu variant with the addition of HA to the region of the upper electrode, the BEP spread did not exceed 30 mV, which is associated with more stable generation throughout the experiment and, probably, a more uniform ion diffusion.

The addition of HA made it possible to increase the voltage generation by 7-16% of the control, depending on the area of their introduction. The best result, an increase of more than 100 mV by the end of the growing season, was characteristic of the BES-HAu variant with additionally applied HA to the area of the upper electrode. It can be assumed that the transport of HA from top to bottom in the growth container plays a positive role in increasing the electrical characteristics of the BES by creating a more intense distribution of ions.

Conclusions: Thus, a certain effect of HA on the electrogenic properties of BES, which is due both to the diffusion of ions in the root environment, and to the BEP value, that reflects the nature of the course of metabolic reactions, and, accordingly, the state of plants, has been revealed.

The use of hybrid technology, which makes it possible to produce plant products and generate electricity by activating oxidative processes in the root environment, is an innovative direction with the prospect of application in the field of autonomous automated agricultural production. BES can perform a dual function, acting as a biosensor for phytomonitoring and providing power to environmental sensors and other low-power devices.

Acknowledgment. The research was funded by the grant of the President of the Russian Federation for state support of young Russian scientists - candidates of sciences (MK-4397.2022.5).

References:

1. Huang L., Angelidaki I. Effect of humic acids on electricity generation integrated with xylose degradation in microbial fuel cells, Biotechnology and bioengineering. 2008, vol. 100, no. 3, p. 413-422. DOI: 10.1002/bit.21786.
2. Kuleshova T.E., Galushko A.S., Panova G.G., Volkova E.N., Apollon W., Shuang Ch., Sevda S. Bioelectrochemical systems based on the electroactivity of plants and microorganisms in the root environment (review), Agricultural Biology. 2022, vol. 57, no. 3, p. 425-440. DOI: 10.15389/agrobiology.2022.3.425eng.
3. Kuleshova T. E., Ivanova A. G., Galushko A. S., Kruchinina I. Y., Shilova O. A., Udalova O. R., Zhestkov A.S., Panova G.G., Gall N. R. (2022). Influence of the electrode systems parameters on the electricity generation and the possibility of hydrogen production in a plant-microbial fuel cell, IJHE. 2022, vol. 17, no. 58, p. 24297-24309. DOI: 10.1016/j.ijhydene.2022.06.001.
4. Lovley D.R., Fraga J.L., Blunt-Harris E.L., Hayes L.A., Phillips E.J.P., Coates J.D. Humic substances as a mediator for microbially catalyzed metal reduction, Acta Hydrochim Hydrobiol. 1998, vol. 26, no. 3. p. 152–157. DOI: 10.1002/(SICI)1521-401X(199805)26:3<152:AID-AHEH152>3.0.CO;2-D.
5. Panova G.G., Udalova O.R., Kanash E.V., Galushko A.S., Kochetov A.A., Priyatkin N.S., Arkhipov M.V., Chernousov I.N. Fundamentals of Physical Modeling of "Ideal" Agroecosystems, Technical Physics. 2020, vol. 65. no. 10, p. 1563-1569. DOI: 10.1134/S1063784220100163

CZU:631.41(477) https://doi.org/10.53040/abap6.2022.29

MICROELEMENTS CONTENT IN CHERNIVTSI REGION

GUNCHAK M.
Chernivtsi branch of the state institution "Institute of soil protection of Ukraine", Ukraine
https://orcid.org/0000-0002-3521-8531, e-mail: gunchak00@ukr.net

The microelements content in Chernivtsi region agricultural plots study conducted. The soils of Chernivtsi region has a high provision of boron, manganese, copper and cobalt, molybdenum and very low content of zinc.

Purpose. The optimal mode of plant nutrition conducts not only macroelements and microelements too. They increase content of chlorophyll in leaves. The photosynthesis intensity increases. The plant breaths increase. The plant resistance against diseases increases too. The microelements need partially satisfies through the right usage of manure and fertilizers, but it is necessary to add these elements separately [1, 2]. So, the evaluation conducted for boron, manganese, copper, zinc cobalt and molybdenum content in Chernivtsi region soils.

Keywords: *soil, fertility, soil monitoring, microelements*

Materials and Method. Chernivtsi branch of state institution *"Institute of soil protection of Ukraine"* conducts researches for Chernivtsi region soils providing of microelements movable matters. The researches conducted as per determined methods in Technique for conducting agrochemical passportization of agricultural plots [3].

Results. There were observed 182.4 thous hectares agricultural plots during recorded period by Chernivtsi Branch of the State Institution "Institute of soil protection of Ukraine" since 2016 to 2020.

They have a high content of boron combinations 0.66 thous. ha and very high content by 181.7 thous, ha (99.7%) by the results of agrochemical observation of agricultural plots. The average content of movable boron consists by 1.22 mg/kg. It confirms the high microelements provision. The weighted average index of movable boron combination increased on 0,03mg/kg during the recorded period.

The manganese movable combinations divided in the following way: very low content - 2.3 thous. ha (1.3 %), low content - 2.1 thous. ha (1.2 %), with increased-74.1 thous. ha (40.6 %), high is 36,5 thous.ha (20.0 %),very high is 49.8 thous.ha (27.3 %). The weighted average index of manganese movable combinations consists of 20.2 mg/kg. It confirms very high provision. The highest average weighted index of manganese movable forms is in Hlyboka district. It consists of 22,75 mg/kg. The lowest content is in Kelmentsy district -12.5 mg/kg. The weighted average index increases from 19.43 to 20.2 mg/kg in comparison with previous observation tour during the recorded period.

The copper movable combinations content divides in following way: very low content 6.8 thous. ha (3,.7 %), low content 2.7 thous. ha (1.5 %), average is 5.0 thous. ha (2.7 %), higher is 14.7 thous. ha (8.1 %), the highest is 33.8 thous. ha (18.6 %), the most highest is 119.3 thous. ha (65.4 %).The average weighted index consists 0,.60 mg/kg. So the region's soils have enough provision of copper salts. The movable salt combination increases by 0.,04 mg/kg in comparison with previous observing tour during the recorded period.

The researched areas with zinc movable combinations divided in following ways: very low content-149,8 thous. ha (82.2%), low content 20,7 thous.ha (11.4 %), with average is 6.1 thous.ha., increased -3,5 thous.ha (1.9 %), higher is 1.7 thous,ha (0.9%), very high is 0.6 thous.ha (0.3 %). The zinc combination average weighted index consists of 0.57 mg/kg. So there is not enough zinc salts provision in regions' soils, so farmers are necessary to add micronutrient fertilizers with zinc content. The zinc movable combinations average weighted index decreases from 0.59 to 0.57 mg/kg during the recorded period in comparison with previous observation tour.

The cobalt movable compositions in observed areas divides in following way: with very low content - 13.2 thous. ha (7.2 %), with small content - 8.6 thous.ha (4.7 %), with average - 7.7 thous.ha (4.2 %), increased -15.0 thous. ha (8.2 %), higher 28.6 thous. ha (15.7 %),very high is 109.2 thous.ha (60.,0 %). The cobalt average weighted index consists of 0.79 mg/kg. The highest content of cobalt movable combinations prevails in regoin's soils.

The molybdenum movable combinations content observed areas divided in following way: very low content is 2.75 thous. ha (1.5 %), low content is 18.5 thous.ha., average is 60.0 thous. ha (329 %), increased is 62.,1 thous.ha (34.1 %), higher is 25.1 thous.ha (13.8 %), very highest is 13.9 thous. ha (7.6 %). The molybdenum movable content average weighted index consists of 0.19 mg/kg.

Conclusions. The average boron movable compositions consists of 1.22 mg/kg in Chernivtsi region by the results of agrochemical researches. The manganese average weighted index consists of 20.2 mg/kg. It conforms very high provision. The copper movable forms average weighted index consists of 0.60 mg/kg. It confirms very high provision. The zinc movable combinations weighted average index consists of 0.57 mg/kg. It conforms very low provision. The cobalt movable combinations average weighted index consists of 0.79 mg/kg. It conforms very high provision. The molybdenum movable content consists of 0.19 mg/kg. It conforms high provision.

References:

1. Gunchak M.V. Dynamics of humus content in Chernivtsi region soil. Problems and perspectives of realization and improve interdisciplinary science researches: abstracts III International scientific conference, t. Lutsk, 3rd June, 2022, p. 129-131 DOI: 10.36074/mcnd-03.06.2022.
2. Nazarenko I.I., Polchina S.M., Nickorych V.A., Soil study: textbook. Knygy-XXI. Chernivtsi. Ukraine.2004. 400 p.
3. Yatsyk I.P., Balyuk S.A., Technique for conducting agrochemical pasportization of agricultural plots. State institution "Soils Protection Institute of Ukraine", Kyiv, Ukraine 2019, 108 p.

CZU:595.78:634.83:632.9 https://doi.org/10.53040/abap6.2022.30

THE SYNTHESIS OF THE MINOR COMPONENT E7-C12Ac OF THE SEX PHEROMONE OF THE *Lobesia botrana*

JALBA Svetlana, ODOBESCU Vasilisa, ERHAN Tatiana
Institute of Genetics, Physiology and Plant Protection,
Chisinau, Republic of Moldova
e-mail: igpppheromones@gmail.com

This paper presents the synthesis of the minor component of the european grapevine moth, *Lobesia botrana* S. - (E)-7-Dodecenyl acetate after an synthesis scheme developed within IGPPP, it consists of 8 stages of synthesis. Rubber dispensers were impregnated with bicomponent compositions of different doses of obtained component and of main component. Pheromone traps was given to be tested in field trials to determine the biological effectiveness.

Key words: *european grapevine moth, minor component, synthesis, pheromone traps*

Introduction. The european grapevine moth, *Lobesia botrana* (Denis & Shiffermüller,1775) is the major pest of grapes (*Vitis vinifera* L.) in Central Europe, the Mediterranean basin and South America. This pest is also found in the Republic of Moldova because vineyards are wide spread on the land of our country. To generally ensure an adequate control of *Lobesia botrana*, it is necessary to monitor the population of this pest throughout the vegetation season. An ecologically harmless method successfully used in agriculture is the method of monitoring with the help of pheromonal traps [1].

The sex pheromone of *L. botrana*, which has been studied since the 1970s, consists of the main compound (7E,9Z)-7,9-dodecadienyl acetate plus at least four other compounds: (7E,9Z)-7,9-dodecadien-1-ol, (Z)-9-dodecenyl acetate, (E)-9-dodecenyl acetate, and 11- dodecenyl acetate. Further studies revealed new compounds that may have synergetic effects like (E)-7-dodecenyl acetate, etc [2].

In order to improve the biological activity of the sex pheromone against the populations of this pest on the territory of Republic of Moldova, we intended to synthesize the minor component (E)-7-dodecenyl acetate and to form bicomponent compositions with main component which will be given to be tested in field trials.

Materials and Method. Commercial chemical reagents were used in the IGPPP laboratory, Integrated Plant Protection for the synthesis of sex pheromone. For the purification of intermediate and final substances were used: vacuum distillation and chromatography on silica gel columns, their purity was tested with the help of thin layer chromatography. Some reactions and the final quality of the products was performed at the liquid gas chromatograph Agilent 8890. For synthesis were used different organic methods, such as: bromination, protection of the –OH group, alkylation in liquid ammonia, trans reduction to ethylene alcohol, isomerization in ethylendiamine, deprotection of the –OH group, acetylation.

Results. Synthesis scheme of the minor component of the sexual pheromone of the european grapevine moth (E)-7-Dodecenyl acetate:

$C_5H_{11}OH + HBr \rightarrow C_5H_{11}Br$ (1)

$C_5H_{11}Br + HC{\equiv}CCH_2OH \rightarrow C_5H_{11}C{\equiv}CCH_2OH$ (2)

$C_5H_{11}C{\equiv}CCH_2OH \rightarrow HC{\equiv}C(CH_2)_6OH$ (3)

$HC{\equiv}C(CH_2)_6OH \rightarrow HC{\equiv}C(CH_2)_6OR$ (4)

$HC{\equiv}C(CH_2)_6OR + C_4H_9Br \rightarrow C_4H_9C{\equiv}C(CH_2)_6OR$ (5)

$C_4H_9C{\equiv}C(CH_2)_6OR \rightarrow C_4\ H_9C{\equiv}C(CH_2)_6OH$ (6)

$C_4\ H_9C{\equiv}C(CH_2)_6OH \rightarrow$trans-$C_4H_9CH{=}CH(CH_2)_6OH$ (7)

trans-$C_4H_9CH{=}CH(CH_2)_6OH \rightarrow$trans-$C_4H_9CH{=}CH(CH_2)_6OCOCH_3$ (8)

The minor component (E)-7-Dodecenyl acetate was synthesized by the following procedure:

Bromination 1-pentanol with conc. HBr led to 1-bromopentanol(1) which, when was alkylated with propargylic alcohol in liquid ammonia, gave the acetylenic alcohol with the triple terminal bond (2). Its isomerization under the action of sodium ammonia and ethylenediamine leads to obtaining of acetylenic alcohol with a triple bond in position 7 (3) which is protected by interaction with 3,4-dihydropyran (4). Its alkylation with ethyl bromide leads to the lengthening of the chain by 2 carbon atoms (5), which upon hydrolysis gives the dodec-7-yn-1-ol alcohol (6), and upon reduction with the help of lithium aluminum hydride in tetrahydrofuran forms the trans -ethylene alcohol (E)-7-Dodecen-1-ol (7) which after the reaction of acylation become (E)-7-Dodecenyl acetate. From the literature it is known that this minor component is contained in an amount of approx. 7% of the sex pheromonal composition given by the authors [2]. So, doses of the minor component were chosen in a close range.

Compositions of the main component with different dozes of 5%, 10%, 15% of the minor component were prepared and were impregnated on rubber septas. This lure were placed in pheromone traps to be tested in field monitoring trials to determine the biological effectiveness for monitoring this pest.

Conclusions. The minor component of the sexual pheromone of the european grapevine moth *Lobesia Botrana* Schiff- (E)-7-Dodecenyl acetate was synthesized within IGPPP laboratory of Integrated Plant Protection. Bicomponent pheromonal blends of the main component were formed with different doses of the minor component and were impregnated on rubber septa forming lures.

They were given to be studied under field conditions the biological activity of the minor component within pheromonal composition for monitoring the population of this pest on the teritory of RM.

Acknowledgment. Research was carried out within the project of the State Program 20.80009.5107.19 “Strenghening capacities of forecasting and control of harmful organisms and phitosanitary risk analysis in integrated plant protection”, financed by the National Agency for Research and Development.

References:

1. Altimira F., Vitta N., and Tapia E., “Integrated Pest Management of Lobesia botrana with Microorganism in Vineyards: An Alternative for Clean Grapes Production”, in Grapes and Wine. London, United Kingdom: IntechOpen, 2021 [Online]. Available: https://www.intechopen.com/chapters/77973 Doi: 10.5772/intechopen.99153
2. Witzgall, Peter & Tasin, Marco & Buser, Hans-Ruedi & Wegner-Kiss, Gertrud & Marco-Mancebón, Vicente & Ioriatti, Claudio & Bäckman, Anna-Carin & Bengtsson, Marie & Lehmann, Lutz & Francke, Wittko. (2006). New Pheromone Components of the Grapevine Moth Lobesia botrana. Journal of chemical ecology. Vol. 31, No. 12, December 2005. Pag. 2923-32. DOI 10.1007/s10886-005-8404-1.

CZU:581.5:581.1 https://doi.org/10.53040/abap6.2022.31

THE GERMINATIVE REACTION AS A PHYSIOLOGICAL INDEX OF THE EFFICIENCY OF THE BIOSTIMULATORS IN PROTECTING PLANTS AT NEGATIVE TEMPERATURES

JELEV Natalia
Institute of Genetics, Physiology and Plant Protection, Chisinau, Republic of Moldova
https://orcid.org/0000-0002-1664-6055, e-mail:jelevnn@yahoo.com

Due to the global warming of the climate, plants are exposed to unfavorable conditions caused by both high temperatures and negatively low temperatures in different periods of development. Such abiotic stress events can cause fundamental changes in the functional state of plants or even negative impact with repercussions on plant productivity and the rural economy [1]. That is why, at present, the fundamental requirements of modern agriculture for specialists in this field is to ensure a guaranteed harvest under conditions of abiotic stress. For this purpose, it is necessary to integrate the methods of physico-chemical biology in ecological agriculture to obtain stable harvests.

In the territory of the Republic of Moldova, in general, plants suffer from winter frosts, drought and summer heat, which makes them much more vulnerable to pests, mycoses and other pathogens. Solving this problem by applying synthetic substances is already out of date, because it leads to the emergence of ecological crises. Obtaining an ecologically harmless harvest has become the primary aim for most producers. Research dedicated to studying the mechanisms of action of biologically active substances offers new opportunities in increasing the level of plant adaptation by inducing resistance systems with the help of biostimulators. Biostimulators condition the reactions, which improve the plants' resistance to different stress factors. Although biostimulators do not have pathogen-eliminating effects, they still contribute to increasing the genetic potential of plant resistance to fight infections through gene products and metabolites.

Among the harmless biostimulators for ecological agriculture and human health is *Reglalg*, extracted from algae. The most sensitive indicator of the plant's state under the influence of exogenous factors is the modification of germination parameters. A suitable model for studying the germination reaction is the seeds of plants that were previously treated with a biostimulator and were exposed to temperature shock. This is due to the fact that at the initial stages of ontogenesis plant seeds germinate quickly, having small sizes, which provides the exact establishment of the smallest changes in the germination processes. Therefore, the **purpose** of this study was to determine the effect of the treatment with the biostimulator *Reglalg* and temperature shock on the germination of seeds of winter wheat's genotypes grown in the fields in different years under different environmental conditions.

Keywords: *winter wheat, varieties, negative temperature stress, constitutive resistance*

Materials and Method. Scientific research was carried out within the Institute of Genetics, Physiology and Plant Protection (IGFPP), in the Plant Biochemistry laboratory in the years 2019 - 2021. Seeds of winter wheat varieties Moldova 614, Moldova 5, Kuialnik, Lautari, Moldova 66 were used as objects of research. The seeds of these varieties grew in optimal, dry and rainy conditions. In each summer of 2019, 2020 and 2021 from the experimental, field of the IGFPP the seeds were collected and involved in the experiments.

The experiments consisted in the treatment of seeds by spraying them with the biostimulator *Reglalg*, observing the proportion permissible in agriculture. Seeds are treated with a *Reglalg* biostimulator with a concentration of 1/200, then soaked in water for 36 hours at a temperature of + 4°C, then subjected to temperature stress for a specified time [2].

In the next step, the seeds were left for 16 hours at a stress temperature of -6°C. After that, they were placed in optimal conditions for germination and after 5 days. The following indicators were determined: germination indicators (germination period, germination energy, total germination); growth parameters (length of the main root, length of the coleoptile and leaf); quantitative indicators (fresh and dry biomass of roots and shoots, water content in germinal roots and shoots). To estimate the biological effect of the *Reglalg* biostimulator and the characteristics of the kinetic germination reaction, the relative germination of experimental seeds was compared with the control at regular intervals.

The obtained results were processed using the STATISTICA 10 software package (Duncan test, t-test, Spearman Rank Order Correlations, etc.).

Results. Analysis of the effect of negative temperature stress on germination and seedling growth showed a significant reduction in germination percentage and plant growth parameters in common wheat genotypes tested both in the variants treated with the biostimulator and in the untreated ones. Comparing the germination of seeds of wheat varieties exposed to the biostimulator *Reglag* and the stress of negative temperatures with control, we note that under the influence of *Reglag,* the percentage of germination was stimulated and, accordingly, the length of the shoot and the roots of dilution seedlings increased with an almost unchanged number of roots. In the experimental variants, the germination modification was due to the effect of the biostimulator and thermal shock. The effect of stimulating the process of germination and growth of seedlings took place on seeds treated with a biostimulator *Reglalg* with a concentration of 1/200 under the action of a low temperature -6°C during 16 hours. In the seeds of the control variant, the effect of temperature stress causes a more pronounced inhibition of germination.

The results obtained indicate that the biostimulator *Reglalg* modifies the thermotolerance and the ability of plants to recover damage caused by heat stress in the metabolism that ensures seed germination. The obtained results demonstrated that the thermotolerance of seedlings obtained from seeds treated with the biostimulator *Reglalg* increases. At the same time, it is shown that the reaction of germination of seeds of different wheat varieties to thermal shock is specific. Thus, there is a prospect of using the seed germination reaction under strictly controlled conditions to test the effectiveness of growth regulators and constitutive thermotolerance of different wheat varieties. In this way, the developed method can be proposed both to test the action of plant growth regulators and in breeding to determine the differences between the thermotolerance of genetically related plants. These results indicate that the treatment of wheat seeds before sowing with the biostimulator *Reglalg* provides an increase in plant resistance to extreme temperatures, fungal diseases and pests, and for this reason, the use of natural preparations is considered an important aspect of ecological agriculture.

Conclusions.

1. Based on the action of shocking with negative temperatures on the seeds at the initial stage of germination, it is possible to differentiate varieties, according to the constitutive (inherent) resistance of the variety and triage of the growth regulators that ensure thermotolerance.

2. The biostimulator Reglalg activates the germination of seeds exposed to the stress with negative temperatures and has an immunomodulatory effect, as well as antistress or self-defense activity of the cultivated plant.

3. After shocking with negative temperatures the varieties Moldova 5, Lautari, and Moldova 66 are distinguished by higher percentage values of seed germination, which demonstrates tolerance to thermal stress.

Acknowledgment. Research was carried out within the project of the State Program „20.80009.7007.07" "Determining the parameters that characterize the resistance of plants with the different level of organization to the action of extreme temperatures in order to reduce the effects of climate change", financed by the National Agency for Research and Development.

References:

1. Dascaliuc, A., Jelev, N., Ralea, T., et al. Mobilization of reserve substances of seeds for germination and growth of seedlings in wheat varieties with different frost resistance. In: Buletinul AŞM. Ştiinţele Vieții. 2020, vol. 341, nr. 2, pp. 54-67. ISSN 1857-064X.
2. Kleșnina L. Physiologically active substances inducers of plant immunity. The conference scientists that „Genetics and Physiology plant resistance". 2011, p. 27. ISBN 978-9975-78-994-3.

CZU:631.53.02+581.48(575.1 https://doi.org/10.53040/abap6.2022.32

VIABILITY TESTING AND GERMINATION CAPACITY

KHUDOYBERDIEVA S.A.
Institute of Botany, Academy of Sciences, Tashkent, Uzbekistan,
https://orcid.org/0000-0002-8948-1239, e-mail: xudoyberdiyevas35@gmail.com

Для большинства растений прорастание и появление семян являются первым этапом эффективного производства. Ключом к укоренению растения является жизнеспособность семени 2 его способность прорастать и появляться в почве. Затем они помогают растениеводам сделать несколько вариантов управления, таких как выбор нормы высева и предотвращение посадки сорняков.

Ключевые слова: банк семян, проверка на всхожесть, жизнеспособность семян, всхожесть.

For the majority of plants, germination and emergence of the seed is the first stage in effective production. The key to plant establishment is a seed's viability—its capacity to germinate and emerge in soil. These then assist plant growers in making several management choices, such as choosing seeding rates and avoiding weed planting.

Keywords: *seed bank, germination testing, seed viability, germination capacity.*

The importance of ex situ conservation has been increasingly recognized in international treaties and regulations in response to the present biodiversity problem. If seeds are of excellent quality and have reached their peak viability, seed banks are an effective strategy to preserve biodiversity. However, there is little data on seed viability in botanic garden seed banks despite the large number of ex situ facilities that have been developed [1].

The viability and quality of the harvested seeds must be under control for effective administration of the seed bank collection [1, 3]. A reliable germination technique must be created for each target species before doing additional germination experiments to track changes in viability. The following four standard germination conditions are commonly applied to a small number of seeds (usually five seeds for each treatment) in the absence of any information of a species' germination needs [2].

At least three months following seed harvest and before storage, tests were conducted. Germination testing and non-germinated seed analyses made up the viability testing process (see ISTA 2006). 100 seeds per accession (or fewer depending on the availability of seeds) that seemed to be viable (well-shaped vs seeds that are deformed, empty, immature, or show indications of predation) were tested and divided into two or four samples. Seeds were put after 24 hours of soaking in distilled water. Insert 9 cm glass Petri dishes lined with a moistened filter, paper disk for a deionized water filter. Each day, seeds were checked, then when the radicle became apparent, germination was noted. One month after the final seed germinated, the germination testing was stopped. Germinated seeds were taken out and put in pots for growth following each count. and expansion. The seeds that failed to sprout were cut test to determine the quantity of fresh, moldy empty, (dead), or underdeveloped seeds. Pre-treatments initial testing on the germination conditions (20 C; 12/12 h, darkness/light) was done. If seeds did not germinate or the outcomes were less than 75%, new treatments should be tried. For several species, pre-treatments were necessary. These included scarifying seeds mechanically or with sulfuric acid, applying gibberellic acid (GA3; 100–500 mg/l), boiling and soaking seeds, cold stratification at 4 C (30–90 days), or alternate warm/cold stratification.

The entire amount of germination capacity (GC) was determined as the total number of seeds germinated divided by the total number of tested seeds minus unviable (empty or dead) seeds (Gosling 2003). Seed viability (SV) was calculated as the number of germinated seeds plus the number judged viable from the cut-test, which is expressed as a percentage of the total (Offord et al. 2004; Crawford et al. 2007). SV not only offers data on the percentage of viable seeds in the collection, but can also serve as a more impartial standard for evaluating the seed collections' quality in comparison for species with severe seed dormancy, with GC. The outcomes of germination experiments are displayed according to the protocol that is best suitable for each species. Data on germination were collected as part of the standard seed bank testing, hence they cannot be used to analysis due to the diversity of the testing circumstances [3].

References:

1. Godefroid Sandrine, Ann Van de Vyver, Thierry Vanderborght Germination capacity and viability of threatened species collections in seed banks May 2009 Biodiversity and Conservation 19(5): 1365-1383.
2. Volis Sergei Plant Conservation. The Role of Habitat Restoration. Kunming Institute of Botany, Chinese Academy of Sciences. 2016.
3. Ferrando-Pardo Inmaculada, Ferrer-Gallego Pablo & Laguna Emilio Lumbreras (2016): Assessing the conservation value of ex situ seed bank collections of endangered wild plants, Israel Journal of Plant Sciences, DOI: 10.1080/07929978.2015.1125676.

CZU:631.811.98:[547+577.1](476) https://doi.org/10.53040/abap6.2022.33

PARA-AMINOBENZOIC ACID DERIVATIVES AS POTENTIONAL PLANT GROWTH REGULATORS

LISOUSKAYA Maryna, MIKHALCHUK A., GONCHARUK Violetta, ZOTOVA Galina, POPOVA Maria
The Institute of Bioorganic Chemistry of The National Academy of Sciences of Belarus, Republic of Belarus
e-mail: goncharuk@iboch.by

Plant growth regulators (PGRs) are widely used in agriculture and horticulture to increase crop production. Conventional synthetic PGRs such as 2,4-dichlorophenoxyacetic acid having harmful effects on the environment and plant health [3], an important task for researchers is to develop alternative innovative plant growth regulators. Natural compounds extracted from plants or produced by bacteria rapidly degrading and being of limited use, PGRs based on synthetic analogs of natural substances or active pharmaceutical agents are considered to be more effective [3]. One of the natural compounds using as a building block in the development of new biologically active substances including PGRs is *para*-aminobenzoic acid (PABA). PABA is a well-known precursor of folic acid and exhibits a wide range of biological activities: antioxidant, antibacterial, antimutagenic, anticoagulant, protective against UV-irradiation [1]. It is also known about the role of PABA in plant thermotolerance and its action as chemical inducer of systemic acquired resistance against plant pathogens [1]. Some PABA derivatives have an auxin like effect. For example, PABA amides containing glycine and glutamic acid residues demonstrate growth stimulating activity due to an increase in the content of formyltetrahydropteroylglutamate (for *Raphanus sativus* and *Triticum aestivum*) [2]; homologous derivatives of PABA containing a phenylureide fragment stimulate the growth of monocotyledonous plants (for example, *Triticum aestivum*) [4]; and 2-hydroxyethylammonium salt of PABA has a stimulating effect on the growth and development of the root system of *Arabidopsis thaliana* [1]. Therefore, the **purpose** of the work is to obtain PABA derivatives and study their growth stimulating and protective activity on agricultural crops seeds.

Keywords: *Para-aminobenzoic acid, PABA derivatives, growth-regulating and protective activity*

Materials and Method. PABA derivatives with the general structural formula 4-$R^1NHC_6H_4COR^2$ were obtained, where R^1 = H, R^2 = $NHCH_2CH_2COOH$ (**1**), R^1 = H, R^2 = $NHCH(CH_3)COOH$ (**2**), R^1 = H, R^2 = $NHCH(CH_2OH)COOH$ (**3**), R^1 = H, R^2 = $NHCH_2CH_2OH$ (**4**), R^1 = C_3H_7CO, R^2 = OH (**5**), R^1 = $HOOCCH_2CH_2CO$, R^2 = OH (**6**), R^1 = $HOCH_2CO$, R^2 = OH (**7**), R^1 = $HOCH(CH_3)CO$, R^2 = OH (**8**), R^1 = C_3H_7CO, R^2 = $NHCH_2CH_2OH$ (**9**), R^1 = C_3H_7CO, R^2 = $O^-NH_3^+CH_2CH_2OH$ (**10**). Under laboratory conditions, the effect of presowing treatment of the synthesized PABA derivatives **1-10** on the growth and development of amaranth *(Amaranthus spp.)*, cucumbers *(Cucumis sativus)*, and tomatoes *(Solanum lycopersicum)* seeds was studied. Seeds were soaked in aqueous solutions of derivatives **1-10** at concentrations of 10^{-4} M and 10^{-6} M in Petri dishes on a double layer of filters in three repetitions. Water was used as a control and PABA was used as a reference compound. To assess the morpho-physiological state of plants after exposure to the studied compounds, growth parameters were measured: germination energy, seed germination, stem and root length, accumulation of fresh and dry mass of seedlings. The protective properties of PABA derivatives were studied on cucumber seeds as a heat-loving crop under conditions of low positive temperature (5°C).

Results. Soaking amaranth seeds in solutions of the synthesized compounds (10^{-4} M, 10^{-6} M) increased their germination compared to the control (water). PABA, **4** and **6** at the concentration of 10^{-4} M activated germination by 43% compared with the control. Compounds **4** and **9** at the concentration of 10^{-6} M increased the germination of amaranth seeds like PABA. Compound **5** showed the highest activity (60% higher than the control).

Compounds **1**, **2**, **4**, and **6** at the concentration of 10^{-6} M activated tomato seed germination energy by 11, 51, 29 and 33% respectively. PABA decreased tomato seeds germination by 7% (10^{-6} M) and 14% (10^{-4} M). On the contrary, its derivatives **1**, **2**, **4**, and **6** at the concentration of 10^{-6} M contributed to an increase in seed germination by 15, 33, 24, and 11%, respectively.

Both *para*-aminobenzoic acid and its derivatives did not have a significant effect on the accumulation of wet and dry weight of 10-day-old tomato plants. An increase in dry matter by 11% was observed only when using compounds **7** (10^{-4} M) and **9** (10^{-6} M).

Used cucumber seeds are characterized by good sowing qualities. As a result, the energy of seed germination in all variants was high and amounted to 97% in the control and 93-100% for the tested compounds. Under the influence of a low positive temperature (5°C), the seeds, which were soaked in solutions of the tested substances, germinated albeit with some delay. The PABA derivatives used at a lower concentration (10^{-6} M) were more effective than the PABA itself.

The study of the effect of the tested compounds on the morpho-physiological parameters of cucumber seedlings also revealed their significantly higher biological effectiveness compared to PABA. Thus, compound **1** increased the growth processes of the stem of cucumber plants by 17%, **4** by 13%, **5** by 15% compared to the control at the concentration of 10^{-6} M. The increase in the measured parameter when using PABA at the concentration of 10^{-4} M was 13%, in 10^{-6} M was at the control level.

Compounds **2**, **3**, **7**, and **9**, also used at a concentration of 10^{-6} M, most actively influenced the root formation of seedlings. Under their influence, the length of the roots of cucumber seedlings increased on average by 22, 17, 22, and 11%, respectively, relative to the control. Under the action of PABA (10^{-4} M), the root length was less than the control by 21%, when using a concentration of 10^{-6} M, the result was within the experimental error.

The greatest increase in fresh weight of cucumber plants was noted as a result of exposure to **5** (10^{-6} M), which amounted to 119% of the control and was higher than the same parameter for PABA (by 17% at 10^{-6} M and by 15% at 10^{-4} M).

The accumulation of dry mass of cucumber seedlings was most actively stimulated by compounds **1**, **2**, **5**, **6**, and **9** (10^{-6} M) – by 17, 20, 22, 23 and 18% respectively.

Conclusions: The obtained results indicate that some of the synthesized derivatives have a higher biological activity than PABA itself. Screening studies show the promise of the obtained derivatives of PABA as growth regulators and plant protection agents.

Acknowledgment. State Committee on Science and Technology of the Republic of Belarus (grant Х22МЛДГ-005) financially supported this work.

Reference:

1. Crisan, M. E., Bourosh, P., Maffei, M. E., Forni, A., Pieraccini, S., Sironi, M., & Chumakov, Y. M.. Synthesis, Crystal Structure and Biological Activity of 2-Hydroxyethylammonium Salt of *p*-Aminobenzoic Acid, PLoS ONE, 2014, vol.9, №7, p. e101892. doi:10.1371/journal.pone.0101892.
2. Nonomura, A. M., Nishio, J. N., Benson, A. A. Methods and compositions for enhancing formyltetrahydropteroylglutamate in plants. Patent WO 01/56385 A1. 2001.
3. Sumalan, R.-L., Croitor, L., Petric, M., Radulov, I., Bourosh, P., Sumalan, R.-M., & Crisan, M. p-Aminobenzoate Organic Salts as Potential Plant Growth Regulators for Tomatoes, Molecules, 2020, vol.25, №7, p. 1635. doi:10.3390/molecules25071635.
4. Yonova, A. P. Synthesis and Biological Activity of Some Amide Derivatives of 4-(Amino- and Phenylureido) Benzoic Acids, ComptesRendus de l'AcademieBulgare des Sciences. 2002, vol.55, №6, p.49–54.

CZU:633.15:631.53:57.084 https://doi.org/10.53040/abap6.2022.34

INFLUENCE OF HEAT SHOCK ON MAIZE SEEDS GERMINATION BY CHANGES IN STARCH CONTENT

MASHCENKO Natalia*, BOROVSKAIA Ala**, IVANOVA Raisa***
Institute of Genetics, Physiology and Plant Protection, Republic of Moldova
**https://orcid.org/0000-003-1869-4357, **https://orcid.org/0000-003-1869-4357,*
***https://orcid.org/0000-0002-2554-2039, e-mail: mne4747@mail.ru*

Higher plants, including *Zea mays*, exposed to excess heat, at least 5 °C above their optimal growing conditions, exhibit a characteristic set of cellular and metabolic responses required for the plants to survive under the high-temperature conditions. These effects caused many physiological changes in mobilization of seed reserve substances and starch consumption for germination. The starch content is one of the main quality indicators of maize seeds. The function of starch as reserve polysaccharides, is to supply energy to the immature, non-photosynthetic plantlets that occurs during the seed germination. The study of changes in reserve substances mobilization, including used starch, during germination of intact and heat shocked seeds could provide the possibility to development the rapid procedure of evaluation the intrinsic resistance of seeds to non optimal temperatures. Knowledge about the mobilization of reserve substances from maize hybrids selected in the Republic of Moldova during germination and their modification under influence of high temperature and natural regulators of growth is very limited. In this regard, **the purpose** of this work was to study the changes in starch content in correlation with reserve substances mobilization for the germination of maize seeds under the influence of supraoptimal temperature and genistifolioside as a natural regulator of growth.

Keywords: *Zea mays, maize seed, germination, starch, genistifolioside*

Materials and Method. Maize seeds of four hybrids Porumbeni 180 (P180), Porumbeni 369 (P369), Porumbeni 383 (P383) and Porumbeni 458 (P458), which differs by physiological characteristics, were generously contributed by the „Porumbeni" Institute of Crop Science in frame of scientific cooperation contract. The purified extract from the aerial part of the broom-leaved toadflax *Linaria genistifolia* (L.) Mill, which contains the sum of iridoid and flavonoid compounds, called genistifolioside, was used as natural regulator of growth (Mashcenko et al., 2015).

The influence of heat shock on maize seeds germination was evaluated by changes in total reserve substances and in starch content. The procedure included following steps: a) soaking seed of maize in water (control batch) or in the solution of genistifolioside at concentrations of 0.001% and 0.005%; b) heat shock by temperature at 50°C, during 30 min; c) seeds germination in optimal conditions and germination energy determination according to the international rules (ISTA, 2017); d) measure of roots and shoot lengths; e) roots and shoots separation from seeds; f) drying the separated biomasses; g) calculation of reserve substances mass and its utilization for germination of intact and exposed to shock seeds; h) determination of reserve substances percentage that was utilised for respiration (Dascaliuc et al., 2020); i) evaluation of starch content in seeds until and after germination, using the Evers polarimetric method (IS0 10520: 1997, 2019); j) reveal the possible correlation between determined indices by Excel software.

Results. The initial starch content in maize seeds of tested hybrids varied from 64.5% to 75.4% of dry mass. The highest amount of starch was evaluated in seeds of the P383 hybrid, the lowest – in hybrid P180. During germination, there was a decrease in the amount of starch by 6.7-7.6% in the seeds of hybrids P458 and P383, while the mobilization of this reserve substance from the seeds of hybrids P180 and P369 was significantly higher and amounted to 10.0-11.0% of the initial starch content. Previo-us studies have shown similar results, that when germinating starchy seeds (*Sorghum bicolor, Chloris virgata,* etc.) reduced only 10-13% of the starch content (Zhao et al., 2018).

Seeds treated before germination with the natural regulator of growth consumed 1-5% less starch for germination that indicated less spending of other reserve substan-ces for respiration and energy support of germination. Thus, genistifolioside contribu-ted to increase in the metabolic efficiency of these hybrids, that was also confirmed by our data. However, the positive impact did not significantly differ between 0.001 and 0.005% concentrations of genistifolioside solution.

Seeds exposed to heat shock at 50ºC utilized 1.3-2.8 times more starch to maintain germination processes compared to the control seeds. The amount of starch mobilized from the endosperm of shocked maize seeds raised to 14.0-22.0%. In terms of the increase in starch consumption, the P458 hybrid was more heat sensitive, followed by the P369 and P383 hybrids; and the less affected was the P180. The application of genistifolioside treatment before heat shock, unfortunately, did not led to an increase in the efficiency of metabolic process in all shocked hybrids, which can be explained by the influence of temperature as the predominant factor.

During seed germination due to the expenditure on respiration and energy support, the dry mass of growing roots and shoots is always lower than the mass of all mobilized substances. The study of correlation dependences of the starch used in the process of germination and other reserve components showed that there are a direct correlation between the spent starch and the amount of reserve substances, which have gone to the growth of roots and shoots. This pattern was observed for both intact seeds and for seeds treated with heat shock and natural regulator of growth - genistifolioside. The Pearson coefficient of correlation between the amount of spent starch and biomass of shoots and roots, depending on the tested hybrid of maize, changed from 0.7508 (P369) to 0.9143 (P180). A strong correlation relationship between the amount of mobilized starch and metabolic efficiency was also established for the P180 hybrid, coefficient of correlation was equal to 0.8562.

Conclusions. The study of changes in content of starch revealed the participation of this reserve substance in the physiological processes of maize seed germination. The more starch was spent on the germination process, the growth of roots and shoots was more intense, and metabolic efficiency was higher. According to the results obtained in this work, the P180 hybrid was most resistant to the effect of high temperature compared to other tested hybrids.

Acknowledgment. The authors gratefully acknowledge colleagues from the „Porumbeni" Institute of Crop Science, who kindly provided us with the maize seeds.

Research was carried out within the State Program no. 20.80009.7007.07 "Determining the parameters that characterize the resistance of plants with the different level of organization to the action of extreme temperatures in order to reduce the effects of climate change" for 2020-2023, financed by the National Agency for Research and Development.

References:

1. Dascaliuc A., Jelev N., Ralea T., et al. Mobilization of reserve substances of seeds for germination and growth of seedlings in wheat varieties with different frost resistance. *Buletinul AȘM. Științele vieții*. 2020, no. 2 (341), p. 54-66.
2. IS0 10520:1997(E). International standard. Native starch. Determination of starch content. Ewers polarimetric method. Reviewed and confirmed in 2019. www.isostandards.com.au.
3. ISTA (International Seed Testing Association). International rules for seed testing. Chapter 5: The germination test. 2017. DOI: https://doi.org/10.15258/istarules.2017.05.
4. Mashcenko N., Gurev A., Lupascu G., Gorincioi E. Iridoid glycosides from *Linaria genistifilia (L.*) Mill. in biological control of soil-borne fungal pathogens of wheat and some structure consideration. *Chemistry Journal of Moldova. General, Industrial and Ecological Chemistry*. 2015, vol. 10, no.1, p. 57-63.
5. Zhao M., Zhang H., Yan H., Qiu L., Baskin C.C. Mobilization and role of starch, protein, and fat reserves during seed germination of six wild grassland species. Front. Plant Sci. 2018, vol. 9, no. 234. DOI: 10.3389/fpls.2018.00234.

CZU:634.11.076:631.563 https://doi.org/10.53040/abap6.2022.35

EFFECT OF STORAGE TECHNOLOGY ON THE TITRATABLE ACIDITY OF APPLES

NICUTA Al.*, BUJOREANU N.**
Institute of Genetics, Physiology and Plant Protection, Chisinau, Republic of Moldova
**https://orcid.org/0000-0003-3964-130X, **https://orcid.org/0000-0001-7997-9757*
e-mail: alexnicuta11@gmail.com

The gustatory properties of fruits, especially the sweet taste, are due to the differences not only in the sugar content, but also in other substances, primarily organic acids. Along with sugars, organic acids are substances used intensively in the biochemical reactions characteristic of metabolic processes, a fact that leads to the decrease of the energy value of the fruits and to the modification of their taste. In this context, the storage technologies applied aim to ensure measures to slow down the processes that stimulate the oxidation of biochemical compounds, in order to maintain the quality of the fruit. **The purpose** of this study was to evaluate the post-harvest influence of the Fitomag preparation on the change in the titratable acidity value of apple fruits, grown under the conditions of the Republic of Moldova.

Keywords: *titratable acidity, storage technology, Fitomag, quality of apple fruit*

Materials and Method. Apples 'Idared', 'Golden Delicious', 'Florina', and 'Reinette 'Simirenko' were collected in "Lefcons-Agro SRL'', Floreni district, Ungheni region, Republic of Moldova. The apples were harvested in the stage of maturity. After the harvesting, the same day, the apple fruits were transported to the experimental base "Carpotron" of the Institute of Genetics, Physiology and Plant Protection (Chisinau, Republic of Moldova). The fruits were stored for 150 days in experimental refrigeration rooms (KHT-1M) according to the scheme:

1. **Normal atmosphere (NA) + control (non-treated fruits**) (O_2 - 21 %, CO_2 - 0.03 %). Apples were stored at 1°C and relative air humidity of 85-90%;

2. **NA+Fitomag**. A part of the fruits were treated the day after harvesting with the ethylene biosynthesis inhibitor Fitomag and subsequently stored under normal atmospheric conditions, as in the case of the control fruits;

3. **Controlled atmosphere (CA) + control (non-treated fruits**) (O_2 - 3 %, CO_2 - 5 %). Apples were stored at 2°C and relative air humidity of 92-95 %.

The laboratory investigations were performed at the Institute of Genetics, Physiology and Plant Protection, Chisinau, Republic of Moldova.

The principle of the working method. The extract obtained (50 ml) as a result of desugaring the biological material was transferred into a porcelain mortar. After that it was left on a water bath to evaporate the extract to a drop (1-2 ml). Next, a little distilled water was added, stirring until a mixture was formed. After that, this mixture was filtered through a Schott funnel. The obtained extract was quantitatively transferred into a volumetric flask, the volume being adjusted to 50 ml with distilled water. After homogenization, 20 ml of solution was transferred from this mixture into a conical flask for titration. 3-4 drops of phenolphthalein were added and titrated with 0.1 N sodium hydroxide solution with continuous stirring until a pink color was obtained which did not disappear for 30 seconds. The titratable acidity obtained was expressed in malic acid. The obtained results were subjected to mathematical analysis according to Microsoft Excel program package.

Results. The content of organic acids constitutes a criterion for appreciation and knowledge of the metabolic processes that take place during the period of growth, ripening and preservation of fruits. Organic acids present in a high proportion in unharvested agricultural products are quantitatively reduced after harvesting, as a result of their use in the Krebs cycle, neutralization or transformation into other organic compounds, which have a substantial influence on the development of physiological diseases in the storage process. The most important organic acids distributed in fruits are: malic acid, citric acid, tartaric acid and oxalic acid, the majority in apples being malic acid (more than 70 %). Malic acid, the main organic acid found in apple fruit, is a main substrate for aerobic respiration, which usually decreases during cold storage.

The obtained results demonstrated that during the storage period, both in the untreated fruits, stored in NA conditions, and in the case of those treated with the Fitomag preparation, stored in the same conditions, there was a visible tendency to decrease titratable acidity values. The presented results show that the biodegradation process of organic acids was largely conditioned by the biological particularities of the cultivar and the applied storage technology.

According to the content of titratable acids, the untreated fruits of the Golden Delicious cultivar were characterized by their intense biodegradation during the storage period, which explains to a large extent the appearance of physiological disorders in the form of scald. The fruits of the Renet Simirenko cultivar at the time of harvesting were distinguished by the highest value of titratable acidity. However, during storage, acidity decreased the most. The untreated fruits of the Idared cultivar were characterized by moderate biodegradation of organic acids, which explains the absence of physiological disturbances in them.

At the end of the storage period, the content of titratable acids in the fruits treated with the Fitomag preparation exceeded by 0.03-0.16 % the values recorded in the control fruits, which indicates that the metabolic processes in the treated fruits proceeded more slowly. In the treated fruits, the lowest rate of biodegradation of organic acids in the storage dynamics was detected in the Renet Simirenko cultivar, recording a decrease of 8.74 % compared to the initial content. In the control variant, a greater amount of titratable acids were consumed in the fruits of the Florina and Renet Simirenko cultivars, which explains the appearance of tissue browning during the storage period.

The losses of titratable acids are also strongly slowed down with the decrease in O_2 concentration and the enrichment of the air in the cold room with CO_2. This fact can be explained by the CO_2 effect of inhibiting the activity of decarboxylating enzymes in the respiratory cycle, thus contributing to maintaining acidity. It was experimentally demonstrated that apples stored at a con-centration of 3 % O_2 and 5 % CO_2 contain more malic acid, a fact also confirmed in our research, which proves a direct dependence between the rate of decrease of titratable acidity in fruits apple taken in the study and the content of O_2 and CO_2 in the cold room. Depending on the cultivar, the content of titratable acids in the fruits kept under CA conditions exceeded by 0,05-0,13 % the values recorded in the treated fruits and by 0.20-0.22 % the values recorded in the control fruits.

At the end of the storage period, different titratable acidity values were detected in the fruits of the researched cultivars. In the case of the treated fruits, the highest value of this indicator was recorded in the fruits of the Renet Simirenko cultivar - 0.94 %, followed by the Idared cultivar - 0.56 %. For the Florina and Golden Delicious cultivars, this indicator was - 0.45 % and 0.40 %, respectively. Under CA conditions, a slower biodegradation of titratable acids was found in the fruits of the Golden Delicious cultivar, registering at the end of storage an acidity value of 0.53 %, which shows a decrease of 1.85 % compared to the initial content.

Conclusions.

1. Analyzing titratable acidity values in fruits during the storage period, it can be mentioned that this is a genetic indicator of the cultivar, but which can vary from year to year depending on the biological particularities of the cultivar and the storage technology applied.

2. The increased content of titratable acids in the treated fruits compared to the untreated ones, found at the end of the storage period, confirms that the Fitomag preparation slowed down the biodegradation of the biochemical compounds involved in the metabolic processes. Consequently, the fruits have maintained their quality at a high level.

3. The storage technology by applying the Fitomag preparation can compete with that of storage in CA conditions, given the fact that it has a number of advantages: minimal investment in equipment, simplicity in application and low electricity consumption.

Acknowledgment. Research was carried out within the project of the State Program **20.80009.5107.18** “Targeted formation of quality and immune system in fruits of late varieties of plum intended for long-term storage”, financed by the National Agency for Research and Development.

CZU: [633.88+615.322]:581.9:58.07 https://doi.org/10.53040/abap6.2022.36

PHARMACEUTICAL POTENTIAL OF SOME PLANT CELL LINES IN AMARANTHUS AND SCILLA CALLUS

NITU Ionut[1], MITOI MONICA Elena[1], BANCIU Cristian[1],
DANAILA-GUIDEASIL Vana[2],
[1] The Bucharest Institute of Biology of the Romanian Academy, Romania,
[2] University of Agronomic Sciences and Veterinary Medicine Bucharest, Romania
e-mail: cristi.banciu@ibiol.ro

The purpose of the research is the analysis of the pharmaceutical potential of two plant species, namely *Amaranthus retroflexus* and *Scilla autumnalis*, which are currently not exploited in this field.

The main objectives of the study are: the extraction and quantification of certain secondary metabolites, the antioxidant activity, as well as the protein content belonging to the two chosen species.

The biological material used consisted of 5 calluses of *Amaranthus retroflexus* and 5 calluses of *Scilla autumnalis*. Callus induction was carried out starting from fragments of somatic tissue obtained by in vitro regeneration of shoots from the seeds of the 2 species.

The results of this study demonstrated that *Amaranthus retroflexus* and *Scilla autumnalis* could be used in the pharmaceutical industry due to their content in certain secondary metabolites of interest such as polyphenols, tannins, triterpenes but also primary metabolites such as proteins. Both species had a total lack or an extremely small amount of flavonoids demonstrated by the lack of specific color resulting from the analysis. The more abundant amount of polyphenols, triterpenes and proteins was identified in *Scilla autumnalis* and tannins were more abundant in the case of *Amaranthus retroflexus* species.

The antioxidant activity present in both studied species was highlighted by the TEAC method, low antioxidant activity by the CUPRAC method. DPPH and FRAP methods did not reveal antioxidant activity for these two types of callus.

CZU:634.11:632.9:632.7.04 https://doi.org/10.53040/abap6.2022.37

SYNTHESIS OF THE MINOR COMPONENT E9-C12OH OF THE SEX PHEROMONE OF THE CODLING MOTH

ODOBESCU Vasilisa, JALBA Svetlana, ERHAN Tatiana
Institute of Genetics, Physiology and Plant Protection,
Chisinau, Republic of Moldova
e-mail: igppppheromones@gmail.com

In this paper is presented the synthesis of the minor component (E)-9-Dodecen-1-ol of the codling moth, *Cydia pomonella* L. The synthesis scheme consists of 7 stages. Compositions with the main component and different doses of the minor component were impregnated on rubber dispenser. Pheromone traps was given to be tested in field monitoring trials to determine the biological effectiveness.

Codling moth (*Cydia pomonella*) is the serious insect pest of apple fruit in different parts of the world. A remarkable damage (80%) of the fruit has been observed due to the insect in temperate parts of all major continents [3]. While being an economically important pest of the apple worldwide, it requires some level of control. One of the control methods is monitoring with the help of pheromonal traps, which are used worldwide against the codling moth. The pheromone blend of the codling moth has been identified and codlemone (E,E)-8,10-dodecadien-1-ol; E8E10-12OH) was found as the major sex pheromone component. Minor pheromone compounds have been identified as well, some of which were found to enhance male antennal response: a saturated alcohol, dodecanol (12OH), two unsaturated alcohols: (E)-8-dodecenol (E8-12OH) and (E)-9-dodecenol (E9-12OH), codlemone aldehyde ((E,E)-8,10-dodecadienal; E8E10-12Ald), etc [2]. There are reported examples of pheromone blend differences among and within populations of a single species. The study of geographic variation in pheromone composition may be helpful to develop efficient trapping schemes for accurately monitoring this economically important pest [1].

Key words: *codling moth, minor component, synthesis, pheromone traps, rubber dispenser*

The aim of our study was the synthesis of the minor component (E)-9-Dodecen-1-ol of the codling moth, *Cydia pomonella* L., to be studied further the influence of this minor component within the pheromonal composition on its atractivness for monitoring populations of this pest in the Republic of Moldova.

Materials and Method. In the IGPPP laboratory for Integrated Plant Protection, for the synthesis of sex pheromone were used commercial chemical reagents. Thin layer chromatography was used to follow the progress of the syntheses. For the purification of intermediate and final substances were used: vacuum distillation and chromatography on silica gel columns, their purity was tested with the help of thin layer chromatography. Quality of the final products was performed at the liquid gas chromatograph Agilent 8890.

Different fine organic synthesis methods were used, such as: bromination, isomerization, alkylation in liquid ammonia, protection of the –OH group, trans reduction to ethylene alcohol, deprotection of the –OH group, acetylation.

Results. Scheme of the synthesis of the minor component of the sex pheromone of the codling moth (E)-9-Dodecen-1-ol:

$C_7H_{15}OH + HBr \rightarrow C_7H_{15}Br$ (1)

$C_7H_{15}Br + HC{\equiv}CCH_2OH \rightarrow C_7H_{15}C{\equiv}CCH_2OH$ (2)

$C_7H_{15}C{\equiv}CCH_2OH \rightarrow HC{\equiv}C(CH_2)_8OH$ (3)

$HC{\equiv}C(CH_2)_8OH \rightarrow HC{\equiv}C(CH_2)_8OR$ (4)

$HC{\equiv}C(CH_2)_8OR + C_2H_5Br \rightarrow C_2H_5C{\equiv}C(CH_2)_8OR$ (5)

$C_2H_5C{\equiv}C(CH_2)_8OR \rightarrow C_2H_5C{\equiv}C(CH_2)_8OH$ (6)

$C_2\ H_5C{\equiv}C(CH_2)_8OH \rightarrow$trans-$C_2H_5CH{=}CH(CH_2)_8OH$ (7)

The minor component E9-dodecenol was synthesized by the isomerization method:

When brominating 1-heptanol with conc. hydrobromic acid, 1-bromoheptanol (1) was formed which upon alkylation with propargylic alcohol in liquid ammonia takes place the introduction of the terminal triple bond and the formation of the respective acetylenic alcohol (2). Its isomerization under the action of NaNH3 and ethylenediamine leads to obtaining of acetylenic alcohol with a triple bond in position 9 (3) which is protected by interaction with 3,4-dihydropyran (4). Its alkylation with ethyl bromide leads to the lengthening of the chain by 2 carbon atoms (5), which upon hydrolysis gives the dodec-9-yn-1-ol alcohol (6), and the reduction with the help of lithium aluminum hydride in tetrahydrofuran leads to obtaining alcohol trans-ethylene - (E)-9-Dodecenol (7). In the specialized literature, the minor component (E)-9-Dodecen-1-ol constitutes approximately 6% of the pheromonal composition. In field trials were given rubber dispensers impregnated with compositions of the main component with different dozes of 3%, 6%, 12% of the minor component.

Conclusions. The minor component of the sex pheromone of the codling moth *Cydia pomonella* (E)-9-Dodecen-1-ol was obtained by isomerization method. Rubber dispensers with different bicomponent pheromonal compositions of the sex pheromone of codling moth *Cydia pomonella* were prepared and were given to be studied the influence of the minor component within the pheromonal composition on its attractiveness in field monitoring trials.

Asknowledment. Research was carried out within the project of the State Program 20.80009.5107.19. “Strengthening capacities for the forecasting and control of harmful organisms and phytosanitary risk analysis in integrated plant protection” financed by the National Agenty for Research and Development.

References:

1. Angela M. Palacio Cortés, Paulo H.G. Zarbin, Daniela M. Takiya, J. Maurício S. Bento, Aline S. Guidolin, Fernando L. Consoli. Geographic variation of sex pheromone and mitochondrial DNA in *Diatraea saccharalis* (Fab., 1794) (Lepidoptera: *Crambidae*), Journal of Insect Physiology, V 56, I 11, 2010, P. 1624-1630, ISSN 0022-1910, https://doi.org/10.1016/j.jinsphys.2010.06.005.
2. Claire Duménil, Gary J. R. Judd, Dolors Bosch, Mario Baldessari, César Gemeno Astrid T. Groot. Intraspecific Variation in Female Sex Pheromone of the Codling Moth Cydia pomonella. Insects, 2014, Vol 5, p. 705-721 DOI: 10.3390/insects5040705
3. Shahnawaz, M.B., Ahmed, M., Arshad, M., Hussain, M., & Khan, S.S. Codling moth damage assessment in apple fruit and its management using insecticide bioassays. European Journal of Experimental Biology, 2014, 4(5):76-81.

CZU:631.811.98:633.11 https://doi.org/10.53040/abap6.2022.38

INVESTIGATION OF THE PROTECTIVE PROPERTIES OF THE REGLALG GROWTH BIOREGULATOR ON *Triticum aestivum* L.

PLATOVSCHII N.*, ZDIORUK Nina, RALEA T.
Institute of Genetics, Physiology and Plant Protection,
Chisinau, Republic of Moldova
**https://orcid.org/0000-0001-6747-8226*
e-mail: Nik.Plat@hotmail.com

This paper presents the results of a study on the use of the growth bioregulator Reglalg on winter soft wheat varieties Moldova 5 and Mission. As a result of the work done, it was found that the use of a growth bioregulator leads to the occurrence of the tillering node deeper in the soil, which favorably affects the development and productivity of plants. It was also found that the variety Mission is more resistant to drought in comparison with the variety Moldova 5.

Keywords: *Triticum aestivum L., tillering node, photosystem 2, flag leaf*

Introduction. In recent decades, it has become increasingly interesting to conduct environmentally friendly agriculture without the use of synthetic preparations of pesticides or fungicidal action. Synthetic drugs are being replaced more and more often by biologically active compounds obtained, as a rule, from various plant or animal products, or obtained by synthesizing an organic compound. Modern methods of plant protection include a large complex of technological techniques that require in-depth knowledge of the use of biologically active substances aimed at mobilizing the mechanisms of resistance and adaptation of plants to the action of biotic and abiotic environmental factors. For the successful application of biologically active substances in agriculture, it is necessary to clearly define the parameters characterizing the primary components of plant adaptive resistance under the influence of the external environment. But it is also worth considering that the use of biologically active substances can have both a short-term effect triggered immediately at the time of application and a long-term effect capable of changing the state of the plant organism throughout the entire period of its development. In this connection, many biological preparations can be directed to solve one or more problems and mainly affect the maintenance of the constancy of the internal environment of the plant organism. **The purpose** of our study was to determine the effectiveness of the use of the *Reglalg* growth bioregulator in integrated plant protection under the influence of adverse environmental factors. The product of *Reglalg* is made from plant material, in particular from *Spirogyra* algae with a pronounced hormonal effect, and is certified in the Republic of Moldova.

Materials and Method. Two varieties of soft winter wheat of Moldova 5 (Moldovan selection) and Missia (Ukrainian selection) were selected as the objects of research. Before sowing, seeds of two varieties were treated with product of *Reglalg* at a concentration of 1/200 (experiment) and water (control), after which they were sown in the experimental field of the Institute of Genetics, Physiology and Plant Protection of the Republic of Moldova. The scheme of the experiment was laid out according to the Latin square in three-fold repetition with the size of plots of 5 m^2.

Results. In the course of the work done, it was found that the plants of the experimental variants form a tillering node 1.5 - 2cm deeper in the soil compared to the control variants, the standard deviation is 0.8 cm on average for three repetitions. From the moment of germination to the exit phase into the tube, studies were conducted to determine the sugar content and the activity of peroxide-splitting enzymes in the tillering node of both variants. As a result, it was found that the experimental variants accumulate 3 to 4% more sugars in the tillering node; the activity of peroxide–splitting compounds in winter is lower in the experimental variants and increases sharply with the onset of spring compared with the control variants. After analyzing the data obtained, it can be assumed that due to the deeper occurrence of the tillering node in the soil, better conditions are created for the normal initial development of seedlings and better overwintering of the tillering node due to the weaker influence of negative temperatures in winter. Stronger plants come out of winter dormancy faster and have an advantage in growth and development over plants that have undergone a worse winter period due to lower costs for recovery processes.

During the summer period of development of the plant organism, studies were conducted aimed at assessing the intensity of development and the rate of aging of the leaf apparatus of the plant by analyzing the activity of photosystem 2 (FS-2) by the method of PAM-fluorimetry. Based on the obtained results, it was possible to establish that the activity of FS-2 in the experimental variants has an advantage over the control variants. This advantage lies in the intensity of activity during lunch hours when the illumination of plants and temperature conditions reaches their maximum values. As the leaves age, the intensity of FS-2 activity decreases sharply and clear differences can be observed in the phase of milk-wax ripeness. In this phase, it was found that the aging rate of the leaf blade in the experimental variants is delayed by 2-3 days compared to the control plants. This effect may be achieved by the fact that nodular roots are formed in deeper soil horizons where the amount of moisture is higher and the soil temperature is much lower. Due to this formation of nodular roots, the plant organism receives more moisture, which delays maturation and thereby increases the period of accumulation of dry substances in seeds.

Studies of the resistance of the flag leaf to the action of thermal stress have shown that the critical dose is a temperature of +49C for 5 minutes, at which there was a steady degradation of the photosynthetic apparatus and, as a consequence, the death of the leaf. The temperature of +47C for 5 minutes is transitional and the experimental variants can be restored almost to the initial level in the shortest possible time compared to the control variants. The final stage of observations was the determination of the yield of two variants, as a result of which it was found that the experimental variants give an increase in yield by about 26% compared to the control.

Conclusions.

As a result of the work done, it was found that the treatment with a *Reglalg* growth bioregulator leads to a deepening of the tillering node, which has a positive effect on its development. Due to finding the tillering node deeper in the soil, plants tolerate the winter period better and develop faster with release and rest due to less damage and restoration costs.

Due to the formation of nodular roots in deeper soil horizons, where the available moisture content is higher, there is a delay in the speed of seed maturation, and thereby experimental variants accumulate more dry matter in seeds, which increase their yield.

It was found that the Missia variety is more resistant to high temperatures compared to the Moldova 5 variety. The yield of the Missia variety is 6% higher compared to the Moldova 5 varieties.

Acknowledgment. Research was carried out within the project of the State Program 20.80009.7007.07 "*Determining the parameters that characterize the resistance of plants with different levels of the organization to the action of extreme temperatures to reduce the effects of climate change*", financed by the National Agency for Research and Development.

CZU:631.86:633.853.494 https://doi.org/10.53040/abap6.2022.39

EFFECTS OF A NEW BIOFERTILIZER GUMILAIT, WG ON YIELD AND OIL CONTENT OF WINTER RAPE SEEDS

ROTARU V.
Institute of Genetics, Physiology and Plant Protection, Chisinau, Republic of Moldova
https://orcid.org/0000-0001-6554-682x
e-mail: rotaruvlad@yahoo.com

The results of the field experiment of using a new multifunctional fertilizer Gumilait, WG, with the inclusion of humic acids, on the productivity of Brassica olearcea are presented. The use of this fertilizer for foliage application with three treatments during vegetation provides activation of growth, the increase of seeds yield. An increase in the oil content of seeds of agricultural crop was noted due to the introduction of humic fertilizer Gumilait, WG. It is concluded that the application of Gumilait, WG in biotechnology of rape crop is an efficient tool to increase the production and quality of seeds of plants in conditions of the Republic of Moldova.

Rapeseed oil is a useful product for human nutrition and an important source of raw materials for the energy and chemical industries, being a promising resource for the production of biofuels [3]. The use of mineral fertilizers can significantly increase the yield of rape seeds and the yield of oil per unit area [1, 2]. In addition to the use of mineral fertilizers, an important reserve for increasing the yield and quality of seeds is the use of humic fertilizers [2, 3]. In modern promising environmental technologies for the cultivation of crops, including rapeseed, the use of new polyfunctional forms of biofertilizer is important [4]. Natural macromolecular substances contained in fertilizers are characterized by high physiological activity, activate the functional activity of the plant and contribute to the formation of a high crop yield.

The purpose of our research is to study the effect of foliar feeding with foliar humic biofertilizer Gumilait, WG on the yield and oil content of rape seeds in the conditions of the Republic of Moldova. To achieve this goal, a field experiment was carried out with rapeseed plants in the central zone of the Republic of Moldova.

Keywords: *Gumilait WG biofertilizer, rape, yield, grain quality*

Materials and Method. In the experiment for foliar feeding of rapeseed hybrid, an aqueous solution of the fertilizer was used with a working fluid flow rate of 300 L/ha for each treatment. All variants of the experiment were evaluated against the background of mineral fertilizer. The soil of the experimental plots is ordinary chernozem, medium thick, medium humus. The experiments were laid in four replications with a plot area of 8 m^2, the arrangement of options was systematic. Gumilait, WG is a leaf fertilizer based on humic acid salts, the manufacturer is Hungary. Gumilait, WG was applied in three terms, the first - in the phase of renewed vegetation, the 2-nd - during the formation of the stem, the 3-rd - in the budding phase each treatment at the rate of 30 g/ha and 100 g/ha of the biofertilizer per 300l of water per hectare. Harvesting was carried out manually, with a seed moisture content of 10%. The yield data obtained were processed mathematically - by the method of dispersion analysis. The oil content of the seeds was determined on a modernized NMR relaxometer [5].

Results. The data obtained during tests of the Gumilait, WG leaf fertilizer show a positive effect of its use in various doses on the yield and quality indicators of winter rapeseed seeds. Carrying out three foliar feeding of plants during the growing season with the preparation Gumilait, WG showed a positive effect on the yield of rape seeds. On average, in the control without the use of foliar top dressing, 2.98 t/ha of rape seeds were obtained. The increase from foliar feeding of rapeseed with standard fertilizer Lignogumat and Gumilait, WG (30 g/ha) was 0.30 and 0.33 t/ha, respectively. Consequently, the rapeseed yield indicators for the options with foliar feeding exceeded the control option by 0.33–0.47 t/ha, or by 11.3–15.8%, which is significant with HCP =0.15 t/ha. Hence, it was found that the highest crop yield – 3.45 t/ha was noted in variant 4 using an increased dose of the fertilizer (100 g/ha). The increase in this variant compared with the control was 15.8%.

Oil content is the main indicator of the quality of rape seeds. A positive effect of foliar feeding on the accumulation of crude fat in rape seeds was revealed. The results of the determination of crude fat showed that the fat content in rape seeds in the control variant was 36.1%. With an increase in the applied dose, an increase in the oil content of seeds by 3.5% relative to the control was observed. The highest oil content (39.6%) was noted in the variant with the use of Gumilait, WG at the dose of 100 g/ha. The conducted studies have shown that foliar feeding of rapeseed plants with humic organic fertilizer Gumilait, WG is an environmentally friendly and economical means of increasing yields. An analysis of the experimental data allows us to conclude that Gumilait, WG is highly effective. Three-time treatments of rape crop (100g/ha) provides not only an increase in yield (by 0.47 t/ha), but is also an economically viable method for using foliar top dressing of oilseed rape. Therefore, the effect of feeding became stronger with increasing concentration and is expressed in an increase in biomass and, as a result, the yield.

Conclusions. The results of the research proved that the use of Gumilait, WG leaf fertilizer had a positive effect on plant productivity and oil yield per hectare of winter rapeseed in the Republic of Moldova.

Acknowledgment. The author expresses his gratitude to Doctor of Biology Oleg Kharchuk and researcher Marcela Kistol for their assistance in determining the oil content in rape seeds and for useful advice.

References:

1. Лупова В.И., Виноградов Д.В. Влияние гуминовых удобрений и доз минеральных удобрений на продуктивность ярового рапса // Вестник аграрной науки. 2020. №3 (84). С. 31-36. DOI: 10.17238/issn 2587-666X. 2020-3-31.
2. Соколов А.А., Лупова Е.И., Мазиров М.А., Виноградов Д.В. Влияние органоминерального удобрения на продуктивность ярового рапса в условиях Рязанской области // Владимирский земледелец. 2020. №1. С. 29-33. DOI:10.24411/2225-2584-2020-10106.
3. Телеш, В. А. Синевич Т. Г., Юргель, С. И. Алимусин Т. А. // Эффективность применения новых органоминеральных удобрений в посевах озимого рапса / Материалы конференции «Современные технологии сельскохозяйственного производства» / XIX Международная научно-практическая конференция, Гродно, 2016. – Издательстого полиграфический отдел УО «ГГАУ». – С. 124-126.
4. Ampong K., Thilakaranthna M.S., Gorim L.Y. Understanding the Role of Humic Acids on Crop Performance and Soil Health. Front. Agron. 2022, 4:848621. doi: 10.3389/fagro.2022.848621.
5. Панов П., Харчук О. Модернизированный ЯМР-релаксометр для изучения состояния воды в растениях и определения содержания масла в семенах. Materialele Conferinţei ştiinţifice internaţionale (Ediţia a 5-a) „Genetica, Fiziologia şi Ameliorarea Plantelor", 23-24 oct. 2014, Chişinău: S.n., 2014 (Tipogr. "Prin-Caro"), p. 144-146.

CZU:635.21:632.937:632.4 https://doi.org/10.53040/abap6.2022.40

POTATO FUNGI DISEASES SPREAD AND CROP BIOLOGICAL PROTECTION IN WESTERN REGION OF UKRAINE

ANDRIYCHUK Tetyana *, SKOREIKO Alla **, ZELYA Avrelia ***
Ukrainian Scientific – *Research Plant Quarantine Station IPP NAAS*
** https://orcid.org/0000-0002-7718-7964;** https://orcid.org//0000-0001-6336-0773:*
****https://orcid.org/0000-0002-1470-7707, e-mail: tatyjana58@gmail.com*

Purpose is to analyze spread of potato infectious spread and ecologization protective elements from complex of basic diseases causative agents in western region of Ukraine.

Keywords: *potato diseases, climatic changes, pathogens, protection, biological preparations*

Introduction. Potato monoculture, non-control chemical protection means usage comes to dangerous disease causative agents save, new resistance pathogen forms (without environment pollution) are reasons for receiving low yields.

Potato defeats many fungi, bacterial, viral diseases through the biological peculiarities. They are more than 60.

The great climatic changes (the air average annual temperature increased more than on 0,9 ^{0}C in Ukraine) comes to stable increase average month temperature rate during the growing period on +0,3-3,4°C.The area of enough wetted areas decreased. The long-term rate of hudrothermal coefficient consisted of 0,9. This index decreased to 0,8 during the last year. The rate of hydrothermal coefficient consisted of 1,3. It characterized the area of enough humidity, but today this rate consisted of 1,2. It conforms the characteristics of not enough humidity areas. The areas' borders moves higher on north.

The change of climatic conditions comes to mass spread of tolerant to higher temperatures micromicets – causative agents of fusarium wilt, canker, verticillium wilt etc. It comes to tubers' decay through the blights of different etiology and yield decrease. The intensive chemicalization of agriculture comes to appear new aggressive forms of causative agents and needs systematic control for complex of pathogen organisms.

Materials and method. The researches conducted on the base of Ukrainian Science- Research Plant Quarantine Station Institute of Plant Protection during 2020-2021 with usage of laboratory (pathogens identification) and field method (plantation study, biological preparations treating of plants). The following biological fungicides were used for the study their protective means against the most spread potato diseases.

Biospectre BT – is a microbiological preparation of insect-fungicide action. It consists of rhizosphere bacteria of order Pseudomonas with titer not less than $5{,}0 \times 10^9$ CFU/cm^3. The consumption rate is 1,5 l/t for pre-sowing seed treatment, and growing plants 10 l/ha.

Gliocladin BT – is a biological soil fungicide based upon microscopic fungi- antagonist *Gliocladium virens*.Titer Gliocladin liquid –- $1{,}5 \cdot 10^9$ CFU/cm^3. The preparation used in rate 2,0 l/t for spraying growing plants – 10 l/ha.

Trychopsin BT – is insecto–fungicide with stimulating growth of peculiarities. Mycelium, fungi spores *Trichoderma viride T–4* and Rhizosphere bacteria *Pseudomonas aureofaciens 306* with titer not less than $2{,}0 \cdot 10^{10}$ CFU /cm^3 are active base for preparation. The consumption rates are the following for tubers treating for 2,5 l/t; for spray growing plants – 8,0 l/ha.

Urozhay TK – is microfertillizer with nutritious elements (g/l): N – 150; Mg – 50; S – 45; Zn – 18; B – 5; Cu – 1,5; Fe – 1,5; Mn – 15; Mo – 0,2; Co – 0,1. The consumption rate is 2 l/t for tuber's treating; 2 l/t for treating growing plants.

The tubers dipped (exposition 15 minutes) in biological preparation suspension: Biospectre (1,5 l/t); Gliocladin BT (2 l/t), Trychopsin BT(2,5 l/t) and joined them in microelements complex (microfertillizer Urozhay TK before planting potato.

The following scheme of experiment is: 1 – Cotrol – non-treated tubers; 2 – tubers treating of preparations composition Biospectre BT (1,5 l/t) + two out of root treating by them (10 l/ha); 3 – tubers treating, before planting by preparation Gliocladin BT (2 l/t) + two out of root treating by them; 4 – treating tubers by preparation Trychopsin BT (2,5 l/t) + two out of root nutrition by them (8,0 l/ha); 5 – treating tubers by preparation Urozhay TK (2 l/t) + 2 two out of root nutrition by them (2 l/ha); 6 – treating tubers by preparations' composition (Biospectre BT – 10 l/ha) and Urozhay TK (2 l/t) + two out of root nutrition by them (Biospectre BT – 10 l/ha**;** Urozhay TK – 2 l/ha); 7 – treating tubers by preparations composition Gliocladin BT (2 l/t) and Urozhay TK (2 l/t) + two out of root nutritious by them (Gliocladin BT – 10,0 l/ha and Urozhay TK – 2 l/ha); 8 – tubers treating by preparation composition Trychopsin BT (2,5 l/t) and Urozhay TK (2 l/t) + and out of root nutrition by them (Trychopsin BT – 8 l/ha/ and Urozhay TK – 2 l/ha).

Varieties Virinea and Sante used in experiments.

Results. The following diseases on growing plants were: black dot (*Colletotrichum coccodes* (Wallr.) S. Hughes) plants defeating recorded more than 20%, alternaria blight (*Alternaria solani* (Ellis & G. Martin) L.R. Jones & Grout, *Alternaria alternata* (Fr.) Keissl.) – 75 and 70 per cent plant defeating; fusarium wilt (*Fusarium oxysporum* Schl.) – defeated 15 % plants, late blight (*Phytophthora infestans* (Mont.) de Bary) – plants defeating consisted of 100%. The last received serious spread in second half of growing through the serious precipitation.

The highest dangerous consisted of causative agents of diseases of orders Fusarium, Phoma, Colletotrichum, Phytophthora by the results of phytopathological analysis. Among them were fusarium, phomosis, canker, late and mixed blights. The most spread diseases were soil tubers infections were canker (number of tubers defeating consisted of 5,0–20%) and fusarium-phoma (number of ill tubers consisted of 22,0–-35,0%) rot. The number of fusarium dry rot causative agents consisted of 42,1%; phomosis – 6,5%; late blight 12,5%, black dot – 17,5%.

The researches results for biological preparations' efficiency study showed that the potato treating by them before planting and during the growing favored decrease of defeated tubers quantity in 1,8–3,7 times. The growing of potato plants height and number of stems on one bush increased in compare with control. The tubers yield increased on 6,6–16,0% through the complex treating.

The biological preparations efficiency in joining with microelements complex against soil-tuber infections consisted for variety Sante 68,3–73,0% and for variety Virinea 60,1–-65,0%.

Conclusions. The studies showed that the most spread received causative agents of diseases character for dry, arid climate. Among them were: black dot of potato (Colletotrichum coccodes (Wallr.) S. Hughes) – plants` defeating consisted of 20%, alternaria blight (Alternaria solani (Ellis & G. Martin) L.R. Jones & Grout, Alternaria alternata (Fr.) Keissl.) – 70 and 75 per cent of plants defeating, fusarium wilt (Fusarium oxysporum Schl.) defeated 15% of plants.

The most spread potato diseases were fusarium, phomosis, black dot, late and joined types of blights.

The biological preparations in complex with microelements usage before potato growing and during the growing favored decrease number of defeated tubers in yield in 1,8–4,4 times and yield increase on 6,6–16,0% in compare with control. The biological preparations efficiency in compositions with microelements against soil-tubers infections consisted of 60,1–73,0%.

CZU:631.527+631.147 https://doi.org/10.53040/abap6.2022.41

CONVENTIONAL PLANT BREEDING AND BIOTECHNOLOGICAL TOOLS FOR A RESILIENT SYSTEM OF PLANT IMPROVEMENT

ANDRONIC Larisa
Institute of Genetics, Physiology and Plant Protection,
Chisinau, Republic of Moldova
https://orcid.org/0000-0002-2761-9917, e-mail: larisa.andronic@igfpp.md

The purpose of this work involved the analysis and underlining of the more significant pathways to reduce the consequences of climate change on crop and reified its adaptive effects.

Keywords: *agricultural biotechnology, breeding, in vitro culture, mutagenesis*

Materials and Method. Systems created on the basis of varieties obtained by classical methods of hybridization, experimental mutagenesis, biotechnological processes based on *in vitro* culture were analyzed.

Results. Extreme climate events underline the fragility of current production systems and accentuate the importance of moving towards a resilient system capable to reducing the negatively effects on crop productivity, confronting the consequences of climate change and adapted to declaimed the dangerous effects, ensuring access to sustainable production. Traditional plant breeding methods have been very successful and have helped provide the required of food volume [1]. Breeding efforts have provided remarkable diversity amongst various crop species and even creation of some new crops. However, the trends in agriculture indicated that traditional methods alone will not be able to keep pace with the growing demands for food, fibre and fuel. High temperatures, longer periods of drought and heat, increased late frost risks, increased heavy rainfall events and extreme weather events are endanger agricultural production systems. At the same time, the intensification of agricultural systems and the excessive use of land have negative effects on the environment, such as habitat fragmentation/loss and biodiversity loss, degradation of water resources and soil health. Plant biotechnology offers an important role to improve crop yields, can strengthen plant breeding efforts to meet these new challenges in a sustainable way. Scientists are continuously developing better tools to improve plant breeding. New precision breeding innovations include both advanced tools - devices like sensors, detectors, and robotics, which have been combined with management technologies for precise and more efficient production system control, and genetic tools like new molecular breeding techniques for gene editing [3]. At the same time researchers are often criticized that genetically modified plants have not boosted yields. Crop plant growth is known to be limited by photosynthetic efficiency, and traditional breeding can increase yields, but gains have stagnated at less than 1% per year for popular crops [4]. To make photosynthesis more efficient, a way of photoprotection is proposed, in which plants avoid strong light at the cost of reducing photosynthesis in the shade through the mechanism called non-photochemical quenching, in which chloroplasts divert photons from their light-capturing molecules and simply dissipate them as heat.

Largely through exploitation of vegetal germplasm, plant vigor, yields of several crops conducted to substantially increasing of conventional breeding programs. Inter-varietal and interspecific hybridizations, coupled with genetic and phytopathological manipulations, proved useful in plant improvement for resistance to diseases (fungus and viruses) and abiotic stress. Based on the particularities of parental factors involvement in the creation of genetic variability in plants (genetic actions and interactions, transgressions) and the establishment of the role of the maternal form, as a component of hybridization, contributing to the regulation of genetic effects interacting with the external environment, technologies for creating performing genotypes were developed by targeting forms of interest and obtaining valuable segregants, as well as optimizing the donor capacity of the genotype. As a result, new valuable varieties of cereal crops were created by a team of the IGPPP, such as: common wheat (Moldova 5, Moldova 11, Moldova 66), durum wheat (Auriu 273, Auriu 2, Arnaut 7, Hordeiforme 333, Hordeiforme 335, Hordeiforme 340, Sofidurum), rye (Zambreni 70), oats (Saltaret). One of the most important achievements of the institute in the direction of the cereal breeding is the creation of triticale varieties, a synthetic species resulting from hybridization of different species - wheat (*Triticum* spp.) and rye (*Secale* spp.), what differ by high nutritional value of grains due to the high content of protein and lysine, potassium, phosphorus, sodium, magnesium and zinc content, also by the lower demand to soil suitability. By the classical approaches within the institute, 5 triticale varieties were created and approved for cultivation (Ingen 93, Ingen 33, Ingen 35, Ingen 40, Ingen 54).

New breeding techniques that include several technologies for introduction of variation into crop plants for plant breeding, in particular the convergence methods between conventional mutagenesis, mainly due to the possibilities of TILLING (Targeting Induced Local Lesions in Genomes) methods that allow the fast detection of mutations in any gene of a genome, are widely applied [2]. Like, by combining classical breeding methods with experimental mutagenesis, leguminous varieties were created: soybean cultivars Albisoara, Amelina, Clavera, lentil cv. Verzuie, cv. Aurie, faba bean cv. Geca 5, grasspea Bogdan. Also, tomato variety ANONA was created as result of interspecific hybridization of variety Novicioc and *Solanum piminellifolium* L. and treatment with gamma rays (100 Gy).

Biotechnological tools can be applied for a range of different purposes (genetic diversification of varieties; disease control and improvement to stress factors, etc.). Such biotechnological procedures, as tissue / embryo culture, androgenesis, are recognized as having a great potential for the promotion biological diversity. In our study, the gamma rays were a source of the variability of quantitative traits (plant height, spike length, apical internode length, number of spikelets and grains per spike, number of productive tillers per plant) in barley cultivars. Also, were *calcaroid* mutation (cal) was obtained by applying physical mutagenesis (250 Gy) and branched mutation (brc) by *in vitro* culture. The comparative evaluation of barley doublehaloid lines derived from androgenesis show significant distinctions in phenological, biometric and agronomic characters compared to the recurrent genotype.

The decrease in biodiversity and the genetic erosion of agrosystems under the influence of unfavorable factors leads to the loss of a considerable part of the initial valuable breeding material. Minimizing the negative impact of environmental factors while maximizing plant production required for sustainable agriculture requires a better understanding of breeding methods and ensuring the genetic diversity of crops. The high level of genetic variability within and between populations is associated with the ability of the species to overcome severe climatic regimes and can be used in the identification of taxa vulnerable to anthropogenic changes, variation of phenotypic traits showing the plasticity of the form's response to environmental changes.

Conclusions: In order to develop a resilient agricultural system, a wide spectrum of innovative processes for crop breeding which respond to the environmental requirements, sufficient, healthy and safe high-quality agricultural products it is necessary. Conservation of resources and promotion of plant biodiversity must remain important objectives.

Acknowledgment. The research was carried out within the project 20.80009.7007.04 "Biotechnologies and genetical processes for evaluation, conservation and exploitation of agrobiodiversity", financed by the National Agency for Research and Development.

References:

1. Datta S.K. Impact of Plant Biotechnology in Agriculture. In: *Biotechnology in Agriculture and Forestry*. Vol. 59 Transgenic Crops IV (Ed. by E.C. Pua and M.R. Davey) © Springer-Verlag Berlin Heidelberg 2007. DOI: 10.1007/978-3-540-36752-9_1.
2. Holme I.B., Gregersen P.L., Brinch-Pedersen H. Induced genetic variation in crop plants by random or targeted mutagenesis: Convergence and differences. In: *Front. Plant Sci*., 2019, Sec. Plant Breeding. https://doi.org/10.3389/fpls.2019.01468.
3. ISAAA. 2021. Breaking Barriers with Breeding: A Primer on New Breeding Innovations for Food security. ISAAA Brief No. 56. ISAAA: Ithac, NY. ISBN: 978-1-892456-70-2.
4. Stokstad E. Engineered crops could have it made in the shade. In: *Science*, 2016, vol. 354, p.816, DOI: 10.1126/SCIENCE.354.6314.816.

CZU:632.7:635.9 https://doi.org/10.53040/abap6.2022.42

INCREASING THE POPULATION AND HARMFUL POTENTIALITY OF THE SUN PEST ON THE FIELD OF WINTER WHEAT IN THE CONDITIONS OF AZERBAIJAN

AZİZOVA N.H.
Research Institute of Crop Husbandry, Baku, Azerbaijan
ID-2NA4GUQ, e-mail:namella@rambler.ru

Purpose: Winter wheat crops occupy the main area of all grain crops in the grain growing of Azerbaijan. However, wheat crops are damaged by many pests, which in some years cause significant damage.

Keywords: *winter wheat, grain, soil-climatic, populations, breeding, variety, damage*

Introduction. In recent years, in some regions of wheat cultivation, an increase in the number and harmfulness of harmful Sun pest has been noted.

Currently, the main problems of grain-growing is the quality of food grains. Among the factors negatively affecting the quality is damage to the grain by sun pest. Damage to grain by adults and bug larvae significantly reduces the gluten content in the grain. It is known that if more than 3% of the grain is damaged by a pest, the baking quality of flour deteriorates significantly. It has been established that the nutrition of adult bugs and larvae, in addition to reducing the mass of grain, also sharply reduces its germination.

The Sun pest *Eurygaster integriceps Puton*, 1881- is one of the main pests of winter wheat in Azerbaijan. In the republic, it is distributed everywhere, in all grain-sowing zones. But the abundance and harmfulness of the phytophage in different soil-climatic zones is not the same. The highest is in conditions of unsecured rainfed land in the zones of Nagorno-Shirvan and South Mugan. The Sun pest in these zones is a constant pest of grain crops, but the dynamics of the Sun pest population is of a periodic nature, in which rises in numbers alternate with depressions.

Materials and method. The studies were carried out in 2020–2022. in the conditions of unsecured rainfed areas of the Gobustan AIA. We studied the distribution, density, food connections, the nature of the damage and the harmfulness of the sun pest.

The pest numbers were counted starting from the tillering stage of winter wheat and the beginning of plant colonization by the sun pest and ending with the stage of full ripeness of the grain.

Laboratory and field estimates of the pest abundance were supplemented by laboratory analyzes of grain damage by the bug. At the same time, the degree of grain damage by a sun pest was established.

Results. In the conditions of the unequipped rainfed areas of South Mugan, the turtle is active from April to July, everywhere gives one generation a year, hibernates in the adult stage. In the spring, in the second half of April, overwintered bugs first populated barley crops, and then, in the phase of budding-earing, winter wheat plants. The bugs damaged the ear and caused its partial or complete white spike. According to our data, the edges of the crops were populated by bugs by 50% more than in the middle of the field.

The first instar larvae appeared in May. Mass development of larvae was observed in the first or second decade of June. The nutrition of older larvae coincided with the milk-wax maturity stage of wheat development, and by the time the grain was fully ripe and harvested, young bugs appeared, resulting in severe damage to the grain.

The greatest damage to winter wheat crops was caused by older larvae and young bugs that inflict injections into grains in the period from milky to full ripeness.

Growing seasons 2020–2022 years under our conditions were characterized by high reproduction of the sun pest. Favorable hydrothermal conditions for the population developed in the spring during the emergence of bugs, mass oviposition, and during hatching and feeding of larvae.

The number of overwintered bugs on grain crops varied over the years from 1.5 to 6.5 ind./m^2, and averaged 2.6 ind./m^2, which indicates the need for insecticide treatment.

In 2020, an increase in the number of bugs in the Gobustan AIA was observed, which was 1.5–4.0 ind./m^2. In 2021 also a high number of sun pests were noted, and the density of adult bugs on crops was 2.0–5.5 ind. /per 1 m^2.

In 2022, the number of overwintered bugs exceeded the economic threshold of harmfulness (ETH), and their average density in the fields ranged from 1.5–6.5 ind./m^2 and the pest posed a threat for wheat crops. Therefore, on production crops, chemical treatments were carried out against the sun pest, and on experimental crops with a sufficiently high background, wheat samples were assessed for damage to plants and grains by bugs.

On the uncultivated area, the number of larvae in the milk maturity stage significantly exceeded the level of ETH, which caused high damage to the grain by the pest. Grain damage on the untreated area was 3.6-8.5%, and on the treated area - 0.6-2.1%, which reduced grain damage.

We also carried out an assessment of the field resistance of winter wheat varieties to natural populations of bugs.

According to our research, winter wheat varieties differ in damage by the sun pest and in the intensity of reproduction of the new generation of the pest on them. Therefore, it is possible to isolate more resistant forms and create varieties on their basis that are less damaged by this pest.

As a result of the evaluation of more than 50 varieties in 2020–2022 varieties were identified that are relatively resistant to sun pest colonization and slightly damaged. According to our research, under the conditions of the Gobustan AIA, the least damage to the grains was found on the varieties Gobustan (0.2%), Gyzylbugda (0.5%) and Shafag (0.6%). Damage to other varieties was in the range of 2.2–6.0%.

Selected variety samples will be used as starting material for breeding winter wheat for resistance to sun pest.

Thus, to protect winter wheat crops from bugs and other pests, it is necessary to systematically monitor the phytosanitary state of crops and, if necessary, treat them with insecticides.

CZU:631.4:634.22:632.7:632.9 https://doi.org/10.53040/abap6.2022.43

SENSITIVITY OF ACARIFAUNA TO THE ACTIVE SUBSTANCE OF SOME INSECTOACARICIDES IN THE AGROCENOSIS OF PLUM CROPS

BATCO M.*, IORDOSOPOL Elena
Institute of Genetics, Physiology and Plant Protection,
Chisinau, Republic of Moldova
**https://orcid.org/0000-0002-3711-4429,* e-mail: *mihai.batcu@yahoo.com*

The efficiency of the integrated protection of agricultural crops against key pests largely depends on the fact of the interaction of the applied pesticides with the species of useful fauna in the agrocenosis. Species of useful fauna constitute the natural lever for regulating the density of phytophagous species in agrocenoses, and this requires a protective attitude towards them. The multilateral analysis of the consequences of pesticide application on harmful and beneficial species has shown that predatory and parasitic species are largely recognized as being more vulnerable to these factors with toxic action. These effects could possibly be due to the fact that the biochemical mechanisms of the phytophagous species, unlike those of the representatives of the useful fauna, are evolutionarily better adapted and disposed to the process of eliminating from the body the negative effects caused by the action of toxic compounds, in the framework of plants host. The ethological particularities of the predators related to the increased mobility in search of the victim also create the increased degree of contact with the applied insectoacaricides. This is also the cause of their increased mortality. At the same time, the individuals of the useful species, which survived as a result of the application of chemical treatments, they face the increased reduction of the nutritional base and, finally, they may simply die due to the lack or insufficiency of food [1]. Thus, it is important that in order to maintain the potential of useful fauna in agrocenoses, the strategy of applying pesticides with an increased degree of toxicity must be completely revised in favor of those that are more selective with a low effect on useful fauna. This clause can be achieved, to a large extent, by the thorough analysis of the action of the pesticides included in the system. In addition to the effectiveness of pesticides against pests, an important criterion is their degree of danger to the environment, taking into account the effect of pesticides on the main components of agroecosystems, including useful fauna. The use of pesticides, which would tolerate the “activity” of beneficial fauna, is an element of conservative biological control which, in turn, leads to a numerical reduction in the chemical treatments required to keep pests below the economic damage threshold. It is important that along with the application of phytosanitary products, the degree of tolerance of useful fauna representatives to them should also increase, thus increasing the resistance of entomoacarifage species populations to the applied toxic factors, something reported in the communications of many researchers. The selection, multiplication and practical application of useful arthropod lines with a high degree of resistance to pesticides as biological control agents in the integrated protection of agricultural crops from pests is important and promising. [2]. Previously, such evaluations were carried out on the analysis of fauna useful for apple culture.

The purpose of this work is to evaluate the sensitivity to insecticides belonging to different mechanisms of action (AI), on entomoakarifags in the agrocenosis of the plum orchard.

Keywords: *acarifages, bifentrin*, *deltametrin, abamectin, indoxacarb, chlorpyrifos*

Material and Methods. Imago *Stethorus punctillum* Weise and predatory mites *Ambliseius andersoni* Chan, and *Typhlodromus pyri*, collected in plum crop agrocenosis, as well as larvae of ages 1 and 2 (first generation) of *Chrysopa ciliata*, obtained from imago, were analyzed. being collected in the same agrocenosis. Imago *Neoseiulus californicus* Mc Gregor was also analyzed, the population of which is resistant to organophosphorus pesticides, obtained from the United States in 2004 and kept in laboratory conditions, without being exposed to the action of pesticides. The contact action of AI on entomophagous and predatory mites has been determined. Experienced concentrations of pesticides similar to the recommended consumption standards for use in plum protection systems. The toxicity assessment was performed according to the IOBC / WPRS recommendations [2]: mortality of beneficial species ≤30% - as harmless (In), mortality 30-79% - weakly toxic (ST), 80-89 - moderately toxic (MT) and mortality ≥90% - very toxic (FT). In testing the resistance of the population *Stethorus punctillum* to insecticides was determined LD 50.

Results. The results obtained regarding the impact of the active substance (a.s.) of some insecticides (AI) attest that for the adult individuals of *S. punctillum* species and *Ch. ciliata* larvae, collected in the orchard with multiple chemical treatments over the years, only a.s. *chlorpyrifos* and *dimethoate* had a very toxic action. The rest a.s. investigated (*indoxacarb, bifentrin, deltamethrin*) at the recommended doses for practical use are harmless or slightly toxic. *Abamectin* also causes long-lasting effects, leading to the emergence of deformed adult larvae (up to 20%). The use of these preparations against pests will help to maintain the mechanisms of stabilization of the biological balance in agrocenosis.

In the analysis of the resistance development process, it was established that the LD_{50} of the *Stethorus punctillum* population in the agrocenosis of the chemically treated plum orchard is 15 times higher than the LD_{50} of the sensitive population compared to *dimethoate* and higher than 500 times - in relation to synthetic *deltamethrin*. Thus, these active substances have become harmless to the given entomophagous, due to the resistance developed over time.

For populations of predatory mites, subjected to less toxic analysis, practically harmless, it turned out to be a.s. *indoxacarb*, while *bifentrin* and *deltamethrin* are weakly toxic, and the most harmful - the new generation product based on *abamectin*. It is worth mentioning that *chlorpyrifos* has shown a weak toxic action on the mite (*Typhlodromus pyri*) which is explained by the formation of resistance to insecticides, because it is known that this pesticide has been mentioned as very toxic to predatory mites. A similar conclusion can be drawn for *bifentrin* and *deltamethrin.*

The populations of plum orchard mites, subjected to chemical treatments, show a less pronounced sensitivity to (IA) studied in relation to the laboratory population of *Typhlodromus pyri* mite. The latter have been shown to be sensitive to dimethoate and deltamethrin, while for the population of *A. andersoni* in the orchard, the recommended doses of these insecticides for use are harmless or slightly toxic. The fact that in the populations investigated by predatory mites there is a process of formation of resistance to dimethoate, deltamethrin and chlorpyrifos, indicated by the fact that in the last 5-7 years, these mites are a constant component of agarocene acarifauna undergoing permanent treatments with these insecticides.

As previously reported, predatory mites are less susceptible to (AI) than phytophagous mites from the same agrocenosis. Some authors associate the idea of developing the tolerance of phytoseid mites or their resistance to a.s. nominated.

Conclusions: The evaluation of natural populations of pesticide-resistant entomoakarifags has a special value in relation to the possibility of their use in practice by laboratory reproduction and subsequent dispersal, as well as their intra-areal redistribution. In connection with the above, it is appropriate to regularly monitor the susceptibility to pesticides of both harmful and beneficial species.

Acknowledgment. Research was carried out within the project of the State Program 20.80009.5107.27 “Development of alternative methods for the control of harmful arthropods in various agricultural cenoses, based on environmentally friendly means and procedures” financed by the National Agency for Research and Development.

References:

1. Amano H., Hasseb M. Recently-proposed methods and concepts of testing the effect of pesticides on the beneficial mite and insect species: study limitations and implications in IPM. Appl. Entomol. Zool. V.36, 2001, N1, P.1-11.
2. James D.G. Beneficial arthropods in Washington hop yard: screening the impact of pesticides on survival and function. Final report for Washington State Commission for Pesticide Registration: March 2004.

CZU:574.5:578 https://doi.org/10.53040/abap6.2022.44

MOLECULAR TECHNIQUES FOR DETERMINING BACTERIAL DIVERSITY IN LAKE ECOSYSTEM

BOGDAN-GOLUBI Nina[1*], SLANINA Valerina[1], BALAN Ludmila[1], RUGINESCU Robert Marian[2**]
[1] Institute of Microbiology and Biotechnology, Republic of Moldova;
[2] Institute of Biology Bucharest, Romania
** https://orcid.org/0000-0003-2199-4414, **https://orcid.org/0000-0002-0461-1437*
e-mail: nina.bogdan.91@gmail.com

Bacteria are unique organisms which represent a large and diverse group of species from varied climatic extremities, play a key role in biogeochemical processes, have a vast array of metabolic functions with quick response to any change in environmental conditions. A lot of research is inspired by isolation of novel aquatic microbes with valuable compounds and it studying by polymerase chain reaction (PCR)-amplified nucleic acids without culturing, morphology, physiology or ecology study. But genetic identification in complex with traditional methods allow microbial communities to be studied with greater precision.
Keywords: *bacteria, Bacillus, PCR, enzyme*

Introduction.The water quality is controlled by multiple parameters like chemical, biological, radiological, and physical. Human activities have affected the water quality of the lakes, thus, microbial composition plays the important role in process of water purification being indicators for the suitability of water quality. Studies have shown that microbes identified in lakes are associated with water quality parameters and environmental conditions and their antimicrobial potential is quite broad and promising from the food industry to therapeutic drugs [2, 3, 5]. According to the literature, authors identified potential of aquatic bacteria with high antagonistic activity due to developed enzymatic complex. Pathogenic microorganisms are mycotoxin producers which can be dangerous agents and cause many diseases.

The authors Babich et al. identified widespread strains of the genera *Pseudomonas*, *Bacillus* also rare genera *Micrococcus* and *Acinetobacter* representatives from Baikal lake. Peptides of the isolated fractions of strains metabolites were proved to be bacteriocins for a broad spectrum [1]. From lake Khubsugul and thermal springs of the Baikal region researcher Suslov identified *Bacillus subtilis* and *B. brevis* which predominate in the bottom sediments both in quantitative composition and species diversity. Cultured bacteria showed high biochemical activity of the protease, amylase, lipase, phosphatase and phospholipase enzymes [4].

Our research was carried out to determine bacterial diversity from water, biofilm and bottom sediments of lake La Izvor (Chisinau) and to study enzymatic, antagonistic activity of selected strains.

Materials and Method. Strains were isolated from the samples of water, bottom sediments and biofilms at the La Izvor lake. Suspensions with 10 g/ml of the samples and 90 ml of sterile distilled water were prepared; each suspension was diluted from 10^{-1} until 10^{-8}. For bacterial identification, dilutions were inoculated in plates with TSA, Kings medium B, SS agar medium, KIA, Endo and incubated at 28 °C. The plates were observed for 72 hours.

To determinate enzymatic activity, we used the method of inoculation on agarized selective media of different compositions. Bacterial isolates were screened using agar plates for testing amylase, catalase, celullase and lipase production, respectively. After incubation at 30°C for 24-48 hours, starch hydrolysis was determined by flooding the plates with iodine solution and hydrogen peroxide. Isolates showing zones of clearance were selected as enzyme producing bacteria.

The antibacterial properties were determined using agar disk-diffusion method, incubation at 30°C, 24-48 h. Antagonistic activity was detected in the clear zones of growth inhibition for *Escherichia coli* ATCC® 25922™ and *Staphylococcus aureus* ATCC 25923.

The bacterial strains were identified by molecular methods by the amplification and sequencing of the 16S rRNA using the universal primers. The PCR conditions were initial denaturation phase for 3 min at 95 °C, 35 cycles of 30 min at 95 °C, 30 s at 53°C, 1 min at 72 °C and the final extension for 7 min at 72 °C. The PCR products were cleaned with the PCR purification kit following the manufacturer instructions. The PCR-products were sequenced in both directions in an Applied Biosystems model 3500 automated DNA sequencing system.

Results. One hundred twenty-two microorganisms were isolated from the water, biofilms and bottom sediments sampled of lake. Isolates were identified based on the morphological, cultural and biochemical characteristics using different tests as: catalase, mannitol, citrate, urease, test CAMP, starch hydrolysis test, BEA test, nitrate reduction test, oxidase test, coagulase test, motar agar test, Methyl Red / Voges-Proskauer (MR/VP), test at MacConkey agar, sulphur reduction test (SIM). Preliminary analysis of phenotypic and morphological characteristics suggests the presence of the following microbial diversity: *Bacillus* sp., *Actinobacteria* sp, *Enterococcus* sp., *Micromyces* and *Pseudomonas* sp. Bacterial strains were selected for molecular identification. Due to molecular techniques applications some studies have reported a surprisingly high bacterial diversity, unsuspected abundance and dominance of groups thought to be relatively rare. The results obtained indicate the most predominate bacteria of *Bacillus* genus presented in water samples, biofilm and bottom sediments.

Identified strains shared more than 99.5 % 16S rRNA gene sequence similarity with *Bacillus velezensis* FZB42 and more than 99.4 % relatedness value with *Bacillus amyloliquefaciens* MPA 1034. Based on the lack of phenotypic distinctive characteristics, researchers Li-Ting Wang et al. (2008) and Fan et al. (2017) proposed *Bacillus velezensis* as a later heterotypic synonym of *Bacillus amyloliquefaciens*. Also were identified strains shared on 99.7 % 16S rRNA gene sequence similarity with *Micrococcus luteus* DSM 200030 and on 99.9 % it DNA relatedness value with *Micrococcus yunnanensis* YIM 65004. At once were determined strains shared on 98.22 % 16S rRNA gene sequence similarity as *Planococcus ruber* CW1, the same similarity as *Planococcus massiliensis* ES2. Identified cultures are possessed activities on three from four named enzymes, some of them are active producers of valuable four exoenzymes.

Antimicrobial activity against *E. coli* ATCC® 25922™ and *S. aureus* ATCC 25923 bacterial test-cultures was detected at strains from bottom sediments, more than 25 mm diameter of the lysis zone.

Conclusions. The ability to determine species of microorganisms is fundamental to the understanding of the structure and function of ecosystem. Most of aquatic bacteria are a rich source of hydrolytic important industrial enzymes. At present, the largest part of the enzyme is occupied by the alkaline proteases due to its varied applications and most of them are derived from *Bacillus* sp. Identified bacteria can be successfully used for practical and scientific purposes.

Acknowledgment. For support in investigation we thank Madalin Iancu Enache, Elena-Simona Neagu and Robert Marian Ruginescu (Institute of Biology Bucharest, Romania). Research was financed by National Agency for Research and Development, project 20.80009.7007.09.

References:

1. Babich O., Shevchenko M., Ivanova S., Pavsky V., Zimina M., Noskova S., Anohova V., Chupakhin E., Sukhikh S. Antimicrobial potential of microorganisms isolated from the bottom sediments of Lake Baikal, Antibiotics (Basel). 2021, vol. 10(8), p. 927-948. https://doi.org/10.3390/antibiotics10080927.
2. Byrsa M., Cebotari V., Burtseva, S. Presence of actinobacteria in the aquatic ecosystems of the “La izvor” lake system in the Chisinau city, Materials of the National Scientific Symposium with international participation “Modern

Biotechnologies - solutions to the challenges of the contemporary world", Chisinau. 2021, p. 41. https://doi.org/10.52757/imb21.007.
3. Slanina V., Bogdan N. Studierea bacteriilor izolate din namolul lacurilor parcului „La Izvor", Conferința științifică națională cu participare internațională "Integrare prin cercetare și inovare", Chișinău. 10-11 noiembrie 2021, p. 112-114.
4. Suslova Mariya. Rasprostraneniye i raznoobraziye slogoobrazuyushchikh bakteriy roda Bacillus v vodnykh ekosistemakh. Dissertatsiya po biologii, Ulan-Ude, Republic of Buryatia, Russia. 2007.
5. Yadav N., Kour D., Yadav A.N. Microbiomes of freshwater lake ecosystems, Journal of Microbiology & Experimentation (JMEN). 2018, vol. 6, № 6, p. 245-248.

CZU:582.711.16:633.88 https://doi.org/10.53040/abap6.2022.45

GOLDEN ROOT AS A SPECIES FOR ELABORATION THE STRATEGIES OF PLANT PROTECTION

CALUGARU-SPATARU Tatiana[1*], DASCALIUC A.[1**], PARIY Ya.[2], PARIY Yu.[2]
[1]*Institute of Genetics, Physiology, and Plant Protection,*
Chisinau, Republic of Moldova,
[2]*Ukrainian Scientific Institute of Plant Breeding, Ukraine*
**https://orcid.org/0000-0002-9671-6948, **https://orcid.org/0000-0003-3210-6144*
e-mail: tcalugaru@yahoo.com

Currently, about the danger of global climate warming, the need for an integrated assessment of plant resistance to the action of extreme temperatures is becoming increasingly evident. A model object to study the mechanisms of plant resistance to stress factors is the golden root (*Rhodiola rosea* L.), a precious medicinal plant that grows spontaneously in the mountains of most continents of the globe. She also grows in the Carpathian Mountains at an altitude of 1500 – 2000 meters. Moreover, existing information is that golden root plants also grow spontaneously at low altitudes near the seashore in Alaska and Sakhalin, with a pronounced continental climate. Although several types of research were provided in the past, the relative role of the different specific adaptations that determined the species' survival in the mentioned conditions is still unknown. To study the resistance mechanisms of plants to abiotic stress factors and their influence on the survival and accumulation of secondary metabolites in plants, during the last 20 years, we have carried out research with the golden root at the cellular, tissular, whole plant, and plantation levels in field conditions.

Keywords: *Rhodiola rosea L., agriculture, introduction, strategies*

Materials and Method. Using the HPLC method, the content, and spectrum of secondary metabolites extracted from golden root rhizomes collected in the Carpathian, Altai, and the Ural Mountains and those collected from artificially cultivated plants in Moldova and Ukraine, were studied. Genotypes collected in the Carpathian Mountains served as starting material for *in vitro* introduction of golden root cell culture and callus. The influence of low temperatures, soil moisture, and air on the growth and survival of plants grown under *in vivo* conditions, as well as ultraviolet radiation and low-temperature shock on the composition of secondary metabolites in golden root cells grown under *in vitro* conditions, was studied. Applying the methods of the systemic approximation, we appreciated the specific role of temperature, soil moisture, and air for plants survival and the accumulation of secondary metabolites in their rhizomes, as well as in cell suspensions and golden root callus cells cultivated under *in vitro* conditions.

Results. Initially, we used our research on the golden root rhizomes collected in the Carpathian, Ural, and the Altai Mountains. Analysis of the composition of the secondary metabolites extracted from the rhizomes of the plants from the mentioned provenances demonstrated that they do not differ significantly according to the content and spectrum of phenylmethanoloids and phenylmethanoloids. At the same time, in the rhizomes of artificially cultivated plants in Ungheni district and the suburb of Chisinau (Moldova), as well as in the Botanical Garden of the National University of Chernivtsi (Ukraine), the content of the mentioned components was shallow.

In vivo research has shown that the artificial cultivation of goldenrod plants is difficult. Even with rigorous maintenance, goldenrod plants die off at an exponential rate with the duration of cultivation. Although the species belongs to the *Crassulaceae* family, which mainly inhabits semi-arid habitats and has an almost cosmopolitan distribution, golden root plants are susceptible to soil and air moisture. Artificial maintenance of high soil moisture did not prevent the gradual elimination of plants grown under conditions when the relative humidity of the air was low.

Culturing the golden root under artificially controlled conditions highlighted another problem that may negatively affect the introduction of the species into agriculture. After about four months of intensive growth under controlled conditions, the plants go dormant. It became clear that premature drying of the aerial part of plants grown under field conditions does not occur due to limited air or soil moisture but mainly due to the influence of the mentioned periodicity (due to dormancy). Furthermore, it is clear that the heat in the second half of July and the autumn months negatively influence the viability of dormant plants. This phenomenon could cause a decrease in viability and the elimination of plants, as observed in our research.

The mentioned results suggested that the specific conditions in the mountains are essential for accumulating secondary metabolites in rhizomes and maintaining plant viability over the years. We introduced the *in vitro* culture of callus and cell aggregates from golden root plants of Carpathian origin to study the factors influencing the biosynthesis of secondary metabolites. Taking into account the meteorological conditions specific to the growth of the golden root in nature, we examined the influence of cell age (cultivation time after each passage), low temperatures, and ultraviolet radiation. The data we obtained demonstrated that in callus cells, or those of cellular aggregates, the content of secondary metabolites increases during the transition from the logarithmic phase to the stationary phase of growth. Incubation of the culture during different periods at low temperatures, or exposure to ultraviolet radiation, demonstrated the tendency to stimulate the accumulation of secondary metabolites in the obtained biomass. The artificial exposure of the golden root cell culture to the combined action of ultraviolet radiation and low temperatures, as well as the introduction of cinnamic alcohol into the cultivation medium, favored the accumulation of cellular biomass, the increase in the content of phenolic compounds, associated with the rise in the antioxidant capacity of the biomass extracts obtained. At the same time, the spectrum and relative content of secondary metabolites remained lower than that determined in extracts from rhizomes collected under natural conditions. Thus, crop age, daily and seasonal thermoperiodism and the ultraviolet radiation are the factors influencing the accumulation of secondary metabolites in golden root rhizomes collected from plants growing spontaneously in mountain areas. Increasing the yield of secondary metabolites in biomass of *in vitro* and *in vivo* culture can be achieved by developing optimal culture exposure regimes to low temperatures and ultraviolet radiation.

Although the literature describes the results of several studies on the content of secondary metabolites in rhizomes collected from spontaneous and artificially cultivated plants and in golden root callus culture, the relative role of different specific adaptations determined the distribution and survival of the species in geographical conditions remains unclear. Therefore, besides the purely scientific interest, the knowledge of the resistance mechanisms of the golden root to stress factors is necessary for the artificial cultivation of plants to obtain secondary metabolites, which have the adaptogenic properties.

Conclusions.

1. *Rhodiola rosea* L. plants, having a vegetation period well adapted to the annual variation of humidity and temperature at the altitude of 1500 - 2000 meters in the mountains, are eliminated in the plain much milder conditions. Elimination occurs because adaptation to mountain conditions was associated with eliminating adaptation traits to environmental conditions with low air and soil humidity. Among the limiting adaptations of the golden root species, we mention the need for the relatively short duration of the period in which the conditions are favorable for the plant's vegetation and the high humidity of the soil and air during this period.

2. The level of organization, age, and living conditions, influence the metabolism and accumulation of secondary metabolites in the cells, tissues, and organs of golden root plants.

3. Based on the data obtained, complex methods of cultivating golden root plants can be developed, ensuring the growth of rhizome biomass characterized by a high content of secondary metabolites. Achieving this goal is a decisive step in reducing the risk of extinction of the *Rhodiola rosea* L. species due to the abusive collection of spontaneous plants as a source of adaptogens.

Acknowledgment. Research was carried out within the project of the State Program 20.80009.7007.07 "Determining the parameters that characterize the resistance of plants with different levels of the organization to the action of extreme temperatures to reduce the effects of climate change", financed by the National Agency for Research and Development.

CZU:579.873.11:632.4 https://doi.org/10.53040/abap6.2022.46

ANTAGONISM OF THE FUNGUS *Trichoderma harzianum* TO PATHOGENIC MICROORGANISM *Alternaria alternata*, ISOLATED FROM WALNUT TREE

CRUCEAN S.*, SCERBACOVA Tatiana**
Institute of Genetics, Physiology and Plant Protection,
Chisinau, Republic of Moldova
** https://orcid.org/0000-0002-4883-1757, **https://orcid.org/ 0000-0002-2632-325X*
e-mail: stefan.crucean@igfpp.md

Agricultural crops suffer from a wide range of pathologies due to the involvement of different causal factors. Among these diseases, 70-80% are caused by pathogenic mycotic microorganisms. Pathogenic mycotic microorganisms have adverse effects on crop growth and their yield. Mycotic microorganism *Alternaria alternata* is one of the causative factors of alternariosis of agricultural crops, registering a high toxicological potential [1].

Guided by this goal, it is necessary to determine the antagonistic activity of fungus *Trichoderma harzianum* CNMN-FD-16 against pathogenic microorganism *Alternaria alternata*.

Keywords: *microorganism, antagonistic activity, Trichoderma harzianum CNMN – FD – 16, Alternaria alternata*

Materials and Method. In this context, as materials were used: microorganism *Trichoderma harzianum* CNMN – FD – 16, *Alternaria alternata*, Petri dishes, nutritive medium PDA (potato, dextrose, agar), fotonic microscope Bel Fotonics, ob. 100 x oc. 40.

As research methods, was used dual culture method with determination of the inhibition index of the pathogen *A. alternata* by the antagonist *T. harzianum* CNMN-FD-16. [2]

The radius of the colonies was measured daily by a linear method (mm) from the edge of the seeded block to the center of the dish. The index of inhibition (%) of the pathogen by the fungus *Trichoderma* was calculated on the 5th and 10th days according to the formula:

$P = ((K-A) \times 100)/K$, as:

P - inhibition index, %

K - fungal growth in control, mm

A - growth of the microorganism in the experiment, mm.

The degree of growth of the antagonist on the *Alternaria* colony was estimated in points: 0 point - no growth, 1 point - antagonist occupies 25% of the area of the pathogen colony, 2 points - antagonist occupies 25-50% of the pathogen colony, 3 points

- antagonist occupies 51-75% of the pathogen colony, 4 points - antagonist occupies 76-100% of the area of the pathogen colony. [3]

Results. Initially, the mycotic pathogen *A. alternata* was isolated from a walnut tree growing in the experimental garden of the National Botanical Garden (Institute) "Alexandru Ciubotaru" and cultivated on the nutrient medium PDA. Therefore, the studies were carried out under controlled laboratory conditions. The strain *Trichoderma harzianum* CNMN-FD-16 is stored in the working collection of the Laboratory of Phytopathology and Biotechnology, registered in the National Collection of Non-pathogenic Microorganisms (CNMN) of the Republic of Moldova. The studies were carried out in compliance with the optimal thermal regime for both microorganisms at a temperature of 24-26^0 C. On the 5th day, the radius of the colonies of the pathogenic microorganism *A alternata* was 6 ± 0.5 mm, and the radius of the antagonist *Tr. harzianum* CNMN-FD-16 was 75 ± 0.5 mm. Inhibition of the pathogen by the antagonist on this period was 58.3%. Inhibition of the antagonist by the pathogen was not observed. On the 10th day, the radius of the pathogen colonies was 10±0.4 mm, and the fungus *Tr. harzianum* CNMN-FD-16 completely populated the agar plate by 85±0.5 mm. The inhibition rate was 74%. The degree of colonization of the pathogen *A. alternata* by the antagonist *Tr. harzianum* CNMN-FD-16 was 3 points.

Conclusion: It was established that the antagonistic strain of *Trichoderma harzianum* CNMN-FD-16 can serve as a potential tool for combating the pathogenic microorganism *Alternaria alternata*.

Acknowledgment. Research was carried out within the State Program project 20.80009.7007.16. "Synergism between natural factors and ecologically harmless microbiological means of regulating the population density of harmful organisms for the protection of agricultural crops in conventional and ecological agriculture", funded by the National Agency for Research and Development.

References:

1. Li, J., Gu, F., Wu, R., Yang, J., Zhang, K., Scientific Reports, Article number: 45456 "Phylogenomic evolutionary surveys of subtilase superfamily genes in fungi", Sci. Rep. 2017, Vol 7, P. 49, http://dx.doi.org/10.1038/srep45456.
2. Sheng Jun Xu, Byung Sup Kim „Biocontrol of Fusarium Crown and Root Rot and Promotion of Growth of Tomato by Paenibacillus Strains Isolated from Soil", The Korean Society of Mycology, Mycobiology, 2014, Vol. 42(2), P. 159, http://dx.doi.org/10.5941/MYCO.2014.42.2.158.
3. Поликсенова В.Д., Храмцов А.К., Пискун С.Г. Методические указания к занятиям по разделу «Микология. Методы экспериментального изучения микроскопических грибов». Минск: БГУ, 2004, P. 36.

CZU:634.11:632.4:632.937 https://doi.org/10.53040/abap6.2022.47

TIMING FOR BIOLOGICAL CONTROL OF PATHOGENS ON REINETTE SIMIRENKO APPLE VARIETY

CURIEV Loredana
Institute of Genetics, Physiology and Plant Protection,
Chisinau, Republic of Moldova
https://orcid.org/0000-0002-1927-8358, e-mail: 2909loredana1994@gmail.com

The phenological phases of plant development are one of the most important indicators for determining the plant species growth, the disease infestation and for carrying out treatments with plant protection products in regional climatic conditions. In this study the phenological phases, diseases identification and biocontrol measures for apple variety 'Reinette Simirenko' were evaluated.

Reinette Simirenko apple has good resistance to *Phyllosticta*, but is very strongly attacked by apple scab and poorly resistant to powdery mildew.

Scope of the study - determination of the optimal timing of the use of biological preparations in the control of powdery mildew and scab on the apple tree variety Reinette Simirenko.

Keywords: *phenological stages, apple, apple scab, powdery mildew, biological control*

Materials and Method. The experiments were mounted in the orchard of the Institute of Genetics, Physiology and Plant Protection for the Reinette Simirenko apple variety, in eight variants, three repetitions, randomly. Phenological stages were determined in the orchard by daily observations from bud breaking until fruit ripening. At the period of vegetation (March – July) nine treatments were carried out with the biological preparations Trichodermin - SC (*Trichoderma lignorum* M-10) and Rizoplan (*Pseudomonas fluorescens* AP-33) and chemical etalon Jeck Pot, SC (Difenoconazole+Penconazole 200+100 g/l) using manual sprinklers. In the early stages of tree development, in the absence of signs of diseases, the following fungicides allowed in organic farming were used: Bouillie Bordelaise (Copper sulphate neutralized with Ca hydroxide, 770 g/kg); Cuprofix 40 Dispers WDG (Tribasic copper sulphate, 400 g/kg).

Results. Phenological stages of Reinette Simirenko apple tree monitoring was carried out in 2022. The following variables were evaluated:

- BBCH 00 Vegetative dormancy: in this stage both vegetative and fruit buds are completely closed covered with brown scales; duration: 01.01-28.02.2022;
- BBCH 03 Budding: The onset of vegetation. Buds begin to open revealing new tissue, the date of detection - 25.03.2022;
- BBCH 54 Mouse ears: buds continue to develop, small leaves called mouse ears can be seen, the date of detection - 04.08.2022;

- BBCH 59 Pink bud: flower buds reveal petals, at this stage turning pink in colour; the date of detection - 18.04.2022;
- BBCH 61 Beginning of flowering: about 10% of flowers open; the date of detection - 21.04.2022;
- BBCH 69 End of flowering: fertilization of flowers is practically 70 percent shaken; the date of detection - 26.04.2022;
- BBCH 71 Fruit of 1cm diameter: in this phase, the binding of the fruits has ended throughout the tree. The fruit is the size of a hazelnut; the date of detection - 12.05.2022;
- BBCH 73 Fruit size 2.5-3.5cm diameter: in this phase the fruit grows at an accelerated rate. In some varieties, some typical characteristics can be distinguished; the date of detection - 17.06.2022;
- BBCH 75 Fruit about half final size of the mature fruit: the characteristic shape of the variety is obvious; the date of detection - 11.07.2022;
- BBCH 78 Fruit about 80% final size; the date of detection - 11.08.2022.

Diseases identification: apple scab was registered on 13.05.22; powdery mildew it appeared on 05.05.22.

In the table 1 are presented data on disease control in different phases of apple tree development.

Table. Scheme of application of the biological and chemical plant protection product depending on BBCH (2022[1])

<table>
<tr><th>Phenological stages</th><th colspan="10">BBCH (Code EPPO)</th></tr>
<tr><td>Variants</td><td>00</td><td>03</td><td>54</td><td>59</td><td>61</td><td>69</td><td>71</td><td>73</td><td>75</td><td>78</td></tr>
<tr><td>Control (non-treated)</td><td rowspan="7">Without treatment</td><td rowspan="7">Without treatment</td><td></td><td></td><td rowspan="7">Without treatment</td><td rowspan="7">Without treatment</td><td></td><td></td><td></td><td rowspan="7">Without treatment</td></tr>
<tr><td>Jeck Pot, EC</td><td></td><td></td><td>*</td><td>*</td><td>*</td></tr>
<tr><td>Rizoplan</td><td></td><td></td><td>*</td><td>*</td><td>*</td></tr>
<tr><td>Trichodermin-SC</td><td></td><td></td><td>*</td><td>*</td><td>*</td></tr>
<tr><td>Rizoplan + Trichodermin-SC</td><td></td><td></td><td>*</td><td>*</td><td>*</td></tr>
<tr><td>Bouillie Bordelaise</td><td>*</td><td></td><td></td><td></td><td></td></tr>
<tr><td>Cuprofix 40 Dispers WDG</td><td></td><td>*</td><td></td><td></td><td></td></tr>
</table>

Note: * - treatment;
[1] - Year

Conclusions.

1. Copper compounds (copper sulphate) should be applied on the BBCH phases of mouse ears and pink button to control apple scab and powdery mildew in apple trees.
2. Biological preparations on the base of the *T. lignorum* M-10 and *Ps. fluorescens* AP-33 need to be applied on the BBCH phases 71 Fruit of 1 cm diameter.
3. Copper sulphate and Trichodermin-SC, Rizoplan it is good to recommended for organic farming.

Acknowledgement. Research was carried out within the State Program project 20.80009.7007.16. "Synergism between natural factors and ecologically harmless microbiological means of regulating the population density of harmful organisms for the protection of agricultural crops in conventional and ecological agriculture", funded by the National Agency for Research and Development.

CZU:635.13:582.24 https://doi.org/10.53040/abap6.2022.48

DAUCUS CAROTA RESISTANCE SOURCES TO MYCOMYCETES PHYTOPATHOGENIC COMPLEX

ENGALYCHEVA Irina*, KOZAR Elena
Federal State Budgetary Scientific Institution Federal Scientific Vegetable Center (FSBSI FSVC), Russia
https://orcid.org/0000-0003-4843-111x, e-mail: *engirina1980@mail.ru*

To solve the problem of year-round supply of fresh carrots to the population, it is necessary to have varieties that retain high commercial qualities for 220-250 days of storage [1, 2]. The resistance of root crops to diseases significantly affects the profitability of their sale after storage (r=-0.64). In large agricultural holdings and small farms, foreign varieties and hybrids are often used, betting on yield. However, the profitability of sales after long-term storage is mainly higher for varieties and hybrids of Russian breeding, due to the least losses of commercial root crops during long-term storage. Compared with stable ones, the profitability of the sale of unstable samples decreases by 2.6 times at a 20-30% level of root crop damage, and at a 40% lesion - by 28 times [3].

The pathocomplex of storage diseases (cagate rot) is represented by a wide range of pathogens, the composition and ratio of which varies depending on the year, variety and place of cultivation [4]. Along with the increasing aggressiveness of local races of pathogens, new races have been introduced in recent years [4]. Therefore, one of the main requirements of modern breeding for immunity is the search for sources of resistance not only to a separate, but also to a complex of pathogens of the cellular rot. In this regard, monitoring the spread of storage diseases in the carrot culture of the canteen and the search for such sources is always relevant and is the goal of our work.

Keywords: *Daucus carota, varieties, resistance, mycomycetes*

Materials and Method. The research material is genetic collections and promising breeding samples of carrots from the laboratories of breeding and seed production of table root crops, genetics and cytology of the Federal State Budgetary Scientific and Scientific Research Center. Phytosanitary monitoring during the storage period of the flowers, identification of the species composition of isolated mycomycetes, the degree of damage and the level of resistance of varietal samples were carried out using appropriate determinants of methods [5,6,7].

Immunological assessment of the stability of carrot samples invitro was carried out by applying agar blocks of ten–day cultures of nine types of the most harmful mycomycete root discs, control - a sterile agar block. The repetition is fivefold. The hybrid Nadezhda F_1 was used as a standard of resistance to mycotic rot. The degree of lesion was taken into account on the seventh day. The ranking of samples into resistance groups was carried out by increasing the volume of the affected area. The following groups are distinguished: stable, tolerant, medium-receptive, receptive and highly receptive.

Results. Annual monitoring in recent years indicates a change in the structure of the pathogenic complex and the genetic composition of phytopathogen populations in carrot culture. In the conditions of the Moscow region, the greatest damage is caused annually by low-temperature sclerotic fungi *Botrytis cinerea*, *Sclerotinia sclerotiorum*, and in recent years the aggressiveness has been increasing. S. nivalis and *Typhula ishikariensis*, whose appearance in this region has been registered recently [8]. In the pathogenic complex of dry rot from fungi of the genus *Alternaria*, *A. radicina, A. corotiincultae* have the greatest harmfulness, and from the genus *Fusarium*, the dominant species of *F. oxysporum* are *F. solani*.The composition of causative agents of fusarium rot in the Moscow region is expanding and is now often encountered *F. avenacium, F. nivale, F. chlamidosporum, F. culmorum*. As long-term data show, the prevalence of certain groups of phytopathogens on carrot culture is largely determined by the origin of the analyzed samples. Thus, on collectible varieties and hybrids of foreign breeding, the epiphytotic character is more often the development of white rot pathogens, affecting about 70% of root crops. Among the samples of domestic breeding, a higher prevalence of fusariosis, fomosis and alternariosis was noted (9-21%). Often resistant varieties to some phytopathogens turn out to be unstable to others, which makes it necessary to search for sources of resistance to their complex for inclusion in the breeding process. For this purpose, an immunological examination was carried out by the method of artificial infection.

During the research period, an increase in aggressiveness and the appearance of new races of invasive mycomycetes was noted, which leads to a decrease in the resistance of carrot varieties and hybrids popular with producers.Within varietal and hybrid populations, the degree of damage to individual root crops can vary widely (27-64%), which makes it possible to conduct intra-population selection of the most stable forms. The most valuable is the group, which includes genotypes that have shown high resistance to most pathogens. Their share in most cases does not exceed 10% of the total number of analyzed root crops within the majority of samples. Among the samples of Russian breeding, the most valuable sources of group resistance to mycotic storage rot are the varieties Margosha and Chantenay 2461, hybrids Nadezhda F1 and Reef F1; among foreign samples - №330, №385, №364.

The selected genotypes with a high level of group resistance are included in the breeding process as a source material for creating new lines and hybrids of table carrots, as well as maintaining and preserving the stability of already created ones. Immunological analysis of the obtained offspring showed high efficiency of selection based on a comprehensive assessment of the stability of individual uterine root crops in invivo and invitro conditions.

Conclusions. The main reason for the decline in the production of marketable carrot products is crop losses from diseases during its long-term storage. As a result, this leads to an increase in prices relative to the autumn months from April by 44% and from July by 50%, until the arrival of a new crop. Varieties and hybrids of local breeding, most adapted to the specific conditions of the cultivation regions due to a higher level of resistance to local populations of pathogens, are economically advantageous in terms of production costs. Due to the change in the species composition and the degree of aggressiveness of new races, it is important to constantly search for new sources of resistance to the complex of pathogens of mycosis and to conduct systematic immunological work to maintain the valuable gene pool of already created resistant forms at the proper level.

References:

1. Yanchenko E.V. Complex evaluation of cultivars and hybrids of carrot according to crop yield, quality and suitability for long-term storage. *Moscow*.2009, 20 p.
2. Borisov V.A., Romanova A.V, Yanchenko E.V., Maslovskiy S. A. Guidance: Storage technology and sell-by date for edible roots. *Moscow*. 2010,31 p.
3. Engalycheva I.A., Kozar E.G., Stepanov V.A.et.al. Resistance of carrots to diseases as a factor of increasing production profitability *IOP Conf. Series: Earth and Environmental Science*. 2021,p.650.
4. Timina L. T., Engalycheva I. A. Complex of pathogens on vegetable crops under conditions of Central region of RF. *Vegetable crop sof Russia*.2019, №. 3-4 (28-29), p.123-129.
5. Pidoplichko N.M. Parasitic fungi of cultural plants. *Kiev*.1977,Vol. 2, 299 p.
6. Gannibal F.B. Monitoring of alternarioses of agricultural crops and identification of fungi of the genus Alternaria. *St.Peterburg*.2011,51 p.
7. GagkaevaT.Yu. Toxigenic fungi on cereal grains: distribution, hazard and control. *Tekhnologii I kachestro khlebobulochnykhi konditerskikh izdeliy*. 2006,111 p.
8. Timina L.T., Pivovarov V.F., Tkachenko O.B. New pathogen of red beet in storage. *Vestnik Rossiyskoy akademii selskokhozyaystvennykh nauk*. 2010, №. 6, p. 39-40.

CZU:595.79:591.53:634.22 https://doi.org/10.53040/abap6.2022.49

FAUNISTIC COMPOSITION AND NUTRITION TYPES OF THE HYMENOPTERA COMPLEX IN A PLUM ORCHARD (III)

ELISEEV S.*, SUMENCOVA Victoria
Institute of Genetics, Physiology and Plant Protection,
Chisinau, Republic of Moldova
**https://orcid.org/0000-0002-3711-4429, e-mail: serghei_eliseev@yahoo.com*

Hymenoptera is one of the key orders within Insecta. They number around 153.000 described species [3]. All of the species known so far, differ a lot in their ecological niches and nutritional preferences. They play different roles in nature, thus, ranging from pollinators (bees), parasitoids (parasitoid wasps) to serious agricultural pests (sawflies).

Plum is one of the most important stone fruit cultures in the Republic of Moldova. It is widely used in many food industry' branches. The plum is often attacked by a number of pests that produce serious damage in both fruit quality and quantity. The presence, significant richness and abundance of the parasitoid Hymenoptera can considerably improve natural control of the pests in a plum orchard.

The purpose of this work was to research the Hymenoptera complex in a plum orchard – its faunistic composition and nutritional properties for better understanding of their role in a plum orchards' ecosystem.

Keywords: *Hymenoptera, parasitoid, wasp, plum, orchard*

Materials and Method. We had been researching faunistic composition of the Hymenoptera in 2016, 2017 in the village of Bacioi (Chisinau vicinity). The former results were presented earlier [1, 2]. The present work was carried out in 2018 in the plum orchard of the Institute of Genetics, Physiology and Plant Protection (IGPPP). Angelino was a plum variety used for present research. Yellow sticky traps hung in the middle of the tree crown were used for collecting Hymenoptera. The traps were replaced with new ones in two weeks from April to September 2018. A total number of 70 yellow sticky traps with 3640 exemplars of Hymenoptera was examined. Microscope magnification (4.5 x 10) was used to key the exemplars. The collected biomaterial was transported to the laboratory and keyed mainly to family taxa. Insects' keying was made using "Hymenoptera of the world: An identification guide to families" [4].

Results. The total number of 24 families was recorded. The results of the work are presented below indicating the name of the family (from the most numerous to least). The percentage and the nutritional preferences are indicated in brackets.

Hymenoptera collected in the plum orchard: Ceraphronidae (28.0%; endoparasitism), Platygastridae (23.0%; endoparasitism), Mymaridae (18.0%; endoparasitism), Encyrtidae (8.0%; endoparasitism), Trichogrammatidae (6.0%; endoparasitism), Aphelenidae (4.0%; endo-, ecto- and autoparasitism), Braconidae (2.3%; endo- and ectoparasitism), Eulophidae (2.0%; endo-, ecto- and hyperparasitism), Pteromalidae (1.1%; hyperparasitism), Bethylidae (1.0%; ectoparasitism), Megaspilidae (1.0%; hyperparasitism), Cynipidae (1.0%; herbivorous), Torymidae (1.0%; ecto- and hyperparasitism, some are herbivorous), Eupelmidae (0.3%; endo-, ecto- and hyperparasitism), Chrysididae (0.2%; cleptoparasitism), Formicidae (0.2%; predators), Diapriidae, Ichneumonidae (both 0.2%; endoparasitism), Tenthredinidae (0.1%; herbivorous), Eurytomidae (0.1%; ecto-, hyperparasitism, some herbivorous), Signiphoridae (0.1%; hyperparasitism), Colletidae (0.1%; pollinators), Figitidae (0.02%; endoparasitism), Perilampidae (0.02%; hyperparasitoids in Ichneumonidae (Hymenoptera) and Cecidomyiidae (Diptera) larvae), unkeyed exemplars (2.06%).

Some of the exemplars were keyed to subfamilies and genera. We keyed *Apanteles* spp. from Braconidae (Aphidiinae). We also keyed *Pnigalio pectinicornis* (Linnaeus, 1758) (Hymenoptera: Eulophidae).

Among first top families (Ceraphronidae, Platygastridae, Mymaridae, Encyrtidae, Trichogrammatidae), all but Ceraphronidae are very important parasitoid wasp families with some, e. g. Encyrtidae, extremely influential in biological control.

The vast majority of keyed Hymenoptera exemplars are parasitoid (95.0%), thus, influencing the pests' population dynamics. Just three families are phytophagous (Tenthredinidae, Colletidae and Cynipidae). The rest of the families use mixed sources of nutrition.

For the first time in three years the leading position was occupied by Ceraphronidae family, moving Mymaridae to third position. Also, for the first time in three years the Trichogrammatidae family made it to top five families. Trichogrammatidae are particularly important being egg parasitoids of many agricultural pests. For three years in a row the Encyrtidae family occupies the fourth position. During 2016 – 2018 period the three orchards share the four "core families" – Mymaridae, Platygastridae, Ceraphronidae and Encyrtidae which comprise permanently the top four most numerous families. New for all three orchards were two small families – Colletidae and Perilampidae.

Conclusions

1. Faunistic composition of the IGPPP plum orchard is comprised of 24 Hymenoptera families.

2. The cumulative part of four main beneficial Hymenoptera families is 55.0%. They vastly dominate the Hymenopteran "landscape" of the plum ecosystem.

3. The three researched orchards share in common the four “core families” – Mymaridae, Platygastridae, Ceraphronidae and Encyrtidae, three of which are important for pest arthropods’ control.

Acknowledgment. Research was carried out within the project of the State Program 20.800009.5107.27 “Elaboration of the alternative methods based on environmentally friendly means and procedures for harmful arthropods control in different agricultural crops” financed by National Agency for Research and Development.

References:

1. Eliseev S., Sumencova V., Batco M., Iordosopol E. Faunistic composition and nutrition types of the Hymenoptera complex in a plum orchard, IX з’їзд Українського ентомологічного товариства (м. Харків 20 -23 серпня 2018 р.). 2018, p.149.
2. Eliseev S., Sumencova V., Iordosopol E. Faunistic composition and nutrition types of the Hymenoptera complex in a plum orchard (II), Materialele Conferinței științifice internaționale (Ediția a VII-ea) “Genetica, fiziologia și ameliorarea plantelor” (m. Chișinău 4 – 5 octombrie 2021). 2021, p. 309, 310.
3. Grimaldi D. A., Engel M. S. Evolution of the Insects, Cambridge University Press, New York, USA, 2005.
4. Hymenoptera of the world: An identification guide to families. Agriculture Canada Publication, Ottawa, Canada, 1993.

CZU:632.937:632.7 https://doi.org/10.53040/abap6.2022.50

THE PERSPECTIVE OF PROCEDURES WHICH COMBAT *Zeuzera pyrina* L.

FRON A.*, IORDOSOPOL Elena
Institute of Genetics, Physiology and Plant Protection,
Chisinau, Republic of Moldova
**https://orcid.org/0000-0001-9709-483X, e-mail:arcadie.fron@gmail.com*

Introduction. In the Republic of Moldova, walnut culture has grown in the last decades (about of 14000 ha.). Currently, no detailed studies have been carried out on the harmful effects produced by *Zeuzera pyrina* L in the walnut orchard. This problem can be solved by clarifying the phenology of this pest in the agroecosystems of the industrial walnut and apple orchards.

Five decades ago, against *Z. pyrina* L. in the apple crops, classic methods of combat were used, at different stages of its development, by cutting and burning the attacked branches. Another control method was the poisoning method by introducing cotton balls moistened in a 10% suspension of 12% hexachloran dust or 10% thiophos emulsion [3]. And three decades ago, organophosphorus preparations products were used against it during the mass flight of butterflies, the egg-laying and the hatching of the larvae periods. Poisoning of the larvae in the galleries was carried out with the products carbofos, antio, metafos and cidial [4]. Currently, in the practice of walnut protection against this pest, Actara WDG and Decis Profi VDG insecticides are used.

In the world practice, 7 species of pathogens from 4 genera (*Bacillus*, *Beauveria*, *Hirsutella* and *Metarhizium*) and 12 species of arthropods (parasitic insects and spiders) together with nematodes are known, they regulate the pest at different ontogenetic stages. The parasite species *Elachertus nigritulus* Zett (Hymenoptera: Eulophidae), is frequently used as a biological agent [2].

Purpose. The goal of this research was development of procedures which combat the branch borer by using pheromone traps and biological agents. The objectives of the research consist of monitoring the population of *Z. pyrina* L. in traps with male sex pheromone, under the influence of the weather conditions of the year 2022. Also we will compare the results in relation to the phenological calendar of development of the pest; and finally, the complex of parasitic insects that regulate it will be highlighted.

Keywords: *Zeuzera pyrina, pheromonal traps, pest control, walnut, threading*

Materials and Method. Pheromone traps, entomological netting, and individuals of parasitic and harmful insects were used. The method of capturing the male sexual pheromone of the branch borer and the diagnostic method of parasite and plant species from the spontaneous flora were used. After collecting and diagnosis up to the species of the biological material of insects, the given individuals were verified with holotypes of species present in the scientific-practical entomological collection of the IGFPP of the Republic of Moldova dating back to 1946. The experiment was set up in the 17 years old walnut plantation (50 ha) of the SRL " Pe Dealul Nucului " (station I), and in the6 year old apple plantation (0.5 ha) (station II) from the experimental lot of the IGFPP.

Results. The monitoring of the flight of *Z. pyrina* L. males at Delta pheromone traps in the conditions of 2022 year was carried out on the walnut and apple crops. According to the phenological calendar [3], the pupa emergence period lasts from the III decade of May to the III decade of July. Butterflies appear from the II decade of June-sean and last until the I decade of August. In our case, the first butterflies were observed on July 27, on average 1 butterfly/trap in both stations. And, over a week (the beginning of the I decade of August) in the July season I, the number of males captured was on average 3 per trap, three times more than in season II. It is noteworthy that July started with lower temperatures compared to June, but without considerable precipitation. Considering that the larvae live in the branches, we can conclude that the humidity in them was also low, thus effect stopping the pupation. So the butterflies did not fly in the II decade of June due to high temperatures (+28.5°C) and low humidity, <40%. In our case, the flight took place in the III decade of July at average temperatures per decade of +23.1°C, with a deviation from the multiannual calendar by 67 days, both for the walnut and apple crops. So, the obtained indices are preventive, and we will continue to follow the flight and the deviation from the multiannual phenological calendar, taking into account the meteorological conditions established in August.

Another possible method in the fight against this pest is the use of biological agents. In order to obtain databases on the triple trophic links of parasites and predators it is necessary to carry out surveys through round-trip threading. In our case, in the dry conditions of 2022, between the rows of walnut and apple plantations, in May and July period, a short natural grassy carpet was observed, consisting of the following plants: in May – *Capsella bursa-pastoris* L. and Stellaria media IT.; in June – *Setaria viridis* L. and July – *Erygeron annua* L. And in the first decade of August, after abundant rainfall, *S. viridis* L.*, E. annua* L., *Ambrosia artemisiifolia* L., and *Portulaca oleraceae* L. were noted. This grassy carpet is the main source of food for the parasite-predator complex, which regulates the pest at different ontogenic stages. Therefore, following the threading and the analysis of the obtained biological material, the presence of two species from the families: *Encyrtidae - Tyndarichus melancis* Dalm was observed, and *Copidosoma truncatelum* Dalm., which is an ovi-larval parasite, and has an alternative host the gamma beetle *Autographa gamma* L.; *Eulophiidae - Euderus abitarsis* Zett., and *Elasmus ciopkolai* Novik, which parasitizes in the larval stage; Ichneumonidae - *Diagdema terebrans* Grav., which is an abundant species in the Republic of Moldova with an alternative host (corn borer *Ostrinia nubilalis* Hb.) [4], and *Prystomerus vulnerator* Panz. endoparasitic species, abundant with 17 alternative host species from the families Tortricidae, Gelechiidae, Yponomeutidae, Pieridae, Pyraustidae, and Sessidae [1].

A Dolichogenidea (=*Apanteles phaloniae* Wilk.) species was noted from the Braconidae family, which has as its alternative host the umbellifer tortricide moth *Aethes smeathamanniana* F. The Tachinidae family fly species, *Nemorilla maculosa* Mg., is a parasite found in the larval stage and frequently found in the country, parasitizing species of twisting moths, such as *Archips rosana L.*, *A. xylosteana* L., *Tortrix viridana* L. and other species from the suborder Microlepidoptera [5]. In our case it was observed feeding on the spontaneous flora of *E. annuus* L. All these above mentioned species, are native and with the perspective of developing technologies for cultivation and use as biological agents.

Conclusions.

The flight of males of the species *Zeuzera pyrina* L. to the walnut and apple pheromone traps, in the conditions of the year 2022, deviated by 67 days in relation to the multiannual phenological calendar;

In the walnut plantation, the average number of males captured was three times higher than in the apple culture;

A number of 8 species of parasites from 5 taxonomic families were detected, which regulate the density of the *Zeuzera pyrina* L. from egg to pupa in apple and walnut culture.

Acknowledgment. Research was carried out within the project of the State Program 20.80009.5107.27 “Elaboration of the alternative methods based on environmentally friendly means and procedures for harmful arthropods control in different agricultural crops”, financed by the National Agency for Research and Development.

References:

1. Iordosopol E. I., Batco M. G. 2021. *Ghid de diagnostică al insectelor parazite și prădătoare la cultura prunului*. / Chișinău.
2. Hegazi, E. M.; et al., 2010. *Suppression of leopard moth (Lepidoptera: Cossidae) populations in olive trees in Egypt through mating disruption*: Journal of Economic Entomology 103 (5), 1621-1627.
3. Вердеревский Д. Д. и др., 1968. *Справочник агронома по защите растений.* / Кишинев. с. 499-501.
4. Савковский П. П. 1990. *Атлас вредителей плодовых, и ягодных культур.* / Киев, с. 87-88.
5. Дорохова И. Г. и др. 1989. *Полезная фауна плодового сада* (Справочник) / Кишинев. стр. 46-84.

CZU:632.937:595.792 https://doi.org/10.53040/abap6.2022.51

THE INFLUENCE OF BIOLOGICALLY ACTIVE SUBSTANCES WITH CAIROMONAL PROPERTIES ON THE ENTOMOPHAGE *Trichogramma evanescens* WESTW

GAVRILITA Lidia[1]*, NASTAS T.[1]**, NITA Uliana[1], BUTUCEL Marina[1], BUTNARU Galia[2]
[1]*Institute of Genetics, Physiology and Plant Protection, Chisinau, Republic of Moldova,*
[2]*Banat University of Agricultural Sciences and Veterinary Medicine „King Mihai I of Romania" from Timisoara*
**https://orcid.org/0000-0001-9266-456, ** https://orcid.org/0000-0002-0322-710X, e-mail: lidia_gavrilita@yahoo.com*

The **purpose** of the research was: to increase biological indices depending on the action of biologically active substances with kairomonal properties on the entomophagous *Trichogramma evanescens* Westw.

Keywords: *Trichogramma, Sitotroga cerealella, kairomon, plant protection, fertility, efficiency, entomophages*

Introduction. Researches have shown that the parasitization percentage of *Trichogramma evanescens* in kairomone-treated variants is significantly higher than in the control and the comparison variant (alcohol 30%), because the biologically active substance serves as an entomophagous attractant. The mode of examination of the interaction - phytophagous and entomophagous as the procedure which stimulates the *Trichogramma* to find its food sources.

Biotechnical methods of combating diseases and pests with Cairomons and other substances with similar action – this group includes in itself the attractants - substances that stimulate animals to find their food sources. The method can be used both for forecasting and warning, but also for direct pest control (Istrate, Gontariu 2020). A wide range of research has been carried out with the use of chemical mediators (especially pheromones, kairomones, synomones and allomones), as a way of use in the monitoring, management or combating of many species of harmful insects, in parallel with the reduction to the elimination of treatments with pesticides and their replacement with biopesticides (Bakthavatsal, 2013).

Materials and Method. The research was carried out in laboratory conditions and in the experimental soybean field of the Institute of Genetics, Physiology and Plant

Protection. The goal was the increase of the biological indices depending on the influence of biologically active substances with kairomonal properties on the entomophagous *Trichogramma evanescens* Westw.

Formula for determining the amount of water required to dilute ethyl alcohol to the required strength is: X = P*(N/M-1); X- the amount of water needed to dilute the ethyl alcohol to the required strength; P - the amount of ethyl alcohol for dilution by variants; N-96 degrees - the strength of the initial ethyl alcohol.

Results. Further researches were carried out with the species of *T. evanescens* Westw, being dominant in soybean culture. The biological indices of *T. evanescens* were: the prolificacy of a female from 24.0 eggs to a female, the hatching of individuals of 86.0%, the share of females 56.0%, the static criterion of quality was 11.5. In order to carry out the research, experiments were set up in laboratory cages, where the search capacity of *T. evanescens* was determined in glass tubes with a length of 1.5 m. A tampon soaked with kairomon was mounted at one end, at the other end the entomophagous was launched. The time traveled by females in the version with kairomon and in the control without kairomon was determined.

As a source of kairomone (Biologically Active Substance) the alcohol extract and eggs of the cereal moth (*Sitotroga cerealella* Ol) were used. The action of the fractions extracted from the scales of the cereal moth on the search capacity of *T. evanescens* W was assessed. It is an active component, for increasing the quality of the entomophagus. In the experiments of 2020-2021, the kairomone with optimal properties, obtained in 2020 with the help of the "Optimclass" program, was used according to Plan Box 3, where the age of the eggs (X1) was 24 hours and 48 hours. Time for the travel by the females of the distance of 1.5m in the control varied from 40.72-41.82-42.84, the age of the eggs 24 hours, which is essentially higher than in the variant with treatment, i.e. in the control the females travel this distance much more slowly.

At the age of the eggs of 72 hours, the time traveled by the females of the distance of 1.5m. at the concentration of 10%, 20%, 30% at different levels of the factors the weight of the eggs (1, 2, 3g) and exposure (5, 10, 15 min) varied from 26.36-27.3-28.96 min. In the control, the time travelled by the females of the 1.5m distance varied from 42.34-44.14-44.46 min at the egg stage. The time traveled by the females of the distance of 1.5m compared to the variant with treatment with alcohol solution at all levels of the factors at the age of the eggs of the cereal moth of 24 hours and 72 hours is significantly lower than in the control.

The research carried out at the treated grain moth larvae stage, the search capacity of *T.evanescens*, the time traveled by the females of the distance of 1.5m at the concentration of 10%, 20%, 30% at different levels of the egg weight factors (1, 2, 3g) and the exposure (5, 10, 15 min) varies from 17.87-17.97-18.08 min. The time traveled by the females of the distance of 1.5m in the control varies from 37.39-40.72-42.84, at the larval stage. The time traveled by the females of the distance of 1.5m at the combination of different factors: the concentration of 10%, 20%, 30%, the weight of the eggs (1, 2, 3g) and the exposure (5, 10, 15 min), at the age of the eggs the 24-hour grain moth and the „Optimclass" program were used to construct the graphs, with the help of which the optimization zone was determined, which is: concentration-30%, weight of treated eggs-1g, duration of treatment-5min, where the time spent by females is minimal.

The search capacity of *Trichogramma evanescens*, at the age of the eggs-72 hours and the larval stage of the host, the optimization area constituted: concentration- 30%, the weight of the treated eggs and larvae 3g, the duration of the treatment 15min, where the time spent by the females is minimal. The optimal area at these stages of development coincides, (age of eggs-72 hours and larval stage) which is explained by the very close development stages of the laboratory host the cereal moth and the identical attractive properties.

Conclusions.

1. Based on the research results obtained in 27 variants in 3 repetitions, i.e. 81 variants, according to the Box – 3 plan of the search capacity of *Trichogramma evanescens* with attractive properties of *Sitotroga cerealella*, the age of the eggs of the cereal moth (*S. cerealella* Ol.) of 24 hours, 72 hours and larvae and the „Optimclass" program, the graphs were built.
2. This way of examining the interaction - phytophagous and entomophagous can be called as a method of increasing the quality of *Trichogramma.* Multiple researches have indicated that chemical substances produced by the host, so-called kairomones, which have a great potential to regulate harmful insects, act on the behavior of the entomophagus.

Acknowledgment. Research was carried out within the project of the State Program 20.80009.5107.27 "Elaboration of the alternative methods based on environmentally friendly means and procedures for harmful arthropods control in different agricultural crops", financed by the National Agency for Research and Development.

References:

1. Istrate Ana-Maria, Gontariu Ioan, 2020 Concepţii moderne în cadrul protecţiei integrate a plantelor Performantica Editura Performantica Institutul Naţional de Inventică, Iaşi Campusul Universitar "Tudor Vladimirescu", p. 3-4. ISBN 978-606-685-708-6 I.
2. Bakthavatsalam, N. P. L. Tandon P. L., Deepa Bhagat, (2013). *Trichogrammatids*: Behavioural Ecology, Biological Control of Insect Pests Using Egg Parasitoids, 10.1007/978-81-322-1181-5-5, (77-103).

CZU:635.21:632.4:632.9 https://doi.org/10.53040/abap6.2022.52

THE PHYTOHORMONES USAGE AS POTATO PROTECTION SYSTEM ELEMENT AGAINST POTATO FUNGI DISEASES IN TERMS OF WESTERN FORESTSTEPPE

GAVRILYUCK A.T. [1*], ZELYA A.G. [1**], NEMERYTSKA L.V.[2***]
[1]*Ukrainian Science Research Plant Quarantine Station Institute of Plant Protection NAAS;*
[2]*Zhytomyr Agrotechnical College, Ukraine*
**https://orcid.org/0000-0002-7982-4365, **https://orcid.org/ 0000-0002-1470-7707, ***https://orcid.org/0000-0001-7933-0587*
e-mail: allona_melnik@ukr.net

Introduction. Potato *Solanum tuberosum* L. is important agricultural crop. It takes important place in food list for men food. It takes important place as a feed for animal husbandry and industry. The potato diseases, causative agents are different phytopathogenic organisms (fungi, viral, bacterium) is important problem for potato study today.

Alternaria blight and late blight are dangerous diseases of fungi diseases. They take serious spread every year in Ukraine territory. They may cause serious losses for potato growing. The decrease quanitity of yield goods quality decrease, storage observed in recent years. The areas defeating happens through the reasons of farming culture decrease. Among them are: non-control fertilizers input and systems of potato nourishing, non- following the agrotechnical requirements for crop rotation optimal terms for planting, absence of quality seeds material, unfavorable weather conditions and defeating pathogen organisms of fungi nature.

The agricultural crops protection from complex of pests is important task for agriculture. The agriculture losses 50-60% from the yield every year. The main crops' yield may increase in terms of soils fertility and favorable climatic terms through the development of biological farming [1, 3, 4]. There are immunomodulators for this aim. They used as stress adaptogens, activators for growing and development. They enforce plants' root system, normalize soil's content and increase absorption of nutritious matters of crop.

Purpose is to determine phytohormones impact on potato fungi development in area of Ukr SRPQS IPP NAAS.

Keywords: *potato, phytohormones, succinic acid, zircon, technical efficiency*

Materials and Method. The studies conducted on the base of Ukrainian Science- Research Plant Quarantine Statio IPP NAAS (UkrSRPQS IPP NAAS), through the put of field trials and analysis executing. The following potato varieties: Strumok, Fantasy, Lugivska, Yavir used for researches. The plants' defeating records conducted as per generally approved technique [2]. The researches conducted on the base of UkrSRPQS IPP NAAS throught the potato plantation immunomodulators spraying.

Zircon is a specialized stimulator of agricultural crops plants growing. The active matter is extract of purple coneflower.

The preparation usage allows to accelerate weak plants and resurrect immunity. It increases products quality. The products ripen on ten days early. The yield increases on 40-60 %. It stimulates the roots and fruits forming. It helps crops to survive draughts, cold, lack of light, humidity excess. It decreased the level of heave metals save and shorten terms of rootening.

Succinic acid is a natural stimulator of growing. It increases seeds germination and sprouting on 30-50%, strengthens rootforming. It increases yield to 40%.It favors the resistance to.

It is possible to conduct ecologic, economic benefit and technological control for development and hazard of dangerous pests, which cause the serious level of losses on the base of phytohormones.

Results. The potato plantation treating conducted 3 times. The spray conducted during the growing period and at the first features of ill (BBCH 61-71). The following treating conducted every 10-14 days.

The researches of phytohormones impact Zircon and succinic acid points on serious decrease of diseases development. The zircon usage inhibits disease development (DD-3.5-7.4, control-10-16.1%) as per studies results. The technical efficiency increased to 65%. The disease development analogously decreased (DD- 3.7 – 7.2%, and control consisted of 10.0-16.1%) during succinic acid usage.

The disease development index consisted of in the scope of 2.8 – 6.0 %, and technical efficiency increased to 71.4% during the mix usage to 71.4%.

Conclusions. The phytohormones usage Zircon and succinic acid had inhibiting impact on potato disease development. It conforms the technical efficiency.

The potato plantation treating by preparation complex Zircon+ succinic acid seriously decreased the ill development.

References:

1. Gavryliuk A. T., Kyryk M. M. Tank mix additives biological preparations efficiency usage with other means against potato alternaria blight. Science of post – industrial society: globalization and transformation processeses V International scientific journal GRAIL OF SCINCE, Vienna, Austria, 04 червня 2021 року. DOI 10.36074/grail-of-science.04.06.2021.016
2. Melnyk A.T., Kyryk M.M. Biological preparations efficiency research against Alternaria blight potato in terms of Western Ukrainian Foreststeppe.

Advanced Biotechnologies- International Scientific Symposium (Vth Edition) p.104. https://ibn.idsi.md/sites/default/files/imag_file/104-104_10.pdf

3. Trybel S.O. Technique pesticides testing and usage. Kyiv.: Svit, 2001- P.448
4. Zelya A.G., Zelya G.V., Makar T.Y., Zelya G.V., The biological preparations usage in potato protection against wart causative agent *Synchytrium endobioticum* (SCHILB) PERC and yellow cyst nematode. Proceedings of international scientific conference Genetica, fiziologia si ameliorarea plantelor. 2013. P. 357 – 361.

CZU:633.15:632.786 https://doi.org/10.53040/abap6.2022.53

THE PEST MONITORING OF *Heliothis armigera* Hbn. ON THE CORN

GHELETIUC Olesea
Institute of Genetics, Physiology and Plant Protection,
Chisinau, Republic of Moldova
https://orcid.org/0000-0002-0028-4547, e-mail: gheletiuco@mail.ru

The purpose of this work was to highlight one of the ecological methods of seasonal monitoring of the population density of the pest cotton bollworm, *Heliothis armigera* Hbn. (Lepidoptera: Noctuidae) on corn.

In recent years, this pest is a particularly acute problem in the agroecosystem plantations of agricultural crops. The larvae of this pest cause essential damage to a wide spectrum of agricultural plants, including the corn, which in the Republic of Moldova is the part of the economically important crops. To protect the harvest, a wide spectrum of pesticides is applied and about 3-4 chemical treatments are carried out annually. In the Republic of Moldova, the areas cultivated with sweet corn constitute approximately 3000 ha annually and are constantly growing. At the same time, chemical treatments, along with pest control, also cause significant damage to the ecological system, which manifests itself not only through direct negative effects, but also indirect ones, which will become visible in the coming years. The widespread use of pesticides also leads directly to the considerable reduction of the beneficial insect species.

Extremely important method for combating this pest is the seasonal monitoring of the population density depending on the species of cultivated plants and the phenological phases of their development. One of the effective solutions would be the development of methods based on natural control mechanisms of the relationships between harmful organisms and cultivated plants. A safe method for detecting and monitoring the population density of this pest is the application of pheromonal traps. The most important advantage of using sexual pheromones is that they are biologically active substances characteristic only for the target species and are not harmful both to the human body and to the environment [1, 2].

Keywords: *maize, Heliothis armigera, cotton bollworm, pheromone, traps*

Materials and Method. The experiments were mounted on the experimental fields of the Institute of Genetics, Physiology and Plant Protection. The research object was the maize crop and the pest *Heliothis armigera*. The evidence of males attracted to the pheromonal traps was carried out 2-3 times a week, during the entire vegetation period. Adhesive supports, traps and pheromonal capsules were replaced as needed.

Results. The observations made found that young larvae feed on leaves, and as they develop, they diversify their nutrition by attacking inflorescences and cobs. Thus, in the corn, the attack during the silking period is very dangerous. The female lays her eggs on the silk and the larvae attack the silk, after which they move onto the cobs. For these reasons, the application of pheromonal traps to monitor the development of the population of that pest will make it easier to highlight both the generations and the predominance interval of the different stages.

As a result of the distribution of three pheromonal traps on one hectare of the corn, the monitoring of the development in the seasonal dynamics of the population of cotton bollworm was carried out. Thus, it was determined that the first males were attracted to the pheromonal traps starting from the second decade of May, which falls within the calendar limits observed during several years of records. Based on the analysis of the obtained results, we found out that in the corn in the agroclimatic conditions of the Republic of Moldova, the pest *H. armigera* Hbn. develops in three generations. Thus, it was established that the development of the first generation takes place from the second decade of May until the first decade of July. During the development of the first generation, about 128 males/trap were attracted to the pheromonal traps.

Further monitoring found that the second generation of that pest develops during the second decade of July and until the first decade of August. During the development of the second generation, about 92 males/trap were attracted to the pheromonal traps. The third generation of that pest includes the period of the second decade of August and the third decade of September. During the development of the third generation, about 76 males/trap were attracted to the pheromonal traps.

The analysis of the obtained results shows that the second and third generations develop faster because the air temperature is higher than during the development period of the first generation. It was shown that all three generations are numerous according to the population density. For these reasons, it is very important to carry out seasonal monitoring in order to fix the generation development interval in order to take the necessary and timely measures to reduce the population density of that pest, thus avoiding major harvest losses.

Conclusions. It was found that the attack during the silking period is very dangerous in the corn crop. In the agroclimatic conditions of the Republic of Moldova, the pest *H. armigera* Hbn. develops in three generations. Carrying out seasonal monitoring allows to fix the generation development interval with the aim of taking the necessary and timely measures to reduce the population density of that pest, thus avoiding major harvest losses.

Acknowledgment. Research was carried out within the project of the State Program 20.80009.5107.27 “Elaboration of the alternative methods based on environmentally friendly means and procedures for harmful arthropods control in different agricultural crops”, financed by the National Agency for Research and Development.

References:

1. Nastas, T., Elisovetscaia, D., Gavrilița, L., Grigor, C., Rusu, I., Gheletiuc, O. Seasonal dynamics of *Heliothis armigera* Hbn. population and biological methods of decreasing its number, «Защита растений в условиях перехода к точному земледелию». 2021, p. 183 – 185. ISBN 978-985-596-930-4.
2. Войняк, В., Ковалев, Б. Эффективность половых феромонов вредителей кукурузы. «Биометод: новые агенты, новые предложения», 2000, p. 25 – 27.

CZU:582.572.4:57.085.2 https://doi.org/10.53040/abap6.2022.54

THE INITIATION OF *Sternbergia colchiciflora* (AMARYLLIDACEAE) IN TISSUE CULTURE

GHEREG Melania*, CIORCHINA Nina**, TABARA Maria***, GHENDOV V.#
National Botanical Garden (Institute)”Alexandru Ciubotaru”,
Chisinau, Republic of Moldova
** https://orcid.org/0000-0001-7406-4347, ** https://orcid.org/0000-0002-5792-5587,*
**** https://orcid.org/0000-0001-5057-115X, #https://orcid.org/0000-0001-6405-3935*
e-mail: melaniaghereg@gmail.com

One of the most threatened groups of higher vascular plants is the family Amaryllidaceae. This family includes worldwide about 1100 species from 85 genera, which occur mostly in tropical and warm temperate regions of the world. It also represents one of the largest groups of ornamental bulbiferous plants that are used in landscape design, particularly in stone and rock gardens. They are of high ornamental value, being used in floral arrangements, as cut flowers and as potted plants for interior design, on balconies and terraces [2].

The genus *Sternbergia* belongs to the family Amaryllidaceae, all species in this family contain highly toxic alkaloids: tazettine, lycorine, belladine, galantamine, etc., which are known to have antimicrobial, antiviral, antitumor, antileukemic and immunostimulating properties [4]. The species of this genus are also of great interest as ornamental plants due to their attractive golden-yellow or white colors (only in *Sternbergia candida* B. Mathew et T. Baytop), which usually bloom in early spring and autumn.

Sternbergia colchiciflora Waldst. et Kit. is a critically endangered species, in the Republic of Moldova, it grows in the adjacent area of Merenii Noi commune (Anenii Noi d.), Copanca commune (Causeni), Ciumai village (Taraclia) and Valeni commune (Cahul), the species is at the northern limit of its range. Abroad, it occurs in Southern Europe and the Caucasus. It is found in glades of downy oak forests and on hills with steppe vegetation. Quantitatively, it grows solitarily or in groups of 3-7 specimens, forming small clumps. The populations are in danger because of the afforestation of steppe sectors. Limiting factors are caused by extreme conditions at the boundary of its range, cultivation of primary steppe sectors, overgrazing. It is a perennial geophyte, ephemeral plant. The fruits and leaves develop in spring; the fruits ripen in April [1]. In summer, the species is inactive, surviving as a bulb. The flowering period is extremely short, lasting for 2-3 weeks, in August-September (depending on the amount of atmospheric precipitation). It can be used as an ornamental and medicinal plant. It is protected by law in the Republic of Moldova, included in the lists of the CITES Convention and in the Red Book of the Republic of Moldova, (3rd edition).

Sternbergia colchiciflora can be propagated by seeds and bulbs. However, the growth of plants from seed takes five or more years from seed to the development of a plant capable of producing flowers. Besides, the ability to form bulbs is low. The reproduction rate is not satisfactory because, 1-2 bulbs are produced per year, and because they are harvested to be used in the pharmaceutical industry and are planted for decorative purposes, there has been a significant reduction of populations in natural habitats [5]. Recently, scientific progress has been characterized by the use of biotechnology in the multiplication and conservation of endangered plants. This study was aimed at obtaining material of *Sternbergia colchiciflora* by tissue culture for its subsequent multiplication and obtaining a large number of bulbs.

Key words: *Sternbergia colchiciflora, conservation, in vitro, initiation, mobilization*

Materials and Method. The research was carried out in the Embryology and Biotechnology Laboratory of the "Alexandru Ciubotaru" National Botanical Garden (Institute).

To make sure that microcloning will be successful, a main condition is the sterilization of the plant material. Because of the severe contamination of the bulbs in our preliminary experiments, we avoided any damage to the explants. The explants taken (bulb pieces, bulbs) from the donor plants were carefully washed under running water for two hours. The first stage of sterilization was carried out in Tween-20 solution, followed by rinsing until the foam disappeared, then the plant material was placed in $KMnO_4$ solution (0.05%) for 20 minutes. At the second sterilization step, we used mercury chloride (0.01%) for 7 minutes, followed by three repeated washings with sterile deionized water for 10 minutes with continuous agitation to remove the sterilizing solution. Then, the plant material was placed in 5% H_2O_2 solution for 5 minutes, after which it was rinsed 3 times with autoclaved distilled water [3].

The plant material for the initiation of tissue culture consisted of bulbs about 0.5-1.0 cm in diameter and inoculated on Murashige and Skoog, 1962 (MS), basic medium with moderate doses of phytohormones. Thus, two types of growth medium were designed as control: V_0: MS= 50% (with half of the amount of microelements and macroelements from the basic medium) and V_1: MS=100% (with the components from the basic medium) with some additional amount of benzyladenine and naphthylacetic acid phytohormones in different concentrations, with pH 5.6-5.8. After inoculating the bulbs on these variants of medium, the samples were kept under the conditions of the growth chamber, at a temperature of 26^0C and atmospheric humidity of about 85%, in the absence of light – conditions similar to natural ones.

This medium formula has been proven effective in the micropropagation of other species of bulbous plants from the spontaneous flora (ex. *Fritillaria montana* Hoppe, *Lilium martagon* L. etc.).

Results. Three weeks after the inoculation of the explants on the growth media, a mild oxidation of the bulbs was observed, without affecting their condition. The results of the experiment are to be analyzed and published later.

Conclusions: In our study we followed the initiation and mobilization of *Sternbergia colchiciflora* explants under *in vitro* conditions. Considering its ornamental value and medicinal properties, this study requires continuity for micropropagation by tissue culture, which is an important way of producing a large number of bulbs and for the conservation of this species.

Acknowledgment. The research was carried out within the research and innovation project 20.80009.7007.19. "The introduction and development of technologies for propagation and cultivation of new species of woody plants by conventional techniques and tissue culture", financed by the National Agency for Research and Development.

References:

1. Cartea Roșie a Republicii Moldova. Ed. a III-a. Ch.: Î.E.P. Știința, 2015, 492 p.
2. Ghendov V., Nina Ciocârlan, Tatiana Sârbu. *In situ* and *ex situ* coservation of threatened Amaryllidaceae species from native flora of Republic of Moldova, Mediul ambiant, NR. 3 (69), 2013, p. 17-20.
3. Ghereg Melania. Metode de asepsizare a materialului vegetal a unor specii din familia Amaryllidaceae. Mat. Conf. "Tendințe contemporane ale dezvoltării științei: viziuni ale tinerilor cercetători" Ediția VI, Chișinău, Moldova, 15 iunie 2017, p. 226-231.
4. Nilufer Seyidoglu, Murat Zencirkiran. Vegetative Propagation of *Sternbergia lutea* (L.) Ker-Gawl. ex Sprengel (Winter Daffodil) by Chipping Techniques. Journal of Biological Sciences. 2008. no.8, p. 966-969.
5. Vuković, N., Šegota, V. & Brana, S. Data deficient *Sternbergia colchiciflora* Waldst. et Kit. (Amaryllidaceae) in Croatian flora – removing the veil of mist. Nat. Croat., Zagreb, 2017, vol. 26, No. 2, p. 261-269.

CZU:632.654:632.937 https://doi.org/10.53040/abap6.2022.55

PLANT EXTRACTS IN SPIDER MITES CONTROL

GLADKAYA Alla*, NASTAS T.**
Institute of Genetics, Physiology and Plant Protection,
Chisinau, Republic of Moldova
**https://orcid.org/=0000-0001-9182-4352,*
*** https://orcid.org/0000-0002-0322-710X*
e-mail: allagladcaia@mail.ru

The use of plant secondary metabolites synthesized by some plant species as part of their natural self-defense against pathogens and pests seems to be an excellent alternative biopesticides are more and more popular with food manufacturers and consumers equally. Biopesticides could grow from 4–5% of the global pesticide market to as much as 20% by 2025 [1]. The important bioactive compounds of neem seed oil belong to the limonoid class of triterpenoids, such as azadirachtin, nimbin [2]. Extracts of rhubarb roots and leaves are a source of various biologically active substances such as emodin, quercetin and oxalic acid [3]. **The purpose** of our research was to determine the biological effectiveness of plant extracts in protecting of cucumber seedlings from spider mites.

Keywords: *Rheum officinale Baill. (Polygonaceae), Azadirachta indica Juss. (Meleaceae), plant extracts, spider mite*

Materials and Method. The subjects of our research were the bioactive substances of *Rheum officinale* and *Azadirachta indica* plants. In the course of research were used the roots and leaves of rhubarb plants manual collection and neem seed oil. The object of our research were spider mites (*Tetranychus urticae* Koch., *Tetranychidae*), feeds on the contents of plant cells, as a result of which the intensity of the photosynthesis process in plants decreases. Spider mites can be detected by the presence of a thin cobweb and white dots on the underside of the leaves. In addition to the harm caused to plants, spider mites can be a carrier of various viral and fungal infections and, in particular, often infects crops with gray rot. The mite infects *Cucumis sativus* L. plants during fruiting and the use of chemical control agents is problematic. The threshold of harmfulness is 20 individuals / leaf [4].

In a laboratory greenhouse, the seedlings of *Cucumis sativus* L. were planted and artificially infested with spider mites. Plants were treated once a week with plant extracts (R - *Rheum officinale* roots; L - *Rheum officinale* leaves; N - *Azadirachta indica* seeds) in 4-fold repetition according to the options: V1 = 5% N; V 2 = 0,5% L; V 3 = 1% R. Control plants were not treated.

To take into account the plants damage by pests, a certain number of plant leaves were examined and the degree of damage to each plant was assessed on a four-point scale: 0 - no damage; 1 - minor damage (no more than 25% of the leaf surface); 2 - significant damage (up to 50% of leaves); 3 - plants are badly damaged (more than 50% of the leaf surface is damaged by insects). The biological effectiveness of protective measures was assessed by comparing the infestation of plants on treated and control plants. The Microsoft Office Excel software package was used to construct graphic materials. Mathematical processing and assessment of the scientific data reliability obtained was carried out using the ABC Pascal platform [5].

Results. In a laboratory greenhouse, planted seedlings of *Cucumis sativus* L. (artificially infested with spider mites) were treated weekly with plant extracts. A month later, the degree of damage to the plants by the pest was determined. The intensity of spider mite's infection in the control was 68% (DEM $_{0,05}$ -7.4). The lowest rate of infestation was observed at 12% after treatments of cucumber seedlings with neem oil. The results of the experiment correlate with the data of modern studies on the mechanism of action of the extract from neem seeds. Neem products act especially in the juvenile stages of insects because the main mechanism of action (azadirachtin) impairs the homeostasis of insect hormones by blocking PTTH release from corpora cardiaca. The oil is considered a contact insecticide with systemic and translaminar activity.

The use of rhubarb root extract reduced the infection rate by up to 18%. The results obtained are consistent with research data that emodin has a deterrent effect on a wide range of invertebrate organisms, inhibits the action of intestinal enzymes (α-amylase and proteinase) of insects. As a result, it was found that oil extract of neem seeds (82.4%) and rhubarb root extract (73.5%) have the maximum biological effectiveness in the control of spider mites. Rhubarb leaf extract contributed to a 28% mortality rate in the pest, which accounted for the extract biological effectiveness of 58.8%.

The most harmful spider mite is in greenhouse, where it gives up to 20 generations within a year. The main method of pest control is treatment with chemical plant protection agents such as Talstar, Neoron, Pegasus, Aktellik, Fosbecid. However, the use of chemicals leads to the emergence of pest resistance to many insecticides and their pollution of the environment. The plant extracts that we used in our research demonstrated high insecticidal efficacy (58,8-82,4%). The ability to protect plants from spider mites by treating them with plant extracts (non-toxic to phytoseiulus) together with beneficial arthropods is a promising area of biological plant protection.

Conclusions. The neem extract showed the maximum insecticidal activity, reducing the infection of *Cucumis sativus* seedlings with spider mites by 82.4%. The biological effectiveness of the rhubarb root extract (75.3%) in the control of *Cucumis sativus* L. seedlings infection with a spider mite was determined. Rhubarb leaf extract has insignificant insecticidal activity in the control of spider mites (58.8%).

Acknowledgment. Research was carried out within the project of the State Program 20.80009.5107.27 “Elaboration of the alternative methods based on environmentally friendly means and procedures for harmful arthropods control in different agricultural crops”, financed by the National Agency for Research and Development.

References:

1. Miresmailli S., Isman M.B. Botanical insecticides inspired by plant-herbivore chemical interactions, Trends in Plant Science, 2014, 19, pp. 29–35.
2. Usharani KV, Dhananjay Naik and Manjunatha RL. Neem as an organic plant protectant in agriculture, Journal of Pharmacognosy and Phytochemistry. 2019, vol. 8, nr. 3, pp. 4176-4184.
3. Gould K., Lister C. Flavonoid functions in plants, Flavonoids Chemistry, Biochemistry, and Applications, CRC Press LLC: Boca Raton, FL, USA. 2006, pp. 397-443
4. Сорока С.В., Биологические (экономические) пороги вредоносности вредителей, болезней и сорных растений в посевах сельскохозяйственных культур, справочник, Прилуки. 2018, 27 с.
5. Рязанова, Л.Г. Основы статистического анализа результатов исследований в садоводстве. Учебно-методическое пособие. Краснодар: КубГАУ. 2013, 61 с.

CZU:632.935 https://doi.org/10.53040/abap6.2022.56

MULTIFUNCTIONAL DEVICE FOR ATTRACTING AND CAPTURING HARMFUL INSECTS

GORBAN V., TODIRAS V.*, SAVRANSCHII D.
Institute of Genetics, Physiology and Plant Protection,
Chisinau, Republic of Moldova
**https://orcid.org/0000-0002-2245-9715,*
e-mail. vgorban.alimeco@ yahoo.com

During last years investigations cowering the elaboration of new systems of integrated plant protection became more active by utilization biorational means of plant protection, and electro optic installations. A great attention is accords to elaboration and selection of sources- attractants and new electro optic structures whice must show a high attractively due to a specific irradiation spectrum and, thus, provide a maximum trapping of harmful insects.

Application of the light traps is a more perfect method for phenology investigation of many important, in an economic aspect plant pest, and results of insects gathering can by used for elaboration short-term prognoses of insect pests development for rendering more precise the terms for craning out of protection measures. Further the light traps for insect can be used as an independent mean for plant pest combating.

Purpose. The existing methods of capturing and collecting harmful insects for the purpose of forecasting and monitoring their development do not ensure the availability of complete data on the species and the density of pest populations. At the same time, many insect species cannot be identified using these methods. Much more effective are the capture methods with the use of ultraviolet radiation sources. The effect of attracting harmful insects with this bait allows to elaborate a variety of trap models, based on the use of light sources with a certain wavelength.

Given that more attention is currently being paid to ecological methods of combating pests of agricultural crops, the need has arisen to carry out scientific research activities on the development of new models of multifunctional traps with an ultraviolet light source, with a pronounced effect of attracting harmful noctuid insects.

When designing and calculating the basic parameters, the optimal exposure value, the spectral range of the radiation source - of the decoy, as well as the constructive parameters of the device were taken into account. Experimental models of elaborated devices depend, first of all, on their intended purpose and destination. Thus, for signaling the appearance of pests, monitoring their development, determining their density in the given agrocenosis, devices are needed, which ensure the maintenance of the specific appearance of the captured specimens in order to study and classify them by species and groups. It is particularly important to fulfill this condition, to signal the appearance of quarantine pests and to take all measures to limit their spread in time.

Keywords: *photo taxis, spectrum, attractants, light traps, optical radiation*

Materials and Method. Currently, within the Institute of Genetics, Physiology and Plant Protection, a multifunctional device has been developed and patented, the detachable constructive elements of which allow this model to be used in several conditions, both for the protection of greenhouse crops and field and perennial ones. The problem that the elaborated device solves consists in reducing the number of harmful insects in greenhouse and field agricultural crops, as well as in stored agricultural products, in ensuring the process of combating harmful insects and increasing the effectiveness of the protection of the respective crops, as well as in ensuring the process for monitoring harmful insects by collecting them alive, which also allows entomological research to be carried out [1].

The multifunctional device for attracting and capturing harmful insects (fig. 1) contains the body 5, in which, coaxial to it, the source of optical radiation 1 with a wavelength of 310...365 nm is mounted, connected by the photoelectric sensor 3 to the source of supply 2, located above the body 5. On the sides of the optical radiation source 1, removable reflective screens 7 are located with the possibility of applying an adhesive to them. The sex pheromone dispenser 4 is located at the bottom of the body 5. The removable insect collector is located under the body 5, made in the form of a set of three interchangeable functional units.

Results. The device works in the following way: - for the signaling and monitoring of harmful insects in annual and perennial field crops, the device is installed and prepared for operation, the removable insect collector 6, made in the form of an interchangeable functional unit, is connected to the device. The photoelectric sensor 3, during the night hours, automatically connects the power source 2. During the period of maximum activity of noctuid insects, having positive photo taxis, they are attracted to the optical radiation source 1 (ultraviolet radiation lamp) and the pheromone dispenser sexual 4 (specific to the insects damaging the respective crops) to the device, where they are captured by the screens 7 with adhesive and the cylindrical vessel with fixative liquid. In collision with the screens 7, the harmful insects stick to their sticky surface, and a large part of the insects fall into the cylindrical vessel with fixative liquid and perish.

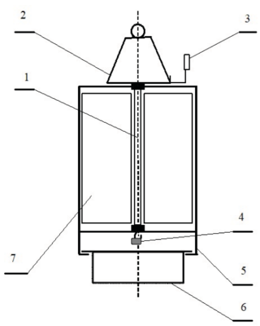

Fig 1. The principle diagram of the multifunctional device for attracting and capturing harmful insects

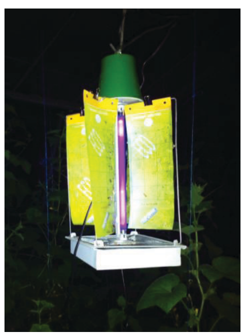

Fig 2. The multifunctional device for attracting and capturing harmful insects placed under greenhouse conditions

Conclusions. The technical result obtained when using the elaborated device consists in increasing the protection effectiveness of agricultural crops in different conditions of their cultivation by using the removable insect collector, made in the form of a set of three interchangeable functional units, which fulfill the functions provided by the practical or scientific purpose and ensures the process of collecting and combating harmful insects, as well as in significantly reducing the number of harmful insects by systematically combating them and minimizing the use of insecticides. The systematic application of ultraviolet light devices for the capture of pest insects contributes to the substantial reduction of pest density and creates favorable conditions for maintaining the effective ratio of beneficial insects, both natural and released, with the aim of regulating the pest density below the level of the economic damage threshold.

Acknowledgment. Research was carried out within the project of the State Program 20.80009.5107.19 "Strengthening capacities for the forecasting and control of harmful organisms and phytosanitary risk analysis in integrated plant protection", financed by the National Agency for Research and Development.

References:

1. GORBAN Victor, MD., TODIRAŞ Vladimir, MD., SAVRANSCHII Denis, MD" Dispozitiv multifuncțional pentru atragerea şi exterminarea insectelor dăunătoare", MD 1602, BOPI 3/2022.

CZU:595.77:634.22 https://doi.org/10.53040/abap6.2022.57

THE ROLE OF THE DOLICHOPODIDAE AND EMPIDIDAE FAMILIES IN THE PLUM PLANTATION AND TRITROPHIC RELATIONSHIPS

IORDOSOPOL Elena
Institute of Genetics, Physiology and Plant Protection,
Chisinau, Republic of Moldova
e-mail: iordosopol@yahoo.com

Purpose: Identification and evaluation role of Dolichopodidae and Empididae species in the regulation of plum pests.
Keywords: *Dolichopodidae, Empididae, predatory, tritrofic, nectariferous plant*

Introduction. The practice of plant protection knows the fact that, as a result of the frequent exposure of perennial crop plantations to disease infestations, they are often affected by stem, bark and branch pests. The most frequently encountered are the species of Coleoptera from the families Bostrichidae (*Psoa viennenzis*), Buprestidae with 10 species from 4 genera (*Anthioxia, Coroebus, Agrilus*), Cerambicidae with 14 species from 12 genera (*Rhagium, Stenocorus, Leptura, Strangalia, Cerambyx, Callidium , Clytus, Chlorophorus, Dorcadion, Leiopus, Agapanthia* and *Oberea*) and Scolytidae with 4 species from 3 genera (*Scolytus, Hylesinus* and *Xyleborus*) [5].

Among the useful species that limit these pests, are parasites from the families: Ichneumonidae, Braconidae, Bethylidae, Pteromalidae, Encyrtidae, Eulophiidae, Eupelmidae, Eurytomidae, Torymidae and the Platygastridae family - parasites of Cerambicidae eggs [5]. Diptera species from the family Dolichopodidae, genus *Medetera* are often found in coniferous and deciduous forests [1].

In the specialized literature, the species *Medetera signaticornis* is mentioned, which is 10 times more abundant in non-deforested trees attacked by *Ips typographus* [3]. The species of *Medetera nitida* increases the mortality of *Scolytus multistriatus* in *Ulmus sp*., from 6 to 25%. The rather high mortality of up to 90% was caused by the species *M. aldrichii*, which is trophically related to *Dendroctonus pseudotsugae* bark beetles, and *Medetera bistriata* is active in the populations of species of the genus *Scolytus* [1]. According to bioecology, dolichopod species lay their eggs on tree trunks near bark beetles entrance holes. Due to their extraordinary ubiquity and their biocenotic importance, these species can be used in biological control programs against vectors of pathogens that affect humans, and other animals or against pests in agroforestry [2]. Specific for dolichopodids, and empidids is that adults capture prey - arthropods from various orders, such as: Diptera, Hemiptera, Homoptera, Lepidoptera (including microlepidopteran larvae from the Tineidae family), Trichoptera, Thysanoptera, Hymenoptera, Neuroptera, Plecoptera, Ephemeroptera, Coleoptera, Collembola and Mites. Species of genus *Dolichopus* usually prey on mosquito larvae. Their larvae inhabit a wide range of habitats and many are invertebrate predators (in soil, wet sand or rotting organic matter). The larvae of the species of genus *Medetera* and *Dolichopus* act as predators under the bark of trees or in the tunnels of bark beetles [4]. The species of flies from the Empididae family are less common and their role in agrocenoses is still not well defined.

Materials and Method. Individuals from the families Dolichopodidae and Empididae cut from the adhesive plates of pheromone traps used against plum moths, bosket moths, and their capture by threading in 25 actions (round-trip) on a total surface served as material of 160 m^2. The diagnosis of the species was made according to the guidelines [5]. Adhesive plates were analyzed after 5 days.

Results. The first adult individuals of species from the Dolichopodidae family (*Medetera petrophiloides*) were observed in the plum plantation at the beginning of the first decade of June preying on the adults of the cicada *Erytroneura flamigera*, the aphids *Brachycaudus cardui*, *B. helichrysi*, *B. prunicola*, *Myzus persicae*, *Phorodon humuli* and *Hyalopterus pruni*. Next, 2 specimens were observed in insignificant quantities during the period 07-10 June, later during the period 10-21 June their number increased 2 times and coincided with the flowering of nectariferous plants such as: *Sinapsis rapae*, *Phacelia tanacetifolia*, *Gypsophilla paniculata*, *Poa annnua*, *Tripholium repens*. In the period July 3-7, the number of individuals decreases due to the lack of the blooming grassy carpet. And, in the period 27.07-01.08 and 01-10.08, 3 exemplaries were registered.

The Empididae family is known for the fact that its adults visit flowers to obtain nectar and some pollen and are from genus *Iteaphila*, *Anthepiscopus*, *Anthalia*, *Allanthalia* and *Euthyneura*. From our investigations the species *Platypalpus pseudofulnipes* was observed between June 10-21 when the flowering of lawn grass also took place. In the period with high temperatures and low humidity, which started from the second decade to the third decade of the same month, it was no longer observed in the plum plantation. In the period with high temperatures and low humidity, which started from the second to the third decade of the same month, it was not observed in the plum plantation. However, following three rounds of threading performed on the scotch (*Polygonum aviculare*) and ambrosia from the periphery of the plantation, *Medetera petrophiloides* and *M. tricorum* were observed in insignificant units (3 specimens).

In order to study the tritrophic links, the pheromone traps of the pyralid *Cydalmia perspectalis* at *Buxus* sp. were analyzed, where a number of 33 individuals of *Medetera petrophiloides*, females and males, which were recorded between July 20-25, 11 times more than in the plum orchard. And, the analysis of 6 trees of the *Picea pungens* species, around which the adhesive plates were placed (their location at a distance of 150 meters from the plum plantation) did not show any bark beetles attack. In order to evaluate the attractiveness of nectariferous, and sidereal plants in the plum plantation, their presence was not observed in the variants, during the high humidity period (01.08-11.08), but 2 specimens from each family were noted in the adhesive plates in the pheromone traps of moths. These indicators are preliminary and with probability we can mention the following: that the glue or sexual pheromone of the pyralid has in its composition some chemical compounds identical to the pheromone of the predator or chemical compounds of food attractants.

Conclusions. In the investigations were noted two species of the Dolichopodidae family of the *Medetera* genus (*M. petrophiloides*, *M. tricorum*), and one species of the fam. Empididae of the genus *Platypalpus* (*P. pseudofulnipes*). Predation activity by *M. petrophiloides* was observed in the colonies of 6 species of plum aphids.

Acknowledgment. Research was carried out within the project of the State Program 20.80009.5107.27 “Elaboration of the alternative methods based on environmentally friendly means and procedures for harmful arthropods control in different agricultural crops”, financed by the National Agency for Research and Development.

References:

1. Aukema B. and Raffa K., 2004. Behavior of Adult and Larval *Platysoma cylindrica* (Coleoptera: Histeridae) and Larval *Medetera bistriata* (Diptera: Dolichopodidae) During Subcortical Predation of *Ips pini* (Coleoptera: Scolytidae). / Journal of Insect Behavior, Vol. 17, No. 1, January, p. 115-128.
2. Coulibaly, B, 2013., Dolichopodidae (Diptera) dans le controle biologique de certaines insectes nuisibles des ecosystems forestiers) / In AGRIS since, Volume, 14, Issue 1, Pag 85-87.
3. Hedgren O., Schroeder M., 2004. Reproductive success of the spruce bark beetle *Ips typographus* (L.) and occurrence of associated species: A comparison between standing beetle-killed trees and cut trees. / Forest Ecology and Management, 203(1-3): 241-250.
4. MEDLOCK J.M. and Snow K.R., 2008. Natural predators and parasites of British mosquitoes / Journal of the European Mosquito Control Association, European Mosquito Bulletin, 25, 1-11.
5. БЕЙ-БИЕНКО Г. Я. 1969. Определитель насекомых европейской части СССР. Том 5. Двукрылые и блохи. Ч.1.; Том 3. Перепончатокрылые. Ч.2. и Ч. 3. - Л.: Наука, 1969. 808 с.1978, 757 с. и 1981, 688с.

CZU:633.16:632.26(479.24) https://doi.org/10.53040/abap6.2022.58

INFECTION OF BARLEY VARIETIES WITH LEAF SPOT DISEASES IN GOBUSTAN REGİON

KARIMOVA SH. R., HAJIYEVA E.A., SADIGOVA H.K.
Research Institute of Crop Husbandry, Baku, Azerbaijan
e-mail: samamakarimova63@gmail.com, e-mail: esmira.haciyeva.1962@gmail.com, e-mail: humaysadigova505@gmail.com

Keywords: *diseases, productivity, pathogen, barley, infection*

In order to protect the food security of the country's population, as well as to provide them with food products, it is envisaged to increase the production of grain products in the adopted state programs. One of the factors that lowers the productivity of cereal crops, including barley, is infection with diseases. As a result, the elimination of damage to barley varieties is one of the important issues for the country. Therefore, the implementation of effective control measures against diseases and the selection of disease-resistant varieties through selection are of great importance. Barley is the second most widely cultivated cereal after wheat. Grain contains 12 % protein, 5,5 % cellulose, 58 - 64 % starch, 2,1 % oil, 1,3 % water, 2,8 % ash. 1 kg of grain is equal to 1,2 feed units, and the high amino acids, which are the basis of animal protein, further increase its value. It has been determined that 30 - 35 % of the damage caused by leaf spot diseases to productivity. The widespread diseases of barley are powdery mildew, rust diseases, barley net blotch and barley striped, rhynchosporiasis, septoria and others. Depending on the level of infection of these diseases, productivity decreases by 10 - 15 %, even 70 - 80 % due to barley striped infection, product quality and technological indicators decrease. The main goal for solving such issues is to create varieties resistant to leaf spot diseases as an efficient and correct, ecologically clean control measure. Leaf spot diseases develop depending on a favorable environment and cause pathological processes in living organisms [2]. Many studies have shown that the degree of damage caused by the disease to the productivity of cereal crops during the vegetation period also depends on the phase in which it begins to develop [1]. Parasites living on the leaves weaken the plant's metabolism, disrupting the normal activity of the stem and roots and causing the plants to weaken. The development and damage of pathogenic fungi on plants depends on the degree and characteristics of infection of their individual organs [3]. Extensive information about the development of fungal diseases affecting the barley plant and their damage in the conditions of the republic has not been studied. In the conditions of Azerbaijan in 1985 - 1990, the distribution and damage of leaf spot diseases, dark brown streak and net helmintosporiosis, their population structure, ras composition was studied by X. C. Tamirazov [4]. Nowadays, studying the prevalence and damage of leaf spot diseases in Azerbaijan is an urgent issue. As a result of the conducted research, it has been known that leaf spot diseases are widespread in the conditions of Gobustan. In Gobustan region, the prevalence and damage of barley plant infected with barley striped, yellow rust, dwarf rust, rhynchospariosis, powdery mildew and septoriosis were studied. Spots of barley net blotch, *(Drechslera teres ito*) and powdery mildew (*Erisiphe gramines*) were observed on the leaves of barley plant during the cultivation period. In the wax-maturity period, the spread and development of causative agents of barley net blotch, barley striped (*Drechslera graminea* ito) and rhynchosporiosis (*Rhyinchosporium graminicola* Neinsen) were observed. These leaf spot diseases weaken plant development, reduce the surface area of leaves and stems, cause small grains, and sometimes completely destroy plants. The spread of these diseases is highly dependent on natural climatic conditions, mainly humidity and normal temperature. In 2021, due to favorable conditions for the development of pathogens in barley and wheat fields in Gobustan region, depending on weather conditions, these diseases are widespread. However, the development of pathogens in the area in 2022 was relatively low depending on the weather. Barley variety samples received from International Selection Centers, selection materials studied in various local nurseries (control, banked variety test) were evaluated according to their phytopathological characteristics, and prospective samples were used as initial material in selection. The infection level of the specified diseases was assessed in field conditions based on the methods (9-point scale) adopted by the International Selection Centers ICARDA and SIMMYT.

In 2022, 153 barley samples in the experimental field at Gobustan region were evaluated for complex fungal diseases. Yellow rust, barley striped, barley net blotch, powdery mildew and rhynchosporiasis take a special place among the main diseases of the barley plant in Gobustan conditions due to their spread and damage to productivity. İn barley experimental fields of Gobustan region barley net blotch was evaluated with 5-8 points (75 %) in 12 of the 16 samples tested in the Competitive variety test in 2022 and 4 samples were resistant and moderately resistant with 1-3 points (25%). 8 samples were resistant and moderately resistant to powdery mildew with a score of 2-4, and 8 samples were moderately susceptible and susceptible with a score of 5-7 (50%). It was determined that 10 samples were moderately susceptible and susceptible to rhynchosporiasis with a score of 5-7 (62,5 %), and 6 samples were moderately resistant with a score of 2-4 (37,5%). Out of 107 prospective samples in control-1 nurseries, 68 were resistant to powdery mildew with a score of 1-3 (63,5 %), 39 samples were moderately sensitive and susceptible with a score of 5 - 8 (36 %). 25 samples with 5-6 points (23,4%) were noted to be susceptible to helminthsporium leaf spot of barley. Yellow rust disease was observed in control-1 nurseries, unlike the competition trial. Thus, 36 out of 107 samples were infected with yellow rust at the level of 5MS – 40S (33,1%), and resistance was observed in the remaining 71 samples (R). Of the 30 samples in control-2 nurseries, 15 were moderately sensitive and susceptible (50%) with powdery mildew disease with 5-7 points, 15 samples were resistant and moderately resistant with 1-3 points, and 12 samples with helminthsporium leaf spot of barley disease with 5-8 points (40%) were infected. In these samples, rhynchosporiosis was found to be infected with 5-6 points (33,3%) in 10 genotypes.

As a result of the research, it was determined that the development of leaf spot diseases was weakened due to the increase in air temperature in the Gobustan region near the end of the vegetation period. The causative agents of barley stripe from fungal diseases infect plants during the development period in early spring and completely destroy the plant until the end of the vegetation period, diseases of brown rust, yellow rust, powdery mildew, barley net blotch, rhynchosporiosis, septariosis by causing serious damage to the vegetative organs of plants, it exposes the plant body to morphological and physiological changes, which ultimately leads to a sharp decrease in important quantitative and qualitative indicators of the farm. In addition, it was determined that the damage caused by leaf spot diseases mainly depends on the period of the plant's vegetation, air temperature, humidity and disease resistance of the planted varieties. Keeping these diseases under control and creating varieties resistant to them should always be in focus and should be continued.

References:

1. Jafarov, I. H. Phytopathology // Baku, East-West, 2012, p.566; pp. 150-151.
2. Kerimova Sh.R. Selection of the initial material of wheat resistant to powdery mildew // Tambov ovl.: Vestnik Journal, 2020. No. 2 (61), pp. 38-42.
3. Tamrazov, Kh.Ch., Ahmadov S.A., Ibrahimov E.R. Distribution and development of leaf diseases of barley plant in Azerbaijan. Theoretical Journal of Agrarian Science, Baku: 2012. No. 3, p. 91-92.
4. Tamrazov Kh.Ch. Leaf diseases of barley in Azerbaijan SSR. Riga, 1986.

CZU:633.356L631.811.98 https://doi.org/10.53040/abap6.2022.59

THE MOLDSTIM INFLUENCE ON THE *Pisum sativum* PLANTS PRODUCTIVITY AND RESISTANCE

KOZAR Elena[1*], KAIGORODOVA Irina[1], ENGALYCHEVA Irina[1], MASHCENKO Natalia[2**]
[1]Federal State Budgetary Scientific Institution Federal Scientific Vegetable Center (FSBSI FSVC), Russia
[2] Institute of Genetics, Physiology and Plant Protection, Chisinau, Republic of Moldova,
** https://orcid.org/0000-0002-1319-5631, ** https://orcid.org/0000-003-1869-4357, e-mail: kozar_eg@mail.ru, e-mail: mne4747@mail.ru*

Increasing the acreage of peas around the world is the main way to increase the production of vegetable protein to make up for its deficiency in human and animal nutrition [1, 2]. Vegetable varieties of peas (*Pisum sativum* L.) they form a separate group and are quite clearly separated from grain varieties by genotype [1]. The value of immature seeds (green peas) of vegetable varieties of peas lies in the unique balanced content of essential amino acids, vitamins, biologically active substances, mineral salts [3, 4].

Currently, a special place in the technology of cultivation of agricultural crops is occupied by the use of biologically active substances of the steroid type. Steroid glycosides are secondary metabolites of higher plants, consisting of a steroid aglycone and one or more sugar chains. Their pre-sowing treatment of seeds, especially with low viability, contributes to an increase in germination energy and germination, intensification of initial growth processes, increased productivity, plant resistance to biotic and abiotic factors [5, 6, 7]. Moldstim biopreparation based on furostanolic glycoside capsicoside obtained from pepper seeds (*Capsicum annum* L.) is recommended for use in agriculture as a bioregulator. However, in relation to vegetable peas, its biological activity has not been studied, which was the purpose of this work.

Keywords: *vegetable peas, steroid glycoside, biological efficacy*

Materials and method. The effect of an aqueous solution of Moldstim in 0.01% concentration was studied. Control - distilled water. Testing was carried out on two varieties of different maturation period – the early-maturing Corsair variety and the medium-maturing Barin variety of the selection of the FSBSI FSVC. They were treated by soaking at the rate of 3 ml of working solution per 100 pieces of seeds, followed by drying. The treated seeds were sown in containers with moistened perlite. On 10th day, seed germination was taken into account and half of the plants were infected with Fusarium oxysporum by introducing an aqueous suspension of pure mushroom culture into the substrate and seedlings were grown on a light installation with a 16-hour light period at a variable temperature of 18/23°C. At the stage of the beginning of the deployment of the first pair of real leaves, measurements and weighing of seedlings were carried out, taking into account the number of plants with symptoms of damage. In field tests, the treatment was carried out in a similar way to laboratory experience. The treated seeds were sown with a precision seed drill Winterstigerplodseed XL. The area of the accounting plot is 2 m^2, the repetition is fourfold, the placement is systematic. Peas were cultivated in accordance with accepted agricultural techniques. During the growing season, field germination and the degree of plant disease were taken into account; in the phase of technical ripeness of green peas, productivity was taken into account. Data processing was carried out using the Light Cycler®480 SW 1.5.1 and Macrosoft Excel 2010 programs.

Results. Moldstim treatment of pea seeds with low viability (63% - control) increased laboratory germination to 87%. In batches of seeds with high initial germination, it increased slightly (by 1-7%), regardless of the experimental conditions. Unlike other plant species, the biopreparation did not have a significant stimulating effect on the growth processes of pea seedlings at the initial stages of development, but it increased the resistance of plants to diseases. With artificial infection of plants with the causative agent *Fusarium oxysporum*, the percentage (by 3-14%) and the degree of manifestation of the symptoms of the lesion decreased: in the Corsair variety from 1.6 points in the control to 0.6 points in the experiment, in the Barin variety – from 2.2 points to 1.4 points. The biological efficiency (BE%) of the action of Moldstim as an adaptogen was also manifested in an increase in the mass and length of the root system, the raw and dry mass of the aboveground part of infected plants. Thus, in the Barin variety, according to these signs, BE was 5-6%, 7% and 33%, respectively, relative to the infected control. In the field, on a natural infectious background, Moldstim treatment also contributed to increasing the resistance of plants to other harmful diseases: rust (pathogens of fungi of the genus *Uromyces*) and ascochytosis (pathogens of fungi of the genus *Ascochita*). The proportion of affected plants with these pathogens, depending on the variety, in the control was 38-45%, in the experimental version – from 5% to 8%. In general, the biological effectiveness of the drug relative to the control in terms of the degree of development of the disease was about 50% for ascochitosis and more than 80% for rust. Seed treatment with Moldstim also had a positive effect on the reproductive functions of vegetable peas. In unfavorable weather conditions this year, the experimental plants bloomed earlier and more amicably than the control ones. The most responsive was the medium-ripened variety Barin. In the technical stage of ripeness, the mass of green peas from one plant relative to the control increased almost twice and averaged 20.1 g. In the early-maturing Corsair variety, the average productivity of plants in the experiment increased 1.4 times and reached 24.5 g. Structural analysis showed that the increase in productivity in both varieties is primarily due to an increase in the number of tied beans on plant (by 1.2-1.8 times), as well as with an increase in the mass of one seed in the Corsair variety and the number of seeds in the bean in the Barin variety. As a result, the economic efficiency of Moldstim on the yield of green peas was 52% and 62%, respectively.

Conclusions. The test of the Moldstim biological preparation indicates its high adaptogenic activity. The treatment of vegetable pea seeds before sowing has a prolonged effect and has an immune-modulating and regulatory effect on the development of plants in the future. As a result, their resistance to diseases of fungal etiology increases, the binding of beans and an increase in productivity. Therefore, further study of the biological activity of various steroid glycosides and other biologically active secondary metabolites of higher plants from the point of view of use on vegetable pea culture is promising in theoretical and applied terms.

References:

1. Dribnokhodova, O.P. Analysis of DNA polymorphism of seed peas: PisumSativumL. Dissertation for the degree of Candidate of Biological Sciences. A.I. Vavilov Institute of General Genetics of the Russian Academy of Sciences, 2009, 154 p.
2. Beilinson V., Chen Z. et. all. Genomic organization of glycinin gene in soybean. Theor.andAppl.Genetics. 2002. v.104(no.6-7). p.1132 - 1140.
3. Croser J.S., Ahmad F.et. all. Utilization of Cicer in chickpeas improvement progress, constraints und prospects Austral.J. Agr. Res. 2003. v.54.no. 5. p.429 - 444.
4. Soldatenko A.V., Pivovarov V.F., et. all. Vegetables in the system of ensuring food security of russia. Vegetablecropsof Russia. 2019.no.2. P.9-15. https://doi.org/10.18619/2072-9146-2019-2-9-15
5. Shukanov, V.P. et. all. New bioregulators of glycoside nature for inducing disease resistance of grain crops., Mat. conferințeiștiințificeinternaționale (Ediția a V-a) «Genetica, fiziologiașiameliorareaplantelor». Chișinău. 2014. no.1. p.445-449.
6. Mashcenko N. et. all. Iridoid Glycosides from Linaria genistifolia (L.) MILL. in biological control of soil-borne fungal pathogens of wheat and some structure. Chemistry Journal of Moldova. 2015. v.10(1).p.57-64.
7. Borovskaya A.D. et al. The effectiveness of bioregulators from Verbascumdensiflorum Bertol. Vegetable of Russia. 2020. no 4. p.6-8.

CZU:633.16:581.1:57.084 https://doi.org/10.53040/abap6.2022.60

ADAPTOGENIC PROPERTIES OF EPIPHYTIC UV-B TOLERANT MICROORGANISMS IN RELATION TO SPRING BARLEY PLANTS TO OXIDATIVE STRESS CONDITIONS

KUDRYAVZHEV D.V.*, GALUSHKO A.S.**, VERTEBNIY V.E.***, KHOMYAKOV YU.V.#, GASIEVA Z.A.##, PANOVA G.G.###

Agrophysical Research Institute, Saint-Petersburg, Russia

**https://orcid.org/0000-0002-8745-9812, **https://orcid.org/0000-0002-0387-7997, ***https://orcid.org/0000-0002-2936-5949, #https://orcid.org/0000-0003-3245-8801, ##https://orcid.org/0000-0003-0126-0181, ###https://orcid.org/0000-0002-1132-9915*

e-mail: gaiane@inbox.ru

The problem of increasing the agroecosystems resistance to the stress factors action arising from global climate change, including increased levels of UV-B radiation and soil moisture deficiency, is very relevant. One of the ways to solve it is the development and use of environmentally friendly biopreparations with phytoprotective and adaptogenic properties [1 and other].

Keywords: *epiphytic microorganisms, metabolites, spring barley. plant resistance, oxidative stress*

The aim of the work is to study under controlled conditions the influence of UV-B tolerant microorganisms on the spring barley plants resistance to the stress factors action: high-intensity UV-B radiation and soil moisture deficiency, leading to the development of oxidative stress.

Materials and Method. Bacterial cultures of the genera *Gordonia sp*. strain 4.1, *Kocuria sp*. strain 4.2, *Arthrobacter sp*. strain 6 were isolated [2] from the of spring barley plants of the Belogorsky variety leaves surface (zoned in the North-West region), irradiated with UV-B radiation, under controlled conditions of the Agrophysical Research Institutes agro-biopolygon. These microbial cultures were identified to the genus level by 16S rRNA gene sequences (Evrogen, Moscow) using the NCBI database [3]. Phytostimulating, phytoprotective and other properties of isolated bacterial strains were studied in lab- and vegetations experiments using culture liquids (CL) of isolated microorganisms. The content of auxins (indole-3-acetic acid, indole-3-lactic acid) in the CL of these strains was determined by ultra performance liquid chromatography (UPLC) on a Waters ACQUITY UPLC H-class chromatograph (Waters, USA) [4].

The above-ground parts of barley plants were treated twice with CL solutions in the previously established most effective concentrations during the tillering-booting period before exposure to stress factors (irradiation with UV-B radiation at a dose of 5 kJ/m; soil moisture deficit at the level of 30% of the total water capacity). The response of plants was assessed by changes in the spectral characteristics of radiation reflected from the leaves surface, providing information on the content of chlorophylls *a* and *b*, flavonols, anthocyanins and carotenoids, on the plants photosynthetic apparatus efficiency, as well as on the growth and productivity indicators [5]. Water-treated plants grown under favorable conditions served as controls.

Results. A series of laboratory experiments showed that the epiphytic microorganisms cultures of *Gordonia sp*. strain 4.1, *Kocuria sp*. strain 4.2, *Arthrobacter sp*. strain 6, isolated from the plants leaves. irradiated with UV-B radiation, have increased resistance to this stress factor (the dose of bacterial cells irradiation with UV-B radiation is 3 kJ/m^2). At the same time, there is a relationship between the tolerance of microbial cultures and the color of their pigments.

The studied microorganisms are able to produce plant growth stimulants (indole-3-acetic acid, indole-3-lactic acid) in CL and to activate the synthesis of photosynthetic pigments chlorophylls *a*, *b*, carotenoids, as well as substances with protective functions - flavonols, anthocyanins - in plant leaves. These properties of isolated microorganisms positively and significantly affect the growth, development and productivity of spring barley plants under favorable conditions and in the event of oxidative stress. So, for example, grain productivity in plants treated with solutions of their CL in certain concentrations increases by 30% under favorable conditions and by 12-34% under the action of UV-B radiation and / or soil moisture deficiency. As a result, the negative effect of these stress factors did not appear relative to control.

Conclusions. Thus, epiphytic microorganisms with a higher tolerance to UV-B radiation had the ability to increase the resistance of barley plants to oxidative stress caused by exposure to high-intensity UV-B radiation and soil moisture deficiency, along with this, they stimulated the plants growth, development and productivity.

Identified mechanisms of the positive effect of these microorganisms CL solutions on the spring barley resistance under oxidative stress conditions:

– activation for the synthesis processes of substances with phytoprotective functions: anthocyanins, carotenoids, flavonols, etc.,

– increasing the photosynthetic apparatus efficiency,

– increasing attraction of nutrients from plants vegetative to generative organs.

The isolated strains of microorganisms are a very valuable material for the creation of environmentally friendly highly effective biopreparations of complex action, designed to increase the stability of agroecosystems in the context of global climate change.

References:

1. Olanrewaju O. S., Glick B. R., Babalola O. O. Mechanisms of action of plant growth promoting bacteria, World Journal of Microbiology and Biotechnology. 2017, V. 33, no. 11, p. 1-16. DOI: 10.1007/s11274-017-2364-9.
2. Workshop on microbiology / Ed. A.I. Netrusova. M.: Publishing Center "Academy", 2005. 608 p.
3. National Library of Medicine NCBI. https://blast.ncbi.nlm.nih.gov.
4. Jiang F., Chen L., Belimov A.A., Shaposhnikov A.I., Gong F., Meng X., Hartung W., Jeschke D.W., Davies W.J., Dodd I. C. Multiple impacts of the plant growth-promoting rhizobacterium Variovorax paradoxus 5C-2 on nutrient and ABA relations of Pisum sativum, J. Exp. Botany. 2012, V. 63, no 18, p. 6421-6430. DOI: 10.1093/jxb/ers301.
5. Kanash E.V., Panova G.G., Blokhina S.Yu. Optical criteria for assessment of efficiency and adaptogenic characteristics of biologically active preparations, Acta Horticulturae. 2013, no 1009, p. 37-44. DOI: 10.17660/ActaHortic.2013.1009.2.

CZU:632.937 https://doi.org/10.53040/abap6.2022.61

CULTIVATION ATTEMPTS OF *Saccharopolyspora spinosa* ON LIQUID MEDIUM

LUNGU Andrei
Institute of Genetics, Physiology and Plant Protection,
Chisinau, Republic of Moldova
https://orcid.org/0000-0002-5024-5765, e-mail: andrei.lungu@igfpp.md

In the last fifty years, pesticides of chemical origin were very actively used, which undoubtedly led to an increase in agricultural production, both quantitatively and qualitatively, and influenced the spread in certain areas and of different crops, which were more difficult before. But people started using these products without examining their impact on the environment and without taking into account that other generations will also need this habitat to develop. Use of pesticides contrary to recommendations led to air, water and soil pollution. Residues generated during the degradation of many active substances from pesticides are present in the environment for a long time, for example, even today large amounts of DDT are detected in the tissues of marine animals.

After society became aware that residues from the environment end up in human food, being the cause of various ailments, a campaign to tighten the standards began. In the last decades a very wide range of active substances have been excluded from the market or their use has been greatly limited. Along with the limitation of the use of some classes of substances and the tendency to develop organic and sustainable agriculture, there has been a shortage of preparations that could be used to solve the problems created by phytopathogenic and harmful agents [1, 2].

Biorational pesticides are products that have a maximum effect on the target and a minimum effect on the environment. Almost 90% of the microbial biopesticides currently available on the market are derived from a single entomopathogenic bacterium, i.e., Bacillus thuringiensis or Bt. Currently, biopesticides comprise a small portion of the total global crop protection market, valued at approximately $3 billion worldwide, accounting for only 5% of the total crop protection market. More than 200 products are available in the United States (US) market, compared to 60 similar products produced in the European Union (EU) market [3]. Although the use of biological pesticides on a global scale is increasing by 10% every year, it seems that the global market needs to grow further in the future if these pesticides are to play a visible role in replacing chemical pesticides and reducing the current over-reliance on them [3]. To solve some of the problems we propose to use the metabolite called spinosad, which is a complex of secondary metabolites synthesized by Saccharopolyspora spinosa [4]. Initially **we propose** to test this metabolite for aphids control under protected soil conditions, which will allow more detailed follow-up of the effects and in case they will have environmental effects they will be minimal [5].

Keywords: *bioinsecticides, S. spinosa, sustainable agricultures, microbial cultivation*

Materials and Method. The strain *Saccharopolyspora spinosa* DSM-44228 was used, the culture is maintained by growth on slanted agar media. And in order to prepare the liquid nutrient medium that will be used for mass growth and extraction of spinosynes, 750 ml Erlenmeyer flasks are used in which the volume of the medium is 100 ml, cultivation takes place at a temperature of 30 ^{0}C. We currently have a rocker that provides 150 r/m. Cultivation time is 192 h. At the moment we are at the stage of selecting the environments that ensure good biomass productivity, verification takes place by microscopy and examination of the amount of mycelium conglomerates, at the next stage it will be analyzed by means of HPLC and the amount of spinosynes [5].

Results. To obtain spinosad, it is necessary to cultivate the actinobacterium S. spinosa on a liquid medium and extract this metabolite in pure form, so that later we can make preparative forms with known concentrations. For this, the DSM-44228 strain was procured, and later the development of the liquid medium began.

A good biomass accumulation of *Saccharopolyspora spinosa* DSM-44228 was obtained on liquid media containing soy flour, yeast extract, malt extract, glucose. In current conditions, the accumulation of this biomass takes place during 8 days of cultivation, which makes cultivation expensive in terms of energy requirements.

Conclusions. The direction of research to develop a nutrient environment that will be an element for cultivation technology is correct, but it is felt that there are some gaps and subtleties that have not yet been touched by the young specialist, there is a need to continue the research and look for the better composition for maximum productivity.

Acknowledgment. Research was carried out within the project of the State Program 20.80009.7007.04 "Biotechnologies and genetical processes for evaluation, conservation and exploitation of agrobiodiversity", financed by the National Agency for Research and Development. We thank Leibniz Institute, DSMZ-German Collection of Microorganisms and Cell Cultures GmbH for granting *S. spinosa* strain DSM 44228

References:

1. Butu M, Rodino S, Butu A. Biopesticide formulations - current challenges and future perspectives. In: Biopesticides. Elsevier; 2022: 19–29
2. Arakere UC, Jagannath S, Krishnamurthy S, et al. Microbial bio-pesticide as sustainable solution for management of pests. In: Biopesticides. Elsevier; 2022: 183–200
3. Damalas C, Koutroubas S. Current Status and Recent Developments in Biopesticide Use. Agriculture 2018; 8: 13. doi:10.3390/agriculture8010013
4. Sachdev S, Singh RP. Current Challenges, Constraints and Future Strategies for Development of Successful Market for Biopesticides. Clim Change Environ Sustain 2016; 4: 129. doi:10.5958/2320-642X.2016.00014.4
5. Akoijam N, Kalita D, Joshi SR. Bacteria and Their Industrial Importance. In: Verma P, Hrsg. Industrial Microbiology and Biotechnology. Singapore: Springer Singapore; 2022: 63–79

CZU:579.64:57.085.2 https://doi.org/10.53040/abap6.2022.62

RESEARCH ON THE ANTIFUNGAL PROPERTIES OF OXIDATED TANIN EXTRACTS

LUPASCU Galina[1]*, GAVZER Svetlana[1], CRISTEA N.[1], LUPASCU L.[2]**, TIMBALIUC Nina[2]

[1]*Institute of Genetics, Physiology and Plant Protection, Chisinau, Republic of Moldova,*

[2]*Institute of Chemistry, Chisinau, Republic of Moldova,*

**https://orcid.org/ 0000-0003-3363-3595,*

***, https://orcid.org/0000-0001-5006-5265*

e-mail:galinalupascu51@gmail.com

In the technologies of creation of preparations with plant protective effect against pathogenic agents, ecologically harmless, it is of great importance to identify the sources of plant raw material of compounds with antimicrobial effect, the development of isolation systems of compounds and the screening of their activity.

Higher plants produce hundreds of thousands of different compounds with important biological, pharmacological and ecological roles that often present a safe way to defend against herbivorous insects, phytopathogenic microorganisms, causative agents of human diseases. In connection with this, crude plant extracts, purified and fractionally directed, are successfully used to create active principles with desired properties. It is estimated that there are about 2.5 million higher plant species, most of which have not yet been examined for their biological activities [4].

Some constituents of tea, especially green tea such as epigallocatechin gallate, epicatechingallate, epigallocatechin and epicatechin are powerful antioxidants that help increase the body's immunity. Data on the antibacterial activity (*Escherichia coli, Listeria monocytogenes*) of tea extracts are known, including green tea [1, 2].

Therefore, research in the field of identification and study of plant raw materials – sources of bioactive compounds with curative and phytosanitary potential, are undeniably current, timely and of a major importance.

Purpose: The aim of this research was to establish the antimicrobial activities of oxidized tannins isolated from black tea leaves, commercial green tea and pomegranate peels.

Keywords: *Fusarium spp., tannin extracts, antimicrobial activity*

Materials and Method. The research was performed under laboratory conditions. The study material included 3 strains of the fungi *Fusarium avenaceum, F. oxysporum, F. equiseti* and 3 extracts of oxidized tannins, isolated from black tea, commercial green tea and pomegranate peel.

In order to obtain the extracts from black tea, green tea, pomegranate peel, the static method of mechanical agitation (maceration and periodic draining) was applied, performed in three consecutive stages of 24 hours at room temperature. The extracts obtained were unified and concentrated by steam distillation produced by Heidolph Instruments GmbH & Co. KG. KG (Germany), after which it was dried at a temperature of 45°C to a constant mass.

The total content of polyphenolic compounds (CTCF) was determined by spectrophotometric method with the Folin-Ciocalteu reagent, partially modified. The measurements were performed 3 times at a wavelength of 765 nm (Jenway UV / Vis 6505 spectrophotometer) and were expressed in mg gallic acid per g of dry plant product (mg GA / g).

To determine the total content (C_{total}) of acidic functional groups (carboxylic and phenolic), the Boehm method was used [3] the calculations being performed according to the equation: $C_{total} = [C_n\ (NaOH) \times V_1 - C_n\ (HCl) \times V_2] / m$, where, C_n (NaOH) – normal concentration of sodium hydroxide solution, 0.05 mol / L; C_n (HCl) – normal concentration of hydrochloric acid solution, 0.05 mol / L; V_1 – volume of sodium hydroxide solution 0.05 mol / L, mL; V_2 – volume of hydrochloric acid solution 0.05 mol / L, mL; m – sample mass, g.

The FTIR spectrum of the researched ethanol extracts were recorded on the PerkinElmer Spectrum 100 FT-IR Spectrometer. Spectra were plotted after potassium bromide pelletization by grinding the dry residue with spectral purity potassium bromide [5].

The PDA (*Potato Dextrose Agar*) medium on which the fungi were grown was supplemented with tannin extracts at concentrations of 0.00125; 0.0025; 0.005; 0.01%. After 3 days from sowing, the growth of fungi was recorded by measuring 2 perpendicular diameters, the average of which served as a biometric index of radial growth. The experiment was performed in 4 repetitions. The data obtained were processed in the software package STATISTICA 8.

Results. The data obtained showed that in the case of *F. avenaceum* fungus, at day 3, the maximum concentration of extracts (0.01%) had the highest inhibitory activity, the diameter of the colonies compared to the control being decreased by 13.3, 16.3; 14.5%, respectively, black tea, green tea, pomegranate. In the evolution of the growth and development of the fungus, it probably adapted to the substrate supplemented with tannin extracts, because on days 4 and 5 the difference from the control decreased significantly.

In the case of the fungus *F. oxysporum*, on days 3, 4, 5 a phenomenon similar to *F. avenaceum* was observed, but the effect of the extracts was slightly weaker.

A more pronounced antifungal activity of the tannin extracts under study was recorded in the case of the *F. equiseti* strain. Thus, on day 3 the diameter of the colonies was 18.4; 21.1: 21.1%, and on day 5 – 29.9; 15.6; 20.0% lower than in the control variant for the action of extracts from black tea, green tea, pomegranate, respectively.

Factorial analysis of the role of fungal factors (*F. avenaceum, F. oxysporum, F. equiseti*), tannin extract, concentration and their interactions in the source of variation of radial growth of fungi, demonstrated the decisive influence of fungal species factor – 98.5; 99.13; 99.52%, respectively, on days 3, 4, 5 of growth. It should be noted that the other factors involved in the interaction of fungi with oxidized tannin extracts were of a minor importance in their radial growth.

Conclusions.

1. The strains of *Fusarium* spp. tested *in vitro* for the reaction to the supplementation of the nutrient medium with commercial black tea, green tea and pomegranate peel extracts demonstrated the differential action of tannic compounds on fungal growth, which denotes their different efficiency.
2. The tannin extracts studied showed the highest antifungal activity in the concentration of 0.01% in the case of *F. equiseti* fungus. In order to develop wheat protection technologies, the reaction of the plants treated with extracts to the action of fungal pathogens is to be tested.

Acknowledgment. Research was carried out within the project of the State Program 20.80009.7007.04 "Biotechnologies and genetical processes for evaluation, conservation and exploitation of agrobiodiversity", financed by the National Agency for Research and Development.

References:

1. Chye F.Y., Hoh S.N. Antimicrobial activity of flavonoid extracts from Sabah tea (*Camellia sinensis*) against *Escherichia coli* and *Listeria monocytogenes*. *J. Trop. Agric. and Fd. Sc.*, 2007, 35(2), p. 245– 251.
2. Mbata T.I., Debiao L.U., Saikia A., Antibacterial activity of the crude extract of Chinese green tea (*Camellia sinensis* L.) on *Listeria monocytogenes*. *Afr. J. of Biotech*., 2008, Vol. 7 (10), p. 1571-1573.
3. Oickle S.A.M., Goertzen L., Katelyn R. et al. Method of agitation, effect of filtering and dilute titrant. Part II. *Carbon,* 2010, 48(12), p. 3313-3322.
4. Ram A.J., Bhakshu L.M., Raju R.R.V. *In vitro* antimicrobial activity of certain medicinal plants from Eastern Ghats, India, used for skin diseases. *J. Ethnopharmacol*., 2004, 90, p. 353-357.
5. Schulz H., Baranska M. Identification and quantification of valuable plant substances by IR and Raman spectroscopy. *Vibrational Spectroscopy*, 2007, 43, p. 13-25.

CZU:633.11:632.4.01:632.93 https://doi.org/10.53040/abap6.2022.63

MANAGEMENT OF ROOT ROT IN COMMON WHEAT

LUPASCU Galina
Institute of Genetics, Physiology and Plant Protection,
Chisinau, Republic of Moldova
https://orcid.org/0000-0003-3363-3595, e-mail:galinalupascu51@gmail.com

Although common wheat is grown in different ecological and geographical areas, which indicates the high adaptive potential of this crop, in recent years the harvest is often compromised quantitatively and qualitatively due to various ecological disturbances – extreme temperatures, droughts that predispose to diseases of various fungal diseases, spread in all wheat-growing countries, having a significant negative impact on grain yield and quality.

Among the many fungal species that populate the soil, about 8,000 species of fungi and oomycetes are associated with the plant diseases, reduced fruit set and threat to food security [1].

Root rot is considered a complex disease, dominated by different pathogens on different surfaces or different pathogens in the succession of the ontogenetic stages of plants. As these diseases present long-term problems for many cereal-growing countries, in order to obtain high and quality crops for wheat and barley, extensive research has been initiated on the pathogens involved, the environmental factors associated with these diseases and crop losses.

Determining the composition of fungal species that cause one disease or another in crop plants is of great importance for the development of the right protection measures and serves as a methodological support in pathogen resistance screening systems. Because the *host-plant-fungus* relationship is often trophic, it is interesting to identify the particularities of the composition of causative agents in plant ontogenesis – a factor on which the nutrient biochemical substrate for the pathogen significantly depends.

Purpose: Establishing of the role of genotype factor and environmental conditions in the manifestation of common wheat resistance to fungal pathogens.

Keywords: *common wheat, fungal diseases, resistance, control*

Materials and Method. Common winter wheat genotypes and *Fusarium* spp., *Drechslera sorokiniana* culture filtrates served as study material. The research was carried out under optimal, suboptimal and low temperature conditions. Based on plant growth characters, the degree and frequency of transgressions, the coefficient of heritability in the broad sense, the genetic progress of resistance to pathogens were calculated.

Results. The fungal complex involved in the rot of the stem base in the common winter wheat is different in the ontogenesis of the plants, the diversity index being 1.49; 2.10 and 2.05, and the dominance – 0.52; 0.52 and 0.38, respectively, the stages of elongation of the straw, baking in milk and complete baking of the grains. In the first stage in the fungal complex dominated *Fusarium solani*, in the 2nd – *Alternaria alternata*, and in the 3rd stage – *Drechslera sorokiniana* (2019). The comparative study of the composition of the fungal species at the stage of complete ripening of the grains in the years 2019 and 2020 demonstrated the dominance of the species *Dreschlera* and *F. equiseti*, respectively [4].

By analyzing the histograms of distribution of wheat plants in phenotypic classes at the interaction with some causative agents of root rot, significant deviations from their normal distribution were found based on growth characters, a phenomenon particularly pronounced in the sensitive genotype (L 101) and less obvious – to the resistant genotype (Moldova 3). This statistical process can therefore serve as a method of identifying wheat genotypes, resistant to the causative agents of root rot. In other words, under the pressure of the biotic factor, the decomposition of the initial plant population into subclasses (subpopulations) with distinct biological properties takes place and considered as a mechanism for forming new lines on the population level [5].

It was found that treating common winter wheat caryopsis with *Drechslera sorokiniana* culture filtrate (CF) leads to decreased seedling growth, the effect largely depending on the genotype. Analysis of the reaction of wheat hybrid combinations (Gamble model: P1, P2, F_1, F_2, BC1, BC2) to *D. sorokiniana* CF revealed pronounced peculiarities of involvement of the places responsible for seedling growth in the system *combination x growth organ x D. sorokiniana* which acted both stimulatively and inhibitively on them, the resistance to the pathogen being determined by the *additive x dominant* epistatic interactions.

Revealing the features of transgressive segregation in plant populations is of great importance for genetic research and optimization of breeding programs. The mechanisms of transgressions have not yet been fully established, but the phenomenon itself is widely used to identify and select plant forms that are resistant to pathogens, pests, and unfavorable abiotic factors.

In response to the action of the metabolites of the fungus *D. sorokiniana*, in the F_2 populations of wheat there are positive transgressive segregants with a frequency of 2.52… 17.86% for the embryonic root and 0.92… 30.51% – stem, which indicates the existence of recombinants with complementary genes that ensure the resistance of wheat plants to pathogen [3].

It has been established that the degree and frequency of transgressions during the interaction of wheat with the fungus *F. oxysporum* at suboptimal (15-17°C) and low temperatures (8-9°C) depend on many factors: 1) combination and direction of crossing, 2) quantitative trait (root, stalk), 3) experiment options (control, culture filtrate – CF), 4) temperature conditions. The data obtained indicate a specific manifestation of transgressive variability in the studied traits of wheat. The highest frequency of positive transgressions was noted during the interaction of wheat with CF of the fungus against the background of suboptimal temperature, varying within 10.3 ... 27.5% in the case of the root and 1.7 ... 92.5% in the case of the stem in 4 of the studied 6-ty combinations. Using 10 lines of winter soft wheat with high economically valuable traits, as well as 4 species of fungi – *Fusarium oxysporum, F. solani, F. gibbosum, Helminthosporium avenae*, it was found that a high coefficient of heritability in the broad sense (h^2) for plant growth organs, indicating a good heritability of the studied traits when interacting with pathogens. Note that the genetic coefficient of variation was also high – 69.32% and 76.50% for the length of the root and stem, respectively, proving the genetic nature of their variability. Based on the high values of h^2 and genetic progress (%), it can be concluded that the reaction of wheat growth organs at an early stage of ontogenesis when interacting with pathogens is controlled by additive genes, which indicates the prospects for creating wheat genotypes resistant to root rot by selecting resistant forms to pathogens [2].

Conclusions. Starting from the above, it can be concluded that the development of a complex system of disease management in common wheat, based on mycological, phytopathological, genetic, agrotechnical knowledge, creates real premises for effective protection of this crop.

Acknowledgment. Research was carried out within the project of the State Program 20.80009.7007.04 "Biotechnologies and genetical processes for evaluation, conservation and exploitation of agrobiodiversity", financed by the National Agency for Research and Development.

References:

1. Fones H.N., Bebber D.P., Chaloner Th. M. et al. Threats to global food security from emerging fungal and oomycete crop pathogens. *Nature food*, 2020, 1, p. 455-456.
2. Lupașcu G. Putregaiul de rădăcină la grâul comun de toamnă. Chişinău: Print-Caro, 2020, 120 p.
3. Lupașcu G., Gavzer S. Determinismul genetic al rezistenței grâului (*Triticum aestivum* L.) la fungul *Drechslera sorokiniana* (Sacc.) Subram. *Buletinul AŞM. Ştiinţele vieţii*, 2018, nr 3(336), p.108-115.
4. Lupașcu G., Gavzer S. Influenţa etapei ontogenetice a plantei-gazdă şi condiţiilor climatice asupra complexului fungic care produce putregaiul de rădăcină la grâu. *Buletinul AŞM. Ştiinţele vieţii*, 2020, Nr 2(341), p. 80-86.
5. Lupaşcu G., Saşco E., Gavzer S., Anesia R., Dicusar I., Sandic Ş. Controlul genetic al caracterelor de rezistenţă şi productivitate la grâul comun, Chişinău: Tipografia AŞM, 2015, 176 p.

CZU:581.5:635.64 https://doi.org/10.53040/abap6.2022.64

EFFECT OF HEAT STRESS ON TOMATOES IN DIFFERENT EVALUATION SYSTEMS

MARII Liliana*, ANDRONIC Larisa**, SAHANOVSCHIH Marionela, TEMNICOV E.

Institute of Genetics, Physiology and Plant Protection,
Chisinau, Republic of Moldova
**https://orcid.org/0000-0003-3702-3583, **https://orcid.org/0000-0002-2761-9917*
e-mail:liliana.marii@igfpp.md

Morphological and physiological changes in response to heat stress (HS) in tomato are different between accessions, at different growth stages and with various HS exposure periods. H_2O_2 signaling plays an important role in the regulation of many biological processes and stress conditions. A recent study found that H_2O_2 acts as a signal during HS memory in a specific manner in heat-sensitive and heat-tolerant tomatoes [1]. The triggering of a plant's defense state can lead to acquired resistance to biotic stress or to acclimatization for abiotic stress [2].

Purpose. The purpose of the research is to highlight the particularities of the response and adaptation reactions of plants of different genotypes in the case of HS action at different growth stages, singular or repeated stress, and depending on the origin of the seed material of the plants.

Keywords: *heat stress, tomato, H_2O_2, morphological indices*

Materials and Method. Experiments were set in a growth or climate chamber under controlled conditions: light/dark cycle of 16/8 h, temperature - various up to 42 °C, and a relative humidity of 60%. *Model 1*: Four tomato genotypes were used – *S. pimpinellifolium*, Rufina, Mary Gratefully, Elvira. For each genotype, 4 Petri dishes of 50 seeds were used. After seed germinated (approx. 72 hours of water immersion), 2 Petri dishes were kept in optimal conditions (26^{0}C), and 2 others were exposed to HS +42^{0}C, 6 hours. The germs in each Petri dish represented an individual variant, they were transplanted into soil substrate, in laboratory conditions. When the seedling had 4 leaves, individual variants included 5 plants in 3 repetitions, were exposed to repeated heat stress - gradual growth of temperature up to 40^{0}C or optimal conditions. In the end, 4 variants with singular or repeated HS resulted: i) early growth stress, ii) early growth / vegetative stage stress, iii) vegetative stress, iv) optimum - lack of stress. At different post stress stages, for each of the 4 variants, the content of H_2O_2 in plant's leaves was determined, as well as histochemical analyzes (Reactive oxygen species (ROS), Lipid peroxidation, and Cell viability) and morphological plant's traits evaluation were performed. *Model 2:* Four tomato genotypes - *S. pimpinellifolium* (TMV tolerant), Rufina

(TMV resistant), Mary Gratefully and Jacota were used. For each genotype three variants was represented: progeny derived from plants infected with Tobacco Mosaic Virus (TMV), Tomato Aspermy Virus (TAV) or healthy ones. Descendants were virus free. The plants were exposed to HS - gradual growth of temperature up to 40^0C. The control variants were growing in optimal temperature - 26^0C.

Results. *Model 1*. The singular or repeated action of HS in plants had specific effects depending on the genotype and the stress application scheme. Following the evaluation of 3 histochemical indicators - accumulation of ROS, lipid peroxidation and the cell viability test in the leaves of the plants from the variants exposed above, the following moments were attested:

Repeated or singular HS, at different stages of development, in a slightly differentiated manner, depending on the genotype and the scheme of its application, contributes to the extensive accumulation of ROS, lipid peroxidation and cell death, reactions lightly attested the variants maintained in optimal conditions. A high correlation was established between visualization of lipid peroxidation reactions area (typically in conducting tissue) and ROS accumulation. ROS in parenchymal tissues have been frequently associated with the location of areas where cells have lost integrity. At the same time, the accumulation of ROS was more intense for 2 genotypes (*S. pimpinellifolium* and Rufina) in plants exposed to repeated stress at early growth / vegetative stage, while for 2 others (Mary Gratefully and Elvira) at a singular stress at the vegetative stage. The most accumulations (as leaf area) of ROS were attested in *S. pimpinellifolium* exposed to repeated stress at early growth / vegetative stage.

HS action (42^0C) at the early growth stage contributes to the inhibition of the plant's development. Thus, the decrease in plant height represented 13.9% compared to optimal conditions for the Mary Gratefully genotype, followed by 9.5% for the Rufina genotype and a minimum of 6.4% for *S. pimpinellifolium*. A similar trend was established for the number of leaves on the main axis and the leaf length, for the last one with a more drastic impact - decrease of up to 51.6% compared to the control for Mary Gratefully and 32.1% for *S. pimpinellifolium*.

In the case of the variants exposed to repeated stress at the early growth / vegetative stage, compared to those exposed primarily at the vegetative stage to HS, we found that, in dynamic 7 days post stress action on the plants, the average values of the analyzed indices were also decreased in the variants subjected to repeated stress, but in this case the hierarchy was changed and *S. pimpinellifolium* had the highest suppression of the analyzed indexes (54.3-31.8%), and Mary Gratifully the lowest (6.6-14%)). The low rate of plant survival after stress in the case of Elvira determined its exclusion from further evaluations.

According to the content of H_2O_2 in the leaves, we found that *S. pimpinellifolium* showed highest values compared to the rest of genotypes, the biggest difference being 32.6% in the optimal variant, 180.6% in the variant treated at the early growth stage, 82.2% in the variant treated at the vegetative stage and 31.3% at repeated early growth / vegetative stage stress. We establish that within the *S. pimpinellifolium* and Rufina genotypes, the highest H_2O_2 content is found in the variants exposed to HS at the vegetative stage, exceeding by 2.13 and 1.52 times, respectively, the values of the repeatedly HS exposed plants, the early growth / vegetative stage, and by 13.9 and 18.1 times the values of HS exposed variants at early growth stage only. By the way, for all 3 genotypes, a considerable decrease (by 2.4-8.0 times) of the H_2O_2 content was established in the variants exposed to HS at the early growth stage compared to the optimal variants. *Model 2.* The evaluation of the action of HS on the progeny of 4 genotypes from plants infected with TMV, TAV or healthy allowed highlighting both the particularities and the uniformity related to the accumulation of H_2O_2 in plants. Thus, we can found that the exposure to HS determined significantly higher values for the H_2O_2 content in the offspring from the plants infected with TAV for Rufina, Mary Gratefully and Jacota genotypes by 9.6, 14.7 and 3.1%, respectively, compared to the TMV variants, and by 38.8, 46.4 and 11.4% respectively compared to the variants from the healthy plants. The highest values of H_2O_2 content per experience were attested for *S. pimpinellifolium*, exceeded by 96% the maximum value of TMV descendants (3 genotypes), 42% VAT variants and 28% healthy variants exposed to HS. Based on these data as well as other previous research, we found that usually TAV has a stronger inter- and transgenerative impact on the indices of the oxidative response compared to TMV, at the same time the significant differences persists in the case of all descendants from virus infected plants compared to healthy ones.

Conclusions. Heat stress undoubtedly contributes to the modification of a series of morphological and physiological indicators associated with the response of plants and their adaptation to stress, in a genotypically specific manner. A series of relevant particularities related to the plant's reaction to stress had been established depending on the stress application plant growth stage and its repetition, as well as the phytosanitary origin of the seed material.

Acknowledgment. The research was carried out within the project of the State Program 20.80009.7007.04, funded by the National Agency for Research and Development.

References:

1. Mintao, S., Fangling, J., Rong, Z., et al. Respiratory burst oxidase homologue-dependent H_2O_2 is essential during heat stress memory in heat sensitive tomato. In: *Scientia Horticulturae*. 2019, 258, doi:10.1016/j.scienta.2019.108777.
2. Slaughter, A., Daniel, X., Flors, V., et al. Descendants of primed arabidopsis plants exhibit resistance to biotic stress. In: *Plant Physiology.* 2012. Vol. 158, Issue 2, p. 835–843. doi.org/10.1104/pp.111.191593.

CZU:633.11:631.811.98 https://doi.org/10.53040/abap6.2022.65

EFFECT OF PHYTOHORMONE-PRODUCING *Bacillus SP.V2026* ON DEVELOPMENT AND PRODUCTIVITY OF EARLY-MATURING WHEAT (*Triticum aestivum* L.)

MIRSKAYA G.V.[1], KHOMYAKOV YU.V.[1], RUSHINA N.A.[1], VERTEBNY V.E.[1], PISHCHIK V.N.[1, 2]
[1]*Agrophysical Scientific Research Institute, St. Petersburg, Russian Federation,*
[2]*All- Russia Research Institute for Agricultural Microbiology, St. Petersburg, Pushkin, Russian Federation e-mail: galinanm@gmail.com*

Purpose. For wheat plants, early maturity is one of the important adaptive features. Increasing the yield of early-maturing wheat cultivars and lines is an urgent problem for agriculture. A possible way of increasing the productivity of grain crops in sustainable agriculture is the use of biological preparations based on PGPB. PGPBs stimulate plant growth and development through various mechanisms, including the production of phytohormones. The paper presents a study of the effect of phytohormone-producing *Bacillus sp. V2026* bacteria on the hormonal status, productivity and the development of different genotypes of early-maturing wheat.

Keywords: *Bacillus sp., Triticum aestivum L., early-maturing, productivity, phytohormones*

Materials and Method. The early-maturing of soft spring wheat (*Triticum aestivum* L.) cv. Sonora 64 (S64) (k-45398) and cv. Leningradskaya rannyaya (LR) (k-142751) and along with ultra-early lines AFI91 and AFI177obtained in the Agrophysical Research Institute were studied. The bacterial strain was isolated from wheat seeds and selected based on their ability to improve the germination of wheat plants; it was identified as *Bacillus* sp. The effects of this epiphytic bacterium on physiological and biochemical responses and endogenous hormone levels at the early stages of ontogenesis, development dynamics and productivity of early-maturing wheat genotypes were studied in model experiments in controlled conditions.

Results. PGPB *Bacillus* sp. *V2026* a producer of indolyl-3-acetic acid (IAA) and gibberellic acid (GA) influenced the development dynamics and productivity of early-maturing cultivars S64 and LR and ultra-early-maturing lines AFI91 and AFI177 of wheat as well as their physiological and biochemical responses and endogenous hormone levels at the early stages of ontogenesis. Inoculation of plants with *Bacillus* sp. *V2026* significantly affected the content of endogenous hormones IAA, GA and trans-Zeatin (tZ) in roots and shoots of early-maturing wheat genotypes. The inoculation of wheat plants with *Bacillus* sp. *V2026* increased the levels of endogenous IAA and GA in wheat of all the genotypes, especially in cv. LR and increased the level of tZ in S64 and LR cvs, but decreased it in AFI177 and AFI91ultra-early lines. Interactions between factors "genotype" and "inoculation" were significant for IAA, GA and tZ concentrations in wheat shoots and roots. The inoculation increased the levels of chlorophylls and carotenoids and reduced lipid peroxidation in leaves of all the genotypes. The inoculation resulted in a significant increase in grain yield (by 33-62%), a reduction in the time for passing the stages of ontogenesis (by 2-3 days), an increase in the content of macro- and microelements and protein in the grain. Inoculation with the bacterium significantly shortened the time to reach each growth stage in early-maturing genotypes, with cycle reduction being greater from seedlings to stem elongation. The stimulating effect of *Bacillus* sp. *V2026* on the cultivars S64 and LR was mostly expressed as the increase in the number of grains, while the effect on the plants of lines AFI91 and AFI177 was mainly expressed in the increase in grain weight. The contents of macro- and microelements and protein in the grain of AFI91 and AFI177 were maximal as compared to other genotypes. Early-maturing wheat genotypes showed a different response to inoculation with bacterium *Bacillus* sp. *V2026*. Cv. Leningradskaya rannyaya was most responsive to inoculation with *Bacillus* sp. *V2026*.

Conclusions: GA- producing *Bacillus* sp. *V2026* can reduce the duration of developmental phases of early-maturing wheat by increasing plant endogenous GA. The bacterium *Bacillus* sp. *V2026* could be used to increase the yield and the grain quality of early-maturing genotypes of spring soft wheat. However further studies are necessary to select the most effective association for growing high-yielding early- maturing wheat plants, since there are the differences in the response of early-maturing wheat genotypes to inoculation with PGPB *Bacillus* sp. *V2026*. The optimization of such combination is important to achieve higher wheat productivity.

CZU:633.11:631.527 https://doi.org/10.53040/abap6.2022.66

STUDYING THE RESISTANCE OF INTRODUCED WHEAT SAMPLES TO DISEASES AND OTHER PARAMETERS, SELECTING THE PRIMARY MATERIAL FOR BREEDING

MİRZAYEVA G.V., IBRAHİMOV E.R., AHMEDOVA F.A.
Research Institute of Crop Husbandry, Baku, Azerbaijan
e-mail: m.gushen@80gmail.com

Grain growing is one of the leading areas of our economy, being considered the biggest wealth of Azerbaijan. After the independence of Azerbaijan, as in many areas of production, certain difficulties have arisen in the field of grain growing. Large areas of land were given to the cultivators and small family-peasant and farms were created. Difficulties in the application of large-scale equipment in newly created farms, lack of chemical and technical means caused the productivity of grain plants to drop significantly. It should be noted that due to the constant increase in the price of cereal grains in the world market in recent years, the provision of food security in the country is always in the focus of the attention of the state of Azerbaijan. Cereal crops, especially wheat, are considered the main regulator of the market of agricultural products. Flour, confectionery and pasta products, starch, beer, alcohol and other food products are made from it. Cereal products are widely used as the main feed base of livestock and poultry. At the same time, the strategic importance of grain production is greater. As a result of the implemented agrarian reforms, the production of grain products in Azerbaijan has increased. Grain farms, which are the basis of the organization of grain production, operate in all regions of the country, and their natural and economic conditions allow the expansion and development of grain growing.

According to the information of the disease and pest control laboratory of the Research Institute of Crop Husbandry, in the years when the strong development of wheat rust, especially yellow rust, is observed, the yield loss is 30-40%, and as a result of rust diseases - 20-25%. The damage caused by the karamel bunt disease to barley reaches 20-30% in some regions of the republic, and the yield decreases by 5-10% due to septoria of wheat and maize fungus (*Ustilago*) disease. Therefore, in all regions of the republic, the role of the implementation of complex control measures, which ensure reliable protection of cereal plants from diseases, is great in obtaining high-quality and high products.

One of the main factors affecting the decrease of grain productivity in Azerbaijan is its diseases. Many diseases (brown, yellow rust, powdery mildew, rust, septoria, helmintosporiosis, fusarium, etc.) cause great damage to grain plants. Every year, on average, more than one million hectares of grain crops are planted in the country. 97.7% of it is accounted for by wheat, barley and corn. However, it is unfortunate that the desired results are not always achieved in the field of grain production in the country. So, every year, diseases, pests and weeds damage grain crops in farms, resulting in the loss of 30-35% of their productivity. Among the diseases of wheat in Azerbaijan, rust disease differs sharply from others in terms of the level of damage to productivity. Since 1999, the yellow rust disease has reached the epidemic level in the country, which has strongly infected our local varieties resistant to the disease and reduced its quality and productivity. It can be said that during these years, the yellow rust disease has mutated and formed a new aggressive race. As a result, many of our durable, high-yielding and high-quality varieties have shown sensitivity to this race. For this reason, Azametli95, Giymatli2/17, Taraggy, Nurlu99, Tale38, Farahim, etc. varieties were withdrawn from production. Creation of new varieties resistant to this pathogen through hybridization or breeding has become one of the current issues.

It is planned to study the samples of wheat varieties introduced from the International Selection Centers CIMMYT and ICARDA for different soil and climatic conditions, by carrying out the preliminary ecological test, according to their important agronomic characteristics, to identify donors for productivity, quality and resistance to diseases, and to recommend their use in breeding.

I would like to mention that the introduction and exchange of genetic materials in the field of wheat breeding has been carried out within the framework of multi-year scientific cooperation between the International Selection Centers CIMMYT and ICARDA and Research Institute ofCrop Husbandry, which has been ongoing since 1996. Every year, a large number of wheat seed samples collected in nurseries of different purposes (for irrigated, arid, semi-arid, rainy areas, heat tolerant, disease resistant, etc.) are received from these centers to the Research Institute of Crop Husbandry. These samples are subjected to preliminary environmental testing both in Absheron and in suitable regions, and a number of their agronomic, morphophysiological and phytopathological characteristics are studied.

In connection with the above, the table provides information on the volume of materials received from the Centers CIMMYT and ICARDA to the Research Institute of Crop Husbandry through the line of international scientific cooperation during 2019-2020.

Table. Wheat nursery and samples introduced and researched from International Centers (Research İnstitute of Crop Husbandry, Absheron, 2019-2020)

N	Name of plant	Number of nursery	Number of sample
1	Bread wheat	8	754
2	Durum wheat	2	120
Total		10	874

As can be seen from the table, field experiments include 874 wheat plant samples collected in 10 nurseries. The nurseries are mainly observation and yield variety test nurseries. 4 of the 10 nurseries included belong to IWWIP (International Winter Wheat Improvement Program) and cover 404 samples. Another 4 nurseries belong to CWANA ICWIP (ICARDA CIMMIT Wheat Improvement Program for CWANA) and cover 350 samples. 2 nurseries belong to CWANA IDIP (ICARDA Status Improvement Program for CWANA) and combine 120 specimens. Of these studied nurseries, 8 belong to bread wheat (754 samples), and 2 to durum wheat (120 samples).

Planted samples were winter, semi-spring and spring according to growth type. Facultative and autumn forms prevailed in nurseries designed according to the joint program of Turkey, CIMMYT and ICARDA, and spring forms prevailed in nurseries purchased directly from CIMMYT and ICARDA. About 53% of soft wheats were of winter type, and 47% of spring type.

At the end of the vegetation year, the optimality of the studied morphophysiological traits was taken into account in the selection of favorable genotypes. Attention has been paid to the optimality of the heading duration and neck. By analyzing the indicators characterizing a number of morphophysiological signs, among the studied material, 50 samples were resistant to yellow rust (R), 130 (MR) were moderately resistant, 140 MS were moderately susceptible, and the remaining samples were S susceptible. Also, non-dormant trunk with optimal heading period (110-127 days) and high yield (600 g/m2 and more) samples were selected and presented as starting material to the breeding program for the purpose of creating new varieties.

CZU:581.5:633.853.74 https://doi.org/10.53040/abap6.2022.67

THE EFFECT OF WATER STRESS ON SESAME (*Sesamum indicum* L.) SAMPLES FROM THE M_3 GENERATION IN THE CONDITIONS OF IT'S ARTIFICIAL MODELING

MOGILDA A.
Institute of Genetics, Physiology and Plant Protection,
Chisinau, Republic of Moldova
https://orcid.org/0000-0001-9159-6038, e - mail: anatolii.mogilda10@gmail.com

Sesame (*Sesamum indicum* L.) is one of the most important oil crops widely cultivated in different regions of the world. For many centuries, sesame seeds have been used as a source of oil, protein, vitamins and minerals for human and animal nutrition [4].

Unlike other crops, sesame is considered to be more drought tolerant [5]. However, drought often occurs together with heat or high temperatures and significantly affects sesame production. Detrimental effects on sesame seed production and quality are significantly observed when water stress occurs, especially at the germination and flowering stages [3]. Severe or prolonged drought negatively influences sesame productivity by reducing the number of capsules per plant, yield and oil quality [1]. Drought stress can also affect the level of secondary metabolites and morphophysiological characteristics of sesame seeds. Seed germination is the first critical and most sensitive stage of the plant life cycle [3] due to its direct and strong correlation with seedling establishment and early growth. As a result of climate change, there is an increased frequency of drought throughout the crop cycle, including the germination stage.

Thus, there is a need to improve crop drought tolerance through breeding and selection of suitable germplasm to be used in the development of adapted cultivars that could enable sustainable and competitive sesame cultivation.

This work was carried out with the aim of comparative testing of sesame samples obtained by the induced mutagenesis (Gy) method, after resistance to osmotic stress under the conditions of its experimental modeling by using the osmotically active substance PEG 6000.

Key words: *sesame, gamma rays, water stress, PEG 6000, optimal concentration*

Materials and method. The *Zaltsadovski, Kadet and Adaptovanii 2* genotypes irradiated with doses of 200-500 Gy in the M3 generation served as study material. The seeds were obtained on the experimental sector of the Institute of Genetics, Physiology and Plant Protection.

For the laboratory tests, polyethylene glycol PEG 6000 was used in the optimal concentration of 15% (-0.295 MPa). For each replicate, 50 seeds were used in Petri dishes (90 mm diameter) containing two layers of filter paper. Two treatments were applied: in the case of the control version, the seeds were soaked in 10 ml of distilled water, and in the treatment with 15% PEG, 10 ml of the solution was used. Petri dishes were kept in the dark in a climate chamber set at 28°C for five days.

The experiment was repeated three times. After five days, the number of germinated seeds (G), root length and stem length (mm) were recorded both in the control variant and under stress conditions [2].

Results. For the control variant, the rate of germinated seeds at *Zaltsadovski, Kadet* and *Adaptovanii 2* with doses of 200-500 Gy was 86-100%, which confirms their good readiness for testing. Under the influence of the osmotic pressure caused by PEG 6000, seed germination decreased to 18% - 76%.

For the *Zaltsadovski* genotype, the most tolerant dose of those studied (200 – 500 Gy) is considered 500 Gy with the degree of inhibition – 59.75 %. According to the length of the root, the smallest difference was found to be - 15.77 mm compared to the control - 32.88 mm and according to the length of the stem - 16.45 mm compared to 34.67 mm to the control, and the biggest difference in the length of the root of 8.40 mm compared to the control – 29.00 mm and the length of the stem – 9.21 mm compared to the control – 34.25 mm was highlighted at the dose of 300 Gy.

In the case of the *Kadet* genotype, inhibition degrees were recorded that are within the limits: 46.04 – 76.94% for all studied doses. The dose of 200 Gy was found to be less susceptible to water stress (46.04 %). By root length the dose of 300 Gy is determined by a smaller difference – 8.97 mm compared to – 35.68 mm in the control and by stem length – 9.12 mm compared to 34.67 mm in the control.

In the *Adaptovanii 2* genotype, the least susceptible to water stress, the doses of 400 Gy, 500 Gy with degrees of inhibition – 45.47% and 41.48% can be noted. Also, at the dose of 500 Gy, the smallest difference can be seen in the length of the root of 14.16 mm compared to the control of 37.76 mm, and in the length of the stem - 11.88 mm compared to the control - 36.88 mm, but also the biggest difference according to the length of the root – 8.91 mm compared to the control – 34.09 mm, and the length of the stem – 11.26 compared to the control – 33.51 mm.

Conclusions: The obtained results demonstrate a seminificant difference of *Zaltsadovski, Kadet* and *Adaptovanîi 2* genotypes with doses of 200 – 500 Gy after resistance to the action of unfavorable factors.

Through the influence of water stress under controlled conditions, the genotypes *Kadet* with the dose of 200 Gy (46.04 %) and *Adaptovanîi 2* with the doses of 400 Gy, 500 Gy (45.47% and 41.48 %) are considered the least susceptible that can be recommended also in conditions of high water stress.

Acknowledgment. The research was carried out within the project of the State Program 20.80009.5107.11 “Long-term ex situ conservation of plant genetic resources in the Gene Bank with the use of molecular biology methods in testing the health status of plant germplasm", financed by the National Research Agency and Development.

References:

1. Boureima S, Eyletters M, Diouf M, Diop T.A, Van Damme P. Sensitivity of Seed Germination and Seedling Radicle Growth to Drought Stress in Sesame, *Sesamum indicum* L. *Res. J. Environ. Sci.* 2011, *5*, 557.
2. Donghua Li, Komivi Dossa ID, Yanxin Zhang, Xin Wei, Linhai Wang, Yujuan Zhang, Aili Liu, Rong Zhou and Xiurong Zhang. GWAS Uncovers Differential Genetic Bases for Drought and Salt Tolerances in Sesame at the Germination Stage, Journal Genes, 2018, p-1-19. doi:10.3390/genes9020087.
3. Dossa K, Yehouessi L, Likeng-Li-Ngue B, Diouf D, Liao B, Zhang X, Cissé N, Bell J. Comprehensive Screening of Some West and Central African Sesame Genotypes for Drought Resistance Probing by Agromorphological, Physiological, Biochemical and Seed Quality Traits. *Agronomy* 2017, *7*, 83.
4. Weiss, E. A. Oilseed Crops, second edition. Blackwell Science LTD, United Kingdom. 2000, 355 pp.
5. FAOSTAT. Available online: http://www.fao.org/faostat/fr/#data/QC (accessed on: 10.07.2022).

CZU:606:579.64 https://doi.org/10.53040/abap6.2022.68

ANTAGONISTIC PROPERTIES OF SOME LOCAL ENTOMOPATHOGENS OF THE BEAUVERIA GENUS

MOLDOVAN Anna[1, 2], CIORICI C.[2], MUNTEANU-MOLOTIEVSKIY Natalia[1]
[1]*Institute of Zoology, Chisinau, Republic of Moldova;*
[2]*Moldova State University, Chisinau, Republic of Moldova*
e-mail: anna.moldovan@yahoo.com

Entomopathogenic fungi of the genus *Beauveria* (Hypocreales) are essential natural regulators of insect populations, characterized by their ability to infect a wide range of hosts, with an increased mortality rate. Using species of the genus *Beauveria* as biological control agents offer numerous advantages, including high efficacy, harmlessness, and compatibility with other IPM (Integrated Pest Management) methods, being considered among the most promising alternatives for pest control [1]. *Beauveria* genus has received considerable commercial attention in the last 30-35 years as a source of strains for the mass production of biopesticides. As a result, it has determined an increased interest in improving their properties and spectrum of use in biological control, driving numerous studies focused on investigating the supplementary beneficial properties such as anti-phytopathogenic potential. Currently, *Beauveria* spp. are considered the most promising microorganisms for the development of complex biological control strategies, through their profiling as endophytes, plant growth promoters, beneficial colonizers of the rhizosphere, and most importantly, *in vitro,* and *in vivo* antagonists of significant plant pathogens [1]. As an outcome of the previously conducted research, native fungal strains of *Beauveria* spp. with the potential to be used as biological control agents were isolated and characterized. The strains of entomopathogenic fungi of the genus *Beauveria* show an intrinsic variability in their ability to inhibit or antagonistically influence phytopathogen growth, development, and viability. Thus, the investigation and precise selection of the most effective strains are required to develop biopesticides with the potential to be applied in complex biological control [4]. **The work aimed** to investigate the antagonistic properties of some local strains of fungi from the *Beauveria* genus for subsequent complex biological protection of crops.

Keywords: *Beauveria, Alternaria, Fusarium, antagonistic properties*

Materials and Method. In the present study, local strains of fungi of the genus *Beauveria* from the collection of the Institute of Zoology and two strains of fungal plant pathogens *Fusarium oxysporum* CNMN-FF-06 and *Alternaria alternata* CNMN-FF-09 from the National Collection of Nonpathogenic Microorganisms of the Institute of Microbiology and Biotechnology were examined. Fungal strains were grown in Petri dishes with PDA (Potato Dextrose Agar) medium to produce conidiospores. After ten days from inoculation, conidia were harvested directly from the surface of the medium to prepare conidial suspensions. Subsequently, 200 µl of each conidial suspension were distributed on new PDA plates. *Beauveria* spp. and *A. alternata* cultures were incubated at 25°C, while those of *F. oxysporum* at 28°C. The antagonistic interaction between entomopathogenic and phytopathogenic fungal strains were investigated using the dual culture method in Petri dishes with sterile PDA medium. The experiments were performed in 4 repetitions. The dual and control cultures were incubated at 25°C in darkness until the phytopathogen from the control sample had completed the plate's colonization. The percentage of inhibition of the radial growth of the phytopathogen (PIRG) was calculated [4]. The delimitation of an inhibition zone between fungal colonies was observed for dual cultures.

Results. The interaction of entomopathogenic species of the *Beauveria* genus and the phytopathogens *Fusarium* spp. and *Alternaria* spp. has been previously examined in other studies, and the antagonistic properties were investigated in different scenarios (*in vitro* and *in vivo*). The species *F. oxysporum* is one of the most extensively explored [2]. At the same time, the antagonistic properties of *Beauveria* spp. against representatives of the genus *Alternaria*, especially *A. alternata*, were less studied [5]. The results of the present work indicate that the native strains of *Beauveria* spp. reduce the radial growth of the investigated phytopathogens. Inhibition of the phytopathogen was recorded for all analyzed dual cultures, varying between different *Beauveria* strains. One showed promising antagonistic potential against both *F. oxysporum* and *A. alternata* species. The data obtained are comparable with other similar data from the literature [2, 3, 5]. Some local strains demonstrate significantly higher PIRG values upon simultaneous inoculation in the same plate of entomopathogen-phytopathogen pairs. In some studies, was observed a substantial difference in the efficiency of *Beauveria* spp. strains, when inoculated preventively, thus indicating the importance of evaluating this strategy's success to properly assess their effectiveness in suppressing phytopathogens *in vitro* [3].

Conclusions.

As a result of this research, the *in vitro* antifungal properties of *Beauveria* spp. native strains against the plant pathogens *Fusarium oxysporum* and *Alternaria alternata* were confirmed. All investigated entomopathogenic strains have shown some degree of inhibition of the phytopathogens' radial growth. The antagonistic interaction between fungal cultures can be attributed to the competition for space and resources, and, possibly, to the production of a set of compounds that interfere and suppress the normal growth of phytopathogens. Although the *in vitro* efficacy of native strains increases their potential use as biopesticides in the complex biological control of both harmful arthropods and fungal phytopathogens, their further evaluation under field conditions remains necessary.

Acknowledgment.

The presented scientific results were financially supported by the project 20.80009.7007.12 “Diversity of hematophagous arthropods, zoo - and phytohelminths, vulnerability, strategies to tolerate climatic factors and the elaboration of innovative procedures for the integrated control of species with socio-economic value” – DIVZOO.

References:

1. Bamisile, S.B. Akutse, K.S., Siddiqui, J.A., Xu, Y. Model Application of Entomopathogenic Fungi as Alternatives to Chemical Pesticides: Prospects, Challenges, and Insights for Next-Generation Sustainable Agriculture. In: *Front. Plant Sci.* 2021. vol. 12, art. 741804. DOI: 10.3389/fpls.2021.741804
2. Barra-Bucarei, L., France, A., Millas, P. Crossing Frontiers: Endophytic Entomopathogenic Fungi for Biological Control of Plant Diseases, In: Hodkinson, T. *et al.* (Ed.), *Endophytes for a Growing World*, Cambridge: Cambridge University Press, pp. 67-92, United Kingdom. 2019.
3. Culebro-Ricaldi, J. M., Ruiz-Valdiviezo, V. M., Rodriguez-Mendiola, M. A., Avila-Miranda, M. E., Gutierrez-Miceli, F.A., Cruz-Rodriguez, R. I., Dendooven, L., Montes-Molina, J. A. Antifungal properties of *Beauveria bassiana* strains against *Fusarium oxysporum* f. sp. lycopiersici race 3 in tomato crop, In: *Journal of Environmental Biology*. 2017, vol. 38, pp. 821-827. DOI: 10.22438/jeb/38/5/MRN-412
4. Deb, L., Devi, R. T., Majumder, D., Dutta, P., Thakuria, D., Rajesh, T., Ningthoujam, K. Antifungal ability of *Beauveria bassiana* (Balsamo) Vuillemin against *Curvularia lunata* causing leaf spot of rice. In: *The Pharma Innovation Journal*. 2021, vol.10, nr.4, pp. 298-303. DOI: 10.22271/tpi.2021.v10.i4e.5941
5. Sinno, M. Selection of Endophytic *Beauveria bassiana* as a Dual Biocontrol Agent of Tomato Pathogens and Pests. In: *Pathogens*. 2021, vol. 10, art. 1242. DOI: 10.3390/pathogens10101242

CZU:595.754:591.5 https://doi.org/10.53040/abap6.2022.69

LABORATORY REARING AND VORACITY OF TWO ANTHOCORID SPECIES (HEMIPTERA: ANTHOCORIDAE) ON DIFFERENT PREYS

MUNTYAN Elena, IORDOSOPOL Elena, BATCO M.*, PLACINTA Mihaella, MAEVSKAYA Valentina
Institute of Genetics, Physiology and Plant Protection, Chisinau, Republic of Moldova
**https://orcid.org/0000-0002-3711-4429, e-mail: moontyane@yahoo.com*

The family *Anthocoridae* is known as an important group of predators of such agricultural pests as thrips, aphids, mites, psyllids, scale insects, as well as immature stages of some lepidopteran insects. Some anthocorids have commercial use to keep thrips populations low in greenhouses. *Orius majusculus* is a Palearctic species commonly found in various agricultural biotopes and wild fauna on the Eurasian continent. This anthocorid species has been used for biological control of thrips in several countries [3]. The genus *Amphiareus* is represented in Europe by two species: *Amphiareus obscuriceps* (Poppius, 1909) and *Amphiareus constrictus* (Stal, 1860). *Amphiareus obscuriceps* is an invasive species, probably of Asian origin, recorded in various European countries [4]. In the Republic of Moldova, it is specified as a rare species [2]. *Amphiareus constrictus* first recorded in Europe (Netherlands) since 2009 [1].

So, due to the increasing interest in the use of natural enemies in the pest management systems, laboratory experiments have been carried out to evaluate the laboratory rearing and the voracity potential of two anthocorid species (*Orius majusculus* and *Amphiareus* sp.) as biological control agents.

Keywords: *predatory bugs, rearing, voracity, preys*

Materials and Method. Adults of *O. majusculus* were collected on wild cannabis in July 2021. *Amphiareus* sp. adults were found in winter trapping belts installed in a plum orchard in October 2021 (IGFPP). Start anthocorids colonies consisted of 25 *O. majusculus and* 45 *Amphiareus* sp. adults. Laboratory anthocorid's colonies were kept at a temperature of 25 ± 1°C, relative humidity 60-70%, and photoperiod 16:8 (L:D). The diet of the bug consisted of frozen *Sitotroga cerealella Oliv.* eggs, Schizaphis graminum aphids, and water. Bean sprouts were used as a substrate for oviposition. *O. majusculus* and *Amphiareus* sp. were reared in laboratory conditions for six and two generations, respectively, before starting the experiments.

The bug's voracity was studied in relation on two preys of these anthocorids at a temperature of 28 ± 1°C. For this, a second instar nymph or one-day-old adult were released into plastic container (1000 ml) covered by cotton fabric. The container was provided with a bean leaf on wet cotton wool in a Petri dish, with *T. urticae* one-day-old eggs or *S. graminum* as prey (50-100 depending on the development stage of the anthocorid). Every 24 hours, the bean leaf was observed under a microscope to record the number of individuals consumed and the age of nymph, after which bugs were placed on a new leaf with prey. Each experiment was repeated at least 8-11 times. Data were statistically processed using Student's t-test to assess differences.

Results. On a mixed diet, the mean duration of the immature stages was 13.0±0.7 days for *O. majusculus* and 17.3±0.2 days for *Amphiareus* sp.. Sex ration of adults was 1:1. The adult lifespan ranged from 12 to 25 days for *O. majusculus* and 20-32 days for *Amphiareus* sp..

The study of the potential voracity of bugs showed that *Amphiareus sp.* consumed significantly more 215.8±7.2 spider mite eggs than *O. majusculus* 115.5±5.6 during nymph development. In the same time, when using *T. urticae* eggs, the duration of the *O. majusculus* immature stage was 7.4±0.5 days, and 11.5±0.5 days for *Amphiareus. sp.*. Thus, the per day voracity of this predatory bugs was 16.2±1.4 and 18.9±0.9 prey/day, respectively, for *O. majusculus* and *Amphiareus* sp.. The adults of *O. majusculus* and *Amphiareus sp.* could destroy 29.5±1.1 and 30.6±4.2 *T. urticae* eggs per day, respectively.

In total, *O. majusculus* nymphs could consume 140.6±4.0, and *Amphiareus sp.* 195.0±2.2 of *S. graminum* aphids. The development time for predators reared on the aphids was 7.7±0.1 and 10.2±0.3 days for *O. majusculus* and *Amphiareus sp.,* respectively. When prey was aphids, the per day voracity of bugs was 18.6±0.8 and 19.2±0.6 for *O. majusculus* and *Amphiareus sp.,* respectively. *O. majusculus* and *Amphiareus sp.* adults could eaten 47.2±2.2 and 61.1±4.5 aphids per day, respectively. Adults eaten significantly fewer spider mite eggs than cereal aphids.

Conclusions.

1. A mixed diet based on frozen eggs of grain moth and cereal aphid is suitable for laboratory rearing of the predatory bug of the genus *Amphiareus* - *Amphiareus* sp. The lifespan of adult bugs at 25°C averaged 25 days on this diet.

2. A comparative study of the *O. majusculus* and *Amphiareus* sp. nymphs development on the *T. urticae* eggs and the nymphs of cereal aphids demonstrated that the bugs are able to complete their development on these preys. However, the bugs showed significant differences in the nymphal stage duration. On all diets, *O. majusculus* nymphs developed faster than *Amphiareus* sp. nymphs, which may be due to the interspecific features of these anthocorids.

3. It was found that *Amphiareus* sp., compared to *O. majusculus*, eaten significantly more spider mite eggs and cereal aphids at the nymphal stage. However, these differences are related to the longer period of development of *Amphiareus* sp. nymphs. The average voracity of bugs during the development on these preys did not differ

significantly. The voracity of *O. majusculus* and *Amphiareus* sp. adults on spider mites eggs and aphids also did not differ significantly. This allows assuming that there will be no serious competition for prey between these predators when living together in a biocenosis (or agrocenosis). However, the type of prey (spider mite eggs or aphid nymphs) essentially affected the voracity of adults. The bugs were significantly less voracious when feeding on mite eggs.

4. It should be emphasized that *O. majusculus* is a common species of predatory bugs in Europe, including the Republic of Moldova. It has been in the collection of anthocorids of the Laboratory of Entomology and Biocenology of the Institute of Genetics, Physiology and Plant Protection since 1957. *Amphiareus* sp. is a new predatory bug of the Anthocoridae family in our collection. In the future, the full species identification will be carried out. In the agrocenosis *Amphiareus* sp. was found by us for the first time. The detection of this predator in a sufficiently large number in winter hunting belts probably indicates its ability to colonize plum trees affected by aphids, scale insects and psyllids in summer of 2021. The possibility and simplicity of rearing this predatory anthocorid under artificial conditions makes it a promising entomophage. However, further research is needed to more fully assess this species as a biological control agent.

Acknowledgments. Research was carried out within the project of the State Program 20.80009.5107.27 “Development of alternative methods for the control of harmful arthropods in various agricultural cenosis, based on environmentally friendly means and procedures” financed by the National Agency for Research and Development.

References:

1. Aukema B., Hermes D. Nieuwe en interessante Nederlandse Wantsen III (Hemiptera: Heteroptera). Nederlandse Faunistische Mededelingen. 2009. V. 31. P. 52–88.
2. Derjanschi V. **S**ome rare Heteroptera species (Hemiptera) from the „Cobîleni” natural reserve Republic of Moldova. Sustainable use and protection of animal world in the context of climate change. 2021. P.187-191. doi.org/10.53937/icz10.2021.31
3. van Lenteren J.C. The state of commercial augmentative biological control: plenty of natural enemies, but a frustrating lack of uptake. BioControl. 2012.V. 57. P.1–20. doi: 10.1007/s10526-011-9395-1.
4. Rabitsch W. True Bugs (Hemiptera, Heteroptera) Chapter 9.1. BioRisk. 2010. V.4. №1. P. 407–433. doi: 10.3897/biorisk.4.44.

CZU:595.78:591.16 https://doi.org/10.53040/abap6.2022.70

SEXUAL AND REPRODUCTIVE CORRELATION OF THE POPULATION OF THE *Agrotis segetum* (Den. et Schiff.)

NASTAS T.*, GHELETIUC Olesea, RUSU Iuliana**, GAVRILUICK Aliona[2]
Institute of Genetics, Physiology and Plant Protection,
Chisinau, Republic of Moldova,
[2]Ukrainian Scientific Research Plant Quarantine Station Institute
of Plant Protection Institute NAAS
** https://orcid.org/0000-0002-0322-710X,*
*** https://orcid.org/0000-0002-6551-0955,*
e-mail: tudor_nastas@mail.ru

Ecosystem functionally is ensured by the relationships between the species that make them and their interactions with abiotic factors. The existence and activity of any pest population is determined by the consumption of the necessary nutrients. About 140 species of phytophagous attack cultivated plants. In the event of an invasion and development of the hazardous pests, crop losses can exceed 50-60% and crops can be completely compromised. Climate change is a key that requires urgent action to change attitudes towards the environment. In this regard, the role of science and research is huge to find alternative solutions and replace harmful methods for the global, regional and local climate.

In the fauna of the Republic of Moldova, 409 species from the Noctuidae family were recorded, some of which periodically cause considerable damage to agricultural crops. One of the corresponding species is *Agrotis segetum*, which causes damage to about 140 plant species, but the most heavily attacked are wheat, soybeans, peas, corn, tomatoes, and others. Chemical control is undesirable in these crops, even more so, taking into account the hidden way of life of the larvae, the results are not the desired ones [1, 2]. The application of sex pheromones to monitor the development and control of the given pest is welcome, but a deeper study of the sexual and reproductive correlation is required.

The purpose of the research is to evaluate the copulatory and reproductive potential in seasonal dynamics and depending on generations of the pest *Agrotis segetum*.

Keywords: *Agrotis segetum, light trap, male, female, spermatophore, eggs*

Material and methods. The experiments were set up under both field and laboratory conditions. The monitoring of the development of the population of the pest *Agrotis segetum* in seasonal dynamics was carried out with the help of light traps. The light trap was placed at a height of 2m from the ground, in close proximity to the experimental fields. The record of the captured biological material and the replacement of the collector was carried out 3 times a week during the entire vegetation period of agricultural crops.

Under laboratory conditions, the biological material, captured in the collector of the light traps, was analyzed and then only the pest species *A. segetum* was selected. The sexual correlation of the pest was determined by the numerical systematization of males and females. By the method of anatomical preparation of the females, the copulatory and reproductive properties of the given species were estimated. The anatomical analysis of the females was carried out in seasonal dynamics throughout the vegetation period of the agricultural crops. Or estimated the number of spermatophores in the copulation bursa and the number of eggs in the ovarioles. The obtained results were subjected to mathematical analyses according to Microsoft Excel.

Results. It was demonstrated that the imago of the given pest reacted to the light trap starting from the first decade of may and extended until the second decade of september. It was established, that during the seasonal activity, the species *A. segetum* developed in three generations.

The biological material captured in the light trap collector was thoroughly analysed under laboratory conditions and only Noctuidae species were selected. Thus, it was found that 473 imago belonging to different species of Noctuidae were captured during the entire growing season of agricultural crops. Then, from the total number of Noctuidae species captured, only the *Agrotis segetum* species was selected. The analysis of the biological material showed that a total of 70 imago of the corresponding species were captured, which were later divided according to the sex index. Thus it was demonstrated that 40 imago belonged to the male sex, and 30 imago - to the female sex. The evaluation of the sexual correlation of the imago *A. segetum* during the vegetation period of the agricultural crops showed that the number of males constituted 57%, and the number of females – 43% (ratio 1.3♂ : 0.8♀).

As a result of the anatomical preparation of the captured females, it was found that the given species is polygamous. The analysis of the females showed that there were from 1 to 6 spermatophores in the copulation bursae, that is, they were copulated up to 6 times. Females that had 2 acts of copulation (30%) and 3 acts of copulation (23%) were encountered most often, which constituted 53% of the total number of captured females. At the same time, it is necessary to mention that the number of females that had more than 3 spermatophores was also significant (13%), and only 20% of the total females were copulated only once. At the same time, it was found that about 10% of the captured females were virgins.

The analysis of the obtained data showed that the number of eggs in the ovaries of females did not depend on the number of copulatory acts. Thus, it was recorded that according to the number of eggs in the ovaries of the females, it corresponded to the presence of three generations, which was also confirmed by monitoring the population with the help of pheromone traps. It was demonstrated that the reproductive potential of females was distributed as follows - for the first generation - 25%, for the second - 24%, and for the third generation - 51%.

The estimation of the obtained results showed us that the phytophagous species *Agrotis segetum*, in the current climatic conditions of the Republic of Moldova, has increased its aggressiveness on agricultural crops. Thus, it can have up to three generations and has a major potential of copulatory and reproductive properties. The corresponding properties can allow the given species to develop intensively throughout the vegetation period causing considerable damage to agricultural crops at all phenological phases of development. The research carried out allows us to conclude that the corresponding pest species requires permanent monitoring, and to modify the methodological system for reducing the population density throughout the growing season of agricultural crops.

Conclusions. The *Agrotis segetum* phytophagus has been shown that the present climate of the Republic of Moldova, increased aggressiveness on crops, and the number of eggs in the egg tubes of the females does not depend on the number of copulatory acts (estimated by the number of spermatophores in the copulatory bags of females). Analysis of the females showed that the copulative bags contained between 1 and 6 sperm, which means that they were paired with the males up to six times. Females with 2 pairs (30%) and 3 pairs (23%), representing 53% of the total number of captured females.

Acknowledgment. Research was carried out within the project of the State Program 20.80009.5107.27 “Elaboration of the alternative methods based on environmentally friendly means and procedures for harmful arthropods control in different agricultural crops”, financed by the National Agency for Research and Development.

References:

1. Țugulea, C., Specii din genul Euxoa Hubner, 1821 (*Lepidoptera, Noctuidae*) – noi pentru fauna Republicii Moldova. In Buletinul Academiei de Științe a Moldovei. Științele Vieții. 2019, nr. 1 (337), pp. 121-124. ISBN 1857-064X. 60;
2. Voloşciuc L. Prospecţiunea impactului dintre organismele dăunătoare asupra culturilor agricole la schimbarea climei. Culegere de lucrări. Schimbarea climei cercetări, studii, soluţii. Chişinău 2000. p. 102-107. ISBN 9975-9988-9-5.

CZU:631.34:634.8 https://doi.org/10.53040/abap6.2022.71

LOW-VOLUME SPRAYING OF THE VINEYARDS WITH UNMANNED AERIAL VEHICLE

POPA Al., TODIRAS Vl.*, GORBAN V.
Institute of Genetics, Physiology and Plant Protection,
Chisinau, Republic of Moldova
**https://orcid.org/0000-0002-2245-9715, email: alexei.popa@igfpp.md*

The control of diseases and pests in vineyards and forestry plantations is one of the main measures to ensure a high level of production. The successful application of control measures requires knowledge of both pests, pathogens, substances and the technical means used to carry out the control in practice. Reducing the consumption of insecticides, fungicides and herbicides is a major requirement imposed on modern sprayers and machines from the conception – design – manufacturing phase to the exploitation phase, diminishing the harmful impact of the technical system on the environment and achieving special economic indicators. In many countries, the trend towards using the latest technologies and moving to precision agriculture, sometimes called smart agriculture, is growing. For a long time, planes and helicopters intended for certain mandatory activities in plant-engaged branches (horticulture, forestry, etc.) have been used worldwide. Now, an increasingly important role is played by intelligent aerial drones (UAV, Unmanned Aerial Vehicle), or drones with a high degree of autonomy and accuracy.

Purpose. The aim of the research was to evaluate the effectiveness of low-volume spraying of the vineyards with the help of the Unmanned Aerial Vehicle (UAV), with the support of the Agri Assistant application.

Keywords: *spraying, unmanned aerial vehicle, grapes, plant protection*

Materials and Method. The researches were carried out during 2022, in the central area of the Republic of Moldova, in a typical vineyard, the experimental group of the Institute of Genetics, Physiology and Plant Protection. The shape of the stumps – bilateral horizontal cord on the high stem (1–1.2 m). Support – vertical trellis with 3 tiered wires in one size. Planting scheme 2.75 x 1.5 m. The agro technical phonic corresponds to the requirements of the normal development of the stumps. The white paper was placed at different levels of the crown of the stump, and between the rows of the plantation. The M6E-2 drone (Unmanned Aerial Vehicle) – unmanned aerial vehicle, is a hexacopter with six engines/propellers and six support arms, each arm being connected to an engine. The drone's flight can be controlled remotely with the help of a human pilot on the ground, or it is carried out autonomously with the help of special computers and programs. The spraying system consists of a tank with a volume of 10L, a pump and 4 nozzles with jets of droplets of different sizes. (60-180 μm).

Results: Basically, Agri Assistant allows route planning, programming and visualization of drone parameters. This is programmed on a well-established route, the application edits and changes the flight trajectory in real time, calculates the spray area of the solution. With the support of the Agri Assistant application, the mapping of the vineyard was carried out for the evaluation in terms of splash density, uniformity and coverage degree achieved by spraying a volume of solution.

Most of the sprayings carried out in horticultural plantations fall into the category of treatments with very high volume >600 l / ha and high volume – 150-600 l / ha. However, in certain cases, spraying with small amounts of solution – 5-50 l/ha – can also be applied. When describing various spraying processes, droplets jets are distinguished both by flow rate and by the finesse of the spectrum resulting from dispersion. Between different types of spraying there are differences in the density of splashes, uniformity and degree of coverage achieved by sprinkling an equal volume of solution. The formed droplets do not have uniform dimensions. For the characterization of the droplet spectrum formed by a sprayer or nozzle, reference sizes such as the average volume diameter (MVD) are used, which is the limit against which half of the volume of the sprayed liquid consists of droplets with a diameter smaller or larger than the MVD. The unit of measurement for volume diameters (MVD) is µm (micron = 1/1000mm). Based on the average volume diameter, the spraying, respectively the spectra of the formed droplets, are classified: very coarse spraying – >500 µm, coarse spraying – 300-500 µm, medium spraying – 200-300 µm, fine spraying – 100-200 µm, very fine spraying < 100 µm. It is considered that in order to achieve a good biological effect, an average of 100 drops per^2 cm of sprayed subject should be provided.

The flight height of the drone was 4 meters from the ground, the flight speed – 5 m/s, the width of the spray – 3 meters. The drone's propellers created a vertical flow of air, thanks to which a fine spraying was made (100-200 µm), very small droplets (60 - 180 µm) very quickly were projected onto the foliar surface. At the same time, it was found that by spraying with low volume, the distribution of the solution on the foliar surface and the degree of coverage was achieved unevenly. Thus, the droplets with diameters below 100 µm, had their own very low displacement speed and their trajectories were influenced by the circulation of atmospheric air currents (wind). It is considered that to achieve a good biological effect, an average of 100 drops per^2 cm of sprayed subject should be provided. Given that with the evolution of the vegetation stage, the foliar mass of the crop is also increased, it follows that the quantities of liquid applied will also increase corresponding to the volume and surface of the treated foliar mass.

Conclusions. As a result of the research carried out, we can find that by spraying with low volume, the distribution of the solution on the foliar surface and the degree of coverage was achieved unevenly. Thus, the droplets with diameters below 100 µm, had their own speed of travel very low and their trajectories were influenced by the circulation of atmospheric air currents.

Asknowledment. Research was carried out with the project of the State Program 20.80009.5107.19. “Strengthening capacities for the forecasting and control of harmful organisms and phytosanitary risk analysis in integrated plant protection” financed by the National Agency for Research and Development.

References:

1. Walter Stahli, Sorin Tiberiu-Bungescu Mașini și aparate de stropit în plantațiile vitipomicole și silvice, Editura Mirton, Timișoara 2005, 165 p. ISBN 973-661-554-5
2. https://gov.md/sites/default/files/document/attachments/intr02_159.pdf
3. https://www.ttaviation.org/pro/m6e-1

CZU:632.9+595.7:591.3 https://doi.org/10.53040/abap6.2022.72

DEVELOPMENT FEATURES OF THE BROWN MARMORATED STINK BUG *Halyomorpha halys* (STAL) IN THE REPUBLIC OF MOLDOVA

RUSU Iuliana
Institute of Genetics, Physiology and Plant Protection,
Chisinau, Republic of Moldova
https://orcid.org/0000-0002-6551-0955, e-mail: iuliana.rusu@igfpp.md

The brown marmorated stink bug, *Halyomorpha halys* (Stal), 1855 (Hemiptera: Pentatomidae) (BMSB) – an invasive species with a natural range of China, Japan, the countries of the Korean peninsula. The stink bug is a dangerous quarantine pest included in the Common List of quarantine facilities of the Eurasian Economic Union. In recent years, the pest has spread to North America, Europe and Russia, where serious damage has been recorded to various vegetable crops and fruit trees. In Europe, it was first identified in 2007. On the territory of the Russian Federation, the stink bug was found in early August 2014 in the decorative plantations of the city of Sochi, Krasnodar Territory [2, 3].

In 2019, the invasive species was first detected on the territory of the Republic of Moldova. Thus, the first stink bug specimens, namely larvae of II-III ages, we discovered in August 2019 on plants *Hibiscus syriacus* L. fam. *Malvaceae*. Later, at the end of the 2019 season and during the 2020 growing season (cropping season), as a result of visual observation, the pest was discovered by us on other species of cultural and decorative plants, including the high number of bugs was registered on the white mulberry *Morus alba* L. [1]. Over the past few years, BMSB has been rapidly gaining momentum in the development and distribution of new territories, including the territory of the Republic of Moldova. One of the main reasons why the pest is comfortably multiplying - favorable climatic conditions for this species, as well as abundance of plant food. Studies of biological features of invasive pests always have a strict local binding, so their conduct is necessary and on the territory of the Republic of Moldova.

The aim of this work was to study some biological features of the development of the BMSB marble stink bug in the agroclimatic conditions of the Republic of Moldova.

Key words: *Halyomorpha halys, invasive species, damage, bioecological peculiarities, range expansion*

Materials and Method. Studies of the biological features of the brown marmorated stink bug *H. halys* were carried out both in laboratory and in the field, on the experimental fields of the Institute of Genetics, Physiology and Plant Protection of the Republic of Moldova.

To determine the pest's survival after wintering on November 1, 2021, imago BMSB in the amount of 50 individuals were distributed in two insulated gardens (25 individuals) and placed on an open terrace. Since the imago hibernates, as a rule, massively, in dry rooms, and in natural conditions - inside large stumps or rotten trunks, it was decided to put corrugated cardboard inside the pits to allow insects to shelter in them, as a substrate, berries and rowan leaves. After 140 days (the third decade of March), the count of surviving stink bugs after wintering was carried out with a further calculation in percentage.

Results. When analyzing the data, we noted that the survival rate of the population after wintering exceeds 50%. The survival rate of females is 12,9% higher than that of males, which we believe will lead to a faster rate of population density.

In the course of observations, it was revealed that at a sunny and daytime temperature of 6-8°C, it is possible to observe the exit of imago from places of wintering and their active movement on walls of houses, fences, but when the temperature drops, insects hide again. This can occur periodically, until the time of steady temperature rise in the night hours to 10-15°C, in the daytime at a median temperature of 15°C and leaf dissolution of different species of plants. In native conditions, we marked the period of release of the stink bug from the diapause from the third decade of April - the second decade of May. In the aftermath, there is a period of intensive feeding lasting from 1 to 2 weeks, and only then comes the period of mating.

In the laboratory, biological features of the *H. halys* stink bug were studied. Insects were contained in boxes measuring 500-5000 cm3 (depending on the age of the stink bug), at room temperature. As a result of our experience we have determined the preliminary duration of development of individual stages of the BMSB ontogenic cycle.

In the course of preliminary studies of the biological features of the pest in the laboratory, we found that the duration of the ontogenic cycle is on average about 75 days (from 55 to 103).

We further established that only at an air temperature of 25-30°C, individuals begin to actively mate and lay eggs. In native conditions, we marked the period of release of the stink bug from the diapause from the third decade of April - the second decade of May. In the aftermath, there is a period of intensive feeding lasting from 1 to 2 weeks, and only then comes the period of mating. Visual observations have shown that BMSB females produce eggs 3-4 times within 6-13 days. The number of eggs in one egg range from 10 to 32. The fertility of one female averages 96 eggs (68-124).

Thus, based on the preliminary data we proved that in the agroclimatic conditions of the Republic of Moldova, this species can develop favorably and can cause economically important crop losses of various crops.

Conclusions: We found that the pest has a survival rate of more than 50%, but that females have a survival rate of 12.9% higher than males, leading to a faster rate of population density development. *H. halys* have been reported to hatch 3-4 times at intervals of 6-13 days. The fertility of one female ranges from 68 to 124 eggs, and the number of eggs in one egg range from 10 to 32 (more than 28 eggs). We proved that in the agroclimatic conditions of the Republic of Moldova, this species can develop favorably and can cause economically important crop losses of various crops.

Acknowledgment. Research was carried out within the project of the State Program 20.80009.5107.27 "Elaboration of the alternative methods based on environmentally friendly means and procedures for harmful arthropods control in different agricultural crops", financed by the National Agency for Research and Development.

References:

1. Rusu Iuliana, Elisovetcaia Dina, Nastas T. Bioecological features of *Halyomorpha halys* Stal (Heteroptera: Pentatomidae) in the Republic of Moldova, "Scientific Studies and Researches". 2021, Universitatea V. Alecsandri, Bacău, 2021. Volume 30, No. 2. SCSB202102V30S01A0003 [0005333] https://pubs.ub.ro/?pg=revues&rev=scsb&num=202102&vol=30&aid=5333
2. Wermelinger B., Wyniger D., Forster B. First records of an invasive bug in Europe: *Halyomorpha halys* Stal (Heteroptera: Pentatomidae), a new pest on woody ornamentals and fruit trees, Mitteilungen der Schweizerischen Entomologischen Gesellschaft. 2008, 81: 1-8. DOI: org/10.5169/seals-402954
3. Митюшев И.М. Первый случай обнаружения клопа *Halyomorpha halys* Stal на территории Российской Федерации. Мониторинг и биологические методы контроля вредителей и патогенов древесных растений: от теории к практике, Матер. Всеросс. конф. с междунар. участием. 2016, с. 147-148. ISBN 978-5-904314-90-3

CZU:632.937.15:634.10 https://doi.org/10.53040/abap6.2022.73

BACTERIOPHAGES *Pseudomonas syringae* pv. *syringae* IN THE BACTERIAL CANKER CONTROL

SAMOILOVA Anna
Institute of Genetics, Physiology and Plant Protection,
Chisinau, Republic of Moldova
https://orcid.org/0000-0003-4976-0644, e-mail: *anna.v.samoilova@gmail.com*

Bacterium *Pseudomonas syringae* van Hall and its pathovars was placed on the top of the ten most important plant pathogens list due to the huge importance for the science and economics [Mansfield et al, 2012]. At present it is known about 60 pathovars of the bacterium *Pseudomonas syringae* van Hall. The causative agent of bacterial canker disease, bacterium *Ps. syringae* pv. *syringae,* is one of the most economically significant *Ps. syringae* pathovars which affects about 180 plant species. The bacterial pathogen can substantially reduce the yield of economically important cultures such as pear, apple and quince. Relatively low temperatures and high humidity are favorable for bacteria *Ps. syringae* pv. *syringae* growth [Pinheiro et al., 2019]. That is why, the phytopathogen may cause the most serious damage in spring during budding stage of plant vegetation.

For to combat bacterial canker agrotechnical, chemical and biological control measures are used. Fungi of the genus *Trichoderma* as well as bacteria *Bacillus subtilis* are used as biological control agents for the bacterial canker disease. The preparation "Pentafag", elaborated in the Republic of Belarus on the basis of five bacterial viruses strains, bacteriophages, has shown high efficacy in the disease suppressing.

Bacteriophages are widely spread and can be detected in the targeted bacteria natural environment. Furthermore, bacteriophages can regulate themselves in the sites of infection, depending of the bacterial population density. Being highly specialized bacterial parasites bacteriophages, can be applied against antibiotic resistant pathogenic bacteria or when chemical control measures are forbidden, for example, during plants bloom stage. For the moment it is known that bacteriophages from the families, *Podoviridae*, *Myoviridae* и *Siphoviridae* infect *Ps. syringae* pv. *syringae* bacteria [Pinheiro et al. 2019, Rabiey et al. 2020].

The aim of the study was to investigate the ability of *Ps. syringae* pv. *syringae* bacteriophage isolate, which we detected in the quince tissues affected with bacterial canker, to inhibit bacteria *Ps. syringae* pv. *syringae* growth in the cut quince shoots.

Keywords: *bacterial canker, Pseudomonas syringae, bacteriophages, biological control*

Materials and Method. Bacteria *Ps. syringae* pv. *syringae* were grown on the King B medium (20 g/L *peptone*, 1.5 g/L K_2HPO_4, 1,5 g/L $MgSO_4$, 10 ml glycerol, 15 g/L agar, 1L distilled water). Bacteriophages were isolated and cultivated by a standard double agar overlay method on the LB agar (1*0* g/L *peptone, 5* g/L *yeast extract, 10* g/L

NaCl, 20 g/L agar) and soft LB agar (0.7% agar). Liquid cultures were grown in LB broth *(10* g/L *peptone, 5* g/L *yeast extract, 10* g/L *NaCl)* at 26˚C.

Results. Quince shoots collected at the IGFPP experimental plot were infected with bacteria *Ps. syringae* pv. *syringae,* isolate PsM1, contained 10^3 CFU/ml and treated with 10^6 PFU/ml of phage isolate ɸPsCy4-a. Shoots, treated with sterile distilled water were used as a control. Experimental quince shoots were incubated at 24°C at moderate humidity. Symptoms of the disease were recorded at 3, 5, 6, 8, 10 and 12 days after inoculation. The assessment of the degree of *Ps. syringae* pv. *syringae* infection on the quince shoots was carried out according to the following scale: 0 – absence of the lesions; 1– 5% lesions; 2– 6-10% lesions; 3 – 11-15% lesions; 4 –16-20% lesions.

Quince shoots treated with sterile distilled water displayed no disease symptoms during the experiment. In contrast, quince shoots infected with bacteria *Ps. syringae* pv. *syringae* demonstrated light necrosis on the third day after infection and the degree of infection was not higher than 2 score at the time of the experiment. Symptoms of bacterial canker disease in the variant of the quince shoots infected with phytopathogenic bacteria *Ps. syringae* pv. *syringae* and treated with bacteriophages were recorded at the tenth day after inoculation, showing 1 score of the infection degree. Thus, it has been found out that the tested bacteriophage isolate was able to inhibit growth of the pathogen in the quince shoots tissues during at least nine days and the degree of infection was lower than in the shoots, infected with the pathogenic bacteria isolate only.

Conclusions.

It has been shown that *Ps. syringae* pv. *syringae* bacteriophage isolate ɸPsCy4-a, detected in the quince tissues was able to suppress growth of the bacterial canker pathogen in the quince shoots in the conditions favorable for the phytopathogenic bacteria development. Therefore, the studied bacteriophage isolate can be considered as potential biocontrol agent for the bacterial canker control in the fruit orchards.

Acknowledgment. Research was carried out within the project of the State Program 20.80009.7007.16 "Synergy between natural factors and environmentally friendly microbiological means of pest population density regulation for crop protection in conventional and organic agriculture", financed by the National Agency for Research and Development.

References:

1. Mansfield J., Genin S., Magori S., Citovsky V., Sriariyanum M., Ronald P., Dow M., Verdier V., Beer S.V., Machado M.A., Toth I., Salmond G. and Foster

G.D. Top 10 plant pathogenic bacteria in molecular plant pathology. Molecular Plant Pathology. 2012, 13: 614-629. https://doi.org/10.1111/j.1364-3703.2012.00804.x

2. Pinheiro LAM, Pereira C, Frazão C, Balcão VM, Almeida A. Efficiency of Phage φ6 for Biocontrol of *Pseudomonas syringae* pv. *syringae*: An in Vitro Preliminary Study. Microorganisms. 2019, 7, 286. https://doi.org/10.3390/microorganisms7090286
3. Rabiey M, Roy SR, Holtappels D, Franceschetti L, Quilty B J, Creeth R, Sundin GW, Wagemans J, Lavigne R, & Jackson RW. Phage biocontrol to combat *Pseudomonas syringae* pathogens causing disease in cherry. Microbial biotechnology. 2020, 13(5), 1428–1445. https://doi.org/10.1111/1751-7915.13585

CZU:633.11:631.52:57.085.2 https://doi.org/10.53040/abap6.2022.74

THE BEHAVIOR OF SOME AUTUMN TRITICAL GENOTYPES TO BIOTIC STRESS *IN VITRO*

SASCO Elena, LEATAMBORG Svetlana
Institute of Genetics, Physiology and Plant Protection,
Chisinau, Republic of Moldova
e-mail: elenasasco5@gmail.com

The given research presents the response of some callus characters of mature embryos of the Costel, Ingen 54, L 161 and Haiduc triticale genotypes to the culture filtrates of *Alternaria alternata*, *Drechslera sorokiniana* and *Fusarium solani*, administered in the Murashige and Skoog nutrient medium. The reaction was differentiated by both triticale genotype and fungal strains. In relation to the witness variant, the variability of the investigated indices showed resistance (R), medium resistance (MR) and only medium sensitivity (MS) for the callus surface in the Costel genotype. Through the cluster analysis (*k-means*) of the integral response to fungal metabolites, the high degree of similarity of the genotypes Ingen 54 and L 161 was established, located at Euclidean distances of 19.9 and 29.9 from other 2 genotypes. The genotypes Ingen 54 and L 161 showed values of the callus biomass index at the level of the witness variant, but also high yields in the vegetation conditions of 2022.

Purpose. In conjunction with the genetic progress achieved in the last decades, the triticale species (x Triticosecale Wittm.) has become an advantageous crop. The high production of plant biomass, but also of grains in a high diversity of pedoclimatic conditions is derived from the high rate of carbon assimilation due to the physiology of the stomata, but also from the low rate of respiration. As a potential genetic source for breeding winter cereals, triticale presents a high genetic diversity of resistance to abiotic stress, a diversity that has not yet been fully explored [2]. Limin A. and Fowler D. (1984) concluded that low temperature resistance of triticale is effectively inherited from rye and modulated by cytoplasmic factors.

The expansion of the worldwide growing area has exposed triticale to a high variety of interrelationships of biotic and abiotic stress environments. Resistance to fungal diseases is being considered the most important and sustainable advantage of the culture. The resistance of triticale to fungal pathogens is attributed to the phenomenon of genetic protection from rye and wheat. However, it is evident that triticales have incorporated more susceptibility to wheat pathogens. Thus, filamentous fungi of the species *Alternaria*, *Drechslera*, and *Fusarium* show increased noxiousness in the agrocenosis of triticale, especially under conditions of climate change [1, 4]. Research on the response of immature embryos in vitro revealed the important role of the genotypic potential in the callus ability on media with *Fusarium* metabolites, though a better differentiation of the resistance of triticale genotypes to the action of fusaric acid [3].

Predictions associated with global climate change imply a large-scale redistribution of pathogens associated with the fungal agent complex in cereal agroecosystems worldwide. The inception of the sources of sustainable resistance is the most advantageous and ecological way to protect both triticale and common wheat from fungal diseases. The objective of this study is to estimate genetic variability for callus characters of mature embryos in response to fungal metabolites and identify sources of resistance to autumn triticale.

Key words: *triticale, Alternaria alternata, Drechslera sorokiniana, Fusarium solani, culture filtrate, callus frequency, callus surface area, callus biomass*

Materials and Method. The native triticale genotypes Costel (C), Ingen 54 (I54) and L 161/88-233 x 188 TR 5021 (L161) were investigated, as well as the Haiduc variety (H), produced in Romania. It has been investigated the response of callusogenesis traits of mature embryos in reaction to the culture filtrate (FC) of 3 strains of *Alternaria alternata*, *Drechslera sorokiniana* and *Fusarium solani*, administered at a concentration of 20% by volume in the Murashige-Scoog (MS) medium. The MS nutrient medium contained a complete set of macro and microelements, vitamins, 2,4-dichlorophenoxyacetic acid (2,4-D) 2 mg/l, meso-inositol 100 mg/l, sucrose 30 g/l and agar-agar 7 g/l, the pH being adjusted to 5.8. The mature seeds were surface sterilized with ethanol, then with calcium chloride solution, rinsed and pre-germinated at 28-30°C. The excised apical meristem was placed in Petri dishes. Callus parameters were recorded at 14 days of culture. The established characters *callus frequency* (%), *callus surface area* (mm^2) and *callus biomass* (mg) were analyzed in the STATISTICA 7 software package.

Results. In the witness variant, *callus frequency*, *callus surface* and *callus biomass* showed variability within the limits: 83.3%...92.3%; 18.9 mg….36.5 mg and 39.1 mm^2…56.1 mm^2.

Under the action of fungal metabolites, the average *callus frequency* index (% compared to the witness) indicated the response of resistance (R, > 80% of the witness) and medium resistance (RM, 70%-80% of the witness) in most interactions, but also medium sensitivity (MS, 60%-70% of the witness) in the interrelationships *I54 x D. sorokiniana* and *H x F. solani*.

The highest *callus surface* character value was recorded in the Haiduc genotype, while the Costel variant showed significant average sensitivity in the reaction to all mycotic metabolites, the character value being 67.7% of the witness. The variability of *callus surface* character in triticale I54 and L161 recorded resistance (R) and medium resistance (MR).

Genotypes I54 and L161 recorded *callus biomass* values higher than or equal to the witness. Costel and Haiduc variants showed a differential response to fungal metabolites. Thus, in the action of FC *A. alternata* and FC *D. sorokiniana*, the variability of the character corresponded to the Resistance (R) gradation, while FC *F. solani* reduced the *callus biomass* at the level of the MR gradation.

Through the cluster analysis (*k-means*) of the integral response to fungal metabolites, it was established the high degree of similarity of the genotypes Ingen 54 and L

161, located at Euclidean distances of 19.9 and 29.9 from other 2 genotypes. The genotypes Ingen 54 and L 161 showed values of the *callus biomass* index at the witness variant level, but also high yields in the vegetation conditions of 2022 (5.7 t/ha and 6.2 t/ha). The Haiduc genotype showed high *callus surface* values - 111.2% of the witness variant, while in field conditions the variety was probably more affected by the vegetation conditions, which led to a much lower harvest (4.5 t/ha). *A alternata* strains produced the lowest variability for *callus frequency*, the coefficient of variation being 19.6%. In the response of triticale genotypes to FC D. sorokiniana, the indices *callus frequency* and *callus biomass* showed high stability, therefore a low phenotype diversification.

Conclusions: The screening of autumn triticale resistance in response to fungal metabolites in vitro, as well as their productivity yield under field conditions, highlighted the investigated genotypes I54 and L161 as future sources in the reproduction of resistance to the pathogens *Alternaria alternata*, *Drechslera sorokiniana* and *Fusarium solani*.

Acknowledgment. Research was carried out within the project of the State Program 20.80009.7007.04 "Biotechnologies and genetical processes for evaluation, conservation and exploitation of agrobiodiversity", financed by the National Agency for Research and Development.

References:

1. Arseniuk E., Góral T. Triticale biotic stresses – known and novel foes. Triticale 2015 Book, Agric-Food Canada. Part II, 2015, p: 83-110.
2. Blum A. The abiotic stress response and adaptation of triticale--A review. In: Cereal Research Communications. 2014, vol. 42, no. 1636010-8001, pp. 359+ DOI:10.1556/CRC.42.2014.3.1 Accessed 12 Aug, 2022.
3. Lupașcu G., Fandeev E. Genetica rezistenței culturii triticale la fuzarioză. Cercetări in vitro. Tipogr. AȘ a RM. Chișinău, 2004, 136 p.
4. Лупашку Г.А. Фузариоз тритикале. Кишинэу: Stiința, 1999, 232 с.

CZU:633.11:632.112:631.527.3 https://doi.org/10.53040/abap6.2022.75

SCREENING OF WHEAT GENOTYPES RESPONSE UNDER DROUGHT CONTROLLED CONDITIONS

SASCO Elena
Institute of Genetics, Physiology and Plant Protection,
Chisinau, Republic of Moldova
e-mail: elenasasco5@gmail.com

The present study was carried out to estimate the response of native wheat genotypes (*Triticum aestivum* L.) Moldova 614, Moldova 66 and the Selania/Accent line to water stress in the early stages of growth and to use sources with a high level of adaptability in resistance improvement programs to drought. The effect of osmotic stress on early growth stages was evaluated under temperature conditions of 15°C and 25°C, using polyethylene glycol (PEG 6000) treatment at concentrations of 10% and 20% d/v. In the conditions of water restrictions produced by PEG 6000 in the 10% concentration both at the optimal temperature of 25oC, but also at the suboptimal one of 15°C, the investigated indices showed the response of tolerance, but also of high resistance. When administering the osmotic in the concentration of 20% at a temperature of 25°C, both the average resistance and the sensitivity of the investigated characters were attested. Moldova 614 recorded the lowest reduction of 23.7% for plant vigor index, while L Selania/Accent recorded a massive reduction of 72.8% for seed vigor index. In the conditions of interaction of major stress factors (*PEG 20% x 15°C*) the genotypes responded with a severe decrease of the investigated parameters. More advantageous PVI was attested only in the Moldova 614 genotype. The variance analysis revealed the temperature factor with the highest weight in the variability of the root and stem length characters (85.7% and 72.2%). The water deficit explained respectively 12.0% and 22.5% of the variance of the characters, while the significant interactions of the stress factors attested advanced weight for the length of the stem in relation to the length of the root. This phenomenon indicates the increased vulnerability of the stem, a phenomenon also highlighted by the phenotypic character of the root/stem ratio.

Purpose. Wheat contributes to global consumption with 55% of carbohydrates, but also 20% of food calories, maintaining an important position in the international grain trade [3]. Abiotic stress extremes such as drought, temperature, salinity, and nutrient imbalance represent major challenges to the grain industry. Drought affects plant growth from germination to maturity, causing morphological, biological, physiological, and molecular changes. More likely to be affected are the stages of early vegetation and reproduction [3]. Tolerance to water deficit as well as thermal stress is a difficult, polygenic quantitative characteristic [2, 3]. In efficient and repeatable phenotypic expression of drought tolerance, it is necessary to use simple early screening methods [2, 4]. One of the sources of improving wheat drought tolerance is presented by the introgression of resistances from the wild gene pool as well as local ones [3]. Anticipating testing in field conditions, targeted are the tolerance indices in the early growth phase under artificially stressful conditions [2, 4]. The present study aimed to select local wheat genotypes,

well adapted to the induction of water stress by the osmotic PEG 6000 under different temperature conditions.

Keywords: *Triticum aestivum L., PEG, germination indices, root length, stem length, dry mass of seedlings, root / stem ratio, seed vigor index, plant vigor index*

Materials and Method. The local winter wheat genotypes Moldova 614 (M 614), Moldova 66 (M 66) and the Selania/Accent line (L S/A), harvest 2020, were investigated under conditions of water and temperature stress. Water restrictions were induced by polyethylene glycol (PEG 6000) in the concentrations of 10% and 20% v/v. The seeds sterilized in ethyl alcohol (96%), then in calcium hypochloride (10%), were pre-germinated for 2 hours and kept for 7 days in Petri dishes at temperatures of 15°C and 25°C. As needed, the seeds were moistened with distilled water or PEG 6000 solution in the concentration of 10% and 20% v/v. Germination parameters (*G*), root and stem length (*RL* and S*L*) and whole plant dry weight (*DWM*) were investigated. Seed vigor index (*SVI*) and plant vigor index (*PVI*) were determined by the product of the germination potential, respectively, with the length [1] or the dry weight of the plant [2]. The results were processed according to the ANOVA test, STATISTICA 7 software package.

Results. In the optimal temperature conditions of 25°C, the water restrictions produced by PEG 6000 in the 10% concentration stimulated the root length and stem length parameters, as well as the dry mass for the researched genotypes. While, at the suboptimal temperature of 15°C, the targeted parameters attested tolerance, but also high resistance. The severe osmotic potential produced by PEG 20% under optimal temperature conditions led to a more efficient response only for root length, respectively in M 614 (82.9%), M 66 (61.4%) and L S/A (50.4%). While the decrease to 45.9%, 25.9% and 24.7% of the respective control had the severe susceptibility of the strain. On a background temperature of 15°C, the water restrictions produced by PEG in the 20% concentration significantly reduced both the root length and the stem length, the reduction being recorded respectively within the limits of 44.6%...53.2% and 17.8%...27.4%. Susceptibility of wheat genotypes to the association of these factors was certified as medium and severe, with stem growth being more disadvantaged. Factorial analysis of variance revealed the *Temperature factor* with the highest weight in the variance of root length and stem length characteristics (74.1% and 61.7%). The *Water defici*t explained respectively 12.0% and 22.5% of the character variance. *Interactions* of the stress factors showed an advanced weight for the length of the stem (5.5%) in relation to that of the root (2.8%). The response of characters in the early stage of plant growth indicates the increased vulnerability of the strain in *wheat x stressor factor* interactions, a phenomenon also highlighted by the phenotypic trait S*L/RL* ratio. In the form of combining the major stress treatments (*PEG 20% x 15°C*), the *G* and *DWM*, as well as the *S/R* ratio, were also decreased. The phenotypic characteristic S*L/RL* is frequently used in attesting the weight of extreme water effects, the reduction being caused by the physiological activities of the root system, which are less sensitive to low water content, while the transfer to the upper part of the plant requires a more massive water potential. In the conditions of administering the osmotic in a concentration of 20% at a temperature of 25^{o}C, the *SVI* and *PVI* integral indices showed low values for L S/A (27.2% and 60.5% of the control), while, at 15^{o}C – decreased values were recorded and for M 66 – 24.4% and 34.6%. In the genotype M 614, the lowest reduction of the *integral indices* was attested under the conditions of interaction of abiotic stress factors.

Conclusions:

The simultaneous action of the severe stressors PEG 20% and the temperature of 15^{o}C registered a massive decrease of all the characters investigated in common wheat.

Factorial analysis of variance revealed the *Temperature factor* with the highest weight in the variability of *Root* and *Stem length* characteristics.

Genotype Moldova 614 recorded the lowest reduction of *Integral indices* under the interaction of abiotic stress factors and can be used in breeding programs as a source well adapted to drought.

Acknowledgment. Research was carried out within the project of the State Program 20.80009.7007.04 “Biotechnologies and genetical processes for evaluation, conservation and exploitation of agrobiodiversity”, financed by the National Agency for Research and Development.

References:

1. Buriro M., Oad F. et al. Wheat seed germination under the influence of temperature regimes. In: Sarhad J. Agric. 2011, vol. 27, no. 4, p. 539-543.
2. Öztürk A., Taşkesenligil B. et al. Evaluation of bread wheat genotypes for early drought resistance via germination under osmotic stress, cell membrane damage, and paraquat tolerance. In: Turkish Journal of Agriculture and Forestry. 2016, vol. 40, p. 146–159. doi: 10.3906/tar-1501-136
3. Raveena R.B., Neelam Ch. Drought Resistance in Wheat (Triticum aestivum L.): A Review. In: International Journal of Current Microbiology and Applied Sciences. 2019, vol. 8, no. 09, p. 1780-1792. DOI:10.20546/ijcmas.2019.809.206
4. Saha R., Hannan A. et al. Selection of drought tolerant wheat genotypes by osmotic stress imposed at germination and early seedling stage. In: SAARC J. Agri. 2017, vol. 15, no. 2, p. 177-192. DOI:10.3329/sja.v15i2.35147

CZU:632.937.14 https://doi.org/10.53040/abap6.2022.76

TRICHODERMA FUNGI FOR PLANT PROTECTION FROM *Albifimbria verrucaria* (MYROTHECIUM)

SCERBACOVA Tatiana
Institute of Genetics, Physiology and Plant Protection,
Chisinau, Republic of Moldova
https://orcid.org/ 0000-0002-2632-325X, e-mail: tscerb@gmail.com

Fungi *Albifimbria verrucaria* (Alb. et Schwein.) L.Lombard et Crous (2016) is known as *Myrothecium verrucaria* (Alb. et Schwein.) Ditmar (1813). Recently, *Myrothecium* was assigned to *Stachybotriaceae family,* Ascomycotha phylum, and called *Albifimbria* [1].

Fungi of *Albifimbria* (*Myrothecium)* Tode ex Fries genus are widely distributed in nature as phytopathogens and can damage all parts of plants. On the leaves, pathogenicity manifests itself in the form of spots. Water ulcers may form on the stems. On solid fruits (aubergine, cucumber), spots and constrictions are formed, and the fruits acquire an ugly shape. On juicy fruits (tomato), ulcers form the fruit cracks and it rots. Rots may develop on the roots. Seed infection causes pre-germinative and post-germinative death of seedlings, stem rot, death of the growth point, and root ulcers [2].

Albifimbria phytopathogens are producers of harmful macrocyclic trichothecene mycotoxins of the verrucarin series. Under favorable weather conditions (high humidity and temperature), they contaminate stubble crops and grassy pastures. After grazing animals on infected substrates, the development of myrotheciotoxicosis may occur. Horses, cattle, and sheep get sick. [3].

To protect plants from *Alb.verrucaria* fungus damage, it is advisable to search for fungi-antagonists that are producers of microbiological preparations. The present research aims to select strains of *Trichoderma* fungi that are promising for protecting plants from the toxin-producing pathogen *Albifimbria verrucaria*.

Keywords: *antagonistic activity; dual culture; inhibition index; Albifimbria verrucaria; Trichoderma*

Materials and Method. The objects of research were 20 *Trichoderma* fungi from the working collection of the laboratory. Some of them were extracted from natural substrates in 2020-2021, others were extracted earlier. Also, strains of *Trichoderma virens* CNMN-FD-13, *T.lignorum* CNMN-FD-14, and *T.harzianum* CNMN-FD-16 were used that are producers of Gliocladin-SC, Trichodermin-SC, Trichodermin-BL, and Trichodermin Th-7F-BL biological preparations. *Alb.verrucaria* pathogen was extracted from cucumber plants. The antagonistic activity of *Trichoderma* against the pathogen was studied by the method of counter cultures on an agar nutrient medium.

The seeding was performed in blocks three times. The radius of the colonies (mm) was measured daily. On the 5th and 10th days, the index of fungi inhibition by each other was calculated in %, and the degree of *Trichoderma* growth on the colony of *Alb.verrucaria* was estimated in points. Microscopy of fungi in the areas of colonies connection and areas of growth was conducted.

Results. On the fifth day of the experiment, in five variants of dual cultures, *Trichoderma* colonies completely populated the agar plate. The pathogen inhibition index of two isolates 3K and 7T was 63%. The rest of the fungi exhibited less antagonistic activity with inhibition rates of 19% - 50%.

On the tenth day of the experiment, five promising fungi Trichoderma 3K, 7T, 12T, 14N, and 2F were identified with pathogen inhibition rates of 63% -71%.

Also, by the tenth day, inhibition of *Trichoderma* fungi by the pathogen was noted in seven variants. Sterile zones with a radius of 2-10 mm were formed between the antagonist-pathogen agents. In these variants, the inhibition of *Trichoderma* fungi by the pathogen was 14-38%, and the inhibition of the pathogen by *Trichoderma* fungi was 17-67%.

By the 15th day of the experiment, the pathogen growth on the *Trichoderma* colony was noted in 11 variants. Isolates 3K, 12T, and 2F that were promising in the first 10 days, did not have a deterrent effect on *Alb.verrucaria* in the subsequent period and thus cannot be used to protect plants from this pathogen.

By the 20th day of the experiment, only the *T.harzianum* CNMN-FD-16 strain and 5 isolates (1K, 4T, 7T, 13N, and 14N) inhibited the growth of the pathogen; *Alb.verrucaria* growth was not observed on them. Microscopic examination of these cultures in the zones of colony junction in isolates 1K, 4T, and 13N showed granular vacuolated mycelium, and the pathogen conidia were absent.

According to the conducted research, it can be concluded that *Trichoderma* fungi can inhibit the development of the toxin-forming pathogen *Alb.verrucaria*, vacuolize the mycelium and prevent the formation of conidia - spores of fungi asexual reproduction.

Out of the 20 *Trichoderma* fungi in the working collection, isolates 1K, 4T, and 13N will be used in further studies to determine the effectiveness of *Trichoderma* fungi in protecting plants from the phytopathogen *Alb.verrucaria*.

Acknowledgments. This research was carried out within the State Program project nr. 20.80009.7007.16. “Synergism between natural factors and ecologically harmless microbiological means of regulating the population density of harmful organisms for the protection of agricultural crops in conventional and ecological agriculture”, financed by the National Agency for Research and Development.

References:

1. Lombard L., Houbraken J., Decock C. et al. Generic hyper-diversity in *Stachybotriaceae.* J. Persoonia. 2016, vol. 36. P. 156-246. doi: 10.3767/003158516X691582.
2. Nicolaev A., Nicolaeva C. Simptomi porajenia rastenii gribami roda *Myrothecium* Tode ex Fries. J. Studia Universitatis. 2010, no. 1(31), p. 81-87. ISSN 1857-1735.
3. Zaichenko O.M., Andrienko O.V., Tsiganenko K.S. Macrocyclic trichothecene mycotoxins: toxicity for warm-blooded animals. J. Sovremennie problemi toxikologii. 2008, no. 4(44), c. 32-37**.** ISSN 1609-0446.

CZU:631.811.98:635.21 https://doi.org/10.53040/abap6.2022.77

BIOLOGICAL COMPLEXES AND BIOSTIMULATING IMPACT ON POTATO GROWTH AND DEVELOPMENT

SOLOMIYCHUK M.[1]*, PIKOVSKY M.[2]**
[1]*Ukrainian scientific-research plant quarantine station Institute of plant protection NAAS,*
[2]*National University of Life and Environmental Sciences of Ukraine*
**https://orcid.org/0000-0001-7394-0333, **https://orcid.org/0000-0003-0689-604X,*
e-mail: ukrndskr.zam@gmail.com

The biological means for potato protection against fungi diseases efficiency researched in terms of Western Foreststeppe of Ukraine in 2018-2019. The usage of complex showed the best result. It was consisted of: **seeds treating** Fitodoctor -0,3 l/t+Biophosphoryn -0,3 l/t+ BioMag-0,3 l/t +Aminostim -0,5l/t; **three times treating during growing**: 1. Fitodoctor-1,5l/ha+Urozhay TK+1,0 l/ha +Aminostim-0,5 l/ha+Adumax+0,05 l/ha; 3. Fitodoctor List-1,0 l/ha+Urozhay TK-1,5l/ha+Aminstim-1.0l/ha+AduMax-0,05 l/ha. It allows to increase yield in 1,8 times in comparison with control. This complex efficiency consisted of 87,2% against *Phytophtora*.

Keywords: *potato, biostimulators, biological fungicides, technical efficiency, yield*

Purpose. Late blight is the most spread and harmful disease in Western Forest-steppe of Ukraine. The heterothallic oomycet *infestans (Mont) de Bary* is a causative agent of this disease [1, 2].

The usage of preparation biological origin and stimulating matters favours yield increase and high potato marketability. The biological plant protection main purpose is to receive high quality production at the terms of biocenosis biological diversity save. [1, 2, 5].

Materials and Method. The researches conducted according to the general approved techniques of testing and pesticides usage. [3, 4].

Results. The study of different biological complexes combinations impact was conducted at the terms of different systematic.

The features of late blight determined on potato leaves and tubers. The first disease features appeared on the leaves of higher stage. They recorded in different periods since second ten-days of June. The quantity of defeated plants consisted of in average 27,5 % and 68,9 % on control.

The second treating extraction during growing have negative impact on all potato growing indices (table 1). The absence of third treating after growing had not such radical impact on plant's indexes. It was caused that the first two treating allowed plant protection during wide spread of potato late blight causative agent. The best result showed the experiments' variant with seeds treating Fitodoctor -0,3 l/t +Biophosphoryn-0,3l/t+BioMag-0,3l/

t+Aminostim-0,5 l/ha+Adumax-0.005l/ha. 2. Fitodoctor – 1,5 l/ha + Trychodermin (Viridin) – 2,0 l/ha + Urozhay TK – 1,5 l/ha + Urozhay Bor 0,5 l/ha + potassium humate – 1,0 l/ha + Adumax – 0,05 l/ha, 3. Fitodoctor – 1,0 l/ha + Urozhay TK – 1,5 л/га + Aminosym – 1,0 l/ha + Adumax – 0,05 l/ha. It allows to increase yield in 1,8 times to control.

The combination of biological fungicides in complexes for potato treating impact on fungi disease appearing showed in the variant with **seeds treating** Fitodoctor -0,3l/t Biophosphorin– 0,3 лl/t + BioMag – 0,3 l/t +Aminostim – 0,5 l/t and **three times treating after growing**: 1. Fitodoctor– 1,5 l/ha + Urozhay TK– 1,0 l/ha + Aminostim – 0,5 l/ha + Adumax – 0,05 l/ha, 2. Fitodoctor – 1,5 l/ha + Trychodermin (Viridin) – 2,0 l/ha + Urozhay TK – 1,5 l/ha + Urozhay Bor 0,5 l/ha + Potassium humate – 1,0 l/ha + Adumax – 0,05 l/ha, 3. Fitodoctor – 1,0 l/ha + Urozhay TK – 1,5 l/ha + Aminostim – 1,0 l/ha + Adumax – 0,05 l/ha. (table 2). The lowest efficiency against late blight showed the combination in absent variant of second stage treating. It coincided in time of mass development of causative agent.

Table 1. Impact of different biological complexes on growing indexes for potato Podolyanka

Experiments' variants	Plant's height, cm	Stem's average number, pcs.	Tubers quanitity (pcs).			Tuber's weight, g/plant	Yield, t/ha
			Commodity fraction	Seeds fraction	Non-conditional		
Control (without treating)	31,1	2,8	1,3	3,6	7,3	184	6,8
Seeds treating : Fitodoctor - 0,3l/t+Biophosphoryn – 0,3 l/t +BioMag – 0,3 l/t + Aminostim – 0,5 l/t ***Treating after growing*** 1. Fitodoctor -1,5 l/ha + Urozhay TK– 1,0 l/ha + Aminostim -0,5 l/ha + Adumax – 0,05 l/ha 2. Fitodoctor– 1,5 l/ha + Trychodermin (Viridin) – 2,0 l/ha + Urozhay TK – 1,5 l/ha + Urozhay Bor 0,5 l/ha + potassium humate – 1,0 l/ha + Adumax – 0,05 l/ha 3. Fitodoctor List – 1,0 l/ha + Urozhay TK – 1,5 l/ha + Aminostim – 1,0 l/ha + Adumax – 0,05 l/ha	34,7	3,8	6	6,2	9,6	262	12,4

Seeds treating Fitodoctor - 0,3l/t +Biophosphorin– 0,3 l/t + BioMag – 0,3 l/t + Aminostim – 0,5 l/t ***Treating after growing*** 1. Fitodoctor-1,5l/ha+Urozhay TK-1,0 l/ha + Aminostim -0,05l/ha 2. - // - 3. Fitodoctor -1,0 l/ha+Urozhay TK-1,5 l/ha+Aminostim-1,0l/ha+Adumax-0,05l/ha	32,5	3,6	4	3,5	5,9	241	10,9
Seeds treating Fitodoctor - 0,3l/t + Bophosphoryn – 0,3 l/t + BioMag – 0,3 l/t + Aminostim – 0,5 l/t. ***Treating after growing*** 1. Fitodoctor -1,5 l/ha + Urozhay TK– 1,0l/ha + Aminostim -0,5 l/ha + Adumax – 0,05 l/ha 2. Fitodoctor– 1,5 l/ha + Trychodermin (Viridin) – 2,0 л/га + Urozhay TK– 1,5 l/ha + Urozhay Bor 0,5 l/ha + Potassium humate – 1,0 l/ha + Adumax – 0,05 l/ha 3. - // -	34,1	3,5	5	4,9	8,4	255	11,4

Table 2. Biological fungicides combinations impact in complexes for potato treating on fungi diseases intensity appearing

Experiments' variant	**Podolyanka**		
	Potato's late blight		
	Plants' defeating, %	Disease development %	Efficiency %
Control (without treating)	68,9	27,5	-
Seeds treating : Fitodoctor - 0,3l/t +Biophosphoryn – 0,3 l/t +Biostim – 0,3 l/t + Aminostim – 0,5 l/t ***Treating after growing*** 1. Fitodoctor -1,5 l/ha + Urozhay TK– 1,0 l/ha + Aminostim -0,5 l/ha + Adumax – 0,05 l/ha 2. Fitodoctor– 1,5 l/ha + Trychodermin (Viridin) – 2,0 l/ha + Urozhay TK – 1,5 l/ha + Urozhay Bor 0,5 l/ha + Potassium humate – 1,0 l/ha + Adumax – 0,05 l/ha 3. Fitodoctor– 1,0 l/ha + Urozhay TK – 1,5 l/ha + Aminostim – 1,0 l/ha + Adumax – 0,05 l/ha	8,8	3,7	87,2

Seeds treating: Fitodoctor - 0,3l/t + Biophoshporyn – 0,3 l/t +BioMag – 0,3 l/t + Aminostim– 0,5 l/t ***Treating after growing*** 1. Fitodoctor -1,5 l/ha + Urozhay TK– 1,0 l/ha + Aminostim -0,5 l/ha + Adumax – 0,05 l/ha 2. - // - 3. Fitodoctor – 1,0 l/ha + Urozhay TK – 1,5 l/ha + Aminostim – 1,0 l/ha + Adumax – 0,05 l/ha	37,9	15,7	44,9
Seeds treating: Fitodoctor - 0,3l/t + Biophosphoryn – 0,3 l/t + BioMag – 0,3 l/t + Aminostim – 0,5 l/t. ***Treating after growing*** 1. Fitodoctor -1,5 l/ha + UrozhayTK– 1,0 l/ha + Aminostim-0,5 l/ha + Adumax – 0,05 l/ha 2. Fitodoctor – 1,5 l/ha + Trychodermin (Viridin) – 2,0 l/ha + Urozhay TK – 1,5 l/ha + Urozhay Bor 0,5 l/ha + Potassium humate – 1,0 l/ha + Adumax – 0,05 l/ha 3. - // -	18,5	8,4	73,1

Conclusions. The following preparation complex: ***treating seeds*** Fitodoctor – 0,3l/t +Biophosporyn – 0,3 l/t +BioMag – 0,3 l/t + Aminostim – 0,5 l/t, and ***three-times treating after growing:*** 1.Fitodoctor – 1,5 l/ha + Urozhay TK– 1,0 l/ha + Aminostim -0,5 л/га + Adumax – 0,05 l/ha, 2. Fitodoctor – 1,5 l/ha + Trichodermin – 2,0 l/ha + Urozhay TK – 1,5 l/ha + Urozhay Bor 0,5 l/ha + Potassium humate – 1,0l/ha +Adumax – 0,05 l/ha, 3. Fitodoctor – 1,0 l/ha + Urozhay TK – 1,5 l/ha + Aminostim – 1,0 l/ha +Adumax – 0,05 l/ha allows to receive the result for yield increase in 1,8 times to control. This complex efficiency against phytophtora consisted of

References:

1. Polozhenets V., Plotnitska N., Nemerytska L. Protection of potatoe varieties from late blight. Karantin I zachyst Roslyn- № 5. – 2011.– C. 17-19. 2.
2. Sergienko V.G., Shyta O.V., Tsurkan R.P., Bogdanovych S.V. Modern pesticides in the protection of potato against diseases and pests. Karantin I zachyst Roslyn.№5-2011-P.17-19.
3. Trybel S.O. Techniques for pesticides treating and usage. Kyiv. Svit. 2001P.448
4. Dospechov B.A. Technique of field trial(with foundamentals of statistic treating researches results).- 5 th ed. add. and reatreated-M.: Agropromizdat., 1985 P.351
5. Solomiychuk, M., & Pikovskyi , M. (2021). Influence of biostimulants and biostimulating complexes on the growth and development of soybeans in the Western Forest-steppe of Ukraine. *Interdepartmental Thematic Scientific Collection of Plant Protection and Quarantine*, (67), 251-269.

CZU:632.937.14 https://doi.org/10.53040/abap6.2022.78

SAFETY ASSESSMENT OF SELECTED ENTHOMOPATOGENIC BIOPESTECIDE SOURCE FOR THE CONTROL OF PESTS

STINGACI Aurelia[1]*, VOLOSHYUK L.[1]**, SERBACOVA Tatiana[1], SAMOILOVA Anna[1], ZAVTONI P.[1], LUNGU A.[1], CURIEV Loredana[1], GONCHARUK Violetta[2]

[1]The Institute of Genetics, Physiology and Plant Protection, Chisinau, Republic of Moldova;

*[2]Institute of Bioorganic Chemistry, National Academy of Sciences of Belarus, Minsk, Belarus *https://orcid.org/0000-0001-6621-9919, **https://orcid.org/0000-0002-7475-4310, e-mail: aurelia.stingaci@gmail.com*

Around the world, nature is considered as the most important approach to healing. However, the use of synthetic chemicals surpassed biochemical due to their reliability, efficacy, and quick knockdown effect. This is a common and scientific fact that synthetic pesticides are injurious to human health and the environment as they are toxic and complex in nature. Biopesticides have been considered as potential substitutes to synthetic pesticides [1, 4].

Biopesticides have been of great interest in the research community and have attracted great attention to synthetic pesticides in controlling pests. More often, various types of microbes have also been used effectively as a biopesticides. The cited literature suggests that biopesticides have been successfully used to enhance plant growth and ultimately to increase yields [3, 7].

Chemical pesticides are widely used worldwide but they are ecologically unacceptable. Use of chemical pesticides has resulted in the disturbance of our environment. Biopesticides are biological pest control agents that are viewed as safer alternatives to the synthetic chemicals that dominate the global insecticide market. A series of problems in the field of plants protection and the growing of ecological products can be solved using three important biological agents: insects, microorganisms (viruses) and bacteria (*B. thuringiensis*, etc.) bioactive substances.

The present paper gives information of *Bacillus thuringiensis* ssp. kurstaki (BT) and baculoviruses preparate, we discuss how evolution, host range determination and pathogenesis have contributed to their inherent safety for non-target organisms including humans. The entomopathogenic microorganisms also can accumulate themselves in the environment and the host population, and it can control the pest insects for a long term by forming epidemic disease in the pest insect population through the external environment stimulation. The quite stable food chain relation of plant-pest insect- natural enemy can be gradually established. Thus it can reduce the risk of the pest insect continuous outbreak and realize the persistent control of pest insects.

Baculoviruses only infect insects, are ubiquitous in the environment and are known to be important in the regulation of many insect populations. Baculoviruses are host specific, infecting only one or a few closely-related species, helping to make them good candidates for management of crop and forest insect pests with minimal off-target impacts. In fact, baculoviruses have been recognized as being amongst the safest of pesticides [1, 2].

The recognition of the necessity for the application of the entomopathogenic viruses and baculoviral preparations elaborated on their basis is determined by the qualitative originality of the pathogenic agents, among which their specificity and epizootic character constitute the main advantages compared with the chemical insecticides. Baculoviral improved product Virin ABB-3 was tested in laboratory against *H. cunea* larvae. In the report there are also submitted the results of the joint application of the biological preparation Virin ABB-3. But in the options there were used both viruses VG and VPN (1:1), the mortality increased from 88% to 92%.

A major constraint on the wider adoption of biopesticides is their susceptibility to the ultraviolet (UV: 290–400 nm) radiation in sunlight, which limits their persistence and efficacy. A number of materials that absorb specific wavelengths, including specialized dyes, chemicals and natural substances such as lignin sulfate, polystyrene latex, Congo Red, green tea, antioxidants, iron oxide and others have been tested to improve the residual activity of entomopathogenic viruses [5].

Here, we describe a formulation technology for biopesticides in which the active ingredient (baculovirus) is an active coal. Importantly, this ingredient protects the sensitive viral DNA from degrading in sunlight, but dissolves in the alkaline insect gut to release the virus, which then infects and kills the pest. We show, using this ingredient, in both laboratory bioassays and field tests, that this can extend the efficacy of the biopesticides well beyond the few hours of existing virus formulations, potentially increasing the spray interval and reducing the need for high application rates. The new formulation has a shelf-life at 30 °C of at least 6 months, which is comparable to standard commercial biopesticides and has no phytotoxic effect on the host plants. These findings suggest that the new formulation technology could reduce the costs and increase the efficacy of baculovirus biopesticides, with the potential to make them commercially competitive alternatives to synthetic chemicals.

Bacillus thuringiensis (Bt) are bacteria found naturally in the environments of every continent of the world. Some of the Bt strains are natural antagonists of some pests. A few Bt strains have been selected and commercialized as biological pest control products. These commercialized Bt strains are valuable to agriculture and public health because of their unique ability to naturally control certain destructive and disease-carrying insect pests while avoiding harm to non-target organisms (such as beneficial insects, people, other mammals, and fish). Biological insect control products based on Bt strains have been used safely and effectively in practical field conditions for more than 50 years.

Acknowledgement. Research was carried out within the State Program project 20.80009.7007.16. "Synergism between natural factors and ecologically harmless microbiological means of regulating the population density of harmful organisms for the protection of agricultural crops in conventional and ecological agriculture, financed by the National Agency for Research and Development, 22.80013.5107.3BL "Methods of complex application of *para*-aminobenzoic acid derivatives and entomopathogenic microorganisms for the control of harmful organisms on fruit and vegetable crops", financed by the National Agency for Research and Development.

References:

1. Chandler, D., Bailey, et.al. The development, regulation and use of biopesticides for integrated pest management. Philosophical Transactions of the Royal Society of London . 2011, Series B, Biological Sciences, vol. 366, p. 1987-1998.
2. Ehlers, R. Regulation of biological control agents and the EU policy support action REBECA. In: Regulation of Biological Control Agents, R.-U. Ehlers (Ed.), 2011, p. 3-23, Springer Dordrecht, ISBN 978-90-481-3663-6, Heidelberg, Germany.
3. Kour D, Kaur T, et.al. Biotechnological applications of bene"cial microbiomes for evergreen agriculture and human health. In: Rastegari AA, Yadav AN, Yadav N (eds) Trends of microbial biotechnology for sustainable agriculture and biomedicine systems: perspectives for human health. Elsevier, Amsterdam, 2020, p. 255–279. https://doi.org/10.1016/B978-0-12-820528-0.00019-3
4. Kumar M, Kour D, et.al. Biodiversity of methylotrophic microbial communities and their potential role in mitigation of abiotic stresses in plants. Biologia, 2019, vol.74, p. 287–308. https://doi.org/10.2478/s11756-019-00190-6
5. Shapiro, M., S. Ei-Salimouny and B. Merle Shepard. 2008. Green tea extracts as ultraviolet protectants for the beet armyworm, Spodoptera exigua, polyhedrosis virus. Biocontr. Sci. Technol. 18:605-617.
6. Rajawat et al. Spatial distribution and identification of bacteria in stressed environments capable to weather potassium aluminosilicate mineral. Brazilian Journal of Microbiology (Springer International Publishing), 2020, vol. 51, nr. 2, p. 751-764. https://doi.org/10.1007/s42770-019-00210-2
7. Singh A, Kumar R, Yadav AN, Mishra S, Sachan S, Sachan SG (2020a) Tiny microbes, big yields: microorganisms for enhancing food crop production sustainable development. In: Rastegari AA, Yadav AN, Yadav N (eds) Trends of microbial biotechnology for sustainable agriculture and biomedicine systems: diversity and functional perspectives. Elsevier, Amsterdam, pp 1–15. https://doi.org/10.1016/B978-0-12-820526-6.00001-4

CZU:581.2:582.6/.9(478-25) https://doi.org/10.53040/abap6.2022.79

DISEASES OF THE *Acer platanoides* AND THEIR CONTROL IN THE GREEN AREAS OF CHISINAU

STRATULAT Tatiana*, SCERBACOVA Tatiana, RAILEANU Natalia,
JALBA Svetlana, CURIEV Loredana, CRUCEAN S, LUNGU A.
Institute of Genetics, Physiology and Plant Protection,
Chisinau, Republic of Moldova
https://orcid.org/0000-0003-3120-7058, e-mail: tgs.05@mail.ru

Green areas are a special element of the urban environment. Trees are essential for healthy communities and people. The state, conservation and development prospects of plantations constitute a whole complex of difficult and important scientific and practical problems. The complex of tree diseases is the most important factor of negative impact in urban plantations. Both infectious and non-infectious types of diseases can be found in green spaces. In park plantings, rot diseases and various infectious lesions of leaves dominate; while in street plantings, non-infectious leaf necrosis and necrosis-cancerous lesions of trunks and branches predominate.

The goal of the study was to identify diseases of the most common to the urban area of Chisinau Norway maple (*Acer platanoides*) and to evaluate the effectiveness of biological control of powdery mildew using a consortium of microorganisms.

Keywords: *green areas, maple, fungal diseases, microorganisms, bioprotection*

Materials and Method. In the pilot park areas, stationary plots were identified, where *A. platanoides* is affected by a complex of diseases characteristic of this area. Observations on stationary plots were carried out systematically during the entire growing season of plants, at least every 10 days. The assessment of the phytosanitary status of *A. platanoides* was carried out during the growing season of 2022 in Riscani Park. The assessment of the development of diseases was carried out with an eye assessment, visually determining the percentage of plant leaves affected by one or another pathogen within the crown, establishing the type of manifestation and type of pathogen, its prevalence, development and harmfulness. The spread of the disease was assessed both by the number of diseased and healthy plants in the area, and in relation to individual plant organs (leaves). The intensity of leaf damage by powdery mildew, cercospora, rust was assessed on a 5-point scale, according to generally accepted methods. In the pilot areas, pathogen control was carried out using biological methods of plant protection. During the growing season, *A. platanoides* was treated with the following microbiological products, widely used as biological fungicides: 1% *Trichoderma lignorum* M-10; 5% *B. subtilis;* 1% *Pseudomonas fluorescens* AP-33, applied in mixture. Treatments were carried out with a manual sprayer.

Results. During the last two growing seasons, leaf diseases were the most widely distributed ones in the plantations of Chisinau. According to „IM Spatii Verzi", in general, up to 27% of trees are in 1 category (completely healthy tree state) and about 70% in categories 2 and 3 (weakened and strongly weakened) in the park plantations. Powdery mildew, rust and some spottings are the dominant tree stand diseases in terms of distribution. The trees of *A. platanoides* were described in the same way according to their phytosanitary state.

In the pilot plots during the observation period April-July 2022 in the Riscani park, the leaves of *A. platanoides* were mainly affected by fungal diseases: powdery mildew (*Uncinula tulasnei*), tar spot of maple (*Rhytisma acerinum*), cercospora leaf spot disease (*Cercospora acerina Hart*.). Biotic factors like pathogens can also cause necrotic spotting, namely marginal leaf necrosis (*Guignardia aesculi*).

In the table below are presented data on the percentage of maple leaf infestation particularly with powdery mildew after the eight treatments by a consortium of microorganisms.

In the control pilot area, the Norway maple infestation with powdery mildew before the start of treatments was approximately at the same level as in the plot intended for treatment with biological preparations on the base of the microorganisms. Already after the first treatment by a consortium of microorganisms, the intensity of the development of the disease decreased in the treated group to 0%. This effect persisted throughout the treatment period. Whereas in the control area, the percentage of disease development during the entire observation period was at the level of 30-37%.

Table. Dynamics of the spread of maple powdery mildew against the background of the use of a consortium of microorganisms (year 2022)

Period of observation										
	Treatments								No treatments	
No.	**Ith**	**IInd**	**IIIrd**	**IVth**	**Vth**	**VIth**	**VIIth**	**VIIIth**		
date	*19.05*	*27.05*	*03.06*	*09.06*	*16.06*	*24.06*	*01.07*	*12.07*	*18.07*	*04.08*
Control	23,7	30,7	37,3	30,7	37,0	33,7	30,7	18,3	20,3	31,0
biocontrol	26,7	0,0	0,3	0	0	0	0,0	0,3	0	0

Conclusions.

As in the previous (2021) year, according to the phytosanitary state, Norway maple trees in the spring-summer season of the current year in the control plot can be classified as category 3. At the same time, powdery mildew control using a consortium of microorganisms makes it possible to restore and maintain the state of trees at the healthy level during the whole period of vegetation (category 1).

Acknowledgment: This work was financially supported by the National Agency for Research and Development under Grant 7/261T (22.80015.7007.261T)

CZU:631.147+574 https://doi.org/10.53040/abap6.2022.80

THE BIOTECHNOLOGY IN SOLVING ECLOGICAL PROBLEMS

VOLOSCIUC L.
Institute of Genetics, Physiology and Plant Protection,
Chisinau, Republic of Moldova
https://orcid.org/0000-0002-7475-4310, e-mail: l.volosciuc@gmail.com

The evolution of agriculture records previously non-existent times, which in addition to the expansion of many technological developments, is dominated by the impact of many ecological problems [2]. Although permanent agriculture has been a significant factor in influencing the environment, it still contains effective levers to keep these issues at an acceptable level. The basis of these actions is represented by the natural mechanisms, currently frequently presented in the functionality of regenerative agriculture, which in synergy with other paradigms of agriculture have different abilities to work in complex and produce systemic effects aimed at reducing the impact of environmental factors.

Keywords: *agriculture, biological protection, biopesticides, biotechnology, environment*

Materials and Method. Various species of phytophagous insects and disease pathogens have been used for research in the main agricultural crops. The effects on insect larvae and pathogens were identified by applying the range of biological agents examined, and symptoms were described using visualization methods, including the use of photon and electron microscopy, and the effectiveness of biological agents was determined by the Abbot formula, which provides natural insect mortality.

At the Institute of Genetics, Physiology and Plant Protection there were the researches on isolation and identification of wide spectrum of entomopathogenic microorganisms: viruses, fungi, nematodes, bacteria and microsporidia. The activity of the Institute covers the stages from the perspective microorganism isolation from natural conditions of biological preparations getting and application development. At first, it is necessary to solve problems at different stages of the production and application process: collection of primary material; isolation in pure culture (identification, study of the biological properties, pilot tests to assess the activity); selected strains (identification and ameliorations of biological agents, patenting, safety, health and toxicology investigations), development of production technology (technological regulations, specifications, methods of application), mass production of the preparations, and technology of application development; establishing their role and place in organic farming systems.

Results. The seriousness of the problems facing food security and food security has necessitated an in-depth analysis of the main types of agriculture and their strengths and weaknesses, taking into account the achievements of modern biotechnologies aimed at reducing the negative impact of technological processes applied in conventional agriculture. Conventional agriculture, being aimed at the maximum extraction of values from the environment to obtain material, financial and social benefits.

Conservative agriculture aims to protect natural resources and reduce the negative impact of applied processes, which ensure increased agricultural productivity and compliance with the conditions of activity of useful biological entities, reducing non-renewable inputs and environmentally harmful practices. Particularly important are the practices of precision agriculture, integrated pest management and high-efficiency irrigation, through which more efficient machines are used to increase the profitability of crops [1].

Regenerative agriculture aims to improve the quality and functioning of natural resources, contributing to the restoration of agro-ecosystems by building elements and biota of soil and biodiversity, ensuring food security of human communities and economic well-being of farmers, proposing integrated solutions using synergistic land improvement phenomena, restoring degraded ecosystems and the specific biodiversity of the area [4].

Regenerative agriculture is oriented towards the application of cultivation techniques that use correctly and completely the properties of the land, without excessive exploitation or impoverishment and contributes to soil regeneration, enriching it and restoring its production capacity in volumes and high qualities at low costs. In the paradigm of regenerative agriculture, a key lever is the long-term processes of adaptation to changing environmental conditions. Its products are well known, although regenerative farms have a significant impact beyond the boundaries of their landscapes, thus developing the capabilities of other natural and man-made ecosystems. This ensures the substantiation of new approaches in compliance with the principles of natural functionality, manifested by the regeneration of system components. We would like to mention that the practical orientation of the achievements of regenerative agriculture without improving the management system will only make a short-term change, which determines the need to process changes in the fundamental systems of thinking and decision-making, which would ensure the natural evolution of at its base [3].

Ecologic agriculture, using the regenerative capabilities of biological entities, is also a philosophy aimed at supporting the special way of life to live in harmony with nature. As a result, the normal functionality of biological entities and humans is recorded. By excluding synthetic inputs and encouraging natural systems, organic farmers contribute to creating a better future for people, the elements of biodiversity and the environment, which reflect ecological and regenerative capacities, registering economic and social phenomena that go beyond sustainability [5].

The biological means and technological processes developed in the institute demonstrate high biological activity in the protection of a wide range of crops in conventional and ecologic agriculture. This type of agriculture not only maintains resources but also improves them, increasing the capacity of conventionally exploited agro-ecosystems.

Conclusions. The degraded state of nature is the outcome of the dramatic population increase, increasing the impact of global environmental problems and the trend of climate change. The resultants of science researches have elaborated many tools to help humanity to reduce global environmental risks and promote global sustainability.

The development and application of environmentally friendly means of plant protection in conventional and organic farming systems are significant results in reducing the ecological impact of agriculture. This is particularly evident in the conditions of organic and regenerative agriculture, in which the natural mechanisms of regulation are fully involved. Like that, biotechnology can be used to minimize environmental pollution by producing environmentally friendly alternatives.

Acknowledgment. The work was carried out with the support of the State Program project 20.80009.7007.16. „The synergism between natural factors and microbiological, environmentally friendly, means of regulating of the population's density of harmful organisms for the crops protection in conventional and organic farming", financed by the National Agency for Research and Development.

References:

1. Farming without plant protection product. Panel for the Future of Science and Technology. Brussels, 2019. 44 p.
2. Global land outlook. Second edition. UN report. Bonn. 2022. 204 p.
3. Regenerative Agriculture: What's Missing? What Do We Still Need to Know? edit. by Dent, D., Boincean B. Springer. 2021. 355 p.
4. Regenerative agriculture in Europe. A critical analysis of contributions to European Union. EASAC policy report 44. 2022. 70 p.
5. Voloşciuc L. Agricultura Ecologică: aspecte teoretice și valențe practice. Chișinău. Tipografia Centrală. 2021. 288 p. ISBN 978-9975-62-451-0.

CZU:632.937+631.147+574 https://doi.org/10.53040/abap6.2022.81

PLANT PROTECTION BIOTECHNOLOGIES CONTRIBUTING TO INCREASING THE ECOLOGICAL PRODUCTION

ZAVTONI P.*, VOLOSCHUK L.**, STINGACI Aurelia***
Institute of Genetics, Physiology and Plant Protection,
Chisinau, Republic of Moldova
** https://orcid.org/0000-0003-1841-0086, **https://orcid.org/0000-0002-7475-4310,*
****https://orcid.org/0000-0001-6621-9919, e-mail: pantelimonzavtoni@gmail.com*

Keywords: *baculoviruses, biotechnology, bioinsicticides*

A decisive role in the practical solution of the tasks of providing the population with food products, and the industry with raw materials, belongs to agricultural specialists three modern biotechnologies for obtaining agricultural production.

Biotechnology is the discipline concerned with the use of living organisms in order to industrially obtain products useful to humans and to adapt microorganisms with active biological capabilities in combating agricultural pests. Biotechnology offers a new methodology in solving various problems of genetics, physiology, microbiology, virology, botany and other biological disciplines. At the present time, biotechnologies contribute a lot to the solution of mankind's problems, such as food, ecological and human health.

In the Republic of Moldova, it is necessary to implement different biotechnologies to obtain biopreparations to combat pests of agricultural crops. The basis of these biotechnologies are bacteria, fungi, entomopathogenic viruses and entomophages, which contribute to the reduction of harmful insects.

Ecological agriculture is based exclusively on the use of organic or biological degradable materials, which ensure the ecological balance of the agricultural system. Ecological agriculture minimizes the use of polluting chemical products, does not use genetically modified plants and thus ensures the maintenance of a biodiversity with high biological productivity.

According to studies undertaken by the United Nations Food and Agriculture Organization (FAO), the actual level of agricultural production worldwide and its rate of growth are considered unsatisfactory. Almost half of the world's population has an inadequate nutrition, of only about 20 - 70 kilocalories per day for one person, compared to about 3000 - 3250 kilocalories per day for one person, as it comes in the countries of Europe and North America. The statistical data obtained within the FAO, annual crop losses worldwide, caused by pests, diseases and weeds are still estimated at 54-60% of the real production, and are worth 150-200 billion dollars [1].

Pesticides were used particularly abusively in greenhouses, orchards and vineyards, where 30-50kg/ha were applied during 10-15 treatments. It was emphasized repeatedly that the intensive application of agricultural chemicalization conditions numerous serious consequences. In parallel to reducing the ravages caused by harmful organisms, pesticides create serious disturbances in the ecological balance, greatly reducing the number and role of useful flora and fauna. Their long-term application leads to some genetic changes in the harmful organisms, a fact that conditions the appearance of resistance to pesticides [3].

Among the microbiological methods of plant protection, which are used in combating harmful organisms, a special place belongs to baculoviral preparations. The serious advantages of ecological agriculture becomes the obtaining and processing of ecological products.

Entomopathogenic baculoviruses, especially from the Baculoviridae family, especially in insects, can be successfully used to obtain viral preparations that cause natural epizootics, contributing to the regulation of their population density [2].

Baculoviruses are vibrios assembled in protein formations called supraviriocapsides (SPVCs), which penetrate in insect body thrue ingestion, reach into the middle intestine and by action of the enzymes, proteinize and release the vibrios, which develop in the epithelial cells and destroy them.

Various biological preparations are used to combat pests in the agriculture of different countries, baculovirotic preparations are increasingly used for their ability to transmit horizontally and vertically, which are maintained in biocenoses, causing epizootics and regulating the density of phytophagous insects.

In the Institute of Genetics, Physiology and Plant Protection a number of microbiological preparations have been developed and approved for obtaining ecological food products:

Virin-ABB-3 – for combating the *Hyphantria cunea* Drury in orchards, forest plantations and parks. The preparation is based on the Nuclear Polyhedrosis Virus (PNV) and Granulosis with cumulative action. The titre is 6 billion particles. Consumption rate – 0.1 – 0.2 kg/ha.

Virin-HS-P is a baculoviral preparation for combating - *Helicoverpa armigera* in vegetables and technical crops. It is a selective preparation and attacks only the target pests without harming the beneficial entomofauna. The titre reaches 6 billion/g. In Ecological Agriculture it is recommended for combating *Helicoverpa armigera* of the age of 2-3 larvae in tomatoes, peppers, eggplants, corn, etc., the consumption rate being 0.15 kg/ha. The interval between processing is 7-8 days.

Virin-MB is a baculoviral preparation of *Mamestra brassicae* nuclear polyhedrosis virus. It is an ecological preparation and selective in combating agricultural pests. The titre is 3 billion/g, the consumption rate is 0.1 - 0.2 kg/ha.

Virin-OS is a baculoviral preparation based on the granulosis and nuclear polyhedrosis viruses, for combating the sow bug and the *Agrotis* (*Ypsilon, Exclamationis*) fleas in vegetable and technical crops. The titre is 3 billion/g, with a consumption rate of 0.1 kg/ha.

Conclusions.

At the present time, biotechnologies contribute a lot to the solution of mankind's problems, such as food, ecological and human health. The basis of these biotechnologies are bacteria, fungi, entomopathogenic viruses and entomophages, which contribute to the reduction of harmful insects.

Acknowledgment. Research was carried out within the State Program project 20.80009.7007.16. "Synergism between natural factors and ecologically harmless microbiological means for regulating the population density of harmful organisms and protection of agricultural crops in conventional and ecological agriculture", financed by the National Agency for Research and Development.

References:

1. Busuioc M. Entomologie agricolă: Manual pentru studenţii instituţiilor de învăşământ superior agronomic. Centru editorial al UASM, Chişinău 2006, 639 p.
2. Theilmann D. A., Blissard G. W., Bonning B., Jehle J. O'Reilly D. R., Rohrmann G. F., Thiem S. & Vlak J. M. Family Baculoviridae. In Virus Taxonomy: Eighth Report of the International Committee of Taxonomy of Viruses. Edited by C. M. Fauquet, M. A. Mayo, J. Maniloff, U. Desselberger & L. A. Ball. San Diego, CA. / Elsevier Academic Press.-2005. - P.177–185.
3. Voloşciuc L. Biotehnologia producerii şi aplicării preparatelor baculovirale în agricultura ecologică. Chişinău, 2009, 234p.

CZU:582.632.2:57.08 https://doi.org/10.53040/abap6.2022.82

BIOLOGICAL ASPECTS OF THE METHODOLOGY FOR OBTAINING *QUERCUS ROBUR* L.

ZDIORUK Nina*, PLATOVSCHII N., RALEA T.
*Institute of Genetics, Physiology and Plant Protection, Chisinau, Republic of Moldova *https://orcid.org/0000-0001-6747-8226, e-mail: zdioruc-nina@mail.ru*

Due to the increase in the average annual temperature and the increased frequency of forest fires leading to the death of forest plantations, our institute has developed a new method for obtaining oak seedlings characterized by high growth and development rates. Seedlings obtained by the new method are characterized by high growth and development energy according to such indicators as average annual growth, plant height, stem diameter and leaf surface index. Oak seedlings obtained by the method developed by us can be used in the repair of forest plantations with a high degree of survival and growth rate.

Against the backdrop of recent years, the temperature regime on the globe is steadily growing, accompanied by serious consequences for the environment. Every year, forest fires occur in various parts of the world, caused by both weather disasters and human activity, as a result of which very significant areas of forest plantations are lost. Forest fires lead to severe damage, and sometimes to the destruction of forest cover, which affects the atmosphere, soil, hydrosphere, and fauna, it is also worth noting significant losses for human resources [2]. I would especially like to emphasize that, along with forest fires, significant harm is caused by human activities associated with deforestation, many of which are perennial plantations. For the European part of the mainland, one of the most valuable forest species is oak, which is listed in the Red Book of the International Union for Conservation of Nature and is valuable for its wood [1]. Oak plantations are characterized as long-lived massifs, however, the intensity of their growth is extremely low and it takes about 150-200 years to obtain plantations up to 20 m in height, which is an extremely long period [3].

Keywords: *Quércus róbur L., leaf surface index, stem diameter, chlorophyll index*

Materials and Method. To restore oak forests after natural disasters or human activity, the Institute of Genetics, Physiology, and Plant Protection (IGFPP) have developed a new technology for producing oak seedlings with high rates of growth and development intensity. Thanks to this development, it becomes possible to repair woodlands with a high degree of survival and rapid growth of oak seedlings. Often, for the repair and laying of new oak forests, the classical technology of reproduction is used by sowing oak acorns into the ground. But it is worth noting that this method is ineffective, for several reasons associated with low germination of acorns, extremely low growth rate of seedlings and also most germinated seedlings die at early stages of life due to disease damage, competition from weeds, and the effect of drought. The method of obtaining oak seedlings developed at our institute allows planting healthy seedlings with a high degree of survival and intensive growth and development in the spring period.

Our experiments have shown that oak plants obtained in laboratory conditions have many advantages over the classical method (by sowing acorns directly into the ground) of obtaining oak plants. An experiment was laid at the IGFPP experimental field in 2019. with the sowing of acorns in the autumn by the classical method (control) and the planting in the spring of oak seedlings obtained previously in laboratory conditions (experience), it was shown that the experimental plants develop significantly compared to the control plants. Over three years of experiments, we carried out measurements of annual growth, average annual growth, leaf surface index, plant height, stem diameter, and chlorophyll index. Studies were also conducted to study the effect of high positive temperatures on the thermal stability of cell membranes and the rate of synthesis of HSP.

Results. According to all the parameters studied, it was found that experimental variants develop more intensively than control plants. Over three years of observations, the experimental plants averaged an annual increase of 25-30 cm and in control plants, the increase was 6-10 cm, the increase in the diameter of the stem of experimental plants is 3-4 m in the third year of development, and in control plants in the third year of development 0.8-1.4 cm. In the third year of development, experimental plants have an average height of 1.50 m, while control plants have an average height of only 20-30 cm it is worth emphasizing that the experimental plants not only stretch upwards but along with their growth in height and the diameter of the stem increases, which protects the plants from fractures during intensive growth. The flatness of the leaf surface between the two variants does not have a strong difference, although it is larger in the experimental variants, the index of the leaf surface of the experimental variants differs significantly from the control and averages 3.5-4.2m^2/m^2.

As noted earlier, the main death of the plant world occurs mainly due to climate change towards high temperatures in connection with which studies were conducted aimed at assessing the effect of high temperatures on the thermal stability of oak plant leaves of both control and experimental variants. As a result of the work done, it was found that the experimental variants are characterized by a higher degree of thermal stability compared to the control variants. It was found that the critical dose of heat shock for oak plants is a temperature of +59°C, 30 min at which loss of more than 60% of electrolytes and cells was observed, the effect of this temperature is 60min. it has already led to almost complete loss of electrolytes by the cell wall. In the experimental variants, the loss of electrolytes by the cell wall was slower compared to the control. There were no significant differences in the rate of BTS synthesis. The higher thermal stability of the experimental variants is explained by their intensive metabolism, which leads to the rapid development of plants.

Conclusions. Thanks to a new method of obtaining planting material with a high degree of survival and intensive metabolism leading to accelerated growth, it becomes possible to restore forests after forest fires or human activity in a shorter time.

Acknowledgment. Research was carried out within the project of the State Program 20.80009.7007.07 "Determining the parameters that characterize the resistance of plants with different levels of the organization to the action of extreme temperatures to reduce the effects of climate change", financed by the National Agency for Research and Development.

References:

1. International union for conservation of nature: IUCN. http://cms.iucn.org
2. https://treeography.com/plantations/natsionalnyy-park-smolenskoe-poozere-3955
3. https://www.rbc.ru/society/29/07/2019/5d3eeeee9a7947963aa2faad

CZU:635.21:632.93 https://doi.org/10.53040/abap6.2022.83

CHOICE OF RESISTANCE SOURCES OF POTATO TO WART *Synchytrium endobioticum* (SCHILBERSKY) PERCIVAL

ZELYA A.G. [1*], OLIYNYK T.M. [2**], ZELYA G.V. [1***], PYSARENKO N.B. [2#], STOYANOVA K.YE. [1##], KUVSHYNOV O.YA. [1###]

[1] *Ukrainian Science-Research Plant Quarantine Station Institute of Plant Protection National Academy of Agrarian Sciences;* [2]*Institute for potato study National Academy of Agrarian Sciences, Kiev, Ukraina*

**https://orcid.org/0000-0002-1470-7707, **https://orcid.org/0000-0002-7235-9413, ***https://orcid.org/[1]0000-0001-7040-1908, # https://orcid.org/0000-0001-6299-2170, ##https://orcid.org/0000-0003-1684-2950, ###https://orcid.org/0000-0003-3649-9889*

e-mail: avrelia.zelya@gmail.com

The researches result for evaluation and choice of potato breeding material resistant to wart received from Institute for potato study National Academy of Agrarian Sciences and it's Polissian research division. This material received from different parent forms crossing combinations. The mark resistant to common pathotype of wart causative agent received 230 hybrides 244 potato samples from testing (97,4%). 6 samples were defeated by disease causative agent and rejected. Hydrobiological analysis of potato resistance to wart showed the option of crossing parent forms resistant x resistant Vectar/Vzirets; Mag/Radomysl; Vectar/Radomysl; Dyna/Vygoda, Irbytsky/Podolia; 89.715c88 /Tiras and 05.2c32 / Granola allowed to receive 100% resistant to wart potato inherits. There were received 66,6 % resistant inherits in the option of crossing resistant X susceptible: 12.13-14 / Ф.11.12-84 resistant to wart and 57,1% resistant to wart 13.54-2 / Vzirets, The resistant varieties recommended for the improving in disease sources and the following usage in breeding process as a potato resistance source to wart.

Keywords: *wart, potato, resistance, choice, inheritance*

Introduction. Potato is one of the important agricultural crops. It uses for food, technical treating and animal's feed. Our country takes the fourth place in the world by gross yield (after China, Russia, India). It takes the fourth place after rice, wheat and maize. The Ukrainian potato gross yield is nearly 21,4 mln. tonnes and sown area is 1,28 mln. ha. It confirms about this crop importance in global problem of provision of food. The potato yield leaves rather low - 16,6 t/ha [4]. The plant is a feeder for many disease causative agents. Wart is the most dangerous disease among them. It is caused the intercellular obligate pathogen *Synchytrium endobioticum* Schilbersky Percival. It is one of the reasons for serious lack of potato yield crop, as a food and feed crop [2].

The most effective and ecologically – friendly way of struggle with potato wart causative agent is to improve resistant to wart potato varieties also with complex resistance to aggressive pathotypes of disease causative agents [3].

Ukrainian Science-Research Plant Quarantine Station IPP NAAS conducts work for choice of new bred potato varieties and hybrids on resistance and four aggressive pathotypes of wart causative agents determined in Ukraine territory.

The improving of new resistant varieties in area of common and aggressive pathotypes of wart causative agent favours the potato production increase and favours phytosanitary state of households with disease sources [7].

The new methods for determining potato resistance to wart started in 20^{th} years of last century abroad. This technique improved [5] and new Standards 7/28 (2) for *Synchytrium endobioticum* approved [1].

The staff of Ukrainian Plant Quarantine Station Institute of Plant Protection National Academy of Agrarian Sciences improved technique for determining potato resistance to wart through biochemical and molecular ways during the times of Ukrainian independence [6,7].

Purpose is to evaluate and choice of potato breeding material resistant to wart, received from different combinations of parents forms for their following improve into production.

Materials and method. There were 230 potato samples for evaluation and choice of potato breeding material with complex resistance to pathotypes of wart causative agent *Synchytrium endobioticum* Schilbersky Percival y 2020-2021. They received from different combinations of inlet parents forms of potato breeding Institute for potato study NAAS and Polessian research division Institute for Potato Study NAAS. The researches conducted as per "Methods for evaluation and selection of breeding material for potatoes resistant to wart *Synchytrium endobioticum* (Schilb.) Perc., Harmonized with EU requirements" [8]. The new Standards PM 7/28 (2) used as a foundaments for it. The European technique for potato samples defeating by causative agent. The infectious background was created by winter zoospores for samples defeating. This way was proposed by the staff of UkrSRPQS IPP NAAS as per EPPO Standarts PM 7/28 (2).

The potato hybrids reaction on defeating potato wart causative agents defeating used for conducting the hydrobiological analysis of inheriting resistance. They were received from different combinations of parents' forms crossing.

The potato variety Polisska rozheva used for quality control. The statistical treating conducted as per Maslov Yi. I. [3].

Results. There were chosen 224 potato samples from 230 resistant to common pathotype causative agent of disease by the results of conducted researches in laboratory terms for determining resistance of breeding potato material to wart *Synchytrium endobioticum (*Schilbersky) Perc. It was consisted of 97,4% (fig.).

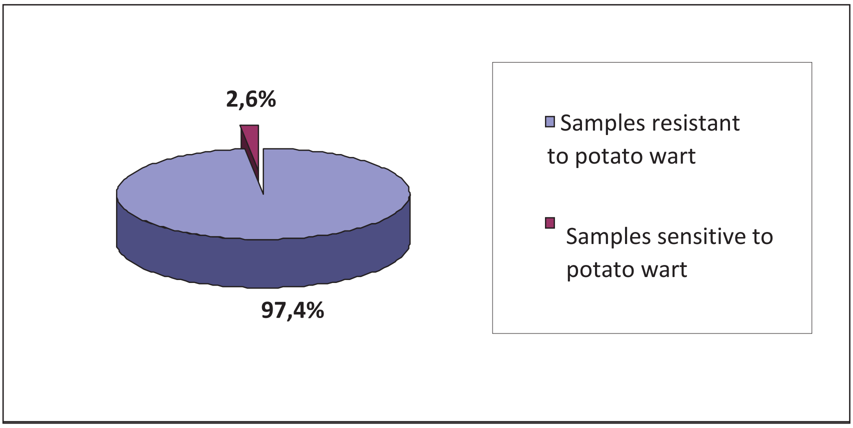

Figure. Choice of potato breeding material resistant to wart during the previous testing.

The hybridological analysis for potato resistance to wart showed that the option for crossing parents forms 14.36-10 x 14.4-3;13.48-22 x 13.17-11; Vectar x Vsirets; Vectar x Radomysl; Charunka x Alliance; Mag x Radomysl; Irbitskyi x Podollya allowed to receive 100% resistant to wart potato inherits.

The following crossing options12.13-14 x Ф.11.12-84 and13.54-2 x Vsirets received 66,6% and 57,2%, respectively resistant inherits.

Table. Potato hybrids reaction received from different parent forms crossings on infecting by wart causative agent *Synchytrium endobioticum (*Schilbersky) Percival (2020-2021)

№ of items	Parents forms and potato hybrids	Quantity of defeated tubers	Average points of disease defeating
1.	14.36-10 (♀) (resistant)	0	1,2
2.	П17 8–2	0	1,4
3.	П17 8–3	0	1,6
4.	П17 8-28	0	1,6
5.	П17 8-39	0	1,4
6.	П17 8-45	0	1,6
7.	П17 8-57	0	1,4
8.	П17 8-62	0	1,6
9.	14.4-3 (♂) (resistant)	0	1,8
	Per cent of resistant forms	100%	
10.	12.13-14 (♀) (resistant)	0	1,6
11.	П17 14-4	0	1,4
12.	П17 14-10	2	4,2
13.	П17 14-15	0	1,4

14.	Ф.11.12-8 (♂) (resistant)	0	2,8
	Per cent of resistant forms	66,6%	
15.	13.54-2(♀) (resistant)	0	1,8
16.	П17 19-2	5	4,6
17.	П17 19-5	5	4,8
18.	П17 19-6	0	2,4
19.	П17 19-6а	0	2,0
20.	П17 19-10	0	2,2
21.	П17 19-26	0	2,0
22.	П17 19-27	5	4,8
23.	Vsirets(♂) (resistant)	0	1,2
	Per cent of resistant forms	57,2%	
24.	13.48-22(♀) (resistant)	0	1,8
25.	П17 24-5	0	1,8
26.	П17 24-8	0	1,6
27.	П17 24-26	0	1,6
28.	13.17-1 (♂) (resistant)	0	1,4
	Per cent of resistant forms	100%	
29.	Vectar (♀) (resistant)	0	1,8
30.	П17 29-3	0	2,0
31.	П17 29-5	0	2,0
32.	П17 29-7	0	1,6
33.	Vsirets (♂) (resistant)	0	1,6
	Per cent of resistant forms	100%	
34.	Vsirets (♀) (resistant)	0	2,0
35	П17 38-1	0	2,0
36.	П17 38-3	0	1,4
37.	П17 38-5	0	1,6
38.	П17 38-10	0	2,2
39.	П17 38-11	0	1,8
40.	П17 38-17	0	2,4
41.	П 17 38-29	0	2,0
42.	П17 38-30	0	2,2
43.	П 17 38-37	0	2,0
44.	П17 38-42	0	1,8
45.	П17 38-50	0	2,2
46.	П17 38-55	0	2,0
47.	П17 38-56	0	2,2
48.	Radomysl (♂) (resistant)	0	2,0
	Per cent of resistant forms	100%	
49.	Charunka (♀)(resistant)	0	1,0
50.	П18 85/8	0	2,0
51.	П18 85/16	0	1,6
52.	П18 75/23	0	1,8

53.	П18 75/30	0	1,6
54.	Alliance (♂) (resistant)	0	1,6
	Per cent of resistant forms	100%	
55.	Mag	0	1,0
56.	П 17 39/22	0	1,0
57.	П17 39/25	0	1,6
58.	П17 39/27	0	1,4
59.	Radomysl(♂) (resistant)	0	2,0
	Per cent of resistant forms	100	
60.	Irbytsky (♀) (resistant)		
61.	П16 59-9	0	1,0
62.	П16 59-10	0	1,0
63.	П16 59-25	0	1,4
64.	Podolyia (♂) (resistant)	0	1,2
	Per cent of resistant forms	100%	

Conclusions.

1. There were chosen 224 (97,4%) potato samples from 230 resistant to common pathotype causative agent during the infecting by zoospores in substrate soil/pearlit in 2020-2021.

2. The hybridological analysis of potato resistance inheritance to wart showed that the following options parents forms of crossings Vectar/Vsirets, Vectar/Radomysl; Charunka/Alliance; Mag/Radomysl; Dina/Vygoda, Irbytsky/Podollia; 89.715c88/Tyras and 05.2c32/ Granola allowed to receive 100% resistant to wart potato inherits.

3. The crossing option 12.13-14/Ф.11.12-84, 13.54-2/Vsirets received 57,1-66,6% resistant inherits.

4. Potato resistant varieties proposed for the put into production in potato wart causative agents sources and for the following usage in breeding process as a source of resistance to potato wart.

References:

1. EPPO Standard PM 7/28/2 *Synchytrium endobioticum. Bulletin OEPP/EPPO Bulletin.* 2017. Vol. 47, No 3. P. 420–440. DOI: 10.1007/s10658-006-9039-y.
2. Fiers M., Edel-Hermann V., Chatot C. et al. Potato soil-borne diseases. A review. *Agronomy for Sustainable Development*. 2012. 32(1). P. 93–132. DOI: 10.1007/s13593-011-0035-z.
3. Maslov Yu. I. Statistical processing of biochemical analysis data of plants. Leningrad: Kolos, 1986. 320 p. (in Russian).
4. State Register of Plant Varieties Suitable for Distribution in Ukraine. 2022.
5. Van de Vossenberg B. T. L. H., Prodhomme C., Vossen J. H, Van der Lee T. A.

(2022) *Synchytrium endobioticum*, the potato wart disease pathogen. *Molecular Plant Pathology*. 23 (4). P. 461-474. DOI: 10.1111/mpp.13183

6. Zelya A. G., Olijnik T. M., Zelya G. V. (2020). Selection of sources of potato resistance to wart *Synchytrium endobioticum* (Schilbersky) Percival. *Peredgirne ta girs'ke zemlerobstvo i tvarinnictvo*. 67. (2). 75–91. DOI: 10.32636/01308521.2020-(67)-2-5. (in Ukrainian).
7. Zelya A. G., Zelya G. V., Oliynyk T. M. et al. (2018). Screening of potato varieties for multiple resistance to *Synchytrium endobioticum* in Western region of Ukraine. *Agricultural Science and Practice*. No 3. P. 3–11. DOI: 10.15407/agrisp 5.03.003.
8. Zelya G. V., Olyinik T. M. et al. (2015). Methods for evaluation and selection of breeding material for potatoes resistant to wart *Synchytrium endobioticum* (Schilb.) Perc., Harmonized with EU requirements. Chernivtsi: Misto. 24 p. (in Ukrainian).

CZU:504.75:582.581.9(575.1) https://doi.org/10.53040/abap6.2022.84

COMPARATIVE ANALYSIS OF GENUS *AGROPYRON* THE MAIN AGRICULTURAL CROP OF UZBEKISTAN

ALIEVA K.B.
Institute of Botany, Academy of Sciences, Uzbekistan
https://orcid.org/0000-0002-8795-3749, e-mail: aliyevakumush77@gmail.com

Виды Agropyron Gaertn. часто называют ростками пшеницы. В соответствии с современной таксономией виды рода Agropyron считаются более подходящими для других родов: Crithopsis, Elymus, Eremopyrum, Pseudoroegneria, Elytrigia, Campeiostachys, Kengyilia, Leymus, Thinopyrum, Vulpia и т. д. Здесь мы сравнили информацию литературы и веб-сайтов, чтобы определить виды рода во флоре Узбекистана.
Ключевые слова: *Agropyron,* пырей, ТАШ, флора Узбекистана, синонимы

Species of Agropyron Gaertn. are frequently referred to as wheatgrass. According to current taxonomy the species of genus Agropyron considered better suited in other genera: Crithopsis, Elymus, Eremopyrum, Pseudoroegneria, Elytrigia, Campeiostachys, Kengyilia, Leymus, Thinopyrum, Vulpia, etc. Here, we compared information of bibliographical sources and websites in order to define species of the genus in flora of Uzbekistan.
Keywords: *Agropyron, wheatgrass, TASH, flora of Uzbekistan, synonyms*

According to the national herbarium fund of Uzbekistan (TASH), there are 3218 herbarium samples which belong to 35 species of the genus *Agropyron* that were collected from 1841 to current days. As stated in volume 2 of "Flora of the USSR" [3], there were about 17 species in the flora of the USSR that belonged to two subgenera, *Elytrigia* and *Eu-agropyrum* (13 and 4 species, suitably). As reported in volume 1 of "Flora of Uzbekistan" [4], there were about 30 species in the flora of Uzbekistan. In accordance with volume 1 of "Key to Plants of Central Asia"[1], there were about 47 species, that related to the flora of Uzbekistan, in Central Asia. Four of them were published in "Grasses of the USSR"[5]. However, in the report of the flora of Uzbekistan in 2020, there were 26 species, and 5 of them, such as *Agropyron drobovii*, *Agropyron interruptum*, *Agropyron macrochaetum* and *Agropyron alatavicum, Agropyron setuliferum* are endemic to mountainous Central Asia and Pamir-Alai, respectively. However, many of them are now accepted as synonyms for species of other genera. That is why we compare 47 species of the genus *Agropyron* on six websites, such as IPNI (International Plant Name Index), GBIF (the Global Biodiversity Information Facility), POWO (Plants of the World Online), COL (The Catalogue of Life), The Plant List, and plantarium.

Materials and Method. Voucher specimens were used in the National Herbarium of Uzbekistan, Institute of Botany, Academy of Sciences of Uzbekistan (TASH). In order to compare information about species of the genus *Agropyron,* we utilized literature resources, especially "Flora of the USSR" [3], "Flora of Uzbekistan" [4], "Key to Plants of Central Asia" [1], "Grasses of the USSR" [5], as well as Internet resources were used: https://www.ipni.org/, www.gbif.org, http://powo.science.kew.org, www.catalogueoflife.org, http://www.theplantlist.org/, and https://www.plantarium.ru/.

Results. According to the results of the comparison of the species of this genus among the databases of the National Herbarium of Uzbekistan, literature resources, and websites, there are about fifty species that belong to the genus *Agropyron* in Uzbekistan. We did not find information about the species *Agropyron buonapartis* and *Agropyron longiaristatum* from the IPNI website, but *Agropyron buonapartis*, *Agropyron badamense*, and *Agropyron kasteki* were accepted as species on the database website of GBIF. Furthermore, we got the same information that *Agropyron badamense*, *Agropyron cristatum*, *Agropyron desertorum*, and *Agropyron fragile* were accepted as species, while the rest of the species of the genus were accepted as synonyms of other genus, mainly as *Crithopsis, Elymus, Eremopyrum, Pseudoroegneria, Elytrigia, Campeiostachys, Kengyilia, Leymus, Thinopyrum, Vulpia* on the websites of POWO, COL, The Plant List, and planetarium.

Conclusions. Many species of the genus play significant role in agriculture as forage and erosion control, especially desert wheatgrass (*Agropyron desertorum*) and crested wheatgrass (*Agropyron cristatum*), and *Agropyron intermedium* [2]. But, there are many confusions for identify taxonomy of genus *Agropyron.* Therefore, in the future, we are going to clarify the real taxonomy of the species by conducting molecular studies on this problematic genus.

Acknowledgment. This study was supported on the basis of the «Tree of life: monocots of Uzbekistan». We are grateful to the curators of TASH access to their herbarium specimens.

References:

1. Bondarenko O.N. Agropyron Gaertn / S. S. Kovalevskaja (ed.). // Conspectus florae Asiae Mediae. T. 1 Acad. Sci.UzSSR. P. 165-179. [In Russian] Taschkent. 1968. (Бондаренко О. Н. Род *Agropyron* Gaertn / род. С. С. Ковалевская. // Определитель растений Средней Азии. Т. 1 Изд-во ФАН Узбекской ССР. С. 165-179. Ташкент, Узбекистан, 1968).

2. Britannica, The Editors of Encyclopaedia. «wheatgrass». Encyclopedia Britannica, 18 Oct. 2019, https://www.britannica.com/plant/wheatgrass.
3. Komarov, Vladimir L., and Boris K. Šiškin. Flora of the U.S.S.R (Flora SSSR). Vol. 2 Vol. 2. Bishen Singh Mahendra Pal Singh. Dehra Dun, India, 1985.
4. Schreder RR, Korovin EP, Vvedensky AI, editors.. Flora of Uzbekistan 1. Academy of Sciences of the Uzbek SSR [In Russian]. Tashkent, Uzbekistan, 1941.
5. Tzvelev N.N. Zlaki SSSR [Grasses of the USSR]. Nauka Publ. 143-150 p. Leningrad, Russia, 1976.

CZU:633.15:631.527 https://doi.org/10.53040/abap6.2022.85

ASSESSMENT OF COLLECTION MAIZE LINES' RESISTANCE TO DROUGHT AND DISEASES

BALICI Elena, GRAJDIERU Cristina*
Institute of Genetics, Physiology and Plant Protection,
Chisinau, Republic of Moldova
https://orcid.org/0000-0003-1560-7924, email: kgrejdieru@mail.ru

A characteristic feature of the ontogenesis of higher plants is the great dependence of their phenotypic structure and functions on environmental conditions at such stages of organogenesis as differentiation of the growth cone, the beginning of flower formation, preparation for gametogenesis, and the formation of male and female gametophytes[1]. In maize under moisture deficiency, the duration of the period between the end of cell division and the cessation of cell growth of styles increases significantly, which leads to a lag in the development of stigmas. High temperature and low air humidity reduce the viability of pollen and negatively affect the pollination and grain content of cobs [2].

Toxigenic fungi can infest maize at different stages of ontogenesis and use pollen as natural vector to enter ears during silk emergence [3, 4]. Due to the quantitative nature of maize resistance to accumulation of the most hazardous micotoxins and its significant dependence on external factors, breeding resistant genotypes proves to be an intricate task. No data regarding R genes associated with resistance to toxigenic *Fusarium spp*. and *Aspergillus spp*. is published. Therefore, field trials to assess maize susceptibility to major fungal pathogens associated with mycotoxin contamination remains the most adequate strategy to fetch out the most perspective genotypes.

Current study focuses on assessing the resistance to drought and susceptibility to fungi of certain maize genotypes at the generative stages of ontogenesis.

Keywords: *maize, generative stage, drought, PCR, mycotoxins, resistance, external factors*

Materials and method. Seven novel inbred maize lines obtained from synthetic populations served as plant material: MAN2488, MAN2493, MAN2491, MAN2483, MAN2470, MAN2466 and MAN2463 (Laboratory of Plant Genetic Resources' collection, IGPPP). Maize plants were cultivated on experimental cornfields under weather conditions of 2022. Visual, metrical and grading scales were used to assess genotype's drought tolerance. During generative stage, the following plant parameters were assessed: tassel flowering period, male and female inflorescence flowering time gap, pollen production properties, mature ear quantity, pollen viability, etc. Pollen viability was determined under laboratory conditions by *in vitro* germination. Maize pollen was sampled at the tasseling phase after anthesis. Total DNA was extracted using CTAB protocol. Nested-PCR was performed in 25 µl PCR-mix (Thermo Fisher Scientific) with primers to specific fungal gene sequences associated with mycotoxin production: Tri8 (DON, *F. graminearum*), FUM6 (fumonisins, *F. verticillioides* and *F. proliferatum*), AflP (aflatoxin B1, *A. flavus* and *A. parasiticus*).

Results. The influence of drought as a limiting factor during corn flowering is manifested in a significant reduction in the tassel flowering period in susceptible genotypes. The variation of the trait among the lines from two to five days was noted. The shortest (two days) interval was observed in MAN2470 and MAN2483 genotypes. A prolonged gap in the flowering of male and female inflorescences up to 3 days was recorded in MAN2493 line; in other genotypes this negative reaction was not observed. The pollen-forming capacity parameter varied from 3 points in lines MAN2470 and MAN2483 up to 5 points in MAN2463. The average level of pollen viability was 71.3%. The variation of the trait under stress conditions ranged from 56% in MAN2466 up to 89% in MAN2488.

Pollen samples were positive for mycotoxigenic strains of A. *flavus, F. graminearum, F. verticillioides* and F. *proliferatum*. Fungus *A. parasiticus*, more specific for maize rhizosphere, was absent in the studied samples. The most prevalent were fumonisin-producing *F. verticillioides* and *F. proliferatum* (21,3% and 20,7% respectively), followed by aflatoxin-producing *A. flavus* (15,5%). DON-producing *F. graminearum* was identified in 11,3% pollen samples. Therefore, overall *Fusarium* species were more abundant compared to *A. flavus*. A qualitative difference in fungal species was observed for pollen samples of the studied maize lines. No toxigenic fungi was identified in pollen samples of line MAN2488. In MAN2493, toxigenic *A. flavus* and *F. proliferatum* were identified. In MAN2491 only *A. flavus* was identified. In MAN2483 and MAN2470 lines, fumonisin-producing *F. verticillioides* was present. Pollen samples of MAN2466 were positive for *F. proliferatum* and F. verticillioides, while in MAN2463 toxigenic *F. graminearum* and *F. proliferatum* were found. Quantitative analysis using terminal dilution assay and Poisson distribution showed that genotype impact was significant ($p<.05$) on accumulation of *F. verticillioides* – among infected maize samples, MAN2466 line was the most prone to propagation of fungi. Mean values of *F. verticillioides* FUM6 copies per 100 µg of plant material were also higher compared to other genes associated with mycotoxin production. Least susceptible genotype was MAN2488.

Conclusions. Thus, under natural conditions in 2022, a field assessment was carried out for drought resistance of seven inbred maize lines. Prolonged atmospheric and soil drought contributed to the identification of genotypic differences in the main indicators of the generative phase of plant development. Despite high air temperatures and low humidity during maize generative phase that are considered suboptimal for fungal propagation, toxigenic strains of *A. flavus* and *Fusarium spp*. associated with FER, GER and *Aspergillus* ear rot diseases were found in maize pollen samples. Therefore, even during hot and dry seasons maize pollen presents a potential risk as natural vector for distribution of toxigenic fungi with subsequent ear infestation and contamination with mycotoxins. Uneven distribution of toxigenic strains among the studied lines suggest that certain genotype-dependent molecular mechanisms are involved in hindering fungal infection during pollen production. Yet, overall low percentage of infection rate and accumulation of toxigenic fungi does not allow to judge upon genotype impact on *Fusarium* and *Aspergillus* infection solely based on pollen analysis. Preliminary data presumes that MAN2466 and MAN2463 maize lines were most prone to *Fusarium* infections under drought conditions and MAN2488 genotypes showed no infection.

Acknowledgment. Research was carried out within the project of the State Program 20.80009.5107.11 "Long-term ex situ conservation of plant genetic resources in the Gene Bank using the methods of molecular biology for plant germplasm health testing", financed by the National Agency for Research and Development.

References:

1. Куперман, Ф.М. Морфофизиология растений. Изд-е 3, д. Москва, 1977. 239 p.
2. Fuad-Hassan, A., Tardieu F., Turc O. Drought-induced changes in anthesis-silking interval are related to silk expansion: a spatio-temporal growth analysis in maize plants subjected to soil water deficit. Plant. Cell Environ. 2008, vol. 31, № 9, P. 1349–1360. DOI: 10.1111/J.1365-3040.2008.01839.X
3. Kostić, A. et al. Mycotoxins and Mycotoxin Producing Fungi in Pollen: Review. Toxins, 2019, vol. 11, № 2, P. 1–20. DOI: 10.3390/TOXINS11020064
4. Thompson, M. E. H., Raizada, M. N. Fungal Pathogens of Maize Gaining Free Passage Along the Silk Road. Pathogens, 2018, vol. 7, № 4, P. 1–16. DOI: 10.3390/PATHOGENS7040081

CZU:[633.8+633.88]:631.527 https://doi.org/10.53040/abap6.2022.86

NEW ACHIEVEMENTS IN AROMATIC AND MEDICINAL PLANT BREEDING

BALMUS Zinaida*, GONCEARIUC Maria, COTELEA Ludmila, BUTNARAS Violeta

Institute of Genetics, Physiology and Plant Protection, Chisinau, Republic of Moldova

**https://orcid.org/0000-0002-1164-6435, e–mail: zinaidabalmus@igfpp.md*

Cultivation and processing of aromatic and medicinal plants (AMP), to be used for maintaining and improving health, are in continuous development in our country. Research on the species *Salvia sclarea* L. and *Lavandula angustifolia* Mill, using modern methods, was initiated at the Research Station for Aromatic Plants and Essential Oils. Since 1996, research of major importance in the field of genetics and breeding of aromatic and medicinal plants, as well as the creation of promising genotypes has been conducted at IGPPP. The cultivation of these species is particularly advantageous due to the cultivars of aromatic and medicinal plants that in droughty years produce higher amounts of good quality essential oil than in the years with normal amount of atmospheric precipitation. Our research was aimed at determining the best uses of aromatic and medicinal plants, the creation and evaluation of new genotypes of aromatic and medicinal plants, the development of cultivars and hybrids adapted to the climatic conditions of the Republic of Moldova, with superior characteristics not only from the point of view of productivity, but also of the quality of the raw material, of the essential oil, due to the high concentration of active principles; maintaining, reproducing and implementing new cultivars.

Purpose. The importance of aromatic and medicinal plants is determined by the multiple uses of essential oils in medicine, perfumery, cosmetics, aromatherapy, food etc.; for this reason, research was focused on the diversification of the initial breeding material, the improvement of the assortment of hybrids and cultivars. Genetics and breeding, as well as creation of new cultivars and hybrids is a continuous process. Each newly approved, patented cultivar is more efficient than the previous ones.

Key words: *hybrids, varieties, medicinal and aromatic plants, essential oil*

Materials and Method. The biological material used in the research is represented by androsterile and inbred lines, hybrids of different types and complexity, cultivars and first generation polycross hybrids obtained from 6 maternal forms of different genetic and geographical origin. Different methods of creating the initial material, cultivars and hybrids were used depending on the biology and specific traits of the species, the degree and the extent of the previous studies carried out on these species. The evaluation of the initial breeding material was carried out in accordance with the methods validated for aromatic and medicinal plants. The essential oil content was extracted by hydro distillation and recalculated to dry matter.

Results. Climate change requires the cultivation and use of plant cultivars that can tolerate drought, high temperatures and are characterized by high productivity. Research results demonstrate that the consequences of drought can be lessened by cultivating varieties of *Salvia sclarea* L., *Lavandula angustifolia* Mill, *Salvia officilalis* L. that, in droughty years, are characterized by enhanced synthesis of the essential oil and, therefore, high productivity. The creation of hybrids and new cultivars adapted to local conditions is indispensable. In the species *Salvia sclarea* L., in the early stages of breeding, mass and individual selection was used, which resulted in the development of the first autochthonous cultivar Moldovenesc-69 (M-69), with a two-year development cycle, and the cultivars Moldovenesc–422 (M–422) and Moldovenesc–404 (M–404). Investigations carried out using modern methods; as a result of which inbred and androsterile lines were created, started in RM in 1978. The creation and inclusion of androsterile and inbred lines of different origin in the hybridization schemes contributed to the development of hybrids. The cultivars of hybrid origin created are the result of multiple experiments during several generations of hybrids, which served as basis for the elaboration of the cultivars: Dacia 50, Dacia 99 and Victor. The genetic diversification of the quality of *Salvia sclarea* L. and the creation of genotypes with high content of essential oil was carried out with the competition of the cultivars of hybrid origin Ambra Plus (AP) and Nataly Clary (NC), both characterized by the manifestation of fixed heterosis at a number of quantitative characters, including the essential oil content. Hybrids (F_1–F_{16}) of *Salvia sclarea* L. have been created and assessed. Valuable hybrids that synthesize and accumulate essential oil content higher than 1% and F_5–F_{16} hybrids (triple, double, complex and backcross) with very high content (1.4–2.0%) were selected. Hybrids of different complexity play an important role in the development of high-productivity cultivars, serving as a basis for the development of cultivars such as: Nataly Clary, Ambra Plus, Balsam, Parfum Perfect and Ambriela. The early, middle and late blooming cultivars Ambra Plus, Ambriela, Balsam, Parfum Perfect, Dacia 99 Victor and Nataly Clary are drought tolerant. They accumulate in droughty years a high content (0.958–1.362%) of essential oil, produce about 15.1-21.4 t/ha of inflorescences in two years of exploitation of a plantation and about 41.1-77.4 kg/ha essential oil, depending on the cultivar.

New genotypes of *Lavandula angustifolia* Mill were created by polycross hybridizations, from which 10 new cultivars were selected. The best 4 cultivars (Moldoveanca–4, Alba–7, Vis magic–10 and Aroma Unica) have high productivity: 7.4 – 12.0 t/ha of inflorescences; 120–170 kg/ha of essential oil; there is a yield of 18.0–20.0 kg of essential oil, which contributes to a substantial increase in profit in agriculture. In order to induce genetic variability, hybridizations were carried out, polycross hybrids were created and assessed and those with very high essential oil content were selected.

The results obtained in the CCC tests allowed submitting 2 new cultivars (Svetlana and Favoare) to official testing.

The works performed on *Salvia officinalis* L. have resulted in the development of an early ripening variety, Miracol that is resistant to drought, frost and wintering. The producing capacity of the variety Miracol is 8.4 q/ha of dry leaves (13% of humidity) or18 kg/ha of essential oil.

A new cultivar of *Pimpinella anisum* L. named Aroma Dalba has been developed to be proposed for farm cultivation. The variety Aroma Dalba is distinguished by resistance to drought and to diseases. The seed production is 258 kg/ha content of the essential oil in fruits is 7.702% (dry matter). The production of the essential oil o the Aroma Dalba variety constituted 20.0 kg/ha.

The research on genetics and breeding of the species: *Origanum vulgare* ssp.*vulgare*, *Origanum vulgare* ssp. *Hirtum, Thymus vulgaris x citriodorus* Pers. (Schreb.) and *Ocimum basilicum var. cinnamonete rubrum* resulted in the creation and evaluation of the initial breeding material and 4 innovations, new cultivars of aromatic plants. Four plant variety patent applications were submitted to State Agency on Intellectual Property and State Commission for Crops Variety Testing of Republic Moldova.

Conclusions.

1. The research conducted over the years of activity in the field of genetics and aromatic and medicinal plant breeding resulted in the creation and homologation of about 24 cultivars, 18 of which have been patented, (*Salvia sclarea* L*., Lavandula angustifolia* Mill*, Salvia officinalis* L., *Melissa officinalis* L., *Anethum graveolens* L., *Calendula officinalis* L., *Carum carvi* L., *Coriandrum sativum* L., *Pimpinella anisum* L., *Silybum marianum* L. etc.) requested both on the domestic market and abroad.
2. The laboratory team has contributed to the development of the cultivation and processing of aromatic and medicinal plants, the implementation of high-productivity cultivars by technological transfer projects and the conclusion of contracts with economic agents from our country and from abroad.

Acknowledgment. Research was carried out within the project of the State Program 20.80009.5107.07 "Reducing the consequences of climate change by creating, implementing varieties of medicinal and aromatic plants drought, frost, winter, disease resistant, which ensures sustainable development of agriculture and guarantees high quality raw material predestined to the perfumery, cosmetics, pharmaceuticals and food industry", financed by the National Agency for Research and Development.

CZU:631.5:581.54 https://doi.org/10.53040/abap6.2022.87

OPPORTUNITIES FOR ADAPTATION AND DEVELOPMENT OF AGRICULTURE IN THE CONTEXT OF CLIMATE CHANGE

BOTNARI V.
Institute of Genetics, Physiology and Plant Protection,
Chisinau, Republic of Moldova
https://orcid.org/0000-0002-0470-0384, e-mail: vasilebotnari@yahoo.com

Keywords: *agriculture, climate, land resources, science, investment, vegetables and irrigation.*

The Republic of Moldova is in the area of risky agriculture. Limited land and water resources make the food supply vulnerable to extreme weather conditions during the year. Climate change can lead to a decrease in the productivity potential of many crops, requiring a review of crop rotation with the determination of risk areas, a review of the spectrum of diseases and pests with the continuous updating of plant protection systems.

Agriculture of the Republic of Moldova, as one of the main branches of the national economy, faces challenges aimed at demonstrating the country's food security capacity and the possibilities of exporting agricultural products. Ensuring increased harvests, of adequate quality at low costs, in different climatic conditions and forms of agriculture, requires deep technological and economic knowledge for the more rational exploitation of natural resources, the selection and efficient exploitation of varieties and hybrids of agricultural crops, maintenance and growth soil fertility.

Global warming makes agriculture more vulnerable, primarily through the lack of moisture for normal plant development and crop formation. The climatic conditions of the last decades show that drought periods and their frequency are increasing from year to year, a factor that already has a negative impact on the productivity of the soil and agricultural crops. According to the data of the Republican Meteorological Service, the droughts of 2019, 2020 and 2022 lasted more than 100 days, strongly affecting the crop formation processes of all crops, especially cereals, soybeans, sunflowers, corn, sugar beets.

In the history of agriculture in our continental climate region, drought and lack of moisture have repeatedly caused large-scale ecological and social calamities with serious consequences for many generations. In memory of a part of the native population, older in age, the terrible effects caused by the drought of 1946-1947, the ordeal and loss of property and human life, the disaster and difficulties that followed in the following period. could not be erased.

Currently, thanks to regional and global cooperation, the consequences of drought on food security can be significantly reduced, what is worse is that the imprint of what happened did not serve and does not serve as a lesson for the future. The Ministry of Agriculture, which developed and approved various versions of the Agriculture Development Strategy, somehow did not take into account global warming trends. It is known that one of the factors of these changes is the progressive warming of the global climate. Several forecasts are currently being developed based on simulation models, which demonstrate that with the increase in average annual temperature in Europe, an increase in the number of hot days, intensity and duration of drought conditions is also forecast, which in the future it may lead to the deterioration of the soil moisture regime and to an increase in the frequency of droughts throughout the territory of the republic.

Due to its geographical location, the territory of the Republic of Moldova is included in the region with insufficient humidity. According to the 3rd National Report on the implementation of the Convention of the United Nations Organization to combat desertification, the Republic of Moldova is characterized as a dry - subhumid geographical area with a hydrothermal coefficient of 0.50 - 0.65. The drought gradually leads to the intensification of the processes of desertification of the land and to the reduction of the capacity to maintain the productivity of agricultural crops [1].

The consequences of droughts have an unfavorable socio-economic character and on the environment, conditioning the degradation of the soil, the decrease in the productivity of agricultural crops, the reduction of water resources, etc. [3]. Adherence to the UN Convention to Combat Desertification provides for the development of local strategies to reduce the effects caused by drought. In this context, the development of a National strategy to adapt the agricultural sector to the effects of global warming, the improvement of irrigation technologies for different crops, the rational use of water resources for irrigation, are of indisputable importance. The insufficiency of water resources and the high cost of irrigation are obvious reasons that emphasize the need to develop recommendations to minimize irrigation water consumption, increasing its efficiency in the formation of an agricultural production unit.

Simultaneously with the positive effects expressed by increasing the harvest, in the process of long exploitation, chernozems and other types of soil under irrigation conditions, may be subject to a series of negative consequences such as: solonetization (sodium accumulation); salinization (accumulation of salts); secondary destructuring and compaction; raising the level of phreatic waters (muddling); intensification of dehumification processes (loss of humus), etc.

Such negative processes were detected as early as 1970-1990. Irrigation of the common chernozem with mineralized water from the Ialpug water basin, Taraclia during the years 1980-1985, led to moderate and in some places strong salinization of the soil. The affected area was about 3000 ha. As a result, the ability to obtain agricultural production on these lands decreased by 30-50%. Currently, the surface of irrigated lands in the Republic of Moldova has decreased from 310 thousand ha. during the 80s of the last century, up to 7 thousand ha (Informative note on the project. The national strategy for the development of the irrigation sector 2030), or dozens and dozens of times, at the same time the productivity of irrigated crops is quite modest [2].

Climate change can lead to a decrease in the productivity potential of many agricultural crops, requiring a review of crop rotation with the determination of risk areas, a review of the spectrum of diseases and pests with the continuous updating of plant protection systems. The insufficiency of water resources and the high cost of irrigation components and works are obvious reasons that emphasize the need to develop recommendations to minimize irrigation water consumption, increasing its efficiency in the formation of an agricultural production unit.

Some forecasts made by specialists warn us that towards the middle of the current century, the frequency of dry years in our area will increase 3 times. These skeptical scenarios, even at the forecast level, must conscientiously worry not only scientists but also the country's leadership, the entire society and, last but not least, the business environment.

For the efficient use of the biological potential of the new performing varieties and hybrids, the pedo-climatic, aquatic and technological resources, modern irrigation systems and equipment, it is opportune to develop and implement some pilot projects in order to carry out a cycle of scientific investigations in this field with business partners interested in developing the agricultural business through research. Demonstration plots will serve as a basis for organizing seminar schools for farmers and other categories of producers.

Acknowledgment. Research was carried out within the project of the State Program 20.80009.5107.03 "Efficient use of plant genetic resources and advanced biotechnologies to increase the adaptability of crop plants to climate change", financed by the National Agency for Research and Development.

References:

1. HG. nr. 367 privind aprobarea Programului Național de Acțiuni de Combatere a Deșertificării Publicat: 27-04-2000 în Monitorul Oficial Nr. 46-49.
2. Proiectul Strategiei Naționale de Dezvoltare a Sectorului de Irigații 2030. https://madrm.gov.md/sites/default/files/ESM, evaluare previtală,_SNDSI 2030.
3. Studiu de performanţă în domeniul protecţiei mediului, Republica Moldova ONU, New York şi Geneva, 2005. Seria de studii de performanţă în domeniul protecţiei mediului, nr. 23.

CZU:635.262:631.53.04 https://doi.org/10.53040/abap6.2022.88

YIELD OF SOFTNECK GARLIC DEPENDING ON THE QUALITY OF PLANTING MATERIAL

BOTNARI V.*, KILINCHUK A.
Institute of Genetics, Physiology and Plant Protection,
Chisinau, Republic of Moldova
**https://orcid.org/0000-0002-0470-0384, e-mail: vasilebotnari@yahoo.com*

Clove placement influences plant growth and development, as well as bulb mass formation. Peripheral garlic cloves are distinguished by their superior quality compared to internal ones (mass ratio is 60: 40%). Studies have found that using cloves from different locations without mass calibration for planting leads to different bulb ripening times, which complicates the harvesting process and leads to a deterioration in garlic quality. Sorting, with the aim of using similarly ground garlic cloves for planting, ensures uniform plant development, along with bulb ripening and better quality products.

Keywords: *garlic, bulb, cloves of garlic, planting material.*

Purpose. In culture, there are two types of garlic: those that form flower stems and those without stems. The latter, due to the complexity of obtaining the planting material, occupies relatively small areas, although it presents significant advantages in the storage process. The areas occupied by garlic that do not form flower stalks are very small, there are no industrial plantations, but they are cultivated mainly on personal plots, while, in general, planting material of commercial varieties is not used, but local forms [1].

Garlic that does not form flower stalks is characterized by a dense bulb with a spiral arrangement of cloves. Teeth of different shapes and sizes, unequal in weight, peripheral teeth are large (3-7 g), internal teeth are small (0.5-3 g). When used as planting material, differences occur between plants in terms of growth, leaf formation, bulb formation, number of cloves and crop size. Therefore, the study of the productivity potential of cloves of different sizes, depending on their location in the bulb (peripheral and internal), is of great practical importance and will contribute to a greater interest of farmers and amateur vegetable growers in the cultivation of softneck garlic. .

Materials and Method. For a comparative study of the morphological characteristics, the planting material was divided into two fractions: the cloves of the peripheral part of the bulb (B3), the cloves of the inner part of the bulb with the removal of the small ones (B2) and the cloves from different locations and without mass calibration (B1) - control. The average weight of cloves for planting in options (B3) and (B2) was 3.6 g, while in the control variant, including small ones, it was 3.2 g. see Planting scheme - a wide band with four lines (20 + 20 + 20 + 80 cm), with a distance of plants in a row of 12-13 cm. The area of the accounting plot is 2.8 m2 (2). The repetition of the experiment is four times.

Results. When planting garlic in the first decade of October, active root formation was revealed in the autumn-winter period (the number of roots per plant was 16-32 pieces). Mass seedling emergenel, taking into account the time of planting, was observed at the beginning of March. Differences in the duration of pre-emergence periods were practically not observed. There were no differences in field germination of cloves. The complete formation of bulbs under favorable climatic conditions was observed at the end of June.

The placement of the clove in the bulb, as planting material, peripheral and internal, has a significant impact on the growth, development, formation of the vegetative mass and the size of the bulbs.

The use of peripheral and internal teeth for planting ensures the formation of larger bulbs. The differences between the variants in the experiment and the control, respectively, are 4.0 g for the peripheral teeth and 3.0 g for the internal teeth.

The use of peripheral cloves for planting ensures the formation of larger bulbs. The differences between the variants in the experiment and the control, respectively, are 4.0 g for the peripheral teeth and 3.0 g for the internal teeth.

Using cloves from different locations for planting without mass calibration, compared to peripheral and internal cloves, significantly reduces growth, total plant and bulb weight. On the sectors where internal and peripheral cloves are used, the height of the plant is 65.4 and 67.5 cm, the total weight of a plant - 48.6 and 52.9 g, the weight of the bulb - 30.3 and 31.3 g, at the same time, when using cloves without mass calibration, the height of the plant does not exceed 61.5 cm, the total mass of a plant is - 42.8 g, the weight of the bulb - 27.3 g. In the structure of the bulb, the number of peripheral cloves prevails over internal ones (the ratio is 60:40%).

In batches where cloves of different sizes were used without sizing, many small bulbs were formed and yields were lowest. To get a larger harvest of garlic and high-quality material, it is better to use large fractions for planting, mainly peripheral cloves.

Table. Influence of the location of the clove in the bulb on the yield and quality of softneck garlic

Option	Total yield kg/ha	Yield structure, kg/ha			
		Yield structure, kg/ha		Non-commercial	
		kg/ha	%	kg/ha	%
B_1	6115,2	4651,2	76,06	1464,0	23,94
B_2	6787,2	5841,1	86,06	946,1	13,94
B_3	7011,2	6117,9	87,26	893,3	12,74

The results of the research allow us to conclude that the highest yield increase was observed in the variant with the use of peripheral cloves for planting, where 996.0 kg/ha more than the control and 226.8 kg/ha were obtained. compared to the variant with the internal teeth.[2].

Research has also found that using cloves from different locations in the bulb for planting without mass calibration leads to a difference in bulb maturity, which makes harvesting more difficult and leads to additional labor costs. At the same time, 24% of the harvest are small unmarketable bulbs. Using cloves of the same weight for planting ensures uniform ripening, a high proportion of standard bulbs and high quality planting material.

Conclusions.

1. The use of large fractions of predominantly peripheral cloves as planting material ensures the formation of a higher yield and quality of garlic bulbs.
2. In the structure of the bulbs, the peripheral cloves have higher commercial and planting qualities than the inner cloves, the ratio of their mass in the bulb is within 60:40%.

Acknowledgment. Research was carried out within the project of the State Program 20.80009.5107.03 “Efficient use of plant genetic resources and advanced biotechnologies to increase the adaptability of crop plants to climate change”, financed by the National Agency for Research and Development.

References:

1. Botnari, V., Chilinciuc, Al. Yield of non-shooting garlic, depending on the position of the cloves in the bulbs. În: Biotehnologii avansate – realizări și perspective: tezele simpoz. șt. intern., 21-22 oct. 2019. Ed. a 5-a. Chișinău, 2019, p. 141. ISBN 978- 9975-56-695-7.
2. Килинчук, А.И., Ботнарь, В.Ф. Агробиологические особенности выращивания нестрелкующегося чеснока. В: Селекция, семеноводство и технологии возделывания сельскохозяйственных культур: междунар. науч.-практ. конф., Тирасполь, 10 апр. 2020 г. Тирасполь, 2020, с. 288-292. ISBN 978-9975-3404-1-0.

CZU:582.929.4:631.527 https://doi.org/10.53040/abap6.2022.89

VALUABLE QUANTITATIVE CHARACTERS STUDIES ON LAVENDER VARIETIES

BUTNARAS Violeta, BALMUS Zinaida*, GONCEARIUC Maria,
COTELEA Ludmila, DUBIT Tatiana
Institute of Genetics, Physiology and Plant Protection,
Chisinau, Republic of Moldova
**https://orcid.org/0000-0002-1164-6435, e-mail: butnarasvioleta@igfpp.md*

With an increased content of essential oil in the 3rd year of vegetation, the lavender clone varieties showed: Fr.5S-8-24 with 6.082, Alba 7-5.784% and Fr. 8-5-15V-5.632% (dry matter). The production of raw material is higher in the variety - late clone Fr.5S-8-24, this being 5.3 t/ha. The highest production of essential oil was attested to the varieties - clones Fr.5S-8-24 (133.3 kg/ha) and Fr. 8-5-15V (97.3 kg/ha) and VM-18V (73.4 kg/ha). The yield of the essential oil in the evaluated clone varieties is 25.2 kg/t for Fr.5S8-24, 21.6 kg/t for Fr.8-5-15V and 18.4 kg/t for the VM-18V genotype.

Keywords: *lavender, species-clones, essential oil, productivity*

Breeding programs for *Lavandula angustifolia* Mill. include the following agronomic characters: high productivity, precocity, resistance to drought, resistance to frost and wintering, tolerance to diseases and pests, superior quality of the raw material. The high content and quality of the essential oil is one of the main tasks in improving lavender. **The purpose** of the research is the evaluation and creation of new clone varieties of lavender with valuable quantitative characters, which are of interest to the agrarian sector, farmers, peasant households and specialized companies that deal with the cultivation of the species.

Materials and Method. As biological material, 9 clone varieties of lavender were used in CCC (Fr.5S-8-24; Cr.13S-6-7; Cr.13S-6-35; VM-18V; Fr.8-5 -15V; Vis magic 10; Alba 7; Moldoveanca 4 and Aroma Unica), third year of vegetation. The experience was located on an area of 1300 m.p., on the experimental fields of the Institute of Genetics, Physiology and Plant Protection. The varieties - clones were planted on the soil surface of 1.4 m x 0.6 m in four repetitions. In early spring, the winter and frost resistance of the varieties was determined, by evaluating the number of shoots per frozen plant, it was appreciated and scored from 1 to 5 points. Phenological evaluations by calendar notation of development phases. Biomorphological evaluations (value of quantitative characters, which ensure productivity - number of floral stems per plant, length of inflorescence, spike, floral stem, number of vertices per floral spike) according to the UPOV Guide and the methods in force. Separation of the essential oil first hydrodistillation in Ginsberg apparatus from samples of fresh inflorescences taken in certain phases of development, hours; determination of oil content; determining the moisture level of plant samples and recalculating the oil content at standard humidity (60%) and at dry matter.

Results. The essential oil content is a valuable trait for cultivars - perspective clones. Under this aspect, during the period 7.07.2021 – 12.07.2021, the essential oil content of the evaluated genotypes is represented depending on the ripening group. Thus, the early genotype Fr.8-5-15V is characterized by a very high essential oil content of 5.632% in relation to the variety - control clone Moldoveanca 4, which accumulated - 4.764% (dry matter).

The late season clone variety Fr.5S8-24 late recorded an essential oil content of 6.082% , the control variety Moldoveanca 4 under the same conditions has an essential oil content of 4.625% (dry matter).

On average per season, in the 3rd year of vegetation the hybrid Fr.5S8-24 accumulated a content of 5.475% of essential oil compared to the variety - control clone Alba 7 with a content of 5.411% (dry matter). The hybrid Fr.8-5-15V (5.474%) was also characterized with high indices. The control variety Moldoveanca 4 accumulated a content of 4.434%. From the medium ripening group, the hybrid VM-18V stood out with 4.482%, the control variety Vis Magic 10, is characterized by only 4.405%. These are the seasonal averages for essential oil content in dry matter. In the 3rd year of vegetation, the production of raw material was determined for the tested lavender clone varieties. Fr.5S8-24 (5.3 t/ha) and Fr.8-5-15V of 4.5t/ha showed the highest production of raw material (inflorescences). Fr.5S8-24 (2.514%) and Fr.8-5-15V (2.162%) accumulated the highest essential oil content in the fresh raw material at standard humidity.

The production of essential oil in some clone varieties is higher than in controls. The clone variety Fr.5S8-24 from the late maturing group proved to be more productive, which ensured an essential oil production of 133.3 kg/ha, 26.1 kg/ha more than the control Alba 7. For the mentioned character the early Fr.8-5-15V was also highlighted, which manifested itself with 12.7 kg/ha of essential oil more than the control Moldoveanca 4. As a result of the data obtained, we can mention that the lavender clone varieties included in comparative competition crops they also have a higher essential oil yield than the controls: 25.1 kg/t at Fr.5S8-24, 21.6 kg/t at Fr.8-5-15V.

The research carried out over several years resulted in the creation of two new varieties of lavender, Svetlana (Fr.5S8-24) and Favoare (Fr.8-5-15V), a Patent Application was submitted to AGEPI, Application of registration in the State Register.

The clone variety Svetlana belongs to the late maturity group. 71.5cm height, 93.3cm plant diameter, spread shape with 854 flower stems. The leaves are dark green and oblong-lanceolate in shape. The shape of the spike - fusiform. The calyx is dark purple, the corolla dark purple. The length of the floral stem is 22.8 cm, and the floral spike is 9.5 cm. Essential oil content at standard humidity (60%) -2.323%, dry matter

5.721%. Essential oil production: 179.2 kg/ha. Yield: 23.4 kg of essential oil/ton of raw material. It is appreciated with a high resistance to frost and wintering of 5 points.

Favoare clone variety - early maturity group. Subshrub with a waist of 68.0 cm, plant diameter 91.3 cm, spreading form with 835 flower stems. Light green leaves, linear shape. Spike shape – narrow-conical. Calyx blue-violet, corolla light purple. The length of the floral stem is 25.cm, and the floral spike is 8.5 cm. Raw material production (inflorescences) - 7.4t/ha. Content in essential oil, at standard humidity (60%) - 2.077%, at dry matter -5.157%. Essential oil production - 155.2 kg/ha. The yield of 20.7 kg of essential oil/ton. It is appreciated with a high resistance to frost and wintering of 4.5 points.

Conclusions.

1. The clone varieties evaluated in comparative competition crops are distinguished by increased productivity and high content of essential oil, Fr.5S8-24 (2.514%) and Fr.8-5-15V (2.162%) accumulated the highest essential oil content in the fresh raw material at standard humidity.
2. With an increased content of essential oil in the 3rd year of vegetation, the clone varieties showed: Fr.5S-8-24 with 6.082, Alba 7-5.784% and Fr. 8-5-15V-5.632% (dry matter).
3. Two new varieties of lavender with outstanding quantitative characters were created: Svetlana (Fr. 5S8-24) and Favoare (Fr. 8-5-15V), which can be used in the pharmaceutical and food industries, as honeydew and anti-erosion plants.

Acknowledgment. The research was carried out within the project of the State Program 20.80009.5107.07"Diminishing the consequences of climate change by creating and implementing varieties of medicinal and aromatic plants with high productivity, resistant to drought, wintering, diseases, which ensures sustainable development of agriculture, guarantees high quality products, predestined for the perfumery, cosmetics, pharmaceuticals, food industry" funded by the National Agency for Research and Development.

CZU:575.22:575.116:631.52 https://doi.org/10.53040/abap6.2022.90

THE GENETIC RESOURCES THE BACKGROUND FOR BIODIVERSITY-AND NEW SPECIES

BUTNARU Gallia
Banat University of Agricultural Sciences and Veterinary Medicine
„King Mihai I of Romania" from Timisoara, Romania
e-mail: galliab@yahoo.com

The genetic resources is commonly used as a method to increase the genetic flexibility of crops is to make use of the gene pool of related wild relatives with this.

In Europe and almost all over the world, the scientific and professional organization EUCARPIA, through its 12 sections, summarizes knowledge related to existing genetic resources, connects institutions, gene banks and researchers from all over the world for collaboration. Within the *Genetic Resources* section, new methods and techniques can be rapidly integrated into the plant breeding.

EUCARPIA in collaboration with COMMYT Mexico have played an important role in promoting Triticale worldwide. Thus, from 1972 until today, they support all the international events related to triticale (1973 - 3, 1980 - 1 and 1984 - 1). At the first International Triticale Symposium in Australia (1986) ITA (*International Triticale Association*) was founded, together supporting and organizing the following symposia (1986 - 2022 - 12 events).

In the list of new performances from gene pool utilization is Tritipyrum (*Triticum durum* × *Thinopyrum bessarabicum*), a specie with genes of tolerance to salinity and drought proposed for breeding programs.

The paper will discussed in parallel the two species created by man, which contribution of diversified the genetic resources.

If we talk about triticale today as a cereal of major importance for the economy of some countries (Poland), or about productions of over 7000 kg/ha (Belgium, Romania), we can say that Tritipyrum is at the beginning of its importance.

In both species, primary and secondary forms were created and exists (*Roudbari*, *Nejad*, *Hassani*, 2017), meiotic instability is manifested in both types of hybrids (*Shahriari*, *Assad*, *Hassani*, 2012), both crops have a good tolerance to abiotic stress (*Hassani*, *Borner*, *Mohamadinejad*, *Roudbari*, *Zeinali*, 2018).

Both species had a period of pioneering, of fundamental research, long for triticale, almost 100 years, and one of actual breeding, of approximately 50 years. It took around 30 years to create and improve Tritipyrum.

In order for triticale to reach recognition as a cereal of economic importance, more than 150 years were needed in which the improved technological progress has been used (mutagenesis, *in vitro* cultivation, improvement assisted by molecular markers). Tritipyrum benefited from the knowledge gained in the production and improvement of triticale.

Both species contributed to the genetic diversification of cereals, to obtaining new combinations of genes and to new phenotypic performances.

Their future is from now on.

CZU:635.71:575.22 https://doi.org/10.53040/abap6.2022.91

NEW GENOTYPES OF THE SPECIES *Thymus* X *Citriodorus* (PERS.) SCHREB. – PRODUCTION AND QUALITY

CHISNICEAN Lilia[1], VORNICU Zinaida[1], IVANTOVA Irina[1], GRIGORAS Valentin[2]
[1]*Institute of Genetics, Physiology and Plant Protection, Chisinau, Republic of Moldova*
[2]*National Institute of Research and Development for Biological Sciences Bucharest, "Stejarul" Biological Research Center Piatra-Neamt, Romania*
e-mail: chisniceanl56@gmail.com

The article presents the results of CCC testing of a new cultivar of lemon thyme – Citronel-pink of the species *Thymus x citriodorus* (Pers.) Schreb. as pharmaceutical remedy, food and melliferous plant, obtained by clonal selection, for the purpose of promoting and implementing it in industrial production.

Keywords: *thymus, plant height, production, essential oil, herba, citral*

Thymus x citriodorus (Pers.) Schreb. is becoming more and more popular, being in great demand, not only as an ornamental and honey plant [1, 2] or a medicinal remedy with unique healing properties [3], but also as a valuable aromatic-spice herb used in the mixture known as "Herbs de Provence" in Europe, Turkey [4] and Iran [5]. The spasmolytic effect [6] and antimicrobial properties, which are due to terpenoids and flavonoids [7], have been confirmed scientifically. The antioxidant activity is due to phenols [8] and to the content of rosmarinic acid. The essential oil has natural preservative properties, important in cooking, when preparing canned foods, marinades or desserts to extend the shelf life of products [9]. Lemon thyme – has many medicinal, aromatic and ornamental qualities, which motivated us to breed it and identify new forms, better adapted to the weather conditions of our country, with a wider range of usage than the spice-aromatic one.

Materials and Method. As initial research material, we used three cultivars of *Thymus vulgaris* var. *citriodora* (Pers.) Schreb., which were procured at an exhibition with sale of planting material and a form of thyme (spontaneous hybrid between *Thymus pulegioides* L. x *T. vulgaris* L.). As a result of clonal selection, several forms were obtained, from which two forms with the highest productivity of raw material and essential oil were selected. The new forms are much more resistant to winter conditions, excluding the need to protect (cover) the plants during the cold period of the year, and are less vulnerable to the long deficiency of precipitation, which is increasingly common in recent years. Cultivated thyme, being a very polymorphic species, should, in our opinion, be propagated by vegetative methods to maintain the obtained characteristics.

Therefore, it was propagated vegetatively. The new forms were provisionally named: C.FI – the control and C.FN – the new cultivar permanently named Citronel-pink.

Results. The CCC testing of the obtained constant forms allowed us to observe that the plants of the tested cultivars are small 21-24 - 25.5 cm, the new cultivar growing slightly larger, depending on the seasonal weather conditions. The diameter of the bush is increasing from year to year, by increasing the number of branches per bush. The duration of the growing season until harvesting was from 85 to 111 days, varying in different years, and was 91 days on average for both cultivars, which were harvested simultaneously.

Table 1. Biomorphological parameters of the *Tyhmus x citriodorus* cultivars, 2019-2021 (average values)

Cultivar	Parameter	Plant height, cm	Bush diameter cm	Number of branches per plant	Inflorescence length, mm	Days until harvesting
C.FI, control	X	24.0	45.3	217.3	2.2	91
	Sx	1.12	3.12	5.8	1.0	-
C.FN, Citronel-pink	X	26.4	64.8	447.3	2.4	91
	Sx	1.45	3.08	6.7	1.1	-

The average productivity of fresh raw material was slightly higher in the new cultivar by 0.99 kg, which was statistically confirmed. When the plants were in full bloom, the essential oil content was assessed, which was 0.285% in the control and 0.32% in the new cultivar, recalculated per hectare, it would be equal to 7.24 kg and 10.3 kg/ha, respectively.

Table 2. The productivity indices of *Tyhmus x citriodorus* cultivars, 2019-2021 (average values)

Tested cultivars	Essential oil content,%		Raw material productivity		
	raw material	dry matter	fresh, t/ha	dry, t/ha	essential oil, kg/ha
C.FI, control	0.303	1.150	3.381	1.060	10.24
C.FN, Citronel-pink	0.326	1.247	4.264	1.344	13.9
DL_{05}	-	-	0.61	-	2.08

It was statistically confirmed that the average productivity of fresh raw material was slightly higher in the new cultivar by 0.88 kg. When the plants were in full bloom, the essential oil content was assessed, which was 0.303 % in the control and

0.326% in the new cultivar, recalculated per hectare, it would be equal to 10.24 kg in the control and 13.9 kg/ha in the new cultivar. For the implementation of the new cultivar, the Patent application no. 580 has been submitted to the State *Agency* on Intellectual Property (AGEPI) and the Application for registration no. 2365085 – to the State *Commission* for *Variety Testing (*CSTSP*)*.

Conclusions. The new cultivar Citronel-pink of *Thymus x citriodorus* can achieve high productivity of raw material to be used for fresh consumption, essential oil extraction, or as pharmaceutical herb in the production of herbal teas and pharmaceutical extracts.

Acknowledgment. The research was carried out within the project of the State Program 20.80009.5107.07 "Reducing the consequences of climate change by creating, implementing varieties of medicinal and aromatic plants drought, frost, winter, disease resistant, which ensures sustainable development of agriculture and guarantees high quality raw material predestined to the perfumery, cosmetics, pharmaceuticals and food industry", financed by the National Agency for Research and Development.

References:

1. Antonie, Iuliana, The biodiversity of the melliferous plants in the surroundings of the town Sebeș (Alba County) and their economical importance. Sebeș: Economic Engineering in Agriculture and Rural Development, Series Management, 2014, Vol.14 (4):13-18
2. Крохмаль, И. Итоги интродукции декоративных видов коллекции низкорослых и почвопокровных травянистых многолетников в Донецком Ботаническом саду НАН Украины. Бюлл. Ботан. сада ДВО РАН. 2010. Вып. 7. С. 135-151.
3. Аль Карави, Х. Особенности накопления фармакологически значимых соединений в представителях рода Тимьян (Thymus L.) В сб. конференции «Новые и нетрадиционные растения и перспективы их использования», Материалы XI международного симпозиума.15-19 июня 2015 года. Пущино. М.: 2015. С.51-53.
4 Bagdat R., et all. and Quality Parameters of *Thymus citriodorus* (Pers.) Schreb. (Synonym *T. fragrantissimus*, *T. serpyllum citratus* and *T. serpyllum citriodorum*) cultivated under Ankara Ecological Conditions. 59th International Congress of GA, Volume: Planta Med. 2011.Vol. 77. P. 1229-1472.
5 Omidbaigi, R. et al. Essential Oil content and constituents of *Thymus × citriodorus* L. at Different Phenological Stages. Journal of essential oil-bearing plants. 2000.12(3). P. 333-337.

6 Broucke, C. et all. Spasmolytic activity of the flavonoids from *Thymus vulgaris* Pharmaceutics Weekblad.1983. Vol. 5. Issue 1. P. 9–14.
7 Horikrrisha, D. et al. Pharmacological investigation of flavonoid glucoside. Indian Journal of Pharmacology. 2004. Vol.36. P. 244-250.
8 Marhamatizadeh, M., Goosheh S. The combined effect of Thymus vulgaris extract and probiotic bacteria (Lactobacillus acidophilus and Bifidobacterium bifidum) on aflatoxin M1 concentration in kefir beverage. Italian Journal of Food Science. 2016. T.28. - N 3. - P. 517-524.

CZU:[502.75+502.8](478-25) https://doi.org/10.53040/abap6.2022.92

CONSERVATION OF MEDICINAL PLANT RESOURCES IN THE NATIONAL BOTANICAL GARDEN (INSTITUTE) "Al. CIUBOTARU"

CIOCARLAN Nina
"Al. Ciubotaru" National Botanical Garden (Institute), Chisinau, Republic of Moldova
https://orcid.org/0000-0002-9477-5848, e-mail: n_ciocarlan@mail.ru

Botanical Gardens play a key role in *ex situ* conservation of plants and always hosted collections of useful plants as one of their primary tasks [2]. The collection of medicinal plants from the National Botanical Garden (Institute) "Al. Ciubotaru" (NBGI), with a long and rich history, has experienced a real development in the last decades. The main activities are focused on the mobilisation and continuous maintenance of medicinal plant genetic resources, elucidation of bioecological and ontogenetic characteristics under *ex situ* conditions, phytochemical studies and agronomic aspects for introduction into primary culture. **The purpose** of the study was to inventory and analyse the gene pool of medicinal plants from NBGI in the 2021-2022 vegetation seasons and bring some scientific results on the most important plant genera from collections studied in recent years.

Keywords: *medicinal plants, ex situ collection, research, conservation*

Materials and Method. As the base of this study, the Collection of Medicinal Plants from the NBGI has served. The source of the mobilization of the medicinal plant genetic resources is: the international exchange of seeds (*Index Seminum*); seeds and vegetal material collected in natural habitats during expeditions; seeds of local reproduction. The studies on introduction of plants by the method of generic complexes were performed according to methodological guidelines [3-5].

Results. The current gene pool of medicinal plants contains 314 taxa (species, subspecies, varieties and cultivars) belonging to 61 families and 164 genera. Predominates perennial herbaceous plants, annual plants – 35 species, medicinal shrubs – 28 taxa. The most representative families are: Lamiaceae Lindl. (29 genera, 101 species), Asteraceae Dumort. (24 genera, 51 species), Rosaceae Juss. (14 genera, 26 species), Scrophulariaceae Juss. (4 genera, 17 species), Fabaceae Lindl. (7 genera, 10 species), Apiaceae Lindl. (5 genera, 7 species) and Ranunculaceae Juss. (6 genera, 7 species). A long-term introduction experiment made possible to create generic complexes and to carry out comparative, complex and interdisciplinary studies (biological, phytochemical, agronomic) in order to highlight the species of perspective for the national economy. The genera with the highest number of species are: *Salvia* L. (with 13 species), *Teucrium* L. (9), *Achillea* L. (9), *Thymus* L. (9), *Artemisia* L. (9), *Mentha* L. (8), *Digitalis* L. (8), *Tanacetum* L. (8), *Scutellaria* L. (8), *Nepeta* L. (7), *Potentilla* L. (7), *Origanum* L. (6), *Geum* L. (5), *Echinacea* Moench (4), *Leonurus* L. (4). In the last two decades, through international seed exchange, the collection was enriched with over 130 taxa received by *Index Seminum* from more than 50 botanical gardens and other specialized scientific institutions. More than 100 species were added to the collection from the local spontaneous flora [1].

The collection contains plants used, both in traditional and modern medicine, in the treatment of various diseases: medicinal plants used to treat cardiovascular disorders, plants with expectorant, antiasthmatic and emollient effects, plants used for digestive, urinary, liver and biliary diseases, plants used in skin disorders, in the treatment of rheumatic pain etc.

The adaptogens group of plants is represented by: *Aralia mandshurica* Rupr. et Maxim., *Eleuterococcus senticosus* (Rupr. et Maxim.) Maxim., *Schisandra chinensis* (Turcz.) Baill., *Securinega suffruticosa* (Pall.) Rehd., *Ocimum sanctum* L. Tinctorial species includes: *Coreopsis tinctoria* L., *Genista tinctoria* L., *Phytolacca americana* L. *Rivina tinctoria* Ham. ex G. Don, *Rubia tinctorum* L., *Indigofera gerardiana* (Wall.) Baker). The number of medicinal shrubs in the collection is in continuous growth: *Vitex agnus-castus* L., *V. cannabifolia* Siebold. et Zucc., *V. negundo* L. *Viburnum opulus* L., *Chaenomeles japonica* Thumb., *Crataegus monogyna* Jacq., *Hippophae rhamnoides* L., *Berberis vulgaris* L., *Pentaphylloides fruticosa* (L.) O. Schwarz.

A complex, interdisciplinary studies are carried out on *Teucrium* L. species (*T. hircanicum* L., *T. nuchense* K. Koch, *T. asiaticum* L., *T. creticum* L., *T. botrys* L., *T. flavum* L., *T. lucidum* L., *T. orientale* L., *T. scorodonia* L.); *Thymus* L. species and cultivars (*Th. vulgaris* L., *Th. vulgaris* L. '*Faustini*', *Th.* × *citriodorus* Schreb., *Th.* × *citriodorus* Schreb. '*Aureus*', *Th. marschallianus* Willd.); *Salvia* L. species (*S. aethiopis* L., *S. austriaca* L., *S. sclarea* L., *S. nutans* L., *S. verticillata* L. and *S. nemorosa* L.); *Artemisia* L. species (*A. annua, A. absinthium* and *A. lerchiana*); *Satureja* L. species (*Satureja montana* L., *S. kitaibelii* Wierzb., *S. parnassica* Heldr. et Sart. ex Boiss., *S. hortensis* L., *S. calamintha* (L.) Scheele., *S. subspicata* Bartl. ex Vis., *S. montana* ssp. *illyrica* Nyman).

Primary introduction studies are conducted on species of the genera *Tanacetum* L. (*T. parthenium* L., *T. boreale* Fisch. Ex Link, *T. balsamita* var. *tanacetoides* Boiss., *T. balsamita* var. *balsamitoides* (Sch . Bip.) Grierson, *T. cinerariifolium* (Trev.) Sch. Bip., *T. vulgare* L., *T. odessanum* (Klok.) Tzvel. și *T. corymbosum* (L.) Scop.) used as remedies in folk medicine since ancient times around the world; *Scutellaria* L. (*S. baicalensis* Georgi, *S. altissima* L., *S. albida* L., *S. albida* ssp. *colchica* (Rech. f.), *S. supina* L., *S. orientalis* L., *S. alpina* L., *S. incana* Biehler), therapeutically important species, but also with special ornamental value; *Achillea* L. (*A. clypeolata* Sibth. et Sm., *A. filipendulina* Lam., *A. millefolium* L., *A. nobilis* L., *A. ochroleuca* Ehrh., *A. odorata* L., *A. colina* L.) etc.

A study on poisonous species with important medicinal value, with an emphasis on the *Digitalis* L. species was initiated. The genus is represented in the collection by 8 species: *D. lanata* Ehrh., *D. grandiflora* Mill., *D. purpurea* L., *D. ferruginea* L., *D. lutea* L., *D. lamarckii* Ivanina, *D. micrantha* Roth ex Schweigg., *D. laevigata* Waldst. ex Kit.

The collection includes a good number of rare and endangered therapeutically important species native to local flora (*Achillea ochroleuca* Ehrh., *Aconitum lasiostomum* Rchb. ex Bess., *Adonis wolgensis* Stev., *Centaurea thirkei* Sch. Bip., *Convolvulus lineatus* L., *Crambe tataria* Sebeok, *Digitalis lanata* Ehrh., *Dryopteris filix-mas* (L.) Schott, *Hepatica nobilis* Mill., *Herniaria glabra* L., *Leucojum aestivum* L., *Nepeta parviflora* M. Bieb., *Scopolia carniolica* Jacq.) and detailed studies on their propagation and conservation perspectives are conducted.

Conclusions. The Collection of Medicinal Plants from NBGI totals 314 taxa**,** belonging to 61 families and 164 genera. As a result of a long-term introduction experiment it has been created generic complexes: *Salvia* (with 13 species), *Digitalis* (10), *Teucrium* (9), *Achillea* (9), *Thymus* (9), *Artemisia* (9), *Menth*a (8), *Tanacetum* (8), *Scutellaria* (8) etc., which allowed carry out comparative, complex and interdisciplinary studies in order to highlight the species of perspective for pharmaceutical and food industry. The entire gene pool of the collection serves primarily as a basis for introduction and conservation research in order to improve the range of medicinal plants with a view to use in the national economy.

Acknowledgment. The research was supported by the National Agency for Research and Development (ANCD) through the project CerCoFlor 20.80009.7007.22.

References:

1. Ciocârlan N. Taxonomic diversity of medicinal plants collection from Botanical Garden (Institute) of ASM. Journal of Botany, 2015, vol. VII, Nr. 2(11), p. 85-90.
2. Hawkins B. Plants for Life: Medicinal plant conservation and Botanic Gardens. Botanic Gardens Conservation International: Richmond U. K., 2008, p. 1- 48.
3. Майсурадзе Н.И., Черкасов О.А., Тихонова В.Л. Методика исследований при интродукции лекарственных растений. ЦБНТИ. Сер. Лекарств. растениеводство. М., 1984, N3, 33 стр.
4. Методика фенологических наблюдений в ботанических садах СССР. Бюл. ГБС АН СССР, 1972, вып. 113, стр. 3-8.
5. Русанов Ф.Н. Метод родовых комплексов в интродукции растений и его дальнейшее развитие. Бюл. ГБС АН СССР. 1971, Вып. 81, с. 15–20.

CZU:635.64:57.08 https://doi.org/10.53040/abap6.2022.93

STUDY OF THE STORAGE POTENTIAL OF TOMATO *(Solanum lycopersicum* L.*)* COLLECTION SAMPLES UNDER *EX SITU* CONSERVATION

CORLATEANU Liudmila[1*], MELIAN Lolita[1**], MIHAILA Victoria[1***], GANEA A. [1#], PITYUL M. [2]

[1]*Institute of Genetics, Physiology and Plant Protection, Chisinau, Republic of Moldova;*

[2]*Pridnestrovian Scientific Research Institute of Agriculture, Tiraspol, Republic of Moldova*

https://orcid.org/ 0000-0002-1018-1832,https://orcid.org/0000-0002-9192-0560, ***https://orcid.org/0000-0003-3984-9477, #https://orcid.org/0000-0002-8658-6879*

e-mail: lcorlateanu@yahoo.com

In long-term *ex situ* conservation of plant germplasm in genetic banks, the main task is to preserve the viability of the seeds, since as a result of aging the seeds gradually lose their germination capacity and genetic homogeneity [6]. Therefore, the study of the storage potential (SP) of seeds is a very important step for *ex situ* conservation of plant genetic resources, especially during long-term storage of collection accessions in a plant genetic bank. In recent years, the determination of this potential has been practiced in many plant genetic banks in different countries [2, 4]. In order to study the storage potential, which indicates the longevity of collection samples during storage, the method of accelerated aging (AA) of seeds is of great interest, the essence of which consists in the artificial acceleration of aging by exposing seeds for a short time at elevated temperature and high relative humidity [1]. There are a number of studies that compared the physiological and biochemical changes in seeds during accelerated aging and long-term storage. Accelerated seed aging allows evaluating the differences between varieties of different types of crops. With the help of the test, it is possible to monitor gene pool samples, i.e. to conduct a permanent record of seed viability and classify genotypes from working and active collections according to the parameters of AA. The test allows to: 1. Identify samples that are not suitable for long-term storage. 2. Give recommendations on the timing of seed reproduction. 3. Indicate the need to restore the viability of valuable collection samples. **The aim** of the research was to study the storage potential of tomato collection samples according to various morphophysiological and biochemical parameters of seeds and seedlings after applying tests for accelerated aging of seeds and electrolyte leakage and to gradate genotypes for this complex trait before *ex situ* conservation.

Keywords: *tomato, viability, accelerating aging, storage potential, ex situ conservation*

Materials and Method. To determine the storage potential of tomato collections, the seed AA- test was used as described in the Handbook of vigor test methods [1]. For tomato seeds, AA- test is recommended to be carried out at an air temperature of 41°C, relative air humidity of 90 - 100%, the aging period is 72 hours. It is often necessary to correct these conditions during the aging of seeds of a particular genotype. For some samples of tomato, a different aging temperature was selected: 42-43°C and a different aging period - 96 hours. The following collection tomato samples were tested: *Serenada*, *Luch*, *Laguna*, *Lyana*, *Potok*, *Zolotaya osen'*, obtained from the Pridnestrovian Scientific Research Institute of Agriculture. In each variant, there were 300 seeds, the experiments were carried out in 3-fold repetition. The control group was tomato seeds of the last reproduction. Data were processed using the *Statistica 7* software package. After AA of seeds, various morphophysiological parameters of tomato seeds and seedlings were determined: germination energy and seed germination, root length, wet and dry root biomass according to the International Rules For Seed Testing [3]. The leakage of electrolytes was determined by the electrical conductivity of solutions with normal and aged seeds [5].

Results. The drop in the germination energy and germination of tomato seeds after the AA-test in comparison with the control was 9.6 - 56.3% and 6.7 - 29.4%, respectively, which indicates the genotypic specificity of the tested samples. Tomato genotypes according to such important indicators as germination energy and seed germination were divided into 2 groups, taking into account changes in these parameters after the test. Group 1 (high SP) included *Serenada*, *Laguna*, and *Lyana* genotypes; in the 2nd group (middle SP) - *Luch*, *Potok* and *Zolotaya osen'* genotypes. In the group of tomato accessions with a high storage potential after AA-test, seed germination remained at a fairly high level: 88.9–93.3%. The drop in seed germination compared to the control averaged by 6.7–9.9%. In the group of genotypes with a middle storage potential after AA-test, seed germination was in the range of 66.2–76.9%. The decrease in this parameter compared to the control is 20.2 - 29.4%. After AA of seeds of various tomato genotypes, a change in other morphophysiological parameters was also observed, namely: the length and wet biomass of roots. The length of seed roots after AA of seeds varied from 9.4 to 16.6 mm depending on the genotype. The maximum inhibition of the development of the root system after the action of high temperature and air humidity was observed in the seeds of the samples *Luch* and *Zolotaya osen'* (middle SP), the decrease in the length of the roots in these variants compared to the control was 1.7-1.8 times. The root system of *Serenada* and *Laguna* samples (high SP) suffered the least damage, the length of roots in these genotypes decreased by 0.67 and 0.74 mm, respectively. In different tomato genotypes, the wet biomass of roots in the control ranged on average from 50.0 to 120.0 mg, and after testing, the decrease in wet biomass was 10.0–60.0 mg compared to the control. The wet biomass of rootlets decreased to the maximum in *Serenada* and *Lyana* genotypes – by 40.0 and 60.0 mg. The leakage of electrolytes was determined by the electrical conductivity of solutions with normal and aged seeds using a conductometer at an exposure of 48 hours. The maximum increase in the electrical conductivity of solutions was found after AA of seeds in genotypes with an average storage potential (*Potok* and *Zolotaya osen'*): by 1.1 and 1.6 mS/m compared with the control. In genotypes with a high storage potential: *Lyana*, *Laguna* and *Serenada*, this indicator increased slightly compared to the control, respectively by 0.30, 0.60 and 1.0 mS/m, which is a favorable factor for maintaining the viability of seeds. Thus, these genotypes did not show a sharp increase in the leakage of electrolytes. An increase of the electrical conductivity of solutions with seeds after AA-test is explained in the literature by an increase in the permeability of protoplasm. The determination of this parameter once again proved that this test is very indicative in the gradation of genotypes according to the longevity of seeds under conditions of *ex situ* conservation.

Conclusions.

1. New conditions of tomato seeds ageing for local hybrids were proposed and tested: air temperature - 42-43°C, ageing period - 96 hours.

2. The accelerated aging test allows determining the storage potential of seeds, which makes it possible to characterize the ability of tomato samples for *ex situ* conservation in the plant genetic bank.

3. The gradation of tomato genotypes according to seed storage potential was carried out. High SP: genotypes Serenada, *Laguna* and *Lyana*; medium SP: genotypes *Luch*, *Potok* and *Zolotaya osen'*.

Acknowledgment. Research was carried out within the project of the State Program 20.80009.5107.11 “Long-term ex situ conservation of plant genetic resources in the Gene Bank using the methods of molecular biology for plant germplasm health testing”, financed by the National Agency for Research and Development.

References:

1. Hampton, J. G. and Tekrony, D. M. Handbook of vigor test methods. International Seed Testing Assn, Zurich, Switzerland, 1995, 120 p.
2. Havstad, T., Aamlid, T. and Lomholt, A. Evaluation of vigor tests for determination of seed storage potential in red clover (*Trifolium pratensis* L.) and timothy (*Phleum pretense* L.). In: Seeds Science and Technology. 2011, V. 39, p. 637-648.
3. International rules for seed testing. M.: Kolos, 1984, 310 p.
4. Mielezrski, F. and Marcos-Filno, H. Assessment of physiological potential of stored pea (*Pissum sativum* L.) seeds. In: Journal of Seed Science. 2013, V. 35, p. 42-50.
5. Алексейчук Г.Н., Ламан Н.А. Физиологическое качество семян сельскохозяйственных культур и методы его оценки. Минск, 2005, 48 с.
6. Корлэтяну Л. Б. Жизнеспособность семян культурных растений в условиях консервации ex situ при действии миллиметрового излучения. Кишинев, 2012, 156 с.

CZU:582.949.27:631.527 https://doi.org/10.53040/abap6.2022.94

RESULTS OBTAINED IN THE CREATION OF SAJE F_1 HYBRIDS IN THE FIRST YEAR OF VEGETATION

COTELEA Ludmila, GONCEARIUC Maria, BALMUS Zinaida*,
BUTNARAS Violeta, DUBIT Tatiana
Institute of Genetics, Physiology and Plant Protection,
Chisinau, Republic of Moldova
**https://orcid.org/0000-0002-1164-6435, e-mail*: *ludmilacotelea@rambler.ru*

The results of the creation and evaluation of 46 simple, triple, double steps-cross and complex F1 hybrids of Salvia sclarea L., in the first year of vegetation, were obtained. The hybrids are distinguished by a series of characters: the height of the plant, the length of the inflorescence, the number of its branches; bloom, produce inflorescences and essential oil in the first year of vegetation. Valuable hybrids were selected by very high essential oil content 1.301-1.906% (dry matter).

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

The creation of hybrids, new varieties of sage (*Salvia sclarea* L.), is indispensable for the creation and evaluation of the initial breeding material. Varieties, hybrids are created for a certain area, certain pedoclimatic conditions of cultivation. Therefore, a special place in the creation of the initial improvement material is occupied by the local forms from the spontaneous or cultivated flora. The species *Salvia sclarea* L. is not found in the flora of the Republic of Moldova.

For the creation of the initial breeding material, forms, genotypes of different genetic and geographical origin were used, such as forms collected from the mountain regions of Central Asia. As initial material, parental forms, hybrids and inbred lines in higher generations were used [1]. The creation of hybrids, varieties of *Salvia sclarea* L. for the Republic of Moldova is very important, because the products made from this species are widely used in perfumery, cosmetics, medicine, the manufacturing industry of a wide range of sanitary and hygiene items, the manufacturing industry of Muscat wines, etc.

Breeding programs for *Salvia sclarea* L. include the following objectives: increased productivity; precocity; superior quality of raw material; superior quality of essential oil and concrete; resistance to frost and winter; drought resistance; resistant to diseases [2].

Material and Method. As biological material, 46 F_1 hybrids (simple, triple, double in steps-cross and complex) of *Salvia sclarea* L. and their parental forms, were used in the first year of vegetation.

During the vegetation period, phenological estimations were made and plant development phases were evaluated. The indices of the morphological characters that influence the harvest of raw material and the production of essential oil were studied: the height of the plant, the length of the inflorescence, the number of ramifications of the inflorescence according to the methods in force. The essential oil content was determined in the full flowering phase of the plants by hydrodistillation in Ginsberg apparatus, later being recalculated to dry substance (70%) to avoid errors caused by the difference in humidity (development phase) of the samples analyzed from each genotype [3]. The statistical analysis of the obtained experimental data was carried out according to the method in force [4].

Results. For *Salvia sclarea* it is extremely important to have hybrids in culture, varieties that bloom profusely in the first year of vegetation and form a high production of inflorescences. The evaluation of the F_1 hybrids showed that in the first year of vegetation, the plants bloom, form flower stalks with a high waist, from 90.9 to 121.3 cm. The most developed floral stems were attested in the simple hybrid [NC 77-11 S_4 x AP 11-11 S_4]F_1. The variability in this character in the hybrids from the first year of vegetation is quite high, and the differences between the hybrids in the character "plant height" are not always significant, as in the characters length of the inflorescence, the number of branches of the first and second degree of the inflorescence.

Another character, on which the yield of the hybrid significantly depends and is important for the accumulation of essential oil, is the length of the inflorescence, which varies from 54.7 to 76.5 cm. The proportion of inflorescence / plant height was over 55%, and in a step hybrid, the inflorescence rate was over 70%. In these hybrids, during the period of mechanized harvesting in the raw material intended for processing, a smaller amount of non-oleiferous organs of the plant (leaves, stems) will be used, thus reducing the expenses for distilling the essential oil.

The number of branches of the first degree of the inflorescence varied from 12 to 20, and for the character "branches of the second degree" – from 17, and in some hybrids this index exceeded 31 branches. Exceptional index (36.0) for this character was recorded by the step hybrid [M-69 489 S_{12} x [(S-1122 60 S_{10} x (M-69 10S_4 x L-15) F_9)]F_5]F_1. The number of whorls on the central spike of the inflorescence varies from 8 to 11.

The optimal structure of plants with low, medium and tall stature, relatively long inflorescences, which constitute 55-70% of the plant height in most of the evaluated hybrid genotypes, facilitated the synthesis and accumulation in the first year of vegetation of a fairly large amount of essential oil, which varies from 0.366 to 1.906% (dry matter). The determination of the essential oil content in the inflorescences, recalculated to dry matter, showed that due to the drought, some hybrids synthesized and accumulated a relatively low amount of oil – 0.366-0.803%, which constitutes 23.9% of the number of evaluated hybrids; 30.4% are hybrids with a high essential oil content of over 1.0%, and 32.6% are hybrid genotypes with a very high essential oil content of 1,301-1,906% (dry matter). As a result of the evaluations, 10 exceptional hybrids were selected and identified for the most important character, they synthesize and accumulate 1,409-1,906% (dry matter) of essential oil.

Conclusions.

1. The F_1 hybrids of *Salvia sclarea* L. created and evaluated bloom, produce inflorescences and essential oil in the first year of vegetation.
2. The hybrid genotypes possess valuable quantitative characters, many of them forming inflorescences 56-76 cm long, with a large number of first-order branches - 12-18 and second-order - 14-36, vertices and flowers, which also result in high productions of inflorescences.
3. Select valuable hybrids that stood out with very high essential oil content - 1.301-1.906% (dry matter).

Acknowledgment. Research was carried out within the project of the State Program 20.80009.5107.07 “Reducing the consequences of climate change by creating, implementing varieties of medicinal and aromatic plants drought, frost, winter, disease resistant, which ensures sustainable development of agriculture and guarantees high quality raw material predestined to the perfumery, cosmetics, pharmaceuticals and food industry”, financed by the National Agency for Research and Development.

References:

1. Cotelea L. Selectarea formelor parentale pentru crearea hibrizilor de perspectivă d*e Salvia sclarea* L. În: Buletinul Academiei de Ştiinţe a Moldovei. Ştiinţele vieţii, 2009, nr. 3(309), p. 96-102.
2. Gonceariuc Maria. *Salvia* L., Ch., 2002, 218 p.
3. Gonceariuc Maria. Şerlaiul. În: Ameliorarea specială a plantelor. În: Ameliorarea specială a plantelor agricole, Tipograf. Centrală, Chişinău, 2004, p. 525-541.
4. Доспехов Б.А. Методика полевого опыта. Москва. Агропромиздат. 1985. с. 185-245.

CZU:575:[63+581.1]:58.085 https://doi.org/10.53040/abap6.2022.95

MAIN OBJECTIVES FOR *EX SITU* CONSERVATION OF PLANT GENETIC RESOURCES UNDER CONDITIONS OF CLIMATIC INSTABILITY IN THE REPUBLIC OF MOLDOVA

GANEA A.
Institute of Genetics, Physiology and Plant Protection,
Chisinau, Republic of Moldova
https://orcid.org/0000-0002-8658-6879, e-mail: anatol.ganea@gmail.com

Keywords: *plant genetic resources, ex situ conservation, ecological stresses*

Global climate change is one of the biggest threats to food production and human well-being in all countries of the world. Over the past decades, there has been an increase in the frequency and intensity of extreme climate events, which has increased the risks of agricultural production. A clear example in this regard is the territory of the Republic of Moldova. More frequent years with dry conditions, extreme elevated temperatures, massive development of epiphytoties and other adverse environmental stresses during the growing season of agricultural crops lead to significant losses of agricultural products and deterioration in their quality. In this regard, the current year 2022 did not appear either. The use of traditional methods and techniques to reduce the detrimental effects of adverse environmental factors on cultivated plants often do not lead to the desired results. According to most researchers and practitioners, the most effective way to resist environmental stresses is the targeted use of the genetic potential of agricultural crops. Involvement in the process of new varieties and hybrids creating of the guaranteed sources of productivity and sustainability gives greater confidence in the successful implementation of the planned breeding tasks. The implementation of these problems provides for an integrated approach, including in the search, collection and creation of gene carriers, as well as modeling the conditions for their conservation and use at all stages of work. Agrobiodiversity of cultivated plants and their wild relatives are considered as the most valuable heritage inherited by the population of the Earth from previous generations and the main capital and working material for solving global problems of mankind in the future. That is why the conservation of plant genetic resources for food and agriculture (PGRFA) at all levels of matter organization (ecosystem, species and genetic) is given special attention in all countries of the world. Similar work is being carried out in Moldova.

Ex situ conservation is one of the most important ways to preserve the hereditary variability of plant genetic resources over a different period of time, including many decades. This strategy of protecting the gene pool of cultivated plants from extinction is widely used in the world in specialized scientific institutions - gene banks. Suffice it to say that currently there are about 1750 gene banks in operation, with about 130 of them each holding more than 10 000 accessions. The total number of preserved plant specimens is 7.4 million. The method of *ex situ* conservation includes a number of stages and activities, which are carried out to varying degrees on the territory of the Republic of Moldova. The preservation of germplasm in the form of seed samples is carried out in research institutes involved in breeding and genetics of agricultural crops, while the genetic material is stored, as a rule, in the form of working collections in paper bags in uncontrolled conditions of the abiotic environment. In this case, the seeds of many species quickly lose their viability and there is a need for frequent reproduction of seed material. Only at the Institute of Genetics, Physiology and Plant Protection, in the created genetic bank, in a modern climatic chamber, active collections of PGRFA are preserved at a temperature of + 2 ...+ 4°C, and freezers have also been prepared for the conservation of the national basic collection of cultivated plants. Genotypes of fruit and berry crops, grapes, perennial essential oil, medicinal and vegetatively propagating plants are stored in field genetic banks. The method is quite energy-consuming and its use is associated with many risks, however, it is widely used in the experimental sites of all institutions that study the plant gene pool. The maintenance of a large number of collections of various crops rises the to problems associated with the lack of financial resources for the purchase of phytosanitary products, the implementation of the necessary agro technical practices and the care of specimens in plantations, and the lack of an irrigation system. This fact does not exclude the possibility of loss of collection samples as a result of adverse abiotic and biotic stresses.

In a number of world's genetic banks, cryopreservation of germplasm in the form of vegetative or generative structures of plants in liquid nitrogen at a temperature of -196°C is practiced. With this approach, while observing all the stages of preliminary preparation of samples, it becomes possible to save them for a very long period of time. In Moldova, such work is not carried out, although there is a long-term positive experience of cryopreservation of farm animal gametes. Unfortunately, in the Republic there is no structural subdivision involved in the *in vitro* conservation of plant genetic resources as part of the genetic bank. For vegetatively propagated species, species that do not produce viable seeds, or form recalcitrant seeds, *in vitro* genotyping is the optimal solution based on plant tissue culture principles. This method consist in a separation of the cell/tissue from a donor plant under aseptic conditions and the placement of biological material on synthetic medium in an appropriate container under controlled environmental conditions. The need for such work exists because some valuable crops (for example, potatoes) require the use of more assured methods of conservation than annual reproduction in the field. Every year, as a result of expeditionary collections conducted by the Laboratory of Plant Genetic Resources, the collections are replenished with valuable local forms of potatoes from various ecological micro zones or other genotypes, the reproduction of which under stressful conditions is very problematic. There are also problems with the preservation of certain samples of the gene pool of the genus *Vitis*, some ornamental and other crops. The implementation of these tasks requires additional funding for the preparation of appropriate premises and the purchase of specialized equipment and materials.

Ex situ conservation of PGRFA is an essential part of the country's biodiversity protection, on which depends the successful use of the gene pool in the development of a competitive agro-industrial sector. This direction is a priority national task, and when forming collections of valuable genotypes, it is necessary to take into account the rich experience gained in research institutions in terms of studying and using the gene pool of cultivated plants. In this regard, existing working collections should be given the status of active collections in compliance with international standards for the conservation, reproduction and documentation of specimens. Curators of working collections should establish close contacts with each other and with the genetic bank for the distribution of responsibilities, the exchange of genetic material, and the implementation of joint research. An important point in the conservation of collections is the maintenance of intraspecific, specific and interspecific variability to adequately represent the integrity of the PGRFA gene pool. Within the framework of conserved botanical taxa, gaps in collections need to be identified, analyzed and supplemented with accessions of crop wild relatives, subspecies, landraces and landraces grown *on farm*, wild food and fodder plants. Forwarding fees should be carried out purposefully, taking into account the established priorities. They can be organized by institutions holding collections to search for new samples, or with the participation of specialists from several scientific departments. This significant amount of work can be successfully completed only with the consolidation of the entire scientific community working in the field of biodiversity protection, genetics and breeding of crops, and the protection of the country's food security. For this purpose, with the support of FAO, the National Program for the Conservation and Sustainable Use of Plant Genetic Resources for Food and Agriculture was developed, which was approved and supported at the international level, but did not find understanding in the country's governing structures. We believe that it is urgent to return to the re-consideration and implementation of this strategic document for the sustainable development of the country's agricultural production.

Acknowledgment. Research was carried out within the project of the State Program 20.80009.5107.11 "Long-term *ex situ* conservation of plant genetic resources in the Gene Bank using the methods of molecular biology for plant germplasm health testing", financed by the National Agency for Research and Development.

CZU:634.8:575.22 https://doi.org/10.53040/abap6.2022.96

THE DEVELOPMENT OF VITICULTURE THROUGH THE REQUIREMENTS PRISM OF GREEN ECONOMY

GLADEI M.
Institute of Genetics, Physiology and Plant Protection,
Chisinau, Republic of Moldova
e-mail: mikegladius@yahoo.fr.

Introduction. The primary imperative of the sustainable development of the wine sector is to obtain high production, with low consumption of resources, in conditions of increased economic efficiency and the use of technological links that contribute to reducing energy consumption. High quality wine derivatives can be ensured, if three main factors are taken into account: the genotype (variety), location of the plantation (soil and climatic conditions) and applied technology (cultivation and processing). The intraspecific genotypes have a wide capacity for use, but at the same time do not ensure the overcoming of climate change barrier. That is why, taking into account the functionality of genotypes and the use of technical algorithms and interspecific hybridization methods, more plastic rhizogenic interspecific genotypes should be created in terms of their adaptation to climate change, with beneficial repercussions on the sustainable development of the wine sector.

Keywords: *area, genotype, green economy, viticulture*

Materials and Method. As object of study served interspecific rhizogenic grapevine genotypes with table grapes "Malena", "Nistreana" and "Algumax", as well as grapes for fresh consumption and processing: "Augustina", "Alexandrina", and "Amethyst" [3]. The respective genotypes are planted in the experimental grapevine sector of the institute. The management technique (forming/shaping) of the plants determines the habitus of the stump, in this case was used the unilateral, bilaterally single-tiered horizontal cord system, with one or two stems and the height of 80 cm, with the vertical management of the shoots. Planting scheme: between rows - 3.0 m, and in a row, from plant to plant - 1.5 m. Support type - vertical trellis with erect (vertical) shoot guidance, support (pole) height - 2, 0 m with three levels of conduction (the first level - one wire each, the second and third levels - two parallel wires each, at a distance corresponding to the thickness of the pole) [2, 4].

Results. Based on the results of the monitoring of environmental factors, it was found that climate changes are amplifying at global level. The generator of these changes was and is the technical-economic progress of society, without taking into account the principles of sustainable development. It is necessary to promote a green economy policy by motivating, stimulating through various aspects (economic-financial, technologies, products, etc.) those who, as a result of the economic activity, cause an impact on the environment. The co-interest of economic agents is required in order to carry out a sustainable activity, both from an economic point of view and also for environmental impact. Otherwise, without the promotion of these policies, the expected results will be minimal, and the state of natural resources and the environment will continue to degrade. In the process of creating new grapevine genotypes, it is necessary to pay special attention to the functional-technological properties, such as:-cultivation technology;-performance/productivity (in relation to the vegetation period and pedoclimatic zone); - the balance between growth and fruiting; - the histoanatomobiochemical and physiological character; - resistance to diseases and pests; - the relevance of resistance to low temperatures; - ripening of grapes; - the chemical composition of berry, juice and derived products; - the attractive appearance of the grapes; - the crunchiness and consistency of the flesh; - aroma and taste; - resistance to cracking of berries; - transport and storage capacity; - the direction of use of the grapes; - waste recovery, as a result of grape processing. Based on the functionality of the genotype, the existence of balanced, sustainable and diversified agroecosystems will be ensured in the future, which will guarantee the rational use of natural resources and a beneficial environment for the development of [1].

The cultivation of grapevine, in accordance with the principles of sustainable development, includes, on the one hand, the reduction of expenses for the procurement and use of chemicals necessary to combat diseases and pests, and on the other hand, the minimization of the negative impact on the environment. The derived products obtained are of high quality. Climate changes require the creation of plant varieties that ensure performance in different production conditions. The current requirements of the wine sector require the creation of new varieties with stable productivity potential, high quality of grapes and wine products. As a result of crossing the genotypes of *V. vinifera* L. (2n=38) x *M. rotundifolia* Michx. (2n=40) were obtained and homologated interspecific rhizogenic grapevine genotypes with table grapes: “Malena”, “Nistreană” and “Algumax” and with grapes for fresh consumption and for processing: “Augustina” , “Alexandrina”, “Sarmis” and “Ametist”, which allow the expansion of the northern area of vine cultivation on own roots and the reduction of the number of chemical treatments, which will contribute to obtaining ecological products and protecting the surrounding environment. These genotypes can be multiplied by the cutting method. The plants obtained are rhizogenic and allow the exclusion of some practical steps from the technological process, which contributes to the reduction of financial resources for the production of planting material and the cultivation of vines. Grafting is a rather complex, risky and expensive technological process that requires special technical and practical knowledge, which consists in obtaining the plant from the joining of two different plant segments from both a genetic and morpho-anatomophysiological point of view. This represents nothing more than a symbiosis of the two partners [4]. Rhizogenic vine plants have a longer exploitation life compared to plants obtained through the grafting process. As a result of the technology for obtaining rhizogenic vine planting material, the stages related to the preparation of the cords for grafting (grafting and rootstock), storage, grafting, stratification, rooting can be omitted. The procedure for vineyard establishment represents a complex process of research and analysis, aesthetic and technical creation, technical-economic planning and calculation, implementation and maintenance. In essence, real premises are created for the implementation of new varieties with increased resistance to the biotic and abiotic factors of the environment, and based on the new cultivation technologies, the high demands of the green agro-industrial economy are realized. Currently, viticultural products with increased hygiene degree, "bio", ecological, biodynamic can really be obtained and successfully marketed only through the development of viticulture with new, interspecific, rhizogenic varieties.

Conclusions.

1. The implementation of interspecific rhizogenic grapevine genotypes will contribute to the expansion of the grapevine cultivation limit towards the Northern area of the Republic of Moldova.
2. The obtaining of viticultural products, especially ecological, can be more easily achieved with the cultivation of new interspecific, rhizogenic varieties, which show increased resistance to biotic and abiotic factors, including extreme climate factors.
3. The green viticultural economy with its agrobiological stability, allows for increased economic efficiency and guarantees an increased hygienic level of grapes, juices, concentrates, wines of various types and distillates.

Acknowledgment. Research was carried out within the project of the State Program 20.80009.5107.03 "Efficient use of plant genetic resources and advanced biotechnologies to increase the adaptability of crop plants to climate change", financed by the National Agency for Research and Development.

References:

1. Alexandrov E. (2020). Crearea genotipurilor interspecifice rizogene de viţă-de-vie. Chişinău, Moldova: Tipogr. ”Lexon-Plus”.
2. Alexandrov E., Botnari, Gaina B. (2020). Soiuri interpsecifice rizogene de viţă-de-vie. Particularităţi de cultivare. Chişinău, Moldova: Tipogr. ”Print-Caro”.
3. Catalogul soiurilor de plante al Republicii Moldova. Ediţie oficială. Chişinău, Moldova, 2020.
4. Dobrei A., Mihaela Mălăescu, Alina Ghiţă, Sala F., Ioana Grozea. (2011). Viticultură: bazele biologice şi tehnologice. Timişoara, România: Tipogr. Solness.

CZU:633.11:575 https://doi.org/10.53040/abap6.2022.97

ABOUT THE CREATION OF DROUGHT TOLERANCE VARIETIES OF BREAD WHEAT

JAHANGIROV A.
Gobustan Experimental Station of Research Institute of Crop Husbandry Ministry of Agriculture of the Azerbaijan Republic, Gobustan, Azerbaijan
https://orcid.org/0000-0001-7547-6589, e-mail: a.cahangir@hotmail.com

Wheat differs in ecological plasticity among cultivated plants and is cultivated on a wide variety of soils and climatic conditions. An important part of wheat crops in the world and in Azerbaijan is grown in dry conditions, and most of it is grown in unsecured rainfed land. Therefore, to increase wheat production under arid conditions, it is important to study the physiological parameters as well as the agronomic characteristics in scientific research. To do this, it is necessary to study the physiological characteristics of new wheat genotypes and study their relationship with productivity under stressful conditions.

Keywords: *bread wheat, variety, drought tolerance, physiological characteristics*

Materials and Method. The study included 12 varieties and 9 stabilized lines of winter bread wheat. The experiments were carried out in the fields, in the foothills of the Gobustan Zonal Experimental Station of the Research Institute of Crop Husbandry, located at an altitude of 800.0 m above sea level. The amount of chlorophyll in flag leaves, the relative moisture capacity of the leaf, the parameters of photosynthetic gas exchange and the remobilization process were studied in the field, on dry and irrigated variants [1]. Based on the change in the amount of chlorophyll in the leaves during ontogenesis, the period of photosynthetic activity of the flag leaf was determined in units of the growing degree days (GDD) [2]. Statistical analysis was performed using JMP 5.0.1 software.

Results. Under the conditions of unsecured rainfed land of Nagorno Shirvan of the Republic of Azerbaijan, in 21 genotypes of bread wheat were studied the amount of chlorophyll, the relative moisture capacity of the leaf, the parameters of photosynthetic gas exchange and the remobilization process in flag leaves. At the same time, changes in the amount of chlorophyll in leaves were studied on the basis of the period of photosynthetic activity of the flag leaf in ontogeny.

As a result of the research, the highest values of relative moisture capacity in dry and irrigated variants were noted in the varieties Vostorg, Tale 38, Murov 2 and Kyrmyzygul 1, the highest values of photosynthesis rate in the arid variant are at Sonmez, Kirmyzygul 1, and in the irrigation of Zirva 85, Sonmez, Aran and Kyrmyzygul 1, the highest values of remobilization were noted in dry conditions in the varieties Murov 2, Zirva 85 and Sonmez, in the irrigation of Murov 2, Zirva 85 and Sonmez. The value of the period of photosynthetic activity of the flag leaf during drought was in the varieties Murov 2 (587 GDD), Kyrmyzygul 1 (538 GDD) and Zirva 85 (557 GDD) and under irrigation conditions Gobustan (583 GDD), Fatima (582 GDD), Murov 2 (662 GDD), Kirmyzygyul 1 (630 GDD) and Zirva 85 (657 GDD). The cultivars Murov 2 and Zirva 85 were distinguished as having the highest values of the indicated physiological index, especially the period of photosynthetic activity of the flag leaf, which is of great importance in drought tolerance. These varieties were taken as a donor as one of the parental forms. As another parental form, local genotypes were taken, as well as samples selected in different years from international nurseries and hybridization was carried out in 50 combinations. The hybrid material was studied up to generation F_4, and in 2019 the selected elite ears were sown separately in one row. In the next year - 2020, rows from one ear (stable lines) were evaluated by disease resistance, agrobiological and morphological characteristics. In order to continue research in the next growing year, 50 stable lines were studied in the control nursery. In the 2021-2022 growing year, the lines Murov 2 *x* Quality, Murov 2 *x* 20thFAWON No. 79, Zirva 85 *x* Gobustan, Zirva 80 *x* 21thFAWON No. 9, Zirva 85 *x* 13IWWIP No. 23, Zirva 85 *x* 15IWWIP No. 26, Zirva 85 *x* 16thIWWIP No. 6 harvested, respectively 5.36, 4.55, 4.44, 4.81, 4.47, 5.20 and 55.6 t/ha and yielded 0.81-1.93 t/ha more than the standard variety Gobustan. These lines were close to the standard in terms of heading time and were resistant to fungal diseases.

Conclusions. 25 numbers selected for heading time, disease resistance, optimal morphobiological characteristics will be studied in the control nursery. Using genotypes selected according to earing time, productivity in arid conditions, resistance to fungal diseases and other complex agrobiological traits, new varieties of bread wheat will be created in the future.

References:

1. Allahverdiev T.I., Huseynova I.M. Physiological bases of drought resistance of wheat. Baku, 2022. 288 p. (in Azerbaijani)
2. Oktem A., Aghirmatlioghlu A. (2006), Determination of GDD (Growing Degree Days) required for some developmental periods in wheat (*Triticum ssp.*) genotypes planted at different dates // Ataturk University, Journal of Agriculture Faculty, 37(1) pp. 29-37 (in Turkish).

CZU:575.22:633.822 https://doi.org/10.53040/abap6.2022.98

STUDY OF THE NON-MENTHOL DIRECTION MINT COLLECTION GENOTYPIC DIVERSITY

JELEZNIAK Tamara, BARANOVA Natalia, VORNIKU Zinaida
Institute of Genetics, Physiology and Plant Protection,
Chisinau, Republic of Moldova
e-mail: galinajelezneac@gmail.com

In the current context, it is becoming increasingly urgent to expand the range of natural products used in different aspects of human activity. Essential oil plants are of great value due to the high demand for the products of their processing (essential oils and their components) for perfumery and cosmetic, pharmaceutical, liquor and food production. Mint is one of the major sources of essential oil in the world. The menthol-synthesizing forms of *Mentha piperita* L. are mostly cultivated. Lately, non-menthol mint cultivars have become widespread, synthesizing essential oils with a predominance of carvone, linalool, linalyl acetate, citral - substances with a wide range of application in the medicinal practice, food and perfumery industries. Mint variety Linaloolnaya contains up to 70% of linalool and is used in the perfume, chemical-pharmaceutical and food industries. It has a pleasant, delicate fragrance. Lavandovaya mint variety is used in traditional medicine as a soothing remedy for various nervous disorders. Carvonnaya mint variety contains up to 80% of carvone and is used in the perfume, confectionery and liquor industries. It is widely used in the USA to flavour chewing gum and toothpaste. Bergamotnaya mint variety refers to linalool and linalacetate direction, whose essential oil contains up to 40% and 45% of these components respectively, as well as citral, limonene, geranyl acetate, which gives the oil a pleasant citrus aroma. The leaves of this mint give the beverages a fresh, citrusy, slightly spicy note.

It is important to research the genotypic diversity of the mint collection in terms of the main morphological and production parameters in order to increase the range of natural flavorings and due to the annually changing weather and climatic conditions and the aggravated problem of drought in Moldova. This will allow the conservation and selection of genotypes that are resistant to the extreme factors and are promising for further research.

Keywords. *mint non-menthol, essential oil, productivity indicators*

Materials and method. Four forms of *Mentha spicata* L. (spearmint) were used in the study: Linaloolnaya, Carvonnaya, Lavandovaya and Bergamotnaya. The mint was planted using the seedling method according to existing techniques. The seedlings were planted in boles at a depth of 18-20 cm and spaced 12-15 cm apart, with a rate of 10 plants/m^2. The total productivity of entire fresh and wilted plants, the dry leaf yield and its ratio to the total mass of raw material were determined. The essential oil content and yield were determined in the wilted material and in the dried leaves. The essential oil content was determined by hydrodistillation in Ginsberg apparatus.

Results. Material was taken from the previous year's plantations in stages by variety as it grew 10-15cm and was planted from 9 to 12 May. The growing season for harvesting aromatic mint raw material was 66-72 days, and was the longest for the Bergamotnaya variety. With a stand density of 8.6-9.8 plants/m^2, their height was 42-60 cm. Carvonnaya was the tallest and Bergamotnaya - the lowest.

Leaves and inflorescences, which contain the main amount of essential oil, are the major valuable parts of mint as raw material for the production of phyto teas, spices and flavourings. In order to preserve them, mint should be harvested before the lower leaves begin to fall off. All mint varieties examined were well foliated. The percentage of leaves in the total raw material yield was 57% to 69%, depending on the sample.

The most productive variety according to green mass yield was Bergamotnaya 5.18t/ha, as it had the highest plant density (9.8plants/m^2). The next in productivity was the variety Linaloonaya (5.11 t/ha). The other two varieties showed roughly the same result, less than five tons: Lavandovaya 4.67 t/ha and Carvonnaya 4.64 t/ha.

The yield of wilted raw material is 29-32% lower than the green mass yield, depending on initial moisture content, and constitutes 3.25 to 3.60 t/ha. Linaloolnaya and Lavandovaya varieties showed the best results with 3.60 t/ha and 3.53 t/ha, the lowest indicator was 3.25 t/ha for the variety Karvonnaya. The mint variety Bergamotnaya, which was the most productive in green mass harvesting, did not retain its leading position due to the high initial moisture content of the raw material, i.e. the lowest dry mass content, showing 3.28 t/ha.

The essential oil content in mint was determined in the wilted raw material, with a 46-62% moisture, and recalculated to a standard 55% moisture. Variety Linaloolnaya had the highest oil content 1,167%, and it was followed by Karvonnaya with 1,079% oil content. For the other two mint varieties, the indicator was lower than one and constituted 0.917% for Lavandovaya and 0.639% for Bergamotnaya, i.e. 22% and 46% lower than for Linaloolnaya variety.

Linaloolnaya variety was the best according to the essential oil yield in the wilted raw material - 42.01 kg/ha. It was followed by Carvonnaya - 35.07 kg/ha with a lag of 16%, and Lavandovaya - 32.37 kg/ha, which is 23% less. Bergamotnaya had 20,96 kg/ha essential oil yield which was the lowest among the studied varieties and was more than twice lower than the best variety's indicator.

The proportion of dried leaves and inflorescences in the total mass of the harvest is an important indicator, since these components are used as raw materials in the perfume, food and pharmaceutical industries. The mass fraction of essential oil in mint leaves with a moisture content of 14%, was between 1.878 and 2.669. Linaloolnaya variety had the highest oil content - 2.669%, followed by Carvonnaya with 2.255% and Lavandovaya with 1.949% - 15% and 27% lower than Linaloolnaya's indicator. Leaves of Bergamotnaya, as the wilted raw material, had the lowest oil content - 1,878%, which consisted 70% of the mint with the highest oil content.

While determining the essential oil yield in the leaves, the trend continued and Linaloolnaya variety, with the highest oil content, was the most productive with a result of 27.4 kg/ha. It was followed by Karvonnaya - 24,9 kg/ha (10% less) and Lavandovaya – 17% less. Bergamotnaya variety, with the lowest oil content, has shown the lowest essential oil yield - 16,5 kg/ha, which was 11 kg/ha less than Linaloolnaya variety. At the same time the Bergamotnaya essential oil is valuable for its unique spicy bergamot fragrance, with a pleasant fresh lemon tint.

Conclusions.

1. The climatic conditions of the Republic of Moldova are suitable for the cultivation of mint just under the prerequisite that irrigation is possible during the active vegetation period.
2. A comparative analysis of the morphological and production values of four *Mentha spicata* varieties that synthesize essential oils with a predominance carvone, linalool, linalyl acetate and citral content revealed highly productive varieties.
3. The Linaloolnaya and Lavandovaya mint varieties were the most productive by wilted raw material yield, showing 3.60 t/ha and 3.53t/ha. The smallest yield - 3.25 t/ha - had Carvonnaya variety. Bergamotnaya showed an average result of 3.28 t/ha.
4. The best mint variety by productivity parameters such as mass fraction and essential oil yield was also Linaloolnaya, with essential oil content of 1.167% in wilt and 2.669% in dried leaves, and essential oil yield of 42.0 kg/ha and 27.4 kg/ha, respectively. Carvonnaya mint variety had these indicators at 1.079% and 2.255% and 35.1kg/ha and 24.9kg/ha levels. Bergamotnaya has the lowest yield of essential oil at 16.5 kg/ha. But its oil is particularly valuable for spicy, citrusy bergamot fragrance, which gives the beverages containing it a unique fresh citrusy, slightly spicy note.

Acknowledgment. Research was carried out within the project of the State Program 20.80009.5107.07 “Reducing the consequences of climate change by creating, implementing varieties of medicinal and aromatic plants drought, frost, winter, disease resistant, which ensures sustainable development of agriculture and guarantees high quality raw material predestined to the perfumery, cosmetics, pharmaceuticals and food industry”, financed by the National Agency for Research and Development.

CZU:633.34:631.423.2 https://doi.org/10.53040/abap6.2022.99

SOIL MOISTURE IN SOYBEAN CENOSIS UNDER DIFFERENT METEOROLOGICAL CONDITIONS

KHARCHUK O.*, KISTOL Marcela**
Institute of Genetics, Physiology and Plant Protection,
Chisinau, Republic of Moldova
* *https://orcid.org/0000-0003-3488-5321,* ** *https://orcid.org/0000-0001-8594-151X*
e-mail:oleg.harciuc@igfpp.md

Any decrease in non-beneficial water consumption must result in increased production per unit of consumed water. Increasing the efficient water use by cultivated soybean *Glycine max* (L.) Merr. requires an accurate assessment of moisture reserves in agrophytocenosis at different seasons. **The aim** of the work was to assess the content of soil moisture in different soil horizons of agrocenoses in the 0-150 cm layer in years with different meteorological conditions, including separately for the arable layer and subsurface horizons.

Keywords: *soybean, soil moisture, drought, cenosis*

Materials and Method. The studies were carried out in 2016--2022 in the fields of the Institute of Genetics, Physiology and Plant Protection, mainly in the cenosis of the Aura variety with traditional cultivation technology ($400*10^3$ plants/ha, row spacing 45 cm). To assess meteorological conditions was used the relative precipitation index *(RPI*) - the ratio of precipitation sum for the given period *P* and the long term average for the same period $\underline{P}$ expressed in percent, $RPI = P/\underline{P}*100\%$; for long period (quarter, year) are such criteria of *RPI* value: 0-49,9% (extremely dry), 50,0-74,9% (very dry), 75,0-89,9% (dry) and 90,0-110,0% (average) [4]. Gravimetric soil moisture samples were taken by hand drill AM-26 at 10-20 cm depth increments to 150 cm deep (both in cenosis and on fallow soil). Soil moisture samples were taken in three repetitions. To determine soil moisture, the samples were dried in an oven at 105 °C to constant weight. Non-destructive individual leaf area (LA) was measured at the central leaf and then the trifoliate area was estimated using the linear equation approach; the plant leaf area was further calculated by the sum of the individual leaves [5].

Results. During the soil moisture accumulation period (September-April), the average amount of precipitation for the long term period (2009-2018) was 326 ± 26 mm. When sowing the total moisture reserves differed over the years primarily depending on the rainfall in the previous period of moisture accumulation in the soil: from 417 mm (300±3 mm in the layer 40-150 cm) in 2017 to 256 mm (187±2 mm in the layer 40-150 cм) in 2020. In 2022 when sowing (April, 15) the total moisture reserves in the 0-150 cm layer were 333 mm (224±2 mm in the layer 40-150 cm).

When comparing the seasonal change in total moisture reserves in the cenosis with areas of black fallow (2019, 2022) it was found that water losses in black fallow occur mainly from the arable layer. When sowing 2019 (April, 25) was 354 mm (264±2 mm in the layer 40-150 cm), but at harvesting-2019 (September, 6) left in cenosis 218±4 mm (167±2 мм in the layer 40-150 cm; at fallow plot - 305±5 mm (238±1 mm in the layer 40-150 cm). When sowing 2022 (April, 15) was 333 mm (214±2 mm in the layer 40-150 cm), but to 102 days after planting (DAP), July, 26 in cenosis left 179±3 mm (142±2 мм in the layer 40-150 cm; at fallow plot left 281 mm (220±2 mm in the layer 40-150 cm). In 2022 on black fallow for 102 DAP period a decrease in soil moisture (near 60 mm relative to sowing) occurred exclusively in the 0-40 cm layer. In both years, in soybean cenosis the moisture reserves in the soil layer 40-150 cm decreased more, then in the fallow plot (minimum by 80 mm). For a soybean grain yield of 29-38 q/ha with a high harvest index, plants should transpire 170 mm of water [1, 2]. In 2022 at stage R6 (stopped the accumulation of dry matter of plants) on each plant with the determination of LA the number of pods and seeds were visually counted. In our study seed productivity of leaf surface was 5,6±0,5 seeds/dm^2 LA compared 6,0±0,2 seeds/dm^2 LA in study under irrigation [3].

In 2021 after 136 days of vegetation, moisture reserves in deep soil layers (40-150 cm) decreased relative to the moisture reserves on sowing by 108 ± 3 mm for the variety Stefanel, and by 126 ± 4 mm for the more vigorous variety Pentata (at the same time, a decrease in moisture reserves in the layer 0-40 cm are the same: for the variety Stefanel - 40 ± 2 mm, and for the variety Pentata - 42 ± 2 mm).

Conclusions. Water losses from the black fallow soil occur mainly from the arable layer. The decrease in the total moisture reserves of deep soil layers of the soybean cenosis is associated mainly with plants. More vigorous varieties consume more water from deeper soil horizons.

Acknowledgment. Research was carried out within the project of the State Program 20.80009.7007.16 "Synergism between natural factors and ecologically harmless microbiological means of regulating the density of populations of pests for the protection of agricultural crops in conventional and organic agriculture", financed by the National Agency for Research and Development.

References:

1. Board J.E. & Maricherla D. Explanations for decreased harvest index with increased yield in soybean. Crop Sci. 2008. Vol. 48, pp. 1995-2002. DOI.org/10.2135/cropsci2008.02.0098
2. Petry M.T., Basso L.J., Carlesso R., Armoa M.S., Henkes J.R. Modeling yield, soil water balance, and economic return of soybean under different water de-

ficit levels. Engenharia Agricola 2020, Jaboticabal, v.40, n.4, p. 526-535 DOI: DOI.org/10.1590/1809-4430-Eng.Agric.v40n4p526-535/2020

3. Sincik M., Candogan B.N., Demirtas C., Büyükcangaz H., Yazgan S. & A.T. Göksoy. Deficit Irrigation of Soya Bean [*Glycine max* (L.) Merr.] in a Subhumid Climate. J. Agronomy & Crop Science. 2008, 194, 200–205. DOI.org/10.1111/j.1439-037X.2008.00307.x
4. Szyga_Pluta K., Grześkowiak K. Warunki pluwialne w Poznaniu w latach 1981–2015. Badania fizjograficzne R. VII – Seria A – geografia fizyczna. 2016 (A67), p. 239–256 DOI 10.14746/bfg.2016.7.18
5. Харчук О.; Кириллов А. Недеструктивное определение листовой поверхности растений сои в сезонной динамике. *Евразийский Союз Ученых.* 2019, №2 (59), 33-36. DOI.org/10.31618/ESU.2413-9335.2019.3.59.33-36

CZU:633.11:631.527 https://doi.org/10.53040/abap6.2022.100

THE IMPORTANCE OF GENETIC RESERVES IN THE CREATION OF NEW WHEAT VARIETIES

KHUDAYEV F.A.*, ABDULLAEV A.M.**, HAJİYEVA S.K.***, VALİYEVA S.C.#
Research Institute of Crop Husbandry, Baku, Azerbaijan
ID-3FDNEDM, ** ID-29Q9V6X, * ID-1ZZ4NNN0,# ID-1079N293*
e-mail: faiq.xudayev.1974@gmail.com

One of the important fields of agriculture is grain growing, especially wheat. Is one of the important crops in Azerbaijan, as in many countries, which has a special weight in ensuring food security. The development of grain growing is always in the center of attention of our state. According to the 2nd strategic goals of «Increasing the production potential of agricultural products along the value chain» and to the 4th strategic goals of «Development of the market of production tools in the field of agriculture and improvement of provision of services" established in the «Strategic Roadmap for the production and processing of agricultural products in the Republic of Azerbaijan» approved by the Decree of the President of the Republic of Azerbaijan dated December 6, 2016 issues such as increasing the production volume of bread and durum wheat for food purposes without expanding the existing planting areas and eliminating dependence on imports, strengthening and promoting the potential of local seed production have been reflected. This shows that grain-growing is one of the main strategic areas in the country's economy in ensuring the national food security of Azerbaijan.

Decree of the President of the Republic of Azerbaijan dated July 19, 2022 «On a number of measures to increase the level of self-sufficiency with food wheat» further stimulated the implementation of research in the direction of breeding for the purpose of ensuring food security in the Republic of Azerbaijan.

Many of the valuable examples of local varieties created in Azerbaijan during a long historical period have been lost or are in danger of being lost due to being suppressed by modern breeding varieties. Targeted research should be continued to eliminate this threat.

As the relief and climate conditions of Azerbaijan are different, so are the soils. Such diversity of natural and geographical conditions has created favorable conditions for the richness of both wild and cultivated flora, including the wheat plant. Approximately 4,500 species of higher plants have been registered in Azerbaijan, which make up 66% of the Caucasian flora, of which 25 species belong to the cereal family.

In 2020-2021, 30,368 germplasms of cereals, legumes and other crops were studied at the Research Institute of Crop Husbandry.

The correct breeding of the starting material and their purposeful involvement in hybridization is the basis for the creation of new high-yielding and high-quality varieties in the future. The current global climate change is causing a decrease in the yield of existing varieties. In order to protect cultivated plants, it is relevant to create new varieties and hybrids of high-yielding, medium-sized, quick-maturing bread and durum wheat with high grain quality resistant to stress factors.

The main goal of the research work is the selection of starting material for the creation of new wheat varieties with high grain yield and quality indicators, resistant to abiotic and biotic stress factors in different soil and climate conditions of our republic.

Keywords: *breeding, bread wheat, durum wheat*

Materials and Method. The development of grain-growing should not be due to the increase of cultivated areas, but due to the creation of new varieties with high yield and quality, resistant to stress factors and their application to production. It stands in front of the breeders as a necessity. One of the ways to solve this problem is to use genetic resources more efficiently, to carefully study ancient and recent wheat populations adapted to local conditions, to determine yield and other indicators of genotypes introduced from different parts of the world in local conditions, and to widely use them in hybridization.

In 2020-2021, 704 bread wheat, 1247 local and introduced foreign varieties of 543 durum wheat of different geographical origins were studied in the collection nursery at the Absheron Subsidiary Farm of the Research Institute of Crop Husbandry in 2020-2021. Each sample was sown by hand in the second decade of November, being the predecessor leguminous plants, in two replicates on an area of 1m^2, and a mass yield was observed in the third decade of November. After every 20 samples, local Murov 2 varieties, which have large cultivated areas in the republic, and Barakatli-95 varieties were sown as a standard for bread wheat, and for durum wheat.

During the vegetation period, agrotechnical maintenance works designed for the region were carried out in the experimental area, 100 kg of complex fertilizer per hectare was applied along with sowing, and 250 kg of nitrogen fertilizer (NH_4NO_3) was given in early spring in the tillering stage. During the vegetation period, the samples were watered twice (in the tillering and milk maturity stage).

Field experiment studies are located in the Absheron Peninsula, the gray-brown soils spread in the area are less fertile and poorly supplied with basic nutrients. The Absheron Peninsula is included in the dry subtropical zone with hot summer, sunny autumn and mild winter. The winter and summer temperatures of the research years, and the amount of precipitation, were generally in accordance with the regional average. In the nursery of the collection, phenological observations were made during the vegetation period, the height of the genotypes was determined, the get infected samples with diseases was evaluated and the technological quality indicators of the grain were determined. Measurements and analyzes generally accepted methods, assessment of leaf rust diseases was conducted based on the modified scales of Cobb recommended by CIMMYT and ICARDA.

As a result of the conducted research, high yield and quality indicators, height, ripeness, resistance to diseases and pests, etc. local and introduced wheat genotypes selected for their characteristics were used in hybridization with the aim of creating new varieties with complex high indicators. At the same time, among the soft wheat genotypes adapted to the soil and climate conditions of Azerbaijan, Mirbashir 128, Ugur, Akinchi 84, Parzivan 1, etc., currently cultivated Gobustan, Murov 2, Azeri, Shafaq 2, Fatima, Farahim, Azamatli 95, Gilavar etc., introduced varieties include Gonen (Turkey), Bezostaya-1 (Russia), Lad (Russia), Umanka (Russia), Nota (Krasnodar), Olvia (Odessa), Renan (France), Sanzor-4 (Uzbekistan), Fin wheat (Finland), SH Morg (England), 17thFAWWON.KN149-193 (CIMMYIT) etc., from local ancient varieties of durum wheat, Sharg, Mirvari, Agbugda-13, Mugan, Tartar etc., currently cultivated Barakatli 95, Karabakh, Goytepe, etc., introduced Fadda-98 (Turkey), Icasyr (Turkey), Karol Odeskaya (Ukraine), Zedoni 3-D-56 (Algeria), Zatino (France), etc. hybridization was performed on genotypes. In 2020-2021, hybridization was carried out in 93 soft and hard wheat genotypes with individual positive traits, and 100 combinations were obtained. The obtained first (F_1) and second (F_2) generation hybrid combinations were studied at the Absheron Subsidiary Farm. The research of prospective forms selected from within the population will be continued in the irrigation and rainfed regions of the republic in the next generations.

Results. As a result of hybridization, bread wheat varieties Parvin, Metin, Altun 2, Shafag 2 for irrigation regions, Farahim varieties of bread wheat for rainfed regions, Ravan and Khudafarin varieties of durum wheat were regionalized and allowed to be used for the production of agricultural products in the territory of the Republic of Azerbaijan and included in the State Register of protected breeding achievements.

The Royal variety of bread wheat for irrigation regions, Galib varitety of durum wheat, Mubariz variety of durum wheat, Gomur-74, Yaseman, Taj 20, Daralayaz varieties of durum wheat were submitted to the Agrarian Services Agency under the Ministry of Agriculture of the Republic of Azerbaijan for registration.

CZU:633.11:631.52 https://doi.org/10.53040/abap6.2022.101

PRODUCTIVITY AND QUALITY OF GRAIN OF WINTER TRITICAL VARIETIES

LEATAMBORG Svetlana, ROTARI Silvia, GORE A.
Institute of Genetics, Physiology and Plant Protection,
Chisinau, Republic of Moldova
e-mail: leatca@mail.ru

The growing interest in the triticale crop is due to 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, as well as an increased content of biologically complete protein, which determines the high fodder qualities and nutritional value of this crop [2, 3, 4]. The main goal of triticale breeding at the present stage is the creation of new high-yielding varieties with increased adaptability, resistance to biotic and abiotic stresses, with high fodder, technological and baking qualities [1, 5]. Periodic droughts cause great damage to the agriculture of our country, as a result of which the yield loss amounts to many tons of grain of wheat and other cereal crops. In this regard, the purpose of this study was to assess the productivity and quality of grain of different varieties and new promising forms of winter triticale and to identify sources of economically valuable traits.

Keywords: *Winter triticale, varieties, productivity, protein, gluten*

Material and method. The research was carried out on the experimental field of the Institute of Genetics, Physiology and Plant Protection. The object of the study were eleven varieties and promising combinations of winter triticale. Fallow served as the forerunner of the experiment. All varieties were sown mechanically on an area of 0.2-0.4 ha in early October with a seeding rate of 5 million seeds per 1 ha. The study of productivity elements was carried out by the method of structural analysis of a sample consisting of 15 plants. The plots were harvested with a Sampo-130 combine in the phase of full grain ripeness. Phenological assessments, determination of resistance to wintering, drought, diseases and productivity were carried out according to the methods of testing varieties of the State Commission for Testing Plant Varieties of the Republic of Moldova.

Results. Important conditions for the successful introduction of winter triticale in Moldova are the selection of highly productive varieties adapted to growing conditions. Therefore, the study of triticale varieties in terms of productivity and grain quality is an urgent task. The paper presents the results of studying 6 varieties and 5 promising combinations of winter triticale according to the main economically valuable traits. Experimental data on the characteristics of productivity in varieties (plant height, number of productive stems, length of the main ear, number of spikelets in the ear, number of grains in the ear, weight of grains per ear, weight of 1000 grains and weight of grains per plant) are presented.

Of great importance is the character of plant height, because it is directly related to resistance to lodging and has an impact on yield. According to the data obtained, it was revealed that the height of plants in triticale lines varied widely - from 117 cm in the Ingen 5 genotype to 144 cm in the Ingen 3 genotype, in the standard variety Ingen 93 it was 125.7 cm, and the productive bushiness was from 2.7 up to 3.3 pcs.

The main components of the crop structure are the length of the ear, the number of grains per ear, the weight of 1000 seeds and the productivity of 1 ear. According to the number of grains from the main ear, the data vary from 55 to 71 pieces, according to the mass of grains from the ear, from 2.2 to 3.6 g, according to the mass of 1000 grains, from plants - from 6.62 to 9.45 g.

The protein content in triticale grain is one of the important criteria for quality indicators, since the nutritional and fodder qualities of the crop are associated with it, and the quality of bread depends on the quantity and quality of gluten. The data show that in the studied varieties of protein protein contain ranged from 14.8 to 16.2%. The following samples stood out with an increased protein content in the grain: Costel (16.2%), Ingen 1 (16.1%), Ingen 4 (15.9%). The crude gluten content ranged from 13.1 (Ingen 3) to 30.7% (Ingen 33). An increased content of gluten was noted in the following varieties: Ingen 33, Ingen 93, Costel, Ingen 1, Ingen 35. The content of carbohydrates in varieties varied from 46.8 (Ingen 54) to 52.8% (Ingen 1). The grain nature of triticale varied from 695 g/l (Ingen 35) to 782 g/l (Ingen 4), and the vitreousness varied from 47% (Ingen 35) to 79% (Ingen 2).

Productivity is the most important indicator for which any agricultural crop is cultivated and depends on many factors, both biotic and abiotic. As a result of the research, it was found that the yield of winter triticale varieties ranged from 4.6 t/ha to 6.88 t/ha, for the standard - 5.96 t/ha. Two genotypes Ingen 1 and Ingen 5 exceeded the standard variety Ingen 93 by 0.15 t/ha and, respectively, by 0.92 t/ha.

Conclusions. The study and analysis of varieties and promising combinations made it possible to identify promising genotypes of winter triticale with economically valuable traits, which will continue to be used in breeding programs.

The grain was characterized by the best technological indicators: grain nature - 782 g/l (Ingen 4), vitreousness - 79% (Ingen 2), protein content - 16.2% (Costel), gluten content - 30.7% (Ingen 33), content carbohydrates - 52.8% (Ingen 1).

The yield of triticale varieties varied from 4.6 to 6.88 t/ha. Two genotypes were noted as the most productive: Ingen 1, their yield was 6.11 t/ha and Ingen 5 - 6.88 t/ha, exceeding the standard Ingen 93 by 102.5% and, respectively, 115.4%.

Thus, high and stable yields can be achieved with a combination of high potential productivity and resistance to adverse environmental factors in the genotype.

Acknowledgment. Research was carried out within the project of the State Program 20.80009.7007.04 "Biotechnologies and genetical processes for evaluation, conservation and exploitation of agrobiodiversity", financed by the National Agency for Research and Development.

References:

1. Singh B., Singh Mavi G., Kaur H., Sohu V.S. A study of character association and genetic divergence in germplasm of triticale (x *Triticosecale*). In: Abstracts of International Conference on Triticale Biology, Breeding and Production. IHAR-PIB Radzikow, 2017, 19 p.
2. Горянина Т. Возделывание тритикале в условиях Самарской области: научно-практические рекомендации. Самара: ФГБНУ «Самарский НИИСХ» 2016, 31 с.
3. Грабовец А.И., Крохмаль А.В. Итоги и перспективы селекции озимого тритикале на Дону. Тритикале. Генетика, селекция, агротехника, использование зерна и кормов. В: Международная научно-практическая конференция, Ростов на Дону, 2014, с. 29-37.
4. Котелникова Л., Буюкли П., Веверицэ Е. Создание нового исходного материала в селекции тритикале. В: Генетика и селекция тритикале в Молдове, Кишинёв, Штиинца, 1992, с. 5-23.
5. Veveriță E., Buiucli P., Rotaru S., Gore A., Leatamborg S. Triticale – cereală nouă pentru agricultura Moldovei. Materialele Conferinței Științifico - Practice consacrată aniversării a 70-a a fondării ICCC «Selecția», Rezultatele și perspective cercetărilor la cultura plantelor de câmp în Republica Moldova. Chișinău, 2014, p.182-188.

CZU:575.2:635.64 https://doi.org/10.53040/abap6.2022.102

THE SPLITTING OF TRAITS CONTROLLED BY *ls* AND *br* GENES IN F_2 POPULATIONS OF TOMATO

MAKOVEY Milania
Institute of Genetics, Physiology and Plant Protection,
Chisinau, Republic of Moldova
e-*mail: m_milania@mail.ru*

The article presents the results of studying and analyzing the nature of the splitting of morpho-biological traits in the populations of F_2 tomato hybrids obtained using crosses of forms carrying mutant marker genes *ls* and *br,* which control the formation of lateral shoots (suchers) and the length of internodes on the main stem of the plant.

Key words: *tomato, mutant marker genes, traits, segregation, variability*

At present, mutant marker genes have been increasingly used in tomato breeding as sources of new germplasm for genetic improvement of existing varieties and obtaining new forms with original combination of traits. To obtain tomato genotypes with low shootability, our studies involved mutant marker genes ls and br.

Materials and Method. The semi-mutant line 11069 and the mutant sample Mo 443 served as the source of these genes, on the basis of which 8 hybrid combinations were created: L11069 x L187; L11069 x L828; L11069 x L556; L11069 x L28; L11069 x L111; Mo 443 x v. MaKrista; Mo 443 x v. MilOranj and Mo 443 x v. Facel. When studying the populations F_2 of these hybrids, we took into account: the intensity of the formation of lateral shoots; internodes length; morphological disturbances in the structure of the flower, fruit weight (150 plants in each combination).

According to the nature of the manifestation and the degree of severity of the studied traits, they are differentiated into groups: high degree of formation of lateral shoots (from 100 to 71%, when a suchers is formed at each node or through one); medium (from 70-40%, every 2-3 knots); low (40-10%, 1 stepchild for 4 knots) and very low (<10%, no suchers or single reduced ones).

– On the basis of “length of internodes”, genotypes in populations are divided into three groups: from 9.1 cm to 12.5 cm and above - long internodes; from 6.1 cm to 9.0 cm internodes of medium length and <6.0 cm - short.

– Morphological disturbances in the structure of the flower, expressed in the form of various deformations of the structure of the flower, its individual elements, including those caused by heterostyly: high degree, from 100 to 70%; medium (70-40%); low, (40-10%); normally developed flowers (<10%).

– Fruit weight: from medium to large (120-71 g); from medium to small (70-40 g.) and from small to very small (40-10 g.).

The results were processed in a dispersion complex using the Statistica 7 program.

Results. A wide range of intrapopulation variability was revealed in all the studied combinations of F_2, according to all of the above characteristics. In the splitting populations of hybrids (the first group) obtained in crosses with the semi-cultivated mutant line 11069 (*ls, br*), the range of variability of traits according to the features of the manifestation of traits was much wider than in hybrids of the second group with the mutant form Mo 443 (*ls*).

Hybrids with line 11069 (*ls* and *br*), in splitting F_2 populations, have more plants (63.9%, 62.0%, 69.9%, 36.9% and 49.6%) with a strong shoot-forming ability (from 71 up to 100%), medium length internodes (6-9 cm) and medium weight fruits (40-70 g), which are combined into one group. Such a set of traits, combined with the degree of their manifestation, indicates the ambiguous influence of mutant genes that control the manifestation of these traits in hereditary populations. It should be noted here that, to a greater or lesser extent, depending on the shoot-forming ability of parental forms, these traits are determined by the genome of cultural lines.

More similarity between genotypes in splitting hybrid populations L11069 x L187 and L11069 x L828, which formed suchers every 2-3 nodes (41-70%), had long internodes (9.1-12.5 cm), less deviations in the structure flowers (from 0 to 40%) and large fruits (up to 140 g). It should also be noted that in the splitting F_2 populations of all hybrid combinations with L11069, the least number of plants with the absence or single reduced side shoots (7.3-12.7%), they have short internodes (<6 cm), but most of them flowers (from 41 to 100%) on the inflorescences of these plants with deformations of varying severity.). Along with them, plants with single lateral shoots and their complete absence, with short and medium length internodes (from 4.6 to 8.6 cm), inflorescence structure and normally developed flowers with high pollen viability (33.6 - 62.1%).

In the splitting populations of F_2 hybrids, the second group with the mutant form Mo443, there are also quite a lot of genotypes with high escaping ability (at each node or through one). Intrapopulation variability for this trait, depending on the combination of crossing, is quite high. No plants without lateral shoots were found, only in the population from the combination of Mo443 x Fakel. A low percentage of genotypes (2.6 and 3.4%) that formed one or two underdeveloped, reduced shoots were also found in the populations Mo443 x MaKrista and Mo443 x MilOranj. Most of the genotypes in the splitting populations of hybrids of this group had very short internodes (<6.0 cm). Probably, the genetic determinism of this type of growth of these forms predetermined the nature of its manifestation.

A wide range of intrapopulation variability was also revealed in the nature of the manifestation of flower traits, although there are fewer genotypes with severe violations of the morphological structure of the flower, relative to hybrids with line 11069. Differences are high both between populations from different hybrid combinations and in the degree of violations in the structure of flowers within one particular hybrid populations. For example, in populations F_2 - Mo443 x MaKrista and Mo443 x Fachel, the torch of genotypes with a high degree of uniformity in the structure of flowers is larger (60.2% and 45.7%). For comparison, in the population of the hybrid Mo443 x MilOranj, there are fewer such genotypes - 25.5%, and the percentage of plants with different types of deformations and sterility of flowers is 56.7%.

Conclusions. The results obtained indicate a negative effect of the mutant marker genes *ls* and *br* on the nature of the manifestation of traits of the reproductive system, and this is especially pronounced in combinations of hybrids of the first group. The less lateral shoots are formed and the shorter the internodes on the plant, the more morphological deviations in the structure of flowers and the smaller the fruits. This indicates a multiple (pleiotropic) effect from the influence of the *ls* and *br* genes due to their insufficient cultivation, or these side effects are due to linkage with other genes that have an indirect effect, enhancing the nature of the manifestation of mutant traits. In the tomato, many mutant genes act pleiotropically, exhibiting one of the most striking traits. In order to suppress the side pleiotropic effects of these genes, which control such significant selection-valuable traits, their more intensive cultivation is probably necessary.

The best combination was L11069 x L28, from the splitting population of which more genotypes were isolated with a favorable combination of traits: the average degree of formation of lateral shoots (41-70%) with internodes of medium length (6-9 cm) with normally developed flowers (anomalies less than 10%) and large fruits (up to 120 g). It is possible that a favorable combination of alleles of different genes responsible for the manifestation of these traits in the genomes of isolated plants leads to optimization of the parameters of the desired selectable traits.

To improve the efficiency of selection of genotypes with limited formation of lateral shoots (suchers) with short internodes and a well-developed generative system, it is preferable to use determinant forms of tomato as components of crossing.

Acknowledgment. Research was carried out within the project of the State Postdoctoral Program 22. 00208. 5107. 03/PD I “Genetic potential of the cultivated and mutant gene pool of tomato (*Solanum lycopersicum* L.), research methods and use in breeding”, financed by the National Agency for Research and Development.

CZU:633.34:581.522.4 https://doi.org/10.53040/abap6.2022.103

LOW TEMPERATURE TESTING OF SOYBEAN LINES

MALII Aliona
Institute of Genetics, Physiology and Plant Protection,
Chisinau, Republic of Moldova
e-mail: malii.aliona@mail.ru

The experiments were carried out with the aim of testing under climate chamber conditions at low positive temperatures (+4˚C, +8˚C) and the optimal temperature (+25˚C) of soybean lines obtained by experimental mutagenesis (γ rays) to select genotypes capable of germinating under low temperature conditions that are recorded in the Republic of Moldova at the end of march - beginning of april.

Climate change in recent years is a global phenomenon with a direct impact on all agricultural crops. These climate changes are also felt in the territory of the Republic of Moldova, where the cultivation of spring crops is associated with a high risk due to regular droughts that leave their mark on the production of agricultural crops, leading to important harvest losses or the death of plants. In addition, due to climate warming in recent decades, the frequency, duration and intensity of summer droughts are continuously increasing [1]. In the soybean crop, the most sensitive phase of the ontogenesis is the filling of the grain, which occurs in August - the driest period of the year, which often leads to incomplete filling of the seeds and a noticeable decrease in yield [2]. In order to avoid thermal and water stress conditions in critical moments (flowering, grain filling), technological methods can be used through early sowing and the selection of genotypes from groups of lower maturity [3].

Germination and emergence of soybean seedlings of the vast majority of varieties are able to withstand only short-term frosts, up to minus 2 - 4 ˚C. In the Republic of Moldova, soybean sowing is recommended in the second half of April - the beginning of May. One of the ways to increase the profitability of soybeans is to move the sowing dates to earlier and extra early dates (late winter - early spring). This requires varieties resistant to low temperatures, with an active development of plants in early spring against the background of low positive temperatures and to survive late spring frosts. An early sowing date for these varieties provides the basis for productivity, as it makes optimal use of the remaining soil moisture from the dry weather winter and allows them to ripen a month earlier than usual, eliminating August droughts [4]. At the same time, early sowing brings a series of advantages to the farmer, limiting their economic risks [5].

Keywords: *soybean, lines, positive low temperatures, optimal temperatures, germination*

Materials and Method. Biological material: The study included 10 soybean lines obtained as a result of γ-ray induced mutagenesis, which are part of the half- early and medium vegetation group.

Research methods: The soybean lines were tested in climate chamber conditions at positive low temperatures (+4˚C, +8˚C) and in the thermostat at the optimal temperature (+25˚C). The seeds were placed in petri dishes on moist filter paper, 20 grains each in three repetitions and kept for 21 days at +4˚C temperature. After the expiration of the term, the same samples were transferred to the regime of +8˚C for 9 days. Germination was studied based on the germination index (in dynamics). The germination process was monitored from the seventh day from the start of the experiment (when the seeds were put to germinate). Data processing was performed in the STATISTICA 7 program.

Results. As a result of testing at the temperature of +4˚C for soybean lines A57M_{10}250, ZA8M_{11}200, Z017M_{10}200 ZN8M_{11}200, AZ176$M_8$100 and Z50M_{10}100 on the 21st day, a germination energy of 1,7% to 16,7% was recorded. In the other lines, the germination was 0%. As a result on the 21st day of testing at a temperature of +4˚C for soybean lines A57M_{10}250, ZA8M_{11}200, Z017M1$_0$200 ZN8M_{11}200, AZ176$M_8$100 and Z50M_{10}100 a germination energy from 1,7 % to 16,7 % was recorded. In the other lines, germination was 0%. The same samples that were transferred to the regime of +8 ˚C for 9 days, germination was recorded for all genotypes and the percentage of germinated seeds increased suddenly (47,9% - 80,4%). The best results on seed germination were recorded in the lines: A57M_{10}250 – 80,4%, ZA8M_{11}200 -75,3% and Z017M_{10}200 – 70,2. Root length, as another indicator of seed germination, was also greater at these three lines and varied within 0,8-1,7 cm at line A57M10250, 1,0-1,5 cm in line ZA8M_{11}200 and 0,6-1,2 cm at line Z017M_{10}200. In optimal conditions, the germination of these lines was 87,4%, 84,2% and 80,7%, respectively. And the germination energy was higher (82,6% - 89,2%), although not too high.

Obvious differences between the ten genotypes were in the expression of germination indices at different calendar dates, which demonstrates that each genotype influences the values of germination indices and their dynamics. The quality of the germination process showed that alongside normal germs, abnormal germs or hardened (non-germinated) seeds also appeared, which can be explained by a specific character of soybean seeds. The cause of these anomalies or the hardened seeds can be, for the most part, in the technical deficiencies of threshing and conditioning, but also in the morpho-anatomical qualities of the seeds, determined by the genotype.

Conclusions. It was established that when the seeds are germinated at a temperature of +4˚C, the selection is more rigorous and effective. The genotypic differences of soybean lines are shown according to the reaction of their seeds to the action of low positive temperatures during germination and the growth of germinal roots. The seeds of the soybean lines of the half-early vegetation group - A57M_{10}250, ZA8M_{11}200, ZN8M_{11}200 and the medium vegetation group - Z017M_{10}200, AZ176$M_8$100, Z50M_{10}100 remain viable at low temperatures. This means that these genotypes can be sown earlier, because when the temperature rises, the germination characteristic of optimal conditions (25˚C) is achieved.

Acknowledgment. The research was carried out within the project of the State Program 20.80009.7007.04 “Biotechnologies and genetic methods for the detection, conservation and use of agrobiodiversity”, financed by the National Agency for Research and Development.

Reference:

1. Corobov R., T Leah T., Budeşteanu S. Schimbările climatice şi provocările asociate pentru Republica Moldova. Raportul Naţional de Dezvoltare Umană în Moldova. Schimbările Climatice în Republica Moldova/ Impactul socio-economic şi opţiunile de politici pentru adaptare Tipar: “Nova Imprim”, Chişinău, Republica Moldova 2010. p. 40-46
2. Жученко А.А. Адаптивная система селекции растений (экологогенетические основы). – М.: Изд-во РУДН и «Агрорус», 2001. – Т. II. – С.904, 1154–1156, 1161–1172, 1172–1177.
3. Лукомец В.М., Бочкарёв Н И., Зеленцов С.В., Мошненко Е.В. Создание сортов сои с расширенной адаптацией к изменяющемуся климату Западного Предкавказья. В: Труды Кубанского государственного аграрного университета. – 2012. –Т. 1. – № 35. – С. 248–254.
4. Зеленцов С.В., Мошненко Е.В., Б Убнова, Л.А. Зедунцов В.С. Некоторые аспекты устойчивости растений к отрицательным температурам на примере сои и масличного льна В: Масличные культуры. Научнотехнический бюллетень Всероссийского научно исследовательского института масличных культур. -2018. – Вып.2 (174). – С. 55-70. DOI: 10.25230/2412-608X-2018-1-173-55-70
5. Клыков В.В. Ранние сроки сева сои как резерв повышения урожайности // Науч.-тех. бюл. ВНИИ масличных культур. – 1988. – Вып. 4. – С. 52–55.

CZU:635.621:631.53.01 https://doi.org/10.53040/abap6.2022.104

APPLYING ACCELERATED AGING METHOD FOR ASSESSING THE LONG-TERM STORAGE CAPACITY OF ZUCCHINI SEEDS (*Cucurbita pepo* L.)

MELIAN Lolita*, CORLATEANU Liudmila**, MIHAILA Victoria***, GANEA A.#
Institute of Genetics, Physiology and Plant protection, Chisinau, Republic of Moldova
**https://orcid.org/ 0000-0002-9192-0560, ** https://orcid.org/ 0000-0002-1018-1832*
****https://orcid.org/ 0000-0003-3984-9477,*
#https://orcid.org/ 0000-0002-8658-6879
e-mail: lolitamelian@gmail.com

The problem of long-term seed storage to preserve genetic diversity is an important aspect that attracts the attention of the scientific community. Recently, the threats of global climate change are increasing; in addition, there are a number of reasons leading to the loss of breeding material due to untimely reproduction for subjective and objective reasons. It is gene banks that provide the necessary conditions for seed storage for a long time. Plant genetic banks in various countries use the accelerated aging test on seeds of different plant species to determine the storage potential of seeds. With the help of this method, it is possible to monitor the collection samples of plant gene pool, which contributes to the possibility of accounting changes in their viability. The accelerated seed aging test makes it possible to adequately model and predict the longevity of seed storage, to assess the differences in aging resistance between varieties of different crop species. The prediction obtained by this method correlates well with the field germination of seeds. This is especially important for determining the timing of reproduction of active collections in plant genetic banks. The method of accelerated aging consists in incubating seeds under conditions of elevated temperature (40-44^0 C) and humidity (90-100%), and the period of exposure of seeds to these factors depends on each specific crop and sometimes on the specific genotype [4]. The duration of combined exposure to these stressors (from 48 to 120 hours) and temperature values for determining the storage potential depend on the plant culture, so the most suitable aging environment must be determined for each species. Studies on the current methods of accelerated aging of seeds of pumpkin crops are very few, especially for zucchini crops. Some of the earlier studies have shown that optimal seed aging conditions vary considerably among pumpkin crop species, such as watermelon [1], melon [2, 5], pumpkin, and zucchini [3]. The aim of our research was to develop a method of accelerated aging to determine the storage potential of some zucchini collection varieties, including those obtained from the Pridnestrovian Research Institute of Agriculture for their subsequent storage in the gene bank.

Keywords: *zucchini seeds, accelerated aging, seed germination energy, seed root growth, electrolyte leakage*

Materials and Method. The following varieties were selected for the method of accelerated aging of zucchini seeds: Skvorushka, Zolotinka, Zebra, Bush, Sote, Gaidamaka, L186, Tsukesha. Exposure to air temperature 43^0C with relative humidity of 90 - 100%, the duration of both stress factors was 96 hours. After accelerated aging, the seeds were germinated in a thermostat at 25^0 C. There were 300 seeds in each variant, and the experiments were carried out in 3-fold replications. Normal seeds from the same reproduction were the control.

Various morphophysiological parameters of zucchini seeds and seedlings were determined during the experiments: germination energy and germination of seeds, root length, wet and dry root biomass, electrolyte leakage by electrical conductivity of solutions with seeds at 24 and 48 h exposures. An N5721M conductivity meter was used to determine the electrical conductivity of seed solutions. Experimental data were processed using the Statistica 7 software package.

Results. In developing the method of accelerated aging of zucchini seeds different combinations of temperature exposure - 41, 42, 43^0 C, as well as different periods of exposure to elevated temperatures and humidity (72, 96, 112 hours) were used.

The most effective method of accelerated aging of zucchini seeds was noted, which revealed significant differences in the manifestation of morpho-biological traits in the studied varieties. The optimum combination of stress factors was exposure to 43^0 C temperature and 90-100% humidity for a combined effect of 96 hours. Thus, the most susceptible to aging was bush variety, which showed final germination in the control 81.1 ± 5.1 %, and in the experiment – 40.0 ± 5.7 % (49.3 % of control). In terms of the average root length it had the following results: in the control 39.9 ± 5.1 mm, in the experiment 22.0 ± 4.6 mm (55.1% of control). The most resistant to aging was the variety L186, seed germination of the control was 98.6 ± 2.3%, and the experiment was 86.3 ± 2.7% (87.5% of control). According to the average length of roots, the following data were obtained: in the control 27.6 ± 5.6 mm, in the experiment 18.1 ± 5.3 mm (65.6 % of control). The above contrasting varieties also revealed differences in electrolyte leakage between control and experience after accelerated aging of zucchini seeds at seed swelling exposures for 48 hours. In the variety Kustovoy, this parameter of electrolyte leakage was 89.4% relative to control, and in the variety L186 electrolyte leakage was at 66.7% relative to control. In this case, the results on resistance to aging genotype L186 and susceptibility variety Kustovoy confirmed, because it is known from the literature that the higher the rate at which seeds can restore membrane integrity, the lower the leakage of electrolytes and the better the quality of the seeds.

Conclusions. The use of the method of accelerated aging of seeds, which consists in their incubation for 96 hours at increased humidity (90-100%) and air temperature

(43^0 C), allows us to adequately simulate the effects of unfavorable factors that play a crucial role in the aging of zucchinis seeds.

The data obtained on the electrical conductivity of solutions with the exposure of seeds for 48 hours allow us to consider this method effective in assessing the aging of seeds from active zucchini collections.

The possibility of forecasting the storage potential of zucchini seeds from active collections of the genetic bank of plants by changes in morphophysiological parameters using the developed test for accelerated aging of seeds was shown.

Acknowledgment. Research was carried out within the project of the State Program 20.80009.5107.11. ”Long-term *ex situ* conservation of plant genetic resources in the Gene Bank using the methods of molecular biology for plant germplasm health testing”, financed by the National Agency for Research and Development.

References:

1. Delouche, J.C. & Baskin, C.C. Accelerated aging techniques for predicting the relative storability of seed lots. *Seed Sci. Technol.*,1973, vol 1, p. 427- 452.
2. Demir, I., Ozden, Y.S. & Yilmaz, K. Accelerated aging test of aubergine, cucumber and melon seeds in relation to time and temperature variables. *Seed Sci. Technol.,* 2004, vol 32 (3), p. 851- 855. DOI: 10.15258/sst.2004.32.3.20.
3. Dutra, A.S. & Vιeιra, V.D. Accelerated aging test to evaluate seed vigor in pumpkin and zucchini seeds. *Seed Sci. Technol.*, 2006, vol 34 (1), p.209-214. DOI:10.15258/sst.2006.34.1.24.
4. International rules for seed testing. Edition 2004. The Iinternational Seed Testing Association (ISTA), Switzerland. 2004, 310 p.
5. Torres, S.B. & Marcos-Filho, J. Physiological potential evaluation in melon seeds. *Seed Sci. Technol.,*2005*,* vol 33, p .341- 350. DOI: 10.15258/sst.2005.33.2.07.

CZU:635.611:575.22 https://doi.org/10.53040/abap6.2022.105

DETERMINATION OF STORAGE POTENTIAL OF GENOTYPES FROM THE MELON COLLECTION (*Cucumis melo* L.) IN THE CONDITIONS OF *EX SITU* CONSERVATION

MIHAILA Victoria*, CORLATEANU Liudmila**, MELIAN Lolita***, GANEA A.#,
Institute of Genetics, Physiology and Plant Protection,
Chisinau, Republic of Moldova
** https://orcid.org/ 0000-0003-3984-9477,*
*** https://orcid.org/ 0000-0002-1018-1832,*
**** https://orcid.org/ 0000-0002-9192-0560,*
#https://orcid.org/ 0000-0002-8658-6879
e-mail: victoriamihaila373@gmail.com

The conservation of genetic resources in genetic banks is considered the most advanced form of conservation of plant genetic material. The storage of plant germplasm in seed form is the most practical and, at the same time, the most practiced method of *ex situ* conservation, allowing the conservation of a large number of samples in a relatively small space. Regardless of the storage conditions (more or less favorable) the seeds age, lose quality and vigor. Seed aging is the result of the accumulation of metabolic and structural damage that conditions a disruption of normal functioning and decreases resistance to adverse environmental factors, even up to the loss of germination capacity. Keeping the viability of the seed is the primary objective in the successful realization of its conservation *ex situ*. New methods need to be applied to determine the quality and storage potential of seeds within a short time. In order to achieve this goal, the method of accelerated aging of seeds (AA) can be used, which involves their thermal treatment, increasing their humidity and keeping the seeds in ovens at temperatures much higher than those for long-term preservation (45 or even 55°C) [3]. The application of the test of accelerated aging of seeds allows to monitor the genotypes in the plant collection, to record the viability of the seeds and to display the genotypes that show a long-term storage capacity in the genetic bank. This communication describes the manifestation of some morpho-physiological and biochemical parameters in the seeds and seedlings of some melon varieties (*Cucumis melo* L.) after application of the test of seed accelerated aging.

Key words: *accelerate aging, seed germination, plant genetic bank*

Materials and Method. The seeds of five melon varieties (*Cucumis melo* L.) received from the Pridnestrovian Scientific Research Institute of Agriculture were used as study material: *Colhoznita, Titovca, Bessarabia, Prednestrovie and Cochetca.* To determine the storage potential of seeds was used accelerated aging test of seeds (AA) by exposing them to temperature of 42-43°C, air humidity – 60-80% for a term of 96 hours. The seeds were placed then in thermostat in Petri dishes at a temperature of 25°C. For each variant of the experience, 150-200 seeds were used according to the International Seed Testing Rules ISTA [1]. The following morpho-physiological parameters of seeds and seedlings were determined: seed viability, lenght of seedling rootles, wet root biomas. From the biochemical parameters, Peroxidase ferment activity was studied in seedling roots according to the method [5]. The obtained results were processed using the *Statistica 7* program package.

Results. Condition of the accelerated aging test on seeds of *Cucumis melo* L. varieties had a significant influence on all investigated parameters. Seed germination in the genotypes included in the study was much lower in the experimental variant compared to the control. The average value of seed germination under control conditions varied within the limits of 90.0-98.0%, and in the test group the indices of this parameter varied from 58.0 to 75.0%. Germinative energy in the control variant exceeded the level of 90.0%, and in the experimental one the values of this parameter fell within the limits of 58.0 - 71.0%. The highest level of germination energy was reported in the *Cochetca* variety - 74.0%, and the lowest level of this parameter was detected in the *Colhoznita* variety (56.0%). The increased degree of variation according to this index reflects the individuality of the genotype and its ability to manifest viability under less specific conditions. Regarding the length of the root the obtained results show that in this case there was also a decrease in the experimental variants compared to the control. Under control conditions, the values of this parameter fell between 2.3±0.05 and 2.96±0.07 cm, and in the experiment this index varied from 1.9±0.11 cm to 2.14±0.06 cm. The data on wet root mass parameters also reflect a decrease in the experimental variants compared to the control. Wet root biomass for seeds in the experimental variant ranged from 0.23 to 0.38 g, while in the experiment the limits of this parameter are 0.13 - 0.33 g. In the present study, research was carried out to determine the content of peroxidase, which performs multiple functions in plant tissues and plays an important role in regulating metabolism. The activity of peroxidase in plant adaptation reactions to adverse environmental conditions is well known [2]. The tolerant forms of plants are distinguished by a higher content of peroxidases [4]. Determination of the peroxidase content in the roots of melon seedlings in the result of the accelerated seed aging test showed a significant increase in its level under heat stress compared to the control. This increase is observed in all varieties included in the study and the overrun is about 40%. The highest increase in peroxidase level was reported in the seed roots of the variety *Titovca* where in control conditions this parameter amounted to 0.16 c.u. and in the experimental variant the peroxidase level was 0.24 c.u.

The application of the test of accelerated aging of the seeds, which represents their incubation at superoptimal temperature and increased humidity for a well-established period, allowed to characterize the storage potential of the seeds of the collection varieties and to highlight the genotypes showing resistance to less specific environmental conditions. The knowledge of these particularities is of major importance in the successful implementation of long-term seed storage procedures in the genetic bank.

Conclusions. Using the accelerated seed aging test, the germplasm storage potential of *Cucumis melo* L. varieties was determined. The application of the accelerated seed aging test and the determination of peroxidase content in root seedling allowed to identify and select genotypes with superior performance of seed quality and vigour indices under less specific conditions. *Cochetca, Titovca* genotypes showed the highest storage potential, which allows their long-term storage in the genetic bank.

Acknowledgment. Research was carried out within the project of the State Program 20.80009.5107.11 “Long-term *ex situ* conservation of plant genetic resources in the Gene Bank using the methods of molecular biology for plant germplasm health testing”, financed by the National Agency for Research and Development.

References:

1. International rules for seed testing. The International Seed Testing Association (ISTA), Switzerland. Edition 2004, 310 p.
2. Negru P., Șișcanu Gh., Erezanu N., Popovici A. Particularitățile activității regulatorilor de creștere și peroxidazei la plantele viticole în funcție de genotip, acțiunea secetei și moinelor. Buletinul Academiei de Științe a Moldovei, Științele vieții. Chișinău, 2008. p. 51-55
3. Pintilie O., Cosma A., Zaharia M., Murariu M., Drochioiu G., Sandu I. Conservarea genetică a varietăților vegetale autohtone şi modificările biochimice. Tehnocopia. 2014, Nr. 2(11), p. 18-23.
4. Ștefârță A., Brânză L. corelația activității unor enzime antioxidative și statusului apei frunzelor de Zea mays L. în condiții de secetă. Buletinul Academiei de Științe a Moldovei, Științele vieții. Chișinău, 2008, 2 (305), p. 45-21. ISSN 1857-064X
5. Ермаков, А.И. и др. Методы биохимического исследования растений. Москва: «Колос», 1987, с.42-43.

CZU:635.658:631.52(479.24) https://doi.org/10.53040/abap6.2022.106

РОЛЬ ПРОДУКТИВНОСТИ И ДРУГИХ ПОКАЗАТЕЛЕЙ СОРТОВ И СОРТООБРАЗЦОВ ЧЕЧЕВИЦЫ ОБЫКНОВЕННОЙ (*Lens culinaris* MEDIC.) В ОБЕСПЕЧЕНИИ ПРОДОВОЛЬСТВЕННОЙ БЕЗОПАСНОСТИ

НАРИМАНЛЫ У.Р.
Азербайджанский государственный экономический университет(UNEC)
e-mail:ulvia0593@gmail.com

Надежное обеспечение населения продовольственными товарами является одной из важнейших задач, стоявших перед каждым государством во все периоды истории и сегодня сохраняющей свою актуальность. Именно поэтому в нашей стране вопрос укрепления продовольственной безопасности всегда находится в центре внимания, и в этом направлении принимаются важные меры. Нашей главной целью является обеспечение населения продуктивной, экологически чистой и в то же время традиционной с точки зрения пищевой безопасности сельскохозяйственной продукцией, и использование устойчивых к неблагоприятным условиям формы в качестве доноров в будущих селекционных работах.

С точки зрения продовольственной безопасности увеличение местного производства экологически чистой и традиционной сельскохозяйственной продукции оказывает серьезное влияние как на самообеспечение населения нашей страны, так и на сокращение финансовых затрат, направляемых на импорт из-за рубежа. В связи с этим основная политика государства направлена на снижение зависимости от импорта, создание благоприятных условий для реализации экспортного потенциала за счет создания продовольственного изобилия.

В последнее время серьезные проблемы возникшие в удовлетворении мирового спроса на продукты питания обусловлены ускорением процессов эрозии земельных и водных ресурсов, пригодных для сельскохозяйственного производства, а также темпами роста населения Земли. Резкое несоответствие между темпами роста спроса на продукты питания и имеющимися производственными ресурсами сулит ряд проблем в обеспечении продовольствием растущего населения планеты. В связи с решением продовольственной проблемы в нашей республике к числу задач относятся создание высокоурожайных и качественных местных сортов чечевицы, устойчивых к биотическим и абиотическим стрессовым факторам, определение оптимальной технологии возделывания, организация семеноводства и распространение семян.

Образцы, включенные в коллекцию, состоят из зеленой чечевицы. Все виды однолетние. Чечевица пищевая (*Lens culinaris* Medic) однолетнее растение высотой 20-75 см. Цветоножка имеет 1-4 цветка и заканчивается усиками. Цветы бывают разных цветов. Согнутые стручки имеют 1-3 семени. Они засухоустойчивы. В 100 г сухой чечевицы содержится углеводов - 53,5 г, белков - 24 г, воды - 14 г, целлюлозы - 3,7 г, золы - 2,5 г, жиров - 1,1 г.

Отсюда видно, что чечевица является отличной заменой мяса, так как в ней мало жира и много белка. Создание новых сортов растений, дающих высокоурожайные, качественные зерновые культуры для богарных регионов нашей республики и их применение в крестьянских и фермерских хозяйствах являются актуальными вопросами. Чечевица занимает уникальное место в этом аспекте.

Цель исследования. Целью исследования является применение в селекции местных и интродуцированных (ICARDA) сортов и сортообразцов одной из самых распространенных и широко используемых пищевых бобовых культур в Азербайджане, Чечевицы обыкновенной (*Lens culinaris* Medic.) с высокими производственными показателями, устойчивых к стрессовым факторам среды с физиологической точки зрения и перспективных в количественном и качественном отношении.

Материалы и методы. Опыты проводились в 2020-2021 годах во Вспомогательном опытном хозяйстве (ВОПХ) Азербайджанского Научно-Исследовательского Института Земледелия на десяти сортах и сортообразцах чечевицы. Схема эксперимента была следующей. Расстояние между рядами 45 см, длина ряда 2 м, расстояние между растениями 5 см, глубина заделки семян 5-7 см.

Результаты. В качестве материала для исследований использовали 10 местных и интродуцированных (ICARDA) образцов чечевицы. Камеральные и полевые исследования проводили в 3-х повторах в зависимости от сезона и в 4-х вариантах: с удобрениями, без удобрений, с микроэлементами и удобрениями и без удобрений с микроэлементами. На исследуемом участке агробиологические особенности чечевицы обыкновенной (*Lens culinaris* Medic.) изучали сравнительно с прошлым годом.

В зависимости от смены климатических условий более благоприятным для посева чечевицы считается период с середины октября до конца ноября. Последовательные фенологические наблюдения проводились за фазами развития растений. Были отмечены фазы цветения, образования стручков и созревания. Хотя основной стебель на начальных стадиях рос медленно, позже происходило ускорение роста и после цветения наблюдалось сильное разветвление.

Одной из основных хозяйственно важных характеристик чечевицы является высота растения. Высокорослые растения развиваются и уплотняют междурядья, происходит затенение нижних частей растения что сдерживает развитие сорняков и сохраняет влагу в почве.

В зависимости от почвенно-климатических условий чечевица всходит в среднем через 6-17 дней после посева. Цветоножка имеет 1-4 цветка и заканчивается усиками. Цветки бывают разной окраски (белые, розовые, лиловые). Растения темно-зеленого цвета. В осенних посадках в растениях образуется антоциановый пигмент, который полностью исчезает в более поздние фазы вегетации, начиная с ранней весны. Всходы начинаются 28 января и заканчиваются 2 февраля. Вегетационный период сортов и сортообразцов колебался в пределах 118-128 дней.

В удобренном варианте стадия начала цветения приходится на 18-23 апреля, 50% цветение- на 20-25 апреля, и полное цветение - на 21-27 апреля.

Полное цветение сначала наблюдалось у сорта Зафар (ст). Начало стадии созревания зерна приходится на 17-27 мая, а полное его созревание - на 3-29 июня. В удобренном варианте DFLR (количество дней до 50% цветения) составлял не менее 83 дней (также и у стандартного сорта Зафар) у большинства образцов, а максимальный – 88 дней у сорта LİEN-LS-17(9). DMAT (количество дней до созревания) составлял 112-128 дней, STAND (полевое стояние растений) оценивался по 1 балловой шкале для каждого образца. В удобренном варианте высота растений (PTNT) была в пределах 17,5-33,3 см. После уборки SYLD (биологическая продуктивность) у каждого сорта и сортообразца составляла 9,34-29,32 ц/га.

Начало цветения у сортов и сортообразцов в удобренном варианте с микроэлементами отмечено 17-23 апреля, 50% цветение - 19-25 апреля, фаза полного цветения - 21-27 апреля. Начало стадии созревания зерна наблюдалось в период с 17 по 26 мая, а полное его созревание – с 30 мая по 5 июня. Наименьшее количество дней до 50% цветения в растении (DFLR) составляло 82 дней у сортообразца LİEN-LS-17(1) и наибольшее 88 дней у сортообразцов LİEN-LS-17(34) и LİEN-LS- 17(9).

Вегетационный период (DMAT) сортов и сортообразцов составил 118-127 дней. Полное созревание у стандартного сорта Zafar происходило за 118 дней. Высота растений достигала (PTNT) 19,5-34,1 см (табл. 3.4). Вегетационный период растения составлял 118-128 дней в удобренном варианте с микроэлементами. Одной из других хозяйственно важных характеристик растений является их продуктивность. Биологическая продуктивность (SYLD) в удобренном варианте с микроэлементами составила 13,5-31,6 ц/га (табл. 1, 2). С этой точки зрения в образцах удобренного варианта с микроэлементами урожайность осенних культур оказалась выше до 30 %, чем яровых.

У образцов без удобрений и без удобрений с микроэлементами цветение начиналось 17-23 апреля, 50% цветение приходилось на 19-25 апреля, полное цветение наступало 21-27 апреля. Полное цветение наблюдалось у сортообразцов LİEN-LS-17(34), LİEN-LS-17(9) 27 апреля, а у стандартного сорта Зафар 22 апреля. Начало стадии созревания в микроэлементном варианте без удобрений приходилось на 17-26 мая, а ее завершение между 27 мая и 5 июня, а в варианте без удобрений между 26 мая и 5 июня. Установлено, что DFLR составляет 82-88 дней в варианте без удобрений. Вегетационный период (DMAT) сортов и сортообразцов в варианте без удобрений составил 118-128 дней, а в варианте без удобрений с микроэлементами - 119-128 дней. Вегетационный период (DMAT) составлял 119-128 дней как в варианте без удобрений, так и без удобрений с микроэлементами. Самый короткий вегетационный период составил 119 дней у сорта Зафар (ст), а самый продолжительный - 128 дней у сортообразца LİEN-LS-17(34). Установлено, что высота растения (PTHT) в микроэлементном варианте без удобрений составляет 19,0-32,3, а в варианте без удобрений - 18,4-32,6. В ходе исследований установлено, что урожайность у сортов и сортообразцов в варианте без удобрений колебалась в пределах 4,52-33,92 ц/га, а в микроэлементном варианте без удобрений - 8,51-30,54 ц/га.

CZU:502.75:634.45:58.08 https://doi.org/10.53040/abap6.2022.107

THE MOBILIZATION AND CONSERVATION OF *Diospyros virginiana* L. PLANTS IN NBGI

ONICA Elisaveta*, ROSCA I.**, CUTCOVSCHI-MUȘTUC Alina***, MITU V.
"Alexandru Ciubotaru" National Botanical Garden (Institute), Chisinau, Republic of Moldova
**https://orcid.org/ 0000-0001-6075-5518, ** https://orcid.org/0000-0002-1304-8033*
****https://orcid.org/0000-0002-9005-6977, e-mail: alinacutcovschi@mail.ru*

The article describes the biological peculiarities of growth, development and cultivation of newly introduced plants of *Diospyros virginiana* in the NBGI.

Keywords: *Diospyros virginiana, introduction, growth, development, fruits*

The genus *Diospyros* L. belongs to the family Ebenaceae Gürke, it includes 200 species occurring naturally in tropical and subtropical areas of Asia. In the Russian Federation, 1 species occurs spontaneously and 4 taxa have been introduced. In Asia, 3 species are widespread (*Diospyros virginiana* L., *D.lotus* L., *D. kaki* L.f.) and several varieties are cultivated. At the Nikita Botanical Garden, Ukraine, there is a rich collection of cultivars of the species *D. kaki* L.f., the agrobiological characters of which and the resistance to diseases and pests have been determined and the specimens that are more adapted to the new climatic conditions have been selected. In the Republic of Moldova, only one species has been introduced and acclimatized to the pedoclimatic conditions of the country – *Diospyros virginiana* L.

The fruits of plants of the genus *Diospyros* L. contain carbohydrates in a higher amount (17-18 %) than citrus fruits (6-9%), peaches (8-11%), apples (7-15%), pears (7 -13%), plums, apricots (7-12%), quinces (9-11%). The fruits, in addition to carbohydrates, are rich in proteins, oils, mineral substances, tannins, cellulose, vitamins, carotene, from which vitamin A and iron salts are synthesized in the human body. The content of tannins gradually decreases until the fruits are fully ripe. The fruits can be eaten fresh, dehydrated or processed. Fresh fruits are a precious dietary product, recommended for the prophylaxis and treatment of anaemia, diseases of the digestive system and gingivitis as an antiseptic. The infusion from persimmon leaves, in its native country, is used as a hemostatic and diuretic remedy, and from the bark – for its astringent and diuretic action. Fresh, dehydrated fruits can be used as a nutritional supplement, in pastry, in the manufacture of non-alcoholic soft drinks, liquor, yogurts. The wood of this species is highly valued on the world market, as it can be used in the manufacture of details for furniture, in the textile industry and the manufacture of musical instruments. *Diospyros virginiana* L. has deep, well-developed root system, so it can be cultivated on degraded soils with a risk of erosion, and for the production of high quality fruits – on soils rich in nutrients.

Diospyros virginiana L. (American persimmon) native to North America, it is a tree of the third size range with moderate growth rate, it grows spontaneously in the country of origin up to 12-18 m tall, it can reach a maximum of 30 m. *Diospyros virginiana* was introduced in the "Alexandru Ciubotaru" National Botanical Garden (Institute) from the Nikita Botanical Garden, it grows as a shrub that reaches 4-5 m in height at the age of 15, but can be managed with monostem. The process of acclimatization of the shrub to the new conditions was problematic. Over the years, the shrub was affected to the snow cover, then it bloomed but did not set fruit, or it produced fruits but did not fully ripen because of early frosts, the seeds were undeveloped, unconditioned. Climate changes, in recent years, have had a beneficial impact on the growth and development of the studied plants. The crown is oval, spreading, with arched branches during the period of flowering and fruit ripening. The dark brown or dark grey bark, with age, deeply cracks into plates with scaly surface. The ovate, pointed buds are covered in winter with thick reddish or purple scales, sometimes persistent at the base of the branches. The plants come out of dormancy in April. The leaves are alternate, elliptic or oval, pubescence is absent on the shiny upper side, but present on the lower side. The robust, pubescent petiole grows up to 1 cm long. Flowering takes place in the second half of May and until the first days of June. Flowering occurs gradually, initially in the upper part of the plant, on the branches of the V-VI order, and on a branch – from the basal to the apical part. The female flowers are solitary, large, and the male flowers are small, grouped by 3 per inflorescence. The flowers are similar in structure to those of *Diospyros lotus* L.f.; they only differ in size, being 2 times larger. The corolla of the flowers ranges from greenish-yellow to creamy-white. In female flowers, the stamens have undeveloped anthers. The fruits look like some large cherry plum fruits, of various sizes and shapes – ovate, slightly elongated, the colour – orange-purple, with yellow mesocarp. The fruits at the beginning of ripening are astringent, sour, and then gradually become soft when fully ripe, sweet after the first frosts, with a specific flavour and taste. The fruit contains 5-6 light-brown seeds. The fruits are produced on young shoots of the current year; they ripen in September-December, depending on the weather conditions, more specifically – the sum of temperatures in autumn. They are preserved and mature fully if stored in refrigerators or on the plant after the first frosts. The generative saplings mature at the age of 5-7 years, and the grafted ones – after the 4th growing season. *Diospyros virginiana* is subthermophilic, resistant to root bacteriosis, therefore it can serve as a rootstock for other species and cultivars of *Diospyros* L., as well as seed material for obtaining cultivars resistant to new pedoclimatic conditions. It grows and develops well in sunny areas, tolerates semi-shade, prefers drained soils, rich in humus, and locations that are sheltered from air currents from the northern side. *Diospyros virginiana* is propagated by seed to obtain rootstock seedlings and for breeding. Vegetative propagation is carried out by 2 methods – by layering (by arching) and grafting (by using a bud or a shoot as scion). The second method is more profitable for the multiplication of new cultivars of the genus *Diospyros* L. As a result of generative propagation, uneven seedlings are obtained, with lower qualities specific to the mother plant and predominantly male. Propagation by seeds is used in forestry plantations, breeding, introduction in other geographical areas, for the reason of obtaining generative seedlings more adapted to the new pedoclimatic conditions, with a well-developed root system. Seeds freshly extracted from soft fruits are sown in well-prepared substrate in containers. In spring, the stratified seeds are sown in hotbeds. Germination is quite uneven, some seeds sprout even after 2-3 years. The generative seedlings obtained from sowing in autumn, at the end of the first growing season, reach a height of 20-25 cm, and the first-order root reaches a length of 30-35 cm. The growth of seedlings lasts until June, depending on the climatic conditions and the compliance with the techniques of cultivation. The seedlings after the first growing season need to be transplanted into containers, because the percentage of survival after transplantation decreases with age. The high percentage of survival is preserved only if planting with protected root (with root ball).

Diospyros virginiana prefers light, sandy, well-drained soils; fruiting is more abundant if the plants are grown on fertile soils. It grows and develops well up to 100 years. It does not require special care, only the removal of damaged and senile branches. If pruned too much to allow the access of more sunlight, the growth of annual shoots will increase, but the productivity and vigour of the plant will be reduced. In early spring, American persimmon, like other fruit trees, is treated with a copper-based solution. The generative and vegetative seedlings are better planted in autumn, at a distance of 5 x 4 m.

Acknowledgment. The research was carried out within the project of the State Program 20.80009.7007.19 “The introduction and development of technologies for propagation and cultivation of new species of woody plants by conventional techniques and tissue culture”, financed by the National Agency for Research and Development.

CZU:631.527:635.54 https://doi.org/10.53040/abap6.2022.108

BIOMORPHOLOGICAL AND QUANTITATIVE CHARACTERISTICS OF TOMATO SC_0 SOMACLONES

PALADI Dana, COTENCO Eugenia*, SIROMEATNICOV Iulia**
Institute of Genetics, Physiology and Plant Protection, Chisinau, Republic of Moldova
**https://orcid.org/0000-0003-0603-3404, ** https://orcid.org/0000-0001-7780-083X*
e-mail: dana.paladi@igfpp.md

With the development of cellular biology, molecular genetics, biochemistry, biophysics, microbiology and genetic engineering, artificially manipulating the genetic information of living organisms became possible resulting in modern biotechnologies with special implications in the improvement of plants and animals, production of pharmaceutical and cosmetic ingredients, valuable chemical and bioenergetic products [1]. *In vitro* culture is a set of techniques that requires the use of aseptic elements and the creation of a perfectly controlled environment, being an advantageous way to increase the chances of inducing and obtaining somaclonal genetic variability and stable genetic somaclones [2].

Keywords: *tomato, in vitro culture, culture medium, tomato somaclone*

Materials and Method. Research was conducted in Laboratory of Plant Resistance and on experimental fields of IGPPP. Five tomato cultivars served as objects of study: three low-temperature resistant genotypes Iulihirsutian, Anatolie, Jacota and two drought resistant CerryDani and Elvira cultivars. Research methods included cell and tissue *in vitro* cultures (optimization of media for inducing the processes of callogenesis, morphogenesis, embryogenesis, regeneration, rhizogenesis), biochemical methods (carbohydrate content determination, determination of dry active compounds in fruits), statistical analysis of the experimental data according to STATGRAPHICS Plus 5.0 software package.

Results. Five variants of Murashige and Skoog culture media (1962), supplements with growth regulators in different concentrations for regeneration and propagation of tomato somaclones were used in the study. To create new forms of plants, different types of explants derived from seedlings obtained aseptically from the germinated seeds of the genotypes included in the research were inoculated on the growth media: stem segments, leaf segments, nodes, internodes, cotyledons and meristems. The stem segments (hypocotyl segments) grown on the culture medium containing Thidiazuron in different concentrations showed high values compared to other types of explants.

We mention that the nature of the cells and tissues inoculated on the culture media, the origin of the explants, the phenophase of explant donor during inoculation, age, explant size and seedling cultivation regime play an important role in the explant reaction to different *in vitro* cultivation conditions in the induction of organogenesis, morphogenesis, embryogenesis and seedling regeneration.

As a result of the use of culture media for dedifferentiation and proliferation of hypocotyl explants, 316 SC_0 somaclones were obtained, which were later adapted to *in vivo* conditions, including Iulihirsutian $SC_0$50-147; Jacota $SC_0$52-45; Anatolie $SC_0$87-34; CherryDani $SC_0$83- 60 and Elvira $SC_0$27 -30 seedlings.

The somaclones were adapted to *in vivo* conditions, preventively in pots in the culture room, later transferred to the solarium, and then cultivated in the open field without irrigation. The plants were planted in the field according to the (70 x 70) x 30 cm scheme. Somaclones were planted in 5 cm rows, 18 plants per row. During the seedling growth and development, the phenological record was made from their planting to the single flowering in volume of 10% and in mass 75%, the formation and ripening of fruits per plant, in order to determine the period of precocity. Under field conditions, the SC_0 somaclones were evaluated based on 40 characters, selecting the best performing forms of interest for the breeding process.

As a result of the evaluation of the SC_0 somaclones, it was established that the plant size varied with the plant height starting at 55cm. $SC_0$83 somaclones showed values up to 68cm. In $SC_0$87 somaclones, practically all plants manifested determinate growth. The branch number per plant criterion varied: four branches for $SC_0$27 and SC052; five branches for $SC_0$50 and $SC_0$87 and maximum for $SC_0$83 - 8 branches. It was stated that inflorescence lengths variation depends on the genotype.

The number of flowers on the first three inflorescences in $SC_0$52, $SC_0$83 and $SC_0$87 somaclones are constant and exceeds somaclones $SC_0$50 and $SC_0$27, the number of fruits on the first three inflorescences is approximately at the same level in somaclones $SC_0$27, $SC_0$50 and $SC_0$52, except for $SC_0$83 and $SC_0$87.

The period of seedling growth and development from planting to fruit ripening was assessed, establishing a period of extra-early precocity. Biochemical analyses of carbohydrate content in fruits were carried out both under laboratory and in field conditions with the portable refractometer. As a result, the carbohydrate content under laboratory conditions recorded higher values compared to those performed directly in the field.

The content of dry active substances in the $SC_0$83 somaclones was 5.5%, surpassing the $SC_0$27 somaclones that presented the value of 3.8%. The studied somaclones demonstrated a productivity between 41 t/ha - 57.1 t/ha.

Conclusions.

1. It was stated that the stem segments (hypocotyl segments) grown on the culture medium containing Thidiazuron in different concentrations showed high values compared to other types of explants.

2. As a result of the use of culture media for dedifferentiation and proliferation of hypocotyl explants, 316 SC_0 somaclones were obtained, which were later adapted to *in vivo* conditions, including Iulihirsutian $SC_0$50-147; Jacota $SC_0$52-45; Anatolie $SC_0$87-34; CherryDani $SC_0$83- 60 and Elvira $SC_0$27 -30 seedlings.

3. The dry active substance content in the $SC_0$83 somaclones was 5.5%, surpassing the $SC_0$27 somaclones which presented the value of 3.8%. The studied somaclones demonstrated a productivity between 41 t/ha - 57.1 t/ha.

Acknowledgment. Research was carried out within the project of the State Program 20.80009.5107.03 “Efficient use of plant genetic resources and advanced biotechnologies to increase the adaptability of crop plants to climate change”, financed by the National Agency for Research and Development.

References:

1. Anghel I., Brezeanu A., Cachiţa C.D. Progrese şi tendinţe în domeniul culturii de celule şi ţesuturi vegetale //Lucrările celui de al V-lea Simp. Naţ. De culturi de celule şi ţesuturi vegetale, Bucureşti, 1993.
2. Ardelean A., Cachiţa C.D. Metabolites from plants tissue and cell cultures// In.:Actualităţi şi Perspective în Biotehnologiile vegetale, Lucr.VI-lea Simp. Naţ. de Cult. de ţesut., şi Celule Vegetale, Oradea,1996, p.1-17

CZU:634.22:575.22 https://doi.org/10.53040/abap6.2022.109

OLD LOCAL PLUM VARIETIES - DONORS OF IMPORTANT TRAITS FOR *Prunus domestica* L. BREEDING

PINTEA Maria*, TERENTII P.
Research Institute for Horticulture and Alimentary Technologies,
Chisinau, Republic of Moldova
**https://orcid.org/0000-0002-5589-4158, e-mail: mariapintea@yandex.com*

Keywords: *plum, local varieties, resilience of breeding*

Purpose: Breeding and genetics of plum.

Materials and Method. Accessions were collected in different north and central pomological zones of the Republic of Moldova (RM). Characteristics of the plants and fruits of varieties were conducted using UPOV descriptor [1, 2, 4]. Chemical evaluation of created, selected, introduced varieties and hybrids, were per formed in the laboratory of biochemistry. Following parameters were examined: total sugars and organic acid content, vitamin C content; Soluble dry material; Non soluble solids; phenol content. Main fruit characteristics such as fruit weight, firmness, titratable acid content and soluble solid substances and important phenological periods such as flowering, harvest time and visual survey of the phytosanitary status (first of all tolerance to PPV on fruits and leaves) etc. were determined as well [3].

Results. In the central and north pomological zones of the RM were collected and characterized accordingly main biological and fruits compounds of 9 old local Moldovan plum varieties (genotypes) (Vinete de Tiraspol, Rotunda-1, Bardace, Bardace 3, Bardace 5, Goldani ciornaia, Prune moldoveneєti, Vinete de Valcinets, Prune moldovenesti 2). Field evaluations demonstrate that there exists some diversity of clones of local Bardace, Vinete moldovenesti, Prune moldovenesti in all pomological zones of the republic. They differ in terms of morphololological growing charracteristics, form and size of fruits, taste and structure of flesh peculiarities, maturity rate, disease resistance and other depending of pedological and micro climatic conditions. Some similarity was noted with some Romanian, Jugoslavian, Ukrainian ones. Evaluated old local plum varieties represent a permanent source for important genetic traits, regarding nutritional qualities, resistance to extreme climatic-ecological conditions, resistance to significant harmful biologic agents. Culture tradition of plum (*Prunus domestica* L.) in RM dates back to almost 2000 years ago, processed plumes (prunes) having significant socio-economic and heritage value. Starting from the 18-19 centuries plums there are cultivated practically in all home garden (domestic orchards). Within the territory of actual RM there were intensively established commercial plums orchards on the basis of local, as well as introduced European varieties. Presently in the R M more than 25000 private farmers there are involved in the production of fruits, especially plums. As consequence of dynamic expansion and reconversion of fruit trees plantation occurred. At the same time old plum genotypes continue to be abandoned and lost. Dried plumes (prunes) as well as fresh fruits continued to have significant socio-economic and heritage value. There are promoted significant changes of the pomiculture in general, that moved from the land-owner old style management to the modern intensive farming, introducing perspective for marketing new European etc. cultivars. Some old Moldovan plums are mentioned scarcely in some papers [1, 2, 4]. Of course, at the same time and lost old plum genotypes continue to be abandoned. Evaluation and establishment of germplasm of old local plums genotypes/varieties are indispensable as well as it is necessary to conduct *in situ* and *on-farm* inventories. More representative by fruit proprieties adaptability and ecological plasticity is Vinete de Moldova, syn. Vengherka moldavskaia. A lot of centuries it was propagated by shoots. *Spreading*: It is widespread all over in the rep. of Moldova, and in the nearby regions of Romania and Ukraine. From 1998 year this cultivar is registered for large propagation in the country, because it is adapted to different soils and moderate continental climate conditions. *Harvesting time*: fruits mature in late August and early September and on the north part of Moldova in the middle of September. *Used value of the fruit***:** of jam called 'povidla', jam, compote, sweet, brandy, but mainly for drying. *Morphological traits. The tree*: Medium-vigorous. The crown is dense and wide-pyramidal. The scaffold branches are well-covered with fertile twigs.

Leaves: Elliptic, medium to large size, dark green color. Younger trees have larger leaves. Leaf stem is medium thick, short to medium long, green or greenish-red color. *Flower:* Medium-large, white with elongated petals. Pistils and stamens are in the same level. *Physiological traits:* **Vigor**: Medium. *Blossoming*: on medium period and explosive. For one day 50 to80% of the flowers can be opened. Self-fertile variety. *Productivity:* There are many biotypes that differ in size of the fruit and yield.

Fruit characteristics. Size and shape: Standard Vinete de Moldova fruits are small to medium, weighing approximately 19-23 g, and there are types of fruit with a mass up to 25 g and more than 40gr. Withi the irrication cultivation. The fruit is of prolonged ovoid form with oval shape. *Fruit powder*: Well defined. *Fruit skin*: Dark blue color with pronounced fruit powder, moderate thin, easy to separate of flash. *Fruit flesh*: Golden to green, moderate juicy, firm, sweet and sour, excellent quality. **Stone**: Small, elongated shape. Stones are easily separated from fruit flesh (freestone). It should be noticed also that field explorative and laboratory evaluations demonstrate that some diversity of clones of local Bardace, Vinete moldovenesti, Prune moldovenesti in different pomological zones of the republic there are exists. They differ in terms of grows strength, form and size of fruits taste and structure of flesh, maturity rate, disease resistance and other characteristics.

Conclusions. Old Moldovan local plum varieties represent a permanent source for important genetic traits, for instance: different desirable nutritional and organoleptical qualities, resistance to extreme agro-ecological conditions, resistance to economically significant harmful biologic agents, which accomplished the program objectives, such as: adaptability to local diverse pedo-microclimatical conditions, manifestation of valuable biological and agronomical traits, including high potential of production and quality of fruits in combination with early and late maturation and ensuring a large season for fresh consume excellent quality in the medium and late seasons as well as resistance to main diseases of species. Main plum varieties are characterized by large fruit size (>40gr in the presence of irrigation), intensively colored, type "prune", universal usage, fruit capacity to accumulate high soluble solids and sugar, different period of fruits maturation. Role of local plum (*Prunus domestica* L.) varieties within fruit growing in our republic became to be important one because tolerance and resistance against Sharka and *Laspeyresia funebrana* Tr., self-fertility, fruit intensively colored, type "*prune*", universal usage, fruit capacity to accumulate phenols, high soluble solids and sugar.

Acknowledgment. Research was carried out within the project of the State Program 20.80009.5107.18 "Targeted formation of quality and immune system in fruits of late varieties of plum intended for long-term storage", financed by the National Agency for Research and Development.

References:

1. Cabluciko G. A. 1953. Sorta plodovih culitur/ Gosudarstvennoe izdatelistvo Moldavii. Kisinev. P 115-118.
2. Guidelines for the conduct of tests for distinctness, uniformity and stability. European Plum (*Prunus domestica* L.). Geneva, 2002. 40p.
3. Juraveli A. M. Et all. 2007. Слива. / Kishinau: 2007, 234 c.
4. Programma i metodica sortoizucenia plodovih, iagodnih i orehoplodnih culitur.1999. Oreol, Izd-vo VNIISPK. 608 p.

CZU:634.21:581.46:575.2 https://doi.org/10.53040/abap6.2022.110

INVESTIGATIONS OF APRICOT FLOWER BIOLOGY

PINTEA Maria
Research Institute for Horticulture and Alimentary Technologies, Chisinau, Republic of Moldova
https://orcid.org/0000-0002-5589-4158, e-mail: mariapintea@yandex.com

Keywords: *apricot, varieties, resilience of breeding.*

Purpose: Breeding and genetics of apricot assortment for cultivation in Republic of Moldova.

Materials and Method. Scope of investigations is consecrated to perform breeding and to creation of apricot genotypes available for the variable agroclimatic resources of rep. Moldova as well as to perform DUS testing of new cultivars bred in rep. of Moldova. Experimental National apricot collection holds more than 335 varieties (local and introduced from different regions) and more than 3000 hybrids, obtained from different type of hybridization, including diallelic ones. According approved methodology within fruticulture, including embryological researches [1-3] there were studied flower buds, pollen viability, manifestation of autofertility and interpollenisation with local and introduced for cultivation apricot varieties.

Results. Importance of apricot investigations regarding flower biology and fructifications are related to obtain adequate yields. Different aspects related to the quality of pollen, the stigma and the ovules development are considered to influence greatly the possibilities of the flowers to set fruits. The effective pollination period (EPP) is considered to be an expression of the likelihood that the flowers set fruit and therefore it links female fertility and pollination by considering in a global form all parameters related to reproductive biology. The need of apricot pollinators, with overlapping blooming times, as well as pollinating insects to transfer the pollen, make some self-incompatible cultivars unsuitable to horticultural practices. Knowledge of this trait and methodologies to determination the genotypes of valuable varieties as soon as possible, is important for planification of hybridizations so that the number of self-incompatible seedlings is to minimize the progenies from controlled crosses. Studies of the flower biology of apricot has had strong implications for the breeding program of this species, which has been developed at the same time. First of all, the knowledge of the factors limiting fruit set in an important factor regarding number of promotion of commercial varieties also being oriented to the selection of parents. Some cultivar-dependent characteristics, like macro styles and flower bud density or drop, indicate that some cultivars would not be a good choice as parents in the breeding program. Other factors, like ovule immaturity at anthesis, are signs of bad adaptation of the cultivars to local climatic conditions and these, therefore, would also be a wrong parental selection. In those cases when such parents must be used, the knowledge of these characteristics is important in order to evaluate the seedlings, paying much attention to the possible segregation of these traits within the progenies in order to select the ones that have not inherited the undesirable characters. When studying pollen from apricot cultivars it was found that, with the exception of some male sterile varieties like Colorao or Arrogante [1]. Most of the studied apricot varieties registered in our country [4] could produce pollen in quantities that range from 2,000 to 4,000 grains per anther, there are observed more than 1000 pollen grains per flower. Furthermore, this pollen has a high percentage of viability and germinates, emitting a pollen tube, in a wide range of temperatures [3,4]. Researches of apricot pollen fertility indicated that only some male sterile varieties. Male-sterile anthers can be distinguished visually from normal fertile anthers during the bloom period. Shrunken, discolored anthers are indicative of male sterility and provide a sharp contrast to the swollen, yellow appearance of normal, pollen-fertile anthers. A relatively high number of male-sterile trees were observed in progenies from controlled hybridizations among fertile local and introduced varieties. But stigma receptivity is fundamental, in many instances, for explanation of phenomena observed during fruit setting. In some cases, the stigma has been considered responsible for the success of some cultivars Studies of apricot immature stigmas at anthesis have been found also in some apricot local and introduced varieties lake Doina, Kostiujrnskii, Vasile Cociu, Robada, Lorna, reaching an optimum receptivity two to four days after anthesis and losing it very quickly thereafter. Many apricot varieties and hybrids with short period of flowering have an extremely short period in which stigmas are receptive. the EPP is determined by the longevity of the ovule minus the time required by the pollen tube to reach the ovule, this indirect estimation will be valid whenever the EPP values do not exceed the stigmatic receptivity period fertility [1-3]. The microscopic approach provides additional information on the parameters that limit the EPP that is not obtained with the estimation in the orchard. The EPP was defined as a function of pollen tube speed and ovule longevity. Therefore, it links female fertility and pollination and is an expression of the likelihood that the flowers set fruit. Flower fertility is the capability to produce fruits when flowers are pollinated, at the right time, with compatible pollen. Theoretically, each normally-developed flower is able to set a fruit if pollinated with the appropriate pollen just after anthesis. Its failure to do so is indicative of female sterility. However, under optimal conditions, flowers are not always pollinated at anthesis and stigmas remain receptive for several days for varieties like Codrean, Krasnosciokii, Pincot, Kioto, Luizet [2, 3]. Stigma receptivity, the speed of pollen tube growth and ovule longevity are three factors commonly-studied in the literature about EPP. Our different studies report their relative important, depending on genotype and micro climatic conditions of aria of planted orchards. There must be a good synchronization between them, although genetic and environmental factors may unbalance the process and, therefore, decrease fruit setting.

Investigated shows the different embryo sac developmental stages in apricot. At anthesis, for many early flowering varieties apricot ovules are not mature and frequently they are in a very immature stage. Most ovules examined were within the first three stages of development in the classification (i.e. from ovules without embryo sac to four-nuclei embryo sacs), with high percentages of ovules without normally differentiated embryo sac. There are found small and delayed embryo sacs at anthesis in apricot cultivars like Vasile Cociu, Lorna etc. with frequent low of yields, whereas most embryo sacs had eight nuclei in two other cultivars which produced good yields generally. But apricot varieties, included in Moldovan Catalog of varieties of plant [4], with immature ovules at anthesis (embryo sacs with four nuclei) produced normal crops. Studies varieties with more than 30% fruit set had also high percentages of functional ovules, suggesting that a certain degree of megagametophyte development at anthesis is necessary for optimal fertilization, although it may not be enough to ensure a good crop since some varieties with high percentages of functional ovules had low fruit set. Both the ovary and the ovule provide signals that orient and direct pollen tube growth to the good rythm and direction course [1-3].

Conclusions. Our investigations demonstrate that different aspects related to flower biology have a close link to fruit set failures in apricot as well as within other thermophile stone fruit trees. Studies on the flower biology of local and introduced apricot varieties have provided valuable information to help select the appropriate parent genotypes for breeding programs and also for knowledge transfer to farmers to avoid losses produced by an inadequate variety selection for orchard establishment. More important there are varieties with high adaptability and ecological plasticity to variable pedo-climatic conditions of pomological zones of country. Presently within the active cultivation in our country of local and foreign varieties available for modern marketing there are important such varieties like Codrean, Nadejda, Vasile Cociu Pincot, Kioto, Faralia.

Acknowledgment. Research was carried out within the project of the State Program **20.80009.5107.18** “Targeted formation of quality and immune system in fruits of late varieties of plum intended for long-term storage”, financed by the National Agency for Research and Development.

References:

1. Egea J., Burgos L., 1992. Effective pollination period as related to stigma receptivity in apricot. Sci Hortic-Amsterdam 52, 77-83.
2. Pintea M.. 2003. Apricot culture (in romanian)/ Kishinau : 2007 – 56 c.
3. Pintea M. 2020**.** Soiuri innovative locale și introduce de cais. *Simp. Șt. Intl. Protecţia plantelor - realizări şi perspective. 27-28 October 2020. Chisinau, Republic of Moldova, Chișinău. Proceedings: ISBN 632.9-633/635 (082) -135.1-111-161.1 P. 295-300*
4. Catalog of Plant Varieties of Republic of Moldova. Chisinau, 2022, p.79.

CZU:575.22:575.116:631.52(478) https://doi.org/10.53040/abap6.2022.111

THE NATIONAL SHARING INFORMATION MECHANISM (NISM) IMPLEMENTED IN THE REPUBLIC OF MOLDOVA

ROMANCIUC Gabriela
Institute of Genetics, Physiology and Plant Protection,
Chisinau, Republic of Moldova
https://orcid.org/0000-0002-0969-557X, e-mail: gabriela.romanciuc@gmail.com

The Global Plan of Action (GPA) for conservation and sustainable utilization of Plant Genetic Resources for Food and Agriculture (PGRFA) is an initiative of Food and Agriculture Organization (FAO), adopted during the Fourth International Technical Conference on Plant Genetic Resources, which held in Leipzig, Germany, from 17 to 23 June 1996. The Conference also adopted the Leipzig Declaration, which focuses attention on the importance of plant genetic resources for world food security, and commits countries to implementing this Plan. It contains the priority actions identified, at local, national, regional and international levels. It provides an integrated framework for systematic, rational, balanced and equitable cooperation.The GPA is a framework of activities encompassing development of in situ conservation of PGRFA, sustaining existing collections, enhancing utilization and increasing capacity of countries regarding education, public awareness and training on these aspects. FAO has developed a monitoring process of implementation of GPA in different countries through a mechanism called National Information Sharing Mechanism (NISM) for monitoring the implementation of GPA. It is an information network for monitoring activities carried out to implement the Global Plan of Action (GPA) on Plant Genetic Resources for Food and Agriculture (PGRFA) NISM has been developed by FAO in partnership with Bioversity International to help monitor in-country progress in relation to the Global Plan Action. NISM is a partnership among stakeholders that contribute to the conservation and sustainable use of plant genetic resources for food and agriculture. The application of the new monitoring approach led to the establishment of 65 National Information Sharing Mechanisms (NISM), which provide comprehensive information on all of the 20 priority activity areas of the Global Plan of Action. As part of this monitoring effort, key national PGRFA stakeholders have established National Information Sharing Mechanisms (NISM), and published detailed information on the state of conservation and sustainable use of PGRFA in their respective countries, through web portals and databases. NISM data, which includes, inter alia, information on more than 24.000 publications, 18.000 projects, 61.000 cultivars and 18.000 stakeholders, can also be accessed through the World Information Sharing Mechanism on PGRFA, and automatically feed the WIEWS database on *ex situ* collections. In all countries that have established NISMs, the mechanism contributed important information to and facilitated the preparation of the Country Report. Data provided by NISMs have also used for the analysis of regional and global trends, for quality assurance and for the identification of priorities and needs in the sector of plant genetic resources for food and agriculture [1]. The experience of the Republic of Moldova in implementation of this mechanism and its outcome is discuss in this article.

Keywords: *plant genetic resources, NISM, conservation, indicators*

Materials and Method. The Global Plan of Action has 18 priority activity areas. For pragmatic and presentational purposes, these are organize into four main groups: In Situ Conservation and Management, Ex Situ Conservation; Utilization of Plant Genetic Resources; Institutions and Capacity Building. These four areas are assess by the NISM [2]. **The purposes** of NISM are promote understanding of PGRFA status and dynamics; allow analysis of gaps + priorities; assist decision-making processes and planning of available resources; Increase visibility of on-going efforts; store historical memory on PGRFA efforts; improve countries capacity to manage PGRFA etc. The main outputs are a partnership among participating stakeholders; a web portal; a national database on PGRFA; An updated assessment of the state of PGRFA conservation and use. A set of tools agreed by the FAO Commission on Genetic Resources for Food and Agriculture are used: 1. List of indicators; 2. Reporting format to monitor the implementation of the GPA and an information system including a database and a search engine, which includes the most comprehensive inventory of national PGRFA-related institutions, experts, publications, laws, and projects, as well as, of cultivated varieties. The Mechanism operates through the voluntary contribution of national institutions, coordinated by the GPA National Focal Point. All stakeholders, specifically, public or private institutions, organizations, enterprises which contribute to the conservation and sustainable utilization of plant genetic resources for food and agriculture in Republic of Moldova can be part of the Mechanism.

Results. Using FAO WIEWS Reporting System, consisting of the PGRFA indicators and reporting format, adopted by the FAO Commission on Genetic Resources for Food and Agriculture, the National Information Sharing Mechanism (NISM) in Republic of Moldova (RM) has been established. In this context, various activities have been carried out. In order to gather relevant information on state of PGRFA in RM, collaboration between national stakeholders was initiated. The obtained data was analyzed, compiled, revised, and recorded into the FAO WIEWS Reporting system, as part of the Moldavian National Information Sharing Mechanism on PGRFA. Due to the narrative explanations for each indicator, it was possible to provide an evaluation rating (from 1 to 9) of achievements obtained in the country. As a result of the NISM implementation, the following aspects can be highlighted. *In situ* conservation of PGRFA in the Republic of Moldova is implement especially, in protected natural areas (NPA). A special role in the *in situ* conservation of PGRFA plays the scientific reserves like Codrii, Iagorlic, Prutul de Jos, Plaiul Fagului, and Pădurea Domnească. Under current conditions, the Protected Area System (PAS) of Moldova is not effectively safeguarding the country's unique agrobiodiversity: a number of natural ecosystem processes, habitats and species are not adequately represented in the existing PAS; the capacity of the institutions responsible for the management of the PAS is generally weak; and the value of the PAS to the socio-economic well being of society is poorly understood and demonstrated. At national level, there is no national program in the field of conservation and use of PGRFA, and so it is very difficult to analyze the real situation in area of documentation of PGR at national level, and the mechanism of access and sharing of information related to PGR to do not exist. At the level of scientific institutions, the capacity to support *ex situ* collections decreases per year, due to the reduction of financing support from the state budget, the lack of human resources, especially the young specialists, and the lack of performance equipment.A major limiting factor for increasing the use of *ex situ* collections is the incomplete characterization and evaluation of samples. Each *ex situ* collection holder institutions has their own way to store characterization/evaluation data, using the specific internationally agreed crop descriptors for morphological traits. A lot of information is document manually in the registers and only a small part of these data has computerized. This situation is similar in practically all *ex situ* collections holder institutions in the country. Public awareness about the importance of plant biodiversity is done through various seminars, round-tables, conferences, mass media materials etc. By the NGO were organized various actions in the society, involvement, especially the young people in his field of activity etc.

Conclusions. The main reason of NISM is to stimulate interest in the field of Plant Genetic Resources among scientists, researchers, teachers, policy makers, users and all those who are interested in safeguarding PGRFA, to promote sustainable agricultural development.

Acknowledgment. Research was carried out within the project of the State Program 20.80009.5107.11 “Long-term ex situ conservation of plant genetic resources in the Gene Bank using the methods of molecular biology for plant germplasm health testing”, financed by the National Agency for Research and Development.

References:

1. Duncan Vanghan. Training for trainers on National Information Sharing Mechanism. Bangkok, 2009. 46p.
2. https://www.fao.org/pgrfa/ - National Information Sharing Mechanism

CZU:633.11:631.527.5 https://doi.org/10.53040/abap6.2022.112

STAGES OF WINTER DURUM WHEAT BREEDING

ROTARI Silvia, GORE A., LEATAMBORG Svetlana, BOGDAN Viorica
Institute of Genetics, Physiology and Plant Protection,
Chisinau, Republic of Moldova
e-mail: rotari.1960@mail.ru

The researches were carried out on the improvement of durum autumn wheat, which aimed to improve the characters and properties of this crop (resistance to frost, drought, fall and the main diseases), which essentially influences the plasticity of the variety and the stability of the harvest. The traditional methods of creating and improving new forms of autumn durum wheat were used: through interspecific hybridization (common autumn wheat x autumn durum wheat) and intraspecific (autumn durum wheat x autumn durum wheat).

Keywords: *durum wheat, common wheat, interspecific hybrids, intraspecific hybrids, variety*

Material and methods. The experimental material was studied in the fields of F1-F4 hybrids, the field of selection, control, comparative competition and crops multiplication. The variety Hordeiforme 335 was used as a control variety. The area of the plots in the selection field is 0.6 m2, control 5 m2 and in comparative competition crops 10 m2 in three repetitions. The selection field was sown manually and the control, competition and multiplication fields were sown mechanized at the beginning of October. The phenological evaluations, the determination of resistance to wintering, drought, diseases and productivity were carried out according to the methods of testing varieties at the State Commission for Testing Plant Varieties of the Republic of Moldova.

Results. Moldovan scientists such as Buiucli P. I., Gheorghev A. N., Rotari S.G. also had a significant contribution to the creation of new forms of durum autumn wheat. Through interspecific hybridization, they created a series of durum autumn wheat varieties: Meleanopus 276, Hordeiforme 16, Chișinevskaia rania, Chișinău 11, and al [1, 4,], which serve us as donors of some valuable characters (productivity, resistance to frost etc.).

That is why the main effort to improve this cereal crop is currently aimed at increasing the resistance of durum autumn wheat to frost, drought and the main diseases (brown rust, powdery mildew, fusarium, etc.) [2].

Phenotypically, the entire range of varieties has been established thanks to the study of qualitative characters. It is represented by 16 varieties: *leucurum, hordeiforme, meleannopus, coerulescens, leucomelan, erytromelan, apulicum, italicum, provenciale, albo-provinciale, valenciae, boeufii, candicans, mutico-leucomelan, mutico-leucurum,* *mutico-coerulescens*. [3]. As a result of the study of durum autumn wheat genotypes, both according to biological characters and according to agronomic indices, we detected genotypes that combine high resistance to wintering, fall and diseases with a high productivity potential. These forms have been widely used in hybridization programs as parents of valuable characters.

As a result of individual selection over several generations, a set of productive lines with low waist, resistant to wintering, drought and diseases (powdery mildew, brown rust, septoria and fusarium) were found. The best lines outperformed the control variety by 110-210 g.

The study of the new lines in the comparative control and competition trials allowed us to select some of them, which do not yield to the most superior varieties, according to productivity and resistance to the biotic and abiotic factors of the environment. This is how short-stem durum wheat varieties were created (Auriu 273, Hordeiforme 335, 333, 339), whose productivity potential varies between 5.5-6 t/ha. The grains of these forms have a high glassiness (94-96%), a high protein content (13.2-15%) and gluten (24-28%). Due to the high productivity and resistance to biotic and abiotic factors, three varieties (Hordeiforme 333, 335 and Auriu 273) were approved in Moldova in 1998, 2000 and 2008.

Varieties Hordeiforme 340, Auriu 1, Auriu 2, Auriu 4, Auriu 5, Hordeiforme 3, Leucurum 1, Leucurum 2, Hordeiforme 3, Sofidurum et al. They were obtained by the intraspecific method of hybridization with further individual selection from subsequent generations. All the varieties created by us are medium-height intensive varieties resistant to fall. According to the mass of 1000 grains, the varieties Auriu 5, Auriu 4 and others are distinguished. Hectoliter weight is an element of grain quality assessment. According to this character, all the varieties exceed the control variety and the highest is in the varieties: Sofidurum, Auriu 273 and Auriu 4. The most important quality attributes are glassiness, protein and gluten content in the grains.

Valuable genotypes were identified for these characters. According to the protein content and the glassiness of the grains, the varieties are marked: Sofidurum, Hordeiforme 340, 335. According to the gluten content, the varieties: Auriu 5, 273 et al. 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 2 t/ha. Due to the high results according to the characters studied at the State Plant Varieties Testing Commission, the following varieties were approved: Hordeiforme 340 in 2016, Auriu 2 – 2020 and Sofidurum – 2021.

Conclusions. As a result of research from the autumn durum wheat collection, the best genotypes were selected according to the valuable characters that we used in the hybridizations.

As a result of carrying out individual selection from several generations, a set of productive lines with low waist, resistant to wintering, drought and diseases (powdery mildew, brown rust, septoria and fusarium) were detected. The best lines outperformed the control variety by 110 -210 g.

The study of the new lines in the comparative control and competition trials allowed us to select some of them, which do not yield to the most superior varieties, according to productivity and resistance to the biotic and abiotic factors of the environment.

As a result of the research, a series of autumn durum wheat varieties were created: Hordeiforme 333 -1998, Auriu 273 - 2008, Hordeiforme 335 - 2000, Hordeiforme 340 - 2016, Auriu 2 - 2020, Sofidurum - 2021 varieties approved in the Republic of Moldova and other varieties. All these varieties were highlighted by high productivity, resistance to abiotic and biotic factors and quality characteristics (glassiness, high protein and gluten content).

Acknowledgment. Research was carried out within the project of the State Program 20.80009.7007.04 "Biotechnologies and genetical processes for evaluation, conservation and exploitation of agrobiodiversity", financed by the National Agency for Research and Development.

References:

1. Buicli P.I., Rotari S. Grâu dur de toamnă în Moldova //Conf. Inter. științifico-practică «Conservarea naturii în Republica Moldova: Probleme, realizări și perspective. Chișinău -1995. P. 171.
2. Rotari S., Veveriță E. Rezistența grâului durum de toamnă la iernare, secetă, cădere și boli. În volumul 39 „Agronomie și Ecologie": Materialele Simpozionului Științific Internațional "Agricultura Modernă - Realizări și perspective" consacrat aniversării de 80 de ani de la înființarea Universității Agrare de Stat din Moldova. 2013. P. 290-93. ISBN 978-9975-64-250-7.
3. Буюкли П. И., Георгиев Н.А. Получение хозяйственно ценных форм озимой мягкой пшеницы при межвидовой гибридизации. //Отдаленная гибридизация растений в Молдавии. Кишинев: Штиинца.-1976, -С. 7-8
4. Буюкли П.И. Твердая озимая пшеница. Кишинев, Штиинца, 1976, 162с.

CZU:635.64:635.042+575.22 https://doi.org/10.53040/abap6.2022.113

CONTENT ANALYSIS OF MAIN CAROTENOIDS IN MATURE FRUITS OF TOMATOES

RUDACOVA Angela[2*], MIHNEA Nadejda[1**], RUDACOV S.[2***], CLIMAUTAN Diana[1]
[1]*Institute of Genetics, Physiology and Plant Protection, Chisinau, Republic of Moldova,*
[2] *State University of Moldova, Chisinau, Republic of Moldova*
* *https://orcid.org/0000-0002-7632-2562, https://orcid.org/0000-0001-9638-2151,*
****https://orcid.org/0000-0003-2591-6114, e-mail: mihneanadea@yahoo.com*

The amount of two carotenoid pigments (lycopene and β-carotene) in mature fruits of 21 tomato genotypes was studied. It was shown high variability in the content of lycopene and β-carotene in genotypes studied, which made it possible to differentiate them into separate clusters and identify those with the highest content of carotenoid pigments. Varieties Rufina and Flacăra, as well as lines L 302, L 404, L 406, L 408, L 410, as the most valuable genotypes, can be involved in the breeding process when creating new varieties with high taste properties.

Keywords: *carotenoid pigments, tomatoes, genotypes, variability*

Purpose. An important characteristic of the quality of tomato fruits is the content of such important carotenoid pigments as lycopene and carotene. In plant cells, lycopene acts as a precursor to all other carotenoids, including beta-carotene. The main function of lycopene and beta-carotene in the human body is antioxidant. Also, these pigments have an immunostimulating and adaptogenic effect [1].

Reducing oxidative stress slows down the development of atherosclerosis and also provides DNA protection, that can prevent tumorgenesis. Therefore, the object of study of many scientists is the study of the total content of carotenoids in different varieties of tomatoes.

Classical plant breeding involves, first of all, the use of source material with a high biological value, the determination of genetic variability, and the selection of the most promising forms from populations, followed by the preservation of valuable genetic sources [2].

The aim of the study was to assess the variability of the content of lycopene and β-carotene in tomato fruits, the selection of the most valuable genotypes for inclusion in the breeding process when creating new varieties with high taste properties.

Materials and Method.The material of biological research was presented by 12 varieties: Rufina (Russia), Dolgonosik (Russia); Broza (Ukraine); Amber, L10B (Romania); Golden Jubilee (USA); Flame, Mary Gratefully, Exclusive, Awakening, Tomiş, CeriDani and 9 lines: L302, L303, L304, L305, L311, L404, L406, L408, L410 (Moldova, Institute of Genetics, Physiology and Plant Protection), of which three varieties - carriers of the r gene (yellow pulp) and 7 varieties - carriers of the β gene (carotenes).

Tomatoes were grown by seedling culture in triplicate according to the standard method. The amount of carotenoids in tomato fruits was determined by the spectrophotometric method [4]. Cluster analysis was performed by constructing dendrograms (agglomerative-iterative algorithm, Ward's method) [3]. The obtained data were statistically processed using the STATISTICA 7 software package.

Results. Analyzing the obtained data of biochemical research, it was found that the evaluated varieties and lines differ significantly in the content of lycopene and carotene. The content of lycopene in the studied genotypes varied within 0.01-1.39 mg/100 g of wet weight. As expected, the highest content of lycopene was recorded in the red forms of tomatoes. Among the varieties and lines with a high content of lycopene, should be noted: Exclusive, CerDani, L 302, L 305, L 304, L 303, for which were recorded values of 1.26; 1.05; 1.39; 1.16; 1.07; 1.04 mg/100 g of wet weight, respectively.

Among the studied varieties and lines, a significant variability in the content of β-carotene was revealed, the range of values for this pigment varied from 0.40 to 3.89 mg / 100 g of wet weight, the maximum content was found in variety Plamya (4.04), followed by line L 408 (3.89), variety Rufina (3.81) and line L 404 (3.57).

It was also found that the total amount of lycopene and β-carotene in the studied genotypes varies within 0.80 - 4.59 mg/100 g of wet weight. The most significant content of pigments (3.36 - 4.59 mg / 100 g wet weight) was found in the varieties Rufina, Flame, L 302, L L 404, L 406, L 408, L 410.

To determine the variability and identify genotypes with higher levels of pigment, we used the method of constructing a dendrogram based on an agglomerative-iterative algorithm - the Ward method.

An analysis of the dendrogram based on the similarity and difference in the content of pigments showed the division of all the studied tomato varieties and lines into 2 large clusters. Cluster 1 includes 9 genotypes, including 4 varieties - Rufina, Flame, Golden Jubilee, Yantar, and 5 lines - L 404, L 408, L 311, L 406, L 410. Cluster 2 - formed by 12 genotypes, of them 8 varieties - Weevil, Mary Gratefully, Deteptarea, Tomiş, L 10B, Vrozhayniy, Exclusiv, CeriDani, and 4 lines - L 303, L 302, L 304, L 305. It should be noted that the first cluster compared to cluster 2 is characterized by higher rates of the studied biochemical indices.

Conclusions.

1. The studied tomato genotypes showed high variability in the content of lycopene and β-carotene, which made it possible to differentiate them into separate clusters and identify those with the highest content of carotenoid pigments.

2. Biochemical analysis of fruits shows that varieties Rufina, Flame and lines L 302, L 404, L 406, L 408, L 410 due to the high content of lycopene and β-carotene can also serve as a starting material in breeding to improve the quality of tomato fruits.

Acknowledgment.

The research was carried out within the project of the State Program 20.80009.7007.04 "Biotechnologies and genetic processes for the evaluation, conservation and valorization of agrobiodiversity", funded by the National Agency for Research and Development.

References:

1. Boon P. Chew2, Jean Soon Park, Teri S. Wong, Hong Wook Kim, Brian B. C. Weng, Katherine M. Byrne, Michael G. Hayek* and Gregory A. Reinhart. Dietary ß-Carotene Stimulates Cell-Mediated and Humoral Immune Response in Dogs. Journal of Nutrition. 2000, vol.130. p.1910-1913.
2. Carli P. et al. Dissection of genetic and environmental factors involved in tomato organoleptic quality. In: BMC Plant Biol., 2011, vol.11, p. 58.
3. Savary S. et al. Use of Categorical Information and Correspondence Analysis in Plant Disease Epidemiology. In: Adv. in Bot. Research, 2010, vol. 54, p. 190-198.
4. Голубкина Н.А., Молчанова А.В., Тареева М.М., Бабак О.Г., Некрашевич Н.А., Кондратьева И.Ю. Количественная тонкослойная хроматография в оценке каротиноидного состава томата. В: Овощи России. 2017, № 5, стр. 96-99.

CZU:633.11:631.526.32(479.24) https://doi.org/10.53040/abap6.2022.114

YIELD AND GRAIN QUALITY FOR DURUM AND BREAD WHEAT VARIETIES

RUSTAMOV Khanbala[1, 2*], HASANOVA Gatiba[1]

[1]Research Institute of Crop Husbandry, Ministry of Agriculture, Azerbaijan;

[2]Genetic Resources Institute, Ministry of Science and Education, Azerbaijan

**https://orcid.org/0000-0001-5521-4266, e-mail:khanbala.rustamov@mail.ru*

The study of the productivity and grain quality indicators of durum and bread wheat varieties in sharply different soil and climatic conditions of Azerbaijan is a pressing issue. In recent years, in various agro-ecological conditions of Azerbaijan research work has been carried out in the direction of the influence of the genotype, environmental factors and growing conditions on productivity and grain quality indicators in durum and bread wheat varieties. As a result of many years of breeding work in the Terter Zone Experimental Station (ZES) of the Research Institute of Crop Husbandry were studied complex agrobiological characteristics in new varieties of durum and bread wheat, promising and zoned and presented for the State Variety Testing. Based on the foregoing, **the purpose** of the research was to study the yield potential and grain quality indicators of new varieties of durum wheat (*Triticum durum* Desf.) and bread wheat (*T.aestivum* L.) under irrigated conditions of Karabakh.

Key words: *durum wheat, bread wheat, varieties, yield, grain quality indicators*

Materials and Method. As a research material were taken, regionalized and high-yielding, promising varieties of durum and bread wheat, studied in the Terter ZES, as well as genotypes selected from materials ICARDA and CIMMYT. In the years 2016-2021, sharply in agrometeorological indicators and cultivation conditions, were analyzed the yield, adaptability and grain quality indicators of durum and bread wheat's varieties. Using well-known methods (Merezhko et al., 1999; Duweiller et al., 2014) were carried out phenological observations and assessments. The cultivation technology is generally accepted for grain crops in the irrigated conditions of Karabakh.

Results. Have been studied the agrobiological characteristics and grain quality parameters in new durum and bread wheat, created because of many years of breeding work in the Terter ZES. Various terms of sowing and watering during the years of research, as well as the agricultural background, made it possible to accurately study the potential and adaptive productivity of varieties. In recent years, for durum wheat varieties the highest "medium-grade" yield was observed in 2018 and 2020 (5,77-5,84 t/ha), and for bread wheat varieties in 2019 and 2020 (6,55-7,25 t/ha) years. The highest "medium-grade" grain quality indicators for durum and bread wheat's varieties were recorded in 2016-2017, 2021 years, and the lowest in 2018 and 2020. In 2018 and 2020 years, when yields were high, grain quality indicators dropped sharply. With a weak agricultural background, the balance of humus, macro and microelements in the soil is sufficient only for the accumulation of the crop. There are some deficit organic and mineral elements for a full filling of grain.

Conclusions. For sharply differentiated eco-geographical conditions of Azerbaijan, it is recommended to create wheat varieties, that are resistant to biotic and abiotic stress factors, with a stable-adaptive yield.

References:

1. Duweiller E., Singh P.K., Mezzialama M., Singh R.P., Dababat A. Diseases and pests of wheat. Guide for field definition (2nd Edition). Translated from English under the general editorship of H.Muminjanov (FAO SEC), Ankara, 2014 [in Russian], 156 p.
2. Merezhko A.F., Udachin R.A., Zuev E.V., Filatenko A.A., Serbin A.A., Lyapunova O.A. et al. Replenishment, preservation in a living form and study of the world collection of wheat, aegilops, and triticale: (Method. instructions) / Ed. A.F.Merezhko. SPb.: VIR, 1999, 82 p. [in Russian].

CZU:631.532/535:581.1 https://doi.org/10.53040/abap6.2022.115

SPEED BREEDING IN CONTROLLED CONDITIONS OF INTENSE LIGHT CULTURE

SINYAVINA N.G.*, KOCHETOV A.A.**, MIRSKAYA G.V.***, PANOVA G.G.#, CHESNOKOV YU.V.##

Agrophysical Research Institute, St. Petersburg, Russian Federation
**https://orcid.org/0000-0003-0378-7331, **https://orcid.org/ 0000-0001-7221-9886, ***https://orcid.org/ 0000-0001-6207-736x, #https://orcid.org/0000-0002-1132-9915, ##https://orcid.org/0000-0002-1134-0292, e-mail: sinad@inbox.ru*

The purpose of the study was to investigate the possibility of speed breeding in the controlled conditions of intense light culture of new economically valuable varieties of cereal and vegetable crops.

Keywords: *speed breeding, intense light culture, crops*

Materials and Method. Breeding and genetic studies were carried out under controlled conditions of intensive light culture of the Agrophysical Research Institute (St. Petersburg, Russia). The aim of the research was transgressive speed breeding for ultra-early ripening (spring soft wheat) and productivity (*Raphanus sativus* L.). The objects of research were spring soft wheat (*Triticum aestivum* L.) and samples of *Raphanus sativus* L. – small radish and daikon. The plants were grown on the original plant growing light equipment (Panova et al., 2015) under specially selected growing regimes for each culture, which accelerated generative development and obtained several generations of plants per year (Kochetov et al., 2021). The source of irradiation was DNaT-400 lamps (LTD «Reflux»), photoperiods were 12/20 hours for spring soft wheat and 12/16 hours for small radish and daikon. The temperature was maintained at 22 ± 2^0 during the day and 20 ± 2^0 at night, the irradiance was 20-25 klx, watering was carried out daily with water, alternating with top dressing with Knop's solution (2-3 times a week). The preliminary stage of research included phenotyping and evaluation of sample collections in light culture and the search for sources of economically valuable traits of productivity and early ripening, as well as the selection of parental pairs to obtain transgressions according to the studied traits. The methodology for obtaining transgressive genotypes is described in detail in (Kochetov et al., 2021). The recurrence for each variety and line was 20-40 plants; in F_2, progeny from 1-3 plants of the first generation were sown in the amount of 100-110 for soft wheat and 150-200 for *Raphanus sativus*. Individually for each F_2 plant, the presence and degree of manifestation of the studied economically valuable traits were recorded; on the basis of this, the selection of the ancestors of future transgressive lines and cultivars was carried out. Statistical processing of the results was carried out using Microsoft Office Excel 2019 and Statistica v. 13.3 (StatSoft Inc., Tulsa, OK, USA).

Results. Speed breeding methodology using artificial light culture has been intensively developing in the world in recent years. Its main goal is to increase the efficiency and accuracy of the breeding process, increase genetic diversity, accelerate the creation of new plant genotypes adapted to new climatic conditions, which is especially important in the era of global climate changes. Under controlled environmental conditions, research is being conducted aimed at the accelerated selection of varieties of various types of crops (Cazzola et al., 2021; Samantara et al., 2022; Watson et al., 2018).

Under the conditions of intense light culture, the Agrophysical Research Institute carried out genetic breeding studies of cereal (spring soft wheat) and vegetable (small radish, daikon) crops. The creation of new samples is based on the methodology of accelerated obtaining of transgressions on economically valuable plant traits (Kochetov et al., 2021). On its basis, valuable ultra-early ripening lines of spring soft wheat, transgressive in terms of heading time, and highly productive early ripening samples of small radish and hybrids of small radish x daikon with a glabrous edible leaves, transgressive in terms of root mass, were obtained. It should be noted that new accessions of wheat are intended for field conditions of the North-West region, while accessions of *Raphanus sativus* L. are adapted to growing under conditions of intense light culture. Studies have shown that, under controlled conditions, it is possible to successfully plant breeding for both open and protected ground, including light culture.

Conclusions. The results obtained allow us to conclude that the use of controlled conditions of intense light culture is highly effective in conducting research aimed at accelerating the plant breeding process. Controlled environmental conditions make it possible to clearly identify selectively valuable genotypes by the plant phenotype, which allows the selection of parental genotypes at the stage of collection assessment, as well as the most clear identification of valuable individuals transgressive for a given trait in F_2 and F_3 hybrid populations. The use of cultivation regimes that accelerate plant ontogenesis contributes to obtaining a larger number of generations of breeding material (F_3 and subsequent generations) per year, and accelerating the production of new constant lines and cultivars. Selection and genetic studies in intense light culture can be carried out for many specific growing conditions, including traditional protected and open ground, by simulating the main parameters of the habitat in the controlled conditions. At the same time, intense light culture can act as a model ecosystem for establishing the mechanisms of interaction “genotype - environment - phenotype”, the understanding of which serves as the basis for obtaining new highly competitive forms of plants.

References:

1. Cazzola F., Bermejo C. J., Gatti I., Cointry E. Speed breeding in pulses: an opportunity to improve the efficiency of breeding programs, Crop and Pasture Science, 2021, vol. 72, no. 3, pp. 165-172, DOI:10.1071/CP20462.
2. Kochetov, A.A., Mirskaya, G.V., Sinyavina, N.G., Egorova, K.V., Transgressive breeding: a methodology for the accelerated production of new plant forms with predictable set of economically valuable traits, Ross. S-kh. Nauka, 2021, no. 6, pp. 29—37, DOI:10.31857/S2500262721060065.
3. Panova G.G., Chernousov I.N., Udalova O.R., et al. Scientific and technical bases of year-round obtaining high yields of high-quality plant products under artificial lighting, Dokl. Ross. Akad. S-kh. Nauk, 2015, no. 4, pp. 17—21.
4. Samantara K., Bohra A., Mohapatra S. R., et al. Breeding More Crops in Less Time: A Perspective on Speed Breeding, Biology, 2022, vol. 11, no. 2, pp. 275, DOI:10.3390/biology11020275.
5. Watson A., Ghosh S., Williams M.J., et al. Speed breeding is a powerful tool to accelerate crop research and breeding, Nat Plants, 2018, no. 4, pp. 23-29, DOI: 10.1038/s41477-017-0083-8.

CZU:635.64:631.527.5:57.085.2 https://doi.org/10.53040/abap6.2022.116

QUANTITATIVE TRAIT ASSESSMENT IN TOMATO F_2 HYBRID COMBINATIONS OBTAINED *IN VITRO* (*Solanum lycopersicon* L.)

SIROMEATNICOV Iulia*, COTENCO Eugenia**, PALADI Dana
Institute of Genetics, Physiology and Plant Protection,
Chisinau, Republic of Moldova
** https://orcid.org/0000-0001-7780-083X, **https://orcid.org/0000-0003-0603-3404,*
e-mail: iulia.siromeatnicov@igfpp.md

Plant breeding is the remarkable applied discipline of plant genetics with the aim of creating new genotypes with high-performing characters and properties, both in terms of production level, as well as yield quality and resistance to extreme environmental conditions [1, 2]. For the creation of new forms of tomato with increased resistance to extreme temperatures and with high productivity under water deficiency conditions, different intra- and interspecific hybridization methods were used. Interspecific hybridization is a method that can induce much higher variability compared to intraspecific hybridization. This method is used to create an initial material for tomato breeding by transferring from wild species such as *L. chilense, L. peruvianum* and *L. hirsutum* to the cultivars some valuable characters, such as resistance to stress factors and useful dry compound content in fruits. Although worldwide there is a large number of hybrids, varieties, lines, and in our country the tomato assortment is vast including genotypes for field cultivation of determinate and semi-determinate growth type intended for industrialization or fresh consumption, the breeding of new varieties always remains up-to-date.

Purpose: research and assessment of quantitative traits in F_2 hybrid populations based on characters of interest for breeding.

Keywords: *tomato, distant hybridization, quantitative traits, hybrid populations*

Materials and Method. The research was carried out in the Laboratory of Genetics of plant resistance and on the experimental fields of IGPPP. For scope achievement 20 hybrid F_2 tomato populations G-164.017F2; G-379.017F2; G-380.017F2; G381-.017F2; G-382.017F2; G-386.018F2; G-388.018F2; G-390.018F2; G-391.018F2; G-392.018F2; G-393.018F2; G-394.018F2; G-395.018F2; G-396.018F2; G-397.018F2; G-398.018F2; G-399.018F2; G-400.018F2; G-418.018F2; G-420.018F2) and for comparative research the paternal and maternal P_1 and P_2 parental forms (Elvira, Novinca Pridnestrovia, Victorina, Toamna de aur, Kecskemet, Peto 86, Flacara, Mia, Iuliperuan, Iulihirsutian, Anatolie, Cerrydani, Cerry maro plum, Cherry red round), lines: L.20, L.25, L.47, L.55, L.63, L.64 and L.71, obtained on the basis of interspecific hybridization and *in vitro* culture served as plant material. Tomatoes were sown in greenhouse (seedling culture) and planted in the field in the hybrid nursery. Planting scheme in the field: (90 x 50) x 30cm distance between plants, in rows of 5 m, 30 plants for each variant. The placement of tomato forms was performed randomly in three repetitions. All genotypes mentioned or evaluated by a complex of valuable characters. During the vegetation period, phenological, morphological and biometric records were made.

Results. The breeding output within a hybrid population in principle is based on the amount of heritable variability of the inheritance degree, transmitted between generations. A real perspective in this aspect is presented by modern biotechnological methods and techniques based on genetic principles, genetic and cellular engineering, *in vitro* culture, somaclonal hereditary variability, distant hybridizations, etc. [3]. The methods of interspecific hybridization with the mobilization of the spontaneous gene pool and *in vitro* cultures allowed us to solve the multitude of problems in the tomato breeding process. Via classic hybridizations, effective traits were transferred in the activity of hybrid plant populations from spontaneous to cultured species. In our experiments, the hybridization between different genetically stable species varies according to the degree of kinship distance between them and the transmission of the genetic information that determined some valuable characters from the spontaneous species to the cultivated ones. Investigations carried out in the field of tomato genetics and breeding have shown us that spontaneous hybridization is one of the main methods for creating and improving tomato culture. All F_2 hybrid populations possessed a growth and development of hybrid progeny of determined type, the height of which does not exceed 80 cm. Vegetable breeding is a continuous process, in which the researcher explores genetic variability and selects genotypes that possess combinations of characters and properties corresponding to current and prospective consumer requirements. The number and value of these new gene combinations, which can be achieved through breeding, depends on the diversity and value of genes from the germplasm collection available to the breeder. As a result of the carried out investigations, 5 hybrid combinations with superdominance compared to the best parent and 5 with positive dominance compared to the parental forms were selected from 20 F2 hybrid combinations from the emergence of seedlings to mass maturation. For plant height eight hybrid combinations with overdominance over the best parent, 2- negative overdominance over the weakest parent, fruit weight in 12 hybrid populations varied with positive overdominance over the best parent. The fruit weight was 46-116 gr. per fruit. The yield of the hybrid progeny, despite the extreme climate conditions, still possessed 30-68t/ha. The content of dry active substance and the biochemical composition of carbohydrates varied depending on the genotype and the extreme climate conditions.

Conclusions. From the seedling emergence until the mass fruit ripening, five hybrid combinations with superdominance compared to the best parent and five with positive dominance compared to the parental forms were selected. For plant height 8 hybrid combinations with overdominance over the best parent, 2- negative overdominance over the weakest parent, fruit weight in 12 hybrid populations varied with positive overdominance over the best parent. The fruit weight was 46-116 gr. per fruit. The harvest of the hybrid progeny, despite the extreme climate conditions, still possessed 30-68t/ha. The content of dry active substance and the biochemical composition of carbohydrates varied depending on the genotype and the extreme climate conditions.

Acknowledgment. Research was carried out within the project of the State Program 20.80009.5107.03 “Efficient use of plant genetic resources and advanced biotechnologies to increase the adaptability of crop plants to climate change”, financed by the National Agency for Research and Development.

References:

1. Sîromeatnicov Iulia, Jacotă A. Obţinerea “*in vitro*” a unor forme de tomate somaclonale precoce cu rezistenţă sporită la temperaturi joase //*Congresul al II-lea al Societăţii de Fiziologie şi Biochimie Vegetală din R. M. Fiziologia şi biochimia plantelor la început de mileniu: Realizări şi Perspective*, Chişinău, 2002, p.264-266
2. Sîromeatnicov Iulia. Mecanismul eredităţii unor caractere specifice la tomate, *Solanum Lycopersicon L.* obţinute *in vitro*. In: *“Biotehnologii avansate - realizării şi perspective (IV simp. naţ. cu part. intern.)”*.. Chişinău, 2016. p. 116.
3. Sîromeatnicov Iulia, Cotenco Eugenia, Ciobanu Renata, Rusnac Ruxanda. Inducerea variabilităţii genetice la tomate Solanum Lycopersicon L. In: *“Biotehnologii avansate - realizării şi perspective (IV simp. naţ. cu part. intern.)”*. Chişinău, 2016. p. 50.

CZU:502.752:582.929.2:58.08 https://doi.org/10.53040/abap6.2022.117

EX-SITU CONSERVATION OF PONTECHIUM MACULATUM (BORAGINACEAE) IN THE NATIONAL BOTANICAL GARDEN

TOFAN-DOROFEEV Elena, IONITA Olga
National Botanical Garden (Institut) "Alexandru Ciuboratu",
Chisinau, Republic of Moldova
e-mail: lentof@mail.ru

The identification of rare and endangered species is a valuable tool for raising awareness of those taxa facing a high risk of extinction. It is a first step towards highlighting the issue of species decline and loss, as well as encouraging decision makers to take action to improve or at least maintain the current state of biodiversity. In recent years, it has become urgently necessary to update and reassess the risk of extinction for species of community interest that grow in natural habitats in our country. Therefore, in 2020, a research program was initiated in the Spontaneous Flora and Herbarium Laboratory which aims to multiply and repatriate to natural habitats several species of community interest.

Keywords: *Pontechium maculatum, rare taxa, species of Community interest, Republic of Moldova*

Materials and Method. In order to establish the chorology of the species, the herbarium collections, kept in the Herbarium of the National Botanical Garden (Institute) "Alexandru Ciubotaru" (Chisinau, Republic of Moldova) were consulted, and a critical analysis of the specimens was carried out according to the classical comparative-morphological method. As biological material for obtaining authentic material, the seeds collected from the natural habitat that were subjected to germination in the Spontaneus Flora and Herbarium Laboratory served, and the seedlings obtained were cultivated on the experimental plot of the National Botanical Garden.

Results. *Pontechium maculatum* (L.) Böhle et Hilger (= *Echium russicum* J. F. Gmel.) is a biennial species with an erect stem of 25-70 cm high, foliated with alternately arranged, linear-lanceolate, descending leaves, with an indument of setiform hairs mixed with short, soft hairs. Spike-like inflorescence, composed of short bracteate cymes. Corolla red-burgundy coloured, infundibuliform shaped; corolla tube straight, without fornix. Stamens and style are much exserted from corolla. Nutlets ovoid-trigonous.

Pontechium maculatum grows through dry meadows and steppes in south-eastern and central Europe, including habitats such as (6210) – Semi-natural dry grasslands and scrubland facies on calcareous substrates (*Festuco-Brometalia*) and (6240) – Sub-Pannonic steppic grasslands, is included in the Habitats Directive Annex IIb, IV b [2, 3], thus it is a species of Community interest that the Republic of Moldova is obliged to protect and monitor.

In Europe, this species grows spontaneously in Bulgaria, the Czech Republic, Hungary, Poland, Romania, Slovakia, Austria, Serbia, Bosnia and Herzegovina and further east in Russia and Turkey. In most of these countries it is a rare species included in the national red lists, and in some countries, it is even included in the Red Books with different degrees of endangerment such as Critically Endangered (CR) in the Czech Republic, Endangered (EN) in Slovakia and Vulnerable (VU) in Bulgaria.

In the Republic of Moldova, it is not protected in any way yet, being included in the Preliminary Red List of vascular plants [1], as well as in the operational lists of the Emerald network as being protected at European level. According to the literature but also to the data from the Herbaria, *Pontechium maculatum* grows sporadically in most steppe sectors but also in the associations of phytocenoses of the subarid forests of *Quercus pubescens*. The Herbarium's collection contains 123 herbal exssiccata from different districts of the country, the most recent exssiccata dating back to 2013.

The situation in the field in recent years differs significantly from that in the literature and Herbaria, the spread of the species being much more limited than existing data shows but also much more threatened due to destroying natural habitats through tourism, grazing, degradation of steppe sectors and invading them with shrubs and worst, by afforestation of steppe slopes, valuable from the biodiversity richness point of view.

In the summer of 2020, several field trips were undertaken in order to identify the populations of *Pontechium maculatum*, being identified a population in the Bugeac steppe vegetation sector. The researched area includes the protected area, occupied by primary steppe communities of *Stipetum (ucrainica) herbosum* and *Stipetum (lessingiana) herbosum* which have been preserved here. The given population vegetates on a slope with North-Western exposure on an area of 1000 m^2 with about 30 generative specimens from which seeds were collected.

In the spring of 2021, seedlings were obtained from these seeds and an experimental plot was created (Figure) that will serve as a seed base for reintroduction and repopulation of natural habitats where the species has disappeared in recent decades. The next steps include both monitoring the existing populations and cultivating the species in *ex-situ* conditions for seed production.

A B C

Figure. *Pontechium maculatum* (L.) Böhle & Hilger in *ex-situ* collection
(A – spring of 2021; B – autumn of 2021; C – summer of 2022)

Conclusions. The way of conservation of a species is determined by its ecological, genetic, biological characteristics and the analysis of the reasons that brought the species to a step of being rare in nature. Based on our preliminary studies, we can say that the main limiting factor is the degree of excessive destruction of habitats, which affects the reproduction capabilities of the species, and the best measure for conservation is *in situ* protection of local populations as well as its multiplication in *ex-situ* conditions and repopulation of suitable natural habitats.

Acknowledgments. The research was supported by the NARD through the Project "Research and conservation of vascular flora and macromycobiota of the Republic of Moldova", 20.80009.7007.22.

References:

1. Ghendov V., Izverskaia T., Shabanova G. Pre-Identified Red List of vascular plants in the flora of Republic of Moldova. In: Revista Botanică. 2012, nr. 1 (5), p. 41-52.
2. Convention on the Conservation of European Wildlife and Natural Habitats. Bern, Switzerland. 1979.
3. Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora, O.J. L206, 22.07.92.1992. P. 0007-0050.

CZU:663.26:579.6 https://doi.org/10.53040/abap6.2022.118

МИКРОБИОМ ВИНОГРАДА И ЕГО ПОТЕНЦИАЛ В ИДЕНТИФИКАЦИИ ТЕРРУАРА

ВЛАСОВ В., МУЛЮКИНА Нина, ЛЯШЕНКО Галина, БУЗОВСКАЯ Марина, МЕЛЬНИК Элла, ПОПОВА Анна
Национальный научный центр «Институт виноградарства и виноделия им. В.Е. Таирова», Украина
e-mail: tairmna2005@ukr.net

Развитие виноградарско-винодельческой отрасли в Украине требует разработки новых принципов, подходов и методов идентификации терруара, направленных на обеспечение мирового рынка высококачественной продукции согласно европейским стандартам. В данном направлении важное значение придается установлению основных факторов, отражающих связи между винопродукцией и генетически детерминированными особенностями местных сортов винограда, экологическими условиями территорий и микробиомов виноградного растения.

Последние факторы позволяют провести микробиологическую идентификацию терруара путем оценки специфичности видового состава упомянутых выше микробиомов. При этом рассматривается как общее разнообразие (количества) таксонов разного уровня, так и наличия таксонов (видов), специфических для данного терруара.

Микробиом винограда представляет собой совокупность видов мицелиальных грибов, дрожжей и бактерий, разнообразие которого зависит таких факторов, как местонахождение виноградника, природно-климатические условия, сорт винограда, используемые агротехнические приемы. При комплексной оценке микробиома виноградного растения и виноградника необходимо выяснить не только его видовой состав, но и определить потенциальный вклад видов в качество винограда и вина.

Исходя из данных, полученных учеными ряда виноградарских стран мира, следует отметить, что таким «идентификатором» могут стать виды дрожжей, тем более что они позволяют характеризовать не только виноградное растение, но также почвы и винопродукцию.

Наши исследования были сосредоточены на изучении дрожжевой микрофлоры и экологических условий территории как основных факторов, вносящих вклад в специфику терруара.

Образцы автохтонных винных дрожжей (в количестве 68 штаммов), выделенных на участках ННЦ «ИВИВ им. В.Е. Таирова» и ГП ДГ «Таировское» на технических сортах и клонах селекции ННЦ «ИВИВ им. В.Е. Таирова» были депонированы в трех крупнейших коллекциях микробных культур мира (Япония, США, Великобритания). Разнообразие выборки для дальнейшего анализа базировалось на различии географического, сортового присхождения и направления использования.

Была проведена ДНК-идентификация подавляющего большинства указанных выше дедепонированных культур винных дрожжей Saccharomyces cerevisiae по локусам - ITS1_5.8S_ITS2 (гены рибосомальной РНК).

Полученные из генобанка Японии сиквенсы были использованы для дифференциации штаммов дрожжей, выделенных на сортах и клонах в ННЦ "ИВИВ им. В.Е. Таирова" и исследования их филогенетических отношений со штаммами другого географического происхождения (промышленные штаммы, референсные штаммы из Чехии, Франции, Германии).

Наличие различия в нуклеотидных последовательностях позволило оценить филогенетические отношения между штаммами. Выявлено, что большинство украинских образцов винных дрожжей являются относительно самостоятельной группой автохтонов и потенциально могут быть вовлечены в микробиомные характеристики теруаров.

Исследование экологических условий для выделенных участков проводился по результатам детального полевого обследования характеристик рельефа, полевого и лабораторного анализа почвы. Изучение климатических и погодних русловий выполняется по данным метеорологических наблюдений на опорном пункте ННЦ «ИВиВ им. В.Е.Таирова», расположенном селекционом участке.

Описание рельефа осуществляется по таким характеристикам как тип рельефа (равнина, водораздельное плато, склон, долина), экспозиция (южная, северная, восточная и западная, а также 4 промежуточные экспозиции - юго-западная, юго-восточная, северо-западная и северо-восточная) и крутизна склонов (3-7, 8-12^{o} и больше).

Изучаются такие характеристики почвы: тип и разновидности, гранулометрический состав, глубина залегания грунтовых вод, содержание гумуса, содержание общин и активних карбонатов, глубина вскипания, содержание комплекса NPK.

Из показателей климата рассматриваются температура и влажность воздуха на высоте 200см, температура на поверхности почвы и на глубинах 20, 40 и 80см, а влажность почвы – в слое 0-20, 0-40, 0-100см. Анализируется режим осадков – общее количество и интенсивность. Климатические условия рассматриваются за теплый период (период с температурой выше 0 ºС) и период активной вегетации (период с температурой выше 10 ºС).

Таким образом, в ННЦ «ИВиВ им. Таирова» в настоящее время получены блоки данных, которые станут основой для комплексной идентификации виноградных терруаров Украины.

List of authors

DESCRIEREA CIP A CAMEREI NAŢIONALE A CĂRŢII

"Advanced Biotechnologies – Achievements and Prospects, scientific international symposium (6 ; 22 ; Chişinău). Scientific International Symposium "Advanced Biotechnologies – Achievements and Prospects", (6th Edition), 3-4 October, 2022 Chisinau : Abstract Book / international scientific committee: Andronic Larisa [et al.] ; organizing committee: Andronic Larisa [et al.]. – Chişinău : Editura USM, 2022. – 358 p. : fig., tab.

Antetit.: Moldova State Univ., Inst. of Genetics, Physiology and Plant Protection, Sci. Assoc. of Geneticists and Breeders of the Rep. of Moldova. – Rez. paral.: lb. engl., rusă. – Referinţe bibliogr. la sfârşitul art. – 100 ex.

ISBN 978-9975-159-81-4.
082
A 23

ISBN 978-9975-159-81-4

Scientific International Symposium
"Advanced Biotechnologies - Achievements and Prospects"
(VIth Edition)

ABSTRACT BOOK

Asistență computerizată – *Maria Bondari*

Bun de tipar 2022. Formatul 70x100 1/12.
Coli de tipar 30,0. Coli editoriale 22,5.
Comanda 115/22. Tirajul 100 ex.

Centrul Editorial-Poligrafic al USM
str. Al. Mateevici, 60, Chişinău, MD 2009