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STUDY OF VALUABLE MORPHO-BIOLOGICAL TRAITS IN SAMPLES FROM THE SESAME COLLECTION AND DEVELOPMENT OF METHODS FOR EXPANDING THE GENETIC VARIABILITY SPECTRUM

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CONCEPTUAL MILESTONES OF THE RESEARCH

Actuality and importance of the chosen topic. Sesame (*Sesamum indicum L.*), known as the "queen of oilseeds," is one of the oldest and most valuable oilseed crops. With a high oil content (48-63 %), protein (16-19 %), and carbohydrates (16-18 %), it is grown on large areas worldwide [1; 2]. The growing interest in sesame cultivation is driven by the presence of valuable compounds such as sesamin, sesamolin, sesamol, and tocopherol, which have antioxidant properties beneficial to health [3].

Global sesame production varies significantly across different regions. While Asia and Africa dominate global production, European countries, although cultivating smaller areas, achieve higher yields. For example, Italy reaches a production of 7,2 t/ha, compared to 0,4 t/ha in Kenya and 1,2 t/ha in Pakistan [4]. The low yield in certain regions can be explained by fundamental factors, such as cultivation on lower-quality soils, the use of poorly skilled labor, nutrient deficiencies, and inadequate agricultural management.

According to FAOSTAT data from 2022, globally, sesame was cultivated on an area of approximately 12,83 million hectares, with a total production of 6,7 million tons, marking a 37 % increase compared to 2012. The largest productions come from countries such as Sudan, Nigeria, Tanzania, India, and China, which together account for 92,6% of the global production [5].

Genetic diversity plays a crucial role in sesame improvement, as it is essential for achieving key traits such as high productivity and stress resistance. Over the past four decades, sesame breeding has led to the development of more than 200 new varieties, and advanced technologies, such as genome editing and marker-assisted selection, have increased their efficiency [6; 7; 8]. At the same time, the conservation of genetic resources is becoming increasingly important in the context of climate change and growing pressure on biodiversity. Gene banks in various parts of the world, including India, China, and South Korea, play an essential role in preserving sesame germplasm [9; 10]. Local sesame populations often exhibit morphological and genetic diversity, making them valuable resources for breeding. However, the low production capacity of sesame, compared to other oilseeds, is influenced by factors such as low harvest volume, sensitivity to stress, and indeterminate growth.

The use of germplasm with high genetic diversity in breeding processes can contribute to the creation of varieties with higher yields, improved traits, and adaptive qualities, which could boost global sesame production [11]. Additionally, genetic mutations induced by ionizing radiation (gamma rays) have proven effective in generating additional genetic variability. For example, exposing sesame seeds to doses of 100-750 Gy has led to the development of new varieties with desirable economic traits such as precocity, increased productivity and high oil content [12; 13].

The impact of climate change on sesame is significant, with extreme temperatures and irregular precipitation affecting physiological processes and productivity. Low temperatures (0-15 °C), for example, cause thermal stress, affecting seed germination, while water stress limits plant development [14; 15; 16], a problem that is becoming increasingly common. Identifying and selecting drought- and heat-resistant genotypes, based on various genetic mechanisms, including photosynthetic efficiency, transpiration, and osmolyte accumulation, are essential for ensuring stable yields [17]. Additionally, sesame is vulnerable to many fungal diseases, such as *Fusarium spp.*-induced wilting and infections with *Alternaria spp.*, which can significantly reduce seed yield. Controlling these diseases through the development of resistant varieties is crucial for maintaining productivity [18; 19].

Despite the progress made in sesame research, there are obstacles that limit the full exploitation of the species' potential. Insufficiently explored genetic diversity hinders the creation of high-performance varieties that would combine high yield with resistance to pests, diseases, and abiotic stresses. Although some progress has been made in breeding, the lines and cultivars developed are not sufficiently adaptable to fluctuating environmental conditions. Research on increasing resistance to abiotic and biotic factors is limited, and an optimized variety that meets all the necessary agronomic characteristics does not yet exist. Furthermore, the relationships between the quantitative seed parameters and oil content, as well as its quality, are not yet fully understood.

In conclusion, the continuous development of new varieties, based on high genetic diversity, represents a key solution for improving sesame production, especially under the pressures of climate change [11].

Research aim. Evaluation of the germplasm of *Sesamum indicum* L. through the analysis of morpho-biological traits, variability of quantitative and qualitative characteristics, resistance to abiotic and biotic factors, and the development of mutant forms using gamma rays as donors of valuable genes for the improvement of the species.

Research objectives:

- Studying the quantitative and qualitative parameters of sesame, distributed based on the precocity index, through cluster analysis of the genetic source distribution.
- Evaluating the genotypes of the sesame collection by determining the contribution of the genotype × cultivation year factors based on quantitative traits;
- Assessing the variability and genetic parameters of the quantitative traits in sesame genotypes from different precocity groups;
- Evaluating the sesame genotypes for abiotic and biotic factors (temperature during germination, water stress, pathogens: *A. alternata*, *F. oxysporum*, *F. solani*) under modeled

experimental conditions and the genetic-molecular identification of pathogens from the genera *Alternaria*, *Fusarium*, and the species *Myrothecium roridum*;

- Assessing the variability and determining the contribution of genotype and generation factors to the quantitative traits of mutant sesame forms in generations M_1-M_4;
- Estimating the phenotypic and genotypic variation in productivity indices of descendants from generations M_1- M_4 exposed to irradiation.

Research hypothesis. Use of a germplasm collection with diversified geographical origin and experimental mutagenesis would constitute important sources for harnessing genotypes, especially for agricultural crops with a high degree of vulnerability to environmental factors and a limited range of variation in traits of interest. Genetic parameters such as phenotypic and genotypic variation, heritability, and genetic gain in productivity traits are crucial elements in quantifying the parents with breeding performance.

Methodology. The research was conducted based on the evaluation of the diversity of the initial material, which includes 40 samples from the sesame collection and 12 mutant forms derived from the irradiated genotypes *Zaltsadovski, Kadet*, and *Adaptovanîi 2*, treated with gamma rays. The differentiated response of morphological and agronomic traits to temperature and precipitation factors was analyzed, highlighting the biological potential for productivity, oil content, and resistance to abiotic and biotic factors. The experimental data were statistically processed using variance analysis, presented in cluster distribution diagrams, histograms, and correlation analyses, using the STATISTICA 8 and Statgraphics 2.1 software packages (ANOVA test).

Theoretical significance. The research conducted provides contributions to deciphering the correlative links between morphological traits, productivity, and resistance to unfavorable environmental factors, on the one hand, and the spectrum of genetic variability, on the other hand. It broadens theoretical knowledge in the field of plant genetics, adaptation, and resistance, and can serve as a scientific basis for the development of diagnostic and control programs for tolerance, growth processes, development, and productivity.

Applicative value. The cultivars of *Sesamum indicum* L., as well as the mutant forms obtained through induced mutagenesis, with high performance in yield and oil content, are used in the research of the Plant Genetic Resources Laboratory at IGFPP and may be recommended for large-scale cultivation in agricultural units. Gene donors with favorable traits for resistance to low temperatures, water stress, and pathogens during the germination phase are of interest for species improvement. The sesame samples from the collection with distinct traits have been introduced into the Gene Bank of the Republic of Moldova with registration numbers 00460 – 00499. The information obtained may contribute to the initiation of a national program for sesame breeding and seed production.

Implementation of scientific results submitted for defense. The results of the research presented in the thesis were reported, discussed, and approved annually at the Scientific Council Meetings of the Institute of Genetics, Physiology, and Plant Protection, as well as presented at the following scientific events: Conferința științifică cu participare internațională - Biodiversitatea în contextul schimbărilor climatice. Ediția a 2-a, (Chişinău, 23 noiembrie 2018); Международный семинар по изучению биоразнообразия на базе Варзобской горно-ботанической станции" Кондара" молодых учёных из стран СНГ, Академия наук Республики Таджикистана, (Таджикистан, Душанбе, 23-30 июня 2019); Biotehnologii avansate – realizări şi perspective: Simpozionul ştiinţific naţional cu participare internaţională. Ediţia V-a (Chişinău, 21-22 octombrie 2019) şi Ediţia VI-a (Chişinău, 3-4 octombrie 2022); „Ştiinţa în Nordul Republicii Moldova: realizări, probleme, perspective", Conferinţă științifică naţională cu participare internaţională. Ediția 7, (Chișinău, 19-20 mai 2023); Conferința științifică a doctoranzilor "Tendințe contemporane ale dezvoltării științei: viziuni ale tinerilor cercetători". Ediția a 8-a, vol.1. (Chișinău, 10 iunie 2019). The results obtained from the scientific investigations conducted for the thesis were implemented in the practical activities of the course "Research techniques in molecular biology," cycle II, at the Department of Biology and Ecology, Faculty of Biology and Geosciences, MSU (implementation act no. 509i from June 8, 2023).

Publications on the thesis topic. The scientific results obtained have been reflected in 25 scientific papers, including 1 article in international journals, 5 articles in national journals, 1 article in national conference proceedings, 11 articles in international and national conference materials, 4 theses at international conferences, and 3 other works abroad, of which 10 are single-author publications.

Summary of the thesis sections. The thesis includes abstracts in Romanian, English, and Russian, a list of abbreviations, an introduction, 5 chapters, general conclusions and recommendations, bibliography with 249 sources, 33 annexes, 54 figures, 20 tables, a declaration of responsibility, and the CV of author.

THESIS CONTENT

The **Introduction** reflects the relevance and importance of the addressed issue, the formulation of the aim and objectives of the research, the presentation of the research hypothesis, and the synthesis of the research methodology. It also covers the theoretical significance and practical value of the work, the implementation of the scientific results proposed for defense, and a summary of the structural sections of the thesis.

I. STUDIES ON THE MORPHO-BIOLOGICAL TRAITS OF *SESAMUM INDICUM* L

Chapter is structured into four subsections, providing a synthetic analysis of the research reported in the specialized literature, based on both theoretical and practical results. The analysis includes the centers of origin and cultivation areas of the species, classification of the *Sesamum* genus, the morphological and biological description of the plant, and the use of oil-rich seeds in the fields of nutrition, cosmetics, and pharmaceuticals. In the following subsections, the genetic diversity, breeding objectives and results, induced mutagenesis, tolerance to low temperatures, water stress, and the main pathogens are presented, followed by the conclusions of Chapter I.

II. MATERIALS AND RESEARCH METHODS

Object of study. Research was conducted during the period 2018-2021 on the experimental plot of the IGFPP, following the methodology for setting up field experiments and maintaining them under optimal agrotechnical conditions. As biological material, 38 cultivars and 2 lines from the *Sesamum indicum* L. collection were used, originating from 10 countries, with a higher proportion of samples from Ukraine (22,5%), Russia (20%), the USA, Turkey, Vietnam, and Uzbekistan, each with 4 sources. Favorable climatic factors (air temperatures and atmospheric precipitation) for sesame growth were recorded in 2018, 2019, and 2021, while 2020 was characterized by high temperatures in august and 8.4 mm of precipitation in the last decade of july through the second decade of september. These climatic conditions allowed for significant differentiation of the samples, based on genetic characteristics and ecological adaptability.

Research methods. The samples were manually sown on plots with an area of 4,5 m² at a density of 17 plants per square meter. Throughout the stages of growth and ontogenetic development of the plants, from seedling emergence to maturity, the phenophases of the life cycle were monitored. Based on the values of the growing period, the cultivars were classified into phenophase groups of the life cycle: early, medium-early, medium-late, and late. For evaluating the morphological characteristics, biometric measurements were performed on the following traits: *plant height*, *internode* and *capsule length*, *number of capsules per plant*, *number of seeds per capsule*, *1000-seed weight*, and *plant productivity*, according to the IPGRI descriptor for sesame [20]. Testing for abiotic and biotic factors was conducted under controlled laboratory conditions. The biological material (seeds) was exposed to a germination temperature of 15°C for 12 days [21] and water stress using a 15 % polyethylene glycol (PEG 6000) solution, maintaining the control and treated variants for 5 days at 28°C [22]. The response to infection with the culture filtrate of the fungi *A. alternata*, *F. oxysporum*, and *F. solani* was carried out in the applied genetics laboratory using the method proposed by Tuite [23]. Each experimental variant and control included 50 seeds × 3 repetitions. The main indicators for evaluating plant responses to these factors were seed germination, root length, and stem length. Genetic-molecular identification of pathogens from the *Alternaria*, *Fusarium*, and *Myrothecium roridum* species was performed using the nested-PCR method [24], employing multiple primer pairs. Oil content was determined by nuclear magnetic resonance (NMR), using 25 seeds × 3 repetitions for analysis at a constant temperature of 19°C

[25]. Irradiation of the *Zaltsadovski*, *Kadet*, and *Adaptovanîi 2* cultivars with doses of 200, 300, 400, and 500 Gy was performed at the RXM-γ-20 installation with a Co^{60} radioactive source [26].

The experimental data were statistically processed using the STATISTICA 8.0 and Statgraphics Plus 2.1 software packages. Genotypic (Vg) and phenotypic (Vph) variance analysis (ANOVA), genotypic (CVG) and phenotypic (CVF) variation coefficients, broad-sense heritability (H^2), and genetic advantage (AG) were calculated based on the formulas proposed by Falconer [27] and Singh [28].

III. EVALUATION OF SESAME GENOTYPES FROM THE COLLECTION BASED ON SOME MORPHO-BIOLOGICAL TRAITS

The studies on the quantitative and qualitative traits of sesame highlighted considerable variability between genotypes, with a significant impact on both yield and oil content in seeds. Phenotypic diversity is determined by genetic factors, environmental conditions, and their interaction, which reflect on the main agronomic indices – seed germination, growing period, seed yield, and biochemical quality. The observed genetic traits influenced the adaptability of plants under the climatic conditions of the research seasons with contrasting parameters [29].

Study of the genetic material from the sesame collection in relation to the length of the growing period and analysis of the phenotypic variability of quantitative traits. An important aspect of the study was the evaluation of the performance of genetic sources based on the duration of the growing period, classified into maturity groups: early, with a duration of up to 113 days, medium early, with 118-127 days, medium late, with 129-134 days, and late, with more than 140 days (figure 3.1).

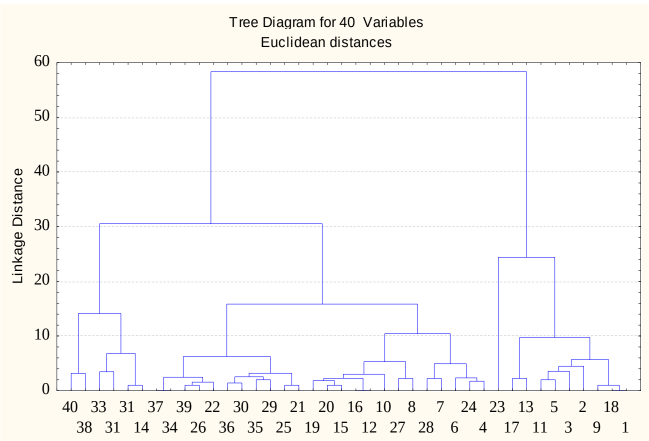

Figure 3.1. Dendrogram of sesame cultivars distribution by maturity (2019-2021)

In the early maturity group, there are 10 cultivars (25,0 %): *L₁*, *Djerelo, Zaltsadovski, Gusar, Natașa, Donskoi belosemianii, Cumhuriyet 99, Boiarin, Adaptovanîi 2* and *N162/0781*. In the medium-early maturity group, 13 cultivars (32,5 %) are included: *Kubanets 57, BiolSadovski, k-1265, Bliscucii, Kubanets 93, k-1621, k-1555, Solnecinîi, Lider, Kubanets 55, Tașkentskii 122,* *VNIIMK-889* and *VNIIMK-1*. The medium-late cultivars group includes 11 samples (27,5 %): *Kadet, L_2, Konditerskii 2058, Belosemeannii 177, Manjurski ulucșennii, Margo, Serebristîi, Iubileinîi, Zalt Sadovzri, UCR/82 n 209-SUAT* and *Oro Shot*. In the late maturity group, there are 6 samples (15,0 %): *k-1257, Liano, Delco, Dulce, Margo Tall* and *Oro 9/71*.

Based on the values of the investigated traits – *plant height* (PH), *internode length* (IL), *capsule length* (CL), *number of capsules per plant* (NCP), *number of seeds per capsule* (NSC), and *productivity per plant* (PP) – the genotypes were grouped into three clusters. For each maturity group, genetic sources with high performance in quantitative traits were highlighted during the experimental years 2019-2021. The cultivars *L_1, Djerelo, Zaltsadovski, Gusar, Natașa, Donskoi belosemanîi, Cumhuriyet 99, Boiarin, Adaptovanîi 2* and *N162/0781* exhibited the highest values for *plant height* (103,5–106.7 cm), *number of capsules per plant* (53,5–54,5 pcs.), and *productivity per plant* (6,6–10,1 g) in the 2021 growing season, with maximum precipitation ranging from 375,9 to 411,9 mm and a hydrothermal coefficient of 1,7. Among these, *L_1*, *Donskoi belosemanîi* and *Cumhuriyet 99* showed high adaptability potential to more stressful hydrothermal conditions in 2019, with a hydrothermal coefficient of 0,81.

In the medium-early maturity group, the cultivars *Kubanes 57, Kubanets 93, Tașkentskii 122, Bliscucii, Solnecinîi, Lider, VNIIMK-889, VNIIMK-1, k-1265, k-1555* and *Kubanets 55* were characterized by relatively high phenotypic variability for *plant height* – 106,2–134,0 cm, *number of capsules per plant* – 44,8–62,6 pcs., and *productivity per plant* – 6,2–10,2 g in the favorable 2021 growing season. *Kubanets 55* was particularly distinguished for its ecological adaptability to diverse hydrothermal conditions, especially in the 2019 growing season, as confirmed by the values of the main quantitative traits.

The medium-late cultivars *Konditerskii 2058, UCR/82 n 209-SUAT, Margo, Zalt Sadovzri, Kadet, Belosemeannâi 177, Manjurski ulucşennîi, Serebristîi* and *Iubileinîi*, under favorable conditions, recorded values ranging from 96,5 to 107,1 cm for *plant height*, 39,8 to 57,0 *capsules per plant*, and 5,2 to 8,9 g of *productivity per plant* in the 2021 growing season. The cultivars *Manjurski ulucşennîi, Iubileinîi* and *Zalt Sadovzri* demonstrated certain performances in the 2019 season, with arid climate conditions, showing a variation in *plant height* between 116,7 and 121,7 cm, *number of capsules per plant* between 45 and 57, and *seed productivity* between 6.2 and 8.8 g.

Under the stressful conditions of the 2019 season, the cultivar *Liano* demonstrated the highest values for biological traits, reaching 134,5 cm in *plant height*, 53 *capsules per plant*, and maximum *seed productivity* of 9,2 g. In contrast, in the 2021 season, the late-maturity cultivars *Liano, Delco, and Dulce* showed high variability for the same traits, with values ranging from 121,2 to 144,2 cm in *plant height*, 65,2 to 79,6 *capsules per plant*, and 11,0 to 12,5 g of *seed productivity*.

These results emphasize the agronomic performance of the *Liano* cultivar under contrasting conditions. Experimental data confirm a hydrothermal coefficient of 0,65 in 2019 and 1,42 in 2021.

Appreciation of sesame collection samples based on analysis of variance. Factorial dispersion variance analysis of the genotypes from the investigated maturity groups showed significant differences between the genotype proportion, the year of cultivation, and their interaction. These results suggest a broad phenotypic diversity, confirming the impact of climatic factors on the variability of the studied traits.

The *year of cultivation* had the largest contribution to the variation of traits, with variability ranging from 96,90 % to 23,17 %. The traits, *capsule length* (CL) and *number of seeds per capsule* (NSC), exhibited variability in comparison to *plant height* (PH), *internode length* (IL), *number of capsules per plant* (NCP), and *productivity per plant* (PP), with factor variabilities of 36,53 % and 44,73 %, respectively. The *genotype* x *year of cultivation* interactions contributed significantly more to the traits *capsule length* (13,91 %) and *number of seeds per capsule* (27,30 %) in the early-maturity group (table 3.1).

Table 3.1. Contribution of factors (%) to the variability of quantitative traits in early-late sesame genotypes in 2019-2021

Factors	Plant traits					
	PH	IL	CL	NCP	NSC	PP
Early maturity group						
Genotype (A)	0,89***	2,31*	36,53***	1,72***	44,73***	2,16***
Year (B)	96,90***	94,13***	47,08***	96,60***	23,17***	95,75***
Interaction (AB)	2,08***	2,54***	13,91***	1,45***	27,30***	1,96***
Medium early maturity group						
Genotype (A)	2,25***	0,02***	46,34***	1,76***	32,05***	2,35***
Year (B)	96,78***	98,38**	47,24***	97,06***	57,91***	95,97***
Interaction (AB)	0,88***	0,02***	4,45***	0,96***	8,09***	1,55***
Medium late maturity group						
Genotype (A)	2,81***	2,10	69,96***	3,76***	30,31***	5,83***
Year (B)	95,27***	92,74***	18,10**	94,53***	59,25***	91,93***
Interaction (AB)	1,83***	2,49	9,20***	1,45***	8,25***	2,07***
Late maturity group						
Genotype (A)	8,61***	17,24***	45,29***	6,30***	30,01***	5,64***
Year (B)	90,28***	78,59***	36,66***	89,37***	56,77***	91,22***
Interaction (AB)	0,95***	2,80*	13,66***	3,87***	7,42	2,81***

*,**, *** - significance at $P \leq 0,05$; 0,01; 0,001

For the medium-early genotypes, a decrease in the contribution of the *genotype* to the variability of the traits *internode length* and *number of seeds per capsule* was observed, but a significant increase was noted for *capsule length*. The impact of the *cultivation year* was significant and high for the traits *plant height* – 96,78 %, *internode length* – 98,38 %, *number of capsules per plant* – 97,06 %, and seed *productivity per plant* – 95,97 %. The *cultivation year* factor had a similar contribution to that of the *genotype* in forming the variability for *capsule length* and increased in comparison to the early group for the *number of seeds per capsule* (57,91 %). The interaction between *genotype* x *cultivation year* presented lower values in this group (table 3.1).

For the medium-late genotypes, the *cultivation year* factor had a significant and wide-ranging contribution, varying between 95,27 % and 18,10 %. For *capsule length*, the genotype factor had a higher contribution (69,96 %), while for the *number of seeds per capsule*, the cultivation year factor had a smaller weight (30,31 %). The interactions between *genotype* x *cultivation year* were higher for the traits *capsule length* and *number of seeds per capsule* (9,20 % and 8,25 %, respectively) in the medium-late sesame group (table 3.1).

The contribution of the *year of cultivation* was significantly higher in the analysis of characters with values between 91,22 % and 36,66 %. In the case of the character *capsule length*, the effect of genotype increased slightly compared to the contribution of *year of cultivation* (45,29 %), and the interaction *genotype* x *year of cultivation* had a higher contribution only for late genotypes (13,66 %) (table 3.1).

Evaluation of genetic variability in quantitative parameters of genotypes within the sesame collection. For the early maturity group, the genotypic variation coefficient (GV) and the phenotypic variation coefficient (PV) recorded the highest values for the following traits: *plant height* (GV = 19,83 %; PV = 22,60 %), *capsule length* (GV = 23,12 %; PV = 24,83 %), *number of capsules per plant* (GV = 49,04 %; PV = 56,17 %), *number of seeds per capsule* (GV = 28,55 %; PV = 31,80 %) and *productivity per plant* (GV = 62,20 %; PV = 66,22 %). Genetic analysis of the characters highlights the high heritability associated with the genetic contribution for *plant height* (H^2 = 0,77; AG = 36,05 %), *capsule length* (H^2 = 0,81; AG = 17,43 %), *number of capsules per plant* (H^2 = 0,76; AG = 69,62 %), *number of seeds per capsule* (H^2 = 0,81; AG = 26,47 %) and *productivity per plant* (H^2 = 0,88; AG = 82,32 %), thus emphasizing the importance of these traits, governed by both additive and non-additive genes, for the continuous improvement of early sesame (table 3.2).

The medium-early genotypes presented moderate to high values of the phenotypic and genotypic coefficient of variation, with maxima for the *number of capsules per plant* (GV = 53,75 %; PV = 60,72 %) and *productivity per plant* (GV = 66,75 %; PV = 70,48 %). Data analysis showed that the medium-early genotypes presented a high variability of heritability (broad sense), with values between 0,60 and 0,93, higher than those for the early genotypes. This suggests a predominantly genetic influence on the studied characters. The genetic contribution varies between 19.65 % and 79.04 % (table 3.2).

Phenotypic coefficient of variation showed higher values than the genotypic coefficient of variation, maintaining the same close relationship of GV and PV for the medium late sesame cultivars. Thus, the genotypic coefficient of variation and the phenotypic coefficient of variation only recorded high values (>20 %) for *plant height* (GV = 28,69 %; PV = 30,10 %), *internode length* (GV = 32,73 %; PV = 36,03 %), *capsule length* (GV = 27,78 %; PV = 28,77 %), *number of capsules per plant* (GV = 37,07 %; PV = 44,21 %), *number of seeds per capsule* (GV = 45,58 %; PV = 48,99 %) and *productivity per plant* (GV = 87,28 %; PV = 89,91 %). Heritability and genetic advance varied within the limits of 0.70…0.94 and 18,65 %…77,62 %, respectively, indicating significant genetic control for these traits (table 3.2).

Table 3.2. Estimation of genetic variability and parameters for productivity traits in 2019 – 2021 for early – late sesame genotypes

Trait	Mean value	V_g	V_{ph}	VG, %	VF, %	H^2	AG, %
Early maturity group							
PH	91,75±0,85	331	430	19,83	22,60	0,77	36,05
IL	2,98±0,02	0,11	0,28	11,05	17,74	0,39	12,94
CL	2,68±0,01	0,38	0,44	23,12	24,83	0.81	17,43
NCP	40,25±0,73	389,75	511,25	49,04	56,17	0,76	69,62
NSC	60,20±0,39	295,50	366,50	28,55	31,80	0,81	26,47
PP	6.36±0.12	15,65	17,74	62,20	66,22	0,88	82,32
Medium early maturity group							
PH	94,06±0,79	1358	1462	39,18	40,65	0,93	44,93
IL	2,99±0,02	0,25	0,41	16,59	21,54	0,60	20,25
CL	2,70±0,01	0,62	0,67	29,13	30,39	0,92	19,65
NCP	39,11±0,61	442	564	53,75	60,72	0,78	70,05
NSC	59,53±0,38	620	700	41,83	44,44	0,88	32,18
PP	6,31±0,10	17,73	19,78	66,75	70,48	0,90	79,04
Medium late maturity group							
PH	100,23±0,69	827	910	28,69	30,10	0,91	33,01
IL	3,04±0,02	0,99	1,20	32,73	36,03	0,83	26,43
CL	2,67±0,01	0,55	0,59	27,78	28,77	0,93	18,65
NCP	45,72±0,67	287,50	408,50	37,07	44,21	0,70	54,75
NSC	57,80±0,47	694	802	45,58	48,99	0,86	37,09
PP	6,96±0,11	36,90	39,16	87.28	89.91	0,94	77,62
Late maturity group							
PH	103,20±1,23	275	378	16,07	18,84	0,73	33.95
IL	3,13±0,03	1,01	1,183	32,11	34,75	0,85	28,53
CL	2,55±0,01	0,25	0,31	19,61	21,83	0,81	17,01
NCP	47,46±1,07	621,70	792.40	52,54	59,31	0,78	69,06
NSC	57,94±0,58	231	339	26,23	31,78	0,68	26,62
PP	7,72±0,17	31,57	34,18	72.78	75.73	0.92	78,55

In the case of late sesame varieties, the coefficient of genotypic variation and the coefficient of phenotypic variation recorded moderate values for *plant height* (GV = 16,07 %; PV = 18,84 %), but high for other 5 characters: *internode length* (GV = 32,11 %; PV = 34,75 %), *capsule length* (GV = 19,61 %; PV = 21,83 %), *number of capsules per plant* (GV = 52,54 %; PV = 59,31 %), *number of seeds per capsule* (GV = 26,23 %; PV = 31,78 %) and *productivity per plant* (GV = 72,78 %; PV = 75,73 %). The evaluation of the late sesame genotypes in the collection highlights the heritability associated with the genetic contribution for *plant height* (H^2 = 0,73; AG = 33,95 %), *internode length* (H^2 = 0,85; AG = 28,53 %), *capsule length* (H^2 = 0,81; AG = 17,01 %), *number of* *capsules per plant* (H^2 = 0,92; AG = 69,06 %), *number of seeds per capsule* (H^2 = 0,68; AG = 26,62 %) and *productivity per plant* (H^2 = 0,78; AG = 78,06 %), also emphasizing the importance of genetic control in the inheritance of these traits (table 3.5).

Differentiation of oil content in sesame seeds. In the seed quality analysis, all sesame samples were grouped by maturity based on the duration from seedling emergence to maturity. The results obtained highlighted a significant correlation between plant precocity and oil content, thus confirming previous observations in the scientific literature [30]. Seeds from earlier-maturing plants generally had a higher oil content (figure 3.2).

In the early maturity group, the highest oil content was recorded for the varieties Djerelo – 55,66 %, Natașa – 56,0 %, and Cumhuriyet 99 – 55,66 %, due to the more accelerated metabolic process during the growing period. Statistically significant differences with standard error values SE = 1.96 % were observed for Gusar – 53,33 % and Boiarin – 51,33 %.

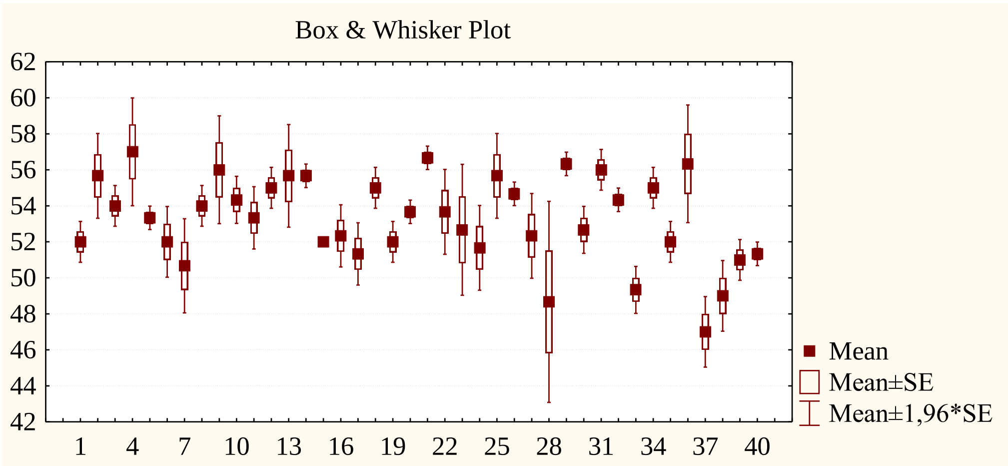

Figure 3.2. Oil content in seeds of genotypes from the sesame collection

1 – *L_1*, 2 – *Djerelo*, 3 – *Zaltsadovski*, 4 – *Kubanets 57*, 5 – *Gusar*, 6 – *BiolSadovski*, 7 – *k-1265*, 8 – *Bliscucii*, 9 – *Natașa*, 10 – *Kubanets 93*, 11 – *Donskoi belosemianîi*, 12 – *k-1621*, 13 – *Cumhuriyet 99*, 14 – *k- 1257*, 15 – *k-1555*, 16 – *Solnecinîi*, 17 – *Boiarin*, 18 – *Adaptovanîi 2*, 19 – *Lider*, 20 – *Kubanets 55*, 21 – *Kadet*, 22 – *L_2*, 23 – *N162/0781*, 24 – *Tașkentskii 122*, 25 – *Konditerskii 2058*, 26 – *Belosemeannîi 177*, 27 – *VNIIMK-889*, 28 – *VNIIMK-1*, 29 – *Manjurski ulucșennîi*, 30 – *Margo*, 31 – *Liano*, 32 – *Delco*, 33 – *Dulce*, 34 – *Serebristîi*, 35 – *Iubileinîi*, 36 – *Zalt Sadovzri*, 37 – *UCR/82 n 209-SUAT*, 38 – *Margo Tall*, 39 – *Oro Shot*, 40 – *Oro 9/71*.

Within the second maturity group, the maximum oil content values in sesame seeds were recorded for *Kubanets 57* with 57 % and *k-1621* with 55 %, placing them at the same level as the previously mentioned samples. Similar results were found for the medium-late varieties *Kadet* with 56,66 %, *Manjurski ulucșennîi*, and *Zalt Sadovzri* with 56,33 % oil, compared to the lower oil content in *UCR/82 n 209-SUAT* – 47 % and *Oro Shot* – 51 %. The oil content in the late maturity group varied between 49% in *Margo Tall* and *Dulce* to 56 %, characteristic of the varieties *Liano* and *k-1257* (figure 3.2).

Generalization of the experimental data regarding seed quality, based on the oil content in seeds, highlighted the presence of samples with remarkable performance in this characteristic in the germplasm collection, reaching maximum values of 55 – 57 %. Among the high-performing varieties in terms of biochemical seed quality are: *Djerelo*, *Natașa*, *Cumhuriyet 99*, *Kubanets 57*, *k-1621*, *Kadet*, *Manjurski ulucșennîi*, *Zalt Sadovzri*, *Liano*, and *k-1257*, which were characterized by superior yields and can be used as donors of initial material for future cycles of cumulative selection.

IV. INFLUENCE OF ABIOTIC AND BIOTIC FACTORS ON SESAME PRODUCTIVITY

The aim of the research was to identify sesame germplasm with resistance/tolerance traits to unfavorable environmental conditions, such as temperature during seed germination, water stress, and pathogens, in correlation with the main productivity parameters. Furthermore, studies were conducted on the genetic-molecular identification of pathogens in the seeds and leaves of sesame germplasm sources from the collection.

Resistance of sesame germplasm to minimum germination temperature. In order to minimize thermal stress on germination and early growth, it was aimed to identify sesame varieties and lines resistant to suboptimal temperatures and their association with productivity parameters. The classification of sesame genotypes was done using a cluster analysis model, which allowed the grouping of these genotypes based on the studied characteristics influenced by the minimum temperature of 15°C. Thus, cluster I includes 23 genotypes (figure 4.1), characterized by the highest values of germination – 75,1%, root length – 5,4 mm, and stem length – 11,3 mm, as indicators of resistance to stress factors.

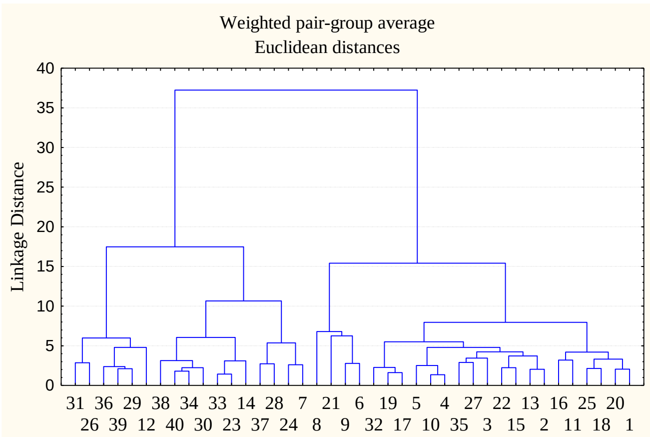

Figure 4.1. Distribution of sesame genotypes into classes based on plant growth and development characteristics under the influence of minimum temperature (15 °C)

Cluster 1 *- 1 – L_1, 2 – Djerelo, 3 – Zaltsadovski, 4 – Kubanets 57, 5 – Gusar, 6 – BiolSadovski, 8 – Bliscucii, 9 – Natașa, 10 – Kubanets 93, 11 – Donskoi belosemianîi, 13 – Cumhuriyet 99, 15 – k-1555, 16 – Solnecinîi, 17 – Boiarin, 18 – Adaptovanîi 2, 19 – Lider, 20 – Kubanets 55, 21 – Kadet, 22 – L_2, 25 – Conditerskii 2058, 27 – VNIIMK-889, 32 – Delco, 35 – Iubileinîi.*

Among the most performant genotypes regarding these indices are: *L_1, Gusar, Natașa, Donskoi belosemianîi* - early, *BiolSadovski, Bliscucii, Kubanets 93, Solnecinîi, Kubanets 55* - medium early, and *Kadet, L_2* - medium late.

From the category with high tolerance to low seed temperatures, the cultivars *L_1, Iubileinnii, Kubanets 55* and *Delco* stand out for their productivity traits, such as the number of capsules per plant – 45,5 – 53,9 pieces and productivity per plant – 7,4 – 8,3 g of seeds.

Assessment of sesame germplasm under water deficit. Identification of sesame genotypes tolerant to soil drought, a common issue in Moldova, is a priority research problem in the context of reducing the consequences associated with final production. Genotypes endowed with this trait allow for the achievement of stable multiyear yields due to their adaptability to water deficiency, which is considered a limiting factor [31].

The evaluation of the sesame germplasm sources in the collection, based on their reaction to drought, modeled in the laboratory, was carried out at the primary stage of ontogenesis – seed germination. The genotypes were classified into resistance categories: resistant, tolerant, highly plastic sensitive, and low stability sensitive, based on tolerance indicators – seed germination, root length, and stem length.

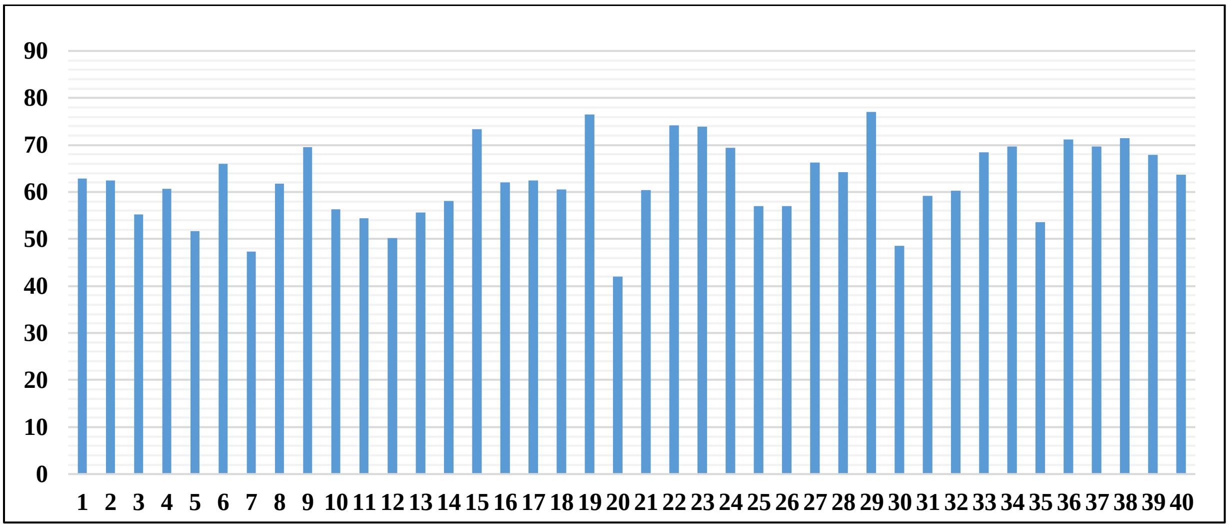

Figure 4.2. The degree of variation (%) of the biological characteristics of sesame genotypes at the early stages of ontogenetic development under the influence of water stress

1 – *L_1*, 2 – *Djerelo*, 3 – *Zaltsadovski*, 4 – *Kubanets 57*, 5 – *Gusar*, 6 – *BiolSadovski*, 7 – *k-1265*, 8 – *Bliscucii*, 9 – *Natașa,* 10 – *Kubanets 93*, 11 – *Donskoi belosemianîi*, 12 – *k-1621*, 13 – *Cumhuriyet 99*, 14 – *k- 1257*, 15 – *k-1555*, 16 – *Solnecinîi*, 17 – *Boiarin*, 18 – *Adaptovanîi 2*, 19 – *Lider*, 20 – *Kubanets 55*, 21 – *Kadet*, 22 – *L_2*, 23 – *N162/0781*, 24 – *Tașkentskii 122,* 25 – *Konditerskii 2058*, 26 – *Belosemeannîi 177*, 27 – *VNIIMK-889*, 28 – *VNIIMK-1*, 29 – *Manjurski ulucșennîi,* 30 – *Margo*, 31 – *Liano*, 32 – *Delco*, 33 – *Dulce*, 34 – *Serebristîi*, 35 – *Iubileinîi*, 36 – *Zalt Sadovzri*, 37 – *UCR/82 n 209-SUAT*, 38 – *Margo Tall*, 39 – *Oro Shot*, 40 – *Oro 9/71.*

The lowest degree of inhibition was observed in the resistant varieties and lines – *Kubanets 55*, *k-1265*, *Margo*, *k-1621*, *Gusar*, and tolerant varieties – *Iubileinîi*, *Donskoi belosemianîi*, *Zaltsadovski*, *Cumhuriyet 99*, *Kubanets 93*, *Conditerskii 2058*, *Belosemianîi 177*, *k-1257*, *Liano*, *Delco*, *Kadet*, *Adaptovanîi 2*, *Kubanets 57*. Furthermore, genotypes sensitive with high plasticity and low stability were identified, such as *VNIIMK-889*, *Dulce*, *Oro Shot*, *k-1555, Lider*, *N162/0781*, and *Manjurski ulucșennîi* (figure 4.2).

Among the genetic source samples included in the first two tolerance categories, *Kubanets 55* and *Iubileinîi* stood out for their performance, with *plant height* of 110,1 cm and 106,2 cm, respectively, *number of capsules per plant* at 45,5 and 53,8 capsules, and *productivity per plant* of 7,4 g and 8,3 g of seeds.

Sesame germplasm variability under the influence of pathogens. Discrimination of germplasm sources based on the degree of influence of pathogens during the seed germination phase is an important objective of the study. This was conducted under controlled laboratory conditions by inoculating spores of *Alternaria alternata*, *Fusarium oxysporum*, and *Fusarium solani*.

It is worth mentioning that these diseases significantly affect seeds and plants, causing major losses in sesame production and reducing the biological qualities of seeds after germination, as well as growth energy. The main objective was to identify resistant genotypes by testing them in the early stages of ontogenesis and correlating them with quantitative traits. The results on this subject are presented below.

Sesame reaction to the action of *Alternaria alternata* culture filtrate. The analysis of the distribution of sesame genotypes based on seedling growth traits treated with culture filtrate (FC) of *Alternaria alternata* showed that genotypes with superior values of average germination – 90,8%, root length – 28,1 mm), and stem length – 19,8 mm were included in cluster 3, which contains a sample of 20 genotypes (figure 4.3). In the culture filtrate-treated variant, the high values of diagnostic traits reflect the particularities of the genotypes, indicating increased tolerance to the action of the *A. alternata* pathogen. Correlation analysis highlighted a strong significant link between root length and stem length in the FC-treated variant ($r = 0.75^*$, $p < 0.05$).

The genotypes *VNIIMK-1* (medium early), *Kadet, Konditerskii 2058*, *Manjurski ulucșennîi*, *Margo*, *Serebristîi* (medium late), and *Liano, Delco, Dulce, Oro 9/71* (late) recorded the highest values for the three indices, making them valuable candidates for use as donors of favorable genes.

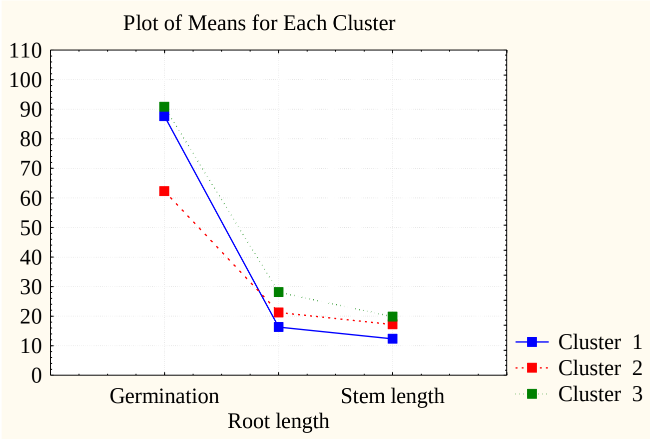

Figure 4.3. Cluster analysis (k-means) of sesame genotypes under the action of FC *Alternaria alternata*.

Cluster 3 - *1 – L_1, 3 – Zaltsadovski,4 – Kubanets 57, 5 – Gusar, 6 – BiolSadovski, 10 – Kubanets 93, 15 – k-1555, 17 – Boiarin, 19 – Lider, 20 – Kubanets 55, 22 – L_2, 23 – N162/0781, 25 – Conditerskii 2058, 26 – Belosemianîi 177, 28 – VNIIMK 1, 30 – Margo, 31 – Liano, 32 – Delco, 34 – Serebristîi, 36 – Zalt Sadovzri.*

Out of the 20 genotypes resistant to the pathogen *A. Alternata*, *L_1*, *Kubanets 55*, *Serebristîi*, *Zalt Sadovsri*, *Liano*, and *Delco* recorded higher values for quantitative traits, including *plant height* – 99,0 to 122,0 cm, the *number of capsules per plant* – 44,4 to 57,0, and seed *yield per plant*, ranging from 7,4 to 9,5 g.

Sesame reaction to the action of *Fusarium oxysporum* culture filtrate. The distribution of the genotypes studied in the Fusarium oxysporum culture filtrate treatment experiment highlighted genotypes with superior values for laboratory germination, with an average of 92,4 %, root length with an average of 30,6 mm, and stem length with an average of 21,2 mm. These were included in cluster 3, consisting of 8 distinct genotypes, which can be considered as gene donors (figure 4.4). In this experiment, a moderate positive correlation was also established between root length and stem length in the FC variant ($r = 0.64^*$, $p < 0.05$).

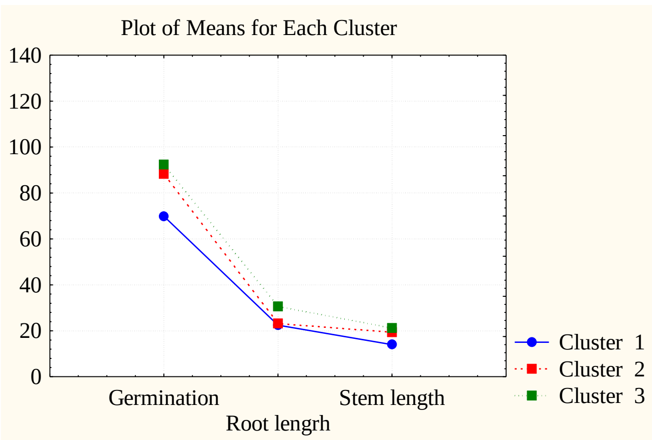

Figure 4.4. Cluster analysis (k-means) of sesame genotypes under the action of FC F. oxysporum

Cluster 3 - *5 - Gusar; 11 – Donskoi belosemianîi; 13 - Cumhuriyet 99; 14 - k-1257; 24 - Taşkentskii 122; 30 - Margo; 31 - Liano; 37 - UCR/82 n 209-SUAT.*

It is worth mentioning that among the samples resistant to the *F. oxysporum* pathogen, the varieties *Margo, k-1257* and *Liano* exhibited some high-performing traits, such as: *plant height* with maximum values of 97,0 cm – 122,0 cm, the *number of capsules per plant* ranging from 42,0 to 54,5 and seed *yield per plant* from 6,6 g to 9,5 g, making them promising for inclusion in production or breeding programs.

Sesame reaction to the action of *Fusarium solani* culture filtrate. In the case of the *Fusarium solani* pathogen, the samples from cluster I (figure 4.5) exhibited the highest values for seed germination with an average of 95,7 %, root length of 28,8 mm, and stem length of 30,71 mm [32]. In this case, moderate correlation links were established – r = 0.40 – between root length and stem length in the FC variant.

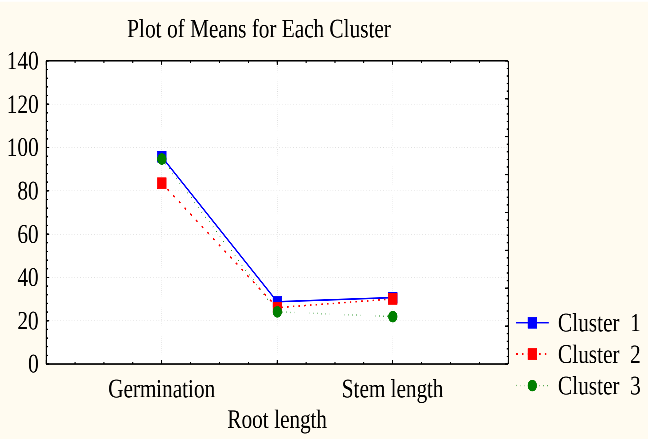

Figure 4.5. Cluster analysis (k-means) of sesame genotypes under the action of FC F. solani

Cluster 1 - 1– *L_1*, 3 – *Zaltsadovski*, 4 – *Kubanets 57*, 5 – *Gusar*, 8 – *Bliscucii*, 10 – *Kubanets 93*, 11 – *Donskoi belosemianîi*, 12 – *k-1621*, 14 – *k-1257*, 16 – *Solnecinîi*, 17 – *Boiarin*, 18 – *Adaptovanîi 2*, 19 – *Lider*, 22 – *L_2*, 25 – *Conditerskii 2058*, 26 – *Belosemianîi 177*, 27 – *VNIIMC-889*, 28 – *VNIIMC-1*, 30 – *Margo*, 31 – *Liano*, 32 – *Delco*, 34 – *Serebristîi*.

The distinct genotypes based on germination, root length, and stem length are *L_1*, *Kubanets 57*, *Gusar* – early, *Bliscucii*, *Solnecinîi*, *VNIIMK-889*, *VNIIMK-1* – medium early, *L_2*, *Belosemeannîi 177, Margo, Serebristîi* – medium late, and *k-1257, Liano, Delco* – late.

The cultivars *L_1*, *Serebristîi*, *k-1257*, *Liano*, and *Delco*, characterized as tolerant to the respective pathogen, exhibited taller plants up to 122,0 cm, formed more than 57 capsules, and had a superior seed *yield per plant* of 9.5 g. These genotypes stood out among those resistant to the *F. solani* pathogen, possessing characteristics that offer positive prospects for their use in production or breeding programs.

Identification of pathogens Alternaria spp., Fusarium spp. and Myrothecium roridum via nested-PCR, was carried out on the seeds of the varieties *Biolsadovski, Zaltsadovski, Lider, Manjurskii ulucișennîi, Kubanets 57, Donscoi belosemianîi, Liano, Natașa, Margo, Solnecinîi, Gusar* and *Serebristîi*, and on the leaves of *Lider, k-1621, Solnecinîi, Natașa, Boiarin, Bliscucii, k-*

1555, Zaltsadovski, Biolsadovski, Donscoi belosemianîi, Gusar, Kubanets 57 and *Manjurskii ulucișennîi*. It is noteworthy that these varieties differ significantly in terms of their susceptibility to the fungal diseases studied. The analysis of DNA extracted from seeds showed that in six genotypes, the pathogens *Alternaria spp.* and *A. alternata* were present (figure 4.6.A), whereas *A. solani* was not detected in the samples analyzed from the varieties *Biolsadovski, Zaltsadovski, Kubanets 57, Manjurskii ulucișennîi, Lider* and *Donscoi belosemianîi* [33]. Regarding the detection of *Fusarium spp.* infections, out of the total of 12 samples analyzed, only the *Zaltsadovski* variety was not infected.

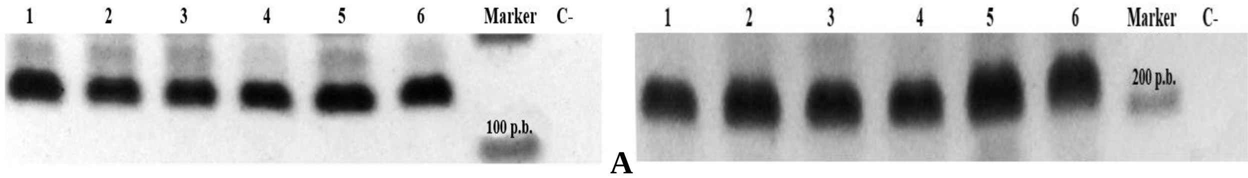

Figure 4.6. Electrophoregrams of nested-PCR products of DNA extracted from seeds (A) and leaves (B) of six sesame cultivars: 1 - *Bialsadovski,* 2 - *Zaltsadovski,* 3 - *Kubanets 57,* 4 – *Manjurskii ulucișenîi,* 5 - *Lider,* 6 – *Donskoi belosemianîi,* using primers to *Alternaria spp (A)* and *Fusarium spp* (B)., H_2O – negative control, Ladder – marker 1kb DNA Ladder.

In the case of leaves, the identification through the genetic-molecular diagnostic method confirmed the presence of *Alternaria spp.* infections in all the genotypes analyzed. *A. alternata* infection was identified in 11 samples, except for the *Natașa* variety, where it was not detected in 2021–2022. Furthermore, infections caused by *Fusarium spp.* (Figure 4.6.B) were diagnosed in all tested genotypes. The pathogens *Fusarium oxysporum* and *Fusarium equiseti* were identified in the *k-1555* genotype and, respectively, in the *Bliscucii* genotype. In the case of other species, such as *Fusarium avenaceum*, it was detected in the varieties *Lider, Donskoi belosemianîi, Manjurskii ulucișennîi* and *Biolsadovski,* while *Fusarium nivale* was found in *Lider* and *Biolsadovski*; *Fusarium culmorum* and *Fusarium sporotrichioides* were detected only in the *Biolsadovski* genotype. Additionally, the presence of *Myrothecium roridum* was detected in the seeds of the *Kubanets 57* variety in 2020, and in the leaves of the *Lider* and *Biolsadovski* varieties in the following year.

The generalization of the results from research carried out with various sources of germplasm found a high degree of tolerance to environmental conditions modeled by temperature, water deficit, and pathogen attacks. The *Kubanets 55* and *Iubileinîi* varieties demonstrated complex resistance during seed germination and high adaptation capacity under artificial drought conditions, while also showing high yields. Furthermore, genotypes with increased resistance to the analyzed pathogens were identified. Preliminary information allows for the efficient use of sesame germplasm in future research with field trials. The process of identification and genetic-molecular analysis of pathogens enables the prediction of the susceptibility of each genotype, providing essential information for assessing the quality of seed material and developing new competitive varieties.

V. INDUCED MUTAGENESIS AS A METHOD FOR EXPANDING THE GENETIC VARIABILITY SPECTRUM IN SESAME

The analysis of information from specialized literature regarding the effects of ionizing radiation shows the achievement of a wide spectrum of mutant plants, including those with valuable agronomic traits and characteristics. Research has demonstrated the effectiveness of seed irradiation doses of sesame in the range of 100-750 Gy, with practical results in creating distinct varieties based on the anthocyanin coloration of the seeds, the absence of branching on the stem, and oil content [26].

Study of genetic material obtained through induced mutagenesis in relation to the duration of the vegetation period and analysis of the variability of quantitative characters in generations M_1 – M_4. The study included the varieties *Zaltsadovski*, *Adaptovanîi* 2 - early, and *Kadet* - medium-late exposed to radiation doses of 200 Gy, 300 Gy, 400 Gy and 500 Gy. The evaluation of mutants was primarily carried out based on earliness compared to the control over the generations M_1 – M_4.

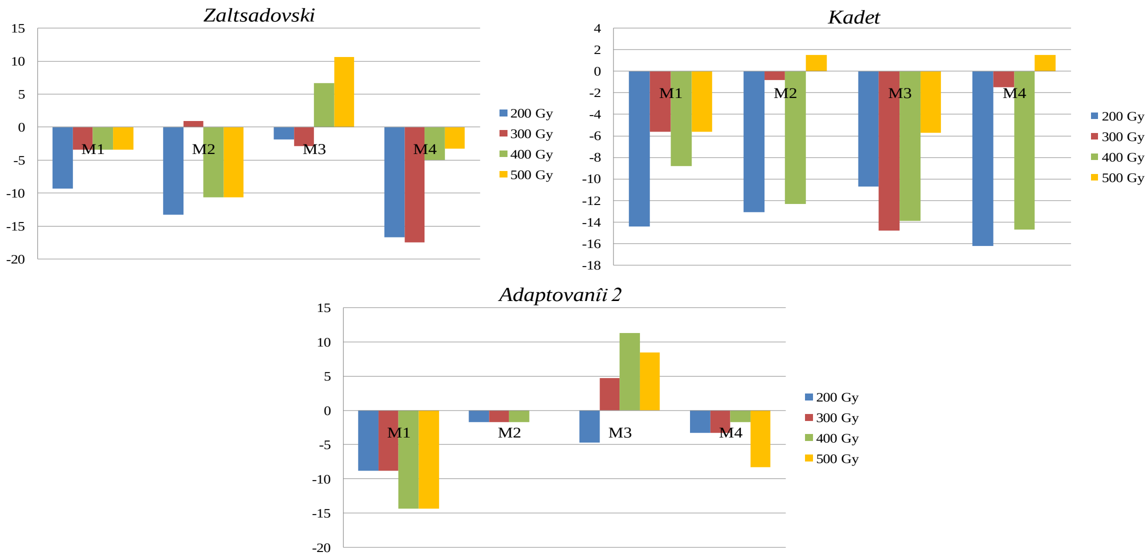

Figure 5.1. Effects of radiation doses on the vegetation phase, relative to the control (%)

Horizontally: M_1 – 2018; M_2 – 2019; M_3 – 2020; M_4 – 2021;
Vertically, left: deviation of the vegetation period under the influence of irradiation doses, % of the control.

The irradiation doses in generations M_1 and M_2 significantly influenced the vegetation period in all the treated genotypes. In the varieties *Zaltsadovski* and *Kadet*, the doses of 200 Gy and 400 Gy caused the strongest reduction in the vegetation period in generations M_1 and M_2, with about a 14 % decrease compared to the control. In the case of the *Adaptovanîi 2* variety, the doses of 400 Gy and 500 Gy had a more pronounced effect in generation M_1. In generation M_3, the mutant forms derived from the genotypes *Zaltsadovski* and *Adaptovanîi 2*, with doses of 400 Gy and 500 Gy, as well as 300 Gy, 400 Gy, and 500 Gy, resulted in an increase in the vegetation period by approximately 11 % compared to the control. In this generation, all irradiation doses caused a significant reduction in the vegetation period in the *Kadet* variety. In generation M_4, for the *Zaltsadovski* and *Kadet* varieties, the doses of 200 Gy and 300 Gy, respectively, 200 Gy and 400 Gy, showed a considerable impact on the vegetation period, with a reduction of 14,7 % to 17,5 %, compared to an 8,3 % reduction in the *Adaptovanîi 2* genotype treated with a 500 Gy radiation dose (figure 5.1).

Induced mutagenesis has significantly contributed to the diversification of the genetic variability of the genotypes based on the morphological and productive traits of the plants, such as *plant height, internode length, capsule length, number of capsules per plant, number of seeds per capsule, mass of 1000 seeds* and *seed productivity per plant*. The mutant forms originating from the *Kadet* variety, irradiated with doses of 300 Gy and 500 Gy, generated mutant forms with improved performance in traits like *plant height, number of capsules per plant* and *seed productivity per plant* across the four generations of reproduction [34]. Additionally, the disappearance of the anthocyanin pigmentation in the inner corolla was observed, while in the control group, pigmentation was present in all generations.

Evaluation of the contribution of factors based on analysis of variance to quantitative traits in generations M_1 – M_4. Contribution of gamma rays (Gy) to the analyzed traits indicates that the genotype (G), radiation (R) and the interaction between G x R significantly influenced (at the level of 99 – 99,9 %) the variation of quantitative characters in sesame plants in generations M_1 - M_4 (table 5.1).

The genotype showed the maximum contribution on the *plant height* (PH) 85,43 %...91,78 %, *internode length* (IL) 74,64 %...91,78 % and *number of capsules per plant* (NCP) 64,85 %...84,80 % in generations M_1 - M_3, but moderate for *capsule length* (CL) 36,62 %...57,26 % in generations M_2 - M_4, *number of seeds per capsule* (NSC) 73,87 %; 54,49 % in M_3 and M_4 and *productivity per plant* (PP) 51,88 %...88,19 % in generations M_1 – M_4. The contribution of the generation factor, both depending on the genotype and on the quantitative character analyzed, reached values from 7,15 % to 91,77 %. The variation of the *internode length* (35,65 %) in the M_4 generation, *capsule length* (70,59 %) in the M_1 generation and the *number of seeds per capsule* (53,17 %; 57,69 %) in the M_1 and M_2 generations were determined, in particular, by the radiation dose. Also, the *genotype* x *radiation* interaction showed maximum contribution in the variance of the *plant height* (42,94 %) and *number of capsules per plant* (44,00 %) in the M_4 generation (table 5.1).

Table 5.1. Contribution of variation sources (%) genotype/radiation in generations $M_1 – M_4$ on the variability of some quantitative traits in sesame

Trait	Generation	Genotype – G	Radiation –R	Interaction G-R
PH	M_1	90,00***	3,97***	5,47***
	M_2	85,43***	3,91***	5,77***
	M_3	91,77***	1,93	5,44***
	M_4	20,63***	33,53***	42,94***
IL	M_1	79,35***	4,38	14,20***
	M_2	74,64***	6,96*	16,00***
	M_3	91,78***	1,50	5,37***
	M_4	10,71	35,65**	28,67*
CL	M_1	7,15	70,59***	18,90***
	M_2	36,62***	33,85***	25,30***
	M_3	57,26***	5,52	34,24***
	M_4	43,16***	23,76***	30,72***
NCP	M_1	65,58***	17,19**	13,29***
	M_2	64,85***	16,49**	14,23**
	M_3	84,80***	0,68	13,39***
	M_4	40,92***	11,50*	44,00***
NSC	M_1	20,74**	53,17***	20,20***
	M_2	14,76*	57,69***	23,32***
	M_3	73,87***	12,31*	9,84*
	M_4	54,49***	19,36**	21,59***
PP	M_1	64,39***	1,90	27,82***
	M_2	51,68**	5,02	33,34***
	M_3	88,19***	1,99*	9,04***
	M_4	58,10***	14,86	20,70**

*, **, *** - significance at $P \leq 0,05; 0,01; 0,001$

Dispersal variability of quantitative traits in sesame. The three-factor dispersion variance analysis revealed very significant differences between *genotype x radiation x generation*, as well as their interaction in the phenotypic expression of the quantitative characters studied (table 5.2), indicating the presence of a wide genetic diversity. Thus, in the mutant forms of sesame (*Zaltsadovski, Kadet* and *Adaptovanîi 2* irradiated with doses of 200 – 500 Gy) the greatest contribution was established for the generation factor (cultivation years 2018 - 2021) which had a positive impact on *plant height* index (57,04 %), followed by *genotype* and *radiation* (35,57 %; 2,06 %); *number of capsules per plant* (70,10 %) followed by *genotype, radiation* (18,97 %; 3,18 %) and *productivity per plant* (83,93 %) followed by genotype and *genotype* x *radiation* interaction (11,28 %; 1,73 %) with the maximum confidence level (99,9 %). Induced mutagenesis had an important contribution on the *number of seeds per capsule* (26,03 %), followed by generation (20,54 %) and *genotype* (17,65 %), with the maximum confidence level (99,9 %). However, *genotype* showed a greater contribution on the *internode length* (48,25 %), followed by *generation* and *radiation* (32,02 %; 1,71 %) with the confidence interval of 99,5 – 99,9%, but also *capsule length* (36,51 %), followed by *radiation* (23,91 %) and *generation* (1,78 %).

Table 5.2. Analysis of the three-factorial dispersion variance of quantitative traits in generations M_1 – M_4

Trait	Genotype (A)	Radiation (B)	Generation (C)	Interaction AB	Interaction AC	Interaction BC	Interaction ABC
PH	35,57***	2,06***	57,04***	1,48***	2,48***	0,30***	0,95***
IL	48,25***	1,71*	32,02***	5,41***	8,52***	1,21*	2,80***
CL	36,51***	23,91***	1,78	10,71***	5,57***	10,05***	10,24***
NCP	18,97***	3,18***	70,10***	3,79***	2,07***	0,60*	0,98***
NSC	17,65***	26,03***	20,54***	15,40***	5,08***	10,47***	3,56***
PP	11,28***	0,40	83,93***	1,73***	1,01**	0,18	1,01***

*, **, *** - significance at $P \leq 0,05$; 0,01; 0,001

In the case of the interaction of the named factors, there is a greater contribution of the genotype x radiation effect to: *capsule length* (10,71 %), followed by the combination *genotype* x *radiation* x *generation* (10,24 %), *radiation* x *generation* (10,05 %), *genotype* x *generation* (5,57 %) with the maximum confidence level of 99,9 %. *Number of capsules per plant* (3,79 %) followed by the combination *genotype* x *generation* (2,07 %), *genotype* x *radiation* x *generation* (0,98 %), *radiation* x *generation* (0,60 %) with the confidence level of 99,5 – 99,9%. *Number of seeds per capsule* (15,40 %) followed by the combination *radiation* x *generation* (10,47 %), *genotype* x *generation* (5,08 %), *genotype* x *radiation* x *generation* (3,56 %) with the maximum confidence level of 99,9 %. *Productivity per plant* (1,73 %), followed by the combination of *genotype* x *generation* and *genotype* x *radiation* x *generation* (1,01 %) with a confidence level of 0 – 99,9 %.

In the interaction between *genotype* x *generation*, the characters with the highest contribution are: *plant height* (2,48 %), followed by the *genotype* x r*adiation* combination (1,48 %), *genotype* x *radiation* x *generation* (0,94 %), and *genotype* x *radiation* (0,30 %) with the highest level of significance. *Internode length* (8,52 %), followed by the *genotype* x *radiation* combinations (5,41 %), *genotype* x *radiation x generation* (2,80 %), and *radiation* x *generation* (1,21 %) with a confidence level of 99,5 – 99,9 % (table 5.2).

Evaluation of genetic variability of quantitative traits in sesame mutant forms from generations M_1 – M_4 highlighted the impact of induced mutations on genetic diversity, heritability and genetic advantage of productivity traits. The results obtained show that phenotypic variation was greater than genotypic variation, highlighting the significant role of genotypes in the total variance of the studied characters (table 5.3). For example, for *plant height*, genotypic variation (Vg = 33,20) and phenotypic variation (Vph = 33,48) were associated with an average height of 98,71 cm, and for the *number of capsules per plant*, Vg = 6,94 and Vph = 7,17, with 43,84 capsules. Also, the *number of seeds per capsule* showed genotypic (Vg = 0,90) and phenotypic (Vph = 1,00) variation corresponding to an average of 63,24 seeds. In contrast, the *internode length* and *capsule length* had lower variations in genotypic and phenotypic values (Vg = 0,013; Vph = 0,013 for *internode length* and Vg = 0,001; Vph = 0,001 for *capsule length*).

Table 5.3. Estimation of variance and genetic parameters for productivity traits in sesame M_1-M_4 progeny

Trait	Mean value	V_g	V_{ph}	VG, %	VF, %	H^2	AG, %
PH	98,712±0,576	33,200	33,477	5,837	5,861	0,992	12,024
IL	2,769±0,016	0,013	0,013	4,057	4,094	0,982	8,361
CL	2,606±0,007	0,001	0,001	1,247	1,276	0,955	2,573
NCP	43,845±0,483	6,944	7,166	6,010	6,105	0,969	12,382
NSC	63,242±0,312	0,904	1,000	1,504	1,581	0,904	3,100
PP	7,577±0,090	0,158	0,166	5,255	5,383	0,953	10,831

The coefficient of genotypic variation had values close to the coefficient of phenotypic variation, with a slight decrease of the genotypic one compared to the phenotypic one, maintaining a close relationship between them for all the studied characters. Thus, the coefficients of variation were the highest for *plant height* (GV = 5,84 %; PV = 5,86 %), *internode length* (GV = 4,06 %; PV = 4,09 %), *number of capsules per plant* (GV = 6,01 %; PV = 6,10 %) and *productivity per plant* (GV = 5,25 %; PV = 5,38 %).

The heritability coefficient in the broad sense is a genetic indicator that reflects the ratio between genetic and phenotypic variation, and the analysis of the data obtained showed high values of heritability (between 0,90 and 0,99), suggesting that these traits are largely controlled by genetic factors (table 5.3). Thus, the studied mutagenic genotypes show a high variability of values for these traits, which indicates a high potential for genetic selection.

Heritability associated with genetic contribution was highlighted for *plant height* (H^2 = 0.99; AG = 12,02%), *internode length* (H^2 = 0,98; AG = 8,36 %), *number of capsules per plant* (H^2 = 0,97; AG = 12,38%) and *productivity per plant* (H^2 = 0,95; AG = 10,83%). These values suggest that the traits are largely governed by both additive and non-additive genes, and direct selection of these traits could be effective in the genetic progress of sesame.

In conclusion, the induced mutagenesis through gamma-ray irradiation of sesame genotypes demonstrated a significant impact on diversifying genetic variability and improving morphological and productive traits. The study revealed that the radiation doses applied significantly influenced the growing period and generated mutant forms with quantitative plant traits such as height, number of capsules, and productivity per plant. The mutant forms exhibited major variability, and the heritability analysis suggests that these traits are genetically controlled, providing an important genetic base for breeding programs of the species. The results obtained confirm the utility of mutagenesis as a method for improving sesame plant characteristics, contributing to the development of cultivars with stable agronomic performance in contrasting climatic conditions.

General conclusions and recommendations

General conclusions:

1. Germplasm sources of *Sesamum indicum L.*, included in the IGFPP collection with origins from various geographical areas (40 genotypes), exhibited wide variability in quantitative and qualitative traits, with a three-year average vegetation period ranging from 95 days for the *N162/0781* variety (Russia) to 151 days for the *Dulce* variety (USA). The cultivars were classified into maturity groups: early - up to 113 days, medium-early - 118-127 days, medium-late - 129-134 days, and late - over 140 days.
2. The evaluation of agronomically valuable traits and properties showed a systematic increase in *plant height*, from 91,8 cm in the early group to 103,2 cm in late-maturity cultivars. Seed *production per plant* averaged 6,36 g in the early group, 6,31 g in medium-early sources, 6,96 g in the medium-late group, and 7,73 g in the late group. Cultivars with the most stable seed production, as an indicator of ecological adaptation, included *L_1, k-1555, VNIIMC-889, L_2, Margo, Serebristîi, Zalt Sadovzri, Oro Shot, Liano* and *Dulce*. *Internode* and *capsule lengths* were less influenced by the vegetation period, which showed more pronounced values in *capsule numbers*—about 40 capsules for early and medium-early genotypes, and 45,7-47,4 *capsules* for medium-late and late groups. Genotypes from early (*Djerelo, Natașa, Cumhuriyet 99*), medium-early (*Kubanets 57, k-1621*), medium-late (*Kadet, Manjurski ulucișennîi, Zalt Sadovzri*), and late (*Liano, k-1257*) classes accumulated a high oil content of 55-57%.
3. The analysis of the contribution of *genotype*, *cultivation year* and their interaction showed a significant influence, with a 94 % weight of the year factor. Significant phenotypic variability for sesame populations from different maturity groups, assessed through factorial analysis, highlighted the major impact of the cultivation year on morphological and productivity traits of sesame. Strong correlations between the contribution of the *cultivation year* factor for traits such as *plant height* (90,28 – 96,90 %), *internode length* (78,59 – 99,99 %), *number of capsules per plant* (89,37 – 97,06 %), and *seed productivity per plant* (91,22 – 95,97%) confirmed their dependence, as well as the influence of year conditions on productivity for all maturity groups. The moderate to high genetic variation coefficient, along with moderate heritability associated with genetic advantage for traits like *plant height*, *number of capsules per plant*, *seed number per capsule*, and *productivity per plant*, predicts genetic progress in sesame breeding.
4. Studies on sesame germplasm revealed significant diversity in the plants' response to abiotic factors, such as thermal stress and water stress. Controlled laboratory modeling of 15°C temperatures and water stress during seed germination allowed for differentiation of samples

from control variants based on germination rate, root length and stem length as indicators of genetic tolerance. Artificial inoculation of seeds with culture filtrates of pathogens from the *Alternaria* and *Fusarium* genera revealed significant variability of genotypes in their tolerance, compared to control variants. Research findings allowed for the grouping of sesame samples according to their resistance to abiotic factors and fungal pathogens. Molecular investigations confirmed the presence/absence of pathogens from species *A. alternata*, *A. solani*, *F. oxysporum*, *F. equiseti*, *F. avenoceum*, *F. nivale*, *F. culmorum*, *F. sporotrichioides* and *Myrothecium roridum* in sesame seeds and leaves.

5. Research results regarding the effects of 200-500 Gy radiation doses on the variability of 6 traits in early-maturing varieties – *Zaltsadovski*, *Adaptivanîi 2* and *Kadet* (medium-late maturity) – confirmed the presence of a significant proportion of mutant plants with shorter vegetation periods in the M_4 breeding *generation*, compared to the control variant. The analysis of *genotype*, *radiation*, and their interaction contribution in the M_4 *generation* revealed an influence of 58 % for genotype, 14,9 % for radiation doses, and 20,7% for the *genotype* × *radiation* interaction on *seed production per plant*.
6. Studies on mutant forms of sesame highlighted that the genetic factor contributed significantly to the variability of the studied traits, with values ranging from 36,62 % to 91,78 %. Radiation and the *genotype* × *radiation* interaction had a decisive influence on traits such as *plant height*, *internode length*, *number of capsules per plant*, and *capsule length*. Three-way analysis of variance indicated that, for some traits, the main factor was the generation.
7. Statistical analysis of genetic parameters in M_1-M_4 generations revealed a genotype variation coefficient close to the phenotypic variation coefficient, emphasizing the important role of irradiated genotypes in the formation of traits like *plant height* (VG = 5,84 %; VF = 5,86 %), *internode length* (VG = 4,06 %; VF = 4,09 %), *number of capsules per plant* (VG = 6,01%; VF = 6,10 %), and *productivity per plant* (VG = 5,25 %; VF = 5,38 %). High values of broad-sense heritability (0,90 – 0,99), coupled with significant genetic advantage values (8,36 – 12,38 %), indicate the involvement of additive factors in the formation of these traits, suggesting that direct phenotypic selection could be an effective method for identifying valuable sesame genotypes.

Practical recommendations:

1. For the cultivation of sesame species in the Republic of Moldova, practically interesting are the varieties with a growth period from germination to technical maturity, which fit within the calendar until the end of September, with stable seed production, such as the cultivars L_1,

k-1555, VNIIMC-889, L_2, Margo, Serebristîi, Zalt Sadovzri, Oro Shot, Liano, Dulce and the mutant forms derived from the *Kadet* variety irradiated with doses of 300 and 500 Gy.

2. Early germplasm sources – *L_1, Donskoi Belosemianîi, Cumhuriyet 99*, medium-early – *Kubanets 55*, medium-late – *Manjurski ulucișennîi, Iubileinîi, Zalt Sadovzri*, and late – *Liano, k-1257*, are recommended for inclusion in breeding programs as donors of genes favorable for earliness and productivity.
3. To increase the efficiency of the sesame breeding process, it is recommended to use mutant forms obtained from the *Kadet* genotype, which are characterized by a significantly shorter vegetation period and high heritability of quantitative traits.
4. The molecular method based on the PCR technique is proposed for the efficient diagnosis of fungal pathogens in sesame seed material, with the aim of eliminating contaminated seed batches.

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Adnotare

La teza cu titlul **“Studiul caracterelor morfo-biologice valoroase la mostrele din colecția de susan și elaborerea unor procedee de lărgire a spectrului variabilității genetice”,** înaintată de către candidatul – **Mogîlda Anatolii,** pentru conferirea titlului științific de doctor în științe biologice la specialitatea – **162.01. Genetică vegetală.**

Chişinău, 2025

Structura tezei: teza este scrisă în limba română și constă din introducere, 5 capitole, concluzii generale și recomandări, bibliografie din 249 de titluri și 33 anexe. Teza conține 124 de pagini cu text de bază, 54 figuri și 20 tabele. Rezultatele obținute sunt publicate în 25 lucrări științifice cu volum total de circa 5,30 coli de autor.

Cuvintele cheie: Susan, colecție, mutageneza indusă, caractere cantitative și calitative, genotip, abiotic, biotic, conținut de ulei, *nested*-PCR, variabilitate genetică.

Scopul lucrării: Evaluarea germoplasmei de *Sesamum indicum L.* prin analiza caracterelor morfobiologice, variabilității însușirilor cantitative și calitative, rezistenței la factorii abiotici și biotici, obținerea prin utilizarea razelor gama a formelor mutante ca donatori de gene valoroase în ameliorarea speciei.

Obiectivele cercetării: Studierea parametrilor cantitativi și calitativi la susan repartizați pe baza indicelui precocității prin analiza clusteriană de repartiție a genotipurilor; aprecierea genotipurilor colecției de susan prin determinarea contribuției factorilor (*genotip x an de cultivare*) pe baza caracterelor cantitative; evaluarea variabilității și a parametrilor genetici ai caracterelor cantitative la genotipurile de susan, pentru toate grupele de precocitate; aprecierea mostrelor colecției de susan după rezistența la factorii abiotici și biotici; evaluarea variabilității și determinarea contribuției factorilor *genotip și generație* la caracterele cantitative ale formelor mutante de susan în M_1-M_4; estimarea variației fenotipice și genotipice la caracterele de productivitate la descendenții M_1- M_4.

Noutatea și originalitatea științifică: Pentru prima dată în Republica Moldova au fost elaborate și experimental argumentate procedeele de evaluare a variabilității caracterelor morfologice, biologice și de productivitate, inclusiv determinarea conținutului de ulei în semințe, rezistenței la temperatura joasă pozitivă, stresul hidric și unii agenți patogeni din colecția de susan de diferită proveniență eco-geografică. A fost demonstrată posibilitatea utilizării factorilor mutageni fizici (raze gama) pentru sporirea variabilității genetice.

Rezultatele obținute constau în: Justificarea științifică esențială pentru identificarea germoplasmei valoroase la susan, bazate pe studiul caracterelor cantitative și calitative, rezistenței la factorii abiotici și biotici stresogeni, precum și în obținerea de forme mutante noi prin mutageneza indusă, pentru utilizarea lor în programele de ameliorare.

Semnificația teoretică: Investigarea legăturilor corelative ale caracterelor morfologice, de productivitate și rezistența la factorii nefavorabili ambientali, pe de o parte, și spectrul variabilității genetice, pe de altă parte, lărgește cunoștințele teoretice în domeniul geneticii, adaptării și rezistenței plantelor și poate servi ca bază științifică pentru elaborarea programelor de diagnosticare și control al toleranței, proceselor de creștere, dezvoltare și productivitate.

Valoarea aplicativă: Cultivarele colecției de *Sesamum indicum* L., precum și formele mutante noi obținute prin mutageneza indusă, cu caractere valoroase, sunt utilizate în investigațiile Institutului de Genetică, Fiziologie și Protecție a Plantelor și pot fi recomandate pentru cultivare în zona centrală a Republicii Moldova. Genotipurile colecției de susan cu însușiri distincte au fost introduse în Banca de gene a Republicii Moldova. Rezultatele obținute în teză pot fi incluse în programele naționale cu scopul obținerii de noi soiuri de susan.

Implementarea rezultatelor: Germoplasma colecției de susan, dar și formele mutante obținute prin mutageneza indusă au fost testate experimental și s-au selectat genotipuri promițătoare pentru programele de ameliorare, rezultatele au fost expuse în cadrul conferințelor științifice la nivel național și internațional, publicate în reviste științifice.

Annotation

Of the thesis entitled **"Study of valuable morpho-biological traits in samples from the sesame collection and development of methods for expanding the genetic variability spectrum"**, Presented by the candidate – **Mogîlda Anatolii,** for obtaining the degree of Doctor in Biological Sciences with specialty – **162.01. Plant genetics.**

Chisinau, 2025.

Structure of the thesis: the thesis is written in Romanian and consists of an introduction, 5 chapters, general conclusions and recommendations, a bibliography of 249 titles and 33 appendices. The thesis contains 124 pages of basic text, 54 figures and 20 tables. The obtained results were published in 25 papers with a volume of over 5,30 sheets of author.

Keywords: Sesame, collection, induced mutagenesis, quantitative and qualitative traits, genotype, abiotic, biotic, oil content, nested-PCR, genetic variability.

Research purpose: Evaluation of the germplasm of *Sesamum indicum* L. through the analysis of morphobiological traits, variability of quantitative and qualitative properties, resistance to abiotic and biotic factors, and the generation of mutant forms using gamma rays as donors of valuable genes for species improvement.

Research objectives: Studying the quantitative and qualitative parameters of sesame belonging to different precocity groups through cluster analysis of genotype distribution; evaluating the collection sesame genotypes by determining the contribution of factors (*genotype × year of cultivation*) based on quantitative traits; evaluating the variability and genetic parameters of quantitative traits in sesame genotypes across all precocity groups; evaluating the collection samples for resistance to abiotic and biotic factors; evaluating variability and determining the contribution of genotype and generation factors to the quantitative traits of mutant sesame forms in M_1-M_4; estimating phenotypic and genotypic variation for productivity traits in the M_1-M_4 descendants.

Scientific novelty and originality: For the first time in the Republic of Moldova, methods for evaluating the variability of morphological, biological, and productivity traits have been developed and experimentally validated, including determining oil content in seeds, resistance to low positive temperatures, water stress, and certain pathogens from a sesame collection originating of different eco-geographical regions. The possibility of using physical mutagenic factors (gamma rays) to induce genetic variability has been demonstrated.

The obtained results consist of providing essential scientific justification for identifying valuable sesame germplasm based on the study of quantitative and qualitative traits, resistance to abiotic and biotic stress factors, as well as the creation of new mutant forms through induced mutagenesis for use in breeding programs.

Theoretical significance: Investigating the correlations between morphological traits, productivity, and resistance to unfavorable environmental factors, on the one hand, and the spectrum of genetic variability, on the other, expands theoretical knowledge in the fields of plant genetics, adaptation, and resistance. It can serve as a scientific basis for the development of diagnostic and control programs for tolerance, growth, development, and productivity processes.

Applicative value: The cultivars from the Sesamum indicum L. collection, as well as the new mutant forms obtained through induced mutagenesis with valuable traits, are used in research at the Institute of Genetics, Physiology, and Plant Protection, and can be recommended for cultivation in the central region of the Republic of Moldova. Valuable sesame genotypes from the collection with distinct traits have been introduced into the Gene Bank of the Republic of Moldova. The results obtained in the thesis can be incorporated into national breeding programs aimed at obtaining new sesame varieties.

Implementation of results: The germplasm of the sesame collection, as well as the mutant forms obtained through induced mutagenesis, has been experimentally tested, and promising genotypes have been selected for breeding programs. The results were presented at national and international scientific conferences and published in scientific journals.

Аннотация

Диссертация «**Изучение ценных морфобиологических признаков образцов из коллекции кунжута и разработка методов расширения спектра генетической изменчивости»**, представленная **Могылда Анатолий** на соискание ученой степени доктора биологических наук по специальности – **162.01. Генетика растений**
Кишинев, 2025.

Структура диссертации: диссертация написана на румынском языке и состоит из введения, 5 глав, общие выводы и рекомендации, библиография из 249 названий и 33 приложений. Диссертация содержит 124 страниц основного текста 20 таблиц 54 рисунков. Полученные результаты опубликованы в 25-и научных работах с общим объёмом около 5,30 авторских листов.

Ключевые слова: Кунжут, коллекция, индуцированный мутагенез, количественные и качественные признаки, генотип, абиотический, биотический, содержание масла, *нестед*-ПЦР, генетическая изменчивость.

Цель работы: Оценка генофонда *Sesamum indicum* L. с помощью анализа морфобиологических признаков, изменчивости количественных и качественных характеристик, устойчивости к абиотическим и биотическим факторам; получение мутантных форм с использованием гамма-лучей как доноров ценных генов для улучшения вида.

Задачи исследования: Изучение количественных и качественных параметров генотипов кунжута, распределенных по индексу раннеспелости с помощью кластерного анализа; оценка коллекции кунжута путем определения вклада факторов (*генотип × год выращивания*) на основе количественных признаков; оценка изменчивости и генетических параметров количественных признаков у генотипов кунжута для всех групп раннеспелости; оценка образцов коллекции кунжута по устойчивости к абиотическим и биотическим факторам; оценка изменчивости и определение вклада факторов *генотип* и *поколение* количественныу признаки мутантных форм кунжута в M_1-M_4; оценка фенотипической и генотипической изменчивости по продуктивным признакам генераций M_1-M_4.

Научная новизна и оригинальность: Впервые в Республике Молдова были разработаны и экспериментально обоснованы методы оценки изменчивости морфологических, биологических и хозяйственно-ценных признаков, в том числе, определение содержания масла в семенах, устойчивости к низким положительным температурам, водному стрессу и некоторым патогенам образцов из коллекции кунжута различного эколого-географического происхождения. Продемонстрирована возможность использования физических мутагенов (гамма-лучей) для повышения генетической изменчивости.

Полученные результаты заключаются в научном обосновании необходимости идентификации ценной гермоплазмы кунжута на основе исследований количественных и качественных признаков, устойчивости к абиотическим и биотическим стрессовым факторам среды, а также получение новых мутантных форм с помощью индуцированного мутагенеза для использования в селекционных программах.

Теоретическая значимость: Исследование сопряженности морфологических признаков, элементов продуктивности и устойчивости к неблагоприятным факторам среды, с одной стороны, и спектра генетической изменчивости, с другой, расширяет теоретические знания в области генетики растений, адаптации и устойчивости и может служить научной основой для разработки программ диагностики и контроля толерантности, процессов роста, развития и продуктивности.

Прикладное значение: Сорта коллекции *Sesamum indicum* L., а также новые мутантные формы, полученные методом индуцированного мутагенеза, обладающие ценными признаками, используются в исследованиях Института генетики, физиологии и защиты растений и могут быть рекомендованы для выращивания на территории Республики Молдова. Генотипы коллекции кунжута с отличительными признаками были включены в состав активнои коллекции Ген банка Республики Молдова. Результаты, полученные в диссертационной работе, могут быть включены в национальные программы с целью получения новых сортов кунжута.

Внедрение результатов: Зародышевая плазма коллекции кунжута а так же мутантные формы, полученные методом индуцированного мутагенеза, протестированы экспериментально и отобраны перспективные генотипы для селекционных программ, результаты были представлены на научных конференциях национального и международного уровня и опубликованы в научных журналах.

MOGÎLDA Anatolii

STUDY OF VALUABLE MORPHO-BIOLOGICAL TRAITS IN SAMPLES FROM THE SESAME COLLECTION AND DEVELOPMENT OF METHODS FOR EXPANDING THE GENETIC VARIABILITY SPECTRUM

162.01. Plant genetics

Summary of PhD thesis in biology

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