SOI: 1.1/TAS
DOI: 10.15863/TAS

Scopus ASJC: 1000

ISSN 2308-4944 (print)
ISSN 2409-0085 (online)

№ 12 (116) 2022

Teoretičeskaâ i prikladnaâ nauka

Theoretical & Applied Science

Philadelphia, USA

Teoretičeskaâ i prikladnaâ nauka

Theoretical & Applied Science

12 (116)

2022

International Scientific Journal

Theoretical & Applied Science

Founder: **International Academy of Theoretical & Applied Sciences**

Published since 2013 year. Issued Monthly.

International scientific journal «Theoretical & Applied Science», registered in France, and indexed more than 45 international scientific bases.

Editorial office: http://T-Science.org Phone: +777727-606-81

E-mail: T-Science@mail.ru

ISSN 2308-4944

12

9 772308 494225

International Scientific Journal

Theoretical & Applied Science

Editorial Board:

				Hirsch index:
21	Prof.	Konstantin Kurpayanidi	Uzbekistan	h Index RISC = 8 (67)
22	Prof.	Shoumarov G'ayrat Bahramovich	Uzbekistan	-
23	Associate Prof.	Saidvali Yusupov	Uzbekistan	-
24	PhD	Tengiz Magradze	Georgia	-
25		Dilnoza Azlarova	Uzbekistan	-
26	Associate Prof.	Sanjar Goyipnazarov	Uzbekistan	-
27	Prof.	Shakhlo Ergasheva	Uzbekistan	-
28	Prof.	Nigora Safarova	Uzbekistan	-
29	Associate Prof.	Kurbonov Tohir Hamdamovich	Uzbekistan	-
30	Prof.	Pakhrutdinov Shukritdin Il'yasovich	Uzbekistan	-
31	PhD	Mamazhonov Akramzhon Turgunovich	Uzbekistan	-
32	PhD	Ravindra Bhardwaj	USA	h Index Scopus = 2 (5)
33	Assistant lecturer	Mehrinigor Akhmedova	Uzbekistan	-
34	Associate Prof.	Fayziyeva Makhbuba Rakhimjanovna	Uzbekistan	-
35	PhD	Jamshid Jalilov	Uzbekistan	-
36		Guzalbegim Rakhimova	Uzbekistan	-
37	Prof.	Gulchehra Gaffarova	Uzbekistan	-
38	Prof.	Manana Garibashvili	Georgia	
39	D.Sc.	Alijon Karimovich Khusanov	Uzbekistan	
40	PhD	Azizkhon Rakhmonov	Uzbekistan	
41	Prof.	Sarvinoz Kadirova	Uzbekistan	
42	Prof., D.Sc.	Shermukhamedov Abbas Tairovich	Uzbekistan	
43	PhD	Bekjanova Ainura	Uzbekistan	
44		Anzhelika Bayakina	Russia	h Index RISC = 3 (18)
45	PhD	Abdurasul Martazayev	Uzbekistan	
46	PhD	Ia Shiukashvili	Georgia	

International Scientific Journal

Theoretical & Applied Science

ISJ Theoretical & Applied Science, 12 (116), 1128.
Philadelphia, USA

Impact Factor ICV = 6.630

Impact Factor ISI = 0.829
based on International Citation Report (ICR)

The percentage of rejected articles:

ISSN 2308-4944

Impact Factor:					
	ISRA (India) = 6.317	SIS (USA) = 0.912	ICV (Poland) = 6.630
	ISI (Dubai, UAE) = 1.582	РИНЦ (Russia) = 3.939	PIF (India) = 1.940
	GIF (Australia) = 0.564	ESJI (KZ) = 8.771	IBI (India) = 4.260
	JIF = 1.500	SJIF (Morocco) = 7.184	OAJI (USA) = 0.350

SOI: 1.1/TAS DOI: 10.15863/TAS

International Scientific Journal

Theoretical & Applied Science

p-ISSN: 2308-4944 (print) **e-ISSN:** 2409-0085 (online)

Year: 2022 **Issue:** 12 **Volume:** 116

Published: 22.12.2022 **http://T-Science.org**

Issue Article

Zebo Haforovna Yodgorova
Karshi State University
Researcher

LINGUISTIC ASPECT OF NEWSPAPER TEXT MODALITY

Abstract: *One of the topical issues of world linguistics is the role of the worldview of native speakers, their national and cultural views, thinking, as well as the universal aspects of the language landscape of the media world in different languages. Aspects of the interdependence between modality and evaluative categories, the presence of cases of intersection of types of categorical units within the framework of modality and differential features in the semantic field, as well as the relationship of modality with other semantic categories indicate that its study as a universal category and the study of their national self-consciousness is one of current and necessary tasks.*

Key words: *media, text, journalism, communication, modality, objective and subjective modality, media language.*

Language: *English*

Citation: Yodgorova, Z. H. (2022). Linguistic aspect of newspaper text modality. *ISJ Theoretical & Applied Science, 12 (116)*, 701-704.

Soi: http://s-o-i.org/1.1/TAS-12-116-58 ***Doi***: crossref https://dx.doi.org/10.15863/TAS.2022.12.116.58

Scopus ASCC: *1203.*

Introduction

Nowadays, modern people get to know the world through media. At the same time, a wide range of language possibilities in the media space embodies the coverage of events taking place in the world through it, bringing national culture to the audience, questions of linguistic mentality in a communication situation. Of course, language as a means of communication in society is carried out on the basis of political, social, economic and cultural information, such as understanding the world, forming a worldview, conclusions.

Since the unity of language and thinking finds its expression in speech, our thought also takes on a material form, i.e., the form of emotional perception, and thus belongs not only to the individual, but also to society. In fact, the language has the ability to exert a certain influence on people and awaken their feelings, informing about the events and phenomena taking place in society.

The coverage and understanding of current events in the world through linguistic units determines not only the methodological appearance of journalism, but also some of its important linguistic features. After all, all forms, functions and functions of the language, with its inseparable connection at all stages of existence, are fixed in different ways in all spheres of life and activity of society. Language is "not an abstract system, it can be seen as a series of practices that always evolve from communicative needs in specific contexts and situations. Each part of the language has its own purpose" [1, 37].

Each society, like each era, each culture has its own media, its own experience and model of interaction and its own language.

The media environment forms a "strategy of behavior, desires, feelings, structure of views" [2, 92]. The media imposes its parameters on social reality and on a person, firmly introducing its own order, its own model of consciousness, the logic of cognition and events, its own time and space into everyday structures.

The media has influenced all types of communication:

1) personalized consciousness, subjectivity, interpersonal communication associated with personal experience, such as mass, collective, non-specific consciousness, aimed at eliminating the boundaries of a personalized subject [3, 46], interesting to a wide audience with the help of replication technologies (press, television, radio, Internet, etc.).) data transfer;

2) non-public (various specialized and private communications), such as mass communications with a certain social orientation, the meaning of the social

context, the transfer of information by means that do not have a public status for various reasons.

As a socially conditioned means of cognition, communication and control, language has a complex structure of the literary language, including various forms - dialects, sociolects, simple language, the language of fiction, the language of the media, specific functional and methodological forms. The existence of variant forms of a language that differ in social status and the composition of language means, the originality of the history of the language and its use in various spheres of life and activity of society, as well as in social education, which unites according to one or another parameter - ethnic, territorial, demographic, political, cultural, professional, labor and related to others.

It is known that language is transformed from a means of communication into a means of influencing the consciousness of a potential consumer. In addition, language can turn from a means of communication into a means of influencing human consciousness. This feature of the language is widely used in modern media.

The category of modality is a linguistic phenomenon closely related to the logical construction of thought, and this category is considered the subject of study not only of linguistics, but also of logic. It forms the basis of the triad of language, thought and logic.

What is the special interest of researchers in the "modality of media language"? What is the relevance of studying linguistic modality, the parameters of which are derived from the media, from the nature of their social and communicative mediation? What is the importance of this problem and the prospects for its research?

"Modality (Latin modalis - measure, method) is a functional and semantic category representing different forms of the relationship of thought to reality, as well as different forms of subjective classification of things [4, 127].

Linguistic modality is a complex and multifaceted category, Sh. According to Balli's description, the "core of the sentence" [5, 96], the structural-structural volume and the functional hierarchy of meanings define two semantic aspects of the sentence, which are determined by its nominative (declarative) and communicative (pragmatic) aspects.

R. Ikromova explains her view of the modal category in the following way: "Modality is a set of techniques that show the relation of thought to reality. Modal forms mean the attitude of the speaker to the content of his speech, to the listener, to the situation, to various things and events, to existence in general [6, 104].

A. Gulomov emphasized [7, 63] that modality expresses an objective-subjective attitude to real being, while A. Nurmonov believes: "Modality is the main unit of a sentence, the most important component of the semantics of a sentence, and the subjective side can act as a unifying sign for the category of modality" [8, 93].

Researchers define modality as a grammatical-semantic category that expresses the speaker's attitude to the judgment he expresses, his assessment of his attitude to the expressed objective reality [9, 64]. In fact, modality is expressed both by grammatical and lexical means (inflectional forms, modal words and prepositions, intonation (tone), etc.).

V. G. Gak distinguishes three stages of the type of modality:

1) by the nature of reporting - declarative and performative;

2) reliability and probability according to the nature of cognition of reality (incomplete reliability);

3) by the nature of the relationship - the expression by the subject of feelings of desire and dissatisfaction [10, 79].

V.V. Vinogradov defines modality as "a conceptual (conceptual) category that is not described with the help of language, but manifests itself in it, through its vocabulary and grammatical structure" [11, 53]. After all, modality is not only a characteristic of reality and unreality, but also a description of the speaker's attitude to his speech.

Of course, researchers who support this opinion show that they took the category of modality from philosophy, because "the category of modality is the attitude of the speaker to the reality in which the speaker establishes a connection between the subject and its sign" [12, 92].

"The concept of modality was introduced from such a branch of philosophy as classical formal logic. All philosophy textbooks define logic as the science of reasoning or the ability to reason [13, 75]. Modality is a broad concept based on categorical logic and psychology, suggesting that the expressed thought is a text, and any text has a modal volume. Focusing on the formation of the modality of subjective reception, he introduced semantic operators with emotive, epistemic, deontic and compositional characteristics, since they serve to express subjective relations, and this process also shows the author's attitude to the content of the text [14, 37]. This situation allows us to conclude how closely the concept of modality is connected with human linguistic activity.

Indeed, the presence of such a wide range of possibilities in the manifestation of the category of modality, no doubt, indicates that this category is a universal phenomenon and that its study is extremely important for understanding the essence of language construction. "The emergence of a universal category of modality at every level of language proves once again that the units of the language system have a wide range of possibilities" [15, 134].

Massachusetts Abdurazakov explains modality with three components:

a) the nature of the modality,

b) the content of the modality,

c) modality condition.

Scientist, "The character of modality is expressed in accordance with the norms of the language, by means of which the action must be performed, can be performed or cannot be performed. "The participant in the situation, that is, the modal subject expressing desire, is in the context of modality" [16, 73].

Modality in the media text is associated not only with the synchronic, but also with the diachronic level. The category of modality needs to be discussed as a universal category, because "in the languages of different systems, it appears in different forms" [17, 67].

So, the type of modality is manifested through linguistic means, the communicative intention of the speaker (writer), the meaning of the modality, expressing his emotional attitude to the content of the sentence, is expressed using the subjunctive mood, tenses of verbs, as well as some conjunctions and prepositions. Text modality plays an important role in the analysis of printed media texts and the identification of their national and cultural characteristics.

Thus, modality is an active component in journalistic texts, it is a universal means that ensures the achievement of the effect intended and planned by the author of the message and affects the recipient for various purposes. Modal categories actively used in journalism allow the author of a journalistic text to clearly, figuratively and concisely convey the desired meaning. It is interesting to describe the different variants of the language landscape of the world using modal means in the journalistic landscape of the world. The purpose of this study is to assess the possibilities of modality by presenting variants of the linguistic landscape of the world in journalism with the help of examples.

Each era has its own ideas and principles that make it conceptually and methodologically recognizable. Undoubtedly, the theories that have become characteristic of today are formed on the basis of understanding the mass media, which are the main information and communication resource of modern man. Today, the media have firmly emerged from their "behind the scenes" space, placing the main plots of the history of man and society at the forefront of the culture that created it, and each time emphasizing one or another of its most important parameters. On their basis, the media project is based on the transformation of media content and technological potential, their creative practices into a qualitatively new cultural and linguistic reality of the individual.

References:

1. Page, R., Barton, D., Unger, J. W., & Zappavigna, M. (2014). Researching Language and Social Media. London and New York: Routledge, 202. (in English).
2. Savchuk, V.V. (n.d.). *Ob#ektivnoj informacii net, ne bylo i ne budet!* Retrieved from https://lenizdat.ru/articles/1070177
3. Pronin, E.I., & Pronina, E.E. (2001). Antinomija-2000: net-myshlenie kak publichnaja sub#ek-tivnost` i kak massovaja ustanovka. V kn.: *Vestn. Mosk. un-ta. Ser. 10. Zhurnalistika*, 1: 5-23.
4. (2008). *Jazyk sredstv massovoj informacii kak ob#ekt mezhdisciplinarnogo issledovanija: 2008.* V kn.: Materialy II mezhdunarodnoj nauch. konferencii. MGU im. M. V. Lomonosova, 14-16 fevralja 2008 g.). M., MAKS Press.
5. Mirzaev, I. (2000). *Ўzekiston Millij Jenciklopedijasi*. 6 t, T..
6. Raninen, A. A. (2011). Kategorija modal`nosti na stranicah gazet kak ob#ekt analiza jazyka SMI. *Vestnik ugorskogo gosudarstvennogo universiteta*, Vypusk 1 (20).
7. Ikromova, R. (1966). *Ўzbek adabij tilida otning modal formalari*. Nomz. dis.-Toshkent.
8. Gulomov, A., & Askarova, M. (1987). *Hozirgi ўzbek adabij tili (snntaksns)*.- Toshkent.
9. Nurmonov, A., Maxmudov, N., Axmedov, A., & Solihўzhaeva, S. (1992). *Uzbek tilining mazmunnj sintaksnsn*. Toshkent.
10. Onerbaeva, A.A. (n.d.). *Kategorii modal`nosti v lingvistikei perevodovedenii*. Retrieved from www.arxiv.uz/Downloads/kategorii-modalnosti-v-lingvistike-i-perevodovedenii.pdf
11. Gak, V. G. (1986). *Teoreticheskaja grammatika francuzskogo jazyka*. Moscow.
12. (n.d.). *V.V. Vinogradov v rabote «O kategorii modal`nosti i modal`nyh slovah v russkom jazyke»*. Retrieved from http://www.twirpx.com
13. Alisova, T.B. (1971). *Dopolnitel`nke otnoshenija modusa i diktuma*. VJa.
14. Jepshtejn, M. (2001). *Filosofija vozmozhnogo. Modal`nosti v myshlenii i kul`ture*. SPb: Aletejja.
15. Lopareva, D.K. (2005). *Avtorskaja modal`nost`: soderzhanie i ob#em ponjatija* (problemyfrazeologi-cheskogo znaka), Voprosy filologii.

16. Bojmirzaeva, S. (2010). *Matn modalligi.* Tashkent: Fan.
17. Abdurazakov, M.A. (1985). *Semanticheskaja struktura vyskazyvanija (Semanticheskie tipy sub#ektov i predikatov)*: Avtoref. dis. …dokt. filolog. nauk. Moscow.
18. Vinogradov, V.V. (1975). *O kategorii modal`nosti i modal`nyh slovah v russkom jazyke.Issledovanija po russkoj grammatike: izbr. trudy.* Moscow: Nauka.

Impact Factor:					
	ISRA (India) = 6.317	SIS (USA) = 0.912	ICV (Poland) = 6.630
	ISI (Dubai, UAE) = 1.582	РИНЦ (Russia) = 3.939	PIF (India) = 1.940
	GIF (Australia) = 0.564	ESJI (KZ) = 8.771	IBI (India) = 4.260
	JIF = 1.500	SJIF (Morocco) = 7.184	OAJI (USA) = 0.350

SOI: 1.1/TAS DOI: 10.15863/TAS

International Scientific Journal

Theoretical & Applied Science

p-ISSN: 2308-4944 (print) **e-ISSN:** 2409-0085 (online)

Year: 2022 **Issue:** 12 **Volume:** 116

Published: 22.12.2022 **http://T-Science.org**

Issue Article

Yernar Shalkharov
South Kazakhstan University after M.O.Auezov
Laboratory of Genomic Foresting in Seikhan Scientific LTD

Said Nalibaev
South Kazakhstan University after M.O.Auezov
Laboratory of Genomic Foresting in Seikhan Scientific LTD

THE USE OF EXTRA RAYS OF ULTRAVIOLET EXCILAMPS IN SYMBIOSIS BY ENRICHING THE SOIL WITH HUMIC FERTILIZERS TO SOLVE PROBLEMS WITH INFERTILE SOIL IN ORDER TO ACCELERATE THE FORTIFICATION OF FORESTS FROM SEEDLINGS TO LARGE INDIVIDUALS OF CONIFEROUS AND DECIDUOUS TREES: ALFA PROTOCOL

Abstract: *Forests in our country have always belonged to the state. With the advent of the market, the situation has not changed, however, private companies began to engage in the use of forest resources (as a rule, uncontrollably). This led to the fact that the forest was only cut down, and its restoration was almost forgotten. It was only in 2007 that the new Forest Code came into force, which regulates many issues related to the country's transition to a market economy. Separate articles of the document relate to the reproduction, restoration and cultivation of forests, measures are provided to ensure this. However, to grow new arrays of green spaces on the site of the cut-down areas, even under the condition of strict compliance with the provisions of the code, is a laborious task, stretched for many years. The developments of scientists of the Pushchino branch of the Institute of Bioorganic Chemistry of the Russian Academy of Sciences named after M.M.Shemyakin and Yu.A.Ovchinnikov will help solve it well and quickly, if, of course, their achievements are used in time and competently.*

Key words: *forest, ecosustem, gumin, exilamp, green technologies, HPV/HIV co-infection, Public health concern, meta-synthesis, Mapping analysis, Africa, Research advancement.*

Language: *English*

Citation: Shalkharov, Y., & Nalibaev, S. (2022). The use of extra rays of ultraviolet excilamps in symbiosis by enriching the soil with humic fertilizers to solve problems with infertile soil in order to accelerate the fortification of forests from seedlings to large individuals of coniferous and deciduous trees: alfa protocol. *ISJ Theoretical & Applied Science, 12 (116),* 705-713.

Soi: http://s-o-i.org/1.1/TAS-12-116-59 ***Doi***: crossref https://dx.doi.org/10.15863/TAS.2022.12.116.59

Scopus ASCC: *1100.*

Introduction

The scientific direction, which is being developed by the staff of the forest technologies group of the Institute, allows you to create high-quality planting material, not only ordinary trees, shrubs, but also plants with certain, sometimes unusual, properties. The head of the group, Candidate of Biological Sciences Konstantin SHESTIBRATOV, answers the questions of the correspondent of "Search".

– Konstantin Alexandrovich, in the opinion of many, the use of wood is mainly associated with the production of paper. The question may arise: is it so necessary in the era of the Internet and the rapid development of digital technologies? This means that the need for wood will not be so great.

– It's too early to draw such conclusions. Recently, the volume of wood use has only been increasing. And the paper produced from cellulose is still needed, even in larger volumes than before. Wood

raw materials are also used for the manufacture of plastic, filters, composite and nanomaterials. New areas of its application are emerging. In particular, bioenergy is gaining momentum, it uses liquid and gaseous fuels, including motor fuels, which are obtained from plant matter.

Picture 1.

Therefore, forests are being cut down at a high rate, and there is almost no reproduction. In the old Soviet system, when there was a planned economy, the restoration of green areas, harvesting and processing of wood were in the hands of the state. Then the situation got complicated. Companies that are not directly interested in its restoration began to cut down the forest. The surviving forestry enterprises continue to produce planting material, but its selling price is a penny. For example, a pine seedling costs only two rubles, which is several times lower than the cost price. This situation is explained by the fact that the old regulations are still in force in the industry.

It is clear that the rules of the game need to be radically changed. This is what the new Forest Code is designed to do. However, it will take a long time, perhaps more than a dozen years, until it will work in full force.

– Apparently, the experience of other countries was also taken into account when preparing the code. How are things there?

– Wood is in demand everywhere, and serious attention is paid to the restoration of forests abroad. If we take the Scandinavian countries that are similar to Russia in terms of climatic conditions, for example Finland, then there the profit from forestry is about 20% of the gross income of the whole country. Many houses are heated by wood using modern technologies. In highly efficient installations (these are not Russian furnaces, in which 50% of the heat goes to the sky), wood chips and pellets are used – pellets from pressed sawdust, branches, leaves – everything that goes to waste during harvesting and processing of forest materials. They burn well, emit a lot of energy.

– How long does it take to restore the cut down forest?

– A lot depends on how to approach it. You can wait 200 years until the plantings accumulate the necessary mass of wood. And you can achieve this in 30 years. To achieve a quick result, we need good agricultural equipment, a breeding base, a competent system of planting and subsequent care for them. Each country has its own peculiarities. The practice cannot be transferred to Russia, for example, from Brazil, where the maximum forest growth is. Even the experience of Finland cannot be used directly, adaptation to our conditions is required. We cannot do without our own scientific base. The Academy of Sciences, in particular our institute, is able to provide great help. We have a methodological base, starting from which it is possible to develop new directions.

– Tell us about your group, about the research you are conducting.

Picture 2.

– Our group is young, organized in 2006. We started with three people: there were two other students besides me. Today there are 23 people in the team. Areas of activity – transgenosis and microcloning of plants. On the basis of the group, an innovative enterprise “Microclone” was created in 2009, from which we practically have no income, but it allows us to work out new technologies. The range of research is constantly expanding. Not so long ago, an open area appeared on the territory of our institute, where we test transgenic plants. Unfortunately, we are still engaged in such plants exclusively for science, since it is still forbidden to grow them in Russia, although it is possible to consume them. Of the transgenic ones, we grow only two breeds: aspen and birch. We are working on the quality and volume of wood, as well as resistance to herbicides.

We have achieved the most significant results in such an area as clonal micropropagation. It implies the cultivation of plant material on artificial media. We reconstruct different growth conditions, taking into account physiological and biochemical aspects, which allows us to get a full-fledged organism from cells. To do this, a meristem is used – an actively growing tissue that is contained in the kidneys, sinuses of plants, at the tips of the roots. The meristem can be called the progenitor of all tissues. By cultivating it, we manage to preserve all the original properties. Although it is not an easy task to make cells, tissue multiply, grow without loss of morphogenic potential, that is, the ability to get a mature plant. Simply making the cell grow without preserving its properties and type is not a problem, it can be done with high doses of growth regulators. But it will be an amorphous, “callus" tissue. It is necessary to experimentally select the procedure of actions, evaluate the biochemical composition of tissues and, based on these data, calculate the necessary conditions for the development of plants. First, there is a long-term work on the selection of a nutrient medium. There is a classic composition used for tobacco. But we work mainly with wood species. These are much more complex, unpredictable objects. In addition, since the development of the plant goes in phases, it is necessary to alternate environments. First, a kidney is laid, from which a shoot is formed. Then stems with leaves are grown. After cutting the cuttings, we proceed to the final stage – the formation of the root. Phytohormones cytokinins and a large amount of sugars, mineral components are needed for kidney laying. Rooting requires auxin growth regulators and a carbohydrate-poor nutrient medium. And for the intermediate stage (stem elongation), phytohormones are usually not needed.

Our goal is to have meristemic tissue, to obtain clone progeny, for example, several thousand plants,

which in the future, while maintaining their properties, will be able to adapt and grow in natural conditions.

– So, you "breed" plants on a completely different principle, not the way they reproduce in nature, when both stems and roots grow from the seed at the same time.

– In natural conditions, the growth process, of course, occurs differently. The plant develops according to a pre-programmed program. The influx of nutrients for the development of stems is provided by the root system. We have everything we need in the environment. Photosynthesis also does not occur under artificial conditions, or, as we say, in vitro. Chlorophyll, which makes plants green, is synthesized, but does not perform its function. The source of energy and carbohydrates is sucrose. And the root system does not fully perform its nutritional functions. It is necessary in order for the plant to take root easier in natural conditions. Then, based on these primary roots, the real ones will grow.

Picture 3.

– How much time passes from the start of work to the stage when the plant can be planted in the soil?

– It depends on the culture. Trees can take three years. The most difficult part of our work is getting a clean culture. In natural conditions, bacteria, viruses, fungi live on trees, a large bouquet of microflora, which is dangerous in artificial conditions. In a sucrose-rich environment, microbes multiply rapidly, killing plants. Therefore, we need to get sterile tissue. To do this, we take a meristem from the kidney that does not contain pathogens. We sterilize the surface with chlorine-containing and other substances, with the help of sterile instruments in especially clean conditions we transfer it to a nutrient medium.

– How do you choose "donors" to receive meristemic tissue?

The relevance of the topic. Currently, along with traditional methods of reproduction of valuable forms and varieties of forest woody plants, the method of culture of isolated organs and tissues (clonal micro-propagation of plants) is used. This problem is even more urgent in the years of accelerated reforestation of mountain forests with deciduous tree species. The advantages of this method include: the speed of production, the exclusion of viral diseases, the need for a small number of initial explants and limited space, the possibility of year-round production of planting material, its long-term preservation with minimal volumes of cold storage, the production of a large amount of planting material per year.

The need for mass reproduction of genetically improved forms of woody plants with the help of tissue culture to improve the qualitative composition of forest plantations by obtaining clone plants resistant to diseases and pests, stress and man-made factors can accelerate the reproduction of forest resources, will allow obtaining genetically improved material much earlier than under normal conditions.

In recent years, plantation crops of birch, alder, poplar with a short rotation period for the production of small-scale wood for pressing purposes, the production of construction parts and pulp have become particularly important.

The relevance of the research topic is currently increasing, due to the need to use selectively improved forms of birch, alder and poplar for plantation afforestation.

The dissertation was completed in accordance with grant No. 14213 Participant of the youth research competition, topic No. 16 "Development of biotechnology in vitro for growing planting material and creating plantation crops of fast-growing tree species in the conditions of the Central Forest", as well as in accordance with the direction of fundamental research works of the Voronezh State Forestry Academy - included in the project'5.4108.2011 "Forestry and ecological foundations of accelerated reforestation of mountain forests" of the Ministry of Education and cience of the Russian Federation.

The aim of the work was to study and analyze the growth and stability of crops of fast-growing tree species using microclonal reproduction. Development of recommendations for the creation of plantation crops of birch, alder and poplar; the use of in vitro biotechnology for the creation of clone seed plantations.

To achieve this goal , it is necessary to solve the following tasks:

1. Select valuable biotypes in stands and crops for cloning.

2. To identify the condition and productivity of plantation crops of birch, alder and gray poplar, created by traditional technologies and regenerants in vitro.

3. To study the qualitative characteristics of the wood libriform of regenerants, seedlings and cuttings of seedlings of the studied species.

4. To give a comparative economic assessment of plantation forest crops created from in vitro regenerants and seedlings.

To study the use of biotechnology in vitro in the creation of clonal forest-seed plantations of alder, birch.

6. Develop recommendations for the creation of plantation crops of birch, alder and poplar using in vitro biotechnology.

The following provisions are submitted for protection:

1. Characteristics of valuable biotypes of birch, alder and poplar for obtaining planting material in vitro;

2. Condition, productivity and growth dynamics of birch, alder and poplar crops created by in vitro regenerants and seedlings;

3. Comparative characteristics of wood fiber indicators of regenerants, seedlings and cuttings;

4. The use of in vitro biotechnology in the creation of clonal alder seed plantations;

5. Economic and economic assessment of forest crops created by in vitro regenerants and seedlings.

Scientific novelty of research:

For the first time, a comprehensive study of quantitative and qualitative indicators of plantation forest crops of birch, alder and poplar in the forest-steppe of the CDR, created by in vitro regenerants, seedlings and cuttings, was carried out. A method for creating clonal forest-seed plantations using in vitro biotechnology on the example of black alder, gray and Karelian birch is proposed.

The practical significance and implementation of the results of the work consists in the development of recommendations for the use of in vitro biotechnology in plantation breeding of fast-growing tree species. Experimental cultures with in vitro regenerants were laid on the fires of the Educational and Experimental Forestry.

Approbation of the work. Research materials were presented:

- at the congress of VOGiS (Moscow, 2009);

at international meetings, conferences, symposiums (Krasnoyarsk, 2005, 2011; Voronezh, 2006, 2010, 2012; Alushta (Kiev), 2008; Petrozavodsk, 2011);

- at republican and regional conferences (Voronezh, 2005, 2007, 2010, 2011; Novocherkassk, 2010).

Personal contribution of the author. The work is the result of research conducted by the author himself with the direct participation as the responsible executor of the grant of U.M.N.I.K. and the executor of the topic of fundamental research on the reforestation of mountain forests. The dissertation uses experimental data obtained by the author at all stages of the work: the choice of direction, the development of a program and methods for conducting the entire complex of field and laboratory research, processing and analysis of the data obtained, preparation of publications.

Publications. Based on the materials of the dissertation, the author published (personally and co-authored) 17 papers with a total volume of 3.5 sq., including one article in the journal recommended by the Higher Attestation Commission

The structure and scope of the dissertation. The dissertation work consists of an introduction, 7 chapters, conclusions and recommendations and is presented on 164 pages, including 27 tables, 32 figures, appendices, a list of references of 229 titles, including 34 in foreign languages.

1. The state of knowledge of the problem

The development of plantation forestry in the Central Chernozem region of Russia using traditional technologies and biotechnologies is one of the urgent problems of the region's economy, especially with the solution of the problem of accelerated reforestation of mountain forests. The works of scientists of foresters are devoted to this problem: A.I. Pisarenko, I.M. Shutov, V.K. Popov, I.V. Sukhov, A.P. Tsarev, N.S. Rusin, A.I. Chernodubov, V.P. Besschetnova, S.S. Veretennikov, A.P. Dotsenko, V.A. Morozov, N.V. Kupriyanov, A.R. Rodina, V.A. Chevidaeva, S.A. Rodina, S.D. Smirnova, G.I. Redko, Yu.P. Efimova, E.V. Titova, A.I. Sivolapova, A.B. Zhigunova, E.M. Romanova, E.A. Kalashnikova, D.A. Shabunina, S.S. Bagaeva, A.P. Maksimenko, I.A. Markova, etc.

The use of microclonal reproduction in the forest-cultural practice of the Central Park began to be introduced from the beginning of the 90s of the XX century (G.P. Butova, T.M. Tabatskaya, O.S. Mashkina, Yu.N. Isakov, A.I. Sivolapov, T.A. Blagodarova and later V.A. Sivolapov, etc.).

2. Natural and climatic conditions and forest fund of the research area

The Voronezh Region is located in the central strip of the European part of Russia. This is the largest area of the Central Chernozem region. Its territory is 52.4 thousand km2.

The climate in the region is temperate continental with an average annual temperature from +5 ° C in the north of the region to +6.5 ° C in the south. Its main features are: a large annual temperature range, a relatively mild winter with partial thaws and

snowfalls, a sunny long summer, moderate and not quite stable humidification with a predominance of summer precipitation. Long dry periods are characteristic, contributing to the formation of outbreaks of mass reproduction of various harmful insects. The continentality of the climate increases from the northwest to the southeast. At the same time, the sum of positive temperatures increases from 2700 in the north to 3200 in the south. In most of the region, the average annual precipitation is 450-550 mm, but over the years this figure can vary from 200 to 900 mm. The average annual maximum temperature is +34.5, and the minimum is 27...-31° C. In summer, dry winds are frequent, coming to us from Central Asia. On average, droughts occur twice every ten years. Recently, the climate has become more unpredictable and contrasting. More dangerous natural phenomena began to occur (abnormal droughts, frost, severe rains-severe frosts, hurricane winds, heavy heavy rains).

3. Objects and methods of research

The objects of research were experimental plantation crops of birch, alder and poplar, created under the leadership of V.K. Popov, A.I. Sivolalov, A.I. Chernodubov, T.A. Blagodarova from in vitro regenerants, seedlings and cuttings in the Educational and Experimental and Novousmansky forestry enterprises of the Voronezh region.

The methods of research were dendrometric, cytological, anatomical and histological, etc.

4. Obtaining planting material of hanging birch and Karelian, creation of plantation crops

Clonal micropropagation, as one of the ways of biotechnology, allows you to obtain a large amount of genetically homogeneous planting material in a short time, significantly speeding up the breeding process, reducing the time for obtaining marketable products of new varieties to 2-3 years instead of 10-12. For microclonal reproduction, the following forms were used: the small-diamond-fractured form of the hanging birch of Voronezh origin; the longitudinally fractured form of the hanging birch of Kiev origin; the high-stemmed form of the Karelian birch. Crops were created in the Kon-Kolodez forestry by rare planting (3><6 m) on uprooted cutting, in forest-growing conditions C2 - Nw. The soils are gray forest sandy loam.

The survival rate of regenerants and seedlings on the plantation was 93%. Annual regenerates in crops differed from seedlings: regenerates had a rounded crown, while seedlings had a pronounced stem.

By the end of the 6th year, the seedlings and regenerants were aligned and it is difficult to distinguish them. The plants are monitored annually.

Table - 1 Comparative characteristics of the main biometric indicators of 14-year-old birch crops created by seedlings and regenerants in vitro _ Origin Averages

landing height, m diameter, cm height to width crown material, m crown, m

Birch Regenerants 12,7±0,33 11,3±0,31 3,1±0,10 4,1±0,14

hung up

Birch seedlings 11,1±0,45 9,3±0,40 5,9±0,24 3,5±0,14

hung up

From the data obtained, it can be seen that in vitro birch regenerates exceed seedlings by biometric indicators: diameter - 21.5% ^(4.0)>t0j05(1.96) differences are significant), height - 14.4% (1f(2.6)>1005(1.96) differences are significant), length of the green part of the crown - 84.6%, crown width -17.1% (t,£(3.0)>to,o5(l,96) differences are significant).

Table - 2 Comparative characteristics of productivity and condition of 14-year-old birch crops created by traditional methods and methods of biotechnology

Name of planting material Stock, m3/ha Weighted average condition category Technical category, %

Business Wood Woodwood

Hanging birch seedlings 85.6 1.2 (healthy) 79.8 20.2

Hanging birch regenerants 192,6 1,1 (healthy) 75,6 24,4

Karelian birch regenerants 32.8 1.0 (healthy) 100.0 -

The weighted average category of the state of the stand varies from 1.0 to 1.2 (healthy), which indicates the high viability of experimental plantation crops.

To identify the role of the origin of planting material on the growth rate of experimental crops created by seedlings and regenegants in vitro, the results of the 2011 inventory were processed by a one-factor dispersion analysis (Table 3).

Table 3 — Summary table of one-factor variance analysis of growth

Sources of variation of the Degree of Freedom Sum of Squared Deviations Mean Square (a2) RF Fst

P=0.05 P=0.01

Intergroup 1 82.36 82.36 9.66 3.9 6.9

Vnugrigroup 112 955,6 8,53

Total 113 1038.0 -

The dispersion analysis of the influence of the factor of origin of planting material on the intensity of growth in diameter showed the reliability of the results. The null hypothesis is rejected with probability (P=0.99) regarding the influence of the origin of the planting material on the growth in diameter of regenerants and seedlings. At 15 years of age, the average diameter at a height of 1.3 m in regenerants is larger than in seedlings by 1.7 cm. Since /-f > Fst there is no doubt about the reliability of the indicators found. The influence of the studied factor is not high d) 2 = 8%. In the conditions of sandy loam forest soils of the Kon-Kolodez forestry in 15 years, the average diameter of birch trees in seedlings is 10.0

± 0.29 cm, in regenerants - 11.7 ± 0.32, which confirms the prospects of using regenerants in forestry practice. There is also an excess in height (Table 4).

The dispersion analysis of the influence of the factor of origin of planting material on the intensity of growth in height showed the reliability of the results. The null hypothesis is rejected with probability (P= 0.95) regarding the influence of the origin of the planting material on the height growth of regenerants and seedlings.

Table 4 - Final table of odagafactor dispersion analysis of the growth of birch crops in height created by seedlings and regenegants in vitro_

Sources of variation of the Degree of Freedom Sum of squared deviations Mean Square (c2) RF F*

P=0.05 P=0.01

Intergroup 1 2.1 26.1 6.07 4.2 7.6

Intragroup 28 121 4.3

Total 29,147 5,06

References:

1. Aeshina, E.H., & Velichko, H.A. (2008). Regeneration of Juniperus sibirica V. In vitro Text. V.N. Sukachev Institute of Forest SB RAS, Krasnoyarsk, Russia. *"Conifers of the boreal zone"*, No. 3 4, pp.333 - 336.
2. Ananyeva, L.I., Nikulin, S.S., Garshina, S.I. (2000). Sorption purification of industrial waters of meat processing enterprises Text. Izd. vuzov. *Food Technology*, No. 4, pp. 113-115.
3. (1983). *A.c. № 1021346. Tillage device* (Deryuzhkin, R.I., Nartov, P.S., Posmetyev V.I., Sukhov I.V., Semenov V.I.). Author's svid., Byul. No. 21, 1983.
4. (1990). *A.C. No. 1581238 Method of combating root-springing aspen in cuttings* (Deryuzhkin, R.I., Sukhov I.V.). Byul. No. 28, 1990. 4 p.
5. (1990). *A. S. No. 1597386 USSR, MKI, 12. Method of microclonal reproduction of Karelian birch* / Butova T.P., Tabatskaya T.M., Skrobova L.L. Byul. No. 37, publ. 7.10.1990.
6. (2001). *A.C. No.34777 Voronezh alder* / T.A. Blagodarova. Registered in the State Register of Breeding Achievements approved for use from 5.06.2001.
7. (2007). *A.C. for selection achievement No. 44340 Priyarsky Poplar* / A.I. Sivolapov, Voronezh State Forestry Academy. According to application No. 9464178,2007.
8. Akhmadullin, I.S. (2011). Examination of birch trees of the Republic of Tatarstan for the purpose of selection of clones for microclonal reproduction by in virto method Text. *Vestn. Kazan State University*, No. 4. pp.112 -114.
9. Bagaev, S.N. (1987). Reproduction of Karelian birch Text. *Lesn. x-vo.*, No. 9, pp. 40 - 41.
10. Bakulin, V.T. (1966). Triploid clone of aspen in the forests of the Novosibirsk region. *Genetics*, No. 11, pp. 58-68.
11. Bakulin, V.T. (2010). *Fragrant poplar in Siberia Text.* (p.110). Novosibirsk: Academic publishing house "Geo".
12. Bander, B.JI. (1959). Karelian birch in the Karelian ASSR Text. *Tr. Latv. agricultural farm. akad.*, Issue VIII, pp. 353 - 365.
13. Barsukova, T.L. (1989). Anatomical structure of shoots of Karelian birch Text. *Izv. vuzov. Lesn. zhurn.*, No. 5, pp. 14-17.
14. Bellegarde, A.L. (1971). *Steppe afforestation Text.* (p.336). Moscow: "Lesn. prom-st".
15. Blagodarova, T.A. (1995). *Selection of black alder (Alnus glutinosa (L) Gaertn.) for breeding in the Central Chernozem region:* Abstract of the dissertation of the Candidate of Agricultural Sciences. (p.19). Voronezh.
16. Blagodarova, T.A., & Popov, V.K. (1994). *Selection in natural populations and the creation of black alder cultures in the Central Forest Text.* Selection and its use in improving forest species: Collection of scientific tr. (pp.97-104). Voronezh: NIILGiS, Kvadrat.
17. Blagodarova, T.A., Nikulin, S.S., & Sivolapov, V.A. (2005). *The value of quaternary ammonium salt for rooting green cuttings of gray alder Tex*t. Fruit-growing, seed-growing, introduction of woody plants. Materials of the VIII International Scientific Conference. Krasnoyarsk: SibSTU, (4th edition).
18. Blagodarova, T.A., & Sivolapov, V.A. (2010). *Selection of alder in TSCHO Text.* Achievements and problems in forest genetics and breeding (to the 40th anniversary of NIILGiS): collection of scientific tr. (pp.199-210). Voronezh: NIILGiS.
19. Bogdanov, P.L. (1960). *Selection and hybridization of poplars. Distant hybridization of plants and animals.* (pp. 209-220). Moscow.
20. Borodin, A.M. (1983). *Program forests.* Text. (p.239). Moscow: Lesn. prom-st.
21. Butova, G.P. Tabatskaya, T.M., & Skrobova, L.L. (1991). *The use of tissue culture methods for reproduction and genetic improvement of forest woody plants Text.* Genetics and selection in forestry. (pp.41-49). Moscow.

22. Bukvareva, E.H., & Aleshchenko, G.M. (2005). *Optimal diversity in natural populations and communities.* Modeling results Text. Proceedings of the Second Congress of the Society of Biotechnologists. Russia. Moscow, October 13-15, 2004 / Edited by R.G. Vasilova. (pp. 13-19). Moscow: "Delta".
23. Bychenkova, E.A. (1967). *Organogenesis in the primary culture of some woody plants and the influence of a number of physiologically active substances on it Text*. Messages on the anatomy and physiology of woody plants. (pp.39-42). L..
24. Verezhnikov, V.N., Nikulin, S.S., Poyarkova, T.N., & Garshin, A.P. (1997). Prospects of isolation of synthetic rubbers from latex by organic coagulants. *Bulletin of the Tambov University*, Vol.2, issue 1, pp. 47-52.
25. Veresin, M.M. (1963). *Forest seed production Text.* (p.158). Moscow: Goslesbumizdat.
26. Veresin, M.M., Mamyrin, M.A., Shemyakin, I.Ya., & Yakubyuk, N.Ya. (1963). *Centenary experience of afforestation in Savalsky forestry Text.* (p.162). Moscow: "Goslesbumizdat".
27. Veresin, M. (1971). *Voronezh Forests Text*. (p.224). Voronezh: "Central Chernozem Book Publishing House".
28. Veresin, M.M., & Tsarev, A.P. (1974). On the results of variety testing of poplars in the Voronezh region Text. Genetics, selection and introduction of forest breeds. *Topics. collection of scientific tr.* Issue 1. Voronezh, pp. 31-42.
29. Veresin, M.M., & Tsarev, A.P. (1974). On the results of variety testing of poplars in the Voronezh region Text. Genetics, breeding and introduction of forest breeds. *Collection of scientific tr.* Voronezh: VNIILM, pp. 31-42.
30. Veresin, M.M., Efimov, Yu.P., & Arefyev, Yu.F. (1985). *Handbook of forest breeding seed production Text*. (p.245). Moscow: Agropromizdat.
31. Veretennikov, S.S., & Kupriyanov, N. V. (1987). Plantation cultivation of spruce Text. *Lesn. x-vo.* No. 2, pp.69-70.
32. Vodin, A.B. (2007). *Phenological forms of Siberian cedar according to the timing of the start of pollen departure Electronic resource.* GO VPO "Siberian State Technological University". Electronic Library Retrieved from http://scholar.google.com/
33. Voronin, I.V., Senkevich, A.A., & Bugaev, V.A. (1975). *Economic efficiency in forestry and agroforestry production* Text. (p.176). Moscow: "Forest industry".
34. Gavrilova, I.A. (1971). *Comparative assessment of anatomical features of wood of some species and hybrids of poplars.* Text.: Abstract. dis. cand. biol. nauk: (p.23). L..
35. Groshev, I.V. (1995). Application of polyalisbrolites based on N.N-dietil-N.N-*dillylamonyl chloride in the production of fiberboard for wastewater treatment.* Abstract of the diss. for the application of the uch. step. Candidate of Technical Sciences. (p.21). MINSK.
36. Globa-Mikhaylenko, D.A., & Commercial, E. N. (1995). Industrial breeding of oak changeable Text. *Lesn. x-vo.*, No. 4, p. 33.
37. Gorobets, A.I., & Loginova, L.A. (2004). Productivity and technical characteristics of the vine on the willow plantation of the Semiluksky nursery. *Nature management: resources, technical support: Inter-university collection of scientific works.* Issue 2, Edited by prof. F.V. Posharnikov. (pp.18-22). Voronezh: VGLTA.
38. Davydov, M.V. (1960). *Black alder of the European part of the USSR.* Text. Publishing house of the Ukrainian Academy of Agricultural Sciences, (p.113). Kiev.
39. Davidov, M.V. (1976). Features of the growth of black walnut plantations Text. *Forestry*, No. 8, pp. 43-45.
40. Danchenko, A.M. (1992). *Biology of fruiting and fundamentals of birch seed production* Text. (p.126). Krasnoyarsk.
41. Dotsenko, A.P. (1986). Reforestation on an industrial basis Text. *Lesn. x-vo*, No. 1, pp. 37-39.
42. Dreiman, E. (1978). Results of vaccinations of Karelian birch Text. *Scientific tr. LSHA*. Riga, Issue 164, pp. 31-35.
43. Zhukov, A.B. (1958). The basic principles of creating pure and mixed cultures Text. *Forest. household*,- No. 2, p.118.
44. (1986). *Laying and cultivation of timber plantations of spruce and pine* Text.: method, recommendations of LenNIILH, BelNIILH, UkrNIILH; comp. I.V. Shutov, (p.105). L..
45. Evdokimov, A.P. (1989). Biology and culture of Karelian birch Text. (p.226). L.: LSU.
46. Egorova, T.A., Klunova, S.M., & Zhivukhina, E.A. (2008). Fundamentals of biotechnology: textbook Text. (p.208). Moscow: Publishing center "Academy".
47. Ermakov, B.S. (1975). *Growing seedlings by cuttings.* Text. (p.152). Moscow: "Lesn. prom-st".
48. Ermakov, V.I. (1986). *Mechanisms of birch adaptation to the conditions of the North Text.* (p.144). L.: Nauka.
49. Efimov, Yu.P. (1997). *Genetic and breeding assessment of objects of permanent forest seed base* Text. Genetics and breeding in the service of the forest: mater. International Scientific and Production Conference. (pp.298-307). Voronezh: NIILGiS.
50. Efimov, Yu.P., & Hirov, A.A. (1983). Seed production and selection of tree species in the

Hungarian People's Republic Text. *Forestry*, No. 3, pp. 76-77.

51. Efimov, Yu.P. (2010). *Seed plantations in breeding and seed production of scots pine* Text. (p.253). Voronezh: publishing house "Istoki".
52. Ivannikov, S.P. (1971). *Breeding and use of poplars in the USSR and abroad (review)* Text. (p.105). Moscow: CBNTI.
53. Ivannikov, S.P. (1980). *Topol*. (p.85). Moscow: Forest industry.
54. Ivannikov, S.P., & Rostovtsev, S.A. (1965). Cellulose content and wood fiber sizes in different varieties of poplars. *Lesn. x-vo.*, No. 5, pp. 37 - 42.
55. Isakov, I.Yu. (2001). *The influence of the pollination method on the breeding features of the seed progeny of Betula pendula Roth, and V. Pubescens Ehrh*. Abstract of the Candidate of Agricultural Sciences. (p.19). Voronezh.
56. Kavtaradze, D.N. (2005). *Biotechnology and socially acceptable risks of managing highly complex systems* Text. Proceedings of the Second Congress of the Society of Biotechnologists of Russia. (pp.41-44). Moscow, October 13-15, 2004 / Edited by R.G. Vasilova. Moscow: "Delta".
57. Kazantseva, E.V. (1997). *Population-genetic analysis of Karelian birch and vegetative reproduction of its valuable forms* Text. Autoref. Dis. Candidate of Agricultural Sciences. (p.24). Moscow.

Impact Factor:					
	ISRA (India) = 6.317	SIS (USA) = 0.912	ICV (Poland) = 6.630
	ISI (Dubai, UAE) = 1.582	РИНЦ (Russia) = 3.939	PIF (India) = 1.940
	GIF (Australia) = 0.564	ESJI (KZ) = 8.771	IBI (India) = 4.260
	JIF = 1.500	SJIF (Morocco) = 7.184	OAJI (USA) = 0.350

SOI: 1.1/TAS DOI: 10.15863/TAS

International Scientific Journal

Theoretical & Applied Science

p-ISSN: 2308-4944 (print) **e-ISSN:** 2409-0085 (online)

Year: 2022 **Issue:** 12 **Volume:** 116

Published: 22.12.2022 **http://T-Science.org**

Issue Article

Yernar Shalkharov
South Kazakhstan University after M.O.Auezov
Laboratory of Genomic Foresting in Seikhan Scientific LTD

Said Nalibaev
South Kazakhstan University after M.O.Auezov
Laboratory of Genomic Foresting in Seikhan Scientific LTD

THE USE OF EXTRA RAYS OF ULTRAVIOLET EXCILAMPS IN SYMBIOSIS BY ENRICHING THE SOIL WITH HUMIC FERTILIZERS TO SOLVE PROBLEMS WITH INFERTILE SOIL IN ORDER TO ACCELERATE THE FORTIFICATION OF FORESTS FROM SEEDLINGS TO LARGE INDIVIDUALS OF CONIFEROUS AND DECIDUOUS TREES: BETA PROTOCOL

Abstract: *The relevance of the topic. Currently, along with traditional methods of reproduction of valuable forms and varieties of forest woody plants, the method of culture of isolated organs and tissues (clonal micro-propagation of plants) is used. This problem is even more urgent in the years of accelerated reforestation of mountain forests with deciduous tree species. The advantages of this method include: the speed of production, the exclusion of viral diseases, the need for a small number of initial explants and limited space, the possibility of year-round production of planting material, its long-term preservation with minimal volumes of cold storage, the production of a large amount of planting material per year. The need for mass reproduction of genetically improved forms of woody plants with the help of tissue culture to improve the qualitative composition of forest plantations by obtaining clone plants resistant to diseases and pests, stress and man-made factors can accelerate the reproduction of forest resources, will allow obtaining genetically improved material much earlier than under normal conditions.*

Key words: *forest, ecosustem, gumin, exilamp, green technologies, HPV/HIV co-infection, Public health concern, meta-synthesis, Mapping analysis, Africa, Research advancement.*

Language: *English*

Citation: Shalkharov, Y., & Nalibaev, S. (2022). The use of extra rays of ultraviolet excilamps in symbiosis by enriching the soil with humic fertilizers to solve problems with infertile soil in order to accelerate the fortification of forests from seedlings to large individuals of coniferous and deciduous trees: beta protocol. *ISJ Theoretical & Applied Science, 12 (116),* 714-722.

Soi: http://s-o-i.org/1.1/TAS-12-116-60 ***Doi***: crossref https://dx.doi.org/10.15863/TAS.2022.12.116.60

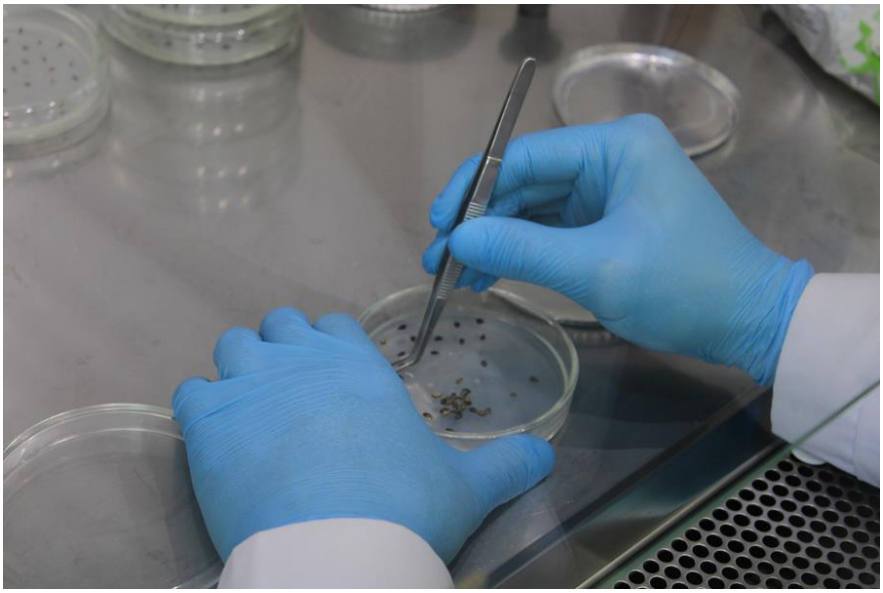
Scopus ASCC: *1100.*

Introduction

The first works on the organogenesis of Pinus sylvestris and Picea abies in Russia were carried out on the basis of the use of hypocotyl explants or seeds at the Russian State Agricultural University (Timiryazev Moscow Agricultural Academy) and the Institute of Bioorganic Chemistry of the Russian Academy of Sciences [13, 14, 24].

Currently, during the joint work of the Institute of Bioorganic Chemistry and SPbNIILH, organogenesis based on the use of the buds of plus trees has been performed, recommendations have been developed for the adaptation of the obtained microregenerants in peat substrate under conditions of film greenhouses [31, 34]. The planting material grown in this way includes several experimental plots of forest crops and their growth is monitored, control is provided by crop variants using two-year-old seedlings from the seedling department of the nursery,

having approximately the same biometric parameters with micro-gear seedlings at the time of planting.



Picture 1.

In the forest zone of Russia, simplified technologies widely used in practice for laying and growing forest crops, as a rule, do not give them growth advantages compared to young plants of natural origin and do not even stop the process of replacing spruce and pine with aspen and birch. In contrast to such plantings, spruce and pine crops planted using intensive agrotechnical techniques grow according to II - 1b bonus classes, i.e. on average 1-3 times higher in productivity than conventional crops. The accelerated high growth rate of such crops is achieved due to a combination of certain factors and conditions. Among the most significant factors that have a huge potential for improvement is the use of selection-improved planting material. However, the development of methods of clonal micro-propagation of conifers in the practice of forestry in Russia is still taking only the first steps.

Of the traits used in population forest genetics, molecular (including biochemical) markers of genes differ in many useful properties. They do not require many years of inheritance analysis in a series of generations, their manifestation does not depend on the modifying action of the environment. Molecular markers, unlike morphological features in coniferous species, have a monogenic nature of inheritance and therefore are objective genetic markers of the degree of differences between populations and taxa. Chronologically, the first molecular markers were allozymes (isoenzymes) - hereditary forms of enzyme proteins. Despite the rapid development of DNA analysis methods, isoenzymes remain very useful genetic markers, since they can be used to obtain reliable and complete genetic information [22]. To date, the results of genetic studies using the method of isoenzyme analysis have allowed us to solve complex issues of taxonomy of pine species [22], spruce [6, 10, 12, 23], larches [20]. The method of molecular labeling is widely used for genetic certification of clonal forest-seed plantations and archives of softwood clones

Picture 2.

At 15 years of age, the average height of regenerants is greater than that of seedlings by 1.9 m. Since Gf > there is no doubt about the reliability of the indicators found. The strength of the influence of the studied factor is not high y2 = 18%. In the conditions of sandy loam forest soils of the Horse-Well forestry in 15 years, the average height of birch trees in seedlings is 12.7 ± 0.35 m, in regenerants -14.6 ± 0.38.

Hanging birch cultures, grown hanging birch cultures, grown from regenerants in vitro: age 14 years of seedlings; age 14 years

Figure 1 - Hanging birch cultures created by regenerants in vitro and

The selection of individual birch biotypes and clones for fiber length may be important for the creation of special-purpose plantation crops (for the production of cellulose raw materials). Long-fiber forms are considered the most valuable. But in general, wood with a libriform length of 0.8 mm or more is suitable (Poluboyarinov, 1976; Gavrilova, 1971, etc.). The use of birch wood is very diverse: from small home crafts to use in construction and the pulp industry.

The length, wall thickness and diameter of the wood libriform were studied. The results of the study show that regenerants have higher indicators than seedlings (Table 5).

Table 5 - Characteristics of the wood libriform of regenerants and seedlings

Tree origin Libriform length, mm Libriform width, mm libriform wall thickness, mm

Birch regenerant 0.88±0.019 22.3±0.06 4.0±0.02

Birch seedlings 0.79±0.016 21.4±0.05 3.8±0.01

5. Cultivation of planting material and creation of alder crops

Black alder grows on waterlogged soils in D4.s conditions, where no other tree species can grow. With the right technology for creating crops, alder stands give high productivity indicators.

To preserve valuable biotypes of black alder (Alnus glutinosa (L.) Gaertn.) and gray (Alnus incana L.), a method of microclonal reproduction has been developed, which is promising for the creation of clone archives, forest seed plantations and plantation crops.

Plantation cultures of black and gray alder from regenerants and seedlings have been created in the Novousmansky forestry. Comparison of the growth of regenerants in the experiment with a closed and open root system showed significantly better growth in the first case (1f=2.75 > tcr =2.04).

But it is not so easy to exclude GMOs from our diet: even if we find "Non-GMO" on the package , there is not enough confidence that this is really the case. The issue of food safety is not considered for plants, such as trees or cotton, which are a food source. But, the same genetic transformation of cedar pine was carried out (Pinus Sibirica), at the Siberian Institute of Plant Physiology and Biochemistry (based

on a gene isolated from corn) in 1999 And cedar is the breadwinner of birds, animals and humans. Biotechnological experiments were also conducted with birch. And birch buds in any phytoapteca are sold as an environmentally friendly product, a recognized remedy in medicine. The green foliage of trees (birches, aspens, etc.) is harvested for animal feed (brooms for goats), conifers in winter give food to moose, hares gnaw the bark of aspens. In general, there is still cause for concern in terms of the safety of transgenic trees for animals and humans. Currently, in the forestry of Russia, methods of biotechnology they are used for the cultivation of planting material, the production of biological forest protection products, the creation of new forms of woody plants with specified characteristics. The most widely used methods of clonal micro-propagation of plants (variousbirch clones). Intensive work is underway on the culture of hybrid willows, poplars, aspen, birch, etc. The actual task is to develop an effective system of clonal micropropagation for conifers, (including Pinus sibirica – cedar). The technology of the next decade is the transgenesis (genetic modification) of woody plants. Increasing the growth rate of the main forest species, increasing their stability and improving the properties of wood are priority tasks of modern forestry science. Creation of new forms of forest breeds by traditional methods of breeding. Genetic transformation makes it possible to modify the properties of woody plants in a short time. The complex of methods of genetic transformation makes it possible to modify individual plant traits point-by-point: to give stability to herbicides, to increase productivity, etc., i.e. to create forms of target purpose. This direction of forest biotechnology orientiis focused exclusively on the plantation method of forest cultivation. More than 150 field polygons have been registered in the world to study the growth of transgenic forest species. Most of them are carried out on the territory of the USA (103), China (9), Canada (7), Finland (5). In Russia, work on the genetic modification of tree species was started in 1999 . At the Siberian Institute of Plant Physiology and Biochemistry. The work was carried out in order to increase the growth rate of aspen, poplar and cedar pine based on the use of the ugt gene isolated from corn. Currently, the problem of reducing the biological diversity of the plant world, including woody plants, is noticeably revealed. Therefore, scientists consider the methods of genetic transformation, molecular labeling, and clonal micro-reproduction of the most valuable tree forms (birch, pine, aspen, and some others) justified. But, despite the fact that good results have been achieved in various areas of forest biotechnology, their widespread introduction into practice has not yet been observed. This is a matter of the future. So, the benefits of biotechnology in forestry are obvious: they consist in an economic advantage for the industry, in order to obtain "fast" wood during plantation reforestation, increased productivity, lower prices for consumers, easier processing of wood. But biotechnological innovations raise such issues of biosafety and the impact of transgenic plants on the natural ecosystem, especially in the issue of genetic exchange between genetically modified trees and wild populations. And there are no convincing answers to these questions yet, and there cannot be. Biotechnology in forestry is a very young science, only time will help scientists to identify and correctly calculate, not only everythingGray alder, No. 6, seedling 48 52 - -

Analysis of the final stage of microspore formation showed that in regenerants and seedlings of black and gray alder, the process of development of the male generative sphere proceeds without significant deviations and ends with the formation of high-quality, equalized pollen.

The characterization of quantitative indicators in cones showed that the differences in the shape of cones were not significant. The cone shape coefficient averaged 0.50 - 0.64. The length of cones in seedlings averaged from 1.6±0.03 to 1.8±0.06 cm, in regenerants - from 1.4± 0.04 to 1.7±0.04 cm. The differences in the length of the cones are significant at (=0.05. The width of the cones in seedlings and regenerants ranged from 0.8 ± 0.04 to 0.9± 0.02 cm. There are no differences in the width of cones in seedlings and regenerants. Laboratory germination of seeds obtained from regenerants and seedlings does not differ and is 85%.

6 Poplar plantation crops

6.1 Poplar crops in the cuttings of the VGLTA Educational and experimental forestry

Plantation crops of the best varieties of poplars were laid in the spring of 1994 during the development of an innovative project for accelerated cultivation of tree species. Fresh aspen cutting with an area of 3.6 hectares was prepared according to the VGLTA technology, type of forest growing conditions C2. The soil is dark gray sandy loam forest, the type of forest growing conditions is C2 (C3), the number of stumps is 650-750 pcs / ha.

Table 8 — Poplar growth in height and diameter in 14 years

The name of the poplar WED. height, m (Him) Coefficient of variation, % Accuracy of experience, % Cp. diameter, cm (D±t) Coefficient of variation, % Accuracy of experience, %

Brabantika №56 18,6±0,54 18,5 3,0 19,0±0,62 23,5 3,5

ES-38 19,6±0,43 10,7 0,8 19,4±0,58 19,6 2,5

And-45/51 19,6±0,95 16,8 1,5 18,9±0,30 15,8 ZD

I-16 17,6±0,99 19,4 2,7 18,6±0,37 24,4 3,5

Regenerate №90 21,7±0,89 14,1 2,3 18,5±0,85 19,0 2,0

Black hybrid 16,1±0,57 13,8 3,0 15,7±0,36 17,4 3,7

The Euro-American Regenerate poplar is distinguished by the best indicators at the age of 14, the average height is 21.7 ± 0.89 m, a pairwise comparison according to the Student's criterion with other varietals, the differences are significant at ¡ = 0.05; the differences in diameter are not significant. We believe that in 15-20 years, in winter or early spring, it is possible to cut poplars. The remaining stumps will give root offspring and shoots from the stump, which will form a new planting of poplars.

6.2 Creation of poplar crops in areas that have been released from agricultural use

In 1983, an experimental variety testing site of polyploid and diploid poplars was created in the Semiluksky nursery of TSNIILGIS, this is an example of the creation of poplar plantation crops in open areas. The soil is degraded chernozem, its preparation was carried out according to the black steam system, seating 4 x 4 m.; the experience is laid down in three repetitions, a widespread diploid - balsamic poplar is presented as a control. For comparison, other triploid and diploid poplars have been introduced. Test crops from fast-growing breeds allow you to get commercial wood in a short time. Experience shows that the Hopersky poplar variety 1 can give an increase of up to 25-30 m3/ha per year (Table 9).Table 9 - Indicators of growth and productivity of poplar cultivars at the age of 26 at the test site in the Semiluksky nursery__

Poplar name Height, m (H±ha) Diameter, cm (D + t) Stock, m3/ha

Balsamic 18.3+0.40 18.0±0.61 91

Robusta - 236 22,5+0,33 26,5 ±0.83 284

E.S.-38 22.8±0.26 23.8±0.72 227

Balsamic Po No. 1 21.5±0.15 24.8±0.91 232

Balsamic Po No.2 22,5+0,17 23,5 ±0.74 243

Khopersky 1 27.2±0,43 37,3+1,15 715

The table shows that at the age of felling (26 years) the Hopersky poplar 1 exceeds the balsamic poplar (control) in diameter by 19 cm, according to

height at 9 m .

To clarify the role of the genotype on growth in diameter, we performed a one-factor analysis of variance. Mathematical processing of the experimental results confirms the validity of the differences: Flf) > Fs, (3.38 > 3.1) at P = 0.05. The null hypothesis is rejected: the difference in the influence of varietal affiliation on growth in diameter turns out to be statistically significant, the strength of the influence is y2 = 59%. When studying the growth in diameter of clones and varieties of poplar at the test site of the Semiluksky nursery, it can be noted that the Hopersky poplar 1 exceeds the diameter of other samples by 11-19 cm.

A one-factor analysis of the variance of the influence of the poplar genotype on height growth also confirms the validity of the differences: F,p > FSI (3.38 > 3.1) at P = 0.05. Since Fr/l > Fs, , the null hypothesis is rejected: it is highly reliable that individual cultivars with different strengths affect the growth in height of trees: the strength of the influence is y2 = 16%.

6.3 Creation of poplar plantation crops by regenerants in vitro

Another plot of poplar plantation crops Khopersky 1 is located in block 26 of the Kony-Kolodezsky forestry of the Lipetsk region. These are the first in the Central Chernozem region test plantation poplar crops from regenerants in vitro, cuttings and seedlings laid in the spring of 1996 on an area of about 7 hectares. The plot under the crops is flat (uprooted felling of pine affected by root sponge), the soils are gray forest sandy loam, forest growing conditions C2.z. Soil preparation was carried out by furrows with a PKL-70 plow. The crops were created by ordinary planting after 6 m., in a row after 3 m., a shrub of pemphigus was introduced as a sealer. Planting regenerants manually under Kolesov's sword and shovel, cuttings - under Kolesov's sword. Regenerates of Hopersky poplar 1 were obtained in the NIILGiS genetics laboratory, for comparison, cuttings of triploid balsamic poplar obtained by E.M. Gulyaeva in the same laboratory were used. Cuttings of balsamic poplar are harvested from a mother plantation with a length of 25 - 30 cm . The survival rate of regenerants was 100%, cuttings took root by 93%.

The plants are monitored annually (Figure 3). The analysis of the obtained data showed that the first three years of the regenerates showed better growth than cuttings of balsamic poplar seedlings. Since 1999, there has been a faster growth of balsamic poplar, and in 2002 the Hopersky poplar 1 lags behind in growth by 88 cm. In 2004, the average height of the Hopersky poplar 1 was 9.3 m, balsamic poplar - 8.8 m, that is, regenerates exceed cuttings by 0.5 m. By 2012, that is, at the age of 16, the heights of the studied poplars are 21.0± 0.45 -19.4±0.39 m.

The diameter of the trees has a greater influence on the stock of wood. At the age of 16, the average diameter of regenerants of the Hopersky poplar 1 is 21.4± 0.51 cm, balsamic triploid poplar 21.8± 0.47 cm.

— ♦ — balsamic poplar Zp —v— Hepersky poplar 1

Figure 3 - Dynamics of growth in height of regenerants of Hopersky poplar 1 and cuttings of triploid balsamic poplar seedlings

Taking into account the condition (viability) at the age of 16 showed that 96% of the trees of the Hopersky poplar are in good condition and 4% are satisfactory, and all the trees of the balsamic poplar are in good condition.

In the Right-bank forestry on dark gray loam, regenerants of the Hopersky poplar 1b 16 years old reach a height of 18.0 ± 0.58 m. and a diameter of 33.0 ± 0.85 cm.

Sixteen-year observations of experimental crops show that it is quite possible to propagate and create plantation poplar crops with regenerants in vitro. Most of them have normal upright growth and good condition.

7. Economic studies of the effectiveness of growing seedlings and regenerants in vitro of hanging birch

To determine and compare the costs of growing 1 hectare in the open ground of the nursery of seedlings and regenerants in vitro of the hanging birch, we calculate technological maps.

It was found that the total cost of growing regnants in vitro in the open ground of the hanging birch nursery is 31953.8 rubles, seedlings -33548.4 rubles. The cost of growing one plant regenerant in vitro and seedling differ slightly. The advantage of the ways of biotechnology is that in a short time (about 2 years) it is possible to obtain a large amount of genetically homogeneous planting material, significantly speeding up the breeding process. In addition, it is extremely important that at the same time there is a recovery of the planting material. By the method of tissue cultures, it is possible to propagate plants that hardly or do not reproduce vegetatively at all.

For the perspective and relevance of the research topic of the dissertation work, we have conducted research on the commercialization of biotechnology in vitro and profit from sales of regenerants of the hanging birch, and also developed a financial plan for the organization of a small enterprise.

The calculation data showed that net discounted income at a discount rate of 10% for the 3rd year of the project and after income taxes will amount to 1,125 million rubles. subject to the sale of 100 thousand pieces of regenerants. The project requires investments of about 1.9 million rubles. These investments are necessary for production costs (about 1.2 million rubles) and salary payments (0.7 million rubles). For 3 years, with the sale of 50 thousand pieces of regenerants, it is predicted to recoup all costs and make a profit. These calculations are given with an estimated share of planting material sales in the Voronezh region market of about 0.3%.

As a result of the conducted research on the use of microclonal reproduction to create plantation crops of fast-growing tree species in the forest-steppe, the following conclusions and recommendations can be made:

1. The most valuable fast-growing species for plantation afforestation in the forest-steppe are: hanging birch, the best varieties of poplar and black alder. In vitro biotechnology is of fundamental importance for the reproduction of economically valuable forms and varieties of woody plants that are difficult to propagate by seeds and cuttings.

2. Dispersion analysis has established the influence of the origin of planting material (in vitro regenerates, seedlings) of hanging birch on growth in height and diameter. On the gray sandy loam forest soils of the Kon-Kolodez forestry, the stock of 14-year-old plantation birch crops created by in vitro regenerates is 192.6 m3/ha, seedlings - 85.6 m3/ha, but the quality of the trunks of seedlings is better than that of regenerants.

3. The experience of creating plantation crops of Karelian birch from regenerants in vitro has shown the great importance of the latter in obtaining special sorts valuable for furniture production.

4. It has been experimentally established that in black and gray alder cultures, differences in height and diameter of in vitro regenerants and seedlings aged 8 years on dark gray loamy moist soils of the Tavrovka River floodplain of the Novousmansky forestry are not significant. For alder, in vitro biotechnology is important when creating clone archives of economically valuable forms, varieties; clonal forest-seed plantations.

5. It is shown that the fruiting of clonal alder seed plantations created by regenerants in vitro begins earlier - from 3-4 years, than in seedlings - from 5-6 years. The viability of pollen ranges from 95 - 98%. The quantitative composition of the emerging pollen in microclonal plants has 22-23% in black alder and up to 52% in gray alder of large pollen (more than 31 microns.). According to the coefficient of the shape of cones, the differences in seedlings and regenerants in vitro are not significant. Laboratory germination of seeds reaches 80%.

6. Plantation crops of poplar of the subgenus Eupopulus Dode, laid by winter cuttings on aspen felling with lowering of stumps and disking of root offspring showed the possibility of obtaining wood for construction parts and pressing in a short time. At the age of 14, the average height of trees ranged from 16.1 ± 0.57 m in the Black Hybrid to 21.7 ± 0.89 m in Regenerate No. 90, the average diameter ranged from 15.7 ± 0.36 cm. in the Black hybrid up to 19.4 ± 0.58 cm in the poplar E.S. - 38.

7. In the Central forest-steppe, 16 years of experience has been accumulated in the creation of plantation crops of a hard-to-root triploid variety of poplar graying Hopersky 1 with in vitro regenerants on gray forest sandy loam soils of the Kony-Kolodez forestry and on dark gray forest loamy soils of the Right-Bank forestry. At the age of 16, the average height of the poplar trees of Khopersky 1 on sandy loam was 21.0 ± 0.45 m, the average diameter was 21.4 ± 1.36 cm; on loam, respectively, 21.0 ± 0.58 m and 33.0 ± 0.85 cm.

The relevance of the topic. Currently, along with traditional methods for breeding valuable forms and varieties of forest woody plants, the method of culture of isolated organs and tissues (clonal micro-propagation of plants) is used. This problem is even more urgent in the years of accelerated reforestation of mountain forests with deciduous tree species. The

advantages of this method include: speed, exclusion of viral diseases, the need for a small number of initial explants and limited areas, the possibility of year-round production of planting material, its long-term preservation with minimal volumes of refrigerating chambers, the production of a large amount of planting material per year.

The need for mass reproduction of genetically improved forms of woody plants with the help of tissue culture to increase the qualitative composition of forest plantations by obtaining clone plants resistant to diseases and pests, stress and man-made factors can accelerate the reproduction of forest resources, will allow obtaining genetically improved material much earlier than under normal conditions.

In recent years, plantation crops of birch, alder, poplar with a short rotation period for obtaining small-scale wood for pressing purposes, construction parts have become particularly important due to the high efficiency of its use.

The relevance of the research topic is currently increasing, due to the need to use selectively improved forms of birch, alder and poplar for plantation afforestation.

The dissertation was carried out in accordance with grant No. 14213 Participant of the youth scientific and innovative competition, topic No. 16 "Development of biotechnology in vitro for growing planting material and creating plantation crops of fast-growing tree species in the conditions of the Central Forest", as well as in accordance with the direction of research work of the Voronezh State Forestry Academy - included in the project 5.4108.2011 "Forestry-ecological foundations of accelerated reforestation of mountain forests" of the Ministry of Education and Science of the Russian Federation.

The aim of the work was to study and analyze the growth and stability of crops of fast-growing tree species using microclonal reproduction. Development of recommendations for the creation of plantation crops of birch, alder and poplar; the use of in vitro biotechnology for the creation of clone seed plantations.

To achieve this goal , it is necessary to solve the following tasks:

1. Select valuable biotypes in stands and crops for cloning.
2. To identify the condition and productivity of plantation crops of birch, alder and gray poplar, created by seedlings, cuttings and regenerants in vitro.
3. To study the qualitative characteristics of the wood libriform of regenerants, seedlings and cuttings of seedlings of the studied species.
4. To give a comparative economic assessment of forest crops created from in vitro regenerants and seedlings.
5. To consider the application of biotechnology in vitro in the creation of clonal forest-seed plantations of alder and birch.
6. To develop a technology for creating plantation crops of birch, alder and poplar using microclonal reproduction.

The following provisions are submitted for protection:

1. Characteristics of valuable biotypes of birch, alder and poplar for obtaining planting material in vitro;
2. Condition, productivity and growth dynamics of birch, alder and poplar plantation crops created by in vitro regenerants and seedlings;
3. Comparative characteristics of regenerant wood, seedlings and cuttings;
4. The use of in vitro biotechnology in the creation of clonal alder seed plantations;
5. Economic and economic assessment of plantation crops created from in vitro regenerants and seedlings.

References:

1. Aeshina, E.H., & Velichko, H.A. (2008). Regeneration of Juniperus sibirica V. In vitro Text. V.N. Sukachev Institute of Forest SB RAS, Krasnoyarsk, Russia. "Conifers of the boreal zone", No. 3 4, pp.333 - 336.
2. Ananyeva, L.I., Nikulin, S.S., Garshina, S.I. (2000). Sorption purification of industrial waters of meat processing enterprises Text. Izd. vuzov. Food Technology, No. 4, pp. 113-115.
3. (1983). A.c. № 1021346. Tillage device (Deryuzhkin, R.I., Nartov, P.S., Posmetyev V.I., Sukhov I.V., Semenov V.I.). Author's svid., Byul. No. 21, 1983.
4. (1990). A.C. No. 1581238 Method of combating root-springing aspen in cuttings (Deryuzhkin, R.I., Sukhov I.V.). Byul. No. 28, 1990. 4 p.
5. (1990). A. S. No. 1597386 USSR, MKI, 12. Method of microclonal reproduction of Karelian birch / Butova T.P., Tabatskaya T.M., Skrobova L.L. Byul. No. 37, publ. 7.10.1990.
6. (2001). A.C. No.34777 Voronezh alder / T.A. Blagodarova. Registered in the State Register of

Breeding Achievements approved for use from 5.06.2001.
7. (2007). A.C. for selection achievement No. 44340 Priyarsky Poplar / A.I. Sivolapov, Voronezh State Forestry Academy. According to application No. 9464178,2007.
8. Akhmadullin, I.S. (2011). Examination of birch trees of the Republic of Tatarstan for the purpose of selection of clones for microclonal reproduction by in virto method Text. Vestn. Kazan State University, No. 4. pp.112 -114.
9. Bagaev, S.N. (1987). Reproduction of Karelian birch Text. Lesn. x-vo., No. 9, pp. 40 - 41.
10. Bakulin, V.T. (1966). Triploid clone of aspen in the forests of the Novosibirsk region. Genetics, No. 11, pp. 58-68.
11. Bakulin, V.T. (2010). Fragrant poplar in Siberia Text. (p.110). Novosibirsk: Academic publishing house "Geo".
12. Bander, B.JI. (1959). Karelian birch in the Karelian ASSR Text. Tr. Latv. agricultural farm. akad., Issue VIII, pp. 353 - 365.
13. Barsukova, T.L. (1989). Anatomical structure of shoots of Karelian birch Text. Izv. vuzov. Lesn. zhurn., No. 5, pp. 14-17.
14. Bellegarde, A.L. (1971). Steppe afforestation Text. (p.336). Moscow: "Lesn. prom-st".
15. Blagodarova, T.A. (1995). Selection of black alder (Alnus glutinosa (L) Gaertn.) for breeding in the Central Chernozem region: Abstract of the dissertation of the Candidate of Agricultural Sciences. (p.19). Voronezh.
16. Blagodarova, T.A., & Popov, V.K. (1994). Selection in natural populations and the creation of black alder cultures in the Central Forest Text. Selection and its use in improving forest species: Collection of scientific tr. (pp.97-104). Voronezh: NIILGiS, Kvadrat.
17. Blagodarova, T.A., Nikulin, S.S., & Sivolapov, V.A. (2005). The value of quaternary ammonium salt for rooting green cuttings of gray alder Text. Fruit-growing, seed-growing, introduction of woody plants. Materials of the VIII International Scientific Conference. Krasnoyarsk: SibSTU, (4th edition).
18. Blagodarova, T.A., & Sivolapov, V.A. (2010). Selection of alder in TSCHO Text. Achievements and problems in forest genetics and breeding (to the 40th anniversary of NIILGiS): collection of scientific tr. (pp.199-210). Voronezh: NIILGiS.
19. Bogdanov, P.L. (1960). Selection and hybridization of poplars. Distant hybridization of plants and animals. (pp. 209-220). Moscow.
20. Borodin, A.M. (1983). Program forests. Text. (p.239). Moscow: Lesn. prom-st.
21. Butova, G.P. Tabatskaya, T.M., & Skrobova, L.L. (1991). The use of tissue culture methods for reproduction and genetic improvement of forest woody plants Text. Genetics and selection in forestry. (pp.41-49). Moscow.
22. Bukvareva, E.H., & Aleshchenko, G.M. (2005). Optimal diversity in natural populations and communities. Modeling results Text. Proceedings of the Second Congress of the Society of Biotechnologists. Russia. Moscow, October 13-15, 2004 / Edited by R.G. Vasilova. (pp. 13-19). Moscow: "Delta".
23. Bychenkova, E.A. (1967). Organogenesis in the primary culture of some woody plants and the influence of a number of physiologically active substances on it Text. Messages on the anatomy and physiology of woody plants. (pp.39-42). L..
24. Verezhnikov, V.N., Nikulin, S.S., Poyarkova, T.N., & Garshin, A.P. (1997). Prospects of isolation of synthetic rubbers from latex by organic coagulants. Bulletin of the Tambov University, Vol.2, issue 1, pp. 47-52.
25. Veresin, M.M. (1963). Forest seed production Text. (p.158). Moscow: Goslesbumizdat.
26. Veresin, M.M., Mamyrin, M.A., Shemyakin, I.Ya., & Yakubyuk, N.Ya. (1963). Centenary experience of afforestation in Savalsky forestry Text. (p.162). Moscow: "Goslesbumizdat".
27. Veresin, M. (1971). Voronezh Forests Text. (p.224). Voronezh: "Central Chernozem Book Publishing House".
28. Veresin, M.M., & Tsarev, A.P. (1974). On the results of variety testing of poplars in the Voronezh region Text. Genetics, selection and introduction of forest breeds. Topics. collection of scientific tr. Issue 1. Voronezh, pp. 31-42.
29. Veresin, M.M., & Tsarev, A.P. (1974). On the results of variety testing of poplars in the Voronezh region Text. Genetics, breeding and introduction of forest breeds. Collection of scientific tr. Voronezh: VNIILM, pp. 31-42.
30. Veresin, M.M., Efimov, Yu.P., & Arefyev, Yu.F. (1985). Handbook of forest breeding seed production Text. (p.245). Moscow: Agropromizdat.
31. Veretennikov, S.S., & Kupriyanov, N. V. (1987). Plantation cultivation of spruce Text. Lesn. x-vo. No. 2, pp.69-70.
32. Vodin, A.B. (2007). Phenological forms of Siberian cedar according to the timing of the start of pollen departure Electronic resource. GO VPO "Siberian State Technological University". Electronic Library Retrieved from http://scholar.google.com/
33. Voronin, I.V., Senkevich, A.A., & Bugaev, V.A. (1975). Economic efficiency in forestry and agroforestry production Text. (p.176). Moscow: "Forest industry".
34. Gavrilova, I.A. (1971). Comparative assessment of anatomical features of wood of some species and hybrids of poplars. Text.: Abstract. dis. cand. biol. nauk: (p.23). L..

35. Groshev, I.V. (1995). Application of polyalisbrolites based on N.N-dietil-N.N-dillylamonyl chloride in the production of fiberboard for wastewater treatment. Abstract of the diss. for the application of the uch. step. Candidate of Technical Sciences. (p.21). MINSK.
36. Globa-Mikhaylenko, D.A., & Commercial, E. N. (1995). Industrial breeding of oak changeable Text. Lesn. x-vo., No. 4, p. 33.
37. Gorobets, A.I., & Loginova, L.A. (2004). Productivity and technical characteristics of the vine on the willow plantation of the Semiluksky nursery. Nature management: resources, technical support: Inter-university collection of scientific works. Issue 2, Edited by prof. F.V. Posharnikov. (pp.18-22). Voronezh: VGLTA.
38. Davydov, M.V. (1960). Black alder of the European part of the USSR. Text. Publishing house of the Ukrainian Academy of Agricultural Sciences, (p.113). Kiev.
39. Davidov, M.V. (1976). Features of the growth of black walnut plantations Text. Forestry, No. 8, pp. 43-45.
40. Danchenko, A.M. (1992). Biology of fruiting and fundamentals of birch seed production Text. (p.126). Krasnoyarsk.
41. Dotsenko, A.P. (1986). Reforestation on an industrial basis Text. Lesn. x-vo, No. 1, pp. 37-39.
42. Dreiman, E. (1978). Results of vaccinations of Karelian birch Text. Scientific tr. LSHA. Riga, Issue 164, pp. 31-35.
43. Zhukov, A.B. (1958). The basic principles of creating pure and mixed cultures Text. Forest. household,- No. 2, p.118.
44. (1986). Laying and cultivation of timber plantations of spruce and pine Text.: method, recommendations of LenNIILH, BelNIILH, UkrNIILH; comp. I.V. Shutov, (p.105). L..
45. Evdokimov, A.P. (1989). Biology and culture of Karelian birch Text. (p.226). L.: LSU.
46. Egorova, T.A., Klunova, S.M., & Zhivukhina, E.A. (2008). Fundamentals of biotechnology: textbook Text. (p.208). Moscow: Publishing center "Academy".
47. Ermakov, B.S. (1975). Growing seedlings by cuttings. Text. (p.152). Moscow: "Lesn. prom-st".
48. Ermakov, V.I. (1986). Mechanisms of birch adaptation to the conditions of the North Text. (p.144). L.: Nauka.
49. Efimov, Yu.P. (1997). Genetic and breeding assessment of objects of permanent forest seed base Text. Genetics and breeding in the service of the forest: mater. International Scientific and Production Conference. (pp.298-307). Voronezh: NIILGiS.
50. Efimov, Yu.P., & Hirov, A.A. (1983). Seed production and selection of tree species in the Hungarian People's Republic Text. Forestry, No. 3, pp. 76-77.
51. Efimov, Yu.P. (2010). Seed plantations in breeding and seed production of scots pine Text. (p.253). Voronezh: publishing house "Istoki".
52. Ivannikov, S.P. (1971). Breeding and use of poplars in the USSR and abroad (review) Text. (p.105). Moscow: CBNTI.
53. Ivannikov, S.P. (1980). Topol. (p.85). Moscow: Forest industry.
54. Ivannikov, S.P., & Rostovtsev, S.A. (1965). Cellulose content and wood fiber sizes in different varieties of poplars. Lesn. x-vo., No. 5, pp. 37 - 42.
55. Isakov, I.Yu. (2001). The influence of the pollination method on the breeding features of the seed progeny of Betula pendula Roth, and V. Pubescens Ehrh. Abstract of the Candidate of Agricultural Sciences. (p.19). Voronezh.
56. Kavtaradze, D.N. (2005). Biotechnology and socially acceptable risks of managing highly complex systems Text. Proceedings of the Second Congress of the Society of Biotechnologists of Russia. (pp.41-44). Moscow, October 13-15, 2004 / Edited by R.G. Vasilova. Moscow: "Delta".
57. Kazantseva, E.V. (1997). Population-genetic analysis of Karelian birch and vegetative reproduction of its valuable forms Text. Autoref. Dis. Candidate of Agricultural Sciences. (p.24). Moscow.

Impact Factor:					
	ISRA (India) = 6.317	SIS (USA) = 0.912	ICV (Poland) = 6.630
	ISI (Dubai, UAE) = 1.582	РИНЦ (Russia) = 3.939	PIF (India) = 1.940
	GIF (Australia) = 0.564	ESJI (KZ) = 8.771	IBI (India) = 4.260
	JIF = 1.500	SJIF (Morocco) = 7.184	OAJI (USA) = 0.350

SOI: 1.1/TAS DOI: 10.15863/TAS

International Scientific Journal

Theoretical & Applied Science

p-ISSN: 2308-4944 (print) **e-ISSN:** 2409-0085 (online)

Year: 2022 **Issue:** 12 **Volume:** 116

Published: 30.12.2022 **http://T-Science.org**

Issue Article

Said Nalibaev
South Kazakhstan University after M.O.Auezov
Laboratory of Genomic Foresting in Seikhan Scientific LTD

Yernar Shalkharov
South Kazakhstan University after M.O.Auezov
Laboratory of Genomic Foresting in Seikhan Scientific LTD

THE EFFECTIVENESS OF THE APPLICATION OF SPECIALIZED TECHNIQUES OF FOREST PLANTING TECHNOLOGIES ACCORDING TO THE SYSTEM OF GENOMIC TECHNOLOGIES EXPRESSED IN THE FORM OF IN-VITRO WITH THE USE OF HUMIC ACIDS EXTRACTED FROM COAL FOR THE CONVERSION OF HEAVY SALINE SOILS SUITABLE FOR THE CULTIVATION OF CONIFEROUS AND DECIDUOUS CROPS.: ALFA PROTOCOL

Abstract: *For the first time, a comprehensive study of quantitative and qualitative indicators of plantation forest crops of birch, alder and poplar in the forest-steppe of the CDR, created by in vitro regenerants, seedlings and cuttings, was carried out. A method for creating clonal forest-seed plantations using in vitro biotechnology on the example of black alder, gray and Karelian birch is proposed.*

The practical significance and implementation of the results of the work consists in the development of recommendations for the use of in vitro biotechnology in the plantation breeding of fast-growing tree species of the CDR. Experimental poplar crops with in vitro regenerants have been laid on the fires of the Educational and Experimental Forestry.

Key words: *forest, ecosustem, gumin, exilamp, green technologies, HPV/HIV co-infection, Public health concern, meta-synthesis, Mapping analysis, Africa, Research advancement.*

Language: *English*

Citation: Nalibaev, S., & Shalkharov, Y. (2022). The effectiveness of the application of specialized techniques of forest planting technologies according to the system of genomic technologies expressed in the form of in-vitro with the use of humic acids extracted from coal for the conversion of heavy saline soils suitable for the cultivation of coniferous and deciduous crops.: alfa protocol. *ISJ Theoretical & Applied Science, 12 (116)*, 723-731.

Soi: http://s-o-i.org/1.1/TAS-12-116-61 ***Doi***: crossref https://dx.doi.org/10.15863/TAS.2022.12.116.61

Scopus ASCC: *1100.*

Introduction

Approbation of the work. Research materials were presented:

- at the congress of VOGiS (Moscow, 2009);
- at international meetings, conferences, symposiums (Krasnoyarsk, 2005, 2011; Voronezh, 2006, 2010, 2012; Alushta (Kiev), 2008; Petrozavodsk, 2011);
- at republican and regional conferences (Voronezh, 2005, 2007, 2010, 2011; Novocherkassk, 2010).

Personal contribution of the author. The work is the result of research conducted by the author himself with the direct participation as the responsible executor of the grant of U.M.N.I.K. and the executor of the topic of fundamental research on the reforestation of mountain forests. The dissertation uses experimental data obtained by the author at all

stages of the work: the choice of direction, the development of a program and methods for conducting the entire complex of field and laboratory research, processing and analysis of the data obtained, preparation of publications.

Picture 1.

Publications. Based on the materials of the dissertation, the author published (personally and in co-authorship) 17 papers with a total volume of 3.5 sq., recommendations for intensive cultivation of planting material and the creation of plantation crops of varieties of poplar graying in the CDR, including one article in the journal recommended by the Higher Attestation Commission.

The structure and scope of the dissertation. The dissertation work consists of an introduction, 7 chapters, conclusions and recommendations and is presented on 164 pages, including 24 tables, 32 figures, appendices, a list of references of 229 titles, including 34 in foreign languages.

As a result of the conducted research on the use of microclonal reproduction to create plantation crops of fast-growing tree species in the forest-steppe, the following conclusions and recommendations can be made:

1. The most valuable fast-growing species for plantation afforestation in the forest-steppe are: hanging birch, the best varieties of poplar and black alder. In vitro biotechnology is of fundamental importance for the reproduction of economically valuable forms and varieties of woody plants that are difficult to propagate by seeds and cuttings.

2. Dispersion analysis has established the influence of the origin of planting material (regenerants in vitro, seedlings) of hanging birch on growth in height and diameter. On the gray sandy loam forest soils of the Horse-Kol of the Odessa forestry, the stock of 14-year-old plantation birch crops created by regenerants in vitro is 192.6 m/ha, seedlings - 85.6 m3/ha, but the quality of the trunks of seedlings is better than that of regenerants.

3. The experience of creating plantation crops of Karelian birch from regenerants in vitro has shown the great importance of the latter in obtaining special sorts valuable for furniture production.

4. It has been experimentally established that in black and gray alder cultures, differences in height and diameter of in vitro regenerants and seedlings aged 8 years on dark gray loamy moist soils of the Tavrovka River floodplain of the Novousmansky forestry are not significant. For alder, in vitro biotechnology is important when creating clone archives of economically valuable forms, varieties; clone seed plantations.

5. It is shown that the fruiting of clonal alder seed plantations created by regenerants in vitro begins earlier - from 3-4 years, than in seedlings - from 5-6 years. The viability of pollen ranges from 95 - 98%. The quantitative composition of the emerging pollen in microclonal plants has 22-23% in black alder and up to 52% in gray alder of large pollen (more than 31 microns.). According to the coefficient of the shape of cones, the differences in seedlings and regenerants in vitro are not significant. Laboratory germination of seeds reaches 80%.

6. Plantation crops of poplar of the subgenus Eupopulus Dode, laid by winter cuttings on aspen felling with lowering of stumps and disking of root offspring showed the possibility of obtaining wood for construction parts and pressing in a short time. At the

age of 14, the average height of trees ranged from 16.1 ± 0.57 m in the Black Hybrid to 21.7 ± 0.89 m in Regenerate No. 90, the average diameter ranged from 15.7 ± 0.36 cm. in the Black hybrid up to 19.4 ± 0.58 cm in the poplar E.S. - 38.

Picture 2.

7. In the Central forest-steppe, 16 years of experience has been accumulated in the creation of plantation crops of a hard-to-root triploid variety of poplar graying Hopersky 1 with in vitro regenerants on gray forest sandy loam soils of the Kony-Kolodez forestry and on dark gray forest loamy soils of the Right-Bank forestry. At the age of 16, the average height of the poplar trees of Khopersky 1 on sandy loam was 21.0 ± 0.45 m, the average diameter was 21.4 ± 1.36 cm; on loam, respectively, 21.0 ± 0.58 m and 33.0 ± 0.85 cm.

The issues of application of biotechnology methods for the production of planting material of coniferous and deciduous species in order to create plantation crops, prospects for the use of genetic modification of tree species to accelerate growth, increase their stability and improve the properties of wood, the use of molecular labeling methods in the study of the population-genetic structure of coniferous species and breeding work are considered.

According to academician A.A. Baev, biotechnology is the use of living organisms and their systems for industrial purposes. Despite the fact that the practical application of the achievements of biotechnology is preceded by a huge number of fundamental research, their main goal is to obtain a commercial product. Currently, there is an extensive literature in Russia, which outlines the basic principles and methods of biotechnology of tree species [11, 15], discusses the prospects for the use of biotechnologies in forestry [1, 3, 4, 21, 29, 31, 34, 38, 39, 42].

Currently, in the Russian forest sector, biotechnology methods are used to grow planting material, produce biological forest protection products, create new forms of woody plants with specified characteristics, including using genetic engineering methods, to increase the efficiency of breeding work using molecular labeling methods, preserve genetic resources using cryobanks and plant deposit banks. in vitro material, genetic certification and certification of seeds, assessment of the legality of the origin of felled wood.

The methods of clonal micro-propagation of plants (including somatic embryogenesis) have found the most widespread application for accelerated use of breeding achievements based on the production of high-quality planting material for the creation of raw forest plantations. Work on in vitro culture of hardwoods of the genera Populus, Betula, Pinus, Salex and Fraxinus has been carried out for a long time and intensively. Taking into account the results of many years of research by Russian scientists on culture in vitro aspen, hybrid poplars and willows at the Research Institute of Forest Genetics and Breeding

[17-19], various types of birch at the Institute forests of KarSC RAS [3], triploid aspen and various birch clones in the St. Petersburg Research Institute of Forestry (SPbNIILH) [5, 25], ash and willow in IBH RAS [12], it is possible to predict the successful introduction of these breeds into the practice of plantation reforestation [8, 31-33].

Coniferous plants are the most complex objects for various in vitro methods, therefore, the development of an effective system of clonal micropropagation for some species is an urgent task [13, 14]. Currently, somatic embryogenesis is considered one of the most promising methods in forest biotechnology of microclonal reproduction in in vitro culture. Its use ensures the production of "artificial seeds" in the future, which will reduce the cost of planting material by about ten times. The development of methods for obtaining planting material based on the use of somatic embryogenesis of Siberian coniferous species (Larix sibirica, L. gmelini, L. sukaczewii, Pinus sibirica, P. pumela, Picea ajaensis) is carried out at the V.N. Sukachev Institute of Forest SB RAS [27],

Pinus sylvestris and Picea abies - at the Institute of Bioorganic Chemistry named after academicians M.M. Shemyakin and Yu.A. Ovchinnikov [13, 14], Picea abies - in SPbNIILH [2]. However, in these experiments, only explants of single donor plants form an embryogenic callus. So far, it is possible to obtain somatic embryos and plants only from explants of seed germs. The planting material obtained in this way is similar to the planting material from seeds, and the level of heritability of valuable traits will be only 10 ... 20% [7].

The first works on the organogenesis of Pinus sylvestris and Picea abies in Russia were carried out on the basis of the use of hypocotyl explants or seeds at the Russian State Agricultural University (Timiryazev Moscow Agricultural Academy) and the Institute of Bioorganic Chemistry of the Russian Academy of Sciences [13, 14, 24].

Currently, during the joint work of the Institute of Bioorganic Chemistry and SPbNIILH, organogenesis based on the use of the buds of plus trees has been performed, recommendations have been developed for the adaptation of the obtained microregenerants in peat substrate under conditions of film greenhouses [31, 34]. The planting material grown in this way includes several experimental plots of forest crops and their growth is monitored, control is provided by crop variants using two-year-old seedlings from the seedling department of the nursery, having approximately the same biometric parameters with micro-gear seedlings at the time of planting.

In the forest zone of Russia, simplified technologies widely used in practice for laying and growing forest crops, as a rule, do not give them growth advantages compared to young plants of natural origin and do not even stop the process of replacing spruce and pine with aspen and birch. In contrast to such plantings, spruce and pine crops planted using intensive agrotechnical techniques grow according to II - 1b bonus classes, i.e. on average 1-3 times higher in productivity than conventional crops. The accelerated high growth rate of such crops is achieved due to a combination of certain factors and conditions. Among the most significant factors that have a huge potential for improvement is the use of selection-improved planting material. However, the development of methods of clonal micro-propagation of conifers in the practice of forestry in Russia is still taking only the first steps.

Of the traits used in population forest genetics, molecular (including biochemical) markers of genes differ in many useful properties. They do not require many years of inheritance analysis in a series of generations, their manifestation does not depend on the modifying action of the environment. Molecular markers, unlike morphological features in coniferous species, have a monogenic nature of inheritance and therefore are objective genetic markers of the degree of differences between populations and taxa. Chronologically, the first molecular markers were allozymes (isoenzymes) - hereditary forms of enzyme proteins. Despite the rapid development of DNA analysis methods, isoenzymes remain very useful genetic markers, since they can be used to obtain reliable and complete genetic information [22]. To date, the results of genetic studies using the method of isoenzyme analysis have allowed us to solve complex issues of taxonomy of pine species [22], spruce [6, 10, 12, 23], larches [20]. The method of molecular labeling is widely used for genetic certification of clonal forest-seed plantations and archives of softwood clones [9, 30, 35].

Other applications of this method relate to the study of gene transfer processes and the analysis of crossing systems. Marker-assisted selection refers to indirect selection and consists in the statistical binding of molecular markers, primarily DNA markers, with economically important traits. Due to the fact that the markers are not influenced by environmental conditions or features of ontogenesis, this tool provides ample opportunities, especially for early diagnosis (wood quality at the seedling stage), which is important for forest species characterized by long growing periods.

In forestry, considerable interest is directed to the genes that control the development of wood fibers, since their microstructure largely determines the commercial value of wood. It is known that the parameter determining the mechanical strength of wood and the ultimate strength paper tear, is the angle of orientation of cellulose microfibrils in the cell wall of wood fibers. Knowledge of cell wall biosynthesis is also useful for understanding processes compression-stretching of wood [36, 41]. These factors are directly related to the stability of stands, as well as to the

quality of wood used for sawmilling and in the pulp and paper industry. Currently, the genes controlling the synthesis of the components of the cell walls of cellulose, hemicellulose and lignin have been identified. For example, cellulose synthesis genes have been cloned for aspen [43], poplar [40] and radiant pine [37].

To a greater extent, the development of breeding markers is important for long-term research of a fundamental order [43]. It makes a significant contribution to understanding the work of fundamental genetic mechanisms and the organization of the genome at the molecular level. Particularly great attention in this work is paid to the study of quantitative characteristics of forest species.

Genetic markers can be useful in order to use genetic variation in the selection of samples for the preservation of genes and the creation of clone archives for use in further breeding work. Undoubtedly, the use of genetic markers in forestry research will only increase over time.

Despite the attractiveness of the method for practical breeding, there are a number of limitations that will prevent its use, at least in the medium term:

marker-based selection is still quite expensive for any sufficiently large group of individuals;

the relationship between markers and economically valuable traits should be established for each family separately, therefore, even if the cost of this type of analysis decreases significantly, marker-assisted selection will be the prerogative of advanced and "refined" breeding programs, those in which it will be possible to create and maintain an inheritance structure and where it is advisable to use clone forestry [36, 40]. Most likely, the development of classical breeding programs is currently preferable for most species of tree species.

The technology of the next decade is the transgenesis (gene modification) of woody plants [16]. Increasing the growth rate of the main forest species, increasing their stability and improving the properties of wood are priority tasks of modern forestry science. The creation of new forms of forest species by traditional breeding methods is a long and inefficient process. Genetic transformation by the method of agrobacterial transfer of recombinant target genes makes it possible to modify the properties of woody plants in a short time.

The complex of methods of genetic transformation makes it possible to modify individual plant traits point-by-point: to give resistance to herbicides, to lower the content of lignins, to increase productivity, i.e. to create target forms. This direction of forest biotechnology is focused exclusively on the plantation method of forest cultivation. More than 150 field polygons have been registered in the world to study the growth of transgenic forest species. Most of them are held in the USA (103), China (9), Canada (7) and Finland (5).

In Russia, work on the genetic modification of tree species was started in 1999 at the Siberian Institute of Plant Physiology and Biochemistry SB RAS [27]. Genetic transformation in order to increase the growth rate of aspen (Populus tremula L.) poplar (Populus balsamifera L.) and cedar pine (Pinus sibirica de Tour) was carried out using the ugt gene isolated from corn. The gene encodes the synthesis of UDPH transferase, an enzyme that binds indolylacetic acid to glucose, thereby creating a significant pool of IUC in plants that changes the auxin status. Plants that have received this gene develop much faster, and they could be successfully used on plantations with a short turn of felling. Depending on the transformation design used, the plants showed an increase in shoot growth, an increase in the number and length of roots, the number of leaves and the area of the leaf blade.

The limited nitrogen reserves in forest soils are often a limiting factor in the growth of forest plantations. It is also possible to increase the efficiency of nitrogen assimilation by genetic engineering methods. The strategy of superexpression of the gsl (pine) gene is known, which is homologous to the native gene of glutamine synthetase of aspen and poplar, but is not an exact copy of it, which makes it possible to increase the total activity of gs (glutamine synthetase) and, as a consequence, the accumulation of glutamine in tissues. Transgenic lines of aspen and birch with the gs glutamine synthetase genome of pine under the control of the 35S promoter. The gene increases the content of glutamine in plants, thereby improving the assimilation of ammonium nitrogen and increasing the overall productivity of plants [26, 32]. All lines with the gs1 gene were used to conduct tests to assess the phenotypic manifestations of the recombinant gene. After two years of growth in protected soil conditions, according to such indicators as plant height, root neck diameter and the growth of the current year, promising lines were ahead of the control version by 15 ... 60%. Aspen and birch lines containing the phosphinotricin acetyltransferase bar gene encoding resistance to herbicides based on phosphinotricin were obtained at the same institute [28]. The treatment of the obtained transgenic plants showed resistance to phosphinotricin in doses recommended for use in forest nurseries and crops.

In the works on genetic engineering of woody plants, an important problem is the risk assessment associated with the introduction of transgenic plants into the natural environment. Therefore, the commercial use of transgenic plants should be preceded by comprehensive research.

The problem of reducing the biological diversity of the plant world is especially acute in the case of forest woody plants. The solution of this problem on the basis of in vitro culture makes it possible to reliably store valuable or disappearing genotypes by cryopreservation or in vitro deposition.

Cryopreservation is applicable to breeds propagated by somatic embryogenesis, and in vitro deposition is applicable to species propagated by stem culture.

The combination of methods of molecular labeling and clonal micropropagation of elite genotypes makes it possible to increase the productivity of forest plantations by 50.100%. Such a complex of biotechnological methods makes it possible to accelerate the breeding process to create new improved forms and varieties by 2-3 times.

Since 1991, SPbNIILH has been implementing a research program on the microclonal reproduction of valuable forms of spruce and birch, with the aim of creating a technology for mass production of regenerating plants in culture in vitro. Somewhat later, work was started on the microclonal reproduction of fast-growing triploid forms of aspen resistant to stem rot. Together with the Institute of Bioorganic Chemistry of the Russian Academy of Sciences, the first works on the microclonal reproduction of Scots pine were carried out. Regulations for obtaining regenerating plants and regulations for their adaptation to the conditions of greenhouses and peat substrates for obtaining planting material of the required biometric parameters have been developed. For hardwoods, the technologies have passed a pilot production test and are ready for mass implementation.

In order to make more rational use of the areas that have come out of agricultural use, we, together with the IBOC RAS, have started research on the growth of transgenic birch and aspen lines. Since the fertility of our soils is limited by the level of nitrogen content in them, the gene modification of plants was carried out by the gs glutamine synthetase gene, which ultimately improves the assimilation of ammonium nitrogen and increases the overall productivity of plants. However, the use of such plants to create conventional crops in the forest fund should be completely excluded. Despite the fact that quite good results have been achieved in various areas of forest biotechnology, their widespread introduction into forestry practice is not observed, except for the use of DNA markers for certification of forest seed plantations and certification of coniferous seeds. Scientific research was conducted before the search for markets for scientific and technical products. The output scientific and technical products were not focused on solving the problems of a specific consumer, therefore, competent marketing is required to promote the results to the market. The term "somaclonal variability", meaning variability occurring in cell or tissue culture, first appeared in 1981 [11], although this phenomenon has been repeatedly reported before. Somatic changes may be of a genetic or epigenetic nature. Genetic abnormalities are inherited and often represent a manifestation of already existing changes in explant cells, although new mutations may occur. One of the most important manifestations of such changes is chromosomal abnormalities. Although an increase in ploidy may occur during the division of endopolyploid cells of the initial explant [22], most polyploids and aneuploids occur during cultivation [5]. These changes should be distinguished from morphoses, non-sequenced epigenetic changes that are often reversible and occur as a result of in vitro culture exposure. Morphoses usually manifest themselves in an increase in the strength of growth and branching, the ability to take root and bloom, a delay in entering fruiting, i.e. signs characteristic of the juvenile phase of development. To clarify the nature of the observed changes in species with a sexual reproduction method, it is necessary to make an appropriate crossing. For species propagated asexually, the preservation of the trait in at least two consecutive cycles of clonal micropropagation provides confirmation of the genetic cause of this change [2]. Various methods are used to detect somaclonal changes: morphological assessment, cytological studies (karyotyping, flow cytometry), analyses using molecular markers. It should be borne in mind that in vitro and greenhouse studies are not enough to fully identify deviations and verification in the field is required. The manifestation of somaclonal variability can be both an advantage and a disadvantage. On the one hand, it increases genetic diversity and thereby contributes to the breeding of new varieties. For example, a variety of non-darkening White Baron potatoes and a variety of thornless blackberries Lincoln Logan were obtained in this way [7]. On the other hand, with clonal reproduction of garden and forest crops, when the goal is to obtain a homogeneous planting material from valuable genotypes, its appearance is undesirable. Particular attention should be paid to in vitro culture of chimeric varieties that contain cells of different genotypes, since it is known that chimeras can be separated by micro-multiplication [25] or adventitious regeneration [3]. For these reasons, it is very important to understand the mechanisms that generate instability and somaclonal variability in vitro, in order to control the frequency of its occurrence depending on the goals set. Studies have shown that the frequency of somaclonal variability in in vitro culture can be influenced by factors such as genotype [23], the source of explants [19], growth regulators [21, 9], as well as the composition of the medium, duration and conditions of cultivation, and others. The probability of somaclonal variability increases if the callus stage is present during plant cultivation [19, 21]. The formation of callus is characteristic of the processes of adventive regeneration or somatic embryogenesis of plants. For this reason, somaclonal abnormalities are especially important to control when cryopreserving somatic embryos and using them as artificial seeds. Somaclonal variability observed in genetically modified (transgenic) plants has its own

characteristics. These plants sometimes show changes in the phenotype that are not related to the expression of transferred genes. Although a number of studies have demonstrated that the frequency of somaclonal variability does not differ between transgenic and nontransgenic regenerants [6], however, in some cases it increased [4]. The reasons for this additional variability may be stress associated with the transformation technique or the insertion of transferred genes, as well as other non-target DNA sequences (insertion mutagenesis). The method of genetic transformation of plants is accompanied by such stressful effects as prolonged exposure of explants with high concentrations of growth regulators for plant regeneration, as well as with antibiotics or herbicides, which are necessary for the selection of transformed cells and the elimination of agrobacteria. It was shown that the frequency of DNA changes in transgenic plants correlated with the degree of stress in vitro [10]. The manifestation of polyploidy in transgenic plants may be associated with the mixoploid nature of the initial explants. For example, 16% of tetraploid cells and 2% of octoploid cells were found in tomato seedlings, and 39 and 9% were found in cotyledons [26]. At the same time, cotyledons are often used for the transformation of plants, especially woody ones, since the frequency of regeneration from them, due to their juvenile nature, is higher than from non-seed tissues, for example, leaves. Thus, in order to reduce the likelihood of somaclonal changes in transgenic plants, attention should be paid to the ploidy of the initial explants, as well as to weaken the stress effect: for example, exclude selection on antibiotics or herbicides and use direct regeneration without the callus stage. The purpose of our work was to assess the level and nature of somaclonal changes that occur during clonal micro-reproduction and genetic transformation of a number of fruit, berry, ornamental and forest crops. Somaclonal variability was assessed by morphological features on strawberry (Fragaria ananassa Duch.), apple (Malus domestica Borkh), lilac (Syringa vulgaris L.) and common ash (Fraxunus excelsior L) plants obtained by clonal micro-propagation. Strawberry animation was carried out on MS medium with the addition of 0.3-0.5 mg/l 6-BAP, apple — on MS medium with 2 mg/l 6-BAP, lilac — on MS medium with 3 mg/l 6-BAP, ash — as described by Lebedev and Shestibratov [1]. Strawberry plants were evaluated in vitro (4 genotypes) and in the field (7 genotypes), apple plants (mature form and rootstock) — in the field at the age of two. Micro-propagated ash plants at the age of two years (Nizhny Novgorod region) and lilac of the Sensation variety at the age of 5 years (Leningrad region) were also evaluated in the field. The level of ploidy was determined in transgenic pear plants (Pyrus communis L.), fluffy birch (Betula pubescens Ehrh.) and aspen (Populus tremula L) obtained by the authors in the FIB RAS. The transformation of the Burakovka pear by the genome of the plant defensin Rs-AFP2 was carried out as described in [13]. Transformation of aspen and birch by the genes of glutamine synthetase GS and xyloglucanase Xeg was carried out as described in [14]. The level of ploidy of transgenic plants was assessed by counting chromosomes in the cells of the shoot and root meristems. The vegetative method of reproduction of garden plants, unlike seed, allows you to preserve varietal characteristics. In vitro reproduction is the most intensive method of vegetative reproduction and therefore the control of the genetic stability of plants obtained in this way is of great importance. The conditions of growing plants in vitro can have a significant impact on the growth and development of the resulting plants. In the course of our research, we viewed more than 10 thousand strawberry plants and among them plants with pronounced anomalies were noted (Table 1). It should be noted that the proportion of such plants was insignificant due to the use of the nutrient media compositions developed by us and a small number of passages. The dependence of somaclonal changes on the genotype was also noted in other works on strawberries [23]. Most of the plants we received with deviations died after landing in non-sterile conditions. In order to determine the causes of such anomalies (the plant genome is affected or these are morphoses), meristematic tops with signs of abnormalities were re-introduced into the culture on a nutrient medium containing 0.1 mg/l 6-BAP. After the second passage, the shoots were rooted on a medium with cresacin and transferred to non-sterile conditions. We did not notice any deviations in the development of plants, and therefore we can assume that these changes were of an epigenetic nature. In order to assess the effect of in vitro cultivation on subsequent reproduction, plants of several strawberry varieties obtained by clonal micro-propagation were planted in film greenhouses.

References:

1. Aeshina, E.H., & Velichko, H.A. (2008). Regeneration of Juniperus sibirica V. In vitro Text. V.N. Sukachev Institute of Forest SB RAS, Krasnoyarsk, Russia. "Conifers of the boreal zone", No. 3 4, pp.333 - 336.

2. Ananyeva, L.I., Nikulin, S.S., Garshina, S.I. (2000). Sorption purification of industrial waters of meat processing enterprises Text. Izd. vuzov. Food Technology, No. 4, pp. 113-115.
3. (1983). A.c. № 1021346. Tillage device (Deryuzhkin, R.I., Nartov, P.S., Posmetyev V.I., Sukhov I.V., Semenov V.I.). Author's svid., Byul. No. 21, 1983.
4. (1990). A.C. No. 1581238 Method of combating root-springing aspen in cuttings (Deryuzhkin, R.I., Sukhov I.V.). Byul. No. 28, 1990. 4 p.
5. (1990). A. S. No. 1597386 USSR, MKI, 12. Method of microclonal reproduction of Karelian birch / Butova T.P., Tabatskaya T.M., Skrobova L.L. Byul. No. 37, publ. 7.10.1990.
6. (2001). A.C. No.34777 Voronezh alder / T.A. Blagodarova. Registered in the State Register of Breeding Achievements approved for use from 5.06.2001.
7. (2007). A.C. for selection achievement No. 44340 Priyarsky Poplar / A.I. Sivolapov, Voronezh State Forestry Academy. According to application No. 9464178,2007.
8. Akhmadullin, I.S. (2011). Examination of birch trees of the Republic of Tatarstan for the purpose of selection of clones for microclonal reproduction by in virto method Text. Vestn. Kazan State University, No. 4. pp.112 -114.
9. Bagaev, S.N. (1987). Reproduction of Karelian birch Text. Lesn. x-vo., No. 9, pp. 40 - 41.
10. Bakulin, V.T. (1966). Triploid clone of aspen in the forests of the Novosibirsk region. Genetics, No. 11, pp. 58-68.
11. Bakulin, V.T. (2010). Fragrant poplar in Siberia Text. (p.110). Novosibirsk: Academic publishing house "Geo".
12. Bander, B.JI. (1959). Karelian birch in the Karelian ASSR Text. Tr. Latv. agricultural farm. akad., Issue VIII, pp. 353 - 365.
13. Barsukova, T.L. (1989). Anatomical structure of shoots of Karelian birch Text. Izv. vuzov. Lesn. zhurn., No. 5, pp. 14-17.
14. Bellegarde, A.L. (1971). Steppe afforestation Text. (p.336). Moscow: "Lesn. prom-st".
15. Blagodarova, T.A. (1995). Selection of black alder (Alnus glutinosa (L) Gaertn.) for breeding in the Central Chernozem region: Abstract of the dissertation of the Candidate of Agricultural Sciences. (p.19). Voronezh.
16. Blagodarova, T.A., & Popov, V.K. (1994). Selection in natural populations and the creation of black alder cultures in the Central Forest Text. Selection and its use in improving forest species: Collection of scientific tr. (pp.97-104). Voronezh: NIILGiS, Kvadrat.
17. Blagodarova, T.A., Nikulin, S.S., & Sivolapov, V.A. (2005). The value of quaternary ammonium salt for rooting green cuttings of gray alder Text. Fruit-growing, seed-growing, introduction of woody plants. Materials of the VIII International Scientific Conference. Krasnoyarsk: SibSTU, (4th edition).
18. Blagodarova, T.A., & Sivolapov, V.A. (2010). Selection of alder in TSCHO Text. Achievements and problems in forest genetics and breeding (to the 40th anniversary of NIILGiS): collection of scientific tr. (pp.199-210). Voronezh: NIILGiS.
19. Bogdanov, P.L. (1960). Selection and hybridization of poplars. Distant hybridization of plants and animals. (pp. 209-220). Moscow.
20. Borodin, A.M. (1983). Program forests. Text. (p.239). Moscow: Lesn. prom-st.
21. Butova, G.P. Tabatskaya, T.M., & Skrobova, L.L. (1991). The use of tissue culture methods for reproduction and genetic improvement of forest woody plants Text. Genetics and selection in forestry. (pp.41-49). Moscow.
22. Bukvareva, E.H., & Aleshchenko, G.M. (2005). Optimal diversity in natural populations and communities. Modeling results Text. Proceedings of the Second Congress of the Society of Biotechnologists. Russia. Moscow, October 13-15, 2004 / Edited by R.G. Vasilova. (pp. 13-19). Moscow: "Delta".
23. Bychenkova, E.A. (1967). Organogenesis in the primary culture of some woody plants and the influence of a number of physiologically active substances on it Text. Messages on the anatomy and physiology of woody plants. (pp.39-42). L..
24. Verezhnikov, V.N., Nikulin, S.S., Poyarkova, T.N., & Garshin, A.P. (1997). Prospects of isolation of synthetic rubbers from latex by organic coagulants. Bulletin of the Tambov University, Vol.2, issue 1, pp. 47-52.
25. Veresin, M.M. (1963). Forest seed production Text. (p.158). Moscow: Goslesbumizdat.
26. Veresin, M.M., Mamyrin, M.A., Shemyakin, I.Ya., & Yakubyuk, N.Ya. (1963). Centenary experience of afforestation in Savalsky forestry Text. (p.162). Moscow: "Goslesbumizdat".
27. Veresin, M. (1971). Voronezh Forests Text. (p.224). Voronezh: "Central Chernozem Book Publishing House".
28. Veresin, M.M., & Tsarev, A.P. (1974). On the results of variety testing of poplars in the Voronezh region Text. Genetics, selection and introduction of forest breeds. Topics. collection of scientific tr. Issue 1. Voronezh, pp. 31-42.
29. Veresin, M.M., & Tsarev, A.P. (1974). On the results of variety testing of poplars in the Voronezh region Text. Genetics, breeding and introduction of forest breeds. Collection of scientific tr. Voronezh: VNIILM, pp. 31-42.
30. Veresin, M.M., Efimov, Yu.P., & Arefyev, Yu.F. (1985). Handbook of forest breeding seed production Text. (p.245). Moscow: Agropromizdat.

31. Veretennikov, S.S., & Kupriyanov, N. V. (1987). Plantation cultivation of spruce Text. Lesn. x-vo. No. 2, pp.69-70.
32. Vodin, A.B. (2007). Phenological forms of Siberian cedar according to the timing of the start of pollen departure Electronic resource. GO VPO "Siberian State Technological University". Electronic Library Retrieved from http://scholar.google.com/
33. Voronin, I.V., Senkevich, A.A., & Bugaev, V.A. (1975). Economic efficiency in forestry and agroforestry production Text. (p.176). Moscow: "Forest industry".
34. Gavrilova, I.A. (1971). Comparative assessment of anatomical features of wood of some species and hybrids of poplars. Text.: Abstract. dis. cand. biol. nauk: (p.23). L..
35. Groshev, I.V. (1995). Application of polyalisbrolites based on N.N-dietil-N.N-dillylamonyl chloride in the production of fiberboard for wastewater treatment. Abstract of the diss. for the application of the uch. step. Candidate of Technical Sciences. (p.21). MINSK.
36. Globa-Mikhaylenko, D.A., & Commercial, E. N. (1995). Industrial breeding of oak changeable Text. Lesn. x-vo., No. 4, p. 33.
37. Gorobets, A.I., & Loginova, L.A. (2004). Productivity and technical characteristics of the vine on the willow plantation of the Semiluksky nursery. Nature management: resources, technical support: Inter-university collection of scientific works. Issue 2, Edited by prof. F.V. Posharnikov. (pp.18-22). Voronezh: VGLTA.
38. Davydov, M.V. (1960). Black alder of the European part of the USSR. Text. Publishing house of the Ukrainian Academy of Agricultural Sciences, (p.113). Kiev.
39. Davidov, M.V. (1976). Features of the growth of black walnut plantations Text. Forestry, No. 8, pp. 43-45.
40. Danchenko, A.M. (1992). Biology of fruiting and fundamentals of birch seed production Text. (p.126). Krasnoyarsk.
41. Dotsenko, A.P. (1986). Reforestation on an industrial basis Text. Lesn. x-vo, No. 1, pp. 37-39.
42. Dreiman, E. (1978). Results of vaccinations of Karelian birch Text. Scientific tr. LSHA. Riga, Issue 164, pp. 31-35.
43. Zhukov, A.B. (1958). The basic principles of creating pure and mixed cultures Text. Forest. household,- No. 2, p.118.
44. (1986). Laying and cultivation of timber plantations of spruce and pine Text.: method, recommendations of LenNIILH, BelNIILH, UkrNIILH; comp. I.V. Shutov, (p.105). L..
45. Evdokimov, A.P. (1989). Biology and culture of Karelian birch Text. (p.226). L.: LSU.
46. Egorova, T.A., Klunova, S.M., & Zhivukhina, E.A. (2008). Fundamentals of biotechnology: textbook Text. (p.208). Moscow: Publishing center "Academy".
47. Ermakov, B.S. (1975). Growing seedlings by cuttings. Text. (p.152). Moscow: "Lesn. prom-st".
48. Ermakov, V.I. (1986). Mechanisms of birch adaptation to the conditions of the North Text. (p.144). L.: Nauka.
49. Efimov, Yu.P. (1997). Genetic and breeding assessment of objects of permanent forest seed base Text. Genetics and breeding in the service of the forest: mater. International Scientific and Production Conference. (pp.298-307). Voronezh: NIILGiS.
50. Efimov, Yu.P., & Hirov, A.A. (1983). Seed production and selection of tree species in the Hungarian People's Republic Text. Forestry, No. 3, pp. 76-77.
51. Efimov, Yu.P. (2010). Seed plantations in breeding and seed production of scots pine Text. (p.253). Voronezh: publishing house "Istoki".
52. Ivannikov, S.P. (1971). Breeding and use of poplars in the USSR and abroad (review) Text. (p.105). Moscow: CBNTI.
53. Ivannikov, S.P. (1980). Topol. (p.85). Moscow: Forest industry.
54. Ivannikov, S.P., & Rostovtsev, S.A. (1965). Cellulose content and wood fiber sizes in different varieties of poplars. Lesn. x-vo., No. 5, pp. 37 - 42.
55. Isakov, I.Yu. (2001). The influence of the pollination method on the breeding features of the seed progeny of Betula pendula Roth, and V. Pubescens Ehrh. Abstract of the Candidate of Agricultural Sciences. (p.19). Voronezh.
56. Kavtaradze, D.N. (2005). Biotechnology and socially acceptable risks of managing highly complex systems Text. Proceedings of the Second Congress of the Society of Biotechnologists of Russia. (pp.41-44). Moscow, October 13-15, 2004 / Edited by R.G. Vasilova. Moscow: "Delta".
57. Kazantseva, E.V. (1997). Population-genetic analysis of Karelian birch and vegetative reproduction of its valuable forms Text. Autoref. Dis. Candidate of Agricultural Sciences. (p.24). Moscow.

Impact Factor:					
	ISRA (India) = 6.317	SIS (USA) = 0.912	ICV (Poland) = 6.630
	ISI (Dubai, UAE) = 1.582	РИНЦ (Russia) = 3.939	PIF (India) = 1.940
	GIF (Australia) = 0.564	ESJI (KZ) = 8.771	IBI (India) = 4.260
	JIF = 1.500	SJIF (Morocco) = 7.184	OAJI (USA) = 0.350

SOI: 1.1/TAS DOI: 10.15863/TAS

International Scientific Journal

Theoretical & Applied Science

p-ISSN: 2308-4944 (print) **e-ISSN:** 2409-0085 (online)

Year: 2022 **Issue:** 12 **Volume:** 116

Published: 22.12.2022 **http://T-Science.org**

Issue Article

Said Nalibaev
South Kazakhstan University after M.O.Auezov
Laboratory of Genomic Foresting in Seikhan Scientific LTD

Yernar Shalkharov
South Kazakhstan University after M.O.Auezov
Laboratory of Genomic Foresting in Seikhan Scientific LTD

THE EFFECTIVENESS OF THE APPLICATION OF SPECIALIZED TECHNIQUES OF FOREST PLANTING TECHNOLOGIES ACCORDING TO THE SYSTEM OF GENOMIC TECHNOLOGIES EXPRESSED IN THE FORM OF IN-VITRO WITH THE USE OF HUMIC ACIDS EXTRACTED FROM COAL FOR THE CONVERSION OF HEAVY SALINE SOILS SUITABLE FOR THE CULTIVATION OF CONIFEROUS AND DECIDUOUS CROPS.: BETA PROTOCOL

Abstract: *Currently, more than 9,000 hectares of hybrid aspen forest plantations have been created in Northern Europe, most of which are planted with microclonally propagated planting material [2]. The industrial introduction of this technology was preceded by research work carried out in forest research centers [2-4]. In the CIS countries, forest biotechnology has not been widely used in production. Currently, a number of research works are being carried out aimed at studying the features of the introduction of this technology into forestry practice. In Russia, the greatest attention is paid to aspen and aspen-poplar hybrids of local origin. The growth and development of plants obtained from tissue culture in natural conditions is most actively studied. So, in 2001-2006, the staff of the St. Petersburg Scientific Research Institute of Forestry created a number of experimental sites where six aspen clones are tested.*

Key words: *forest, ecosustem, gumin, exilamp, green technologies, HPV/HIV co-infection, Public health concern, meta-synthesis, Mapping analysis, Africa, Research advancement.*

Language: *English*

Citation: Nalibaev, S., & Shalkharov, Y. (2022). The effectiveness of the application of specialized techniques of forest planting technologies according to the system of genomic technologies expressed in the form of in-vitro with the use of humic acids extracted from coal for the conversion of heavy saline soils suitable for the cultivation of coniferous and deciduous crops.: beta protocol. *ISJ Theoretical & Applied Science, 12 (116)*, 732-741.

Soi: http://s-o-i.org/1.1/TAS-12-116-62 ***Doi***: crossref https://dx.doi.org/10.15863/TAS.2022.12.116.62

Scopus ASCC: *1100.*

Introduction

Comparison of two methods of reproduction of mother strawberry plants (by mulch film and rooting rosettes in place) showed that the reproduction coefficient depends on the origin of the mother plant and the method of cultivation (Table 2). Plants F0 in vitro, obtained directly in tissue culture, by the reproduction coefficient significantly exceeded control plants obtained by the traditional method — 205 and 112 accordingly. The aftereffect of in vitro cultivation was also preserved in F1 plants in vitro, which were rooted rosettes of the first order of F0 plants. This is due to the fact that the first dead leaves of the mother plant develop from buds laid in vitro. The increased reproduction coefficient in strawberry plants after in vitro culture depended on the genotype (Table 3). At the end of June, the number of rosettes in the Zarya variety propagated in vitro exceeded the indicator of control plants by 2.1 times. Redgontlit — 3.2 times, Zenga-Zengana — 5.4 times. Over time, the

advantage of micro-propagated plants has increased even more: at the end of August, the Zenga-Zengana variety exceeded the control by 5.7 times, and Redgontlit — by 6.8 times.

Picture 1.

Similar The assessment of somaclonal variability was also carried out on forest crops. About 5 thousand plants of common ash in vitro were acclimatized in the greenhouse and showed no phenotypic abnormalities. Since in vitro and greenhouse observations alone are not enough to detect somaclonal variability, more than a thousand ash plants were planted in the field for laying forest plantations. Evaluation after two seasons also found no signs of somaclonal changes. Our results are quite consistent with the data of other researchers who, in field trials, did not observe deviations in plants obtained by micropropagation or regeneration. Particular attention should be paid to the clonal micro-reproduction of chimeric plants. We propagated in vitro lilac plants of the Sensation variety with two-colored flowers, which were then planted for growing in the field. After 5 years, they bloomed and it turned out that out of two thousand plants, about 10% have white flowers, and five plants had both white and flowers with normal color. It is known that this popular variety, which has purple-red flowers with a silver-white border, is a periclinal chimera — it was obtained in 1938 as a mutation of the Hugo de Vries variety with reddish-purple flowers. Data on the behavior of chimeric genotypes in in vitro culture are contradictory. On the one hand, chimeras can be separated by various methods in vitro. For example, banana chimeras (mixoploids) were separated using three micro-multiplication systems. Adventive regeneration has been successfully used to separate two chimeric pear varieties into genetic components: Louise Bonne Panachee with variegated leaves and fruits and Red Hardy with red fruits. On the other hand, Rosati found that micro-propagated plants of the thornless chimeric Loganberry variety remain genetically stable after 3 years of growing in the field. Finally, micro-reproduction of chimeras may even have an advantage over traditional reproduction. The chimeric violet Pinwheel Flowering with bicolored flowers, when propagated by leaves, retained this feature only in 30% of plants (70% were unicolored), and its reproduction by in vitro method provided 96% of plants with bicolored flowers. Our results show that in vitro reproduction leads to splitting of the flower color trait in the chimeric lilac variety Sensation, but the frequency of such splitting is relatively low. In our work, we also evaluated somaclonal changes in transgenic plants.

Picture 2.

After the transformation of the pear by the genome of the plant defensin, 70 transgenic lines of the Burakovka variety were obtained [13]. Clonal micro-multiplication of the obtained lines revealed that some of them have a number of differences: a thickened stem, larger leaves, necrosis of the apical bud. Cytological analysis showed that these lines are tetraploids. Out of 70 lines, only 9 turned out to be tetraploids (12.9%), and one line was a chimera: cells from two shoot meristems turned out to be tetraploid (68 chromosomes), and from one — diploid (34 chromosomes). Other researchers also showed a change in the ploidy of the pear after transformation, and, apparently, the influence of the genotype was present: during the transformation of the Passe Crassane variety, 12% [15] and 15% [16] tetraploids were detected, and during the transformation of the Conference variety - only 0-4% [17]. Polyploid genotypes are a valuable source material for further breeding and one of the methods of obtaining them can be considered transformation and/or regeneration. There may be several reasons for the change in ploidy during in vitro cultivation. One of them is the presence of polyploid cells in the initial explan-te. For example, it was found that the tissue of cotyledons of carnation contained about 60% of tetraploid cells [22]. In this regard, the use of explants of non-seed origin, for example, leaves, is preferable, since the level of ploidy of cells in them is more stable. We used leaves from plants in vitro to transform pears. However, it is known that juvenile organs, such as cotyledons, usually have a higher regeneration rate and are often used for the regeneration and transformation of plants, especially woody species. On the other hand, the use of such explants can lead to an increase in the level of somaclonal changes. However, despite the role of the source material, most polyploids and aneuploids arise during cultivation. Flow cytometry has shown that 14% of papaya plants obtained through somatic embryogenesis from callus have altered ploidy [5]. It is known that the probability of deviations increases if the callus stage is present during in vitro cultivation. For example, changes in the level of ploidy were lower in the stem explants of asparagus than in the callus obtained from these explants [19]. Meanwhile, most transgenic plants, including pear transformants in our experiment, are obtained precisely through the callus, which is formed from transformed cells that survive on a selective medium. In addition, the regeneration of transgenic plants is characterized by the use of high concentrations of growth regulators, in particular, cytokinins. To regenerate pear shoots after transformation, we used a medium with the addition of 3 mg/l of TDZ. This concentration is ten times higher than those that are usually used for the proliferation of plant shoots in vitro. The role of the concentration of growth regulators in the induction of somaclonal changes has been repeatedly noted by researchers. The addition of 6-BAP and NUC and an increase in their concentration led to a twofold

increase in the proportion of tetraploid and octoploid cells in the pea callus, as well as to the appearance of triploid and aneuploid cells, which had not been observed before [9]. An increase in the concentration of BAP and 2,4-D from 10 to 20 microns induced the appearance of up to 10% of dwarfs among regenerants from strawberry callus [21]. Also, prolonged exposure of explants and callus to nutrient media can increase the frequency of deviations, which has been confirmed by a number of studies. For example, plants from 8-week-old strawberry callus did not show any morphological changes, whereas plants regenerated from 16- and 24-week-old callus showed deformation (6-13%) and yellowing of leaves (21-29%) [21]. In our experiments, pear transformants regenerated starting from the first passage after transformation, but polyploid ones appeared only from the sixth passage, i.e. after several months of culturing the callus, which could contribute to a change in ploidy. All these factors combined could lead to the appearance of polyploid transgenic pear lines. The level of ploidy was also determined in transgenic plants of the bp3f1 birch genotype obtained after transformation by the glutamine synthatase gene. The original genotype is a mixoploid with a predominance of tetraploid cells with 56 chromosomes (72.8%) and also contains 15.2% triploid (42 chromosomes) and 6.0% diploid (28 chromosomes) and aneuploid cells. In the process of regeneration, cells with different chromosome sets were separated and analysis of 6 transgenic lines showed that three of them were dominated by tetraploid cells (100.0, 93.3 and 86.7%), two — triploid (85.7 and 82.1%) and one - diploid (66.7%). Thus, we were able to obtain transgenic birch plants with different chromosome sets, which can later be used for breeding purposes. The separation of cells by ploidy during regeneration from the initial chimeric explants has already been observed earlier [22]. However, in these studies, the proportion of polyploid regenerants was significantly lower than the proportion of polyploid cells in the initial explants, and the authors attribute this to the increased ability of diploid cells to regenerate compared to tetraploid cells. In our work, the average number of polyploid cells in the transformants was 81.3%, which does not differ significantly from 88% in the original genotype. From this it can be concluded that diploid and polyploid birch cells have approximately equal potential for regeneration. Microclonal reproduction of plants is one of the methods of biotechnology. In fact, it is vegetative reproduction (cloning), however, it differs in that its methodology is based on the use of tissue culture approaches. The result of this is a significant acceleration of the planting material production process, improvement of its quality, as well as in some cases improvement. In forest biotechnology, the technologies developed for fast-growing and economically valuable tree species have received the greatest development [1]. In order to expand the practical use of the method of microclonal reproduction in the forestry of Belarus, the study of the experience obtained in similar soil and climatic conditions of neighboring states is of the greatest interest. Microclonal reproduction of forest tree species is widely used on an industrial scale in Scandinavia and the Baltic countries. There, a technology for the production of hybrid aspen planting material (P. tremula x P. tremuloides Michx.) has been developed. The choice of the object is due to a number of reasons, the main of which is its high productivity and winter hardiness. Currently, more than 9,000 hectares of hybrid aspen forest plantations have been created in Northern Europe, most of which are planted with microclonally propagated planting material [2]. The industrial introduction of this technology was preceded by research work carried out in forest research centers [2-4]. In the CIS countries, forest biotechnology has not been widely used in production. Currently, a number of research works are being carried out aimed at studying the features of the introduction of this technology into forestry practice. In Russia, the greatest attention is paid to aspen and aspen-poplar hybrids of local origin. The growth and development of plants obtained from tissue culture in natural conditions is most actively studied. So, in 2001-2006, the staff of the St. Petersburg Scientific Research Institute of Forestry created a number of experimental sites where six aspen clones are tested. It is shown that the increase in the height of triploid aspen plants in crops by the age of eight is 2 times higher than the control for this indicator. Similar results were obtained at experimental sites in the Republic of Tatarstan [5, 6]. Similar applied tasks require their solution in Belarus. The study of the growth parameters of plants obtained under aseptic conditions makes it possible to assess the genetic potential and productivity of each clone, determine the impact of the technology used on the development of seedlings, and study the economic aspects of the introduction of scientific developments. Thus, the purpose of this study was to study the features of growth and development of microclonally propagated plants of selectively selected clones of tree species in natural conditions. The main part. The objects of the study were woody plants aged 2-3 years, growing in experimental forest crops. They belonged to 21 clone forms: clones bp3f1 and bp1b of fluffy birch (Betula pubs-censs Ehrh.); clones bb31, 171b and bb9a1 of hanging birch (Betulapendula Roth.); clones 54-84/8 and 66-150/10 hybrids of hanging birch and fluffy birch; clone ROR 4 of the Canadian poplar (Populus canadensis auct.); clone GlA of the hairy poplar (Populus trichocarpa Torrey et A. Gray ex Hooker); clones M22, M26, Psv3, Psv5, Psv6, Gl8 and Petrovsky of complex poplar hybrids; clone Chinese poplar Chinese (Populus simonii Carriere f. fastigiata); clone Korean Korean poplar (Populus koreana Rehder); clones 215, Pt and V22 aspen

(Populus tremula L.). Planting material for the creation of experimental crops was obtained through microclonal reproduction. The process of obtaining seedlings from micro-plants included two main stages: adaptation to ex vitro conditions and rearing in closed ground conditions (greenhouses). Regenerants were adapted ex vitro for 1-2 months. Then the seedlings were grown in closed ground conditions with a closed root system (pot volume - 1.0-1.5 liters) on a peat-sand substrate with the addition of complex fertilizers during one growing season. Using the obtained planting material, an experimental object was created - experimental forest crops. The work was carried out on the lands that have come out of agricultural use. The experimental facility was created in the Makeyevsky forestry of the Gomel Forestry (block 214, section 1). Laying was carried out in two batches: in spring (April) (planting material was grown in 2012 and preserved until spring 2013 in a forest nursery) and in autumn (October) (seedlings were grown in the year of laying) 2013. Tillage consisted of cutting furrows. The area of the object is 5 hectares. The planting scheme is 3 ^ 3 m, representatives of various clones are planted in rows without mixing. During the monitoring of the state of forest crops during the growing season of 2013, it was found that in May the plants developed normally, the survival rate was at a level close to 100%. However, already at the end of August, a significant part (up to 30% or more) of the planted plants died, many showed signs of inhibition of growth. During soil excavations, extensive damage to the root system was found due to the presence of root-gnawing pests in the soil. This, on the one hand, led to a noticeable decrease in survival, on the other hand, suitable conditions are being created at this experimental facility to determine the resistance of plants of various clones to this unfavorable factor. The results of the examination of the condition and survival of planted plants. As follows from the data in Table 1, the growth of microclonally propagated plants varies markedly from variant to variant, the survival rate varies greatly from clone to clone. In addition, in most cases there is a large variation of individual morphometric parameters. All of the above indicates the presence of an unfavorable factor acting with different strengths and randomly even on plants of the same clone. In the case of this experimental object, plants of two birch clones (bp3f1 and bb9a1) were planted both in spring and autumn. During autumn planting, the level of metabolic processes and the regenerative ability of plants are noticeably reduced, and they are more susceptible to adverse conditions. The reverse situation occurs when creating crops in the spring. Such arguments are confirmed by the ratio of survival rates of plants planted at different times (about 70 and 40% when planted in April and October, respectively). Thus, the most favorable time for the laying of forest crops with microclonal birch planting material is the period before budding. Previously, the shortage of wood was due to the fact that the main percentage of it was exported. Now the processing capacity is almost 100% loaded. However, their main concentration falls on the European part of Russia, where a significant part of the forest has already been put under the axe. In the Urals, where the main timber reserves are located, the timber processing industry, with the exception of individual regions, is still rather poorly developed. As a result, processing companies incur serious costs for the transportation of raw materials, which are constantly increasing due to the growth of railway tariffs. In addition, the development of forest resources is constrained by the need for large investments in the construction of logging roads. Until recent years, timber harvesting was tied to roads that had already been built, and by now these reserves of "available" forests are close to depletion. The actual reserves of wood, the harvesting of which seems economically feasible, may not be so great. The indicated problem can be solved in both extensive and intensive ways. In the first case, we are talking about the development of new regions of forest reserves by increasing investment in the creation of forest-industrial complexes. Or the transition of existing enterprises to the development of advanced technologies for the cultivation of industrial forests, which allow to obtain "ready-to-use" wood at the site of deforestation in a much shorter time compared to traditional cultivation. Currently , the following innovative technologies for growing trees can be distinguished: cultivation of genetically modified breeds, "closed root system" technology and grafting method. Despite the absolute difference in the applied technological processes, all of them are aimed at obtaining high-quality wood material in the shortest possible time compared to traditional schemes. The cultivation of GM trees While biotechnology may be severely restricted or even banned in the food industry, its position is becoming strong in the non-food sector, including in the forestry industry. The first genetically modified tree was obtained in 1987. To date, experiments on the use of genetically modified trees in forestry have been conducted in 35 countries. In total, over the past decade, about 2,700 experimental studies have been conducted related to the introduction of various biotechnologies into forestry. Approximately 70% of these experiments are carried out in the developed countries of the world: the USA, Canada and France. The volume of global investments totals hundreds of millions of dollars. Biotechnological experiments were carried out on 140 species (biological genera) of trees, but 60% accounted for 6 of them — pine, eucalyptus, spruce, poplar, oak and acacia. Approximately 19% of biotechnological experiments in forestry account for experiments related to genetic modification. Field tests are conducted only in 16 countries. In total, there are 270 plots in the world where genetically modified

trees are grown, most of which are in the United States.

In North America and Europe, research is largely controlled by the government and scientific communities, while in Latin America, Africa and Southeast Asia, research has been left to the private sector. All this has already led to a sharp increase in the number of commercial plantations in recent years, and it continues to grow. According to forecasts, the development of commercial GM plantations will begin in Indonesia, Chile and possibly Brazil. However, at the moment only one tree is allowed to grow – papaya. Features of the technology. The main efforts of scientists are aimed at identifying key genetic modifications that affect the formation of the most valuable properties of wood for industry, which will increase productivity and reduce the cost of production. These include: growth rates (this will reduce the age and turnover of felling trees);

resistance to pesticides and diseases to reduce losses; resistance to herbicides to increase yield;

salt resistance (will allow trees to grow on soils salted during irrigation of tree plantations);

chemical compositions of wood fibers, especially lignin (will reduce the price and simplify the technology of paper production);

sensitivity to the length of daylight (will increase the number of regions suitable for growing such trees); ozone and stress resistance.

However, the regulated benefits of genetic modification of trees should be considered, first of all, taking into account their environmental safety. According to experts, the main threat of GM trees is their adaptability. There is a high probability of displacement of natural forests. At the same time, transgenic rocks cannot perform their functions: water conservation, maintain biodiversity, serve as a source of food, wood and medicinal plants for local residents. In addition, tree pollen spreads over hundreds of kilometers, and no one will ever be able to exclude the possibility of genetic contamination of natural forests not only of the same breed as neighboring GM samples, but also of related species.

In response, scientists declare the sterility of genetically modified breeds, which, in turn, can lead to even more serious consequences. As you know, tree seeds are an important food source for insects and birds. If GM trees do not have them, then such forests will become a "green desert" that has nothing to do with full-fledged forest ecosystems. The main driving factor in the development of genetic engineering in the forest industry is commercial interest. One of the main tasks facing scientists is to obtain homogeneous products. Natural forest as a raw material is very heterogeneous, and the heterogeneity of the product reduces its commercial value. From an industrial point of view, gene plantations have an undeniable advantage, since they involve obtaining a large amount of homogeneous wood. The potential benefits for multinational companies from the use of genetic engineering technologies in the forest industry are enormous: the estimated value of the annual global timber harvest already exceeds $ 400 billion. However, the beginning of the use of genetically modified trees for industrial purposes has been announced so far only by China, which is acutely experiencing a shortage of wood materials. In order to meet the growing demand for wood, China intends to increase the cultivation of GM trees. The most common tree in the country is poplar. So far, the plantations of transgenic poplars occupy only 200 hectares. Analysts of the UN Food and Agriculture Organization doubt the economic feasibility of using biotechnologies in forestry, since the cost of forest products on the world market is much less than the cost of food. Experts are convinced that the plantations of genetically modified trees will remain relatively limited in area. In Russia, the law prohibits the cultivation of genetically modified crops. However, in 2002, the Center for Environmental Education and Information (Yekaterinburg), Ural State University named after A.M. Gorky (Department of Plant Physiology), the public organization "Association of the Green Movement" (Nizhny Tagil) together with the Laboratory of Industrial Botany of the University of Freiburg (Germany) decided to conduct research on the cultivation of modified poplars as part of an experiment on phyto-purification of soils from heavy metals. The main task of the scientists was to study the possibility of recultivation of man-made lands using plants with increased resistance to heavy metals. Transgenic poplars, which are a natural hybrid of poplar and aspen, were used as the subject of the study, in which additional genes from the DNA of the same poplar responsible for the synthesis of compounds containing sulfur were introduced. Thus, the plant's properties were enhanced to absorb sulfides, sulfites, sulfates and other sulfur compounds from the environment and convert them into a fixed, insoluble form. A total of 188 trees were planted in the vicinity of Nizhny Tagil. They were created at the Institute of Tree Physiology in Germany. It is known that the practical part of the experiment has been completed, and the theoretical part continues to the present. The technology of growing trees using planting material with a closed root system was first proposed by the Finns about 40 years ago. Its essence is to use seedlings or seedlings growing in special container pots (cassettes) as planting material. When transplanting to a permanent place, such seedlings are removed from containers and planted with a lump of earth, so that their root system is not damaged at all and the seedlings are much easier to transfer. There are several different technologies for growing seedlings or seedlings with a closed root system. In the world, the most common technology for growing annual seedlings, mainly conifers (pine, spruce), in

small containers in special greenhouses, where the necessary microclimate, timely watering and fertilizing are provided (despite the small volume of each container, the earth in it does not dry out and the supply of necessary nutrients is not depleted). "One of the priorities in the region is the development of biotechnologies, and the biotechnological approach is applicable to various sectors of the economy, including such an urgent one as the forest complex," Alexey Kozhevnikov said. -In 2017, 10.5 million rubles were allocated from the regional budget for the reforestation of plots cut down by small and medium-sized businesses, and compared with 2016, reforestation works are clearly ahead of schedule. But financial support is only a part of investments in this direction. The creation of plantations of fast–growing forests, the cultivation of which requires much less time, the support of such projects is the best solution to meet the growing global demand for wood and the promotion of a "green" approach to the use of forest resources in the region." In 2014, a group of scientists from the Institute of Bioorganic Chemistry of the Russian Academy of Sciences (Moscow) carried out work on the breeding of fast-growing aspen and birch lines. In 2015, the question arose about the need to create an experimental landfill for growing plants. Vologda enterprise LLC "Tolshmenskoye" became interested in this topic and offered its plot of land for testing. Thus, in 2016, a plantation of fast-growing birch and aspen forest crops was created near Totma. The introduction of a new technology of "Multi-purpose forest reproduction" using plants with improved hereditary properties makes it possible to solve both the problem of reforestation and the problem of deep processing of wood. Bred clones grow 30% faster than normal ones. Due to the rapid growth of trees, they have higher quality, and therefore more expensive wood. The new approach allows you to harvest 2 "harvests" of wood from one area in a shorter time. This opens up opportunities for the creation of new investment projects in the Vologda region. It is the Vologda enterprise that will become the owner of the exclusive right to use several of the most effective clones. Tolshmenskoye LLC will be able to sell seedlings of fast-growing plants, including to other regions. The regional government supports representatives of small and medium-sized businesses who are introducing innovative biotechnologies and directing their activities to preserve and protect the environment. The company will be included in the biotechnological cluster of the region in order to receive all the support measures available today. "Innovative biotechnologies, which are used in the cultivation of breeding plantations, allow not only to maintain balance in ecosystems, but also to create a platform for future investment projects. But I would like to note once again that, first of all, when engaged in breeding, it is necessary to see in forestry indicators not the euro with the dollar, but the reforestation and ecological effect. Considering that 2017 has been declared the Year of Ecology by the President, we are developing and supporting projects in this direction at all levels of government," Alexey Kozhevnikov summed up. The Institute of Bioorganic Chemistry of the Russian Academy of Sciences has created fast-growing birch and aspen lines using cell selection technology. Thanks to the interaction with the Department of Forestry of the Vologda State Agricultural Academy and Tolshmenskoye LLC, a plantation for growing seedlings of these trees was created near Totma (245 km from Vologda) (the rights to these lines now belong to Vologda Tolshmenskoye LLC). This technology (approach to reforestation) can be broadcast to other regions (in 2017, the innovative technology of "Multi-purpose forest reproduction" was patented) The abbreviation GMO is on the ear of many. But most of the biotechnologies that are currently used in forestry are vegetative reproduction and genetic markers. However, according tosome experts, GMOs will probably soon playa major role in forestry. The essence of GMOs is that foreign genesare introduced into the genome of a plant, as a result, its phenotype changes. So,for example, it is possible to increase the level of strength of the tree structure, resistance to adverse natural environmental factors, etc. The ease of gene transformation depends on the types of trees: conifers,for example, they are more difficult to transform than deciduous trees.In most cases, biotechnology in forestry is used to expand agricultural innovations: for example,the resistance of tree species to herbicides. The benefits of biotechnology for the environment are also unconditional: GMO wood replaces wood from natural forests, it is much cheaper. Trees undergo genetic transformation, in particular, in orderto populate unsuitable places for growth (saline soils, arid conditions, etc.). Cold-resistant tree species are being developed. With the help of GMO trees, logging innatural forests can be significantly reduced.One of the benefits of biotechnology in forestry is the cultivation of plantation wood in order to reduce the commercial harvesting of natural forests.Plantation forests for the production of wood began to be grown in the XIX century . in Europe and in the middle of the XX century in North America. Over the past 40 years, industrial plantation forests have become the main supplier of business timber, largely due to higher productivity, as well as due to the high cost of wood obtained from logging of natural forests The risks of using biotechnology will be in the genetic exchange between transgenic and wild trees, which is very undesirable. Transgenic technology turned out to be controversial when it related to agriculture, and part of the controversy is now flowing to forestry. GMOs in agriculture are being persistently introduced by the most powerful multinational corporations into the food market of the world. But the warnings of many scientists, who experimentally (on

animals) prove, are equally insistent. the high level of danger of GMO consumption in food for both humans and animals. Many countries have abandoned the cultivation of GMO vegetables, berries and other products.

References:

1. Aeshina, E.H., & Velichko, H.A. (2008). Regeneration of Juniperus sibirica V. In vitro Text. V.N. Sukachev Institute of Forest SB RAS, Krasnoyarsk, Russia. *"Conifers of the boreal zone"*, No. 3 4, pp.333 - 336.
2. Ananyeva, L.I., Nikulin, S.S., Garshina, S.I. (2000). Sorption purification of industrial waters of meat processing enterprises Text. Izd. vuzov. *Food Technology*, No. 4, pp. 113-115.
3. (1983). *A.c. № 1021346. Tillage device* (Deryuzhkin, R.I., Nartov, P.S., Posmetyev V.I., Sukhov I.V., Semenov V.I.). Author's svid., Byul. No. 21, 1983.
4. (1990). *A.C. No. 1581238 Method of combating root-springing aspen in cuttings* (Deryuzhkin, R.I., Sukhov I.V.). Byul. No. 28, 1990. 4 p.
5. (1990). *A. S. No. 1597386 USSR, MKI, 12. Method of microclonal reproduction of Karelian birch* / Butova T.P., Tabatskaya T.M., Skrobova L.L. Byul. No. 37, publ. 7.10.1990.
6. (2001). *A.C. No.34777 Voronezh alder* / T.A. Blagodarova. Registered in the State Register of Breeding Achievements approved for use from 5.06.2001.
7. (2007). *A.C. for selection achievement No. 44340 Priyarsky Poplar* / A.I. Sivolapov, Voronezh State Forestry Academy. According to application No. 9464178,2007.
8. Akhmadullin, I.S. (2011). Examination of birch trees of the Republic of Tatarstan for the purpose of selection of clones for microclonal reproduction by in virto method Text. *Vestn. Kazan State University*, No. 4. pp.112 -114.
9. Bagaev, S.N. (1987). Reproduction of Karelian birch Text. *Lesn. x-vo.*, No. 9, pp. 40 - 41.
10. Bakulin, V.T. (1966). Triploid clone of aspen in the forests of the Novosibirsk region. *Genetics*, No. 11, pp. 58-68.
11. Bakulin, V.T. (2010). *Fragrant poplar in Siberia Text.* (p.110). Novosibirsk: Academic publishing house "Geo".
12. Bander, B.JI. (1959). Karelian birch in the Karelian ASSR Text. *Tr. Latv. agricultural farm. akad.*, Issue VIII, pp. 353 - 365.
13. Barsukova, T.L. (1989). Anatomical structure of shoots of Karelian birch Text. *Izv. vuzov. Lesn. zhurn.*, No. 5, pp. 14-17.
14. Bellegarde, A.L. (1971). *Steppe afforestation Text.* (p.336). Moscow: "Lesn. prom-st".
15. Blagodarova, T.A. (1995). *Selection of black alder (Alnus glutinosa (L) Gaertn.) for breeding in the Central Chernozem region:* Abstract of the dissertation of the Candidate of Agricultural Sciences. (p.19). Voronezh.
16. Blagodarova, T.A., & Popov, V.K. (1994). *Selection in natural populations and the creation of black alder cultures in the Central Forest Text.* Selection and its use in improving forest species: Collection of scientific tr. (pp.97-104). Voronezh: NIILGiS, Kvadrat.
17. Blagodarova, T.A., Nikulin, S.S., & Sivolapov, V.A. (2005). *The value of quaternary ammonium salt for rooting green cuttings of gray alder Tex*t. Fruit-growing, seed-growing, introduction of woody plants. Materials of the VIII International Scientific Conference. Krasnoyarsk: SibSTU, (4th edition).
18. Blagodarova, T.A., & Sivolapov, V.A. (2010). *Selection of alder in TSCHO Text.* Achievements and problems in forest genetics and breeding (to the 40th anniversary of NIILGiS): collection of scientific tr. (pp.199-210). Voronezh: NIILGiS.
19. Bogdanov, P.L. (1960). *Selection and hybridization of poplars. Distant hybridization of plants and animals.* (pp. 209-220). Moscow.
20. Borodin, A.M. (1983). *Program forests.* Text. (p.239). Moscow: Lesn. prom-st.
21. Butova, G.P. Tabatskaya, T.M., & Skrobova, L.L. (1991). *The use of tissue culture methods for reproduction and genetic improvement of forest woody plants Text.* Genetics and selection in forestry. (pp.41-49). Moscow.
22. Bukvareva, E.H., & Aleshchenko, G.M. (2005). *Optimal diversity in natural populations and communities.* Modeling results Text. Proceedings of the Second Congress of the Society of Biotechnologists. Russia. Moscow, October 13-15, 2004 / Edited by R.G. Vasilova. (pp. 13-19). Moscow: "Delta".
23. Bychenkova, E.A. (1967). *Organogenesis in the primary culture of some woody plants and the influence of a number of physiologically active substances on it Text*. Messages on the anatomy and physiology of woody plants. (pp.39-42). L..

24. Verezhnikov, V.N., Nikulin, S.S., Poyarkova, T.N., & Garshin, A.P. (1997). Prospects of isolation of synthetic rubbers from latex by organic coagulants. *Bulletin of the Tambov University*, Vol.2, issue 1, pp. 47-52.
25. Veresin, M.M. (1963). *Forest seed production Text.* (p.158). Moscow: Goslesbumizdat.
26. Veresin, M.M., Mamyrin, M.A., Shemyakin, I.Ya., & Yakubyuk, N.Ya. (1963). *Centenary experience of afforestation in Savalsky forestry Text.* (p.162). Moscow: "Goslesbumizdat".
27. Veresin, M. (1971). *Voronezh Forests Text*. (p.224). Voronezh: "Central Chernozem Book Publishing House".
28. Veresin, M.M., & Tsarev, A.P. (1974). On the results of variety testing of poplars in the Voronezh region Text. Genetics, selection and introduction of forest breeds. *Topics. collection of scientific tr.* Issue 1. Voronezh, pp. 31-42.
29. Veresin, M.M., & Tsarev, A.P. (1974). On the results of variety testing of poplars in the Voronezh region Text. Genetics, breeding and introduction of forest breeds. *Collection of scientific tr.* Voronezh: VNIILM, pp. 31-42.
30. Veresin, M.M., Efimov, Yu.P., & Arefyev, Yu.F. (1985). *Handbook of forest breeding seed production Text*. (p.245). Moscow: Agropromizdat.
31. Veretennikov, S.S., & Kupriyanov, N. V. (1987). Plantation cultivation of spruce Text. *Lesn. x-vo.* No. 2, pp.69-70.
32. Vodin, A.B. (2007). *Phenological forms of Siberian cedar according to the timing of the start of pollen departure Electronic resource.* GO VPO "Siberian State Technological University". Electronic Library Retrieved from http://scholar.google.com/
33. Voronin, I.V., Senkevich, A.A., & Bugaev, V.A. (1975). *Economic efficiency in forestry and agroforestry production* Text. (p.176). Moscow: "Forest industry".
34. Gavrilova, I.A. (1971). *Comparative assessment of anatomical features of wood of some species and hybrids of poplars*. Text.: Abstract. dis. cand. biol. nauk: (p.23). L..
35. Groshev, I.V. (1995). Application of polyalisbrolites based on N.N-dietil-N.N-*dillylamonyl chloride in the production of fiberboard for wastewater treatment.* Abstract of the diss. for the application of the uch. step. Candidate of Technical Sciences. (p.21). MINSK.
36. Globa-Mikhaylenko, D.A., & Commercial, E. N. (1995). Industrial breeding of oak changeable Text. *Lesn. x-vo.*, No. 4, p. 33.
37. Gorobets, A.I., & Loginova, L.A. (2004). Productivity and technical characteristics of the vine on the willow plantation of the Semiluksky nursery. *Nature management: resources, technical support: Inter-university collection of scientific works.* Issue 2, Edited by prof. F.V. Posharnikov. (pp.18-22). Voronezh: VGLTA.
38. Davydov, M.V. (1960). *Black alder of the European part of the USSR.* Text. Publishing house of the Ukrainian Academy of Agricultural Sciences, (p.113). Kiev.
39. Davidov, M.V. (1976). Features of the growth of black walnut plantations Text. *Forestry*, No. 8, pp. 43-45.
40. Danchenko, A.M. (1992). *Biology of fruiting and fundamentals of birch seed production* Text. (p.126). Krasnoyarsk.
41. Dotsenko, A.P. (1986). Reforestation on an industrial basis Text. *Lesn. x-vo*, No. 1, pp. 37-39.
42. Dreiman, E. (1978). Results of vaccinations of Karelian birch Text. *Scientific tr. LSHA*. Riga, Issue 164, pp. 31-35.
43. Zhukov, A.B. (1958). The basic principles of creating pure and mixed cultures Text. *Forest. household*,- No. 2, p.118.
44. (1986). *Laying and cultivation of timber plantations of spruce and pine* Text.: method, recommendations of LenNIILH, BelNIILH, UkrNIILH; comp. I.V. Shutov, (p.105). L..
45. Evdokimov, A.P. (1989). Biology and culture of Karelian birch Text. (p.226). L.: LSU.
46. Egorova, T.A., Klunova, S.M., & Zhivukhina, E.A. (2008). Fundamentals of biotechnology: textbook Text. (p.208). Moscow: Publishing center "Academy".
47. Ermakov, B.S. (1975). *Growing seedlings by cuttings.* Text. (p.152). Moscow: "Lesn. prom-st".
48. Ermakov, V.I. (1986). *Mechanisms of birch adaptation to the conditions of the North Text.* (p.144). L.: Nauka.
49. Efimov, Yu.P. (1997). *Genetic and breeding assessment of objects of permanent forest seed base* Text. Genetics and breeding in the service of the forest: mater. International Scientific and Production Conference. (pp.298-307). Voronezh: NIILGiS.
50. Efimov, Yu.P., & Hirov, A.A. (1983). Seed production and selection of tree species in the Hungarian People's Republic Text. *Forestry*, No. 3, pp. 76-77.
51. Efimov, Yu.P. (2010). *Seed plantations in breeding and seed production of scots pine* Text. (p.253). Voronezh: publishing house "Istoki".
52. Ivannikov, S.P. (1971). *Breeding and use of poplars in the USSR and abroad (review)* Text. (p.105). Moscow: CBNTI.
53. Ivannikov, S.P. (1980). *Topol.* (p.85). Moscow: Forest industry.
54. Ivannikov, S.P., & Rostovtsev, S.A. (1965). Cellulose content and wood fiber sizes in

different varieties of poplars. *Lesn. x-vo.*, No. 5, pp. 37 - 42.

55. Isakov, I.Yu. (2001). *The influence of the pollination method on the breeding features of the seed progeny of Betula pendula Roth, and V. Pubescens Ehrh*. Abstract of the Candidate of Agricultural Sciences. (p.19). Voronezh.
56. Kavtaradze, D.N. (2005). *Biotechnology and socially acceptable risks of managing highly complex systems* Text. Proceedings of the Second Congress of the Society of Biotechnologists of Russia. (pp.41-44). Moscow, October 13-15, 2004 / Edited by R.G. Vasilova. Moscow: "Delta".
57. Kazantseva, E.V. (1997). *Population-genetic analysis of Karelian birch and vegetative reproduction of its valuable forms* Text. Autoref. Dis. Candidate of Agricultural Sciences. (p.24). Moscow.

Impact Factor:					
	ISRA (India) = 6.317	SIS (USA) = 0.912	ICV (Poland) = 6.630
	ISI (Dubai, UAE) = 1.582	РИНЦ (Russia) = 3.939	PIF (India) = 1.940
	GIF (Australia) = 0.564	ESJI (KZ) = 8.771	IBI (India) = 4.260
	JIF = 1.500	SJIF (Morocco) = 7.184	OAJI (USA) = 0.350

SOI: 1.1/TAS DOI: 10.15863/TAS

International Scientific Journal

Theoretical & Applied Science

p-ISSN: 2308-4944 (print) **e-ISSN:** 2409-0085 (online)

Year: 2022 **Issue:** 12 **Volume:** 116

Published: 22.12.2022 **http://T-Science.org**

Issue Article

Parakhat Allambergenovich Mamutov
Nukus branch of the State Conservatory of Uzbekistan
Deputy Director for Youth Affairs and Spiritual and Educational Work

FORMATION OF A STABLE NATIONAL CREATIVE TEAM IN KARAKALPAK THEATER ART

Abstract: *This article describes the stages of development of Karakalpak theatrical art, the formation of a stable national creative team at the Karakalpak State Academic Musical Theater named after Berdakh, which has been operating since 1926 and has been an example to other creative teams since independence, the originality of the actors' performance, the issues of directing.*

Research methods: Historical processes at the Karakalpak State Academic Musical Theater named after Berdak, ideological styles in performances, originality in the performance of actors, directing and sienography.

Research results: Since 1926, the Korakalok State Academic Musical Theater, named after Berdak, has been steadily developing and developing a stable national ideological community.

Practical application: In order to develop the activities of the Association of Karakalpakstan Theaters, to create national works and to increase the artistic potential of theatrical actors, to take measures to establish and further strengthen international relations.

Key words: *Theater, Berdak, director, actor, play, drama, style, method, history.*

Language: *English*

Citation: Mamutov, P. A. (2022). Formation of a stable national creative team in Karakalpak theater art. *ISJ Theoretical & Applied Science, 12 (116),* 742-745.

Soi: http://s-o-i.org/1.1/TAS-12-116-63 ***Doi***: crossref https://dx.doi.org/10.15863/TAS.2022.12.116.63

Scopus ASCC: *1201.*

Introduction

Substantiation of the topic and its relevance: We study the process of formation of Karakalpak theatrical art in the brains of the Karakalpak State Academic Musical Theater named after Berdakh, which has been operating continuously since 1926 and has been an example to other creative communities since independence.

Karakalpak theaters have their own style and style since its inception. Although the main theme in Karakalpak theatrical art in the post-war years was related to the post-war reconstruction period, there were themes in the lives of different people. All performances featured a struggle between life events, old and new. The relentless research has given impetus to the development of our national drama.

The period when the "Dawn Light" troupe was formed covers the years 1926-1930. The troupe will have 13 creative and technical staff. Jolmurza Aymurzaev, Aytbay Matyakubov, Genjebay Ubaydullaev, Madreyim Matjanov, Jumagul Seytova, Gurbangul Bekmuratova, Maryam Temirkhanova, Perdegul Saekeeva, T.Ismetullaeva, Q.Allaniyazov, Bayniyaz Seytov, J.Pirnazarov, O.Toremuratov. The names of these people became the swallows of the troupe "Dawn Light", today's Karakalpak theater. During these years, the theater was one of the amateur theaters. The staged performances are very simple. The actors did not know the stage speech, the acting skills. Nevertheless, dramaturgy developed. Musical dramas were written. The audience loved the music. The creative style of these years can be called a very simple, amateur team.

Research goals and objectives

The opening of the Tashkent State Institute of Theater and Art named after AN Ostrovsky (now the Uzbek State Institute of Arts and Culture) in 1945 was a great innovation in Central Asian theatrical art. In 1955, 9 young people graduated from the first Karakalpak course in acting. Among them: Sh. Utemuratov, Z. Piyazov, A. Abdaliev, A. Juzimbetov,

A. Khojanazarov, A. Juginisov, B. Tursynov, J. Babanov. One or two groups of graduates of the acting faculty of the institute have contributed to the further development of the stage culture of our theater. In recent years, R. Tureniyazov graduated from the department of directing, in 1963, K. Abdreymov, B. Matchanov, K. Zarymbetov and others graduated from the department of drama and film acting.

In 1966, the director of the musical drama department, People's Artist of Uzbekistan Najimatdin Ansatbaev, People's Artists of Karakalpakstan Dosbergen Ranov, Khojabergen Ayymbetov, Honored Artist of Karakalpakstan Ajar Ansatbaeva joined the theater. Over the years, directors such as Kuvatboy Abdreymov, Najimatdin Ansatbaev, Reyimbay Tureniyazov have created their own style in the theater. Each director came on stage with their new idea. With a new era in mind, performances begin to take the stage.

He tried to create new poses on adomestic theme, which is included in the repertoire of our national theater, which has a wide range of creative opportunities. Thanks to tireless work of directors K. Abdireimov and H. Ansatbaev, the Karakalpak theater became famous among the Soviet Republics. “Othello” by Shakespeare, “ Abu Raykhon Beruni” by Saidjonov, “Novoi in Astrobod” by Makhsumov, “Karakalpak girl” by Baindiev and Abdulov, “On a moonlit night” by Karim, “Gerostrat” by Gorin, “ Orbang should not be overturned” by Ioselani, “ The man who deceived Azroil” by Minnullin, “With his own application” by Umarbekov. He carefully assessed the potensial of the actors. He focused on acting skills. This is the result of the efforts of Islam Alibekov , who created the stage for this year’s large-scale productions, and the power of methods and techniques created in the theatrical arts.

Talented young actors Dosbergen Ranov, Khojabergen Ayymbetov, Utep Kurbanbaev, Raykhan Saparova, Tursungul Kayypnazarova, Marjan Khalmuratova, Mambetbay Sadykov, Jalgasbay Sultabaev, Ajar Ansatbaeva, Zaure Saypova, Azat Ansatbaev will start their careers. These were the years of theatrical research, full of professionalism.

During this period, the theater took part in many festivals of Union theaters and took its rightful place. In 1977, the theater was awarded the Order of the Badge of Honor. K. Rakhmanov's play "Wounded Hearts" (directed by N. Ansatbaev) won the first place in the festival of performances on the theme of the war years, which was held in 1980 among the theaters of the Republic of Uzbekistan.

The 1980s were a time when, from all simplicity, complex works were created. Now there were enough opportunities to stage large-scale works. It’s time to show the national opera and ballet. In 1985, talented young people graduated from the musical drama course. Among them are People's Artists of Uzbekistan Mirzagul Sapaeva, Bazarbay Uzakbergenov, Honored Artist of Uzbekistan, People's Artist of Karakalpakstan Umirbay Kasimbetov, Karakalpak artist Alimbay Seytekov, Honored Artist of Karakalpakstan Sarsenbay Uzakbaev, Ulbosyn Yusupova, Quatbay Daniyarov. The role of directors and actors in the multi-genre nature of the theater is great, because young directors and actors must create a unique style based on their skills, because the development of theater plays an important role in the future of the actor and the theater.

In 1987, the first Karakalpak national opera "Ajiniyaz" was staged. Well-known composer, artist of Uzbekistan and Karakalpakstan N. Muhameddinov will create our national opera "Ajiniyaz". The libretto was written by the hero of Uzbekistan, People's Poet of Uzbekistan and Karakalpakstan I. Yusupov. The staging of the opera marked a new direction for the theater.

Conclusion

The steps of the theater's success continued during the years of independence. After the independence of the Republic of Uzbekistan, as in all spheres of development, the theaters of the Republic began to develop in new ways. In the first year of independence, our theater was named after our great democratic poet Berdakh. Special attention was paid to the arts, including theaters, and a number of resolutions and decrees were developed. The theater must keep pace with the times, Of course, the word bo has found its proof. The reason is that in any period, the theater lives with the pain and joy of this people. History shows us that each epoch has its own living conditions, policies.

For reference, it should be noted that in recent years, our country has been pursuing an effective foreign policy. Cultural, ideological and friendly ties are strengthening. In particular, in the last 4-5 years, significant changes in this area, as well as new ionic steps in our foreign policy, are creating a time for the opening of the pages of history.

Especially today, great historical changes are taking place in the direction of more effective organization of joint work between Uzbekistan and Turkey in political, economic, investment, cultural and humanitarian spheres. It should be noted that Turkey is the first country in the world to recognize the independence of the Republic of Uzbekistan among more than 200 countries.

Today, cultural, friendly and creative ties between the Uzbek and Turkish peoples are becoming stronger and stronger. Festivals, competitions, symposiums and forums, exhibitions, cultural events in various areas of culture are proof of our words. Our Karakalpak State Academic Musical Theater named after Berdakh 2021,On July 1-17, the Turkish Ministry of Culture and Tourism will host the XXI Black Sea International Theater Festival in Trabzon,

Turkey. Aitmatov's performance "Jamiyla". “Every year, theatergoers from different countries of the world come to Turkey for this festival. Of course, each of the iody teams that rode the tashrio has a power flicker in their minds. The reason for this was that the theater troupe was at the next international festival after the international theater festival in 2008 in the Republic of Turkmenistan and in 2009 in Egypt”.

The XXI Black Sea International Theater Festival in Trabzon Aitmatov's play "Jamiyla" was staged by a young director Markabay Usenov, who achieved many successes and won the hearts of the audience. The team of our Academic Theater successfully participated in the festival and was awarded by the organizers with a letter of thanks and souvenirs.

On February 26, 2020, the premiere of the comedy “Malyar” by Turkish playwright Tuncer Djudjenoglu (Tuncer Cucenoglu) took place at the Karakalpak State Academic Musical Theater named after Berdakh. The play was directed by Markhabay Usenov. The audience was greeted with applause in support of every aspect of the performance.

The team of the Karakalpak State Academic Musical Theater named after Berdakh, using the care provided, is staging performances that will please our people and meet today's requirements. Theatrical repertoire includes performances in historical genres, patriotic themes, friendship of peoples, kindness to each other, human values.

References:

1. Allanazarov, T. (1996). *National directing style at the Karakalpak theater*. - Nukus: Bilim.
2. Allanazarov, T. (1987). *Nekotorıe voprosı istorii karakalpakskoy sovetskoy dramaturgii*. – Nukus: Karakalpakstan.
3. Allanbaev, R. O. (2022). Ispolnitelskoe iskusstvo karakalpakskogo eposa: istoriya, razvitie. *Problemı sovremennoy nauki i obrazovaniya*. – Moskva: Presto. ISSN 2413-4635, pp. 50-53.
4. Bayandiev, T. (2011). *Istoriya karakalpakskogo teatra*. – Tashkent: UzGSI.
5. (1940). *Kyzyl Karakalpakstan. (newspaper)*. Let's develop our art on December 4, 80280 (2752). (“Theater of Jas” Albanov, D. (1938). July 2, 50150 (2022). – Page 3.)
6. Mirziyoyev, Sh. M. (2017). *The development of literature, art and culture is a solid foundation for the development of the spiritual world of our people*. Speech at a meeting with representatives of the creative intelligentsia of Uzbekistan. The word of the people. August 4.
7. Mahmudov, J., & Mahmudova, X. (2008). *Basics of directing*. (p.224). Tashkent: National Encyclopedia of Uzbekistan.
8. Marziyaev, J. K. (2020). The principles of the development of present Karakslpakstan's mass media. *International Scientific Journal (ISJ) Theoretical & Applied Science.* – Philadelphia, USA. 03 (83), 500, pp. 274-277. http://www.t-science.org/arxivDOI/2020/03-83/PDF/03-83-52.pdf
9. Marziyaev, J. K. (2022). *Obzor peredach karakalpakskogo televideniya: istoricheskiy podxod.* Donetskie chteniya 2022: obrazovanie, nauka, innovatsii, kultura i vızovı sovremennosti: Materialı VII Mejdunarodnoy nauchnoy konferentsii. (pp.357-340). Donetsk: Izd-vo DonNU. Retrieved from http://science.donnu.ru/wp-content/uploads/2022/10/dch_2022-tom-4-filologicheskie-nauki-chast-1.pdf
10. Kamalova, D. E. (2022). *Rol xudojestvennoy detali v kompozitsii proizvedeniya (Na primere karakalpakskoy literaturı)*. Donetskie chteniya 2022: obrazovanie, nauka, innovatsii, kultura i vızovı sovremennosti: Materialı VII Mejdunarodnoy nauchnoy konferentsii. (pp.194-197). Donetsk: Izd-vo DonNU. http://science.donnu.ru/wp-content/uploads/2022/10/dch_2022-tom-4-filologicheskie-nauki-chast-2.pdf
11. Kamalova, D. E. (2022). Chronotope and its role in the composition of the work (On the example of Karakalpak literature). *ISJ Theoretical & Applied Science*, 09 (113), 105-109. Soi: http://s-o-i.org/1.1/TAS-09-113-19 Doi: https://dx.doi.org/10.15863/TAS.2022.09.113.19
12. Rahmonov, M. (1975). *Uzbek theater from ancient times to the XVIII century.* – Tashkent: Fan.
13. Tursunov, B. (1998). *Problems of dramaturgy and our theater*. (p.108). Nukus: Karakalpakstan.
14. Charshemov, J. A. (2022). The dramaturgy of A. Kozlovsky’s ballet “Tanovar”. *ISJ Theoretical & Applied Science*, 10 (114), 174-177. Soi: http://s-o-i.org/1.1/TAS-10-114-32 Doi:

https://dx.doi.org/10.15863/TAS.2022.10.114.32
15. (n.d.). Retrieved from https://berdax-teatr.uz/
16. (n.d.). Retrieved from https://kknews.uz/kk/84533.html
17. (n.d.). Retrieved from https://t.me/KRteatr/1230
18. (n.d.). Retrieved from https://t.me/kulturapressaRK/2971

Impact Factor:					
	ISRA (India) = 6.317	SIS (USA) = 0.912	ICV (Poland) = 6.630
	ISI (Dubai, UAE) = 1.582	РИНЦ (Russia) = 3.939	PIF (India) = 1.940
	GIF (Australia) = 0.564	ESJI (KZ) = 8.771	IBI (India) = 4.260
	JIF = 1.500	SJIF (Morocco) = 7.184	OAJI (USA) = 0.350

SOI: 1.1/TAS DOI: 10.15863/TAS

International Scientific Journal

Theoretical & Applied Science

p-ISSN: 2308-4944 (print) **e-ISSN:** 2409-0085 (online)

Year: 2022 **Issue:** 12 **Volume:** 116

Published: 23.12.2022 **http://T-Science.org**

Issue Article

Kuanishbek Jienbekovich Turekeev
Karakalpak Research Institute of Humanitarian Sciences of the Karakalpak Branch of the Academy of Sciences of the Republic of Uzbekistan, senior researcher, PhD in History, Nukus, Republic of Karakalpakstan

SOME PASTORAL TRADITIONS OF THE KARAKALPAKS IN THE CONTEXT OF THE ECOLOGICAL CRISIS

Abstract: *The article discusses the way of life and some traditions of the Karakalpak pastoralists in ecological conditions. This problem is highlighted on the materials of the author's field research in the region. Also, the collected data were compared with the ethnographic literature of neighboring peoples.*

Key words: *Karakalpaks, traditions, ecology, pastoralists, shepherds.*

Language: *Russian*

Citation: Turekeev, K. J. (2022). Some pastoral traditions of the Karakalpaks in the context of the ecological crisis. *ISJ Theoretical & Applied Science, 12 (116),* 746-749.

Soi: http://s-o-i.org/1.1/TAS-12-116-64 ***Doi***: crossref https://dx.doi.org/10.15863/TAS.2022.12.116.64

Scopus ASCC: *3300.*

НЕКОТОРЫЕ СКОТОВОДЧЕСКИЕ ТРАДИЦИИ КАРАКАЛПАКОВ В УСЛОВИЯХ ЭКОЛОГИЧЕСКОГО КРИЗИСА

Аннотация: *В статье рассматривается образ жизни и некоторые традиции каракалпакских скотоводов в сложившихся экологических условиях. Данная проблема освещается на материалах полевых исследований автора в регионе. Также собранные данные сопоставлялись с этнографической литературой соседних народов.*

Ключевые слова: *Каракалпаки, традиции, экология, скотоводы, чабаны.*

Введение

Благодаря климату и рекам, протекающим по территории республики, здесь с древнейших времён и по сей день широко развиваются скотоводческие традиции и культура. Этот вопрос, находясь в центре внимания учёных, стимулировал их продолжительные научные изыскания. Так, в трудах А.В.Каульбарса, Л.П.Толстовой, Х.Есбергенова нашли отражение исконные поверья, обычаи и традиции каракалпаков, связанные со скотоводством (2, с. 176-201; 4; 7, с. 98-100, 104-111). В годы независимости этот вопрос был отдельно изучен узбекскими учёными Я.А.Турдимуратовым и А.Ш.Эшмухаматовым на примере Сурханского и Джизакского оазисов (8; 9).

Несмотря на обширный пласт этнографической научной литературы, в ней были рассмотрены образ жизни и традиции скотоводов в сложных экологических условиях. Именно поэтому мы попытались изучить жизнь скотоводов нашего региона.

Уклад жизни скотоводов республики можно рассмотреть на примере кочевых, полукочевых и оседлых общин. Согласно результатам полевых исследований, проведенным в Каракалпакстане, в некоторых местностях Чимбайского, Караузякского и Тахтакупырского районов до сих пор продолжает сохраняться кочевое скотоводство. В южных районах региона (почти во всех аулах, за исключением некоторых степных зон) мы наблюдаем скотоводство, в основе которого лежат традиции оседлой культуры. Исходя из этого в целях изучения поверий, обычаев и обрядов чабанов, мы в основном

стремились вести полевые исследования в северных районах страны.

В настоящее время почти во всех районах нашей республики выращивается крупный и мелкий рогатый скот. В Чимбайском, Караузякском, Тахтакупырском и других районах в основном разводят коз, крупный рогатый скот, частично овец, лошадей и верблюдов. Однако рассматривая их содержание в домашних условиях, мы выявили, что поголовье этих животных значительно ниже по сравнению с прошлым веком. Так, в ауле Багман Чимбайского района в конце прошлого века в каждом подворье имелось 10-20 голов скота, а в наши дни этот показатель в среднем не превышает 5 голов. Если в прежние времена в этом ауле в каждой семье имелась, по крайней мере, хотя бы одна лошадь, то в настоящее время, как оказалось, они есть лишь в двадцати домах. При сравнении поголовья коз, выращивавшихся в данном ауле, мы увидели, что в конце прошлого века в каждой семье имелось в среднем 50 голов, а в последние годы содержание даже 20 голов является весьма затруднительным (13; 15). По утверждению одного из наших респондентов, основные причины резкого сокращения поголовья скота заключаются в отсутствии постоянных источников проточной воды, резком повышении температуры воздуха, вследствие чего происходит острый дефицит пастбищного корма как основного источника питания скота (15).

Говоря о воде, следует особо отметить, что сельское население для поения скота использует проточную воду и воду из артезианских скважин. Если в конце прошлого века в степных зонах и отдалённых аулах было широко распространено использование колодезной воды, то в начале нового века, как выяснилось, это наблюдается намного реже. Полевые исследования, проведенные в 2013 году в Бозатауском и Чимбайском районах показали, что из-за дефицита воды вследствие засухи в реках резко возросло потребление колодезной воды, а отсутствие достаточных запасов водных ресурсов стало причиной падежа скота (11).

Водная проблема наблюдается во всех регионах нашей страны, что отмечается и учёным-этнологом Я.А.Турдимуратовым, изучавшим южные области Узбекистана (8, с. 11-12).

Как результат экологических изменений, происходящий в том числе из-за резкого повышения температуры в связи с глобальным потеплением, мы наблюдаем перемены в растительном мире а, следовательно, и в кормах для скота, с острым дефицитом которых столкнулись животноводы. По сведениям, собранным в Чимбайском, Караузякском и Тахтакупырском районах, в годы водного изобилия крупный рогатый скот не потреблял *боян* (солодка), а в настоящее время кормом служит любая доступная растительность на пастбищах. Следует также отметить, что в прежние времена козы совершенно не ели растение *жынгыл* (тамариск), но из-за недостатка трав в наше время это растение стало для них своего рода деликатесом (15).

В течение летнего сезона животноводы заготавливают корма для животных на зиму. Не ограничиваясь пастбищными травами, сельское население занимается заготовкой кормов, состоящих из кукурузы, отрубей, жмыха, рисовой соломы, которыми обычно дважды, а иногда один раз в день кормят скот в зимнее время. Нехватка кормов ведёт к снижению веса скота и сокращению поголовья пород.

По сведениям наших респондентов, изменения в поголовье животных по сравнению с прошлыми годами в заметной степени происходят в связи с экологическими факторами. Житель местности, проживающий в сельском сходе граждан имени А. Досназарова Караузякского района отмечал, что «если несколько лет назад окот у коз наблюдался дважды в год, то в настоящее время он происходит лишь раз в год» (12). Такая же ситуация наблюдается и в разведении крупного рогатого скота. Поскольку нехватка кормов ведет к снижению веса коров, то и отёл у них происходит реже. Обычными стали случаи, когда из-за диареи у стельных коров происходит замирание развития плода и самопроизвольный выкидыш. Из-за резкого повышения климатических температур у скота, пасущегося на солнце, участились случаи диареи.

Сильная жара ведёт к сокращению водных ресурсов и, как следствие, к нехватке хороших пастбищных трав, в результате чего у коров и у других копытных домашних животных участились случаи появления новорожденных с какими-либо врождёнными аномалиями. Полевые исследования последних лет показывают, что в аулах чаще стали наблюдаться случаи рождения телят с короткими, кривыми и слабыми ногами. Так, на территории сельского схода граждан Макпалкуль Тахтакупырского района в 2021 году наблюдались случаи рождения козлят с отсутствием какого-либо органа (16).

В сложившихся условиях в целях улучшения пород и увеличения поголовья скота эффективные результаты могут быть достигнуты за счёт применения старых, проверенных временем способов. Для улучшения породного состава стада (крупный рогатый скот, овцы, козы) следует чаще (каждые 2-3 года) скрещивать животных с чистопородными производителями, а также выпасать поголовье в смешанном виде. Практика выпаса смешанного стада имелась и у узбеков, поскольку при этом овцы содержались вместе со своими ягнятами, и не допускалось их

бессистемное скрещивание. Для воспроизводства породы овец каждые два года производилась замена самцов. Считалось, что при отсутствии притока новой крови происходит вырождение породы. У чабанов, не соблюдающих это правило, в стаде часто рождались нежизнеспособные ягнята (8, с. 11-12). Чабаны также следуют правилу смешанного выпаса чистопородного скота. По утверждению одного из наших респондентов, «на сто коров приходится четыре быка-производителя, если их будет больше, то никакой пользы от этого нет, также необходимо довольно часто, каждые несколько лет, производить замену быков».

В связи с этим хотелось бы привести некоторые сведения о чабанах, выращивающих крупный и мелкий рогатый скот. В ходе полевых исследований нам удалось собрать интересный материал, позволяющий характеризовать их следующим образом: люди, выбравшие профессию чабана; *гезекши шопанлар*[1]; временно (поденно) пасущие скот люди.

Профессию чабана (людей, занимающихся выпасом скота, у каракалпаков принято называть *«шопан»*. Пасущих крупный и мелкий рогатый скот называют *«падашы»*, лошадей - *«жылқышы», «жылқыман»*, верблюдов - *«түйекеш», «түйекешлик»* (5, с. 275, 518, 660, 739), в основном такое занятие выбирают люди из бедных семей, сироты; не имеющие образования[2]; нуждающиеся в социальной защите или унаследовавшие это занятие от своих отцов. Основным местом их проживания обычно является подворье богатых скотоводов. Месячный заработок чабана устанавливается по договорённости с владельцем стада. Месячная заработная плата чабана, пасущего стадо крупного и мелкого рогатого скота, поголовье которого составляет около 100 голов, варьируется от 500 тысяч до 1 млн. сумов. Размер оплаты зависит от поголовья скота. Если в стаде основную часть составляет крупный рогатый скот, то и заработок чабана выше (14). В отличие от каракалпаков, у туркменских животноводов обычно объединяются несколько фермерских хозяйств, при этом на каждое стадо в 500-600 голов нанимается один чабан на шесть месяцев (лето и осень), а его труд обычно оплачивается в натуральной форме, т.е. за каждые 15 выращиваемых овец он получает 1 ягненка, 2 чаши муки и шерсть с одной овцы (6, с. 61). У таджиков Куляба в течение одного сезона за каждую выращиваемую особь крупного рогатого скота давалось 5 кг, а за овцу или козу 2,5 кг пшеницы (1, с. 178-179). У каракалпаков тоже встречается подобный способ оплаты. Если владелец стада, помимо животноводства, занимается фермерством, то в период сбора урожая он снабжает продовольствием чабана из расчёта членов его семьи. Помимо этого преимущества чабан получает дополнительный доход путем выпаса скота соседей или родственников богатых животноводов. Так, при уходе за мелким рогатым скотом за каждую особь чабан получает 20 тыс., а за особь крупного рогатого скота около 50 тыс. сумов в месяц.

Чабанов, относящихся ко второму типу, в народе называют «*гезек*». Независимо от рода своих занятий, жители аула поочерёдно пасут стадо односельчан. Содержание общинного стада способом *«гезек»* можно наблюдать почти во всех аулах Каракалпакстана, при этом очерёдность устанавливается по количеству семейств, проживающих в ауле. Например, если в ауле проживает 20 семей, каждая из которых отправляет в общинное стадо свой скот, то и очередь, соответственно, приходится на каждый двадцатый день. Если же семья содержит свой скот в личном подворье, то она освобождается от этой обязанности. Следует упомянуть, что традиционно выпасом стада занимались лишь мужчины. Однако в исключительных случаях этим приходится заниматься и женщинам.

Важную роль в жизни чабанов имеют собаки. В особенности всегда ценились сильные, бесстрашные собаки, способные защитить стадо от волков и других хищников. Будучи чрезвычайно чуткими животными, собаки не только предупреждают чабана о грозящей опасности, но и способны противостоять, а иногда и уничтожить напавшего на скот хищника. Чабаны всегда уделяли особое внимание выращиванию и питанию таких собак. Опираясь на собранный материал, можно сказать, что пастухи соседних народов всегда содержали несколько собак. Например, у туркмен при выпасе стада использовались две или три собаки (3, с. 135).

У сурхандарьинских узбеков при стаде принято иметь двух собак, т.е. самца и самку. Если поголовье стада превышает тысячу голов, то обычно содержат две пары сторожевых собак (8, с. 69). Породе собак тоже придавалось особое значение, высоко ценились туркменские алабаи. В Каракалпакстане спрос на собак этой породы всегда оставался высоким. Именно поэтому в Бозатауском и Тахтакупырском районах особое внимание уделяется разведению алабаев. По утверждению животновода А.Алланова, проживающего в Чимбайском районе, «если

[1] *Гезек* – жители аула, пасущие скот по очереди.

[2] В ходе полевых исследований нам встречались чабаны, никогда не имевшие паспорта или каких-либо других документов, удостоверяющих их личность.

волкодавы приносят потомство весной, то их щенков выпаивают козьим молоком, выращивая их в хлеву вместе с новорожденными козлятами. Если выращивать волкодава таким образом, то в будущем он сможет защитить стадо от хищников» (14).

Эта древняя порода собак, широко распространенная у народов Центральной Азии, в русскоязычной литературе встречается под названием «среднеазиатская овчарка», у туркмен и киргизов известна как «алабай», у казаков – «төбет», у узбеков – «бурибасар», а у каракалпаков «борибасар», т.е. волкодав (10). По свидетельству сельских жителей, эти собаки получили такое название благодаря своей силе и способности защитить стадо от волков.

Не все каракалпакские животноводы могли содержать алабаев, поскольку для них требуется много корма. По этой причине большинство чабанов держали обычных собак. Таких домашних собак каракалпаки называют *«көпек ийт»*. По сравнению с алабаями, эти собаки обычно уступают им в размерах, но отличаются особой ловкостью. При выпасе скота наряду с основной задачей, заключающейся в защите стада от хищников, собаки помогают перегонять скот и даже возглавляют его.

Опираясь на результаты полевых исследований, проведённых в нашей республике, следует сказать, что вследствие повышения температуры воздуха, экологической катастрофы и проблем в системе водного обеспечения региона, в сельскохозяйственных традициях, особенно в жизненном укладе животноводов отчётливо прослеживается отрицательное воздействие экологических факторов. В связи с этим происходит сокращение поголовья скота и на свет рождаются телята (ягнята, козлята) с врождённой патологией. Из-за водного дефицита резко снизился уровень воды в колодцах, что ведёт к утрате традиций, связанных с ними. Нашёл подтверждение вывод о том, что ключевую роль в выращивании и сохранении скота играют чабаны. Словом, экологические факторы, изменяя жизненный уклад, сложившийся у скотоводов на протяжении многих веков, вынуждают их отказаться от некоторых традиций, обычаев и обрядов, но, тем не менее, они продолжают бороться за их сохранение.

References:

1. Abduvakhidov, R. (2011). *Traditsionnoe jivotnovodstvo tadjikov kontsa XIX nachala XX vv. (sposobi i metodi uxoda za skotom).* (p.178-179). Scientific notes.
2. Esbergenov, H. (1980). *Perejitki verovaniy i obryadov, svyazannix s xozyaystvom*. Etnografiya karakalpakov XIX-nachalo XX veka (materiali i issledovaniya). Tashkent: Fan.
3. Demidov, S.M. (2016). *Traditsionnoe xozyaystvo turkmen: zemledelie, skotovodstvo, ribolovstvo, oxota.* Turkmeni (Narodi i kul'turi). (p. 113-157). Moscow: Nauka.
4. Kaulbars, A.V. (1887). Drevneyshie rusla Amu-Dar'i. *Zapiski imperatorskogo Russkogo geograficheskogo obshestva*, T.17, No. 4, St. Petersburg.
5. (1958). *Karakalpaksko-russko slovar.* Moscow: State Publishing House of Foreign and National Dictionaries.
6. Niyazklychev, K. (1963). *O skotovodcheskom i zemledel'cheskom xozyaystve Yugo-Zapadnogo Turkmenistana kontsa XIX-nachala XX veka*. Trudi Instituta istorii, arxeologii i etnografii AN Turkmenskiy SSR. (p. 58-70). T. VII. Ashgabat.
7. Tolstova, L.S. (1959). *Karakalpaki Ferganskoy dolini*. Nukus: KKGIZ.
8. Turdimuratov, Ya.A. (2020). *XX asrda Surxon-Sherobod vohasi areal xo'jalik madaniyati (chorvachilik misolida).* Tashkent: "UROK PRESS".
9. Eshmukhamatov, A.Sh. (2022). *Jizzax vohasi aholisining chorvachilik bilan bog'lik urf-odat va marosimlari.* Tar.fan. dok. (PhD) avtoreferati. Tashkent.
10. (n.d.). Polevie materiali avtora za 2013 g. Informator Kishkeneyov Turkmenbay. 1945 g.r. Chimbayskiy r-n.
11. (n.d.). Polevie materiali avtora za 2021 g. Informator Saliev Aralbay. 1969 g.r. Karauzyakskiy r-n.
12. (n.d.). Polevie materiali avtora za 2022 g. Informator Azibaev Sagiy. 1953 g.r. Chimbayskiy r-n.
13. (n.d.). Polevie materiali avtora za 2022 g. Informator Allanov Aman. 1983 g.r. Chimbayskiy r-n.
14. (n.d.). Polevie materiali avtora za 2022 g. Informator Tolegenov Yerkinbay. 1955 g.r. Chimbayskiy r-n.
15. (n.d.). Polevie materiali avtora za 2022 g. Informator Umbetov Markabay. 1962 g.r. Taxtakupirskiy r-n.

Impact Factor:					
	ISRA (India) = 6.317	SIS (USA) = 0.912	ICV (Poland) = 6.630
	ISI (Dubai, UAE) = 1.582	РИНЦ (Russia) = 3.939	PIF (India) = 1.940
	GIF (Australia) = 0.564	ESJI (KZ) = 8.771	IBI (India) = 4.260
	JIF = 1.500	SJIF (Morocco) = 7.184	OAJI (USA) = 0.350

SOI: 1.1/TAS DOI: 10.15863/TAS

International Scientific Journal

Theoretical & Applied Science

p-ISSN: 2308-4944 (print) **e-ISSN:** 2409-0085 (online)

Year: 2022 **Issue:** 12 **Volume:** 116

Published: 23.12.2022 **http://T-Science.org**

Issue Article

Charos Salomovna Chariyeva
Termiz State University
Teacher of the Department of Uzbek Language and Literature,
Uzbekistan

LEXICOGRAPHICAL CHARACTERISTICS OF RELIGIOUS WORDS IN THE UZBEK LANGUAGE

Abstract: *This article presents various views on the study of religious words in the Uzbek language, information and theoretical relations about dictionaries created on the basis of religious lexicon.*

Key words: *religion, religious lexicon, lexicography, encyclopedic dictionary, terminological dictionary, theological theory, heaven, hell.*

Language: *English*

Citation: Chariyeva, Ch. S. (2022). Lexicographical characteristics of religious words in the Uzbek language. *ISJ Theoretical & Applied Science, 12 (116),* 750-752.

Soi: http://s-o-i.org/1.1/TAS-12-116-65 ***Doi***: https://dx.doi.org/10.15863/TAS.2022.12.116.65

Scopus ASCC: *1203.*

Introduction

At the root of the idea of the Third Renaissance promoted by the head of our state in New Uzbekistan, educating young people in the spirit of self-realization with a deep understanding of the concepts of nationality and values, patriotism, and "perfect man" is one of the important needs of today's era. The role of religious knowledge is extremely important in the implementation of this necessity. Our Honorable President Sh.M. Mirziyoyev emphasized the importance of Islam in the world civilization and addressed this issue in his speech at the 72nd session of the UN General Assembly. we really appreciate it. We strongly condemn and will never compromise with those who associate our sacred religion with violence and bloodshed. Islam calls us to goodness and peace, to preserve original human qualities"[1.3].

Materials and Methods

Religion and religious values are the creation of humanity, and are connected to its soul. Philosophers, theologians, sociologists, and psychologists first studied the issues between religion and language due to the interest in self-realization of the human psyche and nature. "Since ancient times, religion has served as a means of controlling people, directing them to a single goal, and also providing knowledge and education. Although religious communication has existed since ancient times, scientific research in this field has appeared relatively recently. When people lived as a community, they resolved any relationship between them on the basis of religion, they received science, manners, and education through religion. For these reasons, the religious lexicon has been considered an important and integral part of human society in all times"[2.237].

As mentioned, religion and related knowledge have played a primary role in the development of the human psyche in all times and everywhere. In the pre-independence period, religious sources and rare works, which are the basis of the national values of the people, were distorted and interpreted. After we gained independence, there was an expansion of the scope of conducting research on the study of the religious lexicon. In particular, in the studies of T. Yuldashev, M. Umarkhojayev, M. Galiyeva, Sh. Sultanova in Uzbek linguistics, U. Qabilov and G. Toychiyeva in Uzbek literature, the issues of religion and philology have been thoroughly studied.

The unique aspect of religious texts is that they are not created by man, but are delivered by the Creator, and people cannot change them according to their wishes. We can witness the different interpretations of the religious lexicon, which is their basis, in a number of dictionaries. The term "religious lexicon" consists of lexical units specific to religious

language, that is, "people use within the framework of religious ethics"[3.369]. A number of religious lexicon dictionaries were created. Among such dictionaries, "Encyclopedia of Islam" published under the editorship of Z. Husniddinov, "Al-Qamus" Arabic-Uzbek encyclopedic dictionary created by academician N. Ibrohimov, O. Nosirov, M. Yusupov, Yu. Rahmatullayev, Arabic-Uzbek dictionary "An-Na'im ul-kabir" created by A. Nishanov, "Religious terms and phrases" dictionary by M. Umarkhojhayev, "Educational" by J. Omonturdiyev and A. Omonturdiyev -explanatory dictionary of mystical revolutions", U.Hasanbayev's "Annotated dictionary of some terms and concepts for religious-educational and socio-spiritual sphere propagandists" can be cited as an example.

In particular, we will analyze the definitions given to the concept of religion in the explanatory dictionary of the Uzbek language, which is considered a very large vocabulary of the Uzbek language: RELIGION [a] Worldview and imagination based on belief in divine power. The religion of Islam. Christianity. Buddhism. Religion is one of the forms of spiritual oppression that oppresses the masses of people everywhere and everywhere who have been working for others all their lives and living in poverty and alienation. V. I. Lenin, Sotsializm va din. *Bir g'oyada ish ko'rdi boy, eshonlar, Din nomidan berib turli farmonlar. Mehnat ahlin ezib, to'kdilar qonlar.* G'ayratiy[11.227]. The above definition and the examples given to it represent the inappropriate and biased interpretation of the attitude towards religion, especially Islam, in the pre-independence period.

The definition of religion after independence is as follows: RELIGION [a. — belief, trust] A set of worldview, imagination, traditions and rituals based on belief in divine power, God. The religion of Islam. Christianity. Buddhism. The verb of another religion is different. Proverb. Islam guides people to the right path. Oybek, Selected works. Where there is a person who is pure in his faith and religion, he will run away for a hundred miles.(S. Ahmad, Hukm)[12.621].

In the research work of U.Y. Koziyev called "Study of Borrowed Words in Explanatory Dictionaries of the Uzbek Language" where the borrowed words in the vocabulary of the Uzbek language were studied, several words expressing religious concepts were found analyzes into thematic groups, which are: words denoting a person, words denoting direction, flow, words denoting activity and process, words denoting creation, injury, words denoting objects, words denoting place, level, words denoting religious categories. We will focus on the analysis of the concepts of "Heaven" and "Hell" belonging to these groups. According to theological theories, the concepts of heaven and hell are contradictory concepts. According to the teachings of Islam, whether people go to heaven or hell in the next world depends on the merits and sins they have done in this world. According to the lexical-semantic meaning, Jannat (Bihisht, Ravza, Jinon) is a flower garden full of flowers, a garden decorated with boston, the waters of which are white as milk, sweet as honey, a spring, a pool, rivers flowing, a hundred thousand There is a world of temples, where various fruits are constantly harvested, where a hundred thousand kinds of delicacies are prepared. - divine space. In Hasanbayev's "Annotated Dictionary of Some Terms and Concepts for Religious-Educational and Social-Spiritual Propagators" Jannat (Arabic - garden, Persian - behisht, dor us-salam, garden 'i eram and others.) The highest blessing in Paradise is to see God's presence. According to Islamic teachings, ten companions were predicted to enter paradise while they were still alive ("Asharai mubashshara"): Abu Bakr Siddiq; Umar bin Khattab; Uthman ibn Affan; Ali ibn Abu Talib; Zubayr ibn Awwam; Talkha ibn Ubaidullah; Sa'd ibn Abu Waqqas, Abu Ubayda ibn Jarrah; Abdurrahman ibn Awf; Said ibn Zayd.

Conclusion

There are seven hells, each of them has its own name: Jahannam, Saqar, Sair, Lazzo, Hutoma, Jahim, Hawiya. They will be filled with punishment according to the sins of the servants, for example, the place of divine torment with chains of black-heated for a thousand years, red-heated for a thousand years, white-heated for a thousand years. Sources say that if a pinhole hole is opened from hell, this world will turn to ashes. The conclusion is that religious terminology is a topic that never loses its value and always needs research. Lexicographic study of the religious lexicon helps to learn the etymology of many words. For humanity, the need to know the knowledge of the religion to which it belongs is always considered a primary and necessary need.

References:

1. (2017). *Speech of the President of the Republic of Uzbekistan Shavkat Mirziyoyev at the 72nd session of the United Nations General Assembly on September 19, 2017.*
2. Koshokova, B. (2020). Different approaches to studying religious lexicon. *Journal of scientific information of TDPU*, No. 6, - p. 237.

3. Makukhovskaya, M. (2002). *Funktsionirovanie sovremennogo polskogo zyzyka.* Language religion. (pp. 369-402). Opole.
4. (2017). *Encyclopedia of Islam*. (p.672). Tashkent: - National Encyclopedia of Uzbekistan - State Scientific Publishing House.
5. Ibrahimov, N. (2017). *Al-Qamous. Arabic-Uzbek encyclopedic dictionary*. Tashkent.
6. Nosirov, O., Yusupov, M., Rakhmatullaev, Yu., & Nishonov, A. (2014). *An-na'im ul-kabir. Arabic-Uzbek dictionary.* (p.810). Namangan.
7. Umarkhoja, M.E. (2016). *Religious terms and expressions. Popular short annotated dictionary*. Tashkent.
8. Omonturdiev, J., & Omonturdiev, A. (2014). *Explanatory dictionary of educational and philosophical terms.* (p.246). Tashkent: Mumtaz Soz.
9. Hasanbaev, U. (2020). *Explanatory dictionary of some terms and concepts for religious-educational and socio-spiritual field promoters.* (p.608). Tashkent.
10. Koziev, U.Y. (2018). *"Study of loanwords in explanatory dictionaries of the Uzbek language"*. Philology. false on dissertation written for the degree of PhD. (p.99). Fergana.
11. (1981). *Annotated dictionary of Uzbek language*, 2 volumes, First volume. (p.227). Moscow.
12. (2020). *An explanatory dictionary of the Uzbek language*, 5 volumes, the first volume. (p.621). Tashkent.
13. Davidov, Y. J. (2021). *Word formation patterns in uzbek language*. International Conference on Agriculture Sciences, Environment, Urban and Rural Development, 16-21 p.s.
14. Nadim, M. H. (2021). Shimoliy afg‘oniston o‘zbeklari etnografik leksikasining tarixiy-etimologik xususiyatlari. Oriental renaissance : *Innovative, educational, natural and social sciences*, 1(2), 22-29.

Impact Factor:					
	ISRA (India) = 6.317	SIS (USA) = 0.912	ICV (Poland) = 6.630
	ISI (Dubai, UAE) = 1.582	РИНЦ (Russia) = 3.939	PIF (India) = 1.940
	GIF (Australia) = 0.564	ESJI (KZ) = 8.771	IBI (India) = 4.260
	JIF = 1.500	SJIF (Morocco) = 7.184	OAJI (USA) = 0.350

SOI: 1.1/TAS DOI: 10.15863/TAS

International Scientific Journal

Theoretical & Applied Science

p-ISSN: 2308-4944 (print) **e-ISSN:** 2409-0085 (online)

Year: 2022 **Issue:** 12 **Volume:** 116

Published: 23.12.2022 **http://T-Science.org**

Issue Article

Mokhichekhra Rustamovna Namozova
Termiz State University
Teacher of the Department of Uzbek Language and Literature,
Uzbekistan

STUDY OF REPETITION WITHIN WORD GROUPS

Abstract: *In this article, the level of study of repeated words in world linguistics, their division into types, types of repeated words within the noun group, repetitions with double, similar meaning, their linguistic features, and examples are analyzed. Repeated words are used in world linguistics with the term reduplication, and their research and study of their types in artistic works serve to fully demonstrate the internal capabilities of our language.*

Key words: *Reduplication, reinforcing repetitions, partial repetitions, repeated words with the same meaning, word groups, meanings of repeated nouns.*

Language: *English*

Citation: Namozova, M. R. (2022). Study of repetition within word groups. *ISJ Theoretical & Applied Science, 12 (116),* 753-755.

Soi: http://s-o-i.org/1.1/TAS-12-116-66 ***Doi***: crossref https://dx.doi.org/10.15863/TAS.2022.12.116.66

Scopus ASCC:

Introduction

Today, Uzbek linguistics is developing in every way. Especially in recent times, studies in the research of artistic language methodology, linguopoetics, linguostylistics, artistic, scientific, and formal methods have given good results. One such methodological tool is artistic repetition. In Uzbek linguistics, a number of works have been carried out in connection with the research of the possibilities of spiritual, methodological and artistic creation of repeated words. Repetitions exist in all languages and can be found within all word groups. There are many types of them, especially within the noun group. The French orientalist J. Leni, while dividing repeated words into categories, emphasizes that adjectives are found in 2 types of reduplication: Complete and incomplete. [18.76]

Gatling's opinion about the meaning of repeated words is as follows: Repeated words used to strengthen meaning differ from affixation in adjectives, adverbs, and adjectives. [17.23]

Materials and Methods

Research on repeated words and a number of works related to revealing their linguistic essence began to appear in Turkish in the 80s. Among these, it is possible to include the scientific work of professor Dmitrev, who for the first time studied repeated and double words at the same time and divided them into categories. [16.12]

In his observations on the Karakalpak language, N.A. Baskakov, talking about the ways of forming words in this language, introduced various repeated words here.

Baskakov divided repeated words into 4 groups:

1. Strengthening pairs of repeated words.

Tyobe-tyobe (mountain)

Game-play (play-play)

2. Repetitive words

3. Repeated words with related meanings

Palav-malov

Somehow

4. Repeated words with the first syllable shortened

Darkness (darkness)

Jaw-jarak

A. Kaydarov extensively studied double-repeated words and their peculiarities in the Uyghur language. He systematized repeated words according to the methods of their formation and divided them into 4 groups:

Group 1 includes homogeneous repeated words, that is, a repeated word is formed by repeating the stem twice without any change:

Pat-pat, hir-hir, pir-pir...

Group 2 repeated words with similar meaning:

a) rhyming repeated words: at-mat, giring-piring

b) repeated words of different forms: shalak-shuluq, shaqir-shukur

c) intersecting repeated words: red-red, ep-enik

Group 3 combines repeated words used to express similar meanings:

I couldn't find it

My eyes widened

He completely forgot…

In this work of Kaidarov, the term double-repeated words is also used together as base expressions.

V. Egorov says in one of his articles: "One of the oldest and easiest ways of forming words in many languages of the world is repeated words. Repeating the same word twice, i.e., the repetition of the word is related to the increase in quality or quantity, speed of movement or repetition. [13.113]

In many languages, repeated words are even an indicator of the plural degree of nouns, the degree of improvement of adjectives, the grammatical categories of subtractive numbers and adverbs.

Egorov also talks about the origin of repeated words from the Turkish language: "Repeated words are quite common in Turkish, including ancient forms denoting an increase in quality: sweet-sweet honey, hungry-hungry, red-red..."(13. 121).

Results and Discussions

In Uzbek linguistics, the difference between repeated words, double words and compound words is considered without connection. B. Madaliev's scientific work "Compound words in the Uzbek language" talks about the existence of repeated words in the Uzbek language, and they are semantically equivalent to pairs of words and compound words. He says that he will come closer. In the way of word formation, words with the same meaning are returned or words with opposite meanings appear. As a result of this, repeated words expressing generalizing meaning are formed: five-five, bosti-bosti, parents, strength... [15.93]

The meanings of the repeated nouns. A noun is considered the most basic part of speech and can be a repeated word in all languages of the world and have different meanings in a sentence:

1. The meaning of the plural. - Carts and carts of hoes, loaves, crowbars, and stretchers were brought to the side of the railway.

2. The repeated noun expresses the external similarity of the object or action when compared. This happens as follows:

• The appearance of the object is compared. - After a while, the young man came in with a stack of papers, beads of sweat were pouring from his forehead.

• The uniqueness of the form or situation is emphasized. - Ayyqiz gazed proudly at the mountains and valleys of cotton.

• Figurative meaning. - There is no account of the blood, it is soaked in the ground, and the youth is in rivers and streams.

• We heard it, we were very happy.

3. Repeated nouns give an idea of the amount of the subject, more precisely, such a repeated form of it strengthens the lexical meaning and expresses the meaning that the amount is many, countless.

- Shelves of old and new constitutions, dictionaries, newspaper sets…

4. Repetition strengthens the meaning of quantity.- We want to knock on the door of a scientist who has spread money in the country, wrote many books.

5. Repeated nouns are also able to express figurative meaning. This form is distinguished by expressiveness in the language. The repeated word serves to strengthen the meaning in the sentence, and the effect of the repeated word is strengthened. The imagery of the metaphorical meaning obtained by the repetition method increases and looks brighter.

This season is the great destiny of labor,

Handfuls of shins full of light. (Gulistan)

... I overcame sufferings, overcame many difficulties like a lion, and earned the right to be a leader by the skin of my forehead. (Sh. Rashidov)

6. Repeated words express continuity and repetition. - You only say beard and beard, - my father did not come empty-handed. (H. Tokhtaboev)

Do you keep saying candy-candy, I'm going to throw the candy with a vase right now. (Tashkent evening)

In a number of works devoted to numbers in the modern Uzbek language, only one number is mentioned in different ways. Interrogative pronouns express plural and intensified meanings when used as repetitions.

Who? What? Interrogative pronouns express the meaning of plural when they are repeated. For example: What, you have no heart and boyish pride, nephew? (Ya. Shukurov)

Who will come? Who is going?

The interrogative pronouns how many, how many, and what also express the plural meaning when they are repeated words. For example: You don't know, brother Sadiq didn't put it on my head for days? (K. Yashin)

It seemed to him that he had walked a long stone path, and he looked back and involuntarily grabbed his collar. (I. Rahim)

Look how much work we have done.

When verbs become repeated words, they serve to express the duration of the action, its repetition, and the incompleteness of the action.

For example: Ho-ho-ho...I laughed out loud on purpose. (H. Tokhtaboev)

Next to him, someone was snoring. (G. Gulam)

Conclusion

In conclusion, the study of repeated words is important not only from the point of view of literature, but also from the point of view of linguistics. The phenomenon of reduplication exists in all languages, and in Uzbek it is an important tool for showing the internal possibilities of the language. The analysis of repeated words within categories is one of the important works, which has not yet been fully analyzed and is still waiting for its own research.

References:

1. Atullah, H. (1981). *"Badoi us-sanoye"*. Tashkent.
2. Hojiahmedov, A. (2001). *"Arts of Poetry"*. Tashkent.
3. Tursunov, U., & Mukhtarov, Sh. (1992). *"Current Uzbek literary language"*. Tashkent: "Uzbekistan".
4. Shoabdurahmanov, Sh. (1980). *"Current Uzbek Literary Language"*. Part 1. Tashkent: "Teacher".
5. (n.d.). *Uzbek, sources of ethno lexicography of, and wedding ceremony in northern Afghanistan*. "Muhammad Humayun Nadim PhD student of Termez State University".
6. Nadim, H. M. (2019). About ethnolinguistics and ethnographic lexicon. *Young scientist*, (30), 147-149.
7. Nadim, M. H. (2021). Historical and etymological characteristics of the ethnographic lexicon of the uzbeks of north afghanistan. *Oriental renaissance: Innovative, educational, natural and social sciences*, 1(2), 22-29.
8. Davidov, Y.J. (2021). *Word formation patterns in uzbek language*. International Conference on Agricultural Sciences, Environment, Urban and Rural Development, (pp. 16-21).
9. Davidov, Y. J. (2021). The Phenomenon of Polysemy and Different Aspects of Conversion. *European Journal of Life Safety and Stability* (2660-9630), T. 12, pp. 245-247.
10. Davydov, Yu. D., & Bazarov, Sh. A. (2021). The phenomenon of ambiguity in works of art. *Innovations in pedagogy and psychology*, Vol. 4, No. 7.
11. Baskakov, N.A. (1956). *"Karakalpak language"*. ed. ANSSR-M.
12. Kaydarov, A. (1951). *"Paired and repeated words"*. L.
13. Egorov, V.G. (1971). *"Composition in the Turkic languages"*. L.
14. Madaliev, B. (1972). *"O'zbek tilida qo'shma so'zlar"*. Toshkent.
15. Dmitreev, N.K. (1930). *"Paired phrases in the Bashkir language"*. ed. ANSSR, department of gum. Sciences, L-1930. (pp. 12-13).
16. Byoting, O. (1961). *translated from German.* L.
17. Leni, J. (1965). *"French Grammar"*. Moscow.

Impact Factor:					
	ISRA (India) = 6.317	SIS (USA) = 0.912	ICV (Poland) = 6.630
	ISI (Dubai, UAE) = 1.582	РИНЦ (Russia) = 3.939	PIF (India) = 1.940
	GIF (Australia) = 0.564	ESJI (KZ) = 8.771	IBI (India) = 4.260
	JIF = 1.500	SJIF (Morocco) = 7.184	OAJI (USA) = 0.350

SOI: 1.1/TAS DOI: 10.15863/TAS
International Scientific Journal
Theoretical & Applied Science
p-ISSN: 2308-4944 (print) **e-ISSN:** 2409-0085 (online)
Year: 2022 **Issue:** 12 **Volume:** 116
Published: 23.12.2022 **http://T-Science.org**

Issue Article

Oliya Khamedovna Kadyrova
Termez State Pedagogical Institute
Vice-Rector (PhD),
Associate Professor for Research and Innovation, Uzbekistan

LINGUOPOETICS IS AN IMPORTANT RESEARCH FIELD OF LINGUISTICS

Abstract: *The article provides information about the formation of the linguopoetics direction, which has emerged today based on the mutual cooperation of linguistics and literary sciences, and the opinions that have arisen in this regard in world linguistics.*

Key words: *linguopoetics, lexical analysis, morphological analysis, sentence, text, text linguistics, phonetic-phonological analysis, meaningful completeness, G'.Abdurahmonov, A.Gulomov.*

Language: *English*

Citation: Kadyrova, O. Kh. (2022). Linguopoetics is an important research field of linguistics. *ISJ Theoretical & Applied Science, 12 (116),* 756-759.

Soi: http://s-o-i.org/1.1/TAS-12-116-67 ***Doi***: https://dx.doi.org/10.15863/TAS.2022.12.116.67

Scopus ASCC: *1203.*

Introduction

In linguistics, the object of study is divided into separate sections, that is, sounds (phonemes) are studied in phonetics-phonology, morphemes in morphology, lexemes in lexicology, simple and compound sentences in syntax. It can be said that in traditional linguistics, the highest and last unit of the highest level of the language is considered as a sentence. In the words of the Polish linguist M.R. Maenova, "Linguistics ends its observations at the end of the sentence, until recently it was considered an open truth." Multi-sentence texts are completely and utterly outside the scope of grammar in the broadest sense of the term.

Materials and Methods

The whole speech work, the study of the text, that is, the approach to the grading of the text in the style of speech - period - a larger fragment - whole today - began in antiquity - with Aristotle and his followers. The development of the concept of text in Russian linguistics dates back to the 40s of the last century. In 1947, A.I. Belich, in his article on the classification of linguistic sciences, drew attention to the fact that in the grammatical description of language facts, a separate place should be given to the entire chain of sentences that are connected on the basis of commonality of meaning and appear in the form of a certain syntactic-semantic integrity, and that it is of crucial importance for the emergence of the concept of text. pointed out that it is appropriate to study the relationships and connections in the chain of such sentences in the syntax department of linguistics[6]. The services of Czech (representatives of the Prague Linguistic Circle), German, French, English, American, Dutch, Polish and other schools of linguistics in the general formation and development of text theory, text linguistics are recognized in world linguistics and are constantly mentioned in scientific research. Problems of text theory and linguistics in Russian linguistics V. V. Odintsov, I. R. Galperin, O. I. Moskalskaya, L. M. Loseva, Yu. M. Lotman, 3. Ya. Turaeva, N. D. Zarubina, It is studied by many linguists such as E. V. Sidirov, O. L. Kamenskaya, A. I. Gorshkov, N. S. Valgipa.

O.I.Moskalskaya, who made a detailed analysis of the research in this direction in linguistics, notes that by the 60s and 70s of the last century, the interest in the linguistic study of the text increased dramatically, that unprecedented researches on text linguistics appeared in world linguistics, and that text linguistics was recognized as an independent linguistic science.

A comprehensive study of the text as a speech and linguistic unit of a separate level requires the creation of a special science within the framework of linguistics - text linguistics.

Results and Discussions

Text linguistics is formed and developed in this way. But in Russian linguistics, there are no lack of critical opinions, such as the fact that text linguistics covers too many issues in its scope of study, and interferes with the problems of other fields of science. For example, the well-known Russian philologist R.A. Budagov wrote on the occasion of the publication of a collection of studies on text linguistics created by a number of world experts "Text linguistics - to what extent is linguistics?" In his article, text linguistics is the process of creating, structuring, understanding, and sorting human text. wants to learn skills such as the perception of compositional integrity, while this would be taking over the tasks of other disciplines, he objects. Academician G. Abdurakhmanov, who was one of the first in Uzbek linguistics, gave a lecture on text theory at the III conference of Turkic scholars of the former Union held in Tashkent on September 10-12, 1980. A. Gulomov emphasizes that the completeness of the thought in the sentence is relative, the completeness of the content in the work is understood from the entire text, he gives an example of a complete text consisting of three paragraphs, and based on it, he writes the following[2]:

1. Expression of opinion is not limited to the scope of the sentence (simple sentence and compound sentence). A complete idea is usually given by a syntactic whole, which is larger than a sentence. The word is a component of this whole.

2. This component is connected with other components of this whole in every aspect (content, grammar) through various means. Its own composition and stylistic features will be preserved.

3. A simple sentence as a whole can form a paragraph by itself under certain conditions.

4. Such a syntactic unit, a syntactic device is considered a text. An incomplete sentence represents a relatively complete thought, the text represents the content of a whole complex.

5. Since the text is a whole, it can also have some headings corresponding to its content.

6. A text is a large piece of speech, and a paragraph is a piece of text. All forms of text (maximum text and minimum text) fully represent a certain topic (content).

German linguist R. Harweg, one of the foreign activists of the study of text problems and the creation of its integrated scientific theory, stated in 1974 that text linguistics would need at least a hundred years to be fully grounded in linguistics. But today it is not even 40 years since this statement was made. But as a natural result of serious scientific research carried out regularly and intensively all over the world, whether it is called text linguistics ("text theory") or "text grammar" ("text syntax"), such a direction is a separate science and It is widely acknowledged and no one denies that it was formed as a subject of study[8].

When studying the meaning structure of nominative units in the language, special attention is paid to the concept of the connotative aspect of semantics in linguistics. V.N. Teliya, who studied this issue in a monographic manner, defines it as "connotation - which enters the semantics of language units in a simple or occasional way, expresses the subject of speech's existence in a sentence, expresses his emotional - evaluation and stylistic attitude towards this same existence, and acquires expressive value according to this information. is a meaningful essence[4]. Connotation, as seen in the definitions, is an aspect related to the speaker's relationship to the means of expression. For example, it is known that the choice of words such as bet, chehra, rukhsor, aft, bashara, turq(all means face) according to the relevant speech situation and subjective point is the opportunity given to the speaker himself.

In Uzbek linguistics, the issue of researching the linguopoetics of artistic texts has been widely studied. As such works, we can point to scientific researches of M. Yoldoshev, Sh. Iskandarova, S. Boymirzaeva, A. Omonturdiev, Sh. Abdurakhmonov, Sh. Akhmedova, L. Jalolova, S. Mominov and other linguists. These authors examined the linguistic and stylistic features of the language of the artistic work, reflected on the unity of form and content, the factors of individualization of character speech, the author's speech, style, artistic skill, cleverness in using words. In all these scientific works, the main attention is focused on the language of the artistic work.

The movement towards a linguistic approach to the poetics of early works of art is observed in the works of writers such as H.H. Niyozi, Cholpon, A. Qadiri, Oybek, G'. Gulom, A. Qahhor, S. Ahmad. Due to the fact that the character of scientific researches about the prose works of recent writers is mainly within the framework of literary analysis and the need to study the language of artistic works from a linguistic point of view has increased, the attention to linguopoetic analysis has increased. A number of things have been done in this regard. In particular, R.U. Normurodov's "Language features of Shukur Kholmirzaev's works" (2000), M. Yoldoshev's "Secrets of the Cho'pon word" (2002), G. Muhammadjonova's "Linguopoetic study of Uzbek poetry of the late 80s and early 90s" (2003). , M. Mukhiddinov and S. Karimov's "Poetic skill of Gafur Ghulom" (2003), D. Nematova's "Linguistic features of Cholpon's journalism" (2004), S. Boymirzaeva's "Linguistic study of Oybek's prose" (2004) Cholpon, Oybek, Gafur Studies have been conducted on traditional themes or poetry dedicated to the study of the works of masters of words such as Ghulam.

As the artistic-aesthetic tasks of the language of the work of art are studied in connection with the theoretical aspects of linguistics, it is appropriate to use the term linguopoetics, which came into use later. Because "Linguopoetic analysis process is not limited to providing information about the writer's language and style, but the originality of the language of the period in which the work was created, the writer's vocabulary, the ways of using language tools, the representation of artistic image tools through language facts, in general, the language from all its levels will consist of analysis" [3].

Conclusion

The term linguopoetics includes a relatively comprehensive concept in the study of the language of an artistic work, and studies the elements that ensure the simplicity of the work at all levels of the language. The role of fiction in the development of the Uzbek literary language and its rise to the level of a national literary language is incomparable. Therefore, it is important to study the language and style of works of creators who contribute to the literature of today.

References:

1. Tukhsanov, M. (1987). *Mikrotekst i sistema viragenia ego kogenetnosti v Uzbekskoi chudojestvennoy rechi:* Avtoref.diss. k-ta filol.nauk,Tashkent.
2. Yoldashev, M. (2009). *Lingupoetic study of the literary text.* Philol. science. doc. diss, Tashkent.
3. Rahmatullayev, Sh. (1993). *Comparison of Uzbek and Russian languages*. (pp.47-48). Tashkent: Uzbekistan.
4. Telija, V.N. (1999). *Pervoocherednye zadachi i metodologicheskie problemy issledovanija frazeologicheskogo sostava jazyka v kontekste kul`tury. Frazeologija v kontekste kul`tury.* (pp.13-24). Moscow: Jazyki russkoj kul`tury.
5. Galperin, I.R. (1981). *Linguistic study of the text as an object*. Moscow.
6. Coseriu, E. (1971). *Thesen zum Thema - Sprache und Dichtung*. In: Beitrage zur Textlinguistik. Hrsg. W.D. Stamp, Munich: Fink.
7. Kadirova, Z. Z. (2021). Periphrases in the prose works of Alisher Navoi. *Theoretical & Applied Science*, (6), 574-579.27.
8. Kadyrova, Z. (2021). The lexical units in the formation of periphrasis (on the example of periphrases in the prose works of Alisher Navoi). *Zhurnal filologicheskih issledovanij*, 6(2), 17-23, 28.
9. Kadirova, Z. Z. (2021). Nominativ features of the periphrases. *Scientific Bulletin of Namangan State University*,2(2), 220-22. 60-1064.
10. Kadirova, O. H. (2022). Motivy svobody i odinochestva v pojezii Lermontova i Usmana Nasyra. *Tradicii i innovacii v izuchenii i prepodavanii jazykov*, 1(1), 173-176.
11. Kadirova, O. K. (2021). Comparative typological analysis of Russian-Uzbek literary relations in their historical development. 湖南大学学报(自然科学版) , 48(12).
12. Kadyrova, O. (2021). Information and communication technologies in the process of teaching foreign languages as the basis of an innovative approach to learning. *Theoretical & applied science*, (9), 649-651.
13. Kadyrova, O. K. (2021). Motivational basis for the formation of eastern and western literature Motivacionnaja osnova formirovanija vostochnoj i zapadnoj literatury. *Zhurnal filologicheskih issledovanij*, 6(3), 17-22. 410 Vol. 10, Issue 11, Nov. (2022).
14. Kadirova, O. H. (2021). Ispol`zovanie uchebnogo perevoda kak odin jeffektivnyh priemov obuchenija russkomu jazyku kak inostrannomu v srednej shkole. *Sovremennoe obrazovanie i vospitanie*, 1(1), 289-294.
15. Kadyrova, O. K. (2021). Foundations of artistic synthesis in the literatures of the west and the east at the present stage. *Innovative engineering and management research*, 10(01), 227-232.
16. Kadyrova, O. K. (2020). Professional pedagogical activity its types and structure. *Aktual`nye problemy gumanitarnyh i estestvennyh nauk*, 1(12), 93-96.
17. Kadyrova, O. H. (2013). Russkij jazyk 5 klass Kniga dlja uchitelja. *Ma#navijat*, 1(1), 160.
18. Kadirova, Z. Z. (2019). Principles of differentiation of periphrasal and euphemic units. *Scientific Bulletin of Namangan State University*, 1(10), 269-273.
19. Kadirova, Z. Z. (2021). Alisher Navoiyning nasriy asarlarida insonga xos xususiyatlarni ifodalovchi perifrazalar. *Ilm sarchashmalari*, 2(2), 176-178.
20. Qodirova, Z. Z. (2019). Perifraza obrazli idroq mahsuli. *Ilm sarchashmalari*, 1(1), 54-57.
21. Kadyrova, O. H. (2002). Mezhliteraturnye tipologicheskie sopostavlenija v processe prepodavanija. *Jangi asr avlodi*, 1(1), 96.

22. Kadirova, Z. Z. (2021). *Some comments on the interpretation and contrast aspects*.
23. Bazarova, E., & Kadirova, Z. (2020). Practical knowledge of the stone names in linguistics. *Scientific Bulletin of Namangan State University*, 2(1), 178-181.
24. Kadirova, Z. Z. (2019). Principles of differentiation of periphrasal and euphemic units. *Scientific Bulletin of Namangan State University*, 1(10), 269-273. 52 ISSN 2181-2632 Retrieved from www.involta.uz
25. Kadyrova, O. H. (1995). *Metodika realizacii sopostavitel`nogo podhoda v professional`noj filologicheskoj podgotovke studentov-bilingvov Uzbekistana* (russkaja i rodnaja literatura).
26. Kadyrova, Z. Z. (2021). Nekotorye kommentarii k interpretacii i protivopostavleniu aspektov terminov perefrazirovanie i perifraz. *Teoreticheskaja i prikladnaja nauka*, 1(6), 486-489.
27. Kadyrova, Z. Z. (2021). Leksicheskie izdanija v formirovanii perifraza o pervom perifraze v proze Alishera Navoi. *Zhurnal filologicheskih issledovanij*, 6(1), 17-23.

Impact Factor:					
	ISRA (India) = 6.317	SIS (USA) = 0.912	ICV (Poland) = 6.630
	ISI (Dubai, UAE) = 1.582	РИНЦ (Russia) = 3.939	PIF (India) = 1.940
	GIF (Australia) = 0.564	ESJI (KZ) = 8.771	IBI (India) = 4.260
	JIF = 1.500	SJIF (Morocco) = 7.184	OAJI (USA) = 0.350

SOI: 1.1/TAS DOI: 10.15863/TAS

International Scientific Journal

Theoretical & Applied Science

p-ISSN: 2308-4944 (print) **e-ISSN:** 2409-0085 (online)

Year: 2022 **Issue:** 12 **Volume:** 116

Published: 23.12.2022 **http://T-Science.org**

Issue Article

Zarifa Rozikulovna Normurodova
Termiz State University
Teacher of the Department of Uzbek Language and Literature, Uzbekistan

THE ISSUE OF EPITHET STUDY IN WORLD LINGUISTICS

Abstract: *The article presents the appearance of the epithet in world linguistics, the comments and scientific views of world linguists about this phenomenon. The fact that there are concepts about the epithet in ancient times, various opinions of linguists and debates about its use as a linguistic tool in linguistics are highlighted.*

Key words: *epithet, epithesis, trope, metaphor, metonymy, synecdoche, hyperbole.*

Language: *English*

Citation: Normurodova, Z. R. (2022). The issue of epithet study in world linguistics. *ISJ Theoretical & Applied Science, 12 (116),* 760-763.

Soi: http://s-o-i.org/1.1/TAS-12-116-68 ***Doi***: crossref https://dx.doi.org/10.15863/TAS.2022.12.116.68

Scopus ASCC: *1203.*

Introduction

For a long time, people have been interested in making their thoughts and feelings self-satisfied and their speech impressive and attractive. As a result of these interests, tropes, that is, language units used figuratively and figuratively, appeared in the language. Linguistic tools that increase the effectiveness of thought are widely used in literary styles, journalism, and oral speech. This is due to the addition of various expressive-emotional colors to the purely logical content. Enhancing the expressiveness of speech is carried out using various means, first of all, using tropes such as epithet, metaphor, metonymy, synecdoche, hyperbole, etc. For our study, the epithet phenomenon is of interest.

Materials and Methods

Many scientists have expressed their different opinions about the phenomenon of epithet for a long time. The epithet is not mentioned in the works devoted to the ancient rhetoric of ancient philosophers Aristotle, Demetrius and their contemporaries. Opinions about this phenomenon began to be expressed after the period in which they lived. The first and somewhat clear definition of an epithet was expressed in the views of ancient Roman rhetoricians. For example, the philosopher Quintilian's definition of an epithet as a means of annoying rather than enriching speech proves our point. In his opinion, speech without epithets remains bare and ugly, and when used more than the norm, speech becomes long or confused. The main opportunity for decoration is the figurative use of words. In 15th century Eastern literary studies, under the term "metaphor" there are opinions about epithets that are the result of characterization. Epithet is a phenomenon of speech that attracted the attention of literary scholars and then linguists from a long time ago, even if it was not mentioned by rhetoricians[1.224]. As early as the 15th century, it was studied in Persian and Uzbek literary studies as part of metaphor. This phenomenon attracted the attention of Western linguists in the 19th century. It can be seen that he was mentioned as an epithet in the works of Adelung, who lived in the last century, as well as A. Ben. The meaning of the concept of "epithet" has been revealed by scientists in different ways. The reason for this is related to the differences in the approach to the morphological and syntactic features of the epithet.

An epithet is a lexical-syntactic trope because it functions as a description or case or appellation. The property of being an epithet appears in a word or several words only in combination with the name of the object or the event it designates. Often adjectives and adverbs act as epithets, but epithets expressed by nouns are not uncommon.

Linguists primarily refer to the semantic features of the epithet, its emotional-evaluative concepts, and morphological and syntactic features. About the metaphorical nature of the epithet M.N. Lapshina. "an epithet is a description or state of an expressive nature that emphasizes the specific quality of an object or

event and is based on a metaphorical revision"[2]. But the epithet can be an expressive tool and play the role of a trope. Or, without creating an image, it is possible to give an emotional assessment to an object or event. In both cases, the epithet creates expressiveness and allows you to achieve the appropriate stylistic effect. A.P. Pavshuk: "an epithet is an artistic description of an object, person, event, process, situation (definition in an aesthetic function), emphasizing, strengthening, from the author's point of view, it can repeat or update the meaning of the defined word Symbols, objects, can be typical and integral to the individual character of a specific object, a micro or macro image, giving it formality, containing hidden meanings and value. it leaves an impression on the viewer in his intellectual, emotional and aesthetic perception[3.20]. This definition emphasizes the multi-functionality of the epithet, its specific features as a universal artistic tool of language.

Scientific sources pay special attention to the figurativeness of the epithet. In particular, in the short dictionary of literary terms (L.I. Timofeev, S.V. Torayev) it is explained that epithet is "a definition that emphasizes one of the characteristics of the subject or one of the impressions of the subject, giving expressiveness and emotionality." A.P. Kvyatkovsky epithet - "a figurative characteristic of a person, event, object through the quality of an expressive metaphor"[4]. In all the above definitions, the formal features of the epithet, its morphological expression and imagery, as its main function, contribute to clarity, semantic duality. Y.M. Skrebnev defines an epithet as "a word or phrase of stylistic importance in the syntactic function of a definition or situation"[5.221]. The author emphasizes the linguistic direction of this interpretation of the epithet, distinguishing it from literary criticism, where the epithet is understood as any word that conveys an emotional or figurative feature of the subject of speech.

The epithet of V. M. Zhirmunisky can work both in the forced and in the original version. He described the evolution of poetic definitions as a transition from the decorative epithet to the rare epithet, and considered the use of the term "epithet" inappropriate for the latter. A definition that defines the individuality of the scientist's point of view necessarily introduces a new feature that is not present in the concept itself and, accordingly, narrows its meaning, and this, in turn, leads to the convergence of such poetic definitions. explains.

Results and Discussions

The problem of distinguishing such concepts as "epithet" remains very difficult. All scientists emphasize that the epithet creates a new feature in the description of the object, but they do not ask how the phrase "new feature" can be understood by itself, in what situation it can be[6].

The epithet has a special place among the descriptive, expressive and figurative tools of the language. In terms of usage, this trope is one of the leaders among metaphors and metonymies. At the same time, we have scientific sources in linguistics and the epithet seems to have received little attention in fiction.

In the works of Western linguists of the 9th century, the term epithet was interpreted as one of the phenomena of formation of figurative meaning and compared to some phenomena of formation of figurative meaning[7]. The formation of figurative meaning is more a linguistic phenomenon, and an epithet is a speech phenomenon. Russian linguist V.M. Zhirmunsky's interpretation of epithets in a broad and narrow sense, that is, in a broad sense, it is equal to all determiners, and in a narrow sense, it is a determiner used to indicate the sign of a noun with a sign that is present in another noun. is very close to his opinion, and in any case he equates epithets with adjectives explained in Uzbek literary studies. V.M. Zhirmunsky's thoughts on the epithet were discussed by I.R. Galperin, N.M. Patotskaya also joins.

The works of the French linguist M. Grevis and the authors of textbooks devoted to the stylistics of the Uzbek language are mostly close to the above ideas. In it, "the epithet is a kind of qualification[8]. But it differs from the permanent adjective in its expressiveness and figurative use. The above opinions expressed by linguists regarding the epithet are not quite correct. Because equating an epithet with a quality or looking at it as a form of it indicates a one-sided coverage of the phenomenon.

In Russian linguistics, it is quite common to interpret epithets in the form of defining words with artistic and expressiveness[9]. An epithet, like other pictorial means, is artistic-colorful and enhances emotional-expressiveness, depending on how it is created. V.P. Grigoriev notes that most of the epithets are new to their formation, and new epithets deepen the perception of existence[10.162]. In some scientific sources, there is an opinion about the interrelationship of descriptive tools such as epithet, simile, metaphor[11.232]. On the basis of such a comparison, artistic tools such as metaphors, similes, and epithets are created, and an opportunity to express the thought in a vivid image and in an effective way is created. Epithet is widely used in speech, among other figurative tools, and creates various speech possibilities. A. T. Rubailo emphasizes that the epithet is a type of trope close to metaphor and metanomy, and calls it an artistic identifier[12.46]. At this point, it should be noted that the epithet differs sharply from permanent determiners in terms of the strength of the level of imagery and specificity of artistic speech. M. Kojina interprets the epithet as a word that emphasizes the characteristic feature of an object and event, is used more in artistic speech, and performs an aesthetic function[13.97]. Even if linguists mention the epithet

in the works devoted to the means of artistic language, they give a brief description of it, but they say almost nothing about the difference between its characteristics and other related phenomena. In addition, epithets are analyzed within the scope of adjectives. The well-known Russian linguist N.P.Patotskaya commented that "Epithet always means the quality, characteristic and sign of something concrete, objective and syntactically separated"[14.141]. Therefore, a deep analysis of epithets will not be without benefits both theoretically and practically. The full study of the laws of this language phenomenon, the study of the language possibilities that are the basis for its occurrence, serve as the main source for experts, and at the same time, creators, especially for the representatives of fiction. The epithet is formed based on the possibility of language fact in the process of speech. For this reason, it is created to express the view of each author in relation to what he wants to describe in his own context. The famous English expert I. V. Arnold said "The epithet expresses the attitude of the author to the thing described"[15]. It can be seen that this tool of artistic language serves as an important tool of artistic literature, especially poetry. It provides an opportunity to deeply analyze the language of ghazals, which are more common in Uzbek classical literature. The emergence of an epithet characteristic of a certain author is related to his worldview, knowledge of the objective world, and his mentality. The spirit is formed in harmony with the past, history and spiritual world of the people. In this respect, the epithet reflects the language of the people, its history and spiritual world. "If the language is a complete reflection of the history and psychology of the people," says M.M. Pokrovsky, "it is impossible to interpret its facts differently." That is, the study of epithets in fiction is the study of the history and the spiritual world of the people who speak this language. This is important both for his history and for his psychology. The French linguist M.Grevis and the authors of textbooks devoted to the stylistics of the Uzbek language also give close views to the above ideas. "In it, Epithet is a kind of adjective.

Conclusion

But it differs from the permanent adjective in its expressiveness and figurative use. Summarizing the above, it can be noted that the appearance of this figurative tool in the language goes back a long time, and today the epithet is a linguistic tool that reveals the history, culture, and spiritual world of the people.

References:

1. (1936). *Ancient theory of language and style*. (pp.223-224). M, L..
2. Lapshina, M.N. (2013). *Stylistika sovrennogo angliyskogo zyzyka:* Uchebnoe posobie stud.uchrejdeniy vyssh.prof. education. M.N. Lapshina. Moscow: ITs Academy.
3. Pavshuk, A.V. (2007). *Yazykovaya priroda i funktsii epiteta v khudojestvennom tekste: na materiale romana Asorina "Volya"*. (p.20).
4. Kvyatkovsky, A.P. (2013). *Poeticheskiy slovar*. Nauch. ed. i sost. I.B. Rodnyanskaya. Mr. humanitarian. flour - 3-e izd., ispr. i dop, Moscow: Izd. Center Ros. Mr. humanitarian. Un-ta, 2013, 587 p.: il, Bibliogr.: p. 519-522, Perechen st.: p. 523-531, Pril.: p. 534-584.
5. Skrebnev, Yu.M. (2003). *Basic stylistics of the English language*. Uchebnik dlya in-tov i fak. inost. summer - 2-e izd., ispr. (p.221,3). Moscow: Astrel. (no English writing).
6. Akhmanova, O. S. (1969). *Slovar lingvisticheskikh terminov*. Moscow: Soviet Encyclopedia.
7. Hamidiy, A., et al. (1967). *Dictionary of literary terms*. T: Teacher.
8. Kozhina, M.N. (1977). *Stilistika russkogo yazyka*. Moscow.
9. Gorbachevich, K.S., & Khablo, E.P. (1979). *Slovar epitetov russkogo literaturnogo yazyka*. (pp.3-5). L.:-Nauka.
10. Grigorev, V.P. (1979). *Poetika slova*. (p.162). Moscow.
11. Grigoryev, V.P. (n.d.). *The indicated work*. (pp.226-232). Bishkek.
12. Tomashevsky, B.V. (1959). *Stylistics and etymology*. (p.201). L..
13. Rubaylo, A.T. (1961). *Khudojestvennye sredstva zyzyka*. (p.46). Moscow.
14. Kozhina, M.I. (n.d.). *Stylistics of Russian language*. (p. 97).
15. Patotskaya, N.A. (1974). *Stlistika sovremennogo franzuskogo zyzyka*. (p.141). Moscow: VSh.
16. Arnold, I.V. (1973). *Stilistika sovremennogo angliyskogo yazyka*. (p.151). L.: Prosveshchenie.
17. Nadim, M. X. (2021). Factors determining the uniqueness of ethnographic vocabulary of northern afghanistan uzbeks. *Mejdunarodnyi jurnal iskusstvo slova*, 4(3).
18. Ahmad, A.A. (2021). “Baburnama”da qishloqchilik so‘zlarining tavsiri.” *Tashhri*, 7.12.

19. Davidov, Y. J. (2022). Ko ‘p ma’nolilik hodisasining yuzaga kelish yo’llari. *Science and innovation*, T. 1, №. B2, pp. 500-503.

Impact Factor:					
ISRA (India)	= 6.317	SIS (USA)	= 0.912	ICV (Poland)	= 6.630
ISI (Dubai, UAE)	= 1.582	РИНЦ (Russia)	= 3.939	PIF (India)	= 1.940
GIF (Australia)	= 0.564	ESJI (KZ)	= 8.771	IBI (India)	= 4.260
JIF	= 1.500	SJIF (Morocco)	= 7.184	OAJI (USA)	= 0.350

SOI: 1.1/TAS DOI: 10.15863/TAS
International Scientific Journal
Theoretical & Applied Science
p-ISSN: 2308-4944 (print) **e-ISSN:** 2409-0085 (online)
Year: 2022 **Issue:** 12 **Volume:** 116
Published: 25.12.2022 **http://T-Science.org**

Issue Article

Ismatullo Ziyadulla o'g'li Akaboyev
Namangan State University
teacher of department of geography
iakaboev@mail.ru

Abdusaid Qayumjon o'g'lu Tokhtanazarov
Namangan State University
Gifted student of the fourth stage of the geography direction
iakaboev@mail.ru

GEOECOLOGICAL PROBLEMS CAUSED BY ANTHROPOGENIC ACTIVITY AT THE VARZIK RESERVOIR

Abstract: *The article presents the effects of the shortcomings in the use of reservoirs on the geoecology of the reservoir surroundings. The causes of water body pollution, the prevention of the negative consequences of these processes for representatives of the flora and fauna, a number of ways to protect them, and the analysis of the main causes of water pollution were considered. Also, taking into account the natural geographical conditions, microclimate, and some parameters of the reservoir, problems arising in the use of the reservoir are described.*

Key words: *Varzik reservoir, anthropogenic factor, geoecological problem, Chust, Govasoy river, euphotic zone, agricultural technology, melioration, pesticides.*

Language: *English*

Citation: Akaboyev, I. Z., & Tokhtanazarov, A. Q. (2022). Geoecological problems caused by anthropogenic activity at the varzik reservoir. *ISJ Theoretical & Applied Science, 12 (116),* 764-768.

Soi: http://s-o-i.org/1.1/TAS-12-116-69 ***Doi***: crossref https://dx.doi.org/10.15863/TAS.2022.12.116.69

Scopus ASCC: *1900.*

Introduction

UDC 504.052

The well-known politician and thinker Mahatma Gandhi expressed the following thoughts about the preservation of nature's blessings and their rational use. "Earth, air, soil and water are not an inheritance from our ancestors, but a debt from our children. So we have to give them at least as much as it was given to us." In fact, if we consider what substances exist in the human body, it can be seen that more than half of it consists of water, which affects the biochemical processes of the body. We actively use water throughout our lives. But, unfortunately, the quality of consumed water is changing from year to year. Over the years, a large amount of drinking water supplied to the population does not meet sanitary standards in terms of quality. Although the quality of underground water is higher than the content of open reservoirs, this water passes through a "filter system" through sand, clay, stones and other rocks. But such cleaning is not able to remove all harmful substances [11].

Natural and economic problems of water reservoirs can be cited as the main factors among the various components that influence the change of nature. After all, reservoirs cause various overlapping problems in water-related economic sectors. Water pollution poses a serious threat to many water bodies on earth and the surrounding areas. Pollution of waterways by direct anthropogenic factors affects not only animals and plants but also changes in the ecosystem. Waste, heavy metals, and harmful substances can cause irreversible damage to the composition of the ecosystem.

Literature review.

The analysis of the relevant scientific literature and information resources shows that a number of studies have been carried out in our Republic on the geographical research of the Varzik reservoir and its

changes. In particular, its natural geographical features and changes observed in it as a result of anthropogenic influence E.A.Toshpolatov, T.S.Tillayev, A.R.Kuzmetov, Kh.Kh.Abdinazarov, S.U.Isroilov, I.Kamolov, B.A.Kamalov, K.M.Boymirzayev, A.S.Baratov, E.A.Soliyev , I.R. Soliyev and others. Regarding changes and technical safety of the water reservoir, M.R. Bakiyev, A.A. Yangiyev, O. Kadirov, N. Karimova, I. U. Majidov, B. Nosirov, R. Khojaqulova, M. Ramatov, Z. Khusanhojayeva and others have done research. However, factors such as climate change, population growth, and increasing demand for resources in recent years show the practical importance of researching the geoecological situation in this area.

Research Methodology.

The expedition, geophysical, observational, statistical, and comparative research methods, as well as hydrological analysis, systematic, ecological, and landscape approaches to the problem were used in conducting this research.

Analysis and results.

Water reserves on the planet are not the same. While some parts of the world have sufficient water bodies, other places can be seen to have large-scale water shortages. Since surface water is the source of water for many settlements, the main cause of water pollution is anthropogenic activity. Varzik Reservoir is located 2 km southeast of the town of Varzik, Chust District, Namangan Region, at an altitude of 850 meters above sea level. (Figure 1). The village of Varzik is geographically located in the foothills.

Figure-1. Aerial photo of the Varzik reservoir.

Source: https://mapcarta.com/34882204 and https://www.mindat.org/feature-11268263.html

Climate: The climate of the area where the reservoir is located is characterized by rapid changes, i.e. dry, hot summer, and cold winter. The maximum air temperature in summer reaches +40 °C, and the minimum air temperature in winter reaches -26 °C. The average annual air temperature is +11.9 °C. Annual rainfall is 300-330 mm (around the Varzik reservoir). The period of the most precipitation is in October-March, which is 75% of the annual precipitation. In the north-northeast region, the wind in the north direction is characterized by a lot of blowing, the average speed is 3.57 m/s. In other directions, the wind speed is not high. During the operation of the reservoir, freezing of the surface of the reservoir was observed in 2008, when the winter months were cold. Then the thickness of the ice was up to 10-15 cm. The period of melting of the reservoir ice corresponds to late February and the first ten days of March. After that, the water temperature starts to rise. In the spring months, the water temperature varies from +4 °C to +10 °C. The period of maximum increase in water temperature corresponds to July, and the average is +27.3 °C.

Suv omborini to‘ldirish manbaining gidrologik tavsifi: G‘ovasoy daryosi Varzik qishlog‘ida joylashgan Varzik suv omborining to‘ldirish manbai. Daryoda suv oqimi may-iyun oylarida ko‘payadi (o‘rtacha 18-22 kub/s), yanvar-fevralda esa pasayadi (o‘rtacha 1,2 kub/s). Govasoy daryosining o‘rtacha yillik suv oqimi sekundiga 5,92 kub metrni tashkil qiladi. Daryoning umumiy uzunligi 96 km, suv havzasi 724 kv.km. Daryoning oqimi yuqori hududlarni sug'orish va suv omborini to'ldirish uchun ishlatiladi. Suv omborini to'ldirish asosan may-iyun oylarida suv toshqini tufayli amalga oshiriladi [2].

Table 1. Parametric data of Varzik reservoir

The reservoir basin has the following morphometric elements (according to the project) at the standard water level (SWL) mark:	
the full volume of the reservoir	16,55 mln.m^3
the length of the basin	1,8 km
maximum width	650 m
maximum depth	38 m
The area of the reservoir	1,17 km^2
Area up to 2 meters deep	0,21 km^2
The total length of the shoreline of the reservoir	7,2 km
Size	0,01 mln.m^3

Source: Karimova. N. Diploma project "Reconstruction of Varzik Reservoir". Tashkent Institute of Architecture and Construction. Tashkent-2015. P.21.

Any dam accumulates some level of sediment in turbid waters downstream. Species of flora and fauna are in direct contact with sediments. Increased sediment concentration often produces turbid waters with a smaller euphotic zone [13] (the layer closer to the surface that receives enough light for photosynthesis to occur). In the Varzik reservoir, this layer also reduces the productivity of plants and negatively affects the livelihood of fish and bird species distributed in the area. Causes disease in fish, thereby increasing the likelihood of illness or death. Turbidity can also cause visual impairment in fish, which affects their feeding (Figure 2):

On May 6, 1993, Uzbekistan adopted the Law "On Water and Water Use" [3]. Protection from contamination, pollution, and depletion, prevention and elimination of the harmful effects of water, improving the condition of water bodies, as well as protecting the rights and legal interests of enterprises, institutions, organizations, farmers, peasant farms, and citizens in the field of water relations consists of.

In particular, serious concerns about the increasing level of pollution from the disposal of agricultural chemicals, and the further pollution of water resources as a result of waste from the mining industry and settlements are increasing day by day. Improper use of water and its low efficiency hinder the development of irrigated agriculture.

Figure-2. Dewatered parts of the Varzik reservoir.
(Photographed by the authors)

Conclusion/Recommendations.

As a result of the observations, it became known that the impact of water resources on the environment as a result of the activities of the population in the agricultural sector can be shown in the following examples:

- agricultural techniques - these techniques pollute the surface and underground waters around the reservoir, even in small quantities, with fuel and oil materials and their waste;
- land reclamation - shallowing of the water reservoir, decrease in rainfall, reduction of some species of plants and animals, and reduction of fish stocks;
- chemical fertilization - as a result of the washing of fields, mineral fertilizers enter water bodies, which leads to the rapid growth of blue-green algae, which die and form a thick layer of sediment on the bottom of water bodies. Their decomposition consumes almost all the oxygen in the water;
- pesticide use - pesticides flow into water bodies and accumulate there. In the human body, it often causes allergic diseases, and in animals and plants, it can penetrate into all tissue systems and cause negative complications;
- impact on the population - erosion, destruction, silting, swamping, salinization, and other negative phenomena of individual natural and economic objects around water bodies may be observed.

References:

1. Kamolov, I. (2011). *"Old and new Varzik"*. Namangan.
2. Karimova, N. (2015). *"Reconstruction of Varzik Reservoir" diploma project work.* Tashkent Institute of Architecture and Construction. Tashkent.
3. (2000). *Law No. 837 of the Republic of Uzbekistan "On Water and Water Use"*. Retrieved from https://lex.uz/docs/-12328?ONDATE=15.09.2017%2000
4. Bakiev, M.R., Yangiev, A.A., & Kadirov, O. (2002). *Hydrotechnical installations*. (p.276). Tashkent: Science.
5. Bakiev, M.R., Majidov, I.U., Nosirov, B., Khojakulov, R., & Rakhmatov, M. (2008). *Hydrotechnical facilities*. Tashkent, 1.2 volumes.
6. Baratov, A.S. (2018). *organization of water management and efficient use of water in Namangan region.* Namangan.
7. Kuzmetov, A.R., Abdinazarov, X.Kh., & Israilov, S.U. (2019). Qualitative and quantitative development of zooplankton organisms in Fergana Valley reservoirs. *Bulletin of Agrarian Science of Uzbekistan*, No. 1 (75), p.119.
8. Tillaev, T.S. (2022). *Surroundings of the Varzik reservoir [geographic point: landscapes and communities]. Plantarium. Plants and lichens of Russia and neighboring countries: an open online atlas and guide to plants*. [Electronic resource] Retrieved 03.12.2022 from https://www.plantarium.ru/page/landscapes/point/11762.html
9. Tashpulatov, E.A. (1975). *Hydrobiology of reservoirs in the western part of the Ferghana Valley*: Abstract of diss. Candidate of Biological Sciences, (p.24). Tashkent.
10. Khusankho'jaev, Z.Kh. (1986). *Hydrotechnical structures in the reservoir*. (p.214). Tashkent: Teacher.
11. (n.d.). *Impact of water and air pollution on human health.* Retrieved from https://kubantoday.ru/vliyanie-zagryazneniya-vody-i-vozdukha-na-zdorove-cheloveka/
12. (n.d.). Retrieved from https://mapcarta.com/
13. (n.d.). Retrieved from https://www.britannica.com/
14. (n.d.). Retrieved from https://www.mindat.org/feature-11268263.html
15. (n.d.). Retrieved from https://v-nadzor.gov.uz/uz_Cyrl_UZ/page/309/namangan-viloyatidagi-suv-omborlarida-urilish-tamirlash-ishlari-zhadal-olib-borilmoda
16. Abdulkasimov, A. A., Baimirzaev, K. M., & Saliev, I. R. (2014). *Protection of anthropogenic landscapes of Central Asia.* Actual issues of the development of modern society: collection of articles of the 4th International scientific and practical conference: in 4 th volumes, Kursk, April 18, 2014. Volume 1, Kursk: Closed Joint-Stock Company "University Book", pp. 15-17, EDN SZKORZ.
17. Kamalov, B. A. (2001). Climate warming: negative or positive. *Environmental Gazette*, (1), 5.
18. Soliev, E. A. (2008). *The water of the rivers of Fargona valley is ok; to evaluate the situation in*

the context of climate change. Dissertation prepared for the degree of Candidate of Geography, 89.

19. Makulov, J. T., & Akaboyev, I. Z. (2020). Analysis of drainage and rain intensity to solve the flood problem in tashkent. *Jekonomika i socium*, (6), 126-129.
20. Akaboev, I. Z., & Hasanova, Sh. D. (2022). Znachenie kartografirovanija v geograficheskom issledovanii sfery uslug naselenija. *Jekonomika i socium*, № 10-1(101), pp. 887-890, DOI 10.46566/2225-1545_2022_1_101_887, EDN FQKLYV.
21. Akaboev, I. Z. (2019). Vazhnost` kartirovanija naselenija v geograficheskih issledovanijah. *Jekonomika i socium*, (12), 162-164.
22. Akaboev, I., & Hasanova, Sh. (n.d.). Jekonomika i socium. *Jekonomika*, 887-890.
23. (2020). Akaboev, I. Z., & Mirabdullaev, B. B. (2020). Some aspects of the process of creating an industrial map using arcgis. Jekonomika i socium, (11), 50-56.
24. Mirzaaxmedov, X. S., & Akaboyev, I. Z. O. G. L. (2021). Mapping the population of namangan region using modern gis technologies. *Theoretical & applied science*, (12), 1070-1074.
25. Tukhtanazarov, A., Abdullajonov, J., & Olimjonova, N. (2022). Establishment and development of" ecosystem services" residential and" eco-school" centers in Uzbekistan. InterConf.
26. Boymirzaev, K. M., Mirzakhmedov, I. K., Sheraliev, M. H., & Tilanova, M. A. (2022). Geoecological condition of north fergana and problems of their optimization. *Journal of Geography and Natural Resources*, 2(1), 41-49.
27. Dzhumakhanov, Sh. Z., & Makulov, J. T. (2019). Cooperation of the republic of uzbekistan with the states of central asian on the prevention of transborder emergencies. *Economy and society*, (11), 238-242.

Impact Factor:					
	ISRA (India) = 6.317	SIS (USA) = 0.912	ICV (Poland) = 6.630
	ISI (Dubai, UAE) = 1.582	РИНЦ (Russia) = 3.939	PIF (India) = 1.940
	GIF (Australia) = 0.564	ESJI (KZ) = 8.771	IBI (India) = 4.260
	JIF = 1.500	SJIF (Morocco) = 7.184	OAJI (USA) = 0.350

SOI: 1.1/TAS DOI: 10.15863/TAS

International Scientific Journal

Theoretical & Applied Science

p-ISSN: 2308-4944 (print) **e-ISSN:** 2409-0085 (online)

Year: 2022 **Issue:** 12 **Volume:** 116

Published: 26.12.2022 **http://T-Science.org**

Issue Article

O. R. Kucharov
"Tashkent Institute of irrigation and agricultural mechanization engineers"
national research university
associate professor,
Republic of Uzbekistan, Tashkent

F. A. Muradov
Samarkand branch of Tashkent University of Information Technologies
named after Muhammad Al Khorezm,
associate professor,
Republic of Uzbekistan, Samarkand

A. A. Sa'dinov
Samarkand branch of Tashkent University of Information Technologies
named after Muhammad Al Khorezm,
Master student
Republic of Uzbekistan, Samarkand
tel.: +(99897) 927-05-65,
farrux2003@yahoo.com

SIMULATION OF THE PROPAGATION OF ACTIVE AEROSOL PARTICLES IN THE ATMOSPHERE METHOD OF CHANGE OF VARIABLES FOR ITS NUMERICAL INTEGRATION

Abstract: *The article discusses as a result, a multidimensional system of partial differential equations was obtained that describes the process of propagation of active aerosol particles in the atmosphere, which takes into account the main factors, that is, the rates of the forward and reverse reactions, under the action of chemical reactions, as well as the absorption of aerosol particles in the atmosphere and other weather conditions. climatic factors, using which it is possible to calculate and predict the concentration of harmful substances over time.*

Key words: *rate of deposition of particles, the process of transfer and diffusion of aerosol particles in the atmosphere, numerical algorithm.*

Language: *English*

Citation: Kucharov, O. R., Muradov, F. A., & Sa'dinov, A. A. (2022). Simulation of the propagation of active aerosol particles in the atmosphere method of change of variables for its numerical integration. *ISJ Theoretical & Applied Science, 12 (116),* 769-787.

Soi: http://s-o-i.org/1.1/TAS-12-116-70 ***Doi***: https://dx.doi.org/10.15863/TAS.2022.12.116.70

Scopus ASCC: *2604.*

Introduction

The process of movement and settling of particles in turbulent atmospheric flows over heat-producing sources was theoretically studied by Smirnov N.N. and his colleagues [1]. The mathematical model developed by the authors takes into account the effects of two-way interaction of the "gas-particle" system and combines deterministic and stochastic approaches. A modified turbulent flow model is used to describe the behavior of the gas phase. The system of equations describing the turbulent flow was obtained by Favre averaging and includes the mass balance in the gas phase, the mass balance of the k th component, and the balance of momentum and energy. The equations of motion of particles, in addition to the forces of gravity,

resistance and the Archimedes force, take into account random turbulent pulsations in the gas flow, the characteristics of which are determined using the solution obtained in the framework of the model k - ε. The obtained results of numerical experiments made it possible to determine the effect of heat release sources on the dispersion and character of particle deposition.

In [2] an attempt was made to study atmospheric dispersion taking into account the sedimentation rate of particles, when the shape of the particles serves as an input parameter of the model. The authors used a semi-empirical formula for non-spherical particles to determine the sensitivity of the volcanic ash cloud transport process to particle shape. The process was modeled using the Lagrangian atmospheric dispersion model. It has been established that there is no noticeable difference in the vertical trajectories of spherical and non-spherical particles 1 μm in size. The vertical motion of 10 μm particles is more sensitive to shape, but the similar motion pattern of spherical and non-spherical particles is preserved, with the settling velocity always positive, and particles moving both downwards and upwards, indicating the predominance of advection and turbulent diffusion. Shape sensitivity increases dramatically with size, such that non-spherical 100 μm particles settle much more slowly and can move along the plume axis 44% farther from the source than spherical particles. The proposed approach makes it possible to more accurately predict the concentration of fly ash in the atmosphere and the distance of its movement.

Naslund E. and Thaning L. presented a solution to the problem of determining the rate of particle settling under unstable atmospheric stratification [3]. The equation of motion for solid spherical particles uses a common drag coefficient. Time constants, stopping times, and settling rates for stable atmospheric stratification are calculated for a wide range of Reynolds numbers. The resulting settling time is compared with the time calculated for the case where settling occurs by atmospheric convection. It has been found that in this case the solid spherical particles will take much longer to settle, resulting in an increase in the drag coefficient caused by an increase in the relative velocity between the particles and the air mass flow. Such amplification is present both for the horizontal wind field, due to the relationship between the movement of particles in different directions, and for the vertical field. The effect is most pronounced in the region of intermediate Reynolds numbers, slightly above the Stokes range, where the increase in settling time can be more than 10% for certain frequencies and amplitudes of turbulent fluctuations.

It should be noted that in problems where physical processes can be identified in an obvious way, for example, the transfer of a substance in the direction of the wind and molecular diffusion, then in this case it would be quite reasonable to use the method of splitting by physical processes at each time layer.

The idea of the splitting method is to reduce the original multidimensional problem to problems of a simpler structure, which are then sequentially or in parallel solved by known numerical methods. This can be achieved in a variety of ways, so by now a large number of different additive difference schemes have been created [4].

For example, in [5] presents an exact numerical method for a class of scalar strongly degenerate convection-diffusion equations. The method is based on the splitting of the convective and diffusion terms. The non-linear convective part is solved using front tracking and size splitting, while the non-linear diffusion part is solved by a semi- implicit finite difference scheme. The method proposed by the authors has a built-in mechanism for detecting and correcting non-physical loss of entropy, which can occur if the time step is large. The authors demonstrate in this paper that the splitting method accurately resolves sharp gradients, can use large time steps, and has first-order convergence. Although the method has small mass balance errors, it is nevertheless quite efficient.

The task was implemented according to the central difference scheme of A. Kurganov and E. Tadmor for accurate modeling of advection reaction processes. The main partial differential equation is divided into two subproblems, which are solved sequentially during each time step. Unlike traditional methods, the scheme proposed by the authors provides a very efficient method for solving the advection-diffusion-reaction equation for any value of the Peclet number. The performed analysis of mass balance errors shows that the unconventional scheme proposed by the authors has a splitting error, which differs from the error that occurs in traditional schemes. Numerical results demonstrate sufficient reliability of the proposed scheme.

Geiser J. and Kravvaritis Ch . presented a new approach to constructing a domain decomposition method based on the iterative splitting method [6]. The proposed two-stage iterative splitting scheme for solving a linear evolutionary equation is based on separation in space and time. The authors studied the convergence properties of the method. The effectiveness of the proposed method is shown by comparing the numerical results with the additive Schwartz wave relaxation method.

The application of the physical splitting method for modeling the process of distribution of harmful substances in the atmosphere was studied in the works of Havasi A. and Farago I. [7]. To illustrate the physical splitting method, the authors use the Danish Euler model. The basic equation for the transport of pollutants over long distances

$$\frac{\partial c}{\partial t} + \nabla(\underline{u}c) = \nabla(\underline{K}\nabla c) + R(\underline{x}, c) + E + gc$$

with appropriate initial and boundary conditions is reduced to several subsystems describing physical processes: horizontal transport, horizontal diffusion, chemical reactions with ejection, sedimentation and vertical exchange. The authors pay special attention to the issue of errors arising as a result of the separation procedure. The authors give several cases when this error disappears, but emphasize that in practice this rarely happens, so it is important to analyze and carefully select the schemes used so that the error is as small as possible.

In the article [8] a mathematical model and a numerical calculation algorithm for analyzing and predicting the process of gas filtration in a porous medium by the coordinate splitting method are presented, and an estimate of its effectiveness is given in comparison with the calculation algorithm by the alternating directions method.

An analysis of the reviewed literary sources shows that by now many authors have already obtained significant scientific results and have developed various approaches and methods for modeling the process under study. However, the analysis also shows that there are certain gaps in this area. In particular, mathematical models of the processes of transfer and diffusion of aerosol emissions in the atmosphere in the multidimensional setting, taking into account changes in the deposition rates of fine particles and weather and climatic factors, as well as the development of efficient conservative numerical algorithms based on methods with a high order of approximation in time and space variables.

The impact on human health caused by the spread of primary and secondary pollutants in the atmospheric air is mainly associated with the respiratory and cardiovascular systems, but can also have far-reaching consequences in the form of cancer and genetic changes [9]. According to research results published in the reports of the US National Academy of Sciences, air pollution leads to premature deaths of up to 8.8 million people every year [10]. The highest mortality rate in this regard is observed in India and China, according to some estimates, up to 500 thousand people annually [11].

Transport systems (including road, rail, sea, river and air), especially in cities, are the largest sources of air pollution. According to many authors, the share of all types of transport can reach up to 60% of the total volume of anthropogenic emissions [12]. Moreover, atmospheric emissions from road transport are an order of magnitude higher than emissions from all other types of vehicles. Given the trend of steady growth in the car fleet, the environmental situation is aggravated in most countries. Gaseous mixtures and solid aerosol particles emitted as a result of the operation of internal combustion engines contain more than 200 types of pollutants, including carcinogens.

Industrial production is the next major group of anthropogenic emission sources. The share of all types of industry on average accounts for up to 40% of the total volume of artificial emissions of pollutants into the atmosphere. This group of sources is extremely diverse both in terms of the composition of industries and the list of emitted pollutants. The largest contribution to air pollution here is made by enterprises of the fuel and energy sector, objects of the metallurgical and chemical industries, mining and construction industries [13].

Household services, including various enterprises of housing and communal services, are sources of pollution in the urban environment. The main sources of air pollution in this group include boiler houses of central heating systems. Depending on the type of fuel used (gas, fuel oil, firewood, coal, etc.), these sources emit into the atmosphere: sulfur dioxide, nitrogen oxides, heavy metals, volatile organic compounds (VOCs), organic hydrocarbons, as well as various in chemical composition solid large and fine particles [13].

Finally, it is worth noting that over the past few decades, the agricultural industry has become on a par with, and in some cases even surpasses, other sources in terms of emissions into the atmosphere. This situation is especially typical for countries with a powerfully developed agricultural sector, for example, the USA, Russia, China, European countries. According to research by scientists at Columbia University (USA), nitrogen-enriched fertilizers and animal waste are among the largest sources of this group of emissions. The combination of such wastes with combustion products forms fine particles, which are very dangerous for the health and life of the population [14].

Sources of emissions into the atmosphere related to household and agricultural groups, depending on weather and climatic conditions, topography characteristics or development of the area, often form a locally limited unfavorable environmental situation, but can also make a certain contribution to the process of transboundary transport of pollutants in the atmosphere.

In table. Clause 2.5 of Annex 2 provides quantitative indicators of global emissions of major pollutants into the atmosphere by groups of anthropogenic sources (data for 2000) [15]. To date, the situation shown in Table. Clause 2.5 varies somewhat for one or another group, due to the efforts associated with the introduction of environmentally friendly technologies in various sectors of activity. However, unfortunately, the general trend towards an increase in emissions persists.

The data given in table. Clauses 2.3-P.2.5 of Appendix 2 correspond proportionally to the existing situation in Uzbekistan. As in other developed

countries, the industry, transport complex and agricultural sector of Uzbekistan play a crucial role in the development of the economy and improving the welfare of the population of our republic. However, enterprises in the mining, metallurgical, petrochemical, chemical and other industries often exceed the current standards for the emission of harmful substances into the atmosphere, and sometimes not several times, but dozens of times.

According to the State Committee for Nature Protection Uzbekistan [16], the level of atmospheric air pollution on the territory of the Republic of Uzbekistan is determined by emissions from stationary and mobile sources. The volume of emissions of pollution into the atmosphere as a whole in Uzbekistan in 2009 amounted to 2125.0 thousand tons, of which: stationary sources accounted for 741.0 thousand tons, or 34.8%, and mobile sources -1384.0 thousand tons, or 65.2% of the total volume of pollutants emitted into the atmospheric air.

As for natural sources of emissions into the atmosphere, in Uzbekistan they mainly include weakly fixed sandy soils of the Karakum and Kyzyl Kum deserts , as well as the drained part of the Aral Sea due to wind erosion.

In addition to the typing shown, sources of air pollution can also be divided into groups and classes depending on the characteristics of the pollutants themselves. There are usually three main groups:

- mechanical pollutants - solid dust particles of cement plants, rock dumps subject to soil erosion, soot from the combustion of boiler fuel, washable tires, etc.;
- chemical pollutants - gaseous substances and fine aerosols that can enter into chemical reactions under the influence of humidity and temperature;
- radioactive pollutants - radiation, isotopes, particles of radioactive dust.

According to the degree of danger to human health and the negative impact on the environment as a whole, pollutants are divided into several classes. According to the current standards in Uzbekistan, the following classification has been adopted [17]:

- Class I - especially dangerous substances (mercury, benz (o) pyrene , hexachlorane, chromium oxides, etc.);
- Class II - hazardous substances (chlorine, calcium fluoride, hydrogen sulfide, formaldehyde, etc.);
- Class III - low-hazard substances (dust, sulfur dioxide, zinc, acetaldehyde, etc.);
- Class IV - non-hazardous substances (ammonia, carbon oxides, dimethyl sulfide, etc.).

The hygienic standard SanPiN RUz N 0293-11 stipulates the values of maximum permissible concentrations (MPC) of harmful substances in the atmospheric air for 485 substances. At the same time, hazard class I substances make up 43 (8.94%); II class - 157 (32.64%), III class - 192 (39.91%) and IV class - 89 (18.5%). Of these, for 199 substances, taking into account the indicator of harmfulness, only the maximum one-time maximum is established, and for 282 substances - the maximum one-time, average daily, average monthly, average annual MPC.

In addition, this hygienic standard contains a list of 39 substances whose release into the atmospheric air is prohibited due to the extremely high biological activity of these substances. Also given are data on summation groups - substances that have a summation effect when they are present in the atmospheric air together.

In conclusion of the paragraph, we will consider the characteristics of some of the main pollutants taken into account when assessing the quality of atmospheric air.

CO_2 - carbon dioxide or carbon dioxide - is formed as a result of the combustion of fossil fuels and biomass, such as coal, oil, natural gas, synthetic fuels, wood. CO_2 - this is the main component of the number of triatomic gases that affect the development of the greenhouse effect.

As a result of incomplete combustion of fuel, carbon monoxide (CO) is also released, a toxic gas that adversely affects the human cardiovascular system. When inhaled , due to the double bond present in its molecule, strong compounds are formed with human blood hemoglobin and, thereby, the flow of oxygen into the blood is blocked. Carbon monoxide belongs to the 4th hazard class and has a one-time maximum allowable concentration of 5.0 mg/ m^3 .

SO_2 - Sulfur dioxide or sulfur dioxide is one of the most toxic gaseous substances, accounting for more than 90% of the emissions of sulfur compounds with flue gases. The largest amount of sulfur contains coal and heavy types of petroleum products. Sulfur dioxide affects oxidation, destroys materials, adversely affects human health. Long-term exposure to sulfur dioxide on a person leads to a loss of taste sensations, shortness of breath, and then to pneumonia, interruptions in cardiac activity, circulatory disorders and respiratory arrest. The duration of this substance in the atmosphere is relatively short (up to 15-20 days), however, given the presence of oxygen and moisture, SO_2 it is often converted into sulfuric acid, which then falls out with precipitation in the form of acid rain. Sulfur dioxide belongs to the III class of danger, the norm of one-time MPC is 0.5 mg/ m^3 .

NO_x - nitrogen oxides - are formed during the combustion of any type of fossil fuel containing nitrogen compounds, as well as as a result of the oxidation of nitrogen in the air during the combustion process. The higher the combustion temperature, the more intense the formation of nitrogen oxides. Also, enterprises producing nitrogen fertilizers, nitric acid and nitrates, aniline dyes, nitro compounds can also be

a source of nitrogen oxides. Nitrogen oxides adversely affect human health, play a role in the formation of the greenhouse effect and the destruction of the ozone layer. In addition, nitrogen oxides are the cause of forest extinction, acid rain and other negative environmental effects. Nitrogen dioxide NO_2 belongs to hazard class II, has a one-time maximum concentration limit equal to 0.085 mg/ m^3.

O_3 Ozone is a gas that has a characteristic odor (after rain). It is a stronger oxidizing agent than oxygen. Ozone is considered the most toxic of all common air pollutants. In the lower atmospheric layer, ozone is formed as a result of photochemical processes involving nitrogen dioxide and volatile organic compounds. Ozone is involved in the formation of the greenhouse effect, negatively affects human health, crops, etc. According to SanPiN standards, ozone belongs to hazard class I, having a one-time MPC of 0.16 mg/m^3 .

Freons are gaseous impurities with a small proportion in the atmosphere. They are released into the atmosphere mainly during the production of thermal insulation materials, foam plastic, etc., they are emitted from the refrigerants of refrigerators, air conditioners, etc. Freons are destroyers of the ozone layer of the atmosphere. They increase the level of ultraviolet radiation of the Earth and contribute to the formation of the greenhouse effect.

Particles of heavy metals such as chromium, manganese, iron, cobalt, nickel, copper, zinc, cadmium, tin, mercury, lead, etc. have been studied. The term "heavy metals" in this context is considered from a medical and environmental point of view, taking into account biological activity and toxicity of these elements. Many heavy metals (iron, copper, zinc, etc.) are involved in biological processes and, in certain amounts, are essential microelements for the life of plants, animals, and humans. However, due to the fact that these elements have the ability to accumulate in the final environment, for example, in body tissues, they can subsequently have a harmful effect on human health, causing a number of diseases. Metals such as lead and mercury are generally defined as toxic because they have no useful role in biological processes.

Solid particles of the type PM_{10} and $PM_{2,5}$ enter the atmosphere in the form of combustion products (smoke, soot, soot) or through removal from the earth's surface. The degree of air pollution with mechanical impurities depends on the type of ground cover (sands, alumina, concrete, asphalt), its sanitary condition (cleanliness, humidity), as well as on the quality of filtration and purification of industrial emissions. Solid dust particles cause irritation of the mucous membranes of the upper respiratory tract and eyes. Therefore, their prolonged exposure causes respiratory diseases. Suspended fine dust is the most hazardous to health, as it is able to penetrate into the lungs and linger in them for a long time. Particles of heavy metals and other toxic substances contained in the dust inevitably lead to poisoning of varying severity.

Whether dust belongs to one or another MPC class and the accepted MPC standards depend on its characteristics. For example, the dust of the Aral salts is included in class III of pollutants at a single MPC rate of 0.5 mg/ m^3 , and dust from lead-zinc production with a lead content of up to 1% belongs to class I and has a single MPC rate of 0.001 mg /m^3. cubic meters.

2. Statement of the problem

Since the process of transfer and diffusion of harmful substances in the atmosphere, taking into account the weather and climatic factors acting on it, the orography of the terrain and other disturbances, is a complex non-stationary process, a more adequate mathematical model was developed for its study. In addition to taking into account essential parameters, this model is considered in a three-dimensional setting and is described on the basis of the basic laws of hydromechanics using a three- dimensional partial differential equation [18, 19, 20, 21, 22, 23, 24, 25, 26, 27]:

$$\frac{\partial\theta}{\partial t}+u\frac{\partial\theta}{\partial x}+v\frac{\partial\theta}{\partial y}+\left(w-w_g\right)\frac{\partial\theta}{\partial z}+\sigma\theta=\mu\left(\frac{\partial^2\theta}{\partial x^2}+\frac{\partial^2\theta}{\partial y^2}\right)+\frac{\partial}{\partial z}\left(\kappa\frac{\partial\theta}{\partial z}\right)+\delta Q; \quad (1)$$

$$\frac{dw_g}{dt}=\frac{mg-6\pi\gamma r w_g-0,5c\rho s w_g^2}{m} \quad (2)$$

with the corresponding initial and boundary conditions:

$$\theta\big|_{t=0}=\theta^0;\quad w_g\big|_{t=0}=w_g^0\ ; \quad (3)$$

$$-\mu\frac{\partial\theta}{\partial x}\bigg|_{x=0}=\xi\left(\theta_E-\theta\right);\qquad \mu\frac{\partial\theta}{\partial x}\bigg|_{x=Lx}=\xi\left(\theta_E-\theta\right); \quad (4)$$

$$-\mu\frac{\partial\theta}{\partial y}\bigg|_{y=0}=\xi\left(\theta_E-\theta\right);\qquad \mu\frac{\partial\theta}{\partial y}\bigg|_{y=L_y}=\xi\left(\theta_E-\theta\right); \quad (5)$$

$$-\kappa\frac{\partial\theta}{\partial z}\Big|_{z=0}=(\beta\theta-f_0);\quad \kappa\frac{\partial\theta}{\partial z}\Big|_{z=H_z}=\xi(\theta_E-\theta). \tag{6}$$

Here x, y, z is the coordinate system; u, v, w - wind speed in three directions [28, 29].

For the numerical solution of the problem (1)-(6), we assume that the u, v, w time functions are piecewise homogeneous.

Because Since the task is described by a system of nonlinear partial differential equations, it is difficult to obtain an analytical solution. Considering the above, when solving the problem numerically, in order to increase the order of approximation in spatial variables, we introduce the following notation [18, 19, 30, 31, 32, 24, 33]:

$$\bar{w}=w-w_g;\theta=e^{\frac{ux+vy}{2\mu}+\frac{\bar{w}z}{2\kappa}}\tilde{\theta}, \tag{7}$$

and instead of equation (1) we get

$$\frac{\partial\tilde{\theta}}{\partial t}+\sigma_1\tilde{\theta}=\mu\frac{\partial^2\tilde{\theta}}{\partial x^2}+\mu\frac{\partial^2\tilde{\theta}}{\partial y^2}+\frac{\partial}{\partial z}\left(\kappa\frac{\partial\tilde{\theta}}{\partial z}\right)+e_1\delta Q, \tag{8}$$

where

$$\sigma_1=\frac{\kappa u^2+\kappa v^2+\mu\bar{w}^2+4\sigma\mu\kappa}{4\mu\kappa};\quad e_1=e^{-\left(\frac{ux+vy}{2\mu}+\frac{\bar{w}z}{2\kappa}\right)}.$$

Taking into account (8), respectively, the initial and boundary conditions have the following form:

$$\tilde{\theta}\big|_{t=0}=\tilde{\theta}^0;\quad \mathrm{w_g}\big|_{t=0}=w_g^0; \tag{9}$$

$$-\mu\frac{\partial\tilde{\theta}}{\partial x}\Big|_{x=0}=\xi\left(e_1\theta_E-\tilde{\theta}\right);\qquad \mu\frac{\partial\tilde{\theta}}{\partial x}\Big|_{x=L_x}=\xi\left(e_1\theta_E-\tilde{\theta}\right); \tag{10}$$

$$-\mu\frac{\partial\tilde{\theta}}{\partial y}\Big|_{y=0}=\xi\left(e_1\theta_E-\tilde{\theta}\right);\qquad \mu\frac{\partial\tilde{\theta}}{\partial y}\Big|_{y=L_y}=\xi\left(e_1\theta_E-\tilde{\theta}\right); \tag{11}$$

$$-\kappa\frac{\partial\tilde{\theta}}{\partial z}\Big|_{z=0}=\left(\beta\tilde{\theta}-e_1f_0\right);\qquad \kappa\frac{\partial\tilde{\theta}}{\partial z}\Big|_{z=H_z}=\xi\left(e_1\theta_E-\tilde{\theta}\right). \tag{12}$$

3. Methods for solving the problem

Numerical solution of problem (8)-(12), the area of change of the desired variable (concentration of harmful substances), taking into account the boundary conditions, will be covered with a square grid area with a step $\Delta x;\ \Delta y;\Delta z$:

$$\Omega_{xyzt}=\Big\{\left(x_i=i\Delta x,\ y_j=j\Delta y,\ z_k=k\Delta z,\ \tau_n=n\ \Delta t\right);$$
$$i=\overline{1,N_x};\ \ j=\overline{1,M_y},\ \ k=\overline{1,L_z},\ n=\overline{0,N_t},\ \ \Delta t=\frac{1}{N_t}\Big\}.$$

To solve the problem (8)-(12), we divide equation (8) into three directions in time Δt and approximate:

direction $\_O\,x$:

$$\frac{\tilde{\theta}^{n+1/3}_{i,j,k}-\tilde{\theta}^{n}_{i,j,k}}{\Delta t/3}+\sigma_1\tilde{\theta}^{n+1/3}_{i,j,k}=\frac{\mu}{\Delta x^2}\left(\tilde{\theta}^{n+1/3}_{i+1,j,k}-2\tilde{\theta}^{n+1/3}_{i,j,k}+\tilde{\theta}^{n+1/3}_{i-1,j,k}\right)+$$
$$+\frac{\mu}{\Delta y^2}\left(\tilde{\theta}^{n}_{i,j+1,k}-2\tilde{\theta}^{n}_{i,j,k}+\tilde{\theta}^{n}_{i,j-1,k}\right)+$$
$$+\frac{1}{\Delta z^2}\left(\kappa_{k+0,5}\tilde{\theta}^{n}_{i,j,k+1}-\left(\kappa_{k-0,5}+\kappa_{k+0,5}\right)\tilde{\theta}^{n}_{i,j,k}+\kappa_{k-0,5}\tilde{\theta}^{n}_{i,j,k-1}\right)+\frac{1}{3}e_1\delta_{i,j,k}Q.$$

We tear off the brackets and, grouping similar terms of the equation, we obtain

$$\frac{\mu}{\Delta x^2}\tilde{\theta}^{n+1/3}_{i-1,j,k}-\left(\frac{3}{\Delta t}+\sigma_1+\frac{2\mu}{\Delta x^2}\right)\tilde{\theta}^{n+1/3}_{i,j,k}+\frac{\mu}{\Delta x^2}\tilde{\theta}^{n+1/3}_{i+1,j,k}=$$

$$=-\left(\left(\frac{3}{\Delta t}-\frac{2\mu}{\Delta y^2}-\frac{\kappa_{k-0,5}+\kappa_{k+0,5}}{\Delta z^2}\right)\tilde{\theta}^{n}_{i,j,k}+\frac{\mu}{\Delta y^2}\tilde{\theta}^{n}_{i,j-1,k}+\frac{\mu}{\Delta y^2}\tilde{\theta}^{n}_{i,j+1,k}+\right.$$

$$\left.+\frac{\kappa_{k-0,5}}{\Delta z^2}\tilde{\theta}^{n}_{i,j,k-1}+\frac{\kappa_{k+0,5}}{\Delta z^2}\tilde{\theta}^{n}_{i,j,k+1}+\frac{1}{3}e_1\delta_{i,j,k}Q\right).$$

To simplify the above equation, we introduce the following notation:

$$a_{i,j,k}=\frac{\mu}{\Delta x^2};\quad b_{i,j,k}=\frac{3}{\Delta t}+\sigma_1+\frac{2\mu}{\Delta x^2};\quad c_{i,j,k}=\frac{\mu}{\Delta x^2};$$

$$d_{i,j,k}=\left(\frac{3}{\Delta t}-\frac{2\mu}{\Delta y^2}-\frac{\kappa_{k-0,5}+\kappa_{k+0,5}}{\Delta z^2}\right)\tilde{\theta}^{n}_{i,j,k}+\frac{\mu}{\Delta y^2}\tilde{\theta}^{n}_{i,j-1,k}+\frac{\mu}{\Delta y^2}\tilde{\theta}^{n}_{i,j+1,k}+$$

$$+\frac{\kappa_{k-0,5}}{\Delta z^2}\tilde{\theta}^{n}_{i,j,k-1}+\frac{\kappa_{k+0,5}}{\Delta z^2}\tilde{\theta}^{n}_{i,j,k+1}+\frac{1}{3}e_1\delta_{i,j,k}Q.$$

As a result, we obtain a tridiagonal system of linear algebraic equations:

$$a_{i,j,k}\tilde{\theta}^{n+1/3}_{i-1,j,k}-b_{i,j,k}\tilde{\theta}^{n+1/3}_{i,j,k}+c_{i,j,k}\tilde{\theta}^{n+1/3}_{i+1,j,k}=-d_{i,j,k}.$$

In the boundary condition (10) we use a second-order approximation and have

$$-\mu\frac{-3\tilde{\theta}^{n+1/3}_{0,j,k}+4\tilde{\theta}^{n+1/3}_{1,j,k}-\tilde{\theta}^{n+1/3}_{2,j,k}}{2\Delta x}=\xi e_1\theta_E-\xi\tilde{\theta}^{n+1/3}_{0,j,k}$$

or

$$3\mu\tilde{\theta}^{n+1/3}_{0,j,k}-4\mu\tilde{\theta}^{n+1/3}_{1,j,k}+\mu\tilde{\theta}^{n+1/3}_{2,j,k}=2\Delta x e_1\xi\theta_E-2\Delta x\,\xi\tilde{\theta}^{n+1/3}_{0,j,k}. \qquad (13)$$

From the resulting tridiagonal system of linear algebraic equations

$$a_{1,j,k}\tilde{\theta}^{n+1/3}_{0,j,k}-b_{1,j,k}\tilde{\theta}^{n+1/3}_{1,j,k}+c_{1,j,k}\tilde{\theta}^{n+1/3}_{2,j,k}=-d_{1,j,k}$$

find $\tilde{\theta}^{n+1/3}_{2,j,k}$ as follows:

$$\tilde{\theta}^{n+1/3}_{2,j,k}=-\frac{a_{1,j,k}}{c_{1,j,k}}\tilde{\theta}^{n+1/3}_{0,j,k}+\frac{b_{1,j,k}}{c_{1,j,k}}\tilde{\theta}^{n+1/3}_{1,j,k}-\frac{d_{1,j,k}}{c_{1,j,k}}. \qquad (14)$$

Equation (14) is substituted $\tilde{\theta}^{n+1/3}_{2,j,k}$ in (13) and found $\tilde{\theta}^{n+1/3}_{0,j,k}$ in the following form:

$$3\mu\tilde{\theta}^{n+1/3}_{0,j,k}-4\mu\tilde{\theta}^{n+1/3}_{1,j,k}-\frac{a_{1,j,k}}{c_{1,j,k}}\mu\tilde{\theta}^{n+1/3}_{0,j,k}+\frac{b_{1,j,k}}{c_{1,j,k}}\mu\tilde{\theta}^{n+1/3}_{1,j,k}-\frac{d_{1,j,k}}{c_{1,j,k}}\mu=$$

$$=2\Delta x e_1\xi\theta_E-2\Delta x\,\xi\tilde{\theta}^{n+1/3}_{0,j,k};$$

$$\tilde{\theta}^{n+1/3}_{0,j,k}=\frac{4\mu c_{1,j,k}-b_{1,j,k}\mu}{3\mu c_{1,j,k}-a_{1,j,k}\mu+2\Delta x\xi}\tilde{\theta}^{n+1/3}_{1,j,k}+\frac{d_{1,j,k}+2\Delta x\xi c_{1,j,k}e_1\theta_E}{3\mu c_{1,j,k}-a_{1,j,k}\mu+2\Delta x\xi}. \qquad (15)$$

Using the above formulas (15), we find the values of the sweep coefficients $\alpha_{0,j,k}$ and $\beta_{0,j,k}$:

$$\alpha_{0,j,k}=\frac{4\mu c_{1,j,k}-b_{1,j,k}\mu}{3\mu c_{1,j,k}-a_{1,j,k}\mu+2\Delta x\xi};\quad \beta_{0,j,k}=\frac{d_{1,j,k}+2\Delta x\xi c_{1,j,k}e_1\theta_E}{3\mu c_{1,j,k}-a_{1,j,k}\mu+2\Delta x\xi}. \qquad (16)$$

Using the above operations in the boundary condition (10), we obtain

$$\mu\frac{\tilde{\theta}^{n+1/3}_{N-2,j,k}-4\tilde{\theta}^{n+1/3}_{N-1,j,k}+3\tilde{\theta}^{n+1/3}_{N,j,k}}{2\Delta x}=\xi e_1\theta_E-\xi\tilde{\theta}^{n+1/3}_{N,j,k}$$

or

$$\mu\tilde{\theta}^{n+1/3}_{N-2,\,j,k} - 4\mu\tilde{\theta}^{n+1/3}_{N-1,\,j,k} + 3\mu\tilde{\theta}^{n+1/3}_{N,\,j,k} = 2\Delta x e_1 \xi\theta_E - 2\Delta \mathrm{x}\,\xi\tilde{\theta}^{n+1/3}_{N,\,j,k}. \quad (17)$$

Sequentially applying the sweep method for *N-1* and *N-2* , we find $\tilde{\theta}^{n+1/3}_{N-1,\,j,k}$ and $\tilde{\theta}^{n+1/3}_{N-2,\,j,k}$:

$$\tilde{\theta}^{n+1/3}_{N-1,\,j,k} = \alpha_{N-1,\,j,k}\tilde{\theta}^{n+1/3}_{N,\,j,k} + \beta_{N-1,\,j,k}; \quad (18)$$

$$\tilde{\theta}^{n+1/3}_{N-2,\,j,k} = \alpha_{N-2,\,j,k}\tilde{\theta}^{n+1/3}_{N-1,\,j,k} + \beta_{N-2,\,j,k} =$$

$$= \alpha_{N-2,\,j,k}\left(\alpha_{N-1,\,j,k}\tilde{\theta}^{n+1/3}_{N,\,j,k} + \beta_{N-1,\,j,k}\right) + \beta_{N-2,\,j,k} = \quad (19)$$

$$= \alpha_{N-2,\,j,k}\alpha_{N-1,\,j,k}\tilde{\theta}^{n+1/3}_{N,\,j,k} + \alpha_{N-2,\,j,k}\beta_{N-1,\,j,k} + \beta_{N-2,\,j,k}.$$

Substituting $\tilde{\theta}^{n+1/3}_{N-1,\,j,k}$ and $\tilde{\theta}^{n+1/3}_{N-2,\,j,k}$ in (18), (19) instead of $\tilde{\theta}^{n+1/3}_{N-1,\,j,k}$ and $\tilde{\theta}^{n+1/3}_{N-2,\,j,k}$, in (17) we find $\tilde{\theta}^{n+1/3}_{N,\,j,k}$:

$$\alpha_{N-2,\,j,k}\alpha_{N-1,\,j,k}\mu\tilde{\theta}^{n+1/3}_{N,\,j,k} + \alpha_{N-2,\,j,k}\beta_{N-1,\,j,k}\mu + \beta_{N-2,\,j,k}\mu - 4\alpha_{N-1,\,j,k}\mu\tilde{\theta}^{n+1/3}_{N,\,j,k} -$$

$$-4\beta_{N-1,\,j,k}\mu + 3\mu\tilde{\theta}^{n+1/3}_{N,\,j,k} = 2\Delta \mathrm{x}\, e_1\xi\theta_E - 2\Delta \mathrm{x}\,\xi\tilde{\theta}^{n+1/3}_{N,\,j,k};$$

$$\tilde{\theta}^{n+1/3}_{N,\,j,k} = \frac{2\Delta x e_1\xi\theta_E - \left(\beta_{N-2,\,j,k} + \alpha_{N-2,\,j,k}\beta_{N-1,\,j,k} - 4\beta_{N-1,\,j,k}\right)\mu}{2\Delta x\xi + \left(\alpha_{N-2,\,j,k}\alpha_{N-1,\,j,k} - 4\alpha_{N-1,\,j,k} + 3\right)\mu}. \quad (20)$$

In the reverse course of the sweep in successively decreasing order of index *i* , the values of concentrations $\tilde{\theta}^{n+1/3}_{N-1,\,j,k}$, $\tilde{\theta}^{n+1/3}_{N-2,\,j,k}$, ..., are determined $\tilde{\theta}^{n+1/3}_{0,\,j,k}$.

By applying the above procedures for sending *Ox* , *we* have the following:

$$\frac{\tilde{\theta}^{n+2/3}_{i,\,j,k} - \tilde{\theta}^{n+1/3}_{i,\,j,k}}{\Delta t/3} + \sigma_1\tilde{\theta}^{n+2/3}_{i,\,j,k} = \frac{\mu}{\Delta x^2}\left(\tilde{\theta}^{n+1/3}_{i+1,\,j,k} - 2\tilde{\theta}^{n+1/3}_{i,\,j,k} + \tilde{\theta}^{n+1/3}_{i-1,\,j,k}\right) +$$

$$+\frac{\mu}{\Delta y^2}\left(\tilde{\theta}^{n+2/3}_{i,\,j+1,k} - 2\tilde{\theta}^{n+2/3}_{i,\,j,k} + \tilde{\theta}^{n+2/3}_{i,\,j-1,k}\right) +$$

$$+\frac{1}{\Delta z^2}\left(\kappa_{k+0,5}\tilde{\theta}^{n+1/3}_{i,\,j,k+1} - \left(\kappa_{k-0,5} + \kappa_{k+0,5}\right)\tilde{\theta}^{n+1/3}_{i,\,j,k} + \kappa_{k-0,5}\tilde{\theta}^{n+1/3}_{i,\,j,k-1}\right) + \frac{1}{3}e_1\delta_{i,\,j,k}Q.$$

Opening the brackets and simplifying like terms, we finally get

$$\frac{\mu}{\Delta y^2}\tilde{\theta}^{n+2/3}_{i,\,j-1,k} - \left(\frac{3}{\Delta t} + \sigma_1 + \frac{2\mu}{\Delta y^2}\right)\tilde{\theta}^{n+2/3}_{i,\,j,k} + \frac{\mu}{\Delta y^2}\tilde{\theta}^{n+2/3}_{i,\,j+1,k} =$$

$$= -\left(\left(\frac{3}{\Delta t} - \frac{2\mu}{\Delta x^2} - \frac{\kappa_{k-0,5} + \kappa_{k+0,5}}{\Delta z^2}\right)\tilde{\theta}^{n+1/3}_{i,\,j,k} + \frac{\mu}{\Delta x^2}\tilde{\theta}^{n+1/3}_{i-1,\,j,k} + \frac{\mu}{\Delta x^2}\tilde{\theta}^{n+1/3}_{i+1,\,j,k} +\right.$$

$$\left. + \frac{\kappa_{k-0,5}}{\Delta z^2}\tilde{\theta}^{n+1/3}_{i,\,j,k-1} + \frac{\kappa_{k+0,5}}{\Delta z^2}\tilde{\theta}^{n+1/3}_{i,\,j,k+1} + \frac{1}{3}e_1\delta_{i,\,j,k}Q\right).$$

To simplify the above equation, we introduce the following notation:

$$\bar{a}_{i,\,j,k} = \frac{\mu}{\Delta y^2}; \quad \bar{b}_{i,\,j,k} = \frac{3}{\Delta t} + \sigma_1 + \frac{2\mu}{\Delta y^2}; \quad \bar{c}_{i,\,j,k} = \frac{\mu}{\Delta y^2};$$

$$\bar{d}_{i,\,j,k} = \left(\frac{3}{\Delta t} - \frac{2\mu}{\Delta x^2} - \frac{\kappa_{k-0,5} + \kappa_{k+0,5}}{\Delta z^2}\right)\tilde{\theta}^{n+1/3}_{i,\,j,k} + \frac{\mu}{\Delta x^2}\tilde{\theta}^{n+1/3}_{i-1,\,j,k} + \frac{\mu}{\Delta x^2}\tilde{\theta}^{n+1/3}_{i+1,\,j,k} +$$

$$+\frac{\kappa_{k-0,5}}{\Delta z^2}\tilde{\theta}^{n+1/3}_{i,\,j,k-1} + \frac{\kappa_{k+0,5}}{\Delta z^2}\tilde{\theta}^{n+1/3}_{i,\,j,k+1} + \frac{1}{3}e_1\delta_{i,\,j,k}Q.$$

As a result, we obtain a tridiagonal system of linear algebraic equations:

$$\bar{a}_{i,j,k}\tilde{\theta}^{n+2/3}_{i,j-1,k} - \bar{b}_{i,j,k}\tilde{\theta}^{n+2/3}_{i,j,k} + \bar{c}_{i,j,k}\tilde{\theta}^{n+2/3}_{i,j+1,k} = -\bar{d}_{i,j,k}. \quad (21)$$

Similarly, repeating the above procedure for the boundary condition (11), we obtain

$$-\mu\frac{-3\tilde{\theta}^{n+2/3}_{i,0,k} + 4\tilde{\theta}^{n+2/3}_{i,1,k} - \tilde{\theta}^{n+2/3}_{i,2,k}}{2\Delta y} = \xi e_1\theta_E - \xi\tilde{\theta}^{n+2/3}_{i,0,k};$$

$$3\mu\tilde{\theta}^{n+2/3}_{i,0,k} - 4\mu\tilde{\theta}^{n+2/3}_{i,1,k} + \mu\tilde{\theta}^{n+2/3}_{i,2,k} = 2\Delta y e_1\xi\theta_E - 2\Delta y\xi\tilde{\theta}^{n+2/3}_{i,0,k}; \quad (22)$$

From the resulting system of equations

$$\bar{a}_{i,1,k}\tilde{\theta}^{n+2/3}_{i,0,k} - \bar{b}_{i,1,k}\tilde{\theta}^{n+2/3}_{i,1,k} + \bar{c}_{i,1,k}\tilde{\theta}^{n+2/3}_{i,2,k} = -\bar{d}_{i,1,k}$$

we find $\tilde{\theta}^{n+2/3}_{i,2,k}$:

$$\tilde{\theta}^{n+2/3}_{i,2,k} = -\frac{\bar{a}_{i,1,k}}{\bar{c}_{i,1,k}}\tilde{\theta}^{n+2/3}_{i,0,k} + \frac{\bar{b}_{i,1,k}}{\bar{c}_{i,1,k}}\tilde{\theta}^{n+2/3}_{i,1,k} - \frac{\bar{d}_{i,1,k}}{\bar{c}_{i,1,k}}. \quad (23)$$

Substituting (23) instead $\tilde{\theta}^{n+2/3}_{i,2,k}$ of in (22), we find $\tilde{\theta}^{n+2/3}_{i,0,k}$:

$$\tilde{\theta}^{n+\frac{2}{3}}_{i,0,k} = \frac{4\mu\bar{c}_{i,1,k} - \bar{b}_{i,1,k}\mu}{3\mu\bar{c}_{i,1,k} - \bar{a}_{i,1,k}\mu + 2\Delta y\xi}\tilde{\theta}^{n+\frac{2}{3}}_{i,1,k} + \frac{\bar{d}_{i,1,k} + 2\Delta y\bar{c}_{i,1,k}e_1\xi\theta_E}{3\mu\bar{c}_{i,1,k} - \bar{a}_{i,1,k}\mu + 2\Delta y\xi}. \quad (24)$$

Using the above formulas (24), we find the values of the sweep coefficients $\bar{\alpha}_{i,0,k}$ and $\bar{\beta}_{i,0,k}$:

$$\bar{\alpha}_{i,0,k} = \frac{4\mu\bar{c}_{i,1,k} - \bar{b}_{i,1,k}\mu}{3\mu\bar{c}_{i,1,k} - \bar{a}_{i,1,k}\mu + 2\Delta y\xi}; \quad \bar{\beta}_{i,0,k} = \frac{\bar{d}_{i,1,k} + 2\Delta y e_1\bar{c}_{i,1,k}\xi\theta_E}{3\mu\bar{c}_{i,1,k} - \bar{a}_{i,1,k}\mu + 2\Delta y\xi}. \quad (25)$$

In the boundary condition (11), using the approximation of the second order of accuracy, we obtain

$$\mu\frac{\tilde{\theta}^{n+2/3}_{i,M-2,k} - 4\tilde{\theta}^{n+2/3}_{i,M-1,k} + 3\tilde{\theta}^{n+2/3}_{i,M,k}}{2\Delta y} = \xi e_1\theta_E - \xi\tilde{\theta}^{n+2/3}_{i,M,k};$$

$$\mu\tilde{\theta}^{n+2/3}_{i,M-2,k} - 4\mu\tilde{\theta}^{n+2/3}_{i,M-1,k} + 3\mu\tilde{\theta}^{n+2/3}_{i,M,k} = 2\Delta y e_1\xi\theta_E - 2\Delta y\xi\tilde{\theta}^{n+2/3}_{i,M,k}. \quad (26)$$

Consistently applying the sweep method for *M-1* and *M-2*, we find $\tilde{\theta}^{n+2/3}_{i,M-1,k}$ and $\tilde{\theta}^{n+2/3}_{i,M-2,k}$:

$$\tilde{\theta}^{n+\frac{2}{3}}_{i,M-2,k} = \bar{\alpha}_{i,M-2,k}\tilde{\theta}^{n+\frac{2}{3}}_{i,M-1,k} + \bar{\beta}_{i,M-2,k} = \bar{\alpha}_{i,M-2,k}\left(\bar{\alpha}_{i,M-1,k}\tilde{\theta}^{n+2/3}_{i,M,k} + \bar{\beta}_{i,M-1,k}\right) +$$
$$+\bar{\beta}_{i,M-2,k} = \bar{\alpha}_{i,M-2,k}\bar{\alpha}_{i,M-1,k}\tilde{\theta}^{n+2/3}_{i,M,k} + \bar{\alpha}_{i,M-2,k}\bar{\beta}_{i,M-1,k} + \bar{\beta}_{i,M-2,k}. \quad (27)$$

Substituting $\tilde{\theta}^{n+2/3}_{i,M-1,k}$ and $\tilde{\theta}^{n+2/3}_{i,M-2,k}$ in (26) and (27), instead of $\tilde{\theta}^{n+2/3}_{i,M-1,k}$ and $\tilde{\theta}^{n+2/3}_{i,M-2,k}$ in (26) we find $\tilde{\theta}^{n+2/3}_{i,M,k}$:

$$\left(\bar{\alpha}_{i,M-2,k}\bar{\alpha}_{i,M-1,k}\mu - 4\bar{\alpha}_{i,M-1,k}\mu + 3\mu + 2\Delta y\xi\right)\tilde{\theta}^{n+2/3}_{i,M,k} =$$
$$= 2\Delta y e_1\xi\theta_E - \bar{\beta}_{i,M-2,k}\mu - \bar{\alpha}_{i,M-2,k}\bar{\beta}_{i,M-1,k}\mu + 4\bar{\beta}_{i,M-1,k}\mu;$$

$$\tilde{\theta}^{n+2/3}_{i,M,k} = \frac{2\Delta y e_1\xi\theta_E - \left(\bar{\beta}_{i,M-2,k} + \bar{\alpha}_{i,M-2,k}\bar{\beta}_{i,M-1,k} - 4\bar{\beta}_{i,M-1,k}\right)\mu}{2\Delta y\xi + \left(\bar{\alpha}_{i,M-2,k}\bar{\alpha}_{i,M-1,k} - 4\bar{\alpha}_{i,M-1,k} + 3\right)\mu}. \quad (28)$$

By reverse running, in the order of successively decreasing index j, the values of concentrations $\tilde{\theta}^{n+2/3}_{i,M-1,k}$, $\tilde{\theta}^{n+2/3}_{i,M-2,k}$,…, $\tilde{\theta}^{n+2/3}_{i,0,k}$ are in the following form:

$$\tilde{\theta}^{n+2/3}_{i,j,k} = \bar{\alpha}_{i,j,k}\tilde{\theta}^{n+2/3}_{i,j+1,k} + \bar{\beta}_{i,j,k}; \quad i = \overline{1,N-1}, \quad j = \overline{M-1,0}, \quad k = \overline{1,L-1}. \quad (29)$$

above procedures are applied for sending *Oz* and we have

$$\frac{\tilde{\theta}_{i,j,k}^{n+1}-\tilde{\theta}_{i,j,k}^{n+2/3}}{\Delta t/3}+\sigma_1\tilde{\theta}_{i,j,k}^{n+1}=\frac{\mu}{\Delta x^2}\left(\tilde{\theta}_{i+1,j,k}^{n+2/3}-2\tilde{\theta}_{i,j,k}^{n+2/3}+\tilde{\theta}_{i-1,j,k}^{n+2/3}\right)+$$

$$+\frac{\mu}{\Delta y^2}\left(\tilde{\theta}_{i,j+1,k}^{n+2/3}-2\tilde{\theta}_{i,j,k}^{n+2/3}+\tilde{\theta}_{i,j-1,k}^{n+2/3}\right)+$$

$$+\frac{1}{\Delta z^2}\left(\kappa_{k+0,5}\tilde{\theta}_{i,j,k+1}^{n+1}-\left(\kappa_{k-0,5}+\kappa_{k+0,5}\right)\tilde{\theta}_{i,j,k}^{n+1}+\kappa_{k-0,5}\tilde{\theta}_{i,j,k-1}^{n+1}\right)+\frac{1}{3}e_1\delta_{i,j,k}Q.$$

Opening the brackets and simplifying like terms, we finally get

$$\frac{\kappa_{k-0,5}}{\Delta z^2}\tilde{\theta}_{i,j,k-1}^{n+1}-\left(\frac{3}{\Delta t}+\sigma_1+\frac{\kappa_{k-0,5}+\kappa_{k+0,5}}{\Delta z^2}\right)\tilde{\theta}_{i,j,k}^{n+1}+\frac{\kappa_{k+0,5}}{\Delta z^2}\tilde{\theta}_{i,j,k+1}^{n+1}=$$

$$=-\left(\left(\frac{3}{\Delta t}-\frac{2\mu}{\Delta x^2}-\frac{2\mu}{\Delta y^2}\right)\tilde{\theta}_{i,j,k}^{n+2/3}+\frac{\mu}{\Delta x^2}\tilde{\theta}_{i-1,j,k}^{n+2/3}+\frac{\mu}{\Delta x^2}\tilde{\theta}_{i+1,j,k}^{n+2/3}+\right.$$

$$\left.+\frac{\mu}{\Delta y^2}\tilde{\theta}_{i,j-1,k}^{n+2/3}+\frac{\mu}{\Delta y^2}\tilde{\theta}_{i,j+1,k}^{n+2/3}+\frac{1}{3}e_1\delta_{i,j,k}Q\right).$$

To simplify the equations obtained, we introduce the notation:

$$\bar{\bar{a}}_{i,j,k}=\frac{\kappa_{k-0,5}}{\Delta z^2};\qquad \bar{\bar{b}}_{i,j,k}=\frac{3}{\Delta t}+\sigma_1+\frac{\kappa_{k-0,5}+\kappa_{k+0,5}}{\Delta z^2};\quad \bar{\bar{c}}_{i,j,k}=\frac{\kappa_{k+0,5}}{\Delta z^2};$$

$$\bar{\bar{d}}_{i,j,k}=\left(\frac{3}{\Delta t}-\frac{2\mu}{\Delta x^2}-\frac{2\mu}{\Delta y^2}\right)\tilde{\theta}_{i,j,k}^{n+2/3}+\frac{\mu}{\Delta x^2}\tilde{\theta}_{i-1,j,k}^{n+2/3}+\frac{\mu}{\Delta x^2}\tilde{\theta}_{i+1,j,k}^{n+2/3}+$$

$$+\frac{\mu}{\Delta y^2}\tilde{\theta}_{i,j-1,k}^{n+2/3}+\frac{\mu}{\Delta y^2}\tilde{\theta}_{i,j+1,k}^{n+2/3}+\frac{1}{3}e_1\delta_{i,j,k}Q^{n+1},$$

and we obtain a tridiagonal system of linear algebraic equations:

$$\bar{\bar{a}}_{i,j,k}\tilde{\theta}_{i,j,k-1}^{n+1}-\bar{\bar{b}}_{i,j,k}\tilde{\theta}_{i,j,k}^{n+1}+\bar{\bar{c}}_{i,j,k}\tilde{\theta}_{i,j,k+1}^{n+1}=-\bar{\bar{d}}_{i,j,k}. \tag{30}$$

For the boundary condition (12) at $z = 0$ we obtain

$$-\kappa_1\frac{-3\tilde{\theta}_{i,j,0}^{n+1}+4\tilde{\theta}_{i,j,1}^{n+1}-\tilde{\theta}_{i,j,2}^{n+1}}{2\Delta z}=\beta\tilde{\theta}_{i,j,0}^{n+1}-fe_1;$$

$$3\kappa_1\tilde{\theta}_{i,j,0}^{n+1}-4\kappa_1\tilde{\theta}_{i,j,1}^{n+1}+\kappa_1\tilde{\theta}_{i,j,2}^{n+1}=2\Delta z\beta\tilde{\theta}_{i,j,0}^{n+1}-2e_1\Delta zf. \tag{31}$$

From the resulting system of equations

$$\bar{\bar{a}}_{i,j,1}\tilde{\theta}_{i,j,0}^{n+1}-\bar{\bar{b}}_{i,j,1}\tilde{\theta}_{i,j,1}^{n+1}+\bar{\bar{c}}_{i,j,1}\tilde{\theta}_{i,j,2}^{n+1}=-\bar{\bar{d}}_{i,j,1},$$

we find $\tilde{\theta}_{i,j,2}^{n+1}$:

$$\tilde{\theta}_{i,j,2}^{n+1}=-\frac{\bar{\bar{a}}_{i,j,1}}{\bar{\bar{c}}_{i,j,1}}\tilde{\theta}_{i,j,0}^{n+1}+\frac{\bar{\bar{b}}_{i,j,1}}{\bar{\bar{c}}_{i,j,1}}\tilde{\theta}_{i,j,1}^{n+1}-\frac{\bar{\bar{d}}_{i,j,1}}{\bar{\bar{c}}_{i,j,1}}. \tag{32}$$

Substituting (32) instead $\tilde{\theta}_{i,j,2}^{n+1}$ of in (31), we find $\tilde{\theta}_{i,j,0}^{n+1}$:

$$3\kappa_1\tilde{\theta}_{i,j,0}^{n+1}-4\kappa_1\tilde{\theta}_{i,j,1}^{n+1}-\frac{\bar{\bar{a}}_{i,j,1}}{\bar{\bar{c}}_{i,j,1}}\kappa_1\tilde{\theta}_{i,j,0}^{n+1}+\frac{\bar{\bar{b}}_{i,j,1}}{\bar{\bar{c}}_{i,j,1}}\kappa_1\tilde{\theta}_{i,j,1}^{n+1}-\frac{\bar{\bar{d}}_{i,j,1}}{\bar{\bar{c}}_{i,j,1}}\kappa_1=$$

$$=2\Delta z\beta\tilde{\theta}_{i,j,0}^{n+1}-2e_1\Delta zf;$$

$$\tilde{\theta}_{i,j,0}^{n+1}=\frac{4\kappa_1\bar{\bar{c}}_{i,j,1}-\bar{\bar{b}}_{i,j,1}\kappa_1}{3\kappa_1\bar{\bar{c}}_{i,j,1}-\bar{\bar{a}}_{i,j,1}\kappa_1-2\Delta z\beta}\tilde{\theta}_{i,j,1}^{n+1}+\frac{\bar{\bar{d}}_{i,j,1}\kappa_1+2e_1\Delta z\bar{\bar{c}}_{i,j,1}f}{3\kappa_1\bar{\bar{c}}_{i,j,1}-\bar{\bar{a}}_{i,j,1}\kappa_1-2\Delta z\beta}. \tag{33}$$

Using the above formulas (33), we find the values of the sweep coefficients $\bar{\bar{\alpha}}_{i,j,0}$ and $\bar{\bar{\beta}}_{i,j,0}$:

$$\bar{\bar{\alpha}}_{i,j,0} = \frac{4\kappa_1\bar{\bar{c}}_{i,j,1} - \bar{\bar{b}}_{i,j,1}\kappa_1}{3\kappa_1\bar{\bar{c}}_{i,j,1} - \bar{\bar{a}}_{i,j,1}\kappa_1 - 2\Delta z\beta};$$
$$\bar{\bar{\beta}}_{i,j,0} = \frac{\bar{\bar{d}}_{i,j,1}\kappa_1 + 2e_1\Delta z\bar{\bar{c}}_{i,j,1}f}{3\kappa_1\bar{\bar{c}}_{i,j,1} - \bar{\bar{a}}_{i,j,1}\kappa_1 - 2\Delta z\beta}. \quad (34)$$

In the boundary condition (12) for $z = H_z$, using the approximation of the second order of accuracy, we obtain the following:

$$\kappa_L\frac{\tilde{\theta}^{n+1}_{i,j,L-2} - 4\tilde{\theta}^{n+1}_{i,j,L-1} + 3\tilde{\theta}^{n+1}_{i,j,L}}{2\Delta z} = \xi e_1\theta_E - \xi\tilde{\theta}^{n+1}_{i,j,L};$$
$$\kappa_L\tilde{\theta}^{n+1}_{i,j,L-2} - 4\kappa_L\tilde{\theta}^{n+1}_{i,j,L-1} + 3\kappa_L\tilde{\theta}^{n+1}_{i,j,L} = 2\Delta z e_1\xi\theta_E - 2\Delta z\xi\tilde{\theta}^{n+1}_{i,j,L}. \quad (35)$$

Sequentially applying the sweep method for *L-1* and *L-2*, we find $\tilde{\theta}^{n+1}_{i,j,L-1}$ and $\tilde{\theta}^{n+1}_{i,j,L-2}$:

$$\tilde{\theta}^{n+1}_{i,j,L-1} = \bar{\bar{\alpha}}_{i,j,L-1}\tilde{\theta}^{n+1}_{i,j,L} + \bar{\bar{\beta}}_{i,j,L-1}; \quad (36)$$

$$\tilde{\theta}^{n+1}_{i,j,L-2} = \bar{\bar{\alpha}}_{i,j,L-2}\tilde{\theta}^{n+1}_{i,j,L-1} + \bar{\bar{\beta}}_{i,j,L-2} = \bar{\bar{\alpha}}_{i,j,L-2}\left(\bar{\bar{\alpha}}_{i,j,L-1}\tilde{\theta}^{n+1}_{i,j,L} + \bar{\bar{\beta}}_{i,j,L-1}\right) +$$
$$+\bar{\bar{\beta}}_{i,j,L-2} = \bar{\bar{\alpha}}_{i,j,L-2}\bar{\bar{\alpha}}_{i,j,L-1}\tilde{\theta}^{n+1}_{i,j,L} + \bar{\bar{\alpha}}_{i,j,L-2}\bar{\bar{\beta}}_{i,j,L-1} + \bar{\bar{\beta}}_{i,j,L-2}. \quad (37)$$

Substituting $\tilde{\theta}^{n+1}_{i,j,L-1}$ and $\tilde{\theta}^{n+1}_{i,j,L-2}$ in (36) and (37), instead of $\tilde{\theta}^{n+1}_{i,j,L-1}$ and $\tilde{\theta}^{n+1}_{i,j,L-2}$ in (35) we find $\tilde{\theta}^{n+1}_{i,j,L}$:

$$\tilde{\theta}^{n+1}_{i,j,L} = \frac{2\Delta z e_1\xi\theta_E - \left(\bar{\bar{\beta}}_{i,j,L-2} + \bar{\bar{\alpha}}_{i,j,L-2}\bar{\bar{\beta}}_{i,j,L-1} - 4\bar{\bar{\beta}}_{i,j,L-1}\right)\kappa_L}{2\Delta z\xi + \left(\bar{\bar{\alpha}}_{i,j,L-2}\bar{\bar{\alpha}}_{i,j,L-1} - 4\bar{\bar{\alpha}}_{i,j,L-1} + 3\right)\kappa_L}. \quad (38)$$

By reverse running in successively decreasing order of the index k, the values of the concentrations of harmful substances $\tilde{\theta}^{n+1}_{i,j,L-1}$, $\tilde{\theta}^{n+1}_{i,j,L-2}$,..., $\tilde{\theta}^{n+1}_{i,j,0}$ are in the following form:

$$\tilde{\theta}^{n+1}_{i,j,k} = \bar{\bar{\alpha}}_{i,j,k}\tilde{\theta}^{n+1}_{i,j,k+1} + \bar{\bar{\beta}}_{i,j,k}; \quad i = \overline{1,N-1}, \quad j = \overline{1,M-1}, \quad k = \overline{L-1,0}. \quad (39)$$

Thus, in this section, an efficient numerical algorithm is developed for solving the problem (1)-(6) with the second order of accuracy in space variables. By software implementation of the developed model and algorithm, it is possible to carry out SE on a computer to study and predict the ecological state of the industrial regions under consideration [34].

4. About programming complexes

The software tool presented in this paragraph, developed in the Embarcadero environment Rad Studio version 10 in C# programming language, consists of: main control unit; block for entering input data; computational unit for numerical integration and conducting SE; a block for forming a database based on the results of numerical calculations; block for interpreting the results of numerical calculations in the form of graphic, animation and tabular objects (Fig. 1-4).

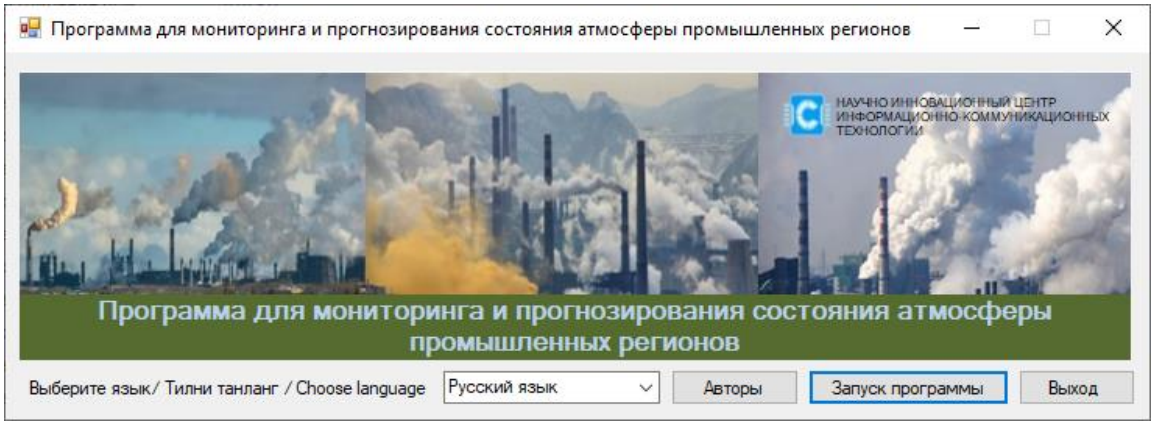


Fig. 1. Main program launch window

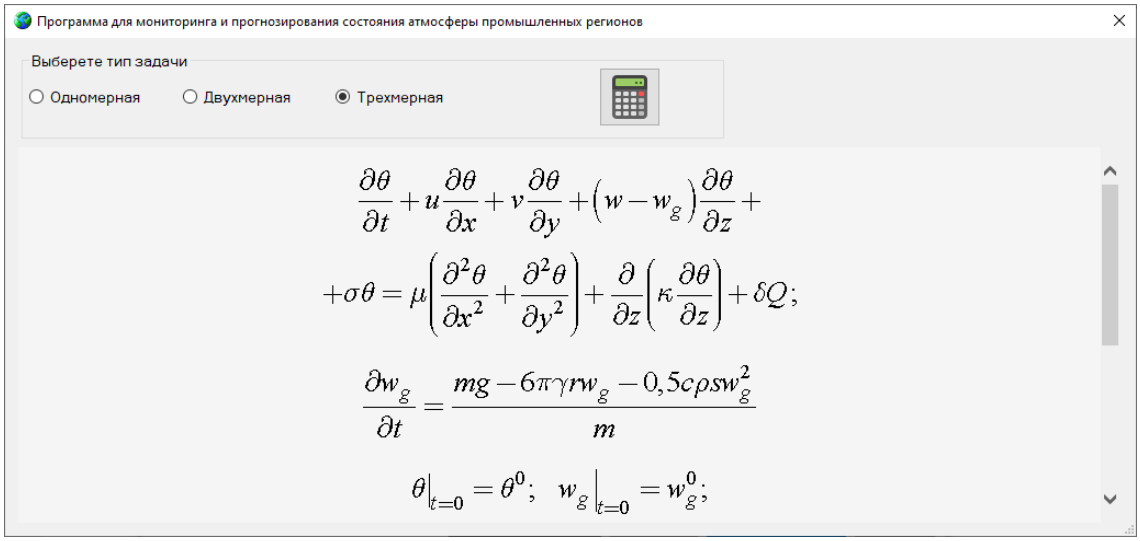


Fig. 2. Interface for selecting the language locale, model and, accordingly, the algorithm of the problem being solved

As part of a software and instrumental complex, this program allows you to monitor the dynamic distribution of harmful emissions in the atmosphere on a computer monitor depending on weather and climate data, terrain orography, characteristics of the underlying surface of the earth and other disturbances affecting the process as a whole [35].

Functional properties of the program:

- creation of an information model for calculating the concentration of harmful substances;
- calculation of the concentration of harmful substances in the atmosphere of the region, depending on the power of the located sources and their number, weather and climatic conditions and other additional factors;
- monitoring and forecasting the state of the air basin of the region under consideration and an animated presentation of the results of numerical calculations performed on a computer;
- activating the interface mode in order to maximize the visualization of human-machine interaction.

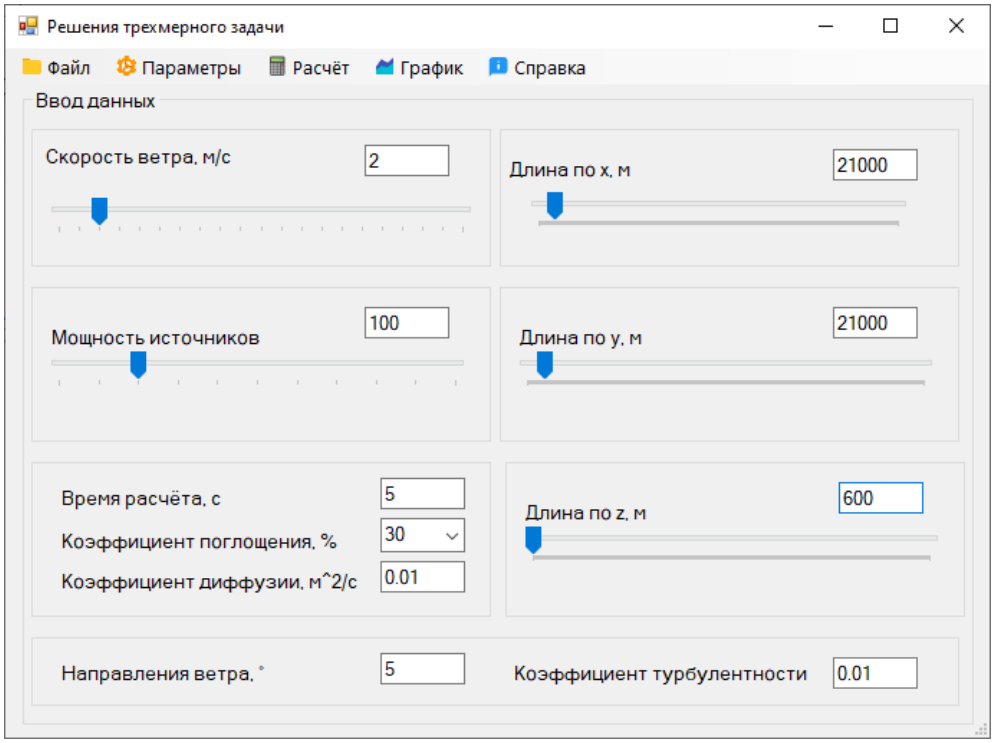
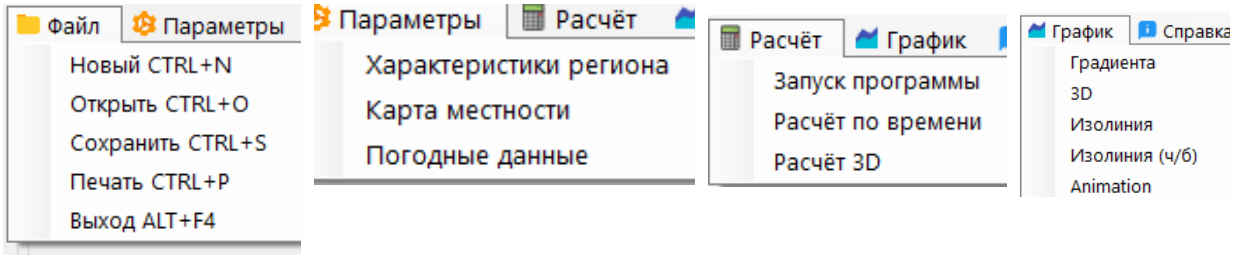


Fig. 3. Interface for entering the parameters of the problem to be solved

The window in fig. 3 contains such parameters as wind speed, source power, calculation time, absorption coefficient of harmful substances in the atmosphere, diffusion coefficient, turbulence coefficient and the size of the area under consideration.



a) *b*) *c*) *d*)

FIg. 4. Elements of the main menu of the program

The main menu of the program (Fig. 4) allows the user to perform the following actions:

In the "File" menu (Fig. 4 *a*), the user has the opportunity to create a new CE; save the created experiment configuration and settings; open a previously saved configuration and experiment parameters; printing of results and graphic objects; and the end of the program.

The "Parameters" menu (Fig. 4 *b*) provides the ability to set the parameters and conditions of the problem being solved: characteristics of the region (size, relief), geographical map of the region (map details), as well as meteorological data for a given area.

Using the "Calculation" menu (Fig. 4 *c*), the user can start the calculation procedure in accordance with the specified settings.

The "Graph" menu (Fig. 4 *d*) is designed to select the preferred form of visualization of the calculation results, including in the form of a gradient, 3D diagram (Fig. 5), color or black and white isolines (Fig. 6), as well as an animated image .

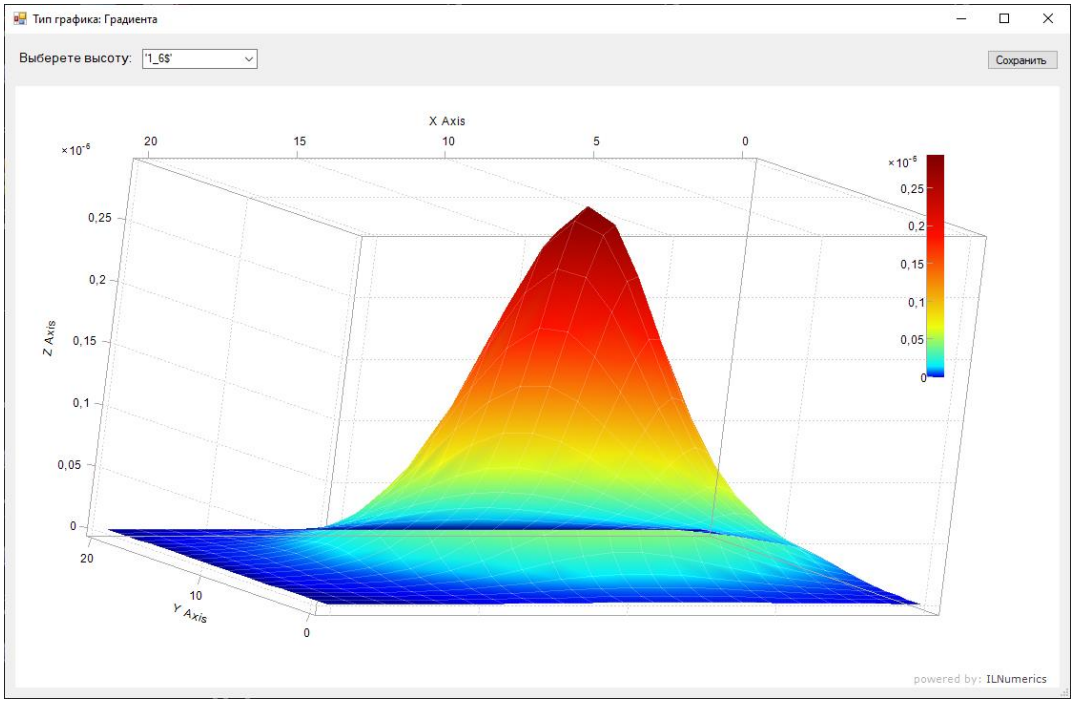


Fig. 5. An example of visualization of calculation results in the form of a color gradient of a three-dimensional shape

As shown in fig. 5, any available layer can be selected for visualization according to the height of the problem solution area. In addition, when choosing a real geographical map of the region, the visualized layers with the distribution of the concentration of harmful substances can be superimposed on the original map - the substrate in the form of a translucent layer, or can be exported for use in third-party applications.

The practical application of the developed software tool in solving the problems of monitoring and predicting the ecological state of the atmosphere makes it possible to automate calculations to determine the concentration of pollution in the boundary layer of the atmosphere, taking into account real meteorological parameters and characteristics of the terrain, to visualize the scale and geography of the distribution of harmful emissions in the environment for a visual assessment of possible negative effects on the ecological state of adjacent territories, taking into account the maximum permissible sanitary standards, as well as to support decision-making on environmental protection measures.

To calibrate the models developed and implemented in this program, a series of SEs was carried out on test data on the problem of predicting the spread of harmful substances in the atmosphere, taking into account the particle settling rate (Fig. 6).

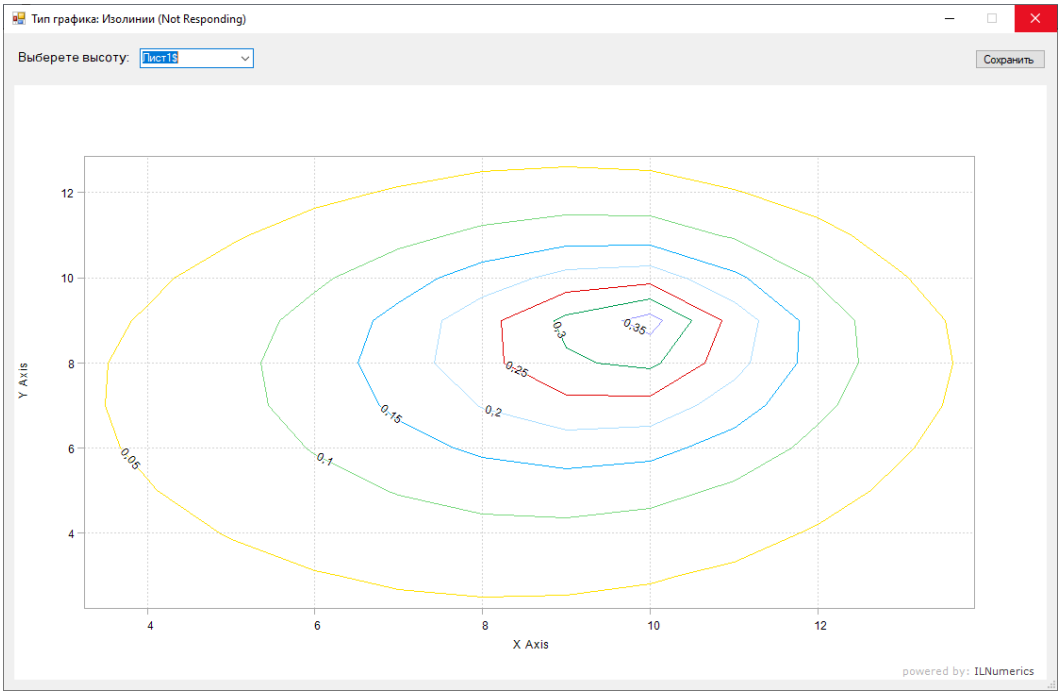


Fig. 6. Distribution of the concentration of aerosol particles with a northeast wind (225°), wind speed $u = 3$ m/s and absorption coefficient $\sigma = 30\%$

The SE were also carried out by setting various parameters of the process of transfer and diffusion of harmful substances, which are given in (Fig. 7-10).

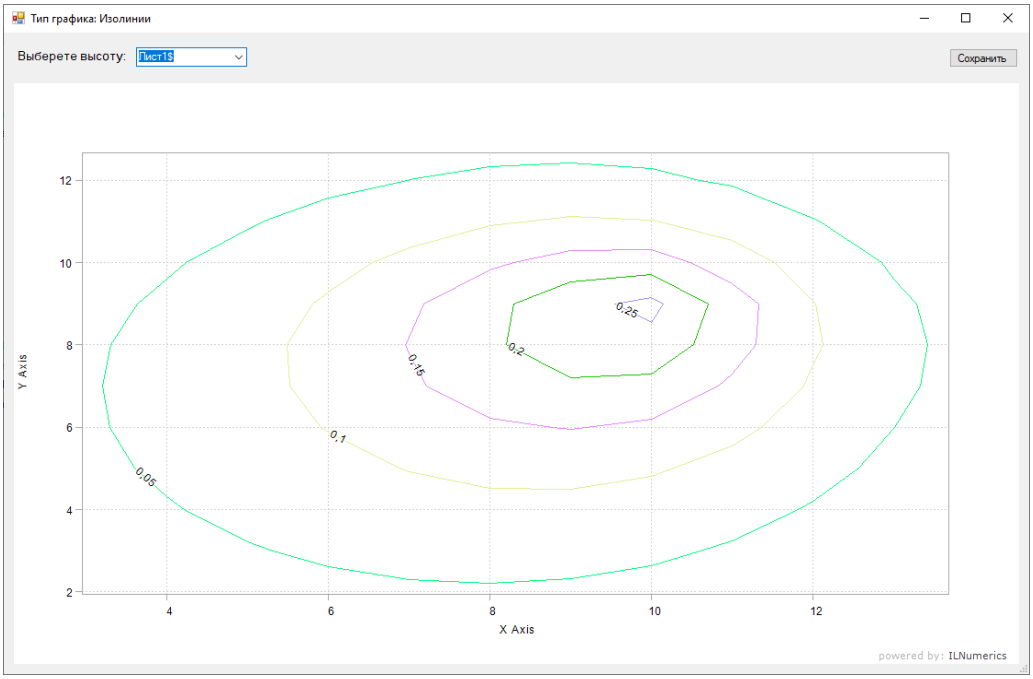


Fig. 7. Distribution of the concentration of aerosol particles with a northeast wind (225°), wind speed $u = 4$ m/s and absorption coefficient $\sigma = 30\%$

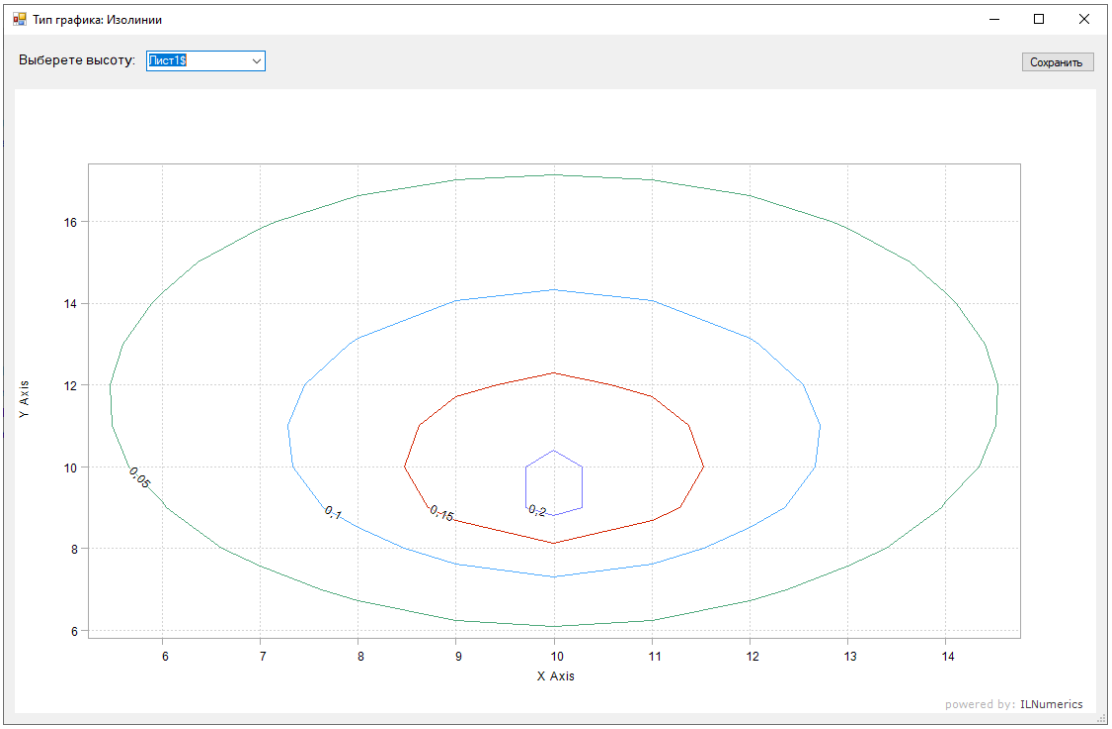


Fig. 8. Distribution of the concentration of aerosol particles at the south wind (0°), wind speed $u = 5$ m/s and absorption coefficient $\sigma = 30\%$

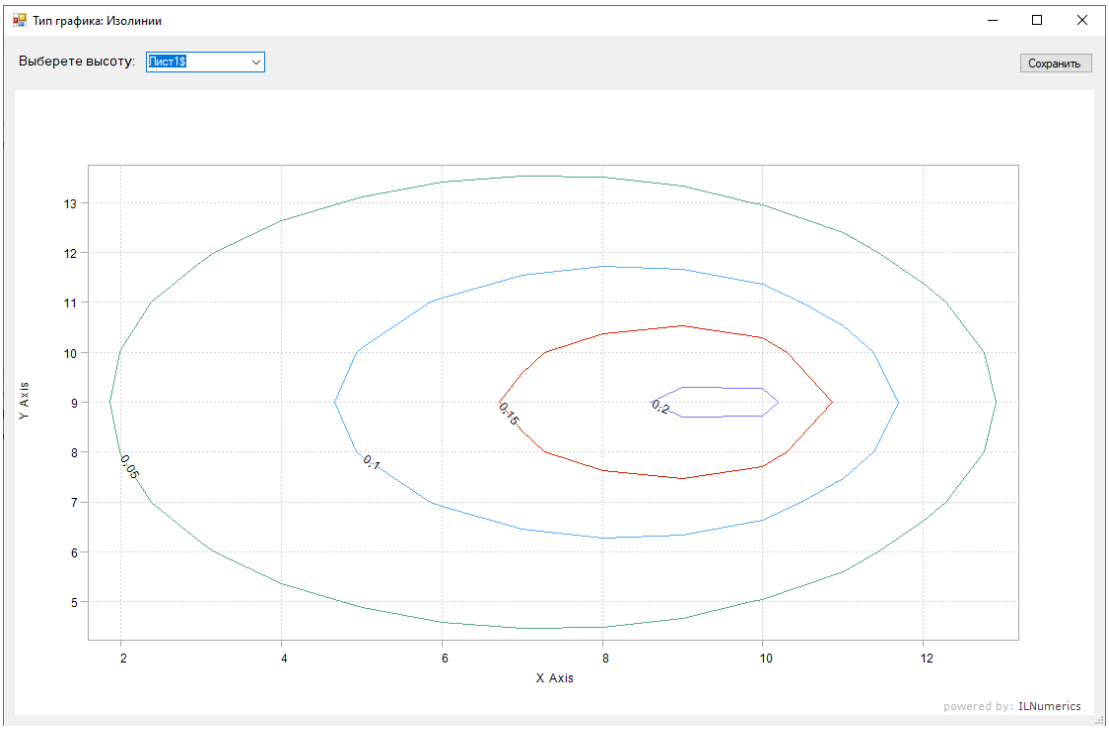


Fig. 9. Distribution of the concentration of aerosol particles with east wind (180°), wind speed $u = 5$ m/s and absorption coefficient $\sigma = 30\%$

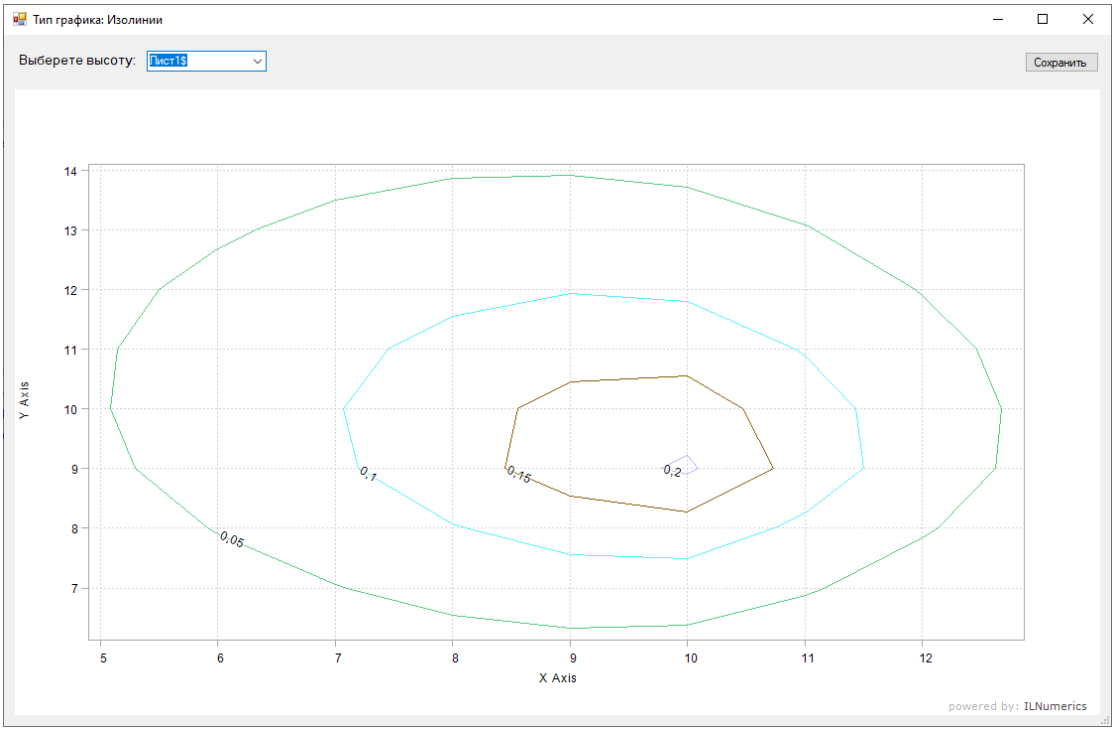


Fig. 10. The concentration of aerosol particles under the prevailing east wind with a speed of $u = 4$ m/s and an absorption coefficient $\sigma = 40\%$

Numerical experiments were carried out for various values of the turbulence coefficient, ground roughness, horizontal and vertical wind speeds, etc. [36].

The transfer was carried out uniformly at all levels, depending on the direction of the wind speed. From the theory of the boundary layer, it is known that with unstable stratification, the values $\kappa(z)$ grow to a level of 200–400 m and rapidly fall with height, tending to zero at the upper boundary of the boundary layer (the height of the boundary layer with unstable stratification reaches 1000–1600 m), and with stable stratification $\kappa(z)$ grow insignificantly in the surface layer and fall with height (the height of the boundary layer is 400–600 m) [36].

According to the numerical calculations carried out on a computer, with an increase in the horizontal component of the wind speed, aerosol particles emitted from industrial sources are transported in the direction of the wind. The area of distribution of pollutants in the surface layer of the atmosphere expands with an increase in the speed of the air mass of the atmosphere (Fig. 6, Fig. 8). This is especially observed at H = 200- 300 м. [36, 21].

Another parameter that significantly affects the process under study is the absorption coefficient (Fig. 9-10). The results of computational experiments show that 10-18% of aerosol particles are absorbed by the atmosphere. The increase in the absorption of harmful substances depends on the humid state of the air mass, and the change in the coefficient itself directly depends on the temperature and humidity of the atmosphere [37].

Special attention was paid to a parameter that also significantly affects the change in the concentration of harmful substances in the atmosphere and on the earth's surface - the rate of deposition of harmful particles, which depends both on the vertical component of the wind speed and on the physical and mechanical properties of the particles [34].

References:

1. Smirnov, N.N., Nikitin, V.F., Legros, J.C., & Shevtsova, V.M. (2002). Motion and Sedimentation of Particles in Turbulent Atmospheric Flows above Sources of Heating. *Aerosol Science & Technology*, vol. 36, Issue 2, pp. 101-122.
2. Saxby, J., Beckett, F., Cashman, K., Rust, A., & Tennant, E. (2018). The impact of particle shape

on fall velocity: Implications for volcanic ash dispersion modelling. *Journal of Volcanology and Geothermal Research*, 2018, vol. 362, pp. 32-48.

3. Naslund, E., & Thaning, L. (1991). On the Settling Velocity in a Nonstationary Atmosphere. *Aerosol Science and Technology*, vol. 14, Issue 2, pp. 247-256.
4. Iversen, T., & Nordeng, T.E. (2001). A numerical model suitable for the simulation of a broad class of circulation systems on the atmospheric mesoscale. *Norwegian Institute for Air Research Techn. Rep*, № 2, pp. 38-51.
5. Holden, H., Hvistendahl, K., & Lie, K. (2000). Operator splitting methods for degenerate convection-diffusion equations II: numerical examples with emphasis on reservoir simulation and sedimentation. *Computational Geosciences*, vol. 4, № 4, pp. 287-322.
6. Geiser, J., & Kravvaritis, Ch. (n.d.). A Domain Decomposition method based on iterative Operator Splitting method. Applied Numerical Mathematics, 209, vol. 59, pp. 608-623.
7. Havasi, A., Bartholy, J., & Farago, I. (2001). Splitting method and its application in air pollution modeling. *Idojaras*, vol. 105, № 1, pp. 39-58.
8. Kurbonov, N. (2018). *Numerical algorithm for solving the problem of gas filtration in porous media by the method of coordinate splitting.* Actual problems of mathematical modeling, algorithmization and programming: Proceedings of the Republican Scientific and Practical Conference. September 17-18, 2018, (pp.133-136). Tashkent.
9. Vallero, D. (2014). *Fundamentals of Air Pollution*, 5th ed, Academic Press, 996 p.
10. Burnett R., et.al. (2018). Global estimates of mortality associated with longterm exposure to outdoor fine particulate matter. *Proceedings of the National Academy of Sciences*, vol. 115, № 38, pp. 9592-9597.
11. Moore, M. (2014). *China's 'airpocalypse' kills 350,000 to 500,000 each year. The Telegraph*. Retrieved from https://bit.ly/2svFHCw
12. Zubkova, A.D. (2018). *Assessment of the impact of pollutant emissions from stationary and diffuse sources on abiotic and biotic components of urban ecosystems:* Cand. cand. chem. Sciences. (p.146). Kazan.
13. Gurova, O.S. (2013). Basic principles of classification of sources of air pollution in urban areas of the Southern Federal District. *Naukovedenie*, No. 5, pp. 1-8. https://naukovedenie.ru/PDF/11trgsu513.pdf
14. Bauer, S., Tsigaridis, K., & Miller, R. (2016). Significant atmospheric aerosol pollution caused by world food cultivation. *Geophysical Research Letters*, vol. 43, Issue 10, pp. 5394-5400, DOI: 10.1002/2016GL068354.
15. (2016). *Outdoor Air Pollution.* International Agency for Research on Cancer, Lion: IARC, 2016, (IARC Monographs. Vol. 109), 448 p.
16. (2013). *Analytical information on the state of the natural environment in Uzbekistan for 2009*. Ecological Movement of Uzbekistan, Retrieved from https://bit.ly/38IkeXL
17. (2011). *List of maximum permissible concentrations (MPC) of pollutants in the atmospheric air of populated areas on the territory of the Republic of Uzbekistan*. Hygienic standards: SanPiN RUz N 0293-11, Instead of SanPiN RUz N 0179-04; approved May 16, 2011, (p.33). Tashkent. (Sanitary rules and norms, hygienic standards of the Republic of Uzbekistan).
18. Sharipov, D., Muradov, F., & Akhmedov, D. (2019). Numerical Modeling Method for Short-Term Air Quality Forecast in Industrial Regions. *Applied Mathematics E-Notes*, № 19, pp. 575-584.
19. Ravshanov, N., Muradov, F., & Akhmedov, D. (2018). Mathematical software to study the harmful substances diffusion in the atmosphere. *Ponte*, vol. 74, № 8/1, pp. 171-179, DOI: 10.21506/j.ponte.2018.8.13
20. Ravshanov, N., Muradov, F., & Akhmedov, D. (2020). Operator splitting method for numerical solving the atmospheric pollutant dispersion problem. *Journal of Physics: Conference Series.* London, Vol. 1441. 012164.
21. Muradov, F.A., Rakhimov, A.Z., Nuriev, Kh.U., & Turdibekov, B.B. (2019). Mathematical model and computational experiment for predicting the ecological state of the atmospheric boundary layer. *Teoriya i praktika sovremennoy nauki*, No. 2 (44), pp. 264-270.
22. Muradov, F.A., & Ravshanov, Z.N. (2019). *Modeling the process of transfer and diffusion of fine aerosols in the atmosphere, taking into account the particle settling rate.* Innovative ideas, developments and modern problems of their application in production, as well as in education: Proceedings of the International Scientific and Practical Conference. Part 2. April 15, 2019, (pp.132-134). Andijan: ASU.
23. Muradov, F.A. (2019). *Numerical modeling of the spread of harmful substances taking into account the rate of deposition of particles in the atmosphere.* Modern problems and their solutions of information and communication technologies and telecommunications: Proceedings of the Republican Scientific and Technical Conference. Part 3. May 30-31, 2019, (pp. 118-121). Ferghana.
24. Muradov, F.A. (2019). *Numerical modeling of the spread of toxic substances taking into*

account the rate of deposition of particles into the surface layer of the atmosphere. Current state and prospects for the use of information technologies in management: Proceedings of the Republican Scientific and Technical Conference. September 5, 2019, (pp.172-178). Samarkand.

25. Ravshanov, N., & Muradov, F.A. (2017). Model and numerical algorithm for the process of transfer and diffusion of active fine particles in the atmosphere. *Information Technologies of Modeling and Control*, Voronezh: Scientific book, No. 2 (104), pp. 132-142.
26. Muradov, F., & Akhmedov, D. (1915). *Numerical Modeling of Atmospheric Pollutants Dispersion Taking Into Account Particles Settling Velocity.* IEEE International Conference on Information Science and Communications Technologies (ICISCT), 4-6 Nov. 2019, Tashkent, 2019, pp. 1-5, Retrieved from https://doi.org/10.1109/ICISCT47635.2019.9011915
27. Ravshanov, N., & Sharipov, D.K. (2011). Model and numerical algorithm for predicting the process of distribution of harmful substances in the atmosphere. *Uzb. journal "Problems of Informatics and Energy*", Tashkent, No. 4, pp. 18-25.
28. Ravshanov, N., Serikbaev, B., & Serikbaeva, E. (2010). Methodology for protecting ecosystems from pollution sources. *Stiinta Agricola, Chisinau*, No. 1, pp. 68-73.
29. Ravshanov, N., Sharipov, D.K., & Toshtemirova, N. (2015). Computer modeling of the propagation of aerosol emissions in the atmosphere. *Problems of Computational and Applied Mathematics*, Tashkent, No. 1, pp. 16-27, http://goo.gl/75uzYF
30. Ravshanov, N., Muradov, F., & Akhmedov, D.D. (2019). *Mathematical and software support for forecasting the ecological state of the atmosphere of industrial regions*. Informatics: problems, methodology, technologies: Proceedings of the XIX International Scientific and Methodological Conference. February 14-15, 2019, (pp.148-153). Voronezh: Voronezh State University.
31. Muradov, F.A., & Narzikulov, Z.Kh. (2018). *Mathematical and software for forecasting and monitoring the spread of toxic substances in the atmosphere.* Actual issues of production of import-substitute products based on the use of local raw materials in the regions of the Fergana Valley: Proceedings of the International Conference, (pp.168-171). Namangan.
32. Ravshanov, N., Muradov, F., & Akhmedov, D. (2018). *Air pollution modeling in spherical coordinates.* Aktual`nye problemy matematicheskogo modelirovanija, algoritmizacii i programmirovanija: Materialy Respublikanskoj nauchno-prakticheskoj konferencii. 17-18 sentjabrja 2018, (pp.210-216). Tashkent: Fan va ta#lim poligraf.
33. Ravshanov, N., Muradov, F., & Akhmedov, D. (2018). *Numerical modeling of the process of transfer and diffusion of harmful substances in the atmosphere in a spherical coordinate system.* Problems of optimization of complex systems: Proceedings of the XIV International Asian School-Seminar. July 20-31, 2018, In 2 hours - Almaty, 2018, Part 2, pp. 142-151.
34. Sharipov, D.K., Muradov, F., & Ravshanov, Z.N. (2017). Mathematical model and computational experiment for monitoring and forecasting the ecological state of the atmospheric boundary layer. *Problems of Computational and Applied Mathematics*, Tashkent, No. 6 (12), pp. 15-28.
35. Muradov, F.A., & Mirbabaev, Sh.R. (2020). *Creating a software tool for predicting and monitoring the spread of harmful substances in the atmosphere.* Innovative ideas, developments into practice: problems and solutions: Proceedings of the International scientific-practical online conference. May 27-28, 2020, (pp.65-68). Andijan.
36. Ravshanov, N., Karshiev, D.A., & Yuldashev, B.E. (2018). Modeling the process of transfer and diffusion of fine particles in the atmosphere, taking into account soil erosion. *International Journal of Humanities and Natural Sciences*, T. 4, pp. 140-152.
37. Muradov, F.A., & Ravshanov, Z.N. (2018). *Mathematical model and computational experiment for forecasting the ecological state of the atmosphere in regions*. Informatics: problems, methodology, technologies: Proceedings of the 18th International Conference. February 8-9, 2018, (pp.191-195). Voronezh, 2018, V. 5.

Impact Factor:					
	ISRA (India) = 6.317	SIS (USA) = 0.912	ICV (Poland) = 6.630
	ISI (Dubai, UAE) = 1.582	РИНЦ (Russia) = 3.939	PIF (India) = 1.940
	GIF (Australia) = 0.564	ESJI (KZ) = 8.771	IBI (India) = 4.260
	JIF = 1.500	SJIF (Morocco) = 7.184	OAJI (USA) = 0.350

SOI: 1.1/TAS DOI: 10.15863/TAS

International Scientific Journal

Theoretical & Applied Science

p-ISSN: 2308-4944 (print) **e-ISSN:** 2409-0085 (online)

Year: 2022 **Issue:** 12 **Volume:** 116

Published: 27.12.2022 **http://T-Science.org**

Issue Article

Fozil Mukhammadievich Boyjigitov
Research Institute of Viticulture and Winemaking
Ph.D., senior researcher,
Horticulture named after Academician M. Mirzaev,
Tashkent, Uzbekistan
fboyjigitov80@mail.ru

LEAF DISEASE OF PEACH

Abstract: *Against moniliosis disease of peach Straj KS (0.4-0.6 l/ha) fungicide was tested. High biological efficiency (up to 90.4%) was achieved during timely chemical treatment with working solutions of these fungicides. As a result, it has been proven that the harvest from the trees is protected from diseases and the quality and quantity of the fruits increases.*

Key words: *peach, tree, leaf, disease, moniliosis, chemical treatment, fungicide, biological efficiency.*

Language: *English*

Citation: Boyjigitov, F. M. (2022). Leaf disease of peach. *ISJ Theoretical & Applied Science, 12 (116),* 788-790.

Soi: http://s-o-i.org/1.1/TAS-12-116-71 ***Doi***: https://dx.doi.org/10.15863/TAS.2022.12.116.71

Scopus ASCC: *1100.*

Introduction

UDC:632.4:632.26

In the republic, peach trees are being cultivated in large areas among fruit orchards. This, in turn, causes widespread spread of diseases in grain orchards and great damage to productivity, as well as a number of problems in fruit cultivation.

Correct and timely organization of protective measures is important for protecting the grown crops from various diseases, storing them, and delivering them to the table in good quality.

The method of chemical control against harmful organisms is considered one of the main measures, and it is fast and highly effective. In the fight against fungal diseases of fruit trees, determining the rate and timing of the use of modern fungicides provides an opportunity to dramatically reduce the number of diseases.

Peach leaf blight disease is widespread in all places, that is, in Germany, Bulgaria, Poland, Romania, Italy and Spain, as well as in Uzbekistan [1, 3, 4, 12, 14].

Peach leaf blight disease appears in early spring: young leaves have amber or red-purple color and a wavy uneven surface, after 10-12 days fungal spores with a white coating appear on the underside of the leaf. The leaves are not brittle, and when a severe disease develops, the swellings turn brown and fall off. When defoliation is strongly developed, it becomes bare at the end of May, nothing grows and does not produce. Branches crack, thin and turn yellow and dry. Infected fruits have wavy swellings and changes in shape [7, 3].

Peach leaf blight disease Taphrina deformans Tul. caused by the fungus [10, 11, 12].

The trees become completely bare when the leaf blight disease develops strongly. This causes the buds to drop, and the crop to remain on the tree. Trees affected by the disease stop growing, and in the winter season, the trees get cold [8].

The fungus Taphrina deformans isolates on all peach trees, and during the growing season, fungal spores develop well on the buds or on the side shoots. In winter, they can be found between or inside the body. Experiments show that after the tissue dies under the influence of the fungus, it lives in a sprophybe state during summer and autumn, and goes to the countryside without ascospores. In Armenia, it is noted that the fungus that causes peach leaf blight overwinters in the form of spores [7].

In Moldavia, the fungus that causes peach leaf blight overwinters in the bud as a spore. Spore sacs can also be stored in shed leaves [9].

In Ukraine, the fungus hibernates without mycelium and occurs as a spore in places where there is cracked glue [6].

In the fight against peach leaf blight disease; Bordeaux liquid containing copper is recommended. The first treatment is in the spring when the buds appear on the trees with a working solution of 1% or 0.75% Bordeaux liquid, the second chemical treatment is after the trees have fallen and the third chemical treatment corresponds to the period of leaves of trees [2, 5, 12].

Research location and methods.

The research was conducted in 2020 in the peach orchards of the Musamukhamedov Sahibi farm, Kibrai district, Tashkent region. The peach tree is 6 years old. The tested fungicide was applied to 5 trees in 3 returns. Chemical treatment 3 times during vegetation; at budding, after flowering and 14 days after 2nd treatment 1000 l/ha working solution was calculated.

The distribution and development of peach leaf blight disease was reported by Chumakov et al. [13] and the biological effectiveness of the drugs tested against the disease was carried out by the methods of Khodjaev [11].

Research results.

The method of chemical control of diseases caused by fungi in peach orchards is fast and highly effective.

In 2020, Straj KS fungicide was tested against peach leaf blight at a consumption rate of 0.3-0.6 l/ha. As a model Horus s.d.g. fungicide was selected (table).

Horus s.d.g. (0.4 kg/ha) when the fungicide was used, the damage was up to 5% on the leaves, the disease development was up to 2.3% and the biological efficiency was up to 91.1%.

According to the results of the experiment, the fungicide Straj KS, which was used at a higher consumption rate of 0.6 l/ha, showed the highest effectiveness against peach leaf blight. In peach leaves, damage was 5.3%, and the development of the disease was recorded up to 2.5%, respectively. Biological efficiency showed up to 90.4%.

Table 1. It has been used against peach leaf blight disease
Biological efficiency of the fungicide Straj KS
Field test-experience, Tashkent region, Qibray district,
"Musamukhamedov owner" f/x., Lola variety.*2020y.*

№	Options	Application rate, kg/ha, or l/ha	Leaves		
			damage,%	disease progression,%	biological efficiency,%
1.	Control – (no chemical treatment)	-	45,7	26,3	-
2.	Horus s.d.g. (750 g/kg) (template) (cyprodinil 750 g/l)	0,4	5	2,3	91,1
3.	Straj KS (cyprodinil 500 g/l)	0,3	9,0	4,5	83,0
		0,6	5,3	2,5	90,4

0.3 l/ha against peach leaf blight disease. The biological efficiency of the tested fungicide at the consumption rate was low, i.e. 85.0% less than that of Straj KS. Disease damage was observed up to 9.0% on leaves. The development of the disease was up to 4.5%. Biological efficiency was recorded up to 83.0%.

Summary.

According to the obtained results, 3 times during the growing season with the working solutions of Straj KS (0.6 l/ha) fungicide against peach leaf blight disease; when the trees are budding, after the trees are flowering and after 14 days of the 2nd treatment, chemical treatment at the expense of 1000 l/ha working solution, the harvested crop is protected from the disease and the quality and quantity of the fruits increases.

References:

1. Alekseeva, S.A. (2003). Chtoby persikovye derevya byli zdorovymi. *J. Zashchita i quarantine plant*, M., No. 5, p.47.
2. Grushevoy, S.E. (1965). *Agricultural phytopathology*. (p.365). Moscow: Kolos.
3. Zaitsev, E.F. (1984). Zashchita kostochkovykh kultur. *J. Zashchita i quarantine plant*, M., No. 4, p.55.
4. Karov, S., & Petkov, V. (1978). Khimicheskie sredstva borby s kurchavostyu listev persika. *Gradin i lozar. science*, No. 5, p.65.
5. Kulibaba, Yu. F. (1969). Kurchavost peach. *J. Zashchita i quarantine plant,* M., #6, p.41.
6. Oganyan, E.A., & Mkrtchan, G.G. (1977). *O nekotorykh gribnyx boleznyakh persika v Severo-Vostochnoy zone Armyanskoy SSR.* Sbornik materialov. (pp.589-595). Yerevan: Ayastan.
7. Pari, I.V., Klochko, N.N., & Tkachenko, G.S. (1986). *Bolezn listev peach. J. Zashchita i quarantine plant*, M., No. 1, p.32.
8. Paterillo, G.A. (1958). Borba s kurchavostyu listev u peach. *J. Sadovodstvo, vinogradstvo i vinodelie v Moldavii*, Kishinev, pp.59-60.
9. Peresypkin, V.F. (1989). *Agricultural phytopathology*. Moscow: Agropromizdat, 1989, P.389-403.
10. Smolyakova, V.M., & Kovtun, I.L. (2004). Zashchita persika ot kurchavosti listev. *J. Zashchita i quarantine plant*, M., #6, p.46.
11. Khodjaev, Sh.T. (2004). *Insecticide, acaricide, biologically active substances and method guidelines for testing fungicides*. (pp.83-90). Tashkent.
12. Hasanov, B.A., Ochilov, R.O., Kholmurodov, E.A., & Gulmurodov, R.A. (2010). *Fruity and nut trees, citrus, berry bushes, and vine diseases and control*. (pp.46-48). Tashkent.
13. Chumakov, A.E., Minkevich, I.I., et al. (1974). *Osnovnoe metody phytopathologicheskih issledovaniy*. Nauchnye trudy VASHNIL. (p.57). Moscow: "Kolos".
14. Yuganova, O.N. (1969). Kurchavost listev apricot. *J. Zashchita i quarantine plant*, Moscow, No. 5, p.48.

Contents

Scientific publication

«ISJ Theoretical & Applied Science, USA» - Международный научный журнал зарегистрированный во Франции, и выходящий в электронном и печатном формате. **Препринт** журнала публикуется на сайте по мере поступления статей.

Все поданные авторами статьи в течении 1-го дня размещаются на сайте **http://T-Science.org**.

Печатный экземпляр рассылается авторам в течение 3 дней после 30 числа каждого месяца.

Импакт фактор журнала

Impact Factor	2013	2014	2015	2016	2017	2018	2019	2020	2021
Impact Factor JIF		1.500							
Impact Factor ISRA (India)		1.344				3.117	4.971		6.317
Impact Factor ISI (Dubai, UAE) based on International Citation Report (ICR)	0.307	0.829							1.582
Impact Factor GIF (Australia)	0.356	0.453	0.564						
Impact Factor SIS (USA)	0.438	0.912							
Impact Factor РИНЦ (Russia)		0.179	0.224	0.207	0.156	0.126		3.939	
Impact Factor ESJI (KZ) based on Eurasian Citation Report (ECR)		1.042	1.950	3.860	4.102	6.015	8.716	8.997	9.035
Impact Factor SJIF (Morocco)		2.031				5.667			7.184
Impact Factor ICV (Poland)		6.630							
Impact Factor PIF (India)		1.619	1.940						
Impact Factor IBI (India)			4.260						
Impact Factor OAJI (USA)						0.350			

Deadlines

	Steps of publication	Deadlines	
		min	max
1	Article delivered	-	
2	Plagiarism check	1 hour	2 hour
3	Review	1 day	30 days
4	Payment complete	-	
5	Publication of the article	1 day	5 days
	publication of the journal	30th of each month	
6	doi registration	before publication	
7	Publication of the journal	1 day	2 days
8	Shipping journals to authors	3 days	7 days
9	Database registration	5 days	6 months

INDEXING METADATA OF ARTICLES IN SCIENTOMETRIC BASES:

International Scientific Indexing ISI (Dubai, UAE)
http://isindexing.com/isi/journaldetails.php?id=327

Cl.An. // THOMSON REUTERS, EndNote (USA)
https://www.myendnoteweb.com/EndNoteWeb.html

Research Bible (Japan)
http://journalseeker.researchbib.com/?action=viewJournalDetails&issn=23084944&uid=rd1775

Scientific Object Identifier (SOI)
http://s-o-i.org/

РИНЦ (Russia)
http://elibrary.ru/contents.asp?issueid=1246197

Google Scholar (USA)
http://scholar.google.ru/scholar?q=Theoretical+t-science.org&btnG=&hl=ru&as_sdt=0%2C5

Turk Egitim Indeksi (Turkey)
http://www.turkegitimindeksi.com/Journals.aspx?ID=149

Directory of abstract indexing for Journals
http://www.daij.org/journal-detail.php?jid=94

DOI (USA) http://www.doi.org

CrossRef (USA) http://doi.crossref.org

Open Academic Journals Index (Russia)
http://oaji.net/journal-detail.html?number=679

Collective IP (USA)
https://www.collectiveip.com/

Japan Link Center (Japan) https://japanlinkcenter.org

PFTS Europe/Rebus:list (United Kingdom)
http://www.rebuslist.com

Kudos Innovations, Ltd. (USA)
https://www.growkudos.com

Korean Federation of Science and Technology Societies (Korea)
http://www.kofst.or.kr

AcademicKeys (Connecticut, USA)
http://sciences.academickeys.com/jour_main.php

Sherpa Romeo (United Kingdom)
http://www.sherpa.ac.uk/romeo/search.php?source=journal&sourceid=28772

Cl.An. // THOMSON REUTERS, ResearcherID (USA)
http://www.researcherid.com/rid/N-7988-2013

RedLink (Canada)
https://www.redlink.com/

Cl.An. // THOMSON REUTERS, ORCID (USA)
http://orcid.org/0000-0002-7689-4157

TDNet
Library & Information Center Solutions (USA)
http://www.tdnet.io/

Yewno (USA & UK)
http://yewno.com/

RefME (USA & UK)
https://www.refme.com

Stratified Medical Ltd. (London, United Kingdom)
http://www.stratifiedmedical.com/

THE SCIENTIFIC JOURNAL IS INDEXED IN SCIENTOMETRIC BASES:

Advanced Sciences Index (Germany)
http://journal-index.org/

Global Impact Factor (Australia)
http://globalimpactfactor.com/?type=issn&s=2308-4944&submit=Submit

CiteFactor (USA) Directory Indexing of International Research Journals
http://www.citefactor.org/journal/index/11362/theoretical-applied-science

JIFACTOR
http://www.jifactor.org/journal_view.php?journal_id=2073

Eurasian Scientific Journal Index (Kazakhstan)
http://esjindex.org/search.php?id=1

SJIF Impact Factor (Morocco)
http://sjifactor.inno-space.net/passport.php?id=18062

InfoBase Index (India)
http://infobaseindex.com

Электронно-библиотечная система «Издательства «Лань» (Russia)
http://e.lanbook.com/journal/

SCIENTIFIC INDEXING SERVICE (USA)
http://sindexs.org/JournalList.aspx?ID=202

International Society for Research Activity (India)
http://www.israjif.org/single.php?did=2308-4944

International Institute of Organized Research (India)
http://www.i2or.com/indexed-journals.html

Journal Index
http://journalindex.net/?qi=Theoretical+%26+Applied+Science

Open Access Journals
http://www.oajournals.info/

Indian citation index (India)
http://www.indiancitationindex.com/

Index Copernicus International (Warsaw, Poland)
http://journals.indexcopernicus.com/masterlist.php?q=2308-4944

International Academy of Theoretical & Applied Sciences - member of Publishers International Linking Association (USA) - international Association of leading active scientists from different countries. The main objective of the Academy is to organize and conduct research aimed at obtaining new knowledge contribute to technological, economic, social and cultural development.

Academy announces acceptance of documents for election as a member:

Correspondents and Academicians

Deadline - January 25, 2023.
Documents you can send to the address T-Science@mail.ru marked "Election to the Academy members".

The list of documents provided for the election:

1. Curriculum vitae (photo, passport details, education, career, scientific activities, achievements)
2. List of publications
3. The list of articles published in the scientific journal ISJ Theoretical & Applied Science
   * to correspondents is not less than 7 articles
   * academics (degree required) - at least 20 articles.

Detailed information on the website http://www.t-science.org/Academ.html

Presidium of the Academy

International Academy of Theoretical & Applied Sciences - member of Publishers International Linking Association (USA) - международное объединение ведущих активных ученых с разных стран. Основной целью деятельности Академии является организация и проведение научных исследований, направленных на получение новых знаний способствующих технологическому, экономическому, социальному и культурному развитию.

Академия объявляет прием документов на избрание в свой состав:

Член-корреспондентов и Академиков

Прием документов осуществляется до 25.01.2023.
Документы высылаются по адресу T-Science@mail.ru с пометкой "Избрание в состав Академии".

Список документов предоставляемых для избрания:

1. Автобиография (фото, паспортные данные, обучение, карьера, научная деятельность, достижения)
2. Список научных трудов
3. Список статей опубликованных в научном журнале ISJ Theoretical & Applied Science
   * для член-корреспондентов - не менее 7 статей,
   * для академиков (необходима ученая степень) - не менее 20 статей.

Подробная информация на сайте http://www.t-science.org/Academ.html

Presidium of the Academy

Signed in print: 30.12.2022. Size 60x84 1/8

«Theoretical & Applied Science» (USA, Sweden, KZ)
Scientific publication, p.sh. 70.5. Edition of 90 copies.
http://T-Science.org E-mail: **T-Science@mail.ru**

Printed «Theoretical & Applied Science»