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Bukharina I.L., Kuzmin P.A., Sharifullina A.M.

**ANALYSIS OF PHYSIOLOGICAL AND BIOCHEMICAL
CHARACTERISTICS of *TILIA CORDATA MILL.* IN CONDITIONS OF
TECHNOGENIC POLLUTION (ON THE EXAMPLE OF THE CITY
NABEREZHNYE CHELNY)**

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*The article describes the physiological and biochemical species characteristic of *Tilia cordata*, which grows in the conditions of different contamination level. Not only the contamination level has a significant impact on the content of studied photosynthetic pigments and metabolites, but also the orientation in space of the assimilatory organs of plants.*

*Key words: *Tilia cordata* (Mill.), technogenic environment, leaf photosynthetic pigments, ascorbic acid, peroxidase activity, tannins.*

Nowadays, large industrial centers are extremely open artificial systems created and entirely dependent on man as only a man is responsible for maintaining the ecological balance and improving the sanitary conditions. Such questions are of particular importance as it is necessary to select species of living organisms that can not only survive in the extreme conditions of urban environment but also have a positive influence on it helping to optimize and improve it (Bukharina and others, 2007). There has always been works to study the potential of plants as a factor in improving the quality of urban and technogeneuous habitats. One of these species of plants is a small-leaved lime which is widely used in landscaping of large industrial cities. For example, it is known, that during vegetation period 1 kg of *Tilia cordata* leaves can accumulate up to 10 gr of sulphur dioxide and up to 10 kg of carbone dioxide and it, in its turn, leads to decreasing of photosynthetic rate and early

yellowing of leaf blade. (Sergeichik, 1984; Kulagin, 1974; Bukharina, Povarnitsina, Vedernikov, 2007).

Naberezhnye Chelny is a city in the Republic of Tatarstan which is located in the Middle Volga region. The average annual rainfall in the region is 555 mm. The average annual atmospheric temperature is 2...3,1°C.

Naberezhnye Chelny is a major industrial centre with the population of 530 thousand people. Mechanical engineering, electric power, construction industry, food and processing industries are the main industries in the city. Kamskii Automobile Plant is the main enterprise forming a company town. On the basis of the "Report on the ecological state of the Republic of Tatarstan" we gave the characteristic of the air pollution level in the areas where woody plants grow. A comprehensive air pollution index (API=15,3) shows a very high level of air pollution in the city. There was found the excess of maximum permissible concentration of benzo(a)pyrene, formaldehyde, phenols and anoxides of carbon and nitrogen.

The object of study is a small-leaved lime (*Tilia cordata* Mill.). The studied species grows in the city in various ecological categories of plantations: along highways (the major highways are Auto 1, and Mira Avenue) and the sanitary-protective zones (SPZ) of industrial enterprises such as plc. "Kamaz": plants "Liteinii" and "Kuznechnii" are the main polluters of the city. The area of Chelninskii forestry (forest and steppe zone of 9539 hectares, forest and steppe region in the European part of Russian Federation) was chosen as conventional control zone (CCZ). The area of the city park "Grenada" was chosen for introduced species. The sample plots were laid in a regular way (5 plots in each area the size of which is not less than 0.25 hectares). To study the content of physiological and biological indexes in the plant leaves within the test plot (TP) the selection (10 plants of each species) and numbering of chosen woody plants were carried out and their living condition was assessed. The chosen species of plants were in a good living and middle-aged generative ontogenetic state (g_2). During the active vegetation period of trees, notably in June, July and August we selected leaves of the middle formation on the annual growth (in one third part at the bottom of the crown of studied plants growing in

southern exposure). Within the test plot we took the soil samples and carried out analysis of them (composite sample contained individual samples after the manner of envelop). The exposure was identified by compass and corresponded to the structure of the part of crown regarding to the north and south. In the plantations along the highways the southern exposure stretched to the avenue.

In the laboratory we identified the content of chlorophyll *a*, *b* and carotinoids in the leaves of woody plants by spectrophotometer method in acetone extracts (the absorption is 662, 644 and 440,5 nm correspondingly). The concentration of pigments was calculated by using Holm-Wettshtein equation. The quantitative content of ascorbic acid was identified in accordance to the State Standard 24556-89 (titration analysis). The content of condensed tannins in the leaves of woody plants was identified by permanganatometric method (Leventhal method modified by Kursanov), and peroxides activity – by colorimetric method of Bojarkin A. M. (Mokronosov, 1992; Workshop (Laboratory session)... 1991; Nikolaevskii, 1999). The analyses of vegetable samples were carried out in the Ecology and Plant Physiology laboratory of Biology Faculty of the Branch of Kazanskii (Privolzhskii) Federal University in Elabuga. The study lasted during two vegetation periods (2011-2012).

The statistical package «Statistica 5.5» was used for mathematical processing of the materials.

For interpretation of obtained materials we used methods of descriptive statistics and multivariate analysis of variance (by cross-hierarchical scheme with the subsequent assessment of differences by multiple comparisons LSD-test).

The content of chlorophylls *a*, *b*, carotinoids, ascorbic acid, tannins and peroxides activity in leaves is the main indexes of physiological and biochemical state (Table 1). Multivariate analysis of variance of the results of the study revealed that complex of growing conditions (the level of significance of $P < 10^{-5}$), the period of vegetation ($P < 10^{-5}$), the exposure of leaves ($P < 10^{-5}$) and the interaction of these factors ($P = 3,98 \cdot 10^{-5}$) influenced the content of chlorophylls *a*, *b*, carotinoids in *Tilia cordata* leaves. The highest amount of chlorophyll *a* and carotinoids was observed in conventional control zone in July in the leaves of northern exposure 2,85 and 11,50 respectively,

while the leaves of the southern exposure contained the highest amount of chlorophyll *b* 2,86 mg/g in dry substance.

The study has shown that in technogenic conditions in the early period of active vegetation the amount of photosynthetic pigments in leaves in comparison with given indexes in conventional control zones significantly rises: chlorophyll *a* by 0,15-0,21 and 0,14- 0,18 (HCP₀₅ = 0,01); chlorophyll *b* by 0,23-0,36 and 0,04- 0,17 (HCP₀₅ = 0,01); carotinoids by 1,45 – 1,83 and 1,06 – 1,47 mg/g in dry substance (HCP₀₅ = 0,02) respectively in the leaves in northern and southern exposures. Moreover, in the leaves in southern exposure the concentration of chlorophyll *b* was higher during the whole period of active vegetation of plants. During the period of observation, on the contrary, it was found a decrease in chlorophyll *a* and carotinoids in leaf blade in comparison with the conventional control zones. Their significantly higher content was observed in the leaves in northern exposure in all categories of plantations.

Multivariate analysis of variance of the results of the study revealed that complex of growing conditions ($P < 10^{-5}$), the period of vegetation ($P < 10^{-5}$), the exposure of leaves ($P = 1,9 \cdot 10^{-5}$) influenced the content of ascorbic acid (AA) in *Tilia cordata* leaves. The highest amount of this metabolite was observed in June in the plants growing in sanitary protective zones of industrial enterprises where the leaves in southern exposure had 440,1 and the leaves in northern exposure had 391,6 mg/%, and it is significantly higher than the indexes of conventional control zones. In July the content of ascorbic acid (AA) decreases sharply (to the level of 156,3-175,0), and in August this level was 153,6 – 190,3 mg/% with the higher content of ascorbate in the leaves in southern exposure. In the plantations growing along highways the small-leaved lime species had some differential characteristics which resulted in considerable reduction of this metabolite in the leaves of plants in comparison with the control plantings during the whole period of observation.

Table 1

Dynamics of physiological and biochemical indexes content in *Tilia cordata* leaves (*Tilia cordata* Mill.) growing in different categories of plantations in the city of Naberezhnye Chelny

Month of vegetation	Leave exposure	Indexes					
		Chlorophyll <i>a</i> , mg/g dry substance (HCP ₀₅ = 0,01)	Chlorophyll <i>b</i> , mg/g dry substance (HCP ₀₅ = 0,01)	Carotinoids, mg/g dry substance (HCP ₀₅ = 0,02)	Ascorbic acid, mg/% (HCP ₀₅ = 2,1)	Peroxides activity, conventional unit (HCP ₀₅ = 0,02)	Tannins, % (HCP ₀₅ = 0,01)
Conventional control zone							
June	northern	1,13	1,29	8,08	316,8	1,40	0,43
	southern	1,03	1,56	7,95	329,6	1,54	0,50
July	northern	2,85	2,42	11,50	176,5	4,12	0,63
	southern	2,63	2,86	11,27	186,3	4,21	0,67
August	northern	2,34	1,84	10,93	112,4	2,72	0,99
	southern	1,88	2,10	9,47	133,4	2,38	1,10
Sanitary-protective zones of industrial enterprises							
June	northern	1,34	1,65	9,91	391,6	2,12	0,36
	southern	1,17	1,73	9,42	440,1	2,46	0,38
July	northern	2,57	2,71	10,93	156,3	2,96	0,74
	southern	2,45	2,91	10,25	175,0	3,22	0,78
August	northern	1,75	2,40	8,14	153,6	1,83	0,95
	southern	1,58	2,70	6,80	190,3	1,90	0,96
Highway plantations							
June	northern	1,28	1,52	9,53	170,4	1,22	0,33
	southern	1,21	1,60	9,01	174,2	1,56	0,32
July	northern	2,53	2,71	10,89	122,8	2,99	0,72
	southern	2,39	2,89	10,23	106,1	3,31	0,73
August	northern	1,58	1,86	7,57	101,4	1,81	0,89

t	southern	1,39	2,00	6,10	92,5	1,99	0,89
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Multivariate analysis of variance of the results of the study revealed that the complex of growing conditions ($P < 10^{-5}$), the period of vegetation ($P < 10^{-5}$), the exposure of leaves ($P = 1,96 \cdot 10^{-5}$) and the interaction of these factors ($P = 0,03$) influenced significantly the peroxides activity in *Tilia cordata* leaves. In the early period of vegetation in June the highest level of peroxides activity was recorded at the plants growing in the sanitary protective zones of industrial enterprises (in the leaves in southern exposure 2,46, in northern exposure - 2,12; which, correspondingly, is higher by 0,9-0,92 and 0,72-0,90 conventional units than in plants growing in conventional control zones and in plantings growing along highways, if $HCP_{05} = 0,02$). Afterwards, peroxides activity in *Tilia cordata* leaves growing in the conditions of technogenic impact decreases but this activity in the leaves in southern exposure keeps going in July and August.

Multivariate analysis of variance of the results of the study revealed that the complex of growing conditions ($P < 10^{-5}$), the period of vegetation ($P < 10^{-5}$), the exposure of leaves ($P = 1,61 \cdot 10^{-5}$) and the interaction of these factors ($P = 2,57 \cdot 10^{-5}$) influenced significantly the content of tannins in *Tilia cordata* leaves. The highest level of tannins was found in plants growing in conventional control zones at the end of the period of active vegetation in August. In the conditions of urban environment the small-leaved lime, presumably, spend this metabolite on the adaptive reactions so its amount decreases. A similar trend has been noted in our earlier publications (Bukharina I.L., Kuzmin P.A, 2012). During the period of vegetation *Tilia cordata* leaves in southern exposure accumulate more tannins growing in sanitary protective zones of industrial enterprises by 0,01 – 0,04; in the plantations along highways – by 0,01 %, in comparison with this indexes in the leaves in northern exposure.

Thus, the small-leaved lime has a specific reaction to anthropogenic impact by changing its physiological and biochemical indexes. Not only has the level of technogenic impact a significant influence on the content of studied photosynthetic

pigments and metabolites but also the orientation in space of the assimilatory organs of plants.

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Zotova A.A., Volokitina T.V., Popova E.V.

**VOLUNTARY ATTENTION FEATURES OF THE NORTHERNER
CHILDREN AGED 7-8 WITH A VISION DISORDER**

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The article is dedicated to study of attention of schoolchildren who have a vision disorder. Voluntary attention indicators were appraised with the help of the computer complex for psychophysiological researchers KPFK-99 "Psychomat". Among first-graders with a vision disorder amount of mistakes rises when increasing speed of tasks implementation, visual control immaturity was noted.

Key words: northerner children, visual disorder, voluntary attention, attention indicators.

According to the data of the Ministry of Health in Russia there are more than one million of children who have eye diseases and vision disorders: nearsightedness, farsightedness, eye's refractive ability disorders, amblyopia, strabismus and others. Process of learning environment gets more difficult for children because of vision disorders. It is known that visual perception incompleteness, fragmentariness, sketchiness, insufficient immaturity of motion and visual-motor coordination delay process of mastering object actions by visually impaired children and have negative influence on forming notions of environment objects. As it is known psychic development of children with visual disorders not differing from normal in the main has some peculiarities. First of all among them there are big difficulties in getting and processing sensory information that slows down cognitive and speech development of a child.

Attention – one of the most important psychic functions, an obligatory condition of education successfulness - plays a vital role in intelligence activity regulation [1, 2, 6]. As D.A. Farber notes, "the role of attention is in making general mobilization

preparedness for activity and its selective function of organization according to concrete tasks and needs” [6]. The researchers of the domestic scientists [2, 3] showed that a qualitative leap in maturing of regulatory systems of the encephalon is in the period from 6 to 7 years old and one can speak about relative maturity of these systems only from 7 to 8 years old. However positive dynamics of voluntary attention mechanisms formation is not characteristic for all children. The complex research carried by employees of the Institute of Developmental Physiology RAE [3] allowed to reveal factors of risk in activity organization of more than 60% of children aged 6–7. Meanwhile almost half of the children do not percept the instruction and another part cannot plan their activity and change it. Such children are characterized by low abilities of activity organization, impulsions and bad controllability.

Voluntary attention mechanisms form intensively among 7-year-old children the basic source of voluntary attention controlling selective influences is the fronto-thalamic system [2, 3, 5]. In most cases the electrophysiological analysis reveals functional immaturity of the regulatory brain systems among the children who have difficulties in education. They differ by lack of all the components of activity voluntary regulation: an ability to accept the instruction, to plan and to work without distraction [2, 3].

For the children living in the European North risk of psychophysiological functions development delay is connected also with extreme climate ecological and socio-economic factors. In long periods of “biological darkness” and “thermal stresses” children spend much time in closed premises at artificial illumination undergoing sensor deprivation that leads to visual-spatial perception development delay.

Eye pathology prevalence among northerner children and insufficient study of their voluntary attention define topicality of the given research.

The research was conducted for the purpose of objective evaluation of voluntary attention with usage of the computer complex for psychophysiological researches KPFK-99 “Psychomat” developed by NII of medical instrument-making RAMN (Moscow, 2006) in “Correction test” mode. The task was in searching among rings

with different marks the one which matches with the produced stimulus. Indices of answers successfulness (%), answers average rate (s), successfulness self-estimation (points) were studied.

90 pupils aged 7-8 of schools of Archangelsk and Rikaskha (Primorskiy region) took part in the experiment: 50 children with normal vision (control group - KG) and 40 children with a vision disorder (experimental group - EG). The individual examination of the children was conducted in the first half of the day.

Distribution normality was checked with use of the Shapiro-Wilk criterion. When comparing control and experimental group parameters the possibility of distribution non corresponding to the normal form turned out to be very high ($p < 0,05$). Wilcoxon signed-rank test was used for estimation of the differences between indices of the EG and the CG. Spearman's rho rank correlation coefficient was calculated [4].

Answers successfulness, answers average rate and tasks implementation successfulness self-estimation in both experimental groups does not differ reliably ($p > 0,05$) what allows to guess presence of similar mechanisms of flowing of children's aged 7-8 with normal and disturbed vision attention processes (table 1)

Table 1

Centile estimation of voluntary attention indices of children aged 7–8, Me (Q1 – Q3)

Attention factor	CG (n = 50)	EG (n = 40)
Answers successfulness	88 (77 - 100)	85 (71 - 92)
Answers average rate	72 (64 - 86)	73 (63 - 101)
Successfulness self-estimation	5 (5 - 5)	5 (4 - 5)

Note. Me – median, Q1 – first quartile, 25th percentile, Q3- third quartile, 75th percentile.

Positive connection between quantity of correct answers and tasks implementation successfulness self-estimation was revealed in both groups when analyzing attention indices interconnections received with the help of the computer

method “Correction test”. Marks of the children with strabismus and amblyopia depended directly on quantity of made mistakes and the first-graders with normal vision estimated themselves basically positively, gave themselves a five.

Positive correlational connections between successfulness, tasks implementation average rate and self-estimation were revealed among normally-seeing school children. The more qualitative and faster the children implemented the correction test the higher they estimated their results. Correctness of finding the necessary stimulus depends on concentration of attention, concentration of the tested child on the task.

The described connections in the group of the visually impaired children were negative what may reflect a different actions program. The children in the experimental group preferred first of all found the necessary stimulus visually and then set to motor implementation of the task (moved the cursor to the variant of the answer) while the first-graders of the control group moved the cursor and compared the stimulus with the pattern simultaneously. The school children with strabismus and amblyopia said: “Over here! Found it!” finding the correct answer variant what reflects a compensatory and regulating speech role.

The first graders with strabismus and amblyopia either tried to implement the task as soon as possible without paying attention to made mistakes or were very concentrated, spent much time practically without making mistakes in answers. The children of the first group estimated effectiveness of their work higher. Big amount of mistakes made by the first-graders of the EG was connected with high speed of implementing tasks. In the course of the diagnostics children aged 7-8 did not pay attention to a stimulus change (rupture direction) and did not compare the chosen answer with the pattern that says about attention disorder.

Thereby voluntary attention estimation according to rate characteristics of tasks implementation by the children with normal and disturbed vision do not differ much. The first-graders with strabismus and amblyopia were noted to have more mistakes when speed of tasks implementation rises that may indicate immaturity of the visual control.

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**STAGES OF BIOPLAST FORMATION WAVE EXPLANATION OF
ONCOLOGICAL DISEASES**

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Article of debatable character. It sets forth the new wave model of bioplast formation which has given the theoretical basis for developing the wave method of curing oncological diseases.

Key words: ferromagnetics, diamagnetics, cell, genome

The article describes new wave hypothesis of formation of bioplast, RNA, DNA and genome which gave a theoretic basis for development of the effective wave method of curing oncological diseases at the cellular level applying electronics.

Material and methods of researches. Material for research were the experiments with bioplasts of James Watson and Francis Crick(1,8) who were the Nobel prize winners in 1962 as well as experiments of other scientists [2,6,7,8,9]. Methods of research are the comparison of those materials with laws of physics.

Research results. In the result of researches we created the new wave model of formation of bioplast, RNA, DNA and genome complying with the laws of physics.

Bioplast formation takes place in the result of interaction of three classes of the magnetic substances: ferromagnetics, paramagnetics and diamagnetics [3,4,5]. In the living tissues the microscopic natural magnet – ferromagnetic matrix (FM) is formed. It becomes the basis of the new cell, the source of its magnetic energy and the diskette that the magnetic record of the gene memory is recorded on and is reproduced from. Paramagnetics get pulled in to the magnetic field of FM and diamagnetics get pushed out of it. As a result the cell nutriment and isolation organ, the Goldgi complex is formed.

None of the works of Nobel prize winners mentions these key words: ferromagnetics, paramagnetics and diamagnetics.

Now comes the question: where does the energy for this FM formation come from? Solar energy is the guarantee of life on Earth. Solar wind moves to the Earth with the speed of 300-2000 km/sec [8]. It carries electrons, protons and other cosmic energetic particles /CEP/. With the speed of 2000 km/sec CEP can magnetize iron in the intercellular matrix, go through the electronic lattices and nucleus of the atoms, easily destruct them and thus cause the microscopic nuclear blast of the nucleus of one atom. Nobel prize winners name this phenomenon as “Release of the heat energy

in the form of blast” [1]. Ferromagnetics, paramagnetics and myriads of particles of the thinnest dark matter (TDM) get involved into this process. As a result a new FM is formed.

All the cells possessing nucleus contain ferromagnetics: iron, nickel and cobalt. Their participation in FM formation makes it to be non-corrosive. All paramagnetics have crystal structure. Paramagnetic oxygen in the liquid form forms liquid crystals. Getting pulled in to the magnetic field of the FM paramagnetics form multisurface paramagnetic single crystal around it. It becomes a nucleus of the new cell.

In the end of XX century the molecular electronics as a new branch of electronics appeared. It is based on creation in the single crystal by raising it of the sections having different qualities the combination of which gives many knots of electronic circuits and even entire electronic circuits. Atomic amplifiers and microwave radiation generators are created. The main part of these devices which acquired the name of quantum amplifiers and generators is the single crystal. This is the role of the paramagnetic single crystal of the nucleus in the cell.

Inside the ferromagnetic its magnetic field can thousand times exceed the outer magnetic field. The transformers work is based on this fact. In addition to that the magnetic field of FM is increased manifold by paramagnetic single crystal of the cell nucleus. That is how the microscopic FM becomes the powerful source of magnetic energy of the cell. Electromagnetic induction starts (EMI).

EMI is waves and at the same time it is flows of electrons, protons and other matters. They flow down from the edges of the single crystal of the cell nucleus. Along them the paramagnetic monomolecular chains of polynucleotides are formed, which means RNA are formed. Beginning of the RNA chain has a minus charge and the second end has a plus charge. Many of these similarly polarized chains coming from all the edges of the single crystal of the cell nucleus create the unusual cell polarity: minus in the center and plus on the cover. But the FM itself is polarized, as usually. This fact explains why the cells do not get together and do not move apart. Their similarly polarized covers get pushed away from each other (plus from plus)

and their FM pull the cells plus to minus. That is why the linear formations appear: muscular and nerve fibers.

Hydrophobic formations cannot give such linear formations.

All the cell mass turns around in the magnetic field of FM. That is why the RNA get twisted, their plus end joins with the minus beginning of the chain and the POWER PAIRS of the oppositely directed paramagnetic chains of DNA are formed. Power pairs do not get separated.

This is why DNA can be eternal and get found in mummies.

Under the impact of EMI flows going down the edges of the single crystal the DNA chain going from the single crystal edge is constantly growing. And the second oppositely directed chain has nothing to grow from. So the single-strand tails are formed on the ends of DNA. Their similarly charged ends (plus and plus) get pushed away from each other forming the fork [1,8]. Nevertheless this is not DNA replication but normal phenomenon of electrodynamics.

Number of DNA corresponds to the number of single crystal edges. The book [1] contains the number of micro photos clearly showing that the source of magnetic energy of the cell is in the center.

FM operates uninterruptedly. Cell mass is growing. But the magnetic field of the FM of basic cell cannot hold the unbounded cell mass next to it. So when under the impact of CEP next to the basic cell or inside it the new FM is formed, the new cell gets quickly formed from the ready cell matter.

Energetic base of the cell being its polarized FM is indivisible. That is why the polarized cell cannot be divided.

Magnetic waves do not absorb each other but get laid one over another. Each particle of the living body is polarized, radiates its wave, sings its song which gets immediately recorded to the magnetic memory of the new FM like to the computer diskette forming the genome record on it. Paramagnetic crystal of the nucleus amplifies it and DNA duplicate it.

Supposedly the long memory is recorded by the wave method on the hard tissues of skulls, concha and other hard parts of the body having crystal structure.

Nerve cells, axons and others are the signals transmitters. The proof of it is that from our childhood we remember only events which happened after the embryo gristle was changed to the real bone as well as the fact that in case of skull injury we lose a part of memory, and in case of spinal column injury people lose the ability to walk.

The soft-bodied animals (medusas) do not have the long memory.

Magnetization of FM in the cell liquid lasts about 40 days [6]. But if CEP get there and magnetize it repeatedly such cell can live for even more days. When cell FM becomes demagnetized the cell having no source of the magnetic energy gets decomposed. Apoptosis takes place. But power pair of the DNA have their own power field. That is why they do not get decomposed but form in groups. Around the groups of DNA of the decomposed cells in their magnetic field the mitochondrion radiating the magnetic energy are formed.

WAVE EXPLANATION OF ONCOLOGICAL DISEASES

By multiple researches of the scientists no special matters were found in cancer tissues. Thus it is not about the chemical content but about the direction of magnetic fields of the cancer cells.

Cellular protein of four-footed animals consists of 20 amino acids and all 20 of them are left-rotating. Thus the magnetic field of the bioplast is also left-rotating. The summary magnetic field of all left-rotating cells of the body creates the general left-rotating magnetic field of the body, its aura. It makes the blood containing non-magnetic iron move along the left-rotating circle and makes the heart work. When heart stops the blood continues flowing, it gets accumulated in auricle. The summary left-rotating magnetic field of the body makes the bowel peristalsis also move along the left-rotating circle. When surgeons do not consider this fact after the surgeries the adhesions appear on the bowels and the peritoneal commissures appear.

Cancer tissues contain cells with left-rotating as well as with right-rotating magnetic field. The effect of any drug has a wave nature as it is again a work of ferromagnetics, paramagnetics and diamagnetics (10). That is why the same drug of FM of the left-polarized cells demagnetizes which is destructs the very cells and quite the contrary feeds the right-polarized cells with the additional energy.

Supposedly this is the mysterious incurability of cancer.

Cancer cells differ by small size and morphologic simplicity. And this gives the opportunity to apply the electronics and diamagnetics to selectively demagnetize and thus destruct the cancer cells with left-rotating as well as with right-rotating magnetic field not damaging the surrounding healthy cells and organs.

Theory of diamagnetism logically explains the nature of toxicity of multi legged blue-blooded animals. Their blood contains not the hemoglobin but haemocyanin containing diamagnetics which getting into the blood flow of four-legged animals demagnetize the FM of the surrounding cells and thus destruct the cells and paralyze nerve fibers.

While irradiation the ionization and FM cells demagnetization also takes place which causes mass decomposition of the cells.

Conclusion. New wave model of bioplasts and genome formation gives the logical explanation of the origin of all living things in the Universe and opens wide perspectives for new explanation of diseases and curing people and animals.

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**THE STUDY OF THE HEARTBEAT OF *DAPHNIA CUCULLATA* G.O. SARS,
1862 IN TEST SOLUTIONS**

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This research shows the possibility of freshwater cladocerans' use with a view to bioindication of water medium. Daphnia are very sensitive to the presence of various toxicants in the medium, which is reflected in the change of heartbeat rate and general physiological state.

Keywords: bioindication, test object, daphnia, control, experiment, test solution, heartbeat rate.

Introduction

Chemical pollution of the biosphere quite often leads to acute toxic-environmental situations. Water pollution is a qualitative exhaustion of waters, the main reason of which is the inflow of untreated or insufficiently pure domestic or industrial sewage. Sewages of machine-building plants contain toxic substances, heavy metal. The most dangerous are sewages of galvanic shops, which contain inorganic acids and its salts, alkali, surfactants, cyanide, copper, chromium. In such conditions it is very important to carry out a timely quality control of water in some water reservoirs for its rational use. Chemical and other methods are used for these aims. Bioindication with the use aquatic organisms is less expensive and more

sensitive, because water inhabitants react to the presence of xenobiotics earlier, than some equipment can register.

Materials and methods of investigation

We studied the cardiac pulsation of freshwater crayfish Cladocera, which were grown in clonal cultures. Daphnia are very sensitive to the presence of toxicants in water, that's why they become a suitable object for bioindication of water environment.

Various researchers used repeatedly Daphnia's heart as an indicator which helps to study the influence of external factors, including the way different substances influence the intensity of vital processes. According to a common conviction, there is a concurrency between Daphnia's heartbeat rate and the level of metabolism [2, 3]. That's why the aim of our work was to study the influence of aqueous solution of zinc chloride on the cardiac pulsation of a representative of (Cladocera) Daphnia cucullata G.O. Sars, 1862. Daphnia represent a widely-spread component of inland waters' zooplankton. They can be found in all their types, i.e. from small puddles to some largest lakes. Daphnia's heart looks like a rounded bag with a pair of lateral spines. By room temperature the heart contracts very fast, namely, up to 200-290 beats per minute, which is the limit for animals.

As a methodological basis of the work was the comparison of Daphnia's heartbeat rate in the experimental solutions and the successive static handling of the primary numerical data [5]. We made use of a stereoscope MBS-9 (10) in order to calculate the heartbeat rate from the moment of timing after 15, 30, 45, 60 minutes. Specific belonging was determined by V.A. Yashnova [8] and S.M. Glagoleva's [4] identification guides. The easiest way to fix Daphnia is to put a crayfish into a drop of water on a glass slide and to cover it carefully with a cover glass, made of wax or plasticine legs. It is more convenient to use a cavity slide for these purposes. Water was replaced with fresh one every 3-4 minutes. After tilting the specimen, one could pour some water under the cover glass with the help of pipette. Just the same way pure water (without pollutant) was replaced with a solution of the investigated

substance. We registered that the temperature in a drop of water on a glass slide was +19⁰ C.

Daphnia cucullata's heartbeat in test solutions

Daphnia were placed in test solutions, namely normal settled water (control) and aqueous solutions of ZnCl₂ of different concentrations. In these solutions we registered the heartbeat rate (the number of beats per minute) every fifteen minutes on an hour exposure. The results of these observations are given in Table 1.

Table 1

Heartbeat rate (bpm) of *Daphnia cucullata* G.O. Sars. in different variations of the experience

Variations of the experience	$\bar{X} \pm S_{\bar{x}}$					
	Time, min					
	0	15	30	45	60	Average
control	271,1 8±1,17	268,8 9±1,13	265,3 0±1,14	261,1 8±1,78	257,2 6±1,51	264,7 6±1,12
solution with 30 mg/l ZnCl ₂	235,8 1±1,83	233±1 ,44	228,8 9±1,80	219,2 6±4,71	210,7 4±6,12	225,5 4±2,59
solution with 60 mg/l ZnCl ₂	179,7 8±4,71	176,6 7±5,00	171,7 8±4,48	159,4 8±4,21	153,1 5±4,50	168,1 7±4,73
solution with 90	117,1 1±1,87	102,8 1±2,52	84,70 ±4,62	53±5, 14	28,59 ±6,14	77,58 ±3,85

mg/l ZnCl ₂						
solut ion with 120 mg/l ZnCl ₂	71,59 ±4,31	51,59 ±5,08	27,48 ±4,97	0,41± 0,40	0	30,21 ±2,76

In the control the crayfish's heartbeat rate was slightly falling in every time span and only after a-half-an-hour period (271,18±1,17 versus 265,30±1,14) it had significant differences ($\alpha = 0,1 \%$). The average heartbeat rate in the Daphnia sample ($n = 27$) was 264,76±1,12 beats per minute. In normal water Daphnia cucullata's heartbeat rate started significantly falling after 30 minutes from the beginning of timing, reflecting their [fatigue](#) in the limited space and anoxia.

Then aqueous solutions of zinc chloride (ZnCl₂) of different concentrations (30, 60, 90, 120 mg/l) were tested on Daphnia in the experiment.

In the experimental concentrated (30 mg/l) solution of zinc chloride Daphnia's heartbeat rate was slightly falling in every 15 minutes, namely from 235,81±1,83 to 210,74±6,12 bpm throughout an hour (table 1). The average heartbeat rate in this sample was 225,54±2,59 bpm.

In a more concentrated (60 mg/l) solution heartbeat rate was slightly falling ($\alpha = 0,01 \%$) in order of magnitude at the beginning of timing (179,78±4,7) (table 1). Such a tendency was observed throughout an hour in all interims. Here the average heartbeat rate was 168,17±4,73 bpm, thus it is much lower than in a less concentrated solution (225,54±2,59).

In a zinc chloride solution, concentration of 90 mg/l, Daphnia's heartbeat was twice reduced in comparison with the control group (117,11±1,87 versus 271,18±1,17). It continued reducing significantly ($\alpha = 0,01 \%$) in every 15 minutes (table 1), and sometimes led to individuals' death. The average heartbeat rate of crayfish was reduced almost to a fourth (77,58±3,85 versus 264,76±1,12).

Almost all crayfish died in more than 30 minutes, while using a concentrated (120 mg/l) solution. At the beginning of timing Daphnia's heartbeat was $71,59 \pm 4,31$ mg/l, being four times less than in the control. Its average is almost eight times less. The increase of an average sample's mistake connects with Daphnia's death in the experiment and the decrease of the sample size.

Thresholds of toxic effect of zinc chloride solution on *Daphnia cucullata*'s heartbeat

The crayfish react to the presence of toxicant in water very appreciable. In more than half an hour a single individual died, even if we used a solution at a concentration of 60 mg/l. The mortality rate was equal to 3,7 % of the total sample (n = 27). In a solution with a concentration of 60 mg/l the crayfish's total mortality rate was 51,85 % of the sample. Single individuals started dying in half an hour and the main part of individuals died in 45 minutes from the beginning of timing. 14 individuals died on an hour exposure (table 2).

Table 2

Total mortality rate of *Daphnia cucullata* G.O. Sars. 1862 in different variations of the experience for an hour

Experimental solution	Death toll	Mortality rate, %
control	0	0
30 mg/l ZnCl ₂	0	0
60 mg/l ZnCl ₂	1	3,7
90 mg/l ZnCl ₂	14	51,85
120 mg/l ZnCl ₂	27	100

In a zinc chloride solution with a concentration of 120 mg/l 3 individuals died from the beginning of timing (mortality rate is 11,11 %), 5 individuals (18,51 %) died in 15 minutes, 11 individuals (40,74 %) – in 30 minutes. A single individual survived

after 45 minutes (mortality rate is (96,30 %). All the *Daphnia* died by the end of a heartbeat's registration (heartbeat stopped).

In our case it is obvious that in an acute experiment on an hour exposure a concentrated (90 mg/l) zinc chloride solution causes death of *Daphnia cucullata* G.O. Sars., i.e. there was a lethal outcome among most of the individuals (LC₅₀). Almost all the individuals died in the experiment at a higher concentration. This condition is of great importance for detecting the thresholds of toxicity that influence the aquatic organisms' vital functions and for establishing MPC of toxicants in water medium.

Summary

During the time the value of *Daphnia*'s heartbeat in pure water was slightly reduced. It connects with the fatigue of crayfish, fixed on a glass slide and the decrease of oxygen supply. The average heartbeat rate was 264 bpm on an hour exposure.

Daphnia's physiological state became worse in the aqueous solution of zinc chloride. It manifested itself through the decrease of heartbeat rate. The heartbeat was significantly reduced (on the average to 168 bpm) in this acute experiment (60 mg/l) on an hour exposure. The mortality rate was equal to 3,7 % of the total sample. In a solution with a concentration of 90 mg/l resulted in lethal outcome of more than half individuals (LC₅₀) – 51,85 %. The main part of individuals died in 45 minutes of an exposure. The average heartbeat rate was about 77,58 bpm. There was a mass elimination almost of all individuals in a more concentrated solution. Almost all crayfish died in more than 30 minutes in the concentrated (120 mg/l) solution.

Zn-compound in a chloride solution has a general toxic effect on *Daphnia cucullata*'s total metabolism. The heart's reaction to the toxicant effect determines and reflects the reaction of the whole organism. Cardiac disturbance connects with the energy balance disorder of the whole organism, which is caused by the cardiotropic effect of a toxicant [1, 6, 7]. Copepodas are very convenient test-object for the study of permissible concentrations and lethal values of dissolved chemicals in aqueous medium. It enables to assess the ecology of the aquatic organisms and their habitat.

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**GETTING INFUSIONS AND DECOCTIONS PLANTS BY
BIOTECHNOLOGICAL METHODS**

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*The aspects of the use of decoctions of plants as well as microbes to protect vineyards from the most common pests and diseases. Found that tomato broth not adversely affect predators and parasites *Lobesia botrana*. Study that provoked broth plant pathogens, especially bacteria that are dormant. In applying the mixture dendrobatsylin 60. The results of the death of three generations of caterpillars using tomato foliage from *Lobesia botrana* on industrial plantations Carpathian region.*

Keywords: *wine, Carpathians, Carpathian Biosphere Reserve, infusions and decoctions of plants *Lobesia botrana*, plant stuff, biologically active substances, environmental safety, herbivores, farmland, trichogramma dendrolimi, dendrobatsylin 60*

The aim of the work *was to find methods for infusions and decoctions of plant biotechnological methods and their application in order to reduce the number of *Lobesia botrana* in Transcarpathia.*

Condition of the problem. At the present stage of development of agricultural production wine is an important branch of the economy of Ukraine. Every year shows a growing interest in clean technologies and scientific methods of protecting crops from pests. Total area of vineyards in the country is about 98.0 hectares. In industrial culture of grapes grown in Crimea, southern steppe zone of Ukraine and Transcarpathia.

In addressing this problem is important to protect and processing grapes from pests as evidenced by the publication of domestic and foreign researchers

Lobesia botrana – a dangerous pest of vineyards. In Ukraine annually massively propagated in all areas of viticulture. Caterpillars damage the buds, flowers, green and ripened berries that wither, crumble or rot. Yield losses are 25-30%, and some years pest can destroy the entire crop.

One of the promising methods of pest control is the use of drugs from plants. They are based on natural plant bioactive substances, unlike pesticides, the pests do not develop resistance to them. For practical application of the most important area of ecology is the study of interactions between plants and herbivores and development based on these environmentally safe means of regulation of the

number of pests in agroecosystems. In this direction, working intensively scientists Ukraine (Derzhypilsky, Babydorych, Mykulyn, Vegera) and scientists Moldova (Koremina).

Now Ukraine has developed the plight of ensuring agricultural plant protection, as the majority of them came from abroad. Meanwhile, in our country grows or little plants that can be considered promising in the fight against pests and diseases.

Research methodic. Insecticidal action of some of them on *Lobesia botrana* we studied in experiments conducted in the laboratory at the University and CBR in 2011-2012.

Plant material crushed into pieces the size of 0,4-2 cm or destroyed into powder and cooked it with water decoction, i.e. the ratio of dry matter and water 1:10, fresh – 1:4.

Field studies of herbal medicines were carried out on tops of tomatoes, gathered it during dried period. Chopped dried foliage diluted with water at the rate of 100 g in 50 liters of warm water. Dry foliage in the field reduced the effectiveness of the solution.

In preparing broth, vegetable mass boiled for 30 min. Broth kept in a glass container in a cool, dark room. Before spraying solution was added to the soap at the rate of 20 g per 10 liters of solution.

In Uzhgorod viticulture in 2011 infusion tomato foliage with knapsack sprayer with a fine-tipped cutting processed over 1200 vines bushes to three generations of *Lobesia botrana* rate of 1 l infusion for 10 bushes of grapes.

Research results. Tested 12 plants Carpathian region showed varying degrees of effectiveness decoctions of plants for caterpillars *Lobesia botrana*. Thus, loss of pest caterpillars in the laboratory for water decoctions was: Ailant high – 61%, elder grass – 48%, Delphinus high – 58%, yarrow – 38%, tansy ordinary – 48% dope usual – 58%, aconite low – 71%, tobacco – 66%, daisy Dalmatian – 61%., celandine – 64% Insehar – 66% decis – 76% arrivo – 76% of tomato foliage – 77% (Fig. 1).

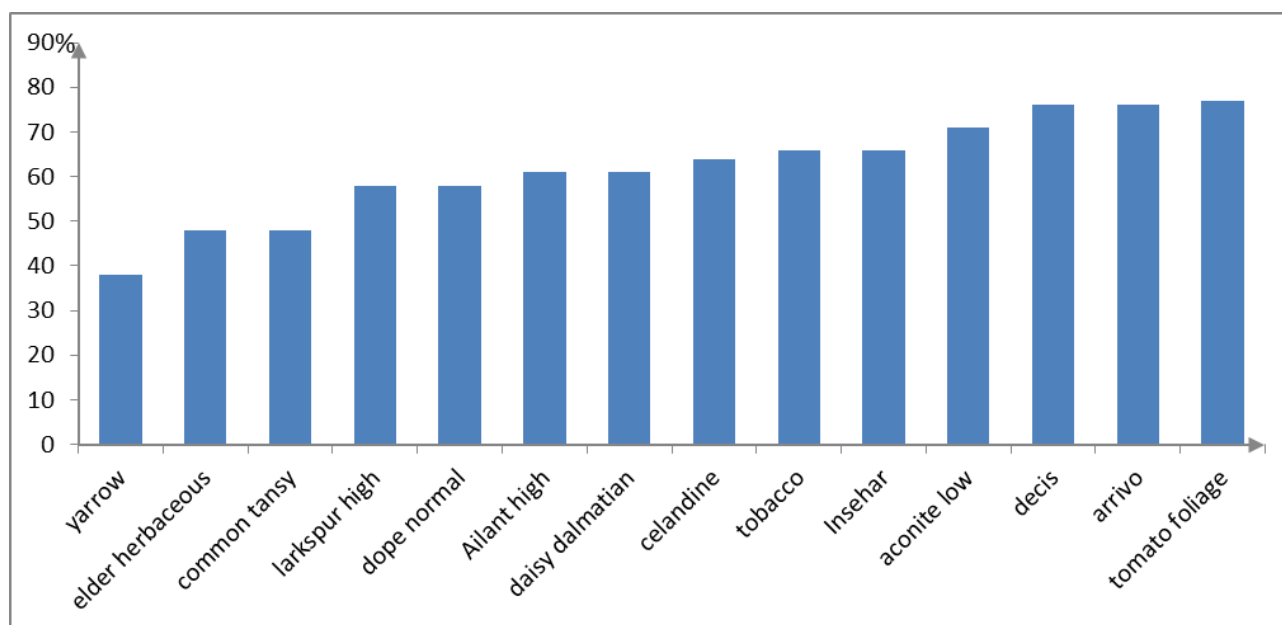


Figure 1. Biological drugs. The biological efficacy of plant concoctions of insehar and insecticides in limiting the number of caterpillars *Lobesia botrana* first generation

The first spraying held May 23 at the beginning of mass revival caterpillars of the first generation, the second on July 11 against the larvae of the second generation. Against the third most harmful, processing carried out on 15 and 29 August at the first appearance of caterpillars on the bunch.

The death of the first generation of caterpillars infusion was 55-61%, 59-63% second, third 69-75%. Damage clusters in the experiment did not exceed 2%, i.e. was below the economic threshold of harmfulness. On damage control plots was within 23-27%.

Found that tomato broth not adversely affect predators and parasites *Lobesia botrana*, not dying from it and trichogramma that was released during the early egg-laying butterflies.

Summary. It was also noted that the broth plants provoked pathogens, especially bacterial, located in the caterpillars in a latent state.

Found that the use of a mixture of dendrobatsylin 60 rate of 5 g. to 1 liter of working fluid up 0.5-1% caterpillars. From these pupae butterflies not reappeared.

The same performance was praised highly in 2012.

The cost of stocking tops and prepare it for processing vines were 2.5 times less than with organophosphorus and other drugs.

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Maskaeva T. A., Labutina M. V., Chegodaeva N. D.

INFLUENCE OF THE FISSILE FORMS OF OXYGEN ON DEATH OF CAGES OF THE MERISTEM OF *ALLIUM FISTULOSUM* L.

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*These researches of ability of the fissile forms of oxygen to induce an apoptosis or a necrosis of cages of an apical meristem of *Allium fistulosum* L. are given in this work.*

Keywords: the fissile forms of oxygen; apoptosis; necrosis.

Today environmental by volumetric and physical factors as a result of which action in alive organisms the free radicals are formed, gained global character and put mankind on a side of an ecological disaster. Though life expectancy of these free radicals is estimated in fractions of a second, they manage to affect intensively the genetic device of an organism and cause undesirable mutations owing to what there are various diseases.

The main factor considered in this work influencing alive system at cell-like level, the fissile form of oxygen (AFK) – the superoxide-coated radical O_2^- being the immediate predecessor of hydrogen dioxide in reaction of restitution of oxygen to water in the course of respiration of aerobic alive systems is.

The purpose of this work consisted in research of ability of AFK to induce an apoptosis or a necrosis of plant cells.

As a test-object the onion Welsh onion (*Allium fistulosum* L) is taken. As a source of O_2^{-*} used the elektroefflyuvialny ionizer of air (the Seteon aero ionizer made by NPTs "Alpha Rhythm"). Seeds placed apart 25 cm from tips of needles and influenced within 40, 60, 80 min. The maintenance of the negative aeroions of the oxygen, defined in a processing place, at 40 min stimulation made $1,3 \times 10^6$, at 60 min – 2×10^6 , at 80 min – $2,7 \times 10^6$ in 1 cm^3 . As pro-oxidizers used hydrogen peroxide ("Sigma", the USA) and iron sulfate ("Sigma", the USA). Control and aero ionization seeds couched on a filter paper in Petri dishes in the solutions containing modifying substances, in the thermostat at 25°C within 48 h. The cages, perishing an apoptosis or a necrosis, revealed methods of a light microscopy (a microscope "Biolam R-11"), using a hematoxylin ("Sigma", the USA).

In monitoring apoptosis signs in plant cells were not found. Cores in them smooth, the chromatin is evenly distributed in a core on all volume that when processing by dye gives a picture of homogeneous smooth coloring. At O_2^{-*} action within 40 min apoptosis signs also were not found. At increase in time of influence till 60 min consolidation of the nuclear chromatin pressed to an internal nuclear membrane that is a precursory diagnostic symptom of an apoptosis also was more observed.

At H_2O_2 action (2 mM) the share of apoptotic cages increased to 13 %, necrotic the changed cages were not observed. In these conditions at O_2^{-*} influence within 40 min the number of apoptotic cages decreased by 33 % in comparison with the monitoring, necrotic the changed cages were not registered. At increase in time of influence till 60 min the share of apoptotic cages increased for 117 % in comparison with monitoring, there were necrotic changed cages (about 13 %). The increase in time of influence of O_2^{-*} till 80 min in the presence of H_2O_2 (2 mM) led to increase of a share of apoptotic cages to 35 %, the share necrotic the changed cages in these conditions increased to 17 %.

The brightest picture of an apoptosis was observed at combined action on plant cells of H_2O_2 (2 mM) and FeSO_4 (2 mM). The cores which are breaking up to 3-5 scrap of the different sizes were thus found, but in some cages cores disappeared that indirectly testified to existence and a necrosis as forms of death of cages.

It is apparent that the high level of death of cages is bound to education in Fenton's reaction of the hydroxyl radical. Thereof, and also as a result of course of accompanying processes as which act padding inflow of ions of Ca^{2+} , catalyzed H_2O_2 , and activation of Ca-zavisimykh of endonucleases [2], increases number of apoptotic cages. Combined action of H_2O_2 (2 mM) and FeSO_4 (2 mM) sharply strengthened fragmentation and disappearance of kernels, the share of apoptotic cages increased to 32 %, and necrotic changed to 19 % in comparison with monitoring. At O_2^{-*} action within 40 min in these conditions the share of apoptotic cages decreased by 22 %, and necrotic cages for 10 % in comparison with monitoring. At increase in time of influence till 60 min and more the number of the cages perishing by an apoptosis and a necrosis, increased. Most brightly it is expressed at stimulation within 80 min. The share of apoptotic cages increased in these conditions for 54 %, and necrotic for 86 %.

By means of Acidum salicylicum participation of H_2O_2 in death of cages of an apical meristem of *A. fistulosum* was shown. Acidum salicylicum is a catalase inhibitor, increases activity superoxide scavenger and by that promotes H_2O_2 level increase in cages. In experiment in all options of experience Acidum salicylicum (5 mM)

promoted increase of a share of apoptotic cells and necrotic cells in *A. fistulosum* sprouts in comparison with monitoring.

The greatest body height of these indexes was observed at O_2^{-*} influence within 80 min together with Salicylic acid (5 mM), H_2O_2 (2 mM) and $FeSO_4$ (2 mM). The share of apoptotic cells increased in these conditions to 61 %, and necrotic there were about 32 %.

It is known that salicylic acid plays a significant role in regulating cell response. So, for example, shows that spontaneous cell death in transgenic *Arabidopsis* gene expression is suppressed as a result of bacterial salicylate hydroxylase that turns salicylic acid to catechol [1]. Salicylic acid is required for the induction of pathogen-dependent cell death in different plant *Arabidopsis* mutants [3].

The data obtained by us confirm data that there is an apoptosis dependent on Salicylic acid [1]. Under certain conditions, bound to excess accumulation in cells of plants of hydrogen peroxide, Salicylic acid promotes increase of quantity of the cells perishing by a necrosis.

AFK role in initiation and apoptosis development in plant cells can consist in oxidizing modification of a molecule of DNA leading to structural changes and activation of genes of cell-like death. Apparently from the provided data, the mechanism of action of inductors of an apoptosis considerably is defined by time of influence of AFK. It is apparent that in case of sparing oxygen stimulation adaptation and compensatory opportunities of an organism are sufficient for elaboration of the proper responses, allowing to support sufficient level of activity and a homeostasis as a whole. The elimination of the cells having violations in DNA, caused by action of particular AFK, by an apoptosis allows an organism to develop particular strategy of behavior for increase of fitness to a surrounding medium. The dominance of a necrotic way of death of cells of *A. fistulosum* at stimulation by the fissile forms of oxygen is direct reflection of developing pathological process.

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**STRUCTURE OF MICROBIAL COMPLEX OF TYPICAL
CHERNOZEM SOIL IN WINTER WHEAT AGROCENOSIS WITH
APPLYING DIFFERENT FARMING SYSTEMS**

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Presented the comparative analysis of the number of main physiological groups of microorganisms typical chernozem soil in winter wheat crops with applying different farming systems. Defined performance of orientation microbiological processes that accompany the growth and development of winter wheat. The influence of farming systems and tillage on the formation of soil's microbial complex for growing winter wheat.

Key words: typical chornozem, microorganisms, agrocenosis, winter wheat, farming system, tillage.

Introduction.

Soil is a major determinant of natural self-repairing resource that supports life on Earth. It is the habitat of living organisms, primarily microorganisms. Sustain useful microbiota on some level is a positive impact on plant productivity and soil fertility, as it is an essential link in the cycle of nutrients, involved in maintaining soil fertility and providing plant nutrients [1, 2].

The viability of soil microflora in agroecosystems largely depends on farming systems and farming practices, which use in growing a particular crop [3]. Management of microbiological processes in order to optimize the production process of plants, agricultural production and preservation of soil fertility is a key problem in creating sustainable productive agroecosystems [4].

However, an important problem in the management of microbial component of soil is an objective, comprehensive study of biodiversity, the structure of microbial communities and understanding the mechanisms in the soil – microorganisms – plant [5].

So, for the scientific substantiation of environmentally sustainable farming systems of particular importance is the study of patterns of structure of microbial communities, functional and spatial organization and orientation of microbiological processes in soil.

Aim of research. The aim of work was to study the influence of farming systems and tillage on the structure of the microbial complex of typical chernozem and on microbiological processes that accompany the growth and development of winter wheat.

Materials and methods. Studying of soils microorganisms conducted in a stationary field experiments Department of Agriculture and Herbiology "Agricultural Experiment Station". The area of studied field is located in the right bank of the steppes of Ukraine and part of Bilotserkivskiy soil area. The terrain is flat. The soil of the field is the typical black soil, medium clayey with the amount of humus 4,5 % in the layer of 0-30 cm.

Investigated farming systems are different in resource supply. For industrial system (control) making 12 tons of organic and 300 kg of active ingredient of fertilizers ($N_{92}P_{100}K_{108}$) per hectare of arable land in the rotation. Protection of crops carries industrial pesticides. In the ecological model priority means are organic fertilizer – 24 t/ha (12 t/ha of manure, 6 t/ha subsistence of the crop, 6 t/ha of green manure mass of crop plantings). The balance of power is compensated fertilizers in the amount of 150 kg/ha ($N_{46}P_{49}K_{35}$).

The biological model of agriculture provided a possible norm of manure (24 t/ha) of arable land in the rotation without making industrial agrochemicals. The using of complex biological drugs for seed treatment and biological crop protection [6].

Resourcing options investigated the background of differentiated and surface soil tillage options.

Selection of soil samples was carried out in a phase of flowering and ripeness of winter wheat in the upper (0-20 cm) of arable layer. Variants of the experiment: 1 – Industrial farming system + differential tillage; 2 – Industrial system + surface tillage; 3 – Ecological system + differential tillage; 4 – Ecological system + surface tillage; 5 – Biological system + differential tillage; 6 – Biological system + surface tillage.

The number of microorganisms of different physiological groups was determined by seeding soil's suspensions on elective nutrient media [7]. The results reflected the number of colony forming units in 1 g absolutely dry soil (CFU/g). Soil moisture was determined thermostatic-weighing method [8].

Index of nitrogen mineralization-immobilization has been calculated from the relation of the number of microorganisms that metabolize mineral and organic nitrogen. Index of pedotrophicity – is correlation between the number of microorganisms that grow on soil agar and «rich» nutrient media. Index oligotrophicity has been determined from the relation the number of microorganisms that grow on «poor agar» and «rich media» [3].

Statistical processing of the results has been performed using the package MS Excel 10.0.

Results and analysis. Investigation of soil samples showed a significant effect of farming systems and tillage on the number of basic physiological groups of bacteria, micromycetes and structure of microbial complex of typical chernozem in agrocenosis of winter wheat (tab. 1, 2).

In the flowering stage of winter wheat from the using of ecological farming system in combination with differential tillage the number of soil the ammonifying microbes was 1,8 times higher, then in the industrial system with differential tillage and was 7,33 million CFU/g of dry soil.

For the using of biological systems with surface tillage the number of ammonifying microbes was the lowest and was 1,51 million CFU/g of soil. The energy resources of microorganisms were aimed at transforming large mass of the harvest (straw) in this farming system, as evidenced by the number of cellulolytic microorganisms in this version (0.10 – 0.14 million CFU/g.).

Table 1

The number of main groups of soil microorganisms in flowering phase of winter wheat in different farming systems and tillage, million CFU*/g of dry soil, 2012

Variant of research	Ammonifying	Oligonitrifying	Immobilizer of mineral nitrogen	Oligotrophic	Pedotrophic	Actinomycetes	Spore-forming bacteria	Cellulolytic	Micromycetes
Industrial system + differentiated tillage	,07	,72	,79	,79	,29	,86	,43	,04	,04
Industrial system + surface tillage	,03	,12	,61	,76	,25	,67	,22	,05	,05
Ecological system + differentiated tillage	,33	,07	,63	,07	,16	,94	,07	,10	,03
Ecological system + surface tillage	,52	,93	,71	,18	,95	,37	,33	,09	,05
Biological system + differentiated tillage	,37	,24	,24	,52	,72	,73	,22	,14	,05
Biological system + surface tillage	,51	,95	,88	,1	,57	,72	,32	,10	,11

*CFU – colony forming units

Number of oligonitrifying microorganisms in industrial system was 1,5 times higher than the ecological and 2 times than the biological system. This indicates a significant reduction of the number of bound nitrogen in the soil under these conditions. Activation of diazotrophic microorganisms leads to associative nitrogen fixation of atmospheric nitrogen.

Found, that the industrial farming system in flowering stage of winter wheat promotes activation of microorganisms that use mineral forms of nitrogen, about ¼ of whom were actinomycetes (0,86 – 1,67 million CFU/g).

The number of oligotrophic microorganisms that develops at low amount of organic matter in the soil was highest in the industrial farming systems with differential tillage and was 5,79 million CFU/g soil in the flowering phase of wheat.

The number of pedotrophic microorganisms that decompose humus compounds was highest in the industrial system with surface tillage and was 2,25 million CFU/g soil. The lowest number of pedotrophic microbes observed in biological system with surface tillage (0,57 million CFU/g of soil).

Table 2

The number of main groups of soil microorganisms in ripeness phase of winter wheat in different farming systems and tillage, million CFU/g of dry soil, 2012

Варіант досліджу	Ammonifying	Oligonitrifying	Immobilizer of mineral nitrogen	Oligotrophic	Pedotrophic	Actinomycetes	Spore-forming bacteria	Cellulolytic	Micromycetes	
Industrial system + differentiated tillage	,24	,36	,4	,66	,15	,43	,29	,03	,03	
Industrial system + surface tillage	,46	,43	,7	,69	,16	,44	,79	,29	,28	,03
Ecological system + differentiated tillage	,63	,43	,5	,28	,94	,52	,87	,65	,06	,03
Ecological system + surface tillage	,93	,16	,6	,38	,10	,09	,87	,31	,59	,02
Biological system + differentiated tillage	,10	,01	,4	,54	,37	,30	,36	,43	,02	,02
Biological system + surface tillage	,79	,34	,1	0,76	,93	,07	,95	,44	,25	,01

The number of micromycetes in the studied soil ranged from 0,03 to 0,11 million CFU /g soil in flowering stage of winter wheat.

There was a decrease the number of ammonifying bacteria at industrial farming system with differential and surface tillage (3,24 and 4,46 million CFU/g of soil,

respectively) and at ecological farming system with differential tillage to 4,63 million CFU/g in ripeness phase of winter wheat. Observed a significant increase in their numbers, compared with the phase of flowering for biological farming system with surface tillage (8,79 million CFU /g). This indicates that the significant amounts of organic nitrogen compounds are available in the soil.

There was a significant reduction of oligonitrifying microorganisms on all variants of the experiment, especially in the industrial farming system (0,36 million CFU/g) in ripeness phase of winter wheat. In ecological and biological farming systems there was increasing the number of assimilators of mineral nitrogen at the end of the growing season of winter wheat, which promoted "biological fixing" it in the soil.

In ripeness phase of winter wheat the number of oligotrophic microorganisms was higher in soil with surface tillage at all the investigated farming systems, that indicates a lower content of nutrients in the soil under these conditions.

For ecological and biological farming systems in phase ripeness of winter wheat is an increase the number of spore-forming bacteria that positively effects on the transformation of organic residues in soil.

It has been observed reduction the number of cellulolytic microorganisms in soil with differential tillage (0,02 – 0,06 million CFU/g of soil). Their number increases dramatically for surface tillage, especially for ecological farming system (0,59 million CFU/g of soil).

It was found that the number of micromycetes decreased in soil in the ripeness phase of wheat, compared with the period of active vegetation, especially in biological farming system (0,02 million for differential tillage and 0,01 million CFU/g – for surface tillage).

Has been calculated index of mineralization-immobilization, of pedotrophicity and oligotrophicity for comparative evaluation of focus microbiological processes in typical chernozem, that accompany growth and development of winter wheat (fig. 1, 2).

In the flowering stage of winter wheat index of mineralization was highest for biological farming system with surface tillage (1,90) and industrial farming system with differential tillage (1,67). This indicates that mineralization processes of organic matter in the soil occur rapidly, microorganisms use mineral forms of nitrogen very active. Its absorption by plants decreases.

In ecological farming system the index of mineralization is much lower and does not exceed 1, that has a positive effect on the accumulation of organic matter in the soil and mineral nitrogen which formed during process of ammonification.

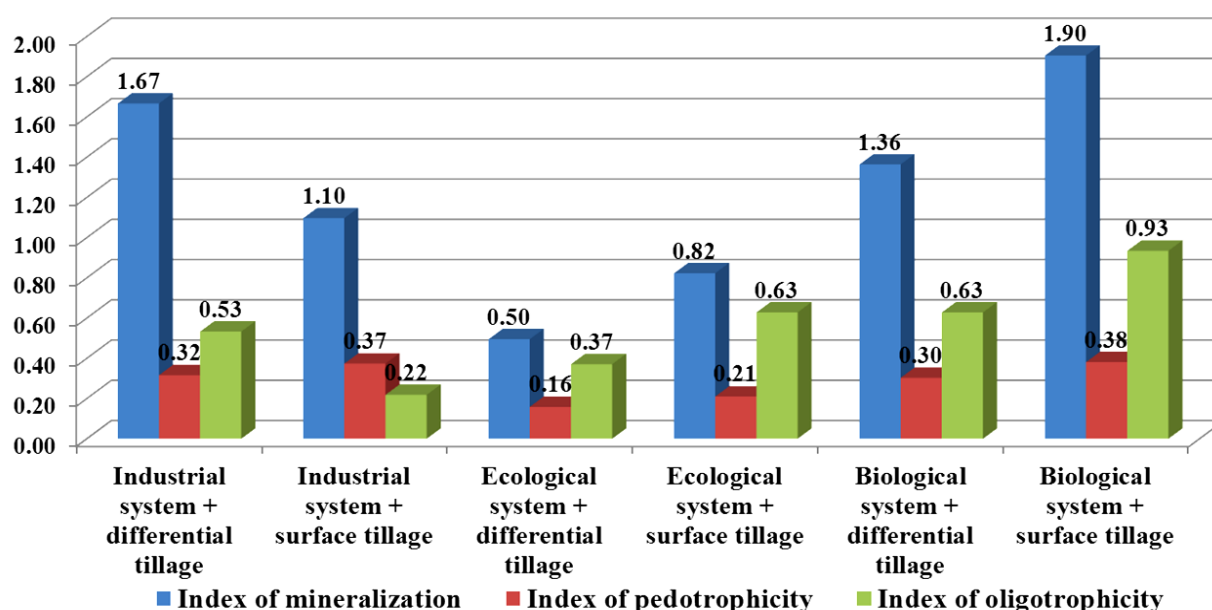


Fig. 1. Orientation of microbiological processes of typical chernozem in flowering phase of winter wheat at different farming systems and tillage

Index of pedotrophicity was highest in industrial and biological farming systems with surface tillage (0,37 and 0,38, respectively). This indicates an increase in the intensity of decomposition of soil organic matter, such as humus compounds. This index was the lowest in ecological farming system with differential tillage (0,16), it indicates the preservation of organic substance in soil under the given conditions.

In flowering phase of winter wheat index of oligotrophicity was higher in biological and industrial farming systems than in the ecological system, which indicates the reduction of nutrients in the soil under these conditions.

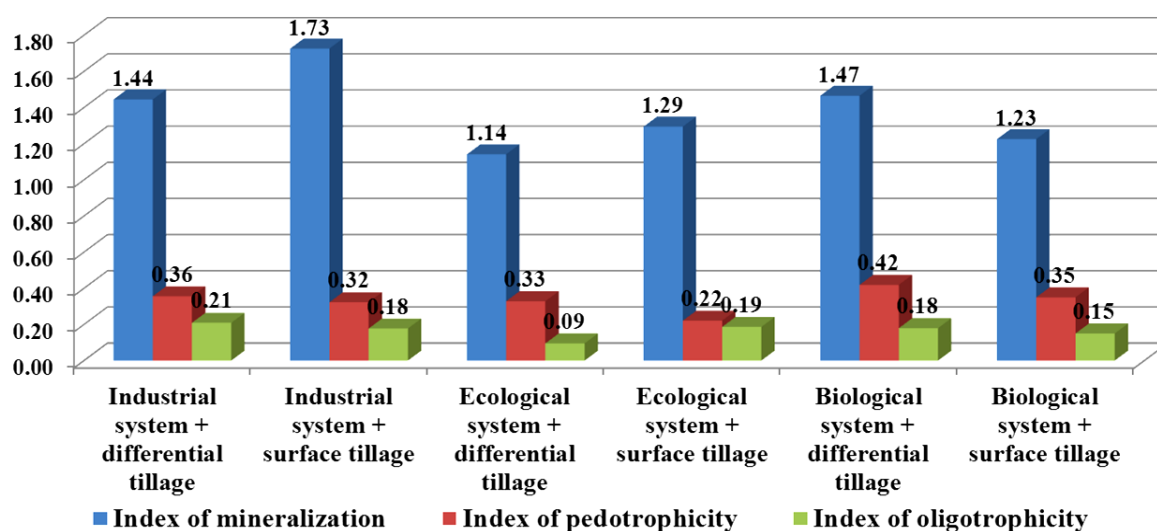


Fig. 2. Orientation of microbiological processes of typical chernozem in ripeness phase of winter wheat at different farming systems and tillage

There are changing orientation microbiological processes in all investigated variants in ripeness phase of winter wheat. Thus, the highest index of mineralization had been recorded by industrial farming system with surface tillage (1,73) and by biological systems with differential tillage (1,47).

There was a change of pedotrophicity index in ripeness phase of winter wheat. Thus, it was the highest for biological and industrial farming systems with differential tillage (0,42 and 0,36, respectively). Index of pedotrophicity was lowest for ecological farming system with surface tillage (0,22).

The index of oligotrophicity decreases at all variants of the experiment in the end of the growing season. It was the lowest for ecological farming system with differential tillage (0,09). This indicates an increase in soil of digestible nutrient substances.

Conclusions. Thus, the using of farming systems and tillage of soil has a significant influence on the structure of the microbial complex of typical chernozem in agrocenoses of winter wheat. Using of ecological farming system in combination with differential tillage of soil promotes mineralization of nitrogen contained in organic compounds, increases the number of ammonifying bacteria in flowering phase, spore-forming and cellulolytic microorganisms in ripeness phase of winter wheat. Using of biological farming system reduces the number of pedotrophic

microorganisms, increases the number of ammonifying bacteria, spore-forming and cellulolytic microorganisms in ripeness phase of winter wheat.

Application of industrial farming system leads to increase the number of oligonitrifying bacteria, immobilizers of mineral nitrogen, oligotrophic, pedotrophic microorganisms and to reduce the number of spore-forming and cellulolytic microorganisms.

Using of differential tillage of soil contributes to the accumulation of nutritious organic substances of soil in ripeness phase of winter wheat.

Application of ecological farming system with differential tillage of soil has a positive effect on soil's microbiological processes in flowering and ripeness phases of winter wheat, contributes to the accumulation of organic substances and mineral nitrogen in soil, improves overall biogenic potential of typical chernozem under these conditions.

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THE EFFICIENCY OF COMBINED USE OF INOCULATION AND EM-TECHNOLOGIES IN THE CULTIVATION OF LEGUMES

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There has been established greater efficiency of the binary fertilizer «Baikal EM-1U» and Bradyrhizobium and Rhizobium strains application for sowing the Annushka soybean and Nadiya bean variety in the soil and climatic conditions of Ukraine Forest Steppes to boost the growth, content of photosynthetic pigments, activity of nitrogen fixation and productivity.

Key words: Glycine max (L.) Merr., Phaseolus vulgaris L., «Baikal EM-1U», Bradyrhizobium, Rhizobium, inoculation, growth, pigments, symbiosis, productivity.

Introduction. The intensification of legume symbiotic nitrogen fixation in modern farming systems can not only be achieved by directed cultivation of legumes species and complementary strains of nodule bacteria, which are used for pre-seed nitrogenization taking into account the specific soil, climatic and agro-technical conditions, but also by creating mixed preparations on their basis [1]. Preparations based on nodule bacteria and natural, synthetic physiologically active substances are successfully introduced into the production [2-5]. The evidence about the more efficient impact of the microorganism association on the plant than other separate strains facilitated the emergence of a new generation of biological products based on microorganisms, these are phosphate-mobilizing bacteria and *Bradyrhizobium*

japonicum, which will allow to form more powerful symbiotic apparatus in soybean than with the help of monoinoculation, symbiotic and associative diazotrophs, *Rhizobia* and Vesicular-Arbuscular Mycorrhizal Fungi, (*Cyanobacteriae*) blue-green algae and nodule bacteria, that have a positive multifunctional impact on plants etc [6, 7].

Considering the problem of creation of new multifunctional microbial preparations with nitrogen-fixing, growth-stimulating and bioprotective properties to increase crop yields and referring to the issue of obtaining high quality products and improving the environment, the use of nitrogen-fixing simbiotrof with EM-preparations (from EM – effective microorganisms). The developer of EM-technology is a Japanese scientist Teruo Higa, who united 86 species of anaerobic and aerobic microorganisms in preparation. His dominant group contains photosynthetic and lactic bacteria, actinomycetes, yeast and other enzyme-forming fungi etc. Each of these components performs its inherent function and interacts with other components and is useful for both plants and soil in its own way [8, 9]. Ten years later, R. Buldagaeva and A. Nechesov, the scientists from Irkutsk (Russia), obtained a similar to EM-preparation – “Baikal EM-1U”. The first experiments with the newly made biological product were conducted under the supervision of P. Shablin and showed its high efficiency. Russian preparation, compared to Japanese product, is marked by the predominance of lactic acid bacteria over photosynthetic, not vice versa [10]. “Baikal EM-1” is produced in Ukraine under the name of “Baikal EM-1U” Ltd. “EM Center, Ukraine” (Kharkiv) in the form of a ready solution with active microorganisms and a concentrate where live parts are at rest and require nutrient medium for activation [11].

The aim of our research work was to establish the expediency of two-component pre-treatment of *Glycine max* and *Phaseolus vulgaris* of *Bradyrhizobium* and *Rhizobium* strains and the use of “Baikal EM-1U” in soil and climatic conditions of Ukraine Forest Steppe.

Material and methods. The objects of our research were bole species *Phaseolus vulgaris* L. Nadiya and *Glycine max* (L.) Merr. Annushka. “Baikal EM-

1U” (TU 24.1-22700554-001-2003) was used in 1 to 100 for the humidification of the surface or 1 to 1000 for 1-hour soaking of seeds. For monoinoculation and combined pre-treatment of legume seeds with “Baikal EM-1U” the bacteria *Rhizobium phaseoli* strain 700 and *Bradyrhizobium japonicum* strain 634b were used.

Field experiments were conducted on black soil (chornozem) with low amount of humus and high loamy mechanical structure of agrobiolaboratory in Ternopil National Pedagogical University named after Volodymyr Hnatiuk. Contents of N (according to Cornfield) – 13,5 mg/100 g soil (low), P and K (according to Chirikovyi), respectively, 14,8 and 11,4 mg/100 g of soil (high), Mn – 68,5 mg/kg soil (middle), B – 1,21 mg/kg, Cu – 3,64 mg/kg soil (high), exchange acidity *pH* 6,7 (neutral).

The technology of cultivating legumes typical to forest steppes of Ukraine with the location in 7th crop rotation without using chemical fertilizers and crop protection means. The location of samples is single-stage sequential with 4-fold frequency.

Results and discussion. An increase in the growth processes, after the simultaneous application of “Baikal EM-1U” and rhizobia, was possible mainly due to the increase in total area and dry mass of leaves on plants, dry weight of roots and stems. Biopreparation “Baikal EM-1U” significantly increased not only the same parameters but also the net productivity of photosynthesis, by 39,8% to control. Inoculation of *Rhizobium phaseoli* revealed significant stimulus only on the formation of leaf surface area and on the mass of root system (tab. 1).

The study of leaf pigments showed that “Baikal EM-1U” had the highest stimulating effect during the phase of budding – the rise of chlorophyll *a* and main carotenoids was, respectively, 19,5 and 23,3%, “Baikal EM-1U” in combination with rhizobia – 15,6 and 13,2% and monoinoculation with rhizobia – 7,5 and 13,7% to control. In the phase of budding, the analyzed factors didn’t show any significant effect on chlorophyll *b* (tab. 2).

Phase of flowering is distinguished by strengthening the combined pre-treatment of bean seeds with “Baikal EM-1U” and rhizobia and reducing the effect of monocultivation with “Baikal EM-1U”. Thus, the combined effect of investigated

factors led to significant increase in chlorophyll *a* 28,5%, chlorophyll *b* – 47,4% and the main carotenoids – 17,9% of the control, inoculation with rhizobia – 16,4, 10,0, 3,3% and with “Baikal EM-1U” – only chlorophyll *a* by 5,3% to the control.

Table 1

The Influence of inoculation and fertilizer “Baikal EM-1U” on the growth processes of *Phaseolus vulgaris* L. Nadiya, % to control

Indicator	“Baikal EM-1U”	St. 700	“Baikal EM-1U”+ st.700
density of shoots	106,2	98,4	109,4
density of plants during the harvest	105,4	107,3	100,0
plant height ⁴	109,5	102,9	109,1
leaves area ³	124,9	135,4	120,6
stem base diameter ³	102,5	98,5	102,0
the weight of dry leaves from one plant ³	110,3	94,5	115,6
the weight of dry stem without the leaves ³	124,3	103,8	112,1
the weight of dry root ³	133,9	111,7	135,1
net product. of photosynthesis ³	139,8	88,5	101,2
average	117,4	104,6	111,7

Note: ² – phase of budding and blooming; ³ – phase of budding, flowering and green beans; ⁴ – phase of the fourth leaf, bud, blossom and full ripening

Table 2

The amount of leaf pigments in *Phaseolus vulgaris* L. Nadiya under the influence of “Baikal EM-1U” and inoculation in the bud stage, mg/100 g raw weight

Indicator	Control	“Baikal EM-1U”	St. 700	“Baikal EM-1U”+ st.700
chlorophyll <i>a</i>	133,0±8,0	159,0±4,0*	143,0±3,5	153,8±6,7
chlorophyll <i>b</i>	83,3±3,2	79,9±3,4	78,3±6,2	84,0±4,7
main carotenoids	57,6±2,2	71,0±3,6*	65,5±0,9*	65,2±6,5

Note: * – significant difference from control

The most remarkable stimulating effect on the formation and functioning of the legume-rhizobium symbiosis between *Phaseolus vulgaris* L. Nadiya, and *Rhizobium phaseoli* bacteria was found in the flowering stage (tab. 3).

Table 3

The legume-rhizobium symbiosis of *Phaseolus vulgaris* L. Nadiya after using “Baikal-EM-1U” fertilizer and inoculation at flowering stage

Indicator	Control	“Baikal EM-1U”	St. 700	“Baikal EM-1U” + st. 700
number of tubercles, pieces/plant	29,8±2,3	50,3±4,9*	61,0±4,2*	82,8±7,1*
dry weight of	42,8±1,9	59,7±4,9	67,3±0,9	113,8±3,

tubercles, mg / plant	3	3*	9*	81*
dry weight of one tubercle, mg	1,47±0,1	1,15±0,1	1,16±0,0	1,45±0,1
GNA of tubercles mkg N ₂ /plant/year	0,92±0,0	0,92±0,0	1,46±0,1	1,72±0,0
SPA of tubercles mkg N ₂ / 1g. dry weight/year	3	9	1*	9*
	16,21±0,64	15,67±0,86	21,73±1,24*	14,23±1,25

Note: * – significant difference from control

The functional activity of tubercles, which was evaluated according to the general nitrogenase activity (GNA), showed the highest activity after the combined treatment with the microbes – the growth was 87,0% to control, monoinoculation with rhizobia – 58,7% and there was no change after using “Baikal EM-1U”. At the same time, specific nitrogenase activity (SNA) of the tubercles significantly increased by 34,1%, only in the variant when *Rhizobium phaseoli* were solely applied (tab. 4).

Higher enzyme activity of catalase in the leaves of legumes in the flowering phase indicates the stimulation of physiological processes of studied biological product – after the combined use of “Baikal EM-1U” and rhizobia by 27,1%, “Baikal EM-1U” – 26,0% and rhizobia strain 700 – 18,3% to the control (216,8 ± 15,2 ml O₂ per 1 g raw weight for 3 min.).

The main criterion of the effective influence of a certain factor on the plant is its impact on productivity. Thus, the study of biological value of bean grain yield showed that the highest growth at 3,6 cwt/ha was after the combined use of rhizobia and “Baikal EM-1U”. Monocultivation with “Baikal EM-1U” and rhizobia turned out to be less effective – growth, respectively, by 1,4 and 1,2 cwt/ha.

The analysis of elements of productivity illustrates that the highest indicated productivity growth of beans after combined application of biological products was mainly due to the high growth of aboveground crop mass – by 29,1%, the number of beans per one plant – 21,9% and the number of seeds per one plant – 33,2%.

Table 4

Key elements of productivity of *Phaseolus vulgaris* L. Nadiya after applying “Baikal EM-1U” fertilizer and inoculation

Indicator	Control	“Baikal EM-1U”	St. 700	“Baikal EM-1U” + st. 700
density of plants, cwt/ha	305,6± 14,0	322,2± 14,3	327,8± 10,6	305,6±1 4,0
biological yield without the leaves, cwt/ha	26,1±2, 0	30,2±2, 4	32,2±3, 1	33,7±2,5
number of beans per one plant, unit	6,4±0,3	6,9±0,4	7,4±0,4	7,8±0,5
number of seeds per 1 plant, unit	26,8±1, 6	31,0±1, 7	32,9±2, 0	35,7±2,4
number of seeds in a bean, pcs	4,1±0,0 9	4,5±0,1 0	4,4±0,1 0	4,5±0,10
weight of 1000 seeds, g	186,2± 6,1	191,6± 4,0	197,2± 4,1	186,2±6, 0
biological crop, cwt/ha	17,5±0, 6	18,9±1, 0	18,7±0, 7	21,1±1,5

Note: * – significant difference from control

There has been established greater efficiency of the binary fertilizer «Baikal EM-1U» and inoculation application for sowing of the Annushka soybean variety to the growth processes (tab. 5).

The study of leaf pigment amount in different phases of growth of soybean plants showed the most significant impact of the factors during the phase of green beans (fig. 1).

Under the influence of bioproduct “Baikal EM-1U” an increase in chlorophyll *a* was 33,5%, chlorophyll *b* – 24,5%, carotenoids – 56,9% to control. *Rhizobia* strain 634b increased the amount of these pigments, respectively, by 23,0, 15,9 and 43,3%,

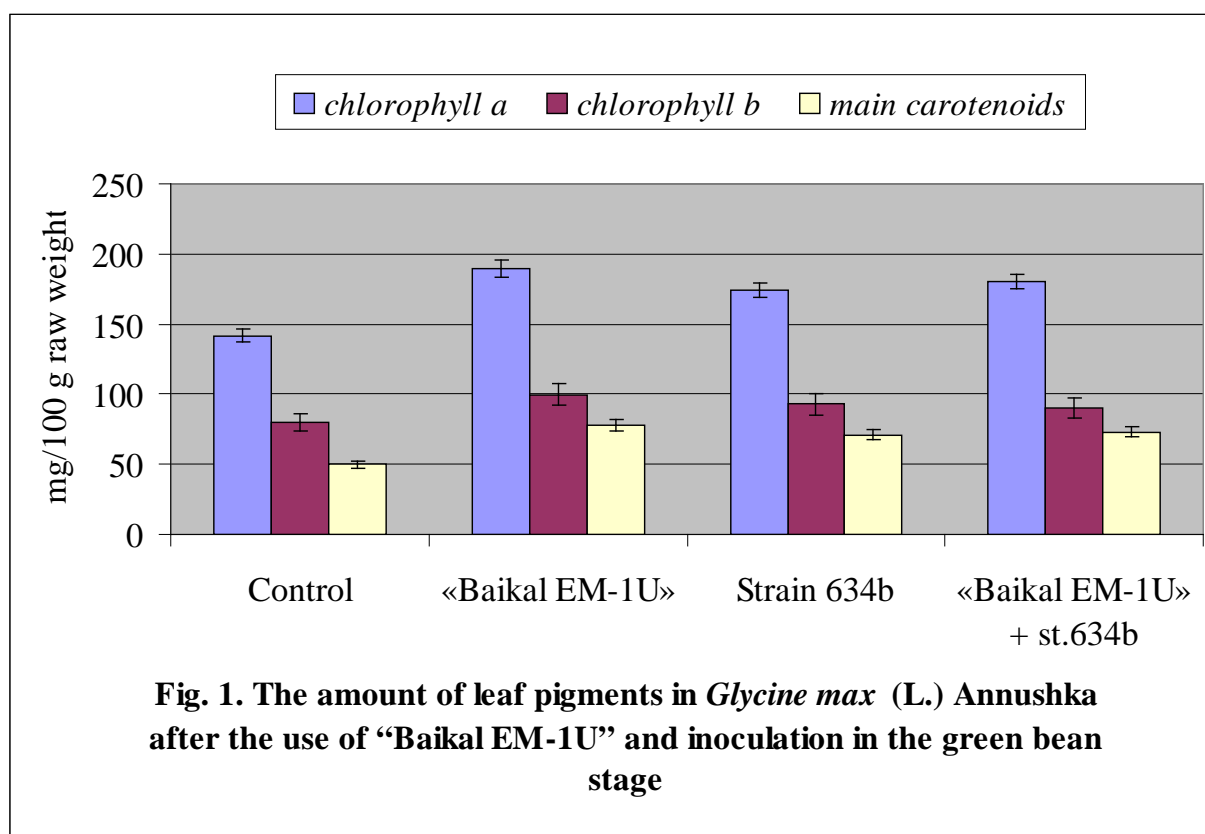
and combined application of rhizobia and biological fertilizer – by 27,1, 12,5 and 46,5% to control. In all tested variants significant increase in chlorophyll *a* and carotenoids was observed, which is due to the protective effect and extending of the operation of the photosynthetic apparatus of studied factors [4, 12].

Table 5

Growth processes of *Glycine max* (L.) Annushka after the use of “Baikal EM-1U” and inoculation, % to control

Indicator	“Baikal EM- 1U”	St. 634b	“Baikal EM- 1U”+ st.634b
germination	118,7	110,3	123,5
field similarity	118,0	109,8	123,0
height ⁵	110,0	109,9	111,8
stem base diameter ³	102,0	106,1	110,7
weight of dry stems without leaves ³	118,8	120,7	130,5
dry root weight ³	117,9	114,4	125,5
dry leaves weight ³	115,0	124,4	121,0
leaves area ³	105,9	123,5	125,1
average	113,3	114,9	121,4

Note: ³ – phase of budding, flowering and green beans; ⁵ – phase of fourth leaf, budding, flowering, green bean and full ripening.



The study of legume-rhizobium symbiosis of *Glycine max* (L.) Annushka showed that fertilizer “Baikal EM-1U” and strain of *Bradyrhizobium japonicum* 634b significantly stimulated the formation of tubercles and their activity (tab. 6).

Table 6

Legume- rhizobium symbiosis of *Glycine max* (L.) Annushka after the use of “Baikal EM-1U” and inoculation in the green bean stage

Indicator	Control	“Baikal EM-1U”	St. 634b	“Baikal EM-1U”+ st.634b
number of tubercles, pieces/plant	64,8±5,1	57,7±5,7	79,6±4,2 *	107,3±5,2 *
dry weight of tubercles, mg / plant	338,4±1 6,56	525,9±2 5,55*	606,3±2 6,18*	593,3±15, 72*
dry weight of one tubercle, mg	5,4±0,36	9,7±0,85 *	7,6±0,31 *	5,7±0,47

GNA of tubercles mkg N ₂ /plant/year	42,76±3, 84	61,15±5, 56*	68,23±4, 56*	80,20±7,9 2*
SPA of tubercles mkg N ₂ / 1g. dry weight/year	128,05± 9,82	143,92± 12,44	132,02± 12,73	135,84±10 ,36

*Note: * – significant difference from control*

Thus, despite the high number of tubercles in the control version, which indicates the high titer of native rhizobia in the soil of agrobiolaboratory field, there was found a growing number of tubercles by 65,6% of control after the combined application of biofertilizer and rhizobia and by 22,8 % – after monoinoculation during the phase of the green bean. Weight of dry tubercles per one plant was growing by 75,3% of control after the combined treatment, and by 79,2% – after monoinoculation and by 55,4% – only after using “Baikal EM-1U”. It should be taken into account that in the latest version the growth of total amount of rhizobia took place due to an increase of 79,6% to the control value of tubercles, which was assessed by their dry weight, not by their quantity and weight, as in the other two variants.

The legume-rhizobium symbiosis which appeared after the application of “Baikal EM-1U” was characterized by higher activity than that formed by the same indigenous bacteria in the control plants. During the phase of green beans General Nitrogenase activity (GNA) increased by 43,0% and the Specific Nitrogenase activity (SPA) – by 12,4% of control. The tubercle that were formed mainly by the industrial strain of *Bradyrhizobium japonicum 634b* had higher by 59,6% GNA and SPA – 3,1% to control. Combined presowing treatment with “Baikal EM-1U” and rhizobia formed the symbiosis, which was marked with the highest GAP – by 87,6% and PNA – by 6,1% to control.

The carried-out research confirmed the interdependence between the forming of soybean yield of *Glycine max* (L.) Annushka and the use of bio-fertilizer “Baikal EM-1U” and its combined use with the strain 634b (tab. 7).

Table 7

The key elements of *Glycine max* (L.) Annushka crop productivity after the use of bio-fertilizer “Baikal EM-1U” and inoculation

Indicator	Control	“Baikal EM-1U”	St. 634b	“Baikal EM-1U”+ st.634b
density of plants, cwt/ha	305,6±1 0,6	338,9±1 0,6*	344,4±6, 4*	372,2±14 ,0*
biological yield without the leaves, cwt/ha	48,8±2,6	58,±2,8*	49,5±3,7	63,9±6,0 *
number of beans per one plant, unit	33,8±2,0	35,9±2,5	29,1±2,0 *	35,2±2,7
number of seeds per 1 plant, unit	67,5±4,5	72,3±5,2	57,5±3,8 *	71,1±5,8
number of seeds in a bean, pcs	2,00±0,0 7	2,02±0,0 6	2,00±0,0 5	2,03±0,0 6
weight of 1000 seeds, g	138,0±2, 8	140,8±4, 5	134,5±2, 2	142,8±4, 5
biological crop, cwt/ha	27,4±1,6	33,3±2,0	27,9±2,0	37,4±2,9 *

Note: * – significant difference from control

Thus, presowing treatment of soybean seeds with biological fertilizer “Baikal EM-1U” promoted the growth of grain productivity by 5,9 cwt/ha compared with the control. Combined use of “Baikal EM-1U” with rhizobia of production strain 634b increased the yield by 10,0 cwt/ha, which indicates the synergistic effect of the studied factors. Bacteria of strain 634b increased productivity by 0,5 cwt/ha, which shows the absence of the benefits of applied strain local indigenous *Bradyrhizobium*.

The analysis of elements of productivity showed that the increase in grain productivity of *Glycine max* (L.) Annushka with combined application of “Baikal EM-1U” and nodule bacteria was possible primarily due to steady growth of stalk density of 21,8% and increase of aboveground plant weight of 30,9% to control, which are important factors of complete legumes crop productivity. “Baikal EM-1U” increased the stalk density by 10,9% as well and aboveground mass by 19,5% compared with control plants. Plant inoculated solely by rhizobia formed 12,7% thicker crops in comparison with control.

The obtained findings indicate that the combined use of microbial fertilizers increased the indicators of both stalk density and crop yield of aboveground plant mass more efficiently than the use of “Baikal EM-1U” solely.

Conclusion. Thus, presowing treatment of *Phaseolus vulgaris* L. Nadiya and *Glycine max* (L.) Annushka in soil and climatic conditions of Ukraine Steppe with EM-fertilizer “Baikal EM-1U” and complementary production strains of nodule bacteria *Rhizobium phaseoli* strain 700 and *Bradyrhizobium japonicum* strain 634b showed that predominantly more effective, according to the complex of physiological and biochemical parameters and the level of crop productivity, is the combined use of bioproducts than their sole use.

The results obtained during the research enable us to suggest a combined presowing treatment with microbiological fertilizer “Baikal EM-1U” and the inoculation of legume seeds as a perspective tendency of crop productivity growth.

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**APPLICATION GEOINFORMATION TECHNOLOGIES FOR
ENVIRONMENTAL MONITORING**

OOO «Gazprom VNIIGAZ»/ Gubkin Russian State University of Oil and Gas

In this report we describe the processing of environmental data and building 3D-models of areas of heavy metals using the software ArcGIS.

Keywords: GIS, 3D-model, the area of distribution, heavy metals.

The basis of this work is put interpretation of environmental monitoring by constructing 3D models to estimate the prevalence of heavy metals in the construction pipeline.

Actuality of this work is to assess the state of the environment as a result of the construction of the pipeline, as well as modeling for effective conservation measures.

Original data for research are quantitative indicators of heavy metals in areas crossing Baydaratskaya Bay Bovanenkovo - Ukhta (coastal zone).

We solve the following problems:

- Construction of 3D-terrain models, water and pipeline;
- Choosing the best method of construction of areas of heavy metals on the basis of quantitative data in places of sampling and built 3D-relief model;
- Construction areas of heavy metals in the area of the pipeline.

To solve the problems was chosen ArcGis software company ESRI, which allows creating 3D-models, using the module ArcScene display them in the form of review scenes, interact with data on a visual level and the database level. This provides a detailed study of the environmental input parameters for further analysis.

Data processing algorithm for environmental monitoring include:

1. Construction of three-dimensional relief model based altitude data and contours;
2. Inclusion in ArcScene water objects, assigning them "base elevation" to coincide with the surface topography;
3. Construction of areas of heavy metals in the passage of the pipeline by the method of interpolation Spline;
4. The conclusion of the final material.

Final conclusions of the material are presented as 3D-models (Fig. 1).

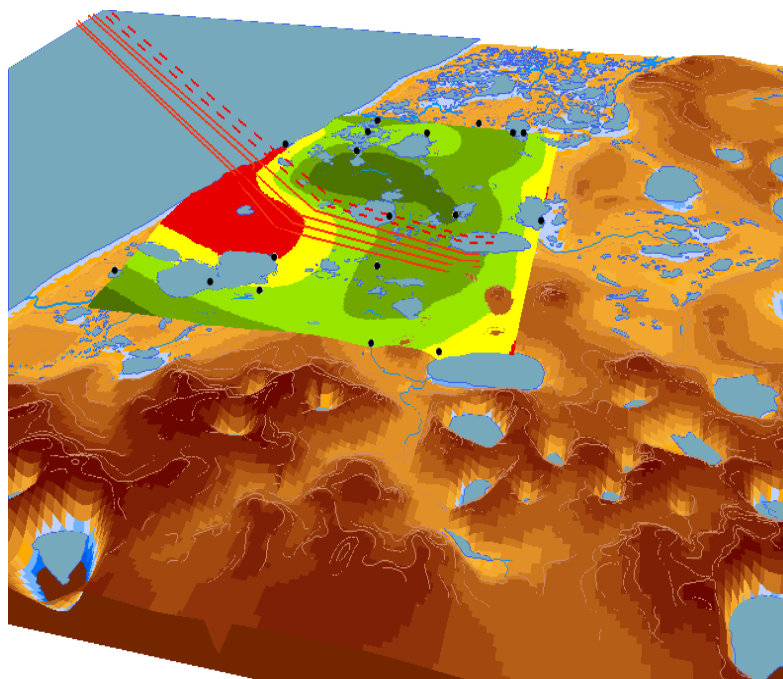


Fig. 1 "The concentration of lead (the coastal zone of the Urals)"

These materials can be added to engineering and environmental studies will clarify the effects of technogenous damage in linear objects in the target area.

The results of indicate that GIS technology - is the best tool for working with spatial data in assessing and predicting the ecological status of the zones of technogenic influence of linear objects (gas pipeline).

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**ENVIRONMENTAL ISSUES CONSTRUCTION OF RAILWAYS IN
PERMAFROST**

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In given report examines the characteristics of the railway in the Republic of Sakha (Yakutia) and the associated environmental problems and risks in the permafrost.

The Keywords: Construction, development, railways, environment, permafrost.

Construction and further development of the railroad in Yakutia will give not only the expansion and growth of the transport system in the country, but also an opportunity to identify access to new fields, that is, to develop productive natural resources.

Currently, rail transport in the country is in the process of formation.

The most important reason, and the main objective of the project development transport network of the Sakha Republic (Yakutia) and the main policies of transport construction is building railway lines Berkakit – Tommot – Yakutsk, and in the future construction of a bridge over the river Lena in Yakutsk.

Bridge over the river Lena year-round communication of the capital and its left-bank territory with the railways across Russia, combine into a single federal highway transportation, «Lena», «Kolyma» and «Viluy», providing constant communication between the Republic of Sakha (Yakutia), and the Amur, Magadan and Irkutsk regions, Khabarovsk Krai [1].

Along with the development of the railway, and economic development is to be guaranteed year-round accessibility, and reducing the cost of organizing freight and passenger traffic, providing comfortable living conditions for the population, much

increased mobility of transport, in turn, will be the development of tourism, and of course will be a significant savings of republican and federal budgets.

Yakutia climate is very severe. It differs sharply continental pronounced. The republic is a cold pole of the northern hemisphere, there was a fixed temperature – 72⁰ C. Summer in Yakutia short but warm. Winter, contrary to a long and severe frosts. Harsh climatic conditions favor the development of permafrost – permafrost.

The total area of Yakutia is 3103,2 thousand km². Thus, Yakutia – the largest political unit, but respectively the largest region of the Russian Federation [2].

Planning and the construction in such severe weather and climatic conditions (permafrost) has a certain specificity, and a lot of problems and difficulties with the high mountain ranges, the huge number of rivers, the low population density and inaccessibility.

Because of the great length of highway design was handled by several design and survey institutes, each of which was assigned to a separate part. To solve complex problems prosecuted a number of research institutes, as well as transport institutions in the country. Construction management was organized by several civil and specialized construction companies [3].

Construction in such conditions requires a thorough study with careful observation of the natural changes and environmentally intensive, process.

Used in the design of data-site operation is unique in the constructed object, applying modeling techniques to predict the dynamics of the geological environment in exposure to engineering objects [4].

During the construction of the railway attention should be paid to preventing the formation of environmental problems. Railroad, natural and obvious, will cross paths migration of wild animals, such as reindeer, production and trade, which is one of the important types of life in the North.

In this connection, one of the important problems is the development of indicators and benchmarks for assessing the ecological impact on the environment in the permafrost, and the development of criteria for ecological capacity depending on the climate and geography, industry and transport infrastructure, the characteristics of

flora and fauna. Despite the fact that the design and construction of the railroad in Yakutia by separate planning and surveying and construction companies, the question of the prevention of environmental problems must be under the unified leadership, with a comprehensive approach should be implemented on the basis of unanimity and present solutions.

Without the development of transport, in particular, without transport infrastructure is not the future and development of the whole society. Necessary to complete the job, provide comfortable living conditions for the population of the Republic of Sakha (Yakutia), through the development of well-functioning, cost-effective, attractive and accessible to all segments of the population of modern rail transport system, free of errors and shortcomings of past years.

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EVALUATION AND STRESSUSTOYCHIVOSTI STRESSCHUVSTVITELNOSTI RUMINANTS AND THEIR OFFSPRING

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Keywords: stressustoychivost, stresschuvstvitenost, physiology, stress reaction, placental ruminant animals, device, lambs, blood, proteins and their fractions, rosette,

plaque forming, phagocytosis, heterophil (normal) antibodies, lysozyme activity, the sensitivity, the method, the diagnosis

Reducing morbidity and mortality of ruminants are highly dependent on the timely diagnosis and prevention stresschuvstvitelnosti. Among the methods that make it possible to apply an objective diagnosis of the stress state of the body, the most important study of hormones of the endocrine system. Determine the content in the peripheral blood ACTH, 11-hydroxycorticosteroids and cortisol, creatine phosphokinase, lactate dehydrogenase. Count the number of eosinophils in 1 mm^3 of blood, establish leukocyte formula. The slaughter of animals explore the internal organs, particularly the adrenals, thymus, spleen, and gastrointestinal tract.

However, for the research and production practices on animal physiology, animal health and livestock have not been developed rapid diagnostic methods stress animals using devices that are suitable for the working environment, stress effects in ruminants.

The purpose of this paper is to evaluate and stresschuvstvitelnosti stressustoychivosti ruminant animals and their offspring. To do this, we have developed a method for determining the stress and postpartum unit for its implementation.

The essence of the device employs a method explained in the drawing, where the figure (Figure 1) - the device assembly.

The device contains a side rack 1, top two and bottom three bases, forming a frame between them installed pipette 4 with a blood sample. In turn, one at the front marked division for visual fixation reaction. Lower base 3 with joint compound 5- attached at one end to the cross piece 6, which strengthened Front 7 with an aperture 8 for fixing pin 9. Against every hole 8 plotted risks with scale 30° , 45° , 60° and above. The device operates as follows: pipette device rinsed with heparin to the mark "P", then select a 0.1% solution of epinephrine hydrochloride driven to isotonic sodium chloride concentration up to the mark "R" and poured on a watch glass. Then the same pipette gaining animal peripheral blood up to the mark "K" on the glass and poured into a solution of epinephrine hydrochloride. Blood and stirred solution of

epinephrine hydrochloride end pipette. Pipette filled with a mixture of adrenaline hydrochloride with blood up to the mark "K" and put in a tripod and tilted from its base at 45 °, (60 °, 75 °, 90 °). Similarly, put a control sample with isotonic sodium chloride solution.

The results of individual stresschuvstvitelnosti body, experience and control is determined by the erythrocyte sedimentation rate in 30 minutes. Accounting is performed visually. The increased sensitivity of the individual to ascertain if the difference of erythrocyte sedimentation rate in the experimental and control samples of 10 mm and above.

In terms of the morphological structure of the blood (red blood cells, hemoglobin, white blood cells and blood count), significant differences between the experimental and control groups (stressustoychivyyh and stresschuvstvitelnyh) ewes are not available. In the control group of ewes over the erythrocyte sedimentation rate (3.60 ± 0.10), less than the phagocytic activity of neutrophils (65.10 ± 7.30) and total protein (6.70 ± 0.18), than in the animals of the experimental group (8.20 ± 0.14 ; 86.50 ± 7.50 ; 7.40 ± 0.24). On other indicators of phagocytic reaction differences between groups of animals were not statistically significant ($P > 0.05$).

Differences between groups of ewes and their lambs for hematological composition (erythrocytes, hemoglobin, leukocytes, and erythrocyte sedimentation rate), false ($P > 0.05$).

According to the number of band and segmented neutrophils in the blood of ewes content segmented neutrophils was higher by 27% compared to the lambs. Of lymphocytes in the blood of ewes at 17% was lower than that of the lambs.

On other indicators leukocyte differences not significant ($P > 0.05$).

Differences in phagocytic capacity between the two groups of ewes and their lambs were significant ($P < 0.05$). In ewes the numbers were $16\,511,44 \pm 11,83$, and lambs, respectively $13\,806,62 \pm 25,63$ microbial cells.

Indicators immunobiological reactivity (phagocytic activity of neutrophils, total protein in serum) in stresschuvstvitelnyh ewes were significantly lower than

stressustoychivyh ($P < 0.05$). The level of natural resistance ewe lambs differ from the widely.

Lambs received from stressustoychivyh ewes (control group), the body temperature was 39.7 ± 0.07 ° C, pulse rate $140,6 \pm 0.96$ and respiratory rate 92.3 ± 1.19 per minute, and the lambs received from stresschuvstvitelnyh (experimental group) - respectively 39.1 ± 0.08 ; 123.4 ± 1.81 ; 80.5 ± 1.03 .

According to the content of total protein and the body length of significant differences between groups of newborn babies has been established. However, the body weight of the experimental group of lambs at birth is somewhat lower compared to the control group of lambs.

Immunobiological reactivity indices (erythrocyte sedimentation rate, spontaneous rosette, the titer of normal antibodies). The lambs of the experimental group the erythrocyte sedimentation rate was 5.30 ± 0.48 , in the control group 4.0 ± 0.59 ($P > 0.05$).

By the number of rosette cells lambs experimental group (8.30 ± 0.50) were superior to their peers of the control group ($4.40, 0.45$ +). The difference in this indicator is statistically significant ($P < 0.001$).

Titer of normal antibodies in the blood of the lambs of the experimental group was significantly lower than in controls ($P < 0.01$).

On hematological parameters erythrocytes, hemoglobin, white blood cells and erythrocyte sedimentation rate between the experimental and control groups of lambs in the month, 2-month and 3 months of age was a significant difference ($P < 0.05$). Number of leukocytes in the lambs in the experimental group was significantly more months of age, lambs than the control group ($P < 0.05$).

Established significant differences between the groups of lambs in the absolute ratio of band, segmented neutrophils, eosinophils, monocytes and lymphocytes. Thus, the number of eosinophils in the lambs in the control group at 59 months of age, %, 2 months, 13% and 3 months of age, 12% had more than their peers of the experimental group. On the relative number of certain types of white blood cells are not established significant differences ($P > 0.05$).

The total protein in the serum of lambs of the experimental group at monthly age of 9%, 2 months, 5% and 3-month to 5% more than in the controls. These differences between the groups of lambs were not statistically significant ($P > 0.05$).

Increase of albumin and globulin in the blood serum of lambs experimental and control groups was different in different age, so the albumin-globulin ratio was different. Characteristically, the lambs of the control group (0.86, 0.14, 0.73), albumin-globulin ratio was higher in all age periods compared with lambs of the experimental group (0.05, 1.05; 0.71). The lambs of the experimental group are shown to globulin content was more than control group lambs (obtained from stresschuvstvitelnyh ewes) than in the experimental (obtained from stressustoychivnyh). Over the study period, the lambs of the experimental group received a higher average daily weight gain (139.33 ± 6.33 g) than in the control group lambs (114.10 ± 7.03 g).

Thus, the results show that the experimental group of lambs in the month, 2 and 3 months of age on hematological composition did not differ from their peers controls. The level of total protein and the ratio of protein fractions in the blood serum test is slightly higher than in the controls, although this difference was not statistically significant ($P > 0.05$). Development of lambs derived from stressustoychivnyh ewes, is more intense than that of counterparts born stresschuvstvitelnymi ewes (control group).

The survey leukocyte phagocytosis shows that the lambs of the experimental group are relatively higher than that of the control group. Thus, the phagocytic activity of the lambs of the experimental group was $36.91 \pm 4.07\%$, the lambs of the control group 21.04 ± 2.60 ($P < 0.05$). In 2-D and 3-month old lambs phagocytic activity of the experimental group was 10% higher. By phagocytic number of statistically significant differences between the experimental and control groups of lambs is not established ($P > 0.05$). The lambs of the experimental group in the age of one month, it was 0.63 ± 0.09 , 2-month 0.45 ± 0.10 and 3-month -0.48 ± 0.09 microbial cells, and the lambs of the control group, respectively, 0.41 ± 0.06 ; 0.36 ± 0.10 and 0.46 ± 0.10 . Phagocytic rate of lambs in the control group consisted of

months of age 1.93 ± 0.17 , 2-month and 2.30 ± 0.52 3-month 2.59 ± 0.36 microbial cells, the lambs of the experimental group, respectively, 1.75 ± 0.22 ; 2.50 ± 0.31 and 3.0 ± 0.45 . Differences between groups of animals were not statistically significant ($P > 0.05$). Phagocytic capacity of the blood was significantly decreased in the control lambs (from 995.1 ± 0.12 to 711.7 ± 0.17) and experimental groups (1586.7 ± 0.35 to 416.9 ± 0.20 microbial cells in 1 mm^3 of blood).

Number of rosette cells in the control group in the months of age (28.9 ± 4.12) are slightly higher than that experienced (20.7 ± 4.97), although the total number of white blood cells, they had about the same (8.45 thousand, 6.60 million). At 2 months of age, the difference between groups was not statistically significant. Found a significant difference ($P > 0.05$) in the percentage of rosette cells between the control (13.13 ± 3.63) and experimental (25.4 ± 5.16) groups of lambs at 3 months of age.

Studying the dynamics of lymphoid cells producing autogemoliziny (plaque-forming cells or side), shows that an increase in side with varying degrees of severity was observed in the experimental group of lambs. With age, the lambs of the experimental group the figure is reduced, and the control group, by contrast, increased ($P < 0.05$). The maximum content of the BOC in the blood of animals of the control group reported a 3-month old. Lambs controls their number was $21.66 \pm 3.6\%$, in the experimental group $8.13 \pm 2.22\%$

Significant difference between the groups of lambs in months of age found on lysozyme activity of serum, and the figure in the experimental lambs was slightly below $2.23 \pm 0.46\%$, than in the control $3.73 \pm 0.56\%$. At 2 and 3 months of age for this indicator of significant differences between groups of animals was observed.

For heterophile antibody titer between the experimental and control groups of lambs in the month, 2 and 3 months of age, significant differences were found.

Thus, our results show that lambs received from stresschuvstvitelnyh ewes (experimental group), the level of natural resistance (phagocytic activity and capacity, based on the percentage rosette and plaque-forming blood cells, as well as the activity of serum lysozyme) yielded lambs born stressustoychivymi ewes, which

apparently was the cause of great morbidity and mortality of ewes and lambs in the experimental group. Results of the determination of postpartum stress in sheep are shown in Table. 1.

Table 1

Postpartum stress in sheep (n = 30)

Group of animals and how infected ewes	Number	The number of cases of the Lambs	The departure of the Lambs Dead birth	Fallen
Control (known)	3	2	-	1
Experienced	12	5	1	3

(estimated)

As shown in Table. 1, postpartum stress in ewes in the control and experimental groups, a number of features. Number stresschuvstvitelnyh ewes was higher in the experimental group than in the control group. The number of cases of lambs in the experimental group is significantly higher than among their peers in the control group. The departure of young was a little more in the experimental group compared with the control group.

To assess individual sensitivity of rabbits and cows were used machine Panchenkov. As a stressor used a 0.1% solution of epinephrine hydrochloride brought to isotonic sodium chloride concentration. Depending on the individual sensitivity of the blood of animals to 0.1% solution of epinephrine hydrochloride in the apparatus Panchenkov including erythrocyte sedimentation rate were formed two groups: a high-sensitivity (experimental) and slabochuvstvitelnaya (control). In the experimental group included animals with elevated erythrocyte sedimentation rate, and the control with the stability of the erythrocyte sedimentation rate, blood. In each group of 10 animals.

The essence of adrenaline test is that this animal took the peripheral blood and determined individual sensitivity to adrenaline in Panchenkov unit, which consists of a tripod, and a set of cylinders, with a diameter of 1 mm.

The results showed that the animals of the experimental group on the clinical and physiological parameters (body temperature, heart rate and respiration) were superior to the control group. Study of hematological parameters indicated that, after the effect of adrenaline, the number of white blood cells and red blood cells have a tendency to decrease. The total number of nucleated blood cells in the experimental group in all cases decreased. Leukopenia was due to a decrease in the level of neutrophils. Number of red blood of animals after exposure via hydrochloride ranged from $5.5 - 6.0 \times 10^{12}$ cells / l, while the impact was $6.0-6.5 \times 10^{12}$.

Wbc animal has the following features. Number of segmented neutrophils after exposure to adrenaline was reduced from 32 to 12%. White blood cell count in the blood was reduced from 53 to 37%. The number of eosinophils in the blood of rabbits to influence adrenaline factor was 2, and after the action of the stress factor of their content was 7. By other forms of relative content of leukocytes in the blood of animals before and after exposure to 0.1% solution of epinephrine hydrochloride significant differences were found.

Percentage, autoimmune rosette blood cells of animals to the effects of adrenaline was less than after it. Attention is called to increase their number, after the impact of adrenal stress factor of 11 to 33%. Marked quantitative increase in eosinophils, monocytes, neutrophils segmented blood involved in autoimmunity - rosette, after exposure to adrenaline hydrochloride.

Results on the effect of adrenaline on immunofiziologicheskie some blood parameters in the postpartum period showed that the erythrocyte sedimentation rate was higher in the experimental group of animals. This figure is the cows of the experimental group was an average of 24 mm, and a control group - 8 mm.

According to the number of white blood cells, the animals of the control group surpassed their peers in the experimental group. The animals of the experimental group the number was an average of 6.5×10^9 cells / L of blood, and the control, respectively, 8.0×10^9 . The number of red blood cells in the animals of the experimental group was 4.6×10^{12} cells / l, and a control group - 5.1×10^{12} .

Wbc in animals of the experimental group has the following feature: neutrophils - 32 cells - 58, monocytes and eosinophils - 8 - 2, and in the control group: neutrophils - 35, -60 lymphocytes, monocytes 3, eosinophils - 2. Percentage of autoimmune plaque-forming cells in the blood of cows in the postpartum period was on average 45.1%. Increased the number of animals that have high individual sensitivity to 0.1% solution of epinephrine hydrochloride. In some animals, the number was more than 50 percent.

The content of plaque-forming cells in the blood of cows in the postpartum period are presented in Table. 2

Table 2

Number of plaque-forming cells of autoimmune blood of cows ($M \pm m$, $n = 10$)

Group of animals	Postpartum period, in days			
Experienced	50 ± 1.05	58 ± 0.28	49 ± 0.19	48 ± 0.28
The control	43 ± 1.30	37 ± 0.22	40 ± 0.17	35 ± 1.30
P	<0.005	<0.001	<0.001	<0.001

As shown in Table. 2, based on the percentage of autoimmune plaque-forming cells in the blood of animals between the groups in the postpartum period was a significant difference.

Thus, to assess individual sensitivity placental ruminants to adverse factors (stressors) can be used adrenaline test.

Adrenaline test is performed with peripheral blood, then mix it with a 0.1% solution of epinephrine hydrochloride and is brought to the entrance of the isotonic concentration apparatus Panchenkov our modification and subject to sedimentation rate during the day in the experimental and control samples, and accounting difference in 10mm and above states sensitivity placental ruminants in the postpartum period to various stressors.

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Kotyuk L.A.

**BIOCHEMICAL CHARACTERISTICS OF LOPHANTHUS ANISATUS
ADANS. WITH INTRODUCTION IN POLISSYA CONDITIONS OF
UKRAINE**

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Introduction. *Lophanthus anisatus* Adans. Is a perennial herb of the Lamiaceae family. North and Central America are considered the motherland of this plant. Wild *Lophanthus* grows in Central Asia, the Far East, the USA and Canada. [7]

The ground part of *Lophanthus* contains the complex of biologically active substances: essential oil, tannins, flavonoids, ascorbic acid, polysaccharides, macro- and microelements [1,7]. According to Velykorodov A.V. and Kovalev V.B., essential oil of *Lophanthus* contains 62.08% of estragole and 24.01% of methyl eugenol. [2]. *Lophanthus* is used in pharmacy, cosmetics and food industry [1, 3].

Thus, the purpose of our research was to study the biochemical composition of phytoherbs and essential oils of *Lophanthus* when introducing it in Zhytomyr Woodlands (Polissya).

Materials and methods. Biochemical studies had been carried out during 2011-2012 years. In the course of study we used bio-flowered variety of *Lophanthus* "Leleka" (*Lophanthus anisatus* Adans cv. *Leleka*) of the second year of vegetation, which have been grown in the Botanical garden of Zhytomyr National Agroecological University.

Raw materials have been gathered during the flowering period (in the first decade of August), when the plants reach their maximum efficiency. Biochemical analyzes have been carried out using conventional methods [4,5,6]. Chromatographic

analysis of the composition of the essential oil has been made with the help of a gas-liquid chromatography Agilent Technologies 6890 [8].

Results and discussion. Results of experimental studies of the composition of phytomass of *Lophanthus* showed that the dry matter content made up $26,60 \pm 0,24$, fiber - $35,21 \pm 0,51$, ash - $5,44 \pm 0,55$, protein - $15,17 \pm 0,19$, total sugars - $5,45 \pm 0,14$, fat - $3,05 \pm 0,29\%$ of absolutely dry mass (Table 1).

The studies have shown that tannins and carotene contained in plant material of *Lophanthus* was insignificant and made up $0,88 \pm 0,06$ and $0,54 \pm 0,01$ mg%, the essential content of ascorbic acid – $44,45 \pm 0,43$ mg % of dry mass. It has been stated that the calcium content in plant material of *Lophanthus* was insignificant and made up $0,33 \pm 0,02\%$.

Table 1

**Biochemical composition of plant material of *Lophanthus anisatus* Adans
cv. *Leleka***

Component	% of absolutely dry mass
Dry matter	$26,60 \pm 0,24$
Fiber	$35,21 \pm 0,51$
Ash	$5,44 \pm 0,55$
Protein	$15,17 \pm 0,19$
Total sugar	$5,45 \pm 0,14$
Fats	$3,05 \pm 0,29$

It's worth mentioning that the plant stuff of *L. anisatus* contains $3,62 \pm 0,59\%$ of phosphorus and $866,69 \pm 78,86$ mg% of potassium, so it can be a valuable source of chemical elements that are vital for metabolism of a human body.

While studying the composition of essential oil of *L. anisatus* we have found 28 components; therefore, the high content of pulegone (60.04%) and -isomenthone (12.59%) indicates that the plant belongs to the mint varieties of *Lophanthus* [3].

The essential oil also contains 5,21% of β -caryophyllene, 3.45% of germacrene D, 3,08% of sevdnon, 2.81% of isopulegol, 2.63% of bicyclo hermakren, 2.06% of piperitenone, 1.23% of menthone. Other components made up between 0.07 and 0.64% (Fig.1).

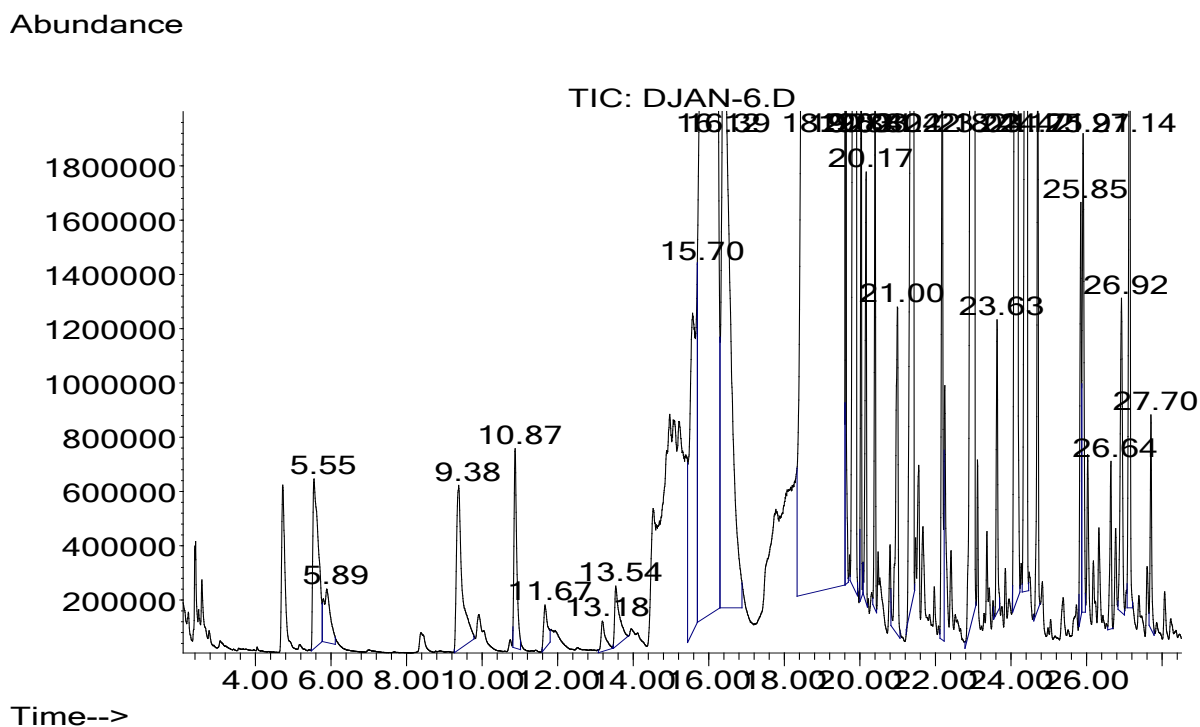


Fig.1. Chromatogram of essential oil of *Lophanthus anisatus*

Conclusion. The research results show that the biochemical study of *Lophanthus anisatus*, introduced in Woodlands (*Polissya*) of Ukraine, confirm its high nutritional value and application in phyto-medicine, food industry and cosmetics, therefore indicating the need for cultivating this type of plant.

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**INFLUENCE OF IMPULSE PRESSURE ON THE CONTENT OF
PHYTOHORMONES, GROWTH AND PRODUCTIVITY OF BUCKWHEAT**

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The influence of impulse pressure (IP) at 11-29 MPa on buckwheat seeds led to the germination reduction, but the mortality of seeds occurred not directly after the treatment due to stress reactions. The IP treatment promotes the acceleration of cell division in root apical meristem and activation of morphogenesis in shoot apical meristem due to the increase in Z-n content in 8-day-old seedlings despite the growth of abscisic acid levels. The productivity of treated plants increased up to 1.8-fold.

Fagopyrum esculentum Moench., meristem, mitosis, germination, yield

INTRODUCTION

Influences of physical factors are used to control growth processes in plants. Different emanations (5), pressure, temperature, etc. affect numerous physiological

processes. Small doses of these factors activate some physiological processes. However, a lot of problems of response mechanisms have not been fully identified.

Osmotic pressure is an important factor for cell survival (1). The phloem transport is controlled by pressure gradients (4). Pressure and mechanical forces are also factors of plant growth and development control (3;6). We have proposed the method of pre-sowing seed treatment by impulse pressure (IP) generated by a shock wave (2;7). It has been shown that the pressures of 11, 23, and 29 MPa promote changes in physiological processes of buckwheat plants (8).

During stress reactions, the concentrations of phytohormones-inhibitors increase (9). However, the quantitative data on the relationship of the intensity of physical factors, phytohormone content, and productivity are absent from the literature.

The foundation of plant productivity potential is laid at the early phases of plant ontogenesis. Root system, stem nodes, as well as leaf and inflorescence primordia originate from meristems at the beginning of germination under the control of phytohormones. It is of interest to study the content of major phytohormones in plants treated by impulse pressure. This is the aim of the research presented here.

MATERIALS AND METHODS

The subject of this research was buckwheat plants (*Fagopyrum esculentum Moench.*). Plants were grown under phytotron and field conditions. Before sowing, seeds were treated by IP (8; 2). Germinated seeds were counted after 2 and 8 days. Mitotic index (MI) was determined in root apical meristems of seedlings aged 2 and 8 days. Material was fixed 6 times every 2 hours for 12 hours. Cell divisions were synchronized at this age, so we calculated the average MI from those 6 tests as a percentage of M-phase cells to a gross amount of cells.

The contents of auxin (IAA), gibberellic acid (GA), Z-n (Z-n), and abscisic acid (ABA) were determined at 1 day of soaking in seeds and at 8 days in leaves. The samples were fixed with liquid nitrogen and homogenized. Hormones were extracted with 80% aqueous ethanol. Extracts were filtered and concentrated to a water residue, at 40°C and then were frozen, thawed and centrifuged. Extracts were acidified to pH 3.0. IAA, GA, and ABA were extracted with ethylacetate. The extracts were dried,

redissolved in ethanol and purified by thin layer chromatography (TLC) in isopropanol - 28% ammonia - water (10:1:1) system. Hormones were prepared from different zones. Solutions of IAA, GA, ABA ("Sigma", USA) were used as standards. The aqueous extracts were alcalinized to pH 8.0 and Z-n was extracted with water-saturated *n*-butanol. Dried extracts were redissolved in ethanol and purified by TLC in *n*-butanol - acetic acid - water (4:1:1) system with the standard solution of Z-n ("Calbiochem", USA). Chromatographic eluates were dried, and a high performance liquid chromatography (HPLC) analysis was performed using a Milikhrom-4 VUF ("Nauchpribor", Russia) equipped with a column with Nucleosil S16 sorbent. The content of substances were computed with the WinChrom program.

The productivity of treated plants was examined in comparison with the control in three replicates (plots), 100 plants were sampled from the plot, and the number of fruits was determined on each plot. Fruits from each sample were combined, weighed, and the average fruit weight per plant was calculated. The weight of 1000 fruits was determined. Calculated arithmetic means, standard errors and Student-t criteria were used. An ANOVA was used for calculation of plant productivity.

RESULTS AND DISCUSSION

The germinating power of seeds depended on the treated pressure (Fig. 1, A). The decreased germinating power of 2-day-old seeds was caused the inhibition of root growth. The germinating power of 8-day-old seedlings treated by IP 11 MPa, corresponded to the control level so this IP did not traumatize seeds significantly. Other IP strengths promoted the lowering of seed germination (28-47%), but the amount of germinated seeds increased in tests with 8-day-old seedlings as compared to tests with 2-day-old seeds. The mortality of seeds occurred not directly after the IP treatment but during germination due to stress reactions.

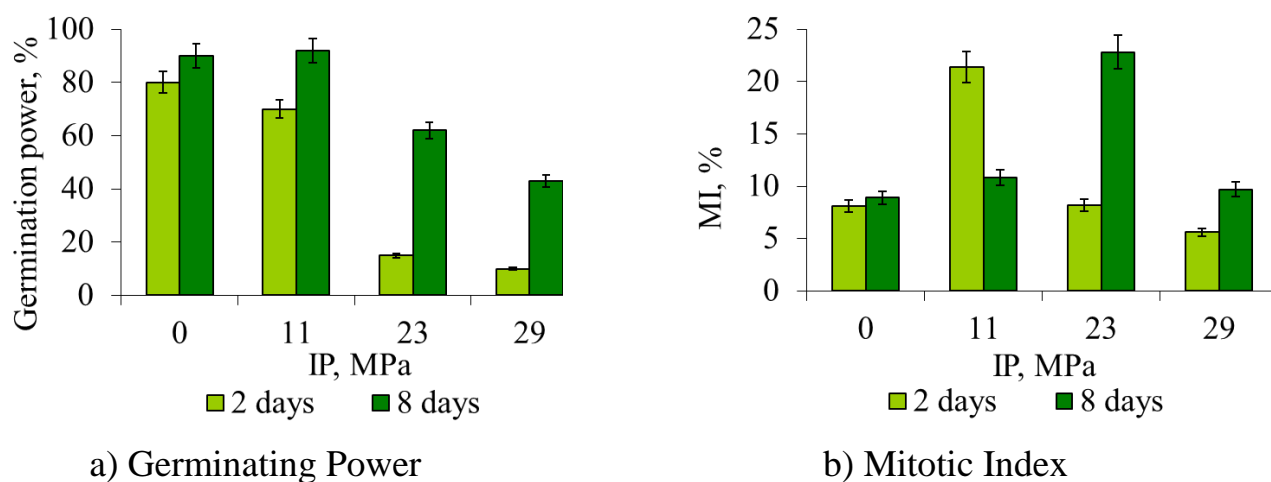


Figure 1. Germinating Power (A) and Mitotic Index (B) of Seeds

The average MI of control seedlings by the 2-3rd day was 8.1%, and it was 8.9% at 8-day-old seedlings (Fig. 1, B). MI increased in seedlings treated by IP 11 MPa at the age of 2 and 8 days versus control. After treatment by IP 23 MPa, the average MI corresponded to control at 2 days and topped it by the 8th day. IP of 29 MPa furthered the diminution of MI at 2 days and their increase at 8 days. There are two distinct phases in this analysis, such as the deceleration and activation of cell divisions. Despite the fact that IP of 11 MPa promotes early activation of MI (2 days), the seed germinating power was decreased. It is possible that the elongation of cells was inhibited. IP 29 MPa served as an inhibitor of the growth of seeds.

The described growth processes depends on the phytohormone content (Table 1). IAA, Z-n, and GA level decreased in our tests in 2-day-old seeds (except at 11 MPa, IAA). Our tests showed the gain of ABA content in seeds/seedlings, so ABA content increased under the effect of stresses (10) and inhibited the growth. The ratio IAA:ABA is the index of the possibility of cell elongation. This ratio was stable in control 2- and 8-day-old seeds/seedlings and differs in treated objects. IAA is known to stimulate the elongation of cells, so IP of 23 and 29 MPa inhibited these process. IP 11 MPa promoted the significant increase of the ratio IAA:ABA in 2-day-old seeds, but high levels of IAA inhibited growth. The inhibition of the elongation of cells was promoted by the hormone balance in 8-day-old seedlings treated by IP.

The ratio Z-n:ABA demonstrated the conditions for the growth of shoots and cell divisions. It was decreased in 2 and 8-day-old seeds/seedlings, so hormone

balance inhibited these processes. A shift in the hormone ratio resulted from the increase of ABA content in treated seeds/seedlings. ABA accumulated in 8-day-old seedlings as compared to 2-day-old seeds. However, there is the evidence of the intensive growth of seedlings under similar conditions (10). The increase of the ratio IAA:Z-n demonstrated the conditions for the cell elongation, and decrease of this ratio promotes the cell divisions. The MI was increased in germinating seeds, so it was related to the damage of the cell division and the accumulation of cells in M-phase. Therefore the germination power was inhibited in treated seeds. Favorable conditions for the cell divisions (decrease of the ratio IAA:Z-n) were observed in 8-day-old seedlings. The increase of MI was the evidence of real growth acceleration.

The ratio GA:ABA decreased in 2- and 8-day-old seeds/seedlings because the IP induced the diminution of the content of GA. This ratio demonstrated the conditions for the growth of embryo due to GA. The content of GA edged in germinating seeds (2 days) and lowered significantly in 8-day-old seedlings. There were probably, protective genetic sequences inhibited damage during germination. Changes in the ratio between growth stimulators and inhibitors are the evidence of damage to the hormonal system, resulting in growth inhibition. The inhibition of vegetative growth activates plant development.

Table 1.

Content of Phytohormones in Germinating Seeds (2 days) and Leaves of Seedlings (8 days) (nmol × g⁻¹ of fresh weight), n=3, M±m, P = 0.5

Variant	IAA	Z-n	GA	ABA	IAA:	Z-n:	IAA:	GA:
					ABA	ABA	Z-n	ABA
2 days								
Control	21,3 ± 0,5	19,3 ± 0,8	163,3 ± 7,2	8,3 ± 0,2	2,6	2,3	1,1	19,7
11 MPa	34,9 ± 0,9*	11,1 ± 0,2*	132,9 ± 6,0	10,7 ± 0,1*	3,3	1,0	3,1	2,4

23 MPa	15,9 ± 0,1*	12,4 ± 0,1*	122,7 ± 2,0	10,4 ± 0,1*	1 .5	1 .2	1 .3	1 1.8
29 MPa	17,9 ± 0,7*	5,7 ± 0,7*	81,7 ± 1,4*	8,8 ± 0,1*	2 .0	0 .6	3 .1	9 .3
8 days								
Co ntrol	432 ± 43	941 ± 88	611 ± 57	154 ± 15	2 .8	6 .1	0 .5	4 .0
11 MPa	408 ± 39	1261 ±117*	389 ± 36*	570 ± 48*	0 .7	2 .2	0 .3	0 .7
23 MPa	306 ± 30	1086 ±106*	862 ± 71*	589 ± 56*	0 .5	1 .8	0 .3	1 .5
29 MPa	414 ± 39	1038 ± 96	464 ± 47*	540 ± 47*	0 .8	1 .9	0 .4	0 .9

The phase of germination is characterized by the forming of shoot apical meristem. Buckwheat stem apices transit to the reproductive stage after 3-4 leaf primordia. The increase of the diameter (11 MPa to 18%, 23 MPa to 9% and 29 MPa to 17%) and height (23 MPa to 16% and 29 MPa to 20%) of apices are shown (Fig.2). The importance of this stage consists in the formation of the assimilating apparatus and reproductive organs, both responsible for future yield. IP promoted the intensification of shoot growth processes.

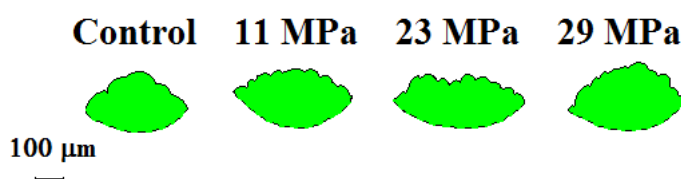


Figure 2. Shoot Apical Meristems of Seedlings Treated by Impulse Pressure

The number of fruits increased more significantly after the treatment of IP 11 MPa. The weight of 1000 fruits did not change significantly. The total fruit weight per plant increased after the influence of IP reaching 1,8-fold maximum at 11 MPa.

The development of the stress reaction resulted in the decrease of plant productivity after the influences of IP at 23 and 29 MPa as compared to 11 MPa (Table 2).

Table 2

Productivity of Buckwheat Plants after the IP Treatment, F01 = 5,6; n=3

Pre ssure, MPa	No. fruits		F	Total weight of 1000 fruits		F	Total fruit weight per plant	
		%		g	%		g	%
0	58	10	75	25	10	30	1,	10
	,2	0		3	,55		0	4
11	10	17	75	26	10	30	2,	18
	0,4	3		3	,74		5	4
23	88	15	75	25	98	30	2,	15
	,2	2		3	,18			4
29	64	11	75	25	99	30	1,	10
	,1	0		3	,29			4

Plant productivity depends on the number of flowers and on the assimilating surface. Buckwheat plants are known to form numerous flowers, but normal fruits are developed only from 4-6% of them. Fruit abscission may be caused by unfavorable external or internal conditions as well as the opening of numerous flowers provokes the abscission. The activation of growth and development in shoot apical meristems conducted the increase of flowers and provide favorable conditions for the supply of forming fruits with assimilates. The formation of assimilating surface and the supply of nutrients to the fruits seem to be essential for fruit formation.

CONCLUSIONS

The early stages of ontogenesis involved changes in the content of hormones. The damage of internal processes was observed in 2-day-old plants. Despite the increase of MI we can state the presence of growth inhibition during the germination of seeds. The level of plant growth inhibition, the peculiarities of the reparation of

damage and the plant growth stimulation depend on the IP. The compensatory stimulation of growth and development in root and shoot apical meristems promotes the forming of internal tissues in roots and stems, the amplification of assimilating surface of leaves and the increase of the number and weight of fruits.

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**PECULIARITIES NORTHERN PIKE (*ESOX LUCIUS L.*) OF BIOLOGY
IN SPECIAL COMMODITY FISH FARMS OF THE FOREST-STEPPE
ZONE OF UKRAINE**

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*The article describes main biological indicators of northern pike (*Esox lucius L.*) in three special commodity fish farms of the Forest-steppe zone of Ukraine. The length and weight growth curves, as well as equations that describe them are provided. Fulton's condition factor of different age groups was analyzed. It was found different growth rates in the studied populations. A possibility of the presence of fast-growing populations of northern pike in such water bodies was established. In order to reduce the negative impact of fast-growing populations of northern pike on stocked traditional polyculture fishes, a minimum stocking weight of at least of 100 g was recommended.*

Key words: northern pike, special commodity fish farms, length and weight growth curves, Fulton's condition factor.

Rapid development of modern national economy, especially commercial fisheries, resulted in increasing human impact on aquatic ecosystems. This load is multidirectional and has quite a diversified impact on aquatic resources of our water bodies. As the result, over the past 10 years, commercial fish harvest in traditional fishery water bodies have a tendency to decrease, which threatens the maintenance of

food security of the State and supply of the necessary quantity of fish products to the population of Ukraine.

On the one hand, fish stock in seas and the Dnieper reservoirs are overexploited, and the traditional fish farming in ponds using the intensive technology is economically unfeasible due to high prices of fish feeds and energy sources. This resulted in the necessity of looking for alternative sources of fish products [1, 2].

By the availability of small reservoirs, Ukraine is ranked the 2nd in Eurasia after the Russian Federation. These reservoirs are mostly man-made, which were constructed from 1960s to 1980s to support the needs of the former USSR's economy in the water supply, irrigation, fire safety, etc.

The common feature of these water bodies is the fact that they were not built for fisheries, therefore they are not especially intended for intensive aquaculture [13]. Due to peculiarities of the current Ukrainian legislation, intensive and semi-intensive fish farming and fish ranching are in fact prohibited in these reservoirs [3]. As a result such activities as special commodity fish farms (hereinafter - SCFF) became very popular and widespread. This form of organization allows optimizing food chains in water bodies, preventing eutrophication processes, mass aquatic plant development, swamping, as well as increasing natural fish production with minimum harm to the environment by stocking the water bodies with a complex of traditional polyculture (common carp, silver carp, bighead carp and their hybrids, grass carp) [1].

As a matter of fact, this is the extensive fish farming in water bodies, which are not suitable for fish farming. During the development of the SCFF, it is necessary to consider that these water bodies already have native fish fauna and certain its species, especially those of higher trophic links, due to the nature of their feed, can cause significant harm to future farms. In this regard, study of the biology of mass predators in water bodies, which are planned for SCFF, recently took on special significance.

As it is known from the available literature, these waters are mainly inhabited by stunted form of northern pike, but its biological indices vary considerably depending on the conditions of existence in water bodies [4-7, 14].

Our investigations of ichthyofauna of small water bodies of Ukraine, which were conducted by the Institute of Fisheries of the NAAS from 2009 to 2012 showed that the main big predator of small reservoirs is northern pike (*Esox lucius L.*), which naturally occur before starting artificial fish stocking.

In this regard, there is a need of predicting its degree of future impact on stocked fish. The most important indices for forecasting are biological characteristics of northern pike, namely condition factor and rate of linear and weight growth.

The aim of this work was to analyze and systematize information on biological characteristics of northern pike in small water bodies of the Forest-steppe zone of Ukraine in order to objectively assess its real commercial value and the probable impact on the function of reservoirs under SCFF regime.

Materials and methods.

The materials on the biology of northern pike were collected during 2009-2012 within the framework of development of a scientific and biological rationales and regimes of SCFF fisheries exploitation.

Works were carried using conventional methods adapted to conditions of small water bodies [9-12].

Three ponds with almost the same abiotic conditions, where SCFFs were organized, were chosen for analysis. All studied ponds are located in the Forest-steppe zone and the main hydrochemical parameters of water quality of all these water bodies meet the requirements for water fishery enterprises of Ukraine [15].

Graphic and statistical processing was performed using MS Excel 2003 and its add-ons. [8]

Results and discussion.

Main integral indices, which characterize conditions of existence of the species in water bodies, are its linear and weight growth.

Northern pike in the studied reservoirs had different rates of linear growth (fig.1):

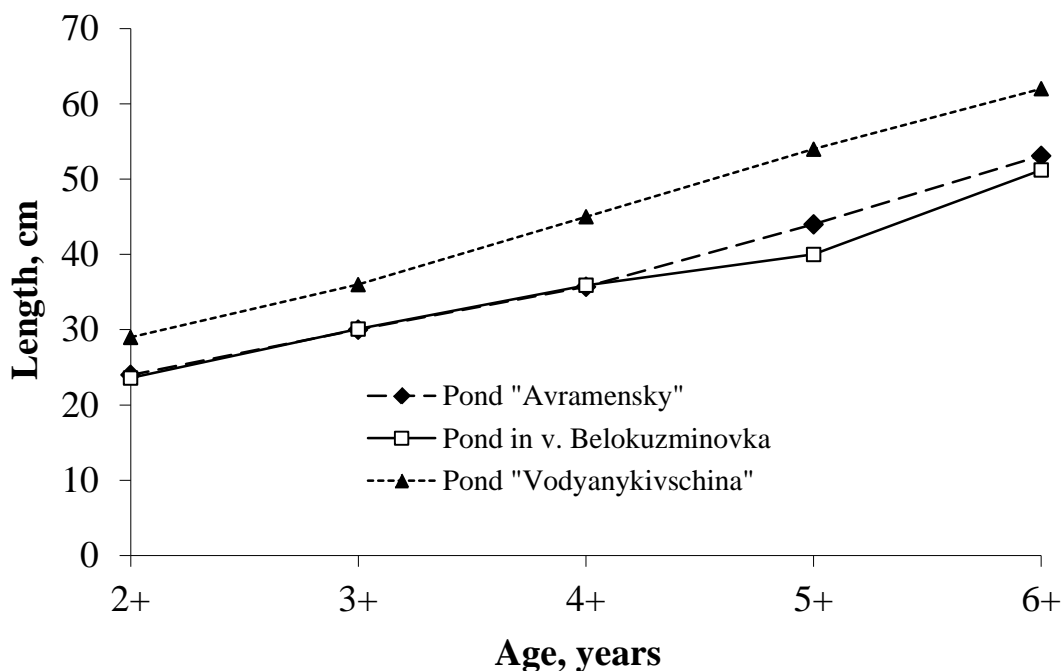


Fig. 1. Linear growth rate of northern pike in the studied ponds.

For greater clarity, there were constructed equations that describe linear growth of the studied populations by approximating the data with the aid of the least squares method.

The approximation value (R^2) of trends data is high (greater than 0.85) and shows high significance, which allows us to use these equations to describe growth dynamics (tab. 1):

Table 1.

The equations that describe the linear growth of northern pike in the studied ponds.

Water body	Linear growth equations	Approximation value (R^2)
Pond "Avramensky"	$y = 7,22x + 15,70$	0,9887
Pond in v. Belokuzminovka	$y = 6,51x + 16,63$	0,9732
Pond "Vodyanykivschina"	$y = 8,40x + 2,00$	0,9983

Fig. 1 and tab. 1 shows that the growth of individuals from the studied populations was different. To establish the fisheries value and the likelihood of harm of northern pike to the future fish farming activity, more important is weight growth. The rate of weight growth is shown in figure 2.

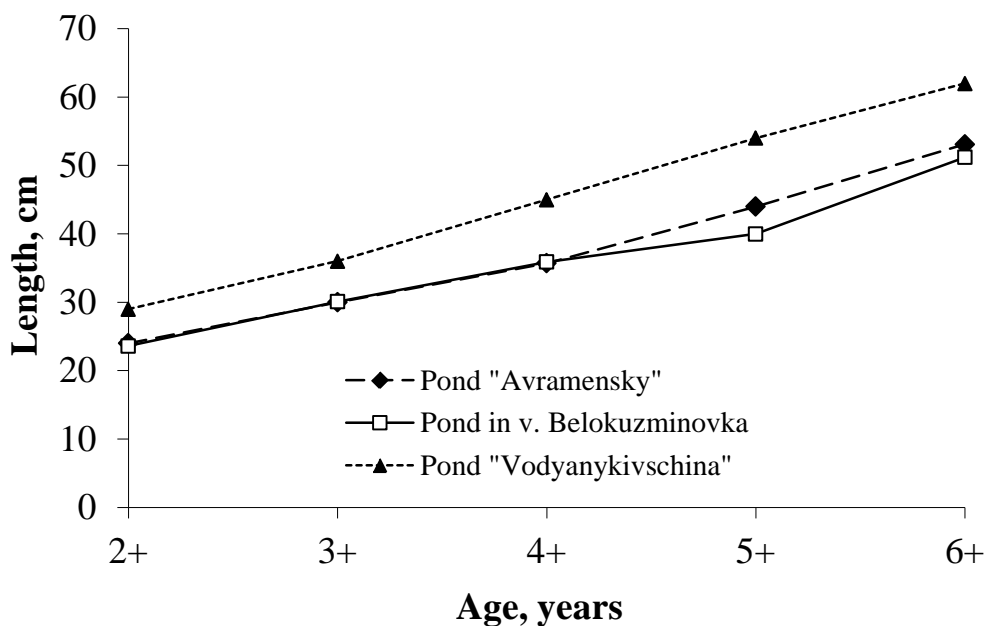


Fig. 2. Weight growth rate of northern pike in the studied ponds

In order to improve the interpretation of the data, we constructed equations that describe linear growth of the studied populations by approximating the data with the aid of the least squares method.

The approximation value (R^2) of trends data is high (greater than 0.85) and shows high significance, which allows us to use these equations to describe the dynamics of weight growth (tab. 2):

Table 2.

Equations that describe the growth of body weight of the northern pike in studied ponds.

Water body	Weight growth equations	Approximation value (R^2)
Pond "Avramensky"	$y = 170,82 x^{0,9290}$	0,8969
Pond in v. Belokuzminovka	$y = 158,48 x^{0,9426}$	0,9112
Pond "Vodyanykivschina"	$y = 239,90 x^{1,2198}$	0,9510

Fig. 2 and tab. 2 shows that the increase in the weight of individuals in the studied populations also significantly varies. The Fulton's condition factor of the studied fish was analyzed to clarify if this is not related to the availability and accessibility of food base. Cumulative data on this factor are given in tab. 3.

Table 3.

Fulton's condition factor of different age groups of the northern pike in the studied ponds, $M \pm m$.

Water body	Fish age			Average in the water body
	3+	4+	5+	
Pond "Avramensky"	1,31± 0,25	1,46± 0,25	1,59± 0,18	1,45±0 ,22
Pond in v. Belokuzminovka	1,39± 0,27	1,51± 0,21	1,60± 0,23	1,54±0 ,27
Pond "Vodyanykivschina"	1,74± 0,31*	1,81± 0,30*	1,88± 0,18*	1,78±0 ,35*

Note: * – t-test, $p < 0.05$.

Tab. 3 shows that the Fulton's condition factor of northern pike from the pond "Vodyanykivschina" is statistically significantly higher than in other water bodies. This suggests that, conditions of life are more favorable for the studied species and the availability and accessibility of the food base in this pond are the best that determines the difference in the rate of linear and weight growth.

The investigations show that these water bodies can have not only stunted but also fast-growing forms of northern pike that should be taken into account when developing scientific and biological rationales and regimes for SCFFs. The biological indices of northern pike from the pond "Vodyanykivschina" were closer to pike of the Kremenchuk reservoir. [4] This suggests strong possibility of increased mortality of fingerlings of stocked fish with normative weight (25-30 g) from northern pike. SCFF users were recommended to stock these water bodies with the age-1+ fish with the individual weight of at least 100 g.

When developing scientific and biological rationales in order to establish the northern pike fishery value, researchers should carry out field studies, because the use of "expert assessments" or "water bodies-analogues" is not representative.

Conclusion

Linear and weight growth of pike from the studied populations was different: the northern pike from the pond "Vodyanykivschina" had higher rate of linear and weight growth, which was comparable to the growth of pike of the Dnieper reservoirs.

Northern pike population in the pond "Vodyanykivschina" had higher Fulton's condition factor than other studied populations, that indicated the best conditions for the existence of the investigated species in this water body and explained the higher rates of linear and weight growth.

Taking into account the rate of linear and weight growth of the northern pike in the pond "Vodyanykivschina", it was recommended to stock the age-1+ fish with the individual weight of at least 100 g in order to reduce mortality of fingerling due to predators.

During the development of the scientific and biological rationales and regimes of SCFF, it is necessary to conduct field studies, since even quite similar water bodies can be inhabited by very different fish populations. The application of "expert assessments" or "water bodies-analogues" is not representative.

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**COMPARATIVE ANALYSIS OF BIOPOLYMER COMPLEXES FROM
MUSHROOMS (*AGARICUS BISPORUS*)**

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*Biopolymer complexes were isolated from mushrooms (*Agaricus bisporus*). It was shown that polysaccharides were their main component. The impact of processing conditions on the chemical composition of complexes, their structural characteristics, functional and physiological properties was established.*

Key words: Agaricus bisporus, chitin, glucan, melanin, structural characteristics, functional and physiological properties

Biodegradability, biocompatibility, non-toxicity are responsible for widespread use of polysaccharides in the different fields of a human activity. Chitin and its deacetylated form – chitosan as prospective gel-forming and emulsifying agents, matrices for enzyme immobilization and components of dietary supplements occupy a special place among polysaccharides [1].

In Ukraine the cultivated edible mushrooms, especially *Agaricus bisporus*, can be prospective renewable and non-seasonal source of chitin-containing substances. During their growing and gathering a large amount of substandard raw materials (stipes of mushrooms and their fruit body of irregular shape and non-standard size) is piled up. It is 5 – 20 % of production volume [2]. For foodstuff producing this raw material is not used. However, it is of interest as a source of valuable bioactive

substances.

It is supposed [3], that mushroom chitin is in the complex with β -(1 \rightarrow 3) glucan and melanin in the cell wall. It hampers obtaining a pure preparation of chitin. However, chitin extracted in combination with β -glucan, well-known bioactive compounds that positively influences on the human immune system [4] and with melanin, effective antioxidant [5], will have broader range of the physiological effects than pure chitin.

Analysis of published data showed that information on the composition and properties of these complexes was practically absent. That is why investigating properties of chitin-containing biopolymer complexes from the mushrooms which differ in ratio of their constituents is so important.

The aim of this work was to obtain chitin-containing biopolymer complexes from *Agaricus bisporus* and to make their comparative analysis.

Biopolymer complexes were obtained by sequential processing of substandard raw materials with hot water and 3.7 % HCl solution at ambient temperature in order to remove the water-soluble and mineral substances. The solid residue was treated with 7.0 % NaOH solution at 98 °C, the time of treatment varied in the range of 90 – 270 min. The residue was washed with deionized water to reach a neutral pH of scourage. Then it was dried. A number of brown preparations was obtained.

In the isolated products amount of total nitrogen was determined by the Kjeldal method [6], melanin content – by the spectrophotometric method [5]. The carbohydrates level was determined by the concentration of reducing substances formed during the hydrolysis of the samples with mineral acids solutions; amount of chitin – by the Elson-Morgan method [7].

IR spectra were recorded on the 8400S FT-IR spectrometer (Shimadzu) in the range of 4000 – 400 cm^{-1} . Crystallinity and symmetry indices were determined [8].

Functional and physiological properties of the resulting complexes were estimated according their water retention (WRC) and fat binding (FBC) capacities, sorption of cholic acid and lead ions [9].

The chemical composition of the isolated samples is given in Table 1. It was

determined that carbohydrate component was dominant. Increase in contact time of sodium hydroxide solution with raw material stimulated rise of carbohydrate level in the samples from 65.7 to 79.0 %. A great number of polysaccharides belonged to the group of easily hydrolysable. They made up 44.7 – 46.7 %. Only glucose was found by the chromatography method in their hydrolysates. Consequently, glucan was present in the complexes. It was split by weak solutions of mineral acids. Glucosamine was identified in hydrolysates of hardly hydrolysable polysaccharides. This monosaccharide was a structural unit of chitin. The content of the latter ranged from 29.4 to 50.3 % of the total amount of carbohydrates and increased with the rise of alkali treatment time.

Table 1

The chemical composition of biopolymer complexes, % (of dry matter)

Rate	Processing time, min.				
	90	120	180	240	270
The total amount of carbohydrate	65,7	69,6	71,2	77,4	79,0
including easily hydrolysable polysaccharides	30,7	33,3	33,9	34,6	35,4
including chitin	19,3	22,5	27,1	33,9	39,7
The total amount of nitrogen	3,2	3,3	3,2	3,1	3,3
including protein nitrogen	1,9	1,7	1,3	0,7	0,5
Melanin	19,8	17,2	16,3	15,5	14,1

Melanin that is a polymer of a phenolic nature and protein accompanied to carbohydrates. Simultaneous reduction in melanin and protein levels in the isolated products and increasing in time of alkaline agent impact made possible to imply availability of melanin and protein complex.

The FT-IR spectra of the samples had several bands at 3265, 3105, 1635 – 1665 (amide I), 1550 – 1575 (amide II) and 953 cm^{-1} that were typical for chitin [2, 9] (Fig. 1). These spectra differed from each other only by the intensity of the main bands. It

was associated with the various chitin content in the complexes. Depending on the macromolecules package α -, β -, γ -forms of chitin can be distinguished. The presence of the absorption band at 1655 cm^{-1} indicated that chitin was in the α -form. In addition, the degree of acetylation of chitin was no more than 55.2%.

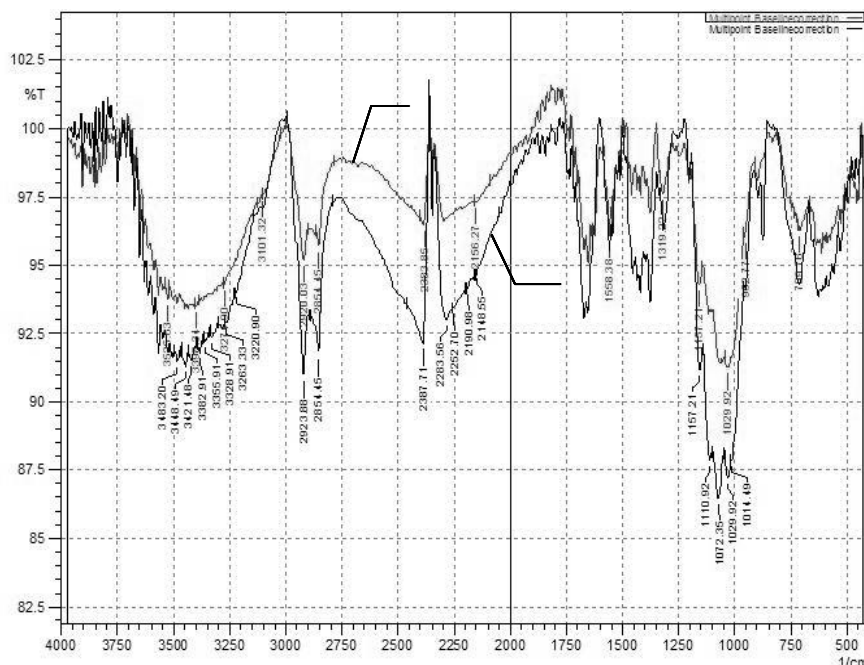


Fig. 1. The IR spectra of the samples: 1 –biopolymer complex isolated in the processing of raw materials with sodium hydroxide solution for 90 min; 2 - biopolymer complex isolated in the processing of raw materials with sodium hydroxide solution for 270 min

The presence of the band at 890 cm^{-1} in the FT-IR spectra of the samples (with the simultaneous absence of band near 850 cm^{-1} , which corresponds to the α -configuration of the glycosidic bond) confirmed that monosaccharides residues were connected by β -linkage in the molecules of two polysaccharides: chitin and glucan. The bands at 2920 , 1370 , 1250 , 1200 , 1155 and 1075 cm^{-1} assigned to β -(1-3)-glucan [10] were found in FT-IR spectra. Based on these data we suggested that β -(1-3)-glucan was in the composition of biopolymer complexes.

The typical melanin bands near $1610 - 1590\text{ cm}^{-1}$ which correspond to the vibration of the aromatic ring and about 1400 cm^{-1} due to the presence of the carbonyl group of the quinones [5] were observed in the FT-IR spectra.

Impact of time that was necessary for treatment of raw material with sodium hydroxide solution on changing in structural characteristics of the complexes was determined by crystallinity and symmetry indices.

The crystallinity index rose from 1.48 to 2.76 when action time of alkaline solution on raw material increased. The ratio of strong intramolecular and weak intermolecular hydrogen bonds in the structure of the complex was characterized by the symmetry index. When duration of the alkaline effect was minimum, the symmetry index was 0.89, when it was a maximum the symmetry index was equal to 0.66. This fact indicated the decrease in the number of hydroxyl groups involved in weak hydrogen bonds.

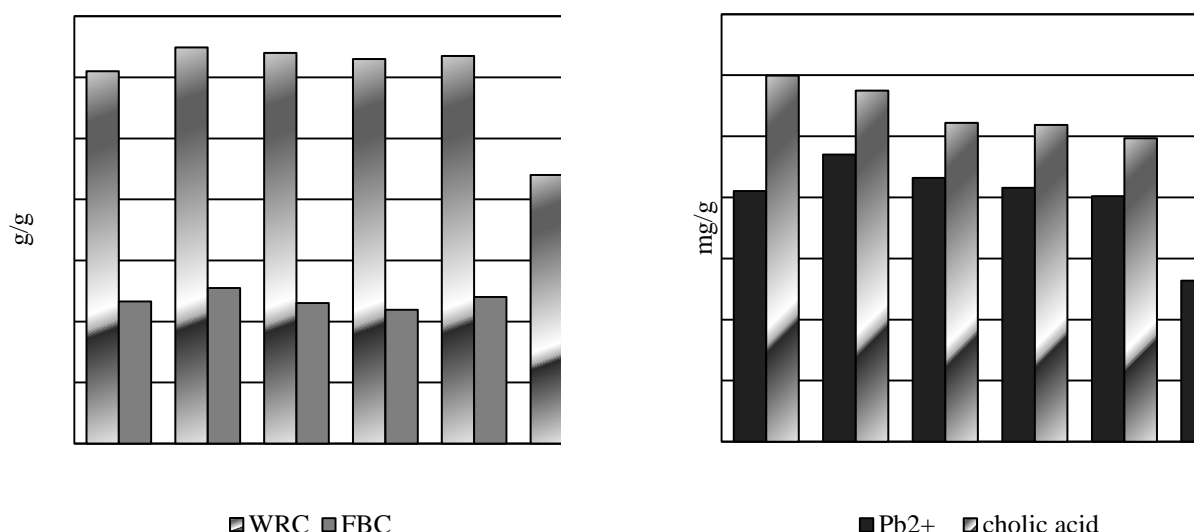
Similar results were obtained in researching interaction between the macromolecules in the biopolymer complexes when they were exposed to the agent that destroyed hydrogen bonds [11]. With the increasing in treatment time of the samples a fraction of intermolecular hydrogen bonds was reduced by 5.5 times, which was probably connected with their destruction and partial removal of the complexes components consequences.

Possibility for using isolated products as components of food supplements was estimated on the ground of their functional and physiological properties, namely: WRC, FBC, sorption of Pb^{2+} and cholic acid. The chitin obtained from the shells of crayfish was chose as the comparative standard.

According to the data shown in Fig. 2, the complexes did not differ in the WRC and FBC from chitin significantly. In this case, the WRC of all the samples was more than their FBC. It should be noted that increasing contact time of sodium hydroxide solution with raw material from 90 min up to 120 min and from 240 min up to 270 min promoted rising in rates of both WRC and FBC preparations. This fact probably was connected with the changes in chemical composition of the products and packaging of biopolymers. The sample obtained during the treatment of mushroom biomass for 120 min was the best according to WRC and FBC levels.

When the time of alkaline treatment increased the capacity of the test products to sorbed Pb^{2+} ions at first rose but then decreased. It can be explained by the fact that

the binding of polyvalent metal cations can be implemented through interaction with amino groups of chitin, the carboxyl groups of protein, the hydroxyl groups of melanin. However, this process is influenced not only by the ratio of these polymers in the samples but also by their availability. Likely that the increase in the crystallinity of the samples reduced the possibility of the metal ions contact with appropriate functional groups.



WRC and FBC of biopolymer complexes

Sorption activity of the samples to relation of Pb²⁺ ions and cholic acid

Fig. 2. Functional and physiological properties of the biopolymer complexes

Cholesterol-lowering activity of sorbents is estimated by their sorption activity in relation to cholic acid, genetically related to cholesterol. It was shown that with increasing action time of sodium hydroxide solution on raw material the rate of sorption cholic acid decreased. Perhaps this was caused by reduction in hydrophobic substances such as melanin and protein in the composition of samples. In that case extracted biopolymer complexes were more efficient sorbents of cholic acid than such well-known plant chelators as dietary fiber of wheat bran (in 2.7 – 3.2 times) [12] and chelators of animal origin as chitin (in 3.7 – 4.5 times) [9].

The presence of easily hydrolysable glucan in the complex makes possible to suggest that in the stomach it will hydrolyze till low-molecular compounds under the

influence of hydrochloric acid. According to literary data [13] low-molecular compounds are captured by cells of the intestinal mucosa and transferred in submucosa, where they activate macrophages, then lymphocytes are activated due to macrophages. Lymphocytes of the intestinal mucosa penetrate into the mucous membranes of various organs. Thus immunomodulating properties of the biopolymer complexes can occur.

Thus, biopolymer complexes were isolated from substandard mushrooms. Polysaccharides chitin and β -glucan were their dominant component. Rise in duration of mushrooms alkali treatment caused increase in polysaccharides content and their crystallinity. The isolated complexes, as well as chitin, were enterosorbents. Sorption properties for all the samples were not inferior to chitin but surpassed them. The product with the highest content of melanin was the most effective enterosorbent which actively bound compounds of steroid nature. That make possible to forecast its ability of reducing cholesterol level in physiological fluids and also to forecast immunomodulating properties for the sample with the highest amount of glucan. It can be expected that the sample with the highest amount of glucan has immunomodulating properties. These data make possible to simulate the composition and physiological activity of biopolymer complexes, which can be used as functional food ingredients and components of food supplements.

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HERBICIDES INFLUENCE ON ALGAE FUNCTIONAL ACTIVITY

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The correlation between the algae cells and pesticides is very complex: some substances can inhibit photosynthetic activity and at the same time stimulate cell division, other cause obvious morphological violations but do not inhibit physiological processes. The analyses of toxicity of the glyphosate and dicamba herbicides on green and blue-green algae cultures are done. The more sensitive to the preparation effect were the genus of Cyanophyta. With increasing the time of contact of the herbicides with algae resulted to their destruction and thus reduced toxicity.

Key words: herbicide, algae, quantity, toxicity, toxic.

Introduction.

Mass use of the crop protection chemicals (pesticides) in the agriculture leads to the diffusion of toxic substances in the biosphere. The more pesticide production, the most impact it has on the biological processes in the soil, natural water and the clearer effect of collateral and distant consequences of its use in the biosphere. Competent analysis, control, timely forecasting and the prediction of possible consequences of pesticides soaking into water is the guarantee of proper aqua ecosystems functioning.

Algae are the basis of aqua ecosystems and can be used as bio indicators of the water environment. Their high sensitivity to pollutants is an advantage of use in the bio testing of photo synthetics. Light for them is not only a source of energy, but also an active existing distractive factor, besides destruction processes are activated sharply in violation by toxicants of different stages of metabolism [2].

Based on the analysis of the domestic and foreign information to very important pesticides for the drinkable water control, the surface and underground water sources

for drinking purpose are classified preparations on the base of dymetoat, diazynona, chlorpyrifos, karbendazym, metalaxyl-M, propikonazol, tebukonazol, tryadymephon, flutryaphol, tsyprokonazol, atrazine, acetochlor, bentazon, haloksyphop-R-methyl, glyphosate, 2,4-dyhlorfenoksy acetic acid and its salts, 2-methyl-4-hlorfenoksy acetic acid and its salts, desmedyfam, dicamba, dymetenamid, etophumezat, kletodyma, metolahlora, pendymetalin, prometrin, tryfluralin, fenmedyfama and hlorydazon [1, 4].

The main criterion of algae culture is its total number. Besides, the part of living cells, the violation rate of growth, physiological parameters of photosynthesis, morphological changes (for example: cell size) and other indicators of cultures are taken into consideration. Scientific research according to evaluation of the herbicide glyphosate and dicamba (mentioned above) was done according to the standard of techniques or methods [6, 7, 8] on the blue-green algae pure monoculture (*Microcystis aeruginosa* Kutz. Emend. Elenk., *Nostoc* sp., *Anabaena* sp.) and green algae (*Ankistrodesmus braunii* Nägeli., *Chlorella vulgaris* Beijer). The algae cultivation held on cultures of Fitzgerald in modification of A. Zehnder and P. Gorem №11 [6] under the light intensity of 3 thousand luks with doing terns from light to dark 16/8 hours and the temperature of 20-24 ° C. Photosynthetic activity of algae was determined by the method of Kh.M.Pochynka [5].

The low concentrations of herbicides (0.1 mg/dm³) were effected the process of quick growth and the development as green, as blue-green algae cultures. In culture *Ankistrodesmus braunii* at 0.1 mg/dm³ of dicamba increased the total number of cells and relative growth rate.

Obtained probit (test) analysis of this culture mortality is proved by the facts and figures in (Table 1.). Within three exposure intervals (24, 48 and 72 hours), the increase of the concentration from LC₁ to LC₁₅ was being observed. The toxic effect was eliminated due to the high rate of cell division. While increase in the environment of the herbicide concentration, the toxic effect was fully seen. It means that the toxic effect of the preparation on the culture of green algae *Ankistrodesmus braunii* was increased with increasing time of exposure to. The medial lethal

concentration during the exposure of the preparation effect was being decreased and reached a 72 hour - 5.962 mg/dm³.

Table 1.

Probit (test) analysis of the culture mortality of *Ankistrodesmus braunii* under the effect of decamba of herbicide.

LC	Concentration, mg/dm ³		
	24 hour	48 hour	72 hour
LC ₁	0	0	0,003
LC ₅	0	0,001	0,024
LC ₁₀	0,001	0,009	0,095
LC ₁₅	0,008	0,024	0,216
LC ₅₀	8,759	3,804	5,962
LC ₈₅	7391,951	418,862	156,942
LC ₉₀	36377,140	1272,965	340,089
LC ₉₅	385681,952	6608,002	1069,536
LC ₉₉	32318966,0	145069,833	9172,117

However, it should be noted that in LC₉₉ probit- analysis, with an exposure of 24 and 48 hours, has an incredibly high concentrations, suggesting that algal culture of high concentrations of the herbicide did not die completely, leaving a single viable cells, which was confirmed by microscopy .

Cyanobacteria were more sensitive to the addition of the given toxicant. Stimulation of the developmen of biomass green algae *Chlorella vulgaris* happened under the effect of glyphosate and dicamba in the range from 0.1 mg/dm³ to 0.5 mg/dm³, while *Nostoc sp.* at the same concentration it relative rate of growth decreased according to control by 1.3 times. Beginning with the concentration of 10 mg/dm³, the biomass growth as blue-green, as green algae decreased, and therefore the indicator of relative growth of rate. With more long herbicides influence (120 hours) at concentrations more than 200 mg/dm³ the toxicity effect was more evident:

irreversible destruction of cells was started and therefore algal biomass at the same concentrations decreased in comparison with the original. Besides, under the influence of toxicants the violation of the morphology of algae cells was resulted from it. The phenomenon of some morphological abnormalities, on the example of a pure culture of algal *Ankistrodesmus braunii* was revealed. After 48 hours of exposure under the effect at the maximum concentrations of dicamba (100 mg/dm³) first observed the agglutination of cells (formation of conglomerates) (Fig. 1, Fig. 2), and then its lysis. The herbicides concentrations of 50-100 mg/dm³ on 72 hour by research experiment called simultaneous lysis of many cells. This was clearly observed in fluorescent microscopy, which allows to distinguish living cells from dead algae and those were being decomposed. The living cells shine by bright red color, damaged cells shine by crimson color, dead by green color.



Figure 1. Forming of the cell's conglomerate of the algae *Ankistrodesmus braunii* under the effect of dicamba in concentration of 100 mg/dm³ for 48 hours of exposition.

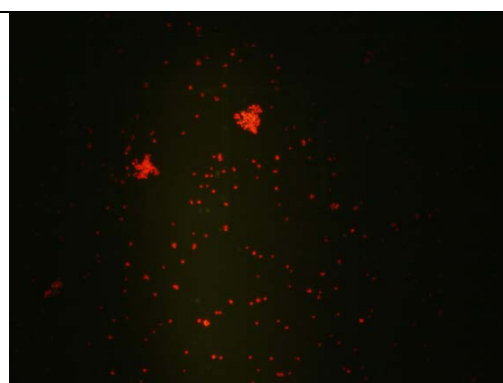


Figure 2. The cells of the algae of *Ankistrodesmus braunii* under the control of 48 hours of exposition (luminescent microscopic).

Young cells of green algae *Ankistrodesmus braunii* for 48 hour of experiment under the effect of dicamba in a concentration of 100 mg/dm³ lost color and stretched in length. Similar toxicological effects have been researched in the scientific works of Hapochka L.D. [3], he proves in, that by the effect of various concentrations of toxicants, the mass of green alga *Selenastrum quadricauda* gradually changed its color from becoming a rich brown or vice versa becoming discoloured. Some toxicants can not cause noticeable changes in color, but the algae lost turgor and easily affected.

At the beginning of research the glyphosate at a concentration of 0.1 mg/dm³ insignificantly inhibited photosynthesis of culture *Microcystis aeruginosa*, and on the seventh day, this effect is not observed, to some extent the stimulation of the physiological function of the algae was revealed. In the culture of *M. aeruginosa* the effect of toxicant activity was significantly different from their natural populations, it is not here shrouded by the mucous cells membrane and therefore react on any algaecide in much lower concentrations than in the natural conditions. Formation of mucous covers is one of the ways to adapt the algae to the toxic environment that serves for functional isolation of the cell and a decreasing of its metabolism. In colonial forms the outer layer of cells that will be intoxicated, dies, forming "impenetrable for the poison" layer. Under the covering of low penetrable membrane, the inner part of the colony continues to live and reproduce. In the cell culture of *Microcystis aeruginosa* low protected by the mucous membranes compared with colonies of algae in the natural environment. The toxicants of the environment better contact with the algae cells in the culture circumstances and penetrate well into the cells by affecting on the changes in biochemical processes.

With increasing the content of glyphosate in the environment was the gradual inhibition of the photosynthesis, which is completely stopped at a concentration of 50 mg/dm³ in the culture of *Nostoc sp.* and 100 mg/dm³ in culture of *Ankistrodesmus braunii* (Fig. 3).

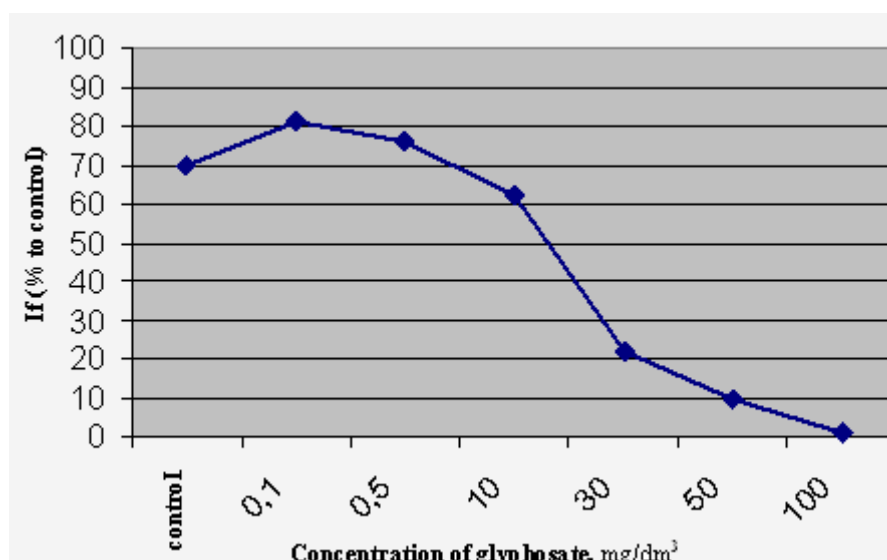


Figure 3. Changing of intensity of algae culture *Nostoc sp.* under the influence of glyphosate concentration.

Increasing the rate of photosynthesis of the culture as blue-green as green algae occurred at low concentrations of herbicides (from 0.1 mg/dm³ to 0.5 mg/dm³). The stimulation of photosynthesis and increasing the culture biomass of algae in the small concentrations of dissolved herbicides environment, evidently it was stipulated by comparatively high disintegration in the alkalis environment, as the same was argued by other researchers [3].

Conclusion. Toxic effects of herbicides according to algae commonly are seen in such concentrations that almost rare seen in waters. Besides herbicides that fall into the water quickly reduce their toxicity, which eventually becomes a stimulant for algae growth. Researched herbicides of glyphosate and dicamba at concentrations of 0.1 - 0.5 mg/dm³ increase the intensity of photosynthesis and biomass augmentation of all researched algae cultures. More sensitive to the toxicants influence were Blue-green algae. The stimulating effect of concentrations of herbicides 0,1 - 0,5 mg/dm³ was shown on cultures of green algae *Ankistrodesmus braunii* and *Chlorella vulgaris*, together with it, a significant true decrease seen under the influence of the concentration of relative growth rate of green algae cyanobacteria *Microcystis aeruginosa*, *Nostoc sp.*, *Anabaena sp.*, cultures. Concentrations of

herbicides more than 50 mg/dm³ inhibit the development of both as green as blue-green algae. This is evident not only in reducing the growth of biomass, number of cells, but also cease a complete growth, the appearance of morphological abnormalities and mass lysis of cells. Among the anomalies the following are found: loss of color and stretching in length of cells.

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**SOUTHERN KAZAKHSTAN, WAYS OF SOIL DETOXICATION IN
TURKISTAN TOWN ON THE BASIS
OF PLANTS – HYPER – ACCUMULATORS**

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The anthropogenic soil pollution is a rather actual problem because the life on the earth exists at the expense of it. The most dangerous substances for soil are heavy metals (HM). In this research work we have studied the sources of heavy metals' penetration into the soil system of Turkistan district, Southern Kazakhstan and also the ways of extraction with the help of plants – hyper – accumulators. This method of soil and environment purification was called as phytoremediation – Greek “phyton” (plant) and Latin “remedium” (to restore). Phytoremediation became effective and economically favourable method of purification when it was discovered that plants – hyper – accumulators could accumulate in their leaves about 5 % of nikel, zink and copper (dry weight). We have taken wheat (*Triticum*), barley (*Hordeum*), sunflower (*Helianthus*), buckwheat (*Fagopyrum*), maize (... *indentata*), soya bean (*Glycine*) and mustard (*Brassica juncea*).

Key words: antropogenic pollution; heavy metals; the accumulation of heavy metals; plants – hyper – accumulators; phytoremedy; carcinogens; pesticides; humus; soil erosion.

INTRODUCTION

The work contains studies about evaluation of intensiveness of heavy metals' accumulation in plants; the studies were made in the area of ferro – concrete plant, railway station, motor way, built – up area, farming area. The actuality of the research works is grounded by the intensive quantative and qualitative emaciation of soil resources in the industrial part of Turkistan. There are 13 industrial objects, the biggest ones are cotton manufacturing plants Joint – Stock Yassi KPIO, “Teplo – Electro Tsentral”, the asphalt plants “Nurstroi” Lmt, ferro – concrete plant, joint

Kazakh – English enterprise “Parabe” which produces dressing and others. The climatic conditions of the region are not favourable – moderate deserted with a high degree of continentality (table 1).

Table 1.

Climatic indicators of the city of Turkestan

Climate of Turkestan													
Indicator	Jan.	Feb.	Mar.	Apr.	May.	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Year
Absolute maximum, °C	19	23	31	36	40	47	49	46	42	35	28	22	49
Average maximum, °C	2	5	13	22	28	34	36	35	29	20	11	3	20
Average temperature, °C	-3	-0	7	15	21	27	29	27	20	12	5	-2	13
Average minimum, °C	-7	-5	1	8	14	18	20	18	12	4	-0	-6	6
Absolute minimum, °C	-34	-39	-28	-8	-4	3	6	3	-5	-14	-32	-33	-39
Norm of a precipitation, mm	22	26	27	23	24	5	5	2	3	10	26	27	200

Turkistan is one of few towns in the world where the temperature is +49 C in summer, in winter ringing frost can happen. Summer time is rather hot: the average temperature in July is + 27,8 C; in January -31 C. Big daily waverings of the temperature are typical for summer time (15 – 20 C), in winter less than 10 C, because the sun doesn't get thoroughly warmed. The winter weather in not stable, it varies from thaws to cold snaps.

Soil is polluted by toxic chemicals from sewage, industrial wastes and exhausts, pesticides. Every year, in Turkistan region, as in the whole world, the part of soil is taken from the agricultural circulation. The soil of that region belongs to grey earth, erosion, acid rains, pesticides and toxic wastes damage it. Among polluting substances which bring much of damage to the biological objects the heavy metals are the most harmful, because the combination of the intensive atmospheric dispersion in biosphere and a considerable concentration of them in soil could be toxic for all living organisms. Heavy metals are well absorbed and they interact with the soil humus making compounds hard to dissolve.

This is the way of their accumulation in soil. Besides, continuous migration of the accumulation happens under the influence of different factors. The maximal concentration is found 1 – 5 km away from the pollution. It could exceed background levels 1 – 2 times. The concentration of heavy metals exceeds 15 – 20 km nearby the

background levels, in the distance it reduces. The depth of metals penetration does not exceed 20 cm, where there is much of pollution the depth is 160 cm. Where the acid reactions take place there is a danger of toxic reactions in subsoil waters in water – soluble forms. The soil which is out of the reach contains even distribution of heavy metals. Much of migration capability has mercury (Hg) and zinc (Zn), they are distributed at the depth of 0 – 20 cm. Lead (Pb) is mostly accumulated on the superficial layer (0 – 2,5 cm), cadmium (Cd) is somewhere between them. In the humus sediments one could find Pb, Cd, Ag. The humus soil of the polluted territories is rich with heavy metals.

For solving this problem we made researches by the use of phytoremediative methods (they raise the soil fertility), firstly by means of negative affect. About heavy metals' harmful influence on the soil a number of books, articles, science editions were published. Unfortunately, we know a little about mechanisms of heavy metals' accumulation because much of attention was paid to the assimilation of compounds of nitrogen, phosphorus and other elements.

The plants assimilate little soluble compounds of heavy metals and therefore their roots excrete into the soil their natural substances compounds. The access of heavy metals to the soil raises the ferments of reductase which are found in the membranes of root cells. The transfer mechanism of heavy metals from the roots to the overground part of the plants is done by moving them in the form of compounds through the vascular system. So, timely reduction of pollution risk with its further elimination of heavy metals' transfer in the digestion system is the principal task of the researches. The aim of our research work was to study the accumulation process of the heavy metals in the plants and their interaction with soil conditions. We set the following tasks: to evaluate the quantitative indices of accumulations of heavy metals as cadmium, lead, copper and zinc (Cd, Pb, Cu, Zn); to find out correlated dependence in the system of "soil – plant", to define the levels of absorbing capabilities of wheat, barley, sunflower, buckwheat, maize, soya bean and mustard with regard to the heavy metals.

MATERIALS AND METHODS

Research objects are:

1) plants – hyper-accumulators – wheat, sunflower, barley, maize, buckwheat, and mustard;

2) soil covering of the grey earth in Turkistan region Southern Kazakhstan;

3) heavy metals which are included in the list of pollutants, Cd, Pb, Cu, Zn.

The following main methods of research are used: field study with the selection of samples of plants and soil methods of chemical analysis, statistic and cartographic methods. While making ecology – geochemical researches we have chosen 75 soil and 105 vegetable samples introduced by 7 kinds of plants. The area sample selection in the layer of 0 – 40 sm was made by the method of an envelope. The content of the heavy metals' mass forms were defined in the accredited laboratory of the Research institution "Ecology" at the A.Yassawi international Kazakh – Turkish University by the atomic – absorbing method which was accepted in agrochemistry and agroecology. Also the general content of humus and the potential acidity (pH_{KCl}) of the soil solution.

RESULTS

Summary results of the statistic of the statistic processing of monitoring data for definition the gross content nearby the industrial buildings, agricultural fields and motorways are shown in table 2 and in the figure 1.

Table 2

Gross structure of soils (%)

№	Sampling place	Humus	C	Hygroscopic water	SiO ₂	Fe ₂ O ₃	Al ₂ O ₃	CaO	MgO	SO ₃	P ₂ O ₅
1	joint Kazakh – English enterprise «PARAB»	1,2	0,75	0,45	41,99	4,16	7,34	17,23	5,43	1,89	0,110
2	gasoline warehouse	0,9	0,6	0,4	44,86	3,72	8,4	16,22	3,98	1,72	0,175
3	cotton plant joint-stock company Yassy	1,5	0,62	0,38	46,70	3,08	5,65	17,74	4,34	1,03	0,358
4	railway depot	0,8	0,93	0,95	47,27	3,17	5,74	17,74	3,97	1,3	0,125
5	fuel warehouse	1,2	0,99	0,42	46,63	3,62	3,52	15,2	6,88	1,7	0,103
6	plant of ferro-concrete products	1,1	0,56	0,9	43,77	3,26	6,42	17,99	4,34	1,78	0,128
7	plant of construction materials «Akjol»	1,5	1,03	0,54	46,91	3,26	3,24	18,24	3,99	2,12	0,08
8	the city central electric - heatstation	1,1	0,99	0,45	45,77	3,30	3,25	15,60	3,40	1,72	0,08
9	plant of asphalt «Nurstroy»	0,9	1,01	0,52	44,56	3,44	3,55	15,22	4,21	1,80	0,05
10	bypass road	1,5	0,91	0,83	44,90	3,56	3,40	16,10	3,55	1,65	0,03
11	agricultural fields	3,5	2,8	1,2	42,6	5,2	8,5	20,4	7,2	1,5	1,5

Analysis of the received data prove that these territories are polluted by zink; cooper, lead, cadmium.

Consequently, heavy metals pollute not only the territories of industrial buildings others but also nearby settlements with agricultural lands. In the soil samples maximum permissible concentration was exceeded. On the agricultural lands the heavy metals are mostly detained in the humus layer of the soil which has a good capability of biogeochemical absorbtion.

Statistical analysis of data distribution of heavy metals in plants (wheat, lead, sunflower, barley, buckwheat, maize, soya, bean and mustard) show the average quantity.

The histograms of data distribution according to Cd, Pb, Cu, Zn shown in the figure 2 are considered normal, to the left of zero. Therefore we can deferminе that on the examined territory the background concentration of the heavy metals in plants prevail. We have completed the rows according to the degree of the heavy metals accumulation (in decreasing order): cadmium (Cd) – soya bean > buckwheat > mustard >maize > barley > wheat > sunflower; lead (Pb) – barley > sunflower > buckwheat > mustard > soya > bean > wheat > maize; cooper (Cu) – sunflower > buckwheat > soya bean > mustard > maize > barley > wheat; zink (Zn) – sunflower > soya bean > buckwheat > maize > mustard > wheat > barley; Accumulating in high

concentrations in different parts of the plants the heavy metals display their toxic. The highest accumulation has soya bean and sunflower. The size of pollution plants – hyper – accumulators was defined by comparing with the maximal allowed level (MAL) of heavy metals in plants and with the distant source of influence and with the account of rose of winds.

For the evaluation the elements' liveness on the local level we applied the biological absorbability factor (BAF)

$$N_s = \frac{N_p}{KBП},$$

(1)

Where N_p – is presence of the element in the plants ashes, N_s – is the presence of the element in soil where the plant grows. The manner of heavy metals' accumulation in plants we evaluated according to the classification of elements with the regard of BAF.

The peculiarity of mineral nutrition is the main factor which influences heavy metals accumulation in plants. Much of Zn and Cu it is accumulated in sunflower, buckwheat, soya beans, maize. Much of Cd is found in soya beans, buckwheat. Much of Pb is found in barley, sunflower, buckwheat. It was found out that Cd which belongs to the group of the poor biological absorbability on the territory of Ferro – Concrete Production factory could be included into the group of middle biological absorbability. The intensity of the biological absorbability of Pb is found in buckwheat, mustard, barley, sunflower which allows to justify the transfer of Pb to the group of the elements of strong biological absorbability.

All plants could not be intensive biological absorbent of Cu because it belongs to the group of middle absorbability. Zn belongs to a group of the weak biological absorbability, it justifies moving this element from intensive to poor group of accumulation and strong capture. Basing on the calculation of the indices of active pollution and elements concentration factors in plants the heavy metals were divided according to the degree of intensive accumulation in plants. The accumulation of chemical elements is in the following elements is in the following consequence: $Pb >$

Cd > Zn > Cu. The analysis of spatial distribution of heavy metals in plants allowed to state: location of maximal pollution is found on the agricultural lands nearby Ferro – Concrete Production and depot of the railways; the major part of plants do not have indices more than the allowed level, the exception is only Pb. The number of it excess with the regard to normal concentration of the element in the examined plants is 66 %. Pb mostly contains in barley (Pb_{average} = 15.2 mg/kg), sunflower (Pb_{average} = 14,1 mg/kg). Maximal concentration of the element was found in barley (Pb_{max} = 38,7 mg/kg) it is 6,4 times above the norm.

The presence of Pb in plants is supplied through soil and air (transport and factories). The presence of Cd in agricultural cultivation is normal.

DISCUSSION

1. When grounding the evaluation norms of soil pollution by the heavy metals on the local level one must take into account the background level of the heavy metals' presence and the type of soil making layer.

2. There is rather close correlative concentration between the fixed biological absorption factor and the presence of heavy metals in soil it allows to use approximate admissible concentrations on the territory as the normative index.

3. A huge number of heavy metals accumulates in the plants with rather big low leaves. A set of bioaccumulators in plants which are cultivated in region's farms in defined: Pb > Cd > Zn > Cu.

4. The outer boarder of manufacturing zones of influence is 4 – 7 km away from the manufacturing grounds.

5. It is important to arrange series of the activities for prevention the plant pollution, exactly, to reduce the use of rotation of crops with fodder crops and crops requiring tilling between rows in 5 km zone of overnorm exceeding the level of pollution of soil around the manufacturing plants; to explore the short - fielded rotation of crops with grain, industrial crops and perennial grass (if not to use forage then they are grown for seeds) or the annual plants (mustard, sunflower, maize and others).

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**IMMUNOBIOLOGICAL BASIS AND PRINCIPLES FOR
DETERMINING THE COMPATIBILITY OF ANIMALS DURING EMBRYO**

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The purpose of this paper is to identify the immunological basis and principles determine the compatibility of animals in embryo. Therefore, it is necessary in each case to biotechnological methods of reproduction of animals in laboratory research use alloantigens erythrocytes or serum proteins of the peripheral blood of animals donors and recipients.

Compatible animals embryo established by asking: - the reaction of erythrocyte sedimentation rate of the peripheral blood of the donor and the recipient. What

is the study of blood serum and stood out to the blood serum of the donor recipient was added, and by the serum of the recipient - blood donor, on a slope 45 ° pinetok determined erythrocyte sedimentation rate and compared with the control. For the selection of animals used for embryo transfer device that consists of a tripod, set pipettes, base and stand for adjusting the angle of inclination. Accounting is performed visually. Animals for the embryo to determine the compatibility in the case when the difference of erythrocyte sedimentation rate in the experimental and control samples in the range of 1-10 mm.

Key words: immunobiology, Biotechnology, reception, transplantation, embryo donor, recipient, compatibility, erythrocyte sedimentation rate, the device

Introduction. Under current conditions in the agricultural sector of Tajikistan and in many areas of Russia, including in animal problem obtaining viable offspring with high economic-useful features to this day remains an important issue. The solution to this problem with the introduction of biotechnological breeding techniques placental ruminants. This calls for more efficient technologies and methods of reproduction of animals, one of these forms is a way to determine the compatibility of animals during embryo transfer from animal to animal donor recipient.

The nature of immunological, immunogenetic and immunofiziologicheskikh relations after fertilization in placental ruminants in the mother-embryo-fetus can be more objectively assessed only in the presence of antigens that are specific for that particular system of blood donors and recipients. [7] To date is not known which of the histocompatibility antigens / MHC / are present in the embryo donor animal during the period preceding the implantation during pregnancy.

The purpose and objectives. The purpose of this paper is to identify the immunological basis and principles determine the compatibility of animals in embryo. Therefore, it is necessary in each case to biotechnological methods of reproduction of animals in laboratory research use alloantigens erythrocytes or serum proteins of the peripheral blood of animals of donors and recipients. [1]

Material and methods. Immunological methods we used to determine the compatibility of donor and recipient animals for embryo transfer.

Compatible animals established by embryo transfers: reaction of erythrocyte sedimentation rate of the peripheral blood of the donor and the recipient. What is the study of blood serum and stood out to the blood serum of the donor recipient was added, and by the serum of the recipient - blood donor, on a slope 45° pinetok determined erythrocyte sedimentation rate and compared with the control. The essence of the proposed method lies in the fact that for this purpose the donor and the recipient of the jugular vein blood was taken in the morning to feed. That portion of the blood serum was used to prepare the donor and recipient. [2]

For the selection of animals used for embryo transfer device that consists of a tripod, set pipettes, base and stand for adjusting the angle of inclination.

The essence of the device employs a method explained in the drawing, where Figure 1 - instrument assembly. The essence of the device employs a method explained in the drawing, where Figure 1 - instrument assembly.

The device contains a side rack 1, top two and bottom three bases, forming a frame between them installed pipette 4 with a blood sample. In turn, one at the front marked division for visual fixation reaction. Lower base 3 with joint compound 5- attached at one end to the cross piece 6, which strengthened Front 7 with an aperture 8 for fixing pin 9. Against every hole 8 plotted risks with scale 30° , 45° , 60° and above.

Given the possibility of influence immunobiological and immunogenetic donor status and antigenic factors embryo at immunofiziologicheskoe condition of the recipient process was carried out with the serum donor and recipient blood in the proposed device.

Similarly, put control samples instead of serum donor and the recipient took isotonic sodium chloride solution.

The selection of animals for embryo transfer was carried out according to a study of erythrocyte sedimentation rate in the experimental and control samples in an hour.

Accounting is performed visually. Animals for the embryo to determine the compatibility in the case when the difference of erythrocyte sedimentation rate in the experimental and control samples in the range of 1-10 mm.

The reaction of blast transformation of lymphocytes in the presence of blood serum proteins of the recipient and vice versa put / MM Averbakh / 1974 /. To do this, from the sterile tubes containing 1 ml. tselnoy blood with a drop of 0.1 ml heparin. placed in vials of neutral glass containing 4 ml. 199 medium and 1 ml. Serum cattle. In the culture medium, 200 U / ml. penicillin and 100 U / ml. streptomycin (to maintain sterility), and then the optimal dose of tissue antigen (serum) of the recipient animal at the rate of 40 mg of protein per 1 ml. culture fluid. The tubes were placed vertically in an incubator at 37 ° C. After 5 days of incubation produced removal, fixing and painting cell seeding. What is out of the tube, in which the cultured cells, the supernatant was removed whole. Pellet was resuspended and carefully poured for 10 minutes. 8 ml of 10% acetic acid. Liquid with the cells was poured into centrifuge tubes, they were centrifuged for 10 min at 3000-4000 r / min. All the supernatant was removed to the last drop. Cells were fixed in the same tube 7.6 drops of ethanol. The pellet was resuspended in ethanol and poured into the glass. Glass air-dried and stained azureozinom. Under the microscope in an immersion system is considered 300-500 cells. Blastobrazovaniya percentage determined by considering the following cellular forms: lymphocytes / cell diameter 7.0-7.5 mm / blastopodobnye transitional forms / cell diameter 8-13 mm / blasts / D cells more 14mkm / cells in mitosis

We have tested the reaction: blast transformation of lymphocytes and erythrocyte sedimentation rate of donor and recipient by our method.

More cost effective and efficient for the practice of livestock animals to determine compatibility with embryo transplantation from donor to recipient was erythrocyte sedimentation rate in the system of the peripheral blood of the donor and recipient are conducted by our modification of our proposed device.

Results of research and discussion. The results of comparative effectiveness research known / RBTL / and the proposed method of selecting animals for embryo transfer are presented in Table. 1.

Table 1

Comparative efficacy of the known and anticipated method of selecting animals for embryo

Methods	The quantity of test animals	Study course embryo recipients	
		Be strap	Ab ort
Known / control /	5	2	1
Prospective / experience /	5	4	-

The data in Table. 1 show that the proposed method has a significant advantage over the known method. The outcome of embryo transfer recipients in 5 animals using the known method of determining the compatibility of transplantation led to a 2-mind physiologically normal pregnancy, and the use of the proposed method, respectively, to 4. Among the recipients of the animals using the proposed method spatologiey pregnancy and abort is not revealed.

Results of the determination of erythrocyte sedimentation rate in the blood of donors and recipients are shown in Table. 2.

Table 2

Erythrocyte sedimentation rate of animal blood
donors and recipients
(M ± m; n = 9)

Index	Individual rooms donor animals							
	6512				6513			
	experienc	Contro	Experienc	Contro	Experienc	Contro	Experienc	contro

	e	l	e	l	e	l	e	l
Erythrocyte sedimentation rate, mm / h	9,60 ± 1,09	2,72 ± 0.50	10,56 ± 1.09	2,72 ± 0.50	12,78 ± 1.09	2,72 ± 0.50	14,78 ± 1.09	2,72 ± 0.50
Td		5.73		6.53		8.38		10.05
P		<0.001		<0.001		<0.001		<0.001

The selection of animals for embryo transfer was performed on result study of erythrocyte sedimentation rate in the system of peripheral blood donor and recipient animals in the experimental and control samples in an hour. Accounting is performed visually. Compatible animals for embryo was considered in the case when the difference of the erythrocyte sedimentation rate in the experimental and control samples in the range of 1-10 mm.

The study of erythrocyte sedimentation rate in the blood compatible animal donors and recipients were:

1. Donor / 6512 / - recipients (6337), 2. Donor / 6513 / - Recipient (4951);
3. Donor / 6512 / - recipients (n / n) 4. Donor / 6512 / - recipients (3447)
5. Donor / 6512 / - recipient (6305).

As shown in Table. 2, on the erythrocyte sedimentation rate in animals of donors and recipients were established significant differences in the experimental and control samples. In the experimental samples, the rate was 9,60 ± 1,09; 10,56 ± 1,09; 12,78 ± 1,09; 14,78 ± 1,09, and in control samples, respectively 2,72 ± 0,50 (P <0.001).

This analysis allowed us to establish the degree of genetic similarity among donors and recipients, which is close to the value of erythrocyte sedimentation rate in the range of 1-10 mm. The data in Table. 1 data shows little similarity livestock

donors to recipients compared with ESR for individual recipients. With the incorporation of animals in large groups are smoothing their individual characteristics. The recipient does not lead to higher rates of embryos sedimentation rate.

The process of healing embryo transplant is two organisms, genetic information, coupled with the third immunofiziologicheskimi factors, and different from the shape in the process of natural evolution (fruit combines genetic material from two individuals and contacts the immunobiological mechanisms of one of them).

All of this points to the need for careful attention to the immunogenetic, immunobiological iimmunofiziologicheskomu status of both donors and recipients at reception embryo transfer from donor to recipient.

Conclusion. The results of the study of immunobiological compatibility and incompatibility with animal embryo showed that the outcome of transplantation depends on the rate of erythrocytes in the peripheral blood system of animal donors and recipients. We have established significant differences in the experimental and control samples in the system of peripheral blood donor cows and cow-recipients. In the experimental samples, the rate was 9.60 ± 1.09 ; 10 ± 1.09 ; 12.78 ± 1.09 and 14.78 ± 1.09 , and in the control samples, respectively, 2.72 ± 0.05 ($P < 0.001$).

This is indicated by the statement MA Frolova, MI Verbitsky, EA Zotikova (1984) and others that the intensity, duration and outcome of the immune response is determined by the degree of antigenic differences between donor and recipient, the level of reactivity of the recipient, the nature of the graft, the presence in it of the lymphoid tissue specific content of histocompatibility antigens.

The effectiveness of transplanting cattle embryos is determined by many factors, which have been summarized NewcombPowson (1980). Initially believed that the susceptibility of the uterus in lyutienovuyu phase of infection and the release of the embryos from the female reproductive system due to stimulation of the cervix during transcervical introduction of embryos leads to a lower efficiency of non-surgical embryo transfer. But imitation embryo insemination showed that, under certain

precautions danger importations into the uterus is unlikely, as the release of eggs from the transplanted uterus after the 4th cycle is absent [3, 4].

Found that the transfer of embryos in the uterine horn on the side of the ovary with corpus luteum compared with its base is more effective. Mechanism is not yet fully clear, but it may be assumed that the location of the embryo has a direct impact on its ability to exercise or lyuteotropny antilyuteotichesky signal to the ovary during natural lyuteolizisa.

Embryo transfer efficiency is largely determined by synchronized display of hunting in the donor and recipient. In cattle, the maximum percentage of pregnancies obtained after synchronous transplant. As an early and a late embryo transfer is accompanied by a similar decrease in the percentage of engraftment.

Full compliance to the antigens of donor and recipient may only identical, it provides sustained engraftment of transplanted embryo (or body) without immunnodepressivnoy therapy. In all the remaining cases have immunological conflict between recipient and graft. Intensity, duration and outcome of the immunological response determined by the degree of antigenic differences between donor transplant, the presence in it of the lymphoid tissue, specific content of histocompatibility antigens [5].

Thus, our study on the compatibility of animals embryo consistent with studies NO Sukhova et al (1992). The authors point to the need to analyze the impact of genetic similarity of donors and recipients at engraftment embryos. They revealed facts contrary to established ideas about effective and better fertility of cows inseminated with the sperm of less similar in genotype bulls. With a decrease in the index of genetic similarity manufacturers donor-recipient producers to antigens of red blood cells decreases graft acceptance embryos. In animals, the recipients to get accustomed embryos compared to non-pregnant, significantly lower rates geterogemagglyutininov and a higher level of natural (normal) antibody [6].

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**THE BASIC INDICES OF CONTINUOUSLY CULTIVATED SOD-
PODZOL SOIL CHARACTERISTICS OF NORTHERN TERRITORIES (IN
THE CASE OF TOBOLSK DISTRICT, TYUMEN REGION)**

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Nowadays comprehensive and detailed study of the main characteristics which are designated properties of certain soil for growing of cultivated plants in adverse agroclimatic conditions of northern territories are of relevance [1, 2].

Tobolsk district is situated in the northern part of Tyumen region, in subboreal forest zone and occupies 17,222 km². Summer time climate is formed under the influence of cyclones moving from the west. However intrusion of arctic air causes cooling and frosts in the beginning and in the end of summer period. Anticyclones of the Central Asia enhance climate continentality in wintertime which leads to relative severity of the period [3]. Territories of the region are characterized by severe cold winter and short frost-free period. Not only annual but daily sharp temperature fluctuations are observed, especially at spring. Climate instability is related to unhampered intrusion of arctic air masses from the north and dry air masses from Kazakhstan.

By its hydrological-climatic conditions Tobolsk district belongs to highly humid zone and zone of insufficient heat supply [4].

Climatic conditions have essential influence on soil formation process and determine geographical and physico-chemical uniqueness of soil cover. This region differentiates by the great variety of soils. Main soil types are: floodplain, podzols, sod-podzols, grey forest soils, alluvial-meadow soils, boggy soils, black soils, sodium soils, ash gray soils, loessial loam.

Big spatial and time contrast of edaphic-climatic characteristics complexifies growing conditions of cultivated plants [2]. That's why it is essential to know morphological, physical and chemical peculiarities of soil cover and its ultimate composition for realization of ecological and biological potential of crop varieties.

The work's goal is study of morphological features, physical and chemical characteristics and elemental ultimate composition of soil from experimental plot with the account of meteorological factors.

The research was conducted in 2009–2011 years on the experimental plot in Malaya Zorkaltseva village, Tobolsk district of Tyumen region, according to agroclimatological zoning situated in subboreal region.

Data on air temperature in Tobolsk district for 1900–2008 years were obtained on "Joint hydrometeorological station of Tobolsk district". Analysis of multiannual data showed that average monthly air temperatures in the period from November to

March has negative values, and from April to October – positive, mean yearly air temperature was 0,6°C.

Yearly variation of temperatures is characterized by minimum in January – February (-17,2°C) and maximum in July (+18,6°C). Mean temperature of cold period from November to March is -13,2°C. The coldest months – January and February with minimal temperatures -48,5°C (1964) and -47,7°C (1967). Duration of period with mean daily temperature above 0°C is 190 days, above +5°C and +10°C – 157 and 116 days, respectively. According to multiannual data minimal July temperature is +39,6°C (1901). Spring begins after 10 April with the passage of daily temperature through 0°C, but in the end of May and in the beginning of June snowfalls are possible. However at times warm and even dry weather (+15–23°C) sets because of moving of dry warm air masses from Kazakhstan. Time of passage of mean air temperature through +10°C is accepted to denote the beginning of summer (21 May – 10 June).

Characterizing thermal regime of soils from Tobolsk district it is possible to remark that they undergo rather protracted and deep freezing in winter; slow thawing and warming of soils is common in spring.

By the results of profiling it was established that soil of the plot is well-cultivated residual carbonate, sod-podzol on ancient alluvium deposits. The surface is billowy, without erosional features, profile character is simple unbroken. Signs of textural and structural profile dissimilarity are layers of heavy grain texture up to B horizon and light grain texture in C horizon. Gleization signs are absent, calcareousness features are weak. Profile strength is 110 cm. Parent rock material – sand alluvial deposits of the first terrace above the Irtysh river floodplain. Soil profile composition is the next: Ap (0–38 cm), E (38–48 cm), EB (48–76 cm), Bh,f,al (76–93 cm), C (93 – 110 cm).

Productivity of plants cultivated on the soil with high cryogenic load is determined by the level of warm and water supply during their growth and development. The object of research in our field experiment was soft summer wheat.

2009–2011 years vegetation seasons were considerably differed both between them and with mean multiannual values. Observed fluctuations of mean daily air temperatures were from +10,8°C (May) to +17,2°C (July) in 2009, from +8,9°C (September) to +17,5°C (July) – in 2010 and from +10,8°C (May) to +18,0°C (June) – in 2011. Minimal daily temperatures were observed in May 2009 and 2011 and in September 2010; maximal temperatures – in July 2009 and 2010 and in June 2011. It is possible to characterize the years of the research as warm with sharp fluctuations of daily and monthly temperatures. The overage above multiannual data made: in 2009 – 2,8°C, in 2010 – 0,5°C, in 2011 – 3,2°C. Sum of active temperatures was above the normal (1500–1700°C) at the average for the whole period on 219°C and made 1977,4°C in 2009, 1855,4°C in 2010 and 1925,3°C in 2011.

Precipitation total during plant vegetation was close to norm in 2009 and in 2011 and made 311,3 mm and 358,2 mm in each year respectively. 2010 year vegetation period belongs to critical by precipitation (221,9 mm), which is lower than norm for 73,1 mm. Months characterized by shortage of moisture were determined: July and September 2010 (precipitation totals were 19,9 and 30,0 mm respectively); May, August and September 2011 (precipitation totals were 8,5, 46,6 and 39,5 mm respectively). In some periods minimal precipitation values were noted: 2009 (July – 91,4 mm, August – 89,6 mm), 2010 (July – 61,4 mm, August – 78,7 mm), 2011 (June – 162,5 mm, July – 101,1 mm).

Laboratory analyses were made on the basis of accredited laboratory “Ecotoxycology” (POCC RU. 0001.516420) of Tobolsk complex scientific station, Ural division of the Russian academy of sciences.

Sample collection for the research was made by soil sampling tube according to Russian state standard (GOST) 2816–89, Ruling Documents (RD) 52.18.156-99, GOST 17.4.3.01.

Soil moisture is important characteristic for passing of ontogeny stages by organism from the moment of seed germination. Moreover, this characteristic has immediate impact on soil chemical composition because of having influence on transition of chemical elements from immobile forms to mobile.

Soil moisture regime for certain period was determined according to GOST 28268-89 during vegetation (May, June, July, August, September). Moisture content in the soil (39,4%) was sufficient and favorable for summer wheat seed germination and sprout forming in June 2011. Soil moisture was low in 2009 and 2010 (11,7 and 13,6% respectively), which was reflected by field germination rate and biological resistance of plants. The important period in water consumption is thought to be booting and ear formation stage i.e. period of reproductive organs formation which comes to be in July in our research. Maximally hard conditions for wheat were observed in July 2010 which was characterized by precipitation deficit on the background of increased air temperatures. Soil moisture during this period was no higher than 6,8%. Low soil moisture (9,0%) was observed in August 2011, when milk stage of grains took course and plants consumes 20–30% of all moisture during vegetation period. Warmth and water regime influenced on soil chemical properties, the degree of mobility of different elements and plant ability to consume them through its root system.

Physical and chemical soil characteristics from experimental plot Malaya Zorkaltseva village of Tobolsk district are presented in the Table 1.

Soil acidity is stated by the negative logarithm of the hydrogen ion concentration pH. This characteristic determines availability of chemical elements for plant organism. It is worth to mention that amelioration of sod-podzolic soils leads to changes in qualitative composition of organic matter, decrease of fulvic acids composition and increase of lime humates. At the same time as a result of amelioration the base exchange capacity increases and composition of exchangeable cations changes: increasing of consumed Ca^{++} and Mg^{++} and decreasing of exchange H^+ and Al^{+++} .

Reaction of soil solution markedly changes because of saturation of soil by Ca^{++} and Mg^{++} cations: pronounced acidity, which is characteristic to virgin soils, gradually replaced by subacidic and sometimes neutral and weakly alkaline reaction. Biological activity of soil microbial flora– nitrate bacteria and azotobacter, which

does not occur in virgin soils and weakly cultivated soils or occurs in very fractional amount, intensifies because of it [5].

Soil of the experimental plot belongs to weakly alkaline type and has medium pH 7,70. It is known that nutrients and chemical elements for wheat plants will be available under pH range 6,0–7,5. If pH level is lower, key nutrients will be either less available or become toxic for plants. Therefore, soil pH of experimental plot can be referred as satisfying to requirements of the culture.

Dry residue (solid residue) is a characteristic of soil salinity, it is determined by the ratio of anions and cations in the soil solution. In normal conditions it can't exceed 0,30%, in soil samples it is equal to 0,35%. Salinity is determined by salt content in soil solution. Salts are need to be formed mostly sodium, calcium and magnesium cations with chloric and sulfuric anions. Potash cations, bicarbonate, carbonate and nitrate anions can make insignificant part. Thus results by dry residue in soil which were obtained in this experiment allow to draw conclusion that anion and cation amount is optimal and they are the main compounds of the soil in current agroclimatic conditions.

Table 1

Physical and chemical indices of continuous cultivated residual carbonate sod-podzol soil

Sample	Sample taken for analysis	GO	GO	By anions, mg-eq.			By cations, mg-eq.			Biogenic substances, mg/kg			
		ST 264 23-85	ST 264 23-85	GO ST 264 25-85, п.1	GO ST 264 26426-85	GO ST 264 24-85	ompu tation al meth od	GO ST 264 26487-85	GO ST 264 87-85	GO ST 264 89-85	GO ST 261 07-84	G OST 26488-85	G OST 26 207-84
		pH, un.	Dr y residue, %	Cl ⁻	SO ₄ ²⁻	HC O ₃ ⁻	a ⁺	Mg ²⁺	Ca ²⁺	NH ₄ ⁺	N O ₂ ⁻	N O ₃ ⁻	H ₂ PO ₄ ⁻ и HPO ₄ ⁻
2009 year	1	7,54 ±0,10	0,38	0,40 ±0,06	0,80 ±0,10	0,30 ±0,10	,23	1,98 ±0,20	5,43 ±0,41	8,70 ±1,30	14, 0±0,50	10 ,0±0,8	80 ,0±6,0
	2	7,51 ±0,10	0,36	0,43 ±0,06	0,70 ±0,11	0,30 ±0,10	,40	1,98 ±0,20	5,43 ±0,41	8,60 ±1,30	8,5 1±0,50	10 ,7±0,8	80 ,0±6,0
	3	7,53 ±0,10	0,32	0,33 ±0,05	0,70 ±0,11	0,30 ±0,10	,71	1,98 ±0,20	5,62 ±0,42	8,90 ±1,30	8,3 7±0,30	10 ,5±0,8	77 ,0±6,0
	Average	7,53 ±0,10	0,35	0,39 ±0,06	0,70 ±0,11	0,30 ±0,10	,45	1,98 ±0,20	5,49 ±0,41	8,70 ±1,30	10, 3±0,40	10 ,4±0,8	79 ,0±6,0
2010 year	1	7,64 ±0,10	0,36	0,30 ±0,05	3,30 ±0,20	0,30 ±0,11	,50	1,91 ±0,19	5,56 ±0,42	15,5 ±1,60	12, 1±0,70	4, 2±0,8	31 0±16,0
	2	7,59 ±0,10	0,34	0,30 ±0,05	3,30 ±0,10	0,30 ±0,10	,29	1,79 ±0,20	5,56 ±0,42	15,5 ±1,60	11, 5±0,50	4, 1±0,8	31 0±16,0
	3	7,51 ±0,10	0,34	0,43 ±0,06	3,30 ±0,20	0,28 ±0,11	,13	1,72 ±0,17	5,56 ±0,42	15,6 ±1,60	9,5 9±0,30	4, 3±0,9	33 0±17,0
	Average	7,58 ±0,10	0,35	0,34 ±0,05	3,30 ±0,20	0,29 ±0,11	,97	1,81 ±0,19	5,56 ±0,42	15,5 ±1,60	11, 3±0,50	4, 2±0,8	31 7±16,3

2011 year	1	7,71 ±0,10	0,34	0,38 ±0,06	3,30 ±0,20	0,33 ±0,10	,99	1,98 ±0,20	5,56 ±0,42	3,60 ±0,50	4,8 7±0,50	12 ,2±0,9	38 0±19,0
	2	7,90 ±0,10	0,36	0,47 ±0,07	3,30 ±0,11	0,35 ±0,10	,86	2,04 ±0,15	5,68 ±0,43	3,40 ±0,50	4,6 0±0,30	11 ,3±0,9	41 0±21,0
	3	7,92 ±0,10	0,34	0,48 ±0,07	3,30 ±0,20	0,33 ±0,10	,77	2,04 ±0,15	5,62 ±0,42	4,00 ±0,60	6,4 3±0,50	11 ,5±0,9	44 0±22,0
	Average	7,84 ±0,10	0,35	0,44 ±0,07	3,30 ±0,20	0,23 ±0,10	,87	2,02 ±0,16	5,62 ±0,42	3,70 ±0,60	5,3 0±0,40	11 ,7±0,9	41 0±20,7
Year average	7,70 ±0,10	0,35	0,39 ±0,06	2,40 ±0,20	0,34 ±0,10	,76	1,94 ±0,18	5,56 ±0,42	9,30 ±1,17	9,3 0±1,20	8, 96±0,4	8, 80±0,8	

The amount of anions in soil is considerably less than the amount of cations. Anion-cation balance is shifted toward cations.

On the basis of the obtained data on biogenic substances, it may be concluded that the nitrogen in the soil is presented in three forms: ammoniacal (NH_4^+), nitrate (NO_2^-), nitrite (NO_3^-), there is a sufficient amount of it in the soil.

Phosphorus is available in mobile forms H_2PO_4^- и HPO_4^- , it is contained in the soil in large amount. Its accumulation is conspicuous over time, the maximum was observed in 2011, the minimum – in 2009, respectively.

The humus content (I.V. Tyurin method in V.N. Simakov modification), in the soil is not high and it varied slightly: year 2009 – 1,86%, year 2010 – 1,45% year 2011 – 1,76%.

The total content of the chemical elements (As, Ca, Cd, Co, Cr, Cu, Fe, Mg, Mn, Mo, Ni, Pb, Sb, Sr, Zn) was estimated in soil samples, as well as their stationary and mobile forms, by atomic emission methods of inductively coupled plasma on the spectrometer OPTIMA-7000 DV (Perkin Elmer).

According to the research years average data on the total composition, it was found that the topsoil contained, mg/kg: As - $16,95 \pm 0,18$; Ca - $456,0 \pm 18,66$; Cd - $6,83 \pm 0,00$; Co - $16,85 \pm 0,00$; Cr - $16,43 \pm 0,00$; Cu - $0,99 \pm 0,19$; Fe - $301,73 \pm 21,62$; Mg - $288,93 \pm 29,66$; Mn - $96,65 \pm 1,97$; Mo - $16,23 \pm 0,00$; Ni - $17,04 \pm 0,64$; Pb - $25,71 \pm 1,64$; Sr - $1,89 \pm 0,12$; Zn - $21,72 \pm 1,28$.

The reference points, such as clarks for chemical elements, are necessary for detection of natural soil-geochemical changes and correct assessment of the soil composition of elements, as well as hygienic standards: maximum and approximate permissible concentration (MPC) and (APC). The study used the conventional world soil clarke, proposed by D.P. Malyuga [6].

As a result of determination of chemical substance concentrations (C_c) in soil, it was found that chemical elements form two groups in background sample comparing to conventional world Clarke [7]. The excess over the MPC is not revealed.

The elements of the 1st group – Co, Mo, Pb, Cd are characterized by an increased content in the soil relative to clarke, which indicates the accumulation of

these substances, but not higher than the MAC level. The coefficient of the chemical substance concentration (Cs) is from 1,61 units - Co to 3,42 units - Cd. The increased content of these elements may be due to geochemical characteristics of the parent rock materials.

More numerous 2nd group of elements - Mn, Cr, Sr, As, Ni, Cu, Zn, Mg, Ca, Fe, shows the deficit relative to Clarke, its critically low content in the soil, suggesting that there is an elements subtraction.

Sample preparation for the determination of chemical elements stationary forms, associated with the various soil components was performed to obtain the acid extracts in the microwave decomposition system under pressure Speedwave MWS-2 (made in Germany BERGHOF Products+Instruments Gmb H), using the individually selected mode. This process applies extra pure HNO₃ and HCL acids, which additionally underwent the distillation in the purification system BSB-939-IR.

According to the content, in the form of stationary compounds, bounded with soil components, elements can be conventionally divided into two groups: calcium, iron, magnesium, manganese occur in a large amount in the stationary forms (from 64,98 mg/kg – Mn, to 284,90 mg/kg – Ca) and form a small cluster. Other chemical elements are poor in the soil (0,39 mg/kg – Mo, to 6,74 mg/kg – Pb) in a stationary forms and form a large group of trace elements.

Mobile element forms were determined by the chemical fractionation. In the present study, after the comparative overview of the most commonly used chemical elements fractions and extraction agents, the Sposito method appeared to be effective for their recovery. However, some extraction agents of the method were replaced by those with similar properties and device-oriented. Furthermore the oxide fraction, extracted by the Pampura method, was added to the factions set, offered by Sposito. This fractionation allowed detection of the mobile element compounds in soil samples of 2009–2011 years, to determine their chemical fractions and ratio, to conduct a statistical analysis of samples (tab. 2).

Three fractions (of the total amount of mobile forms) were found to be dominant for As, Ca, Cd, Co, Mo, Ni, Pb: exchange fraction – 26,7% (Ni) – 29,1%

(Co), organic – 26,6% (As) – 34,3% (Ca) and soluble – 18,2% (Ca) – 21,8% (Co). Elements are bounded with both the various soil components (mineral components, hydroxides and oxides, colloids) and the organic substance, in almost equal proportions, form stable complexes with them and play the principal role in plant nutrition. The water-soluble forms are most mobile, potentially more mobile, since they are transported by surface and ground waters, are easily involved in biogeochemical migration, are available to plants. In addition, the exchange and the water-soluble fractions are the reserve of plants nutrition.

The most of the Mg and Sr content in the soil also falls at the organic (28,8% and 28,7%) and the exchange fraction (22,1% and 26,9%); 17,1% of magnesium of the mobile forms total content is contained in residual compounds. This is a strategic reserve, bounded with carbonates and bicarbonates Fe, Mn, Al. The manganese proportion in the organic fraction is 60,6%, and only 16,7% – in the exchange fraction. The iron is in the organic – 39,1%, oxide – 28,6%, residual fraction – 26,2%, it is presented in the soil (mainly) in the form of stable complexes with organic substance. Its occurrence is considerably less in the form of cations and sesquioxides hydrates in colloid-soluble form. The copper is bounded with carbonates and bicarbonates, it is found only in the carbonate fraction (100%). The proportion of zinc oxide fraction is 91,3%, the residual fraction – 8,7%. This element forms stable surface complexes and is released while the destruction of Fe and Mn hydroxides.

Table 2

**Mobile forms of elements and their distribution in chemical fractions in soil of the experimental plot, 2009–2011
years average**

Element		As	Ca	Cd	Co	Cr	Cu	Fe
The sum of mobile forms, mg/kg		16,30 ±0,26 CV=2 ,26	171,13 ±0,81 CV=0, 67	6,84 ±0,00 CV= 0,00	16,85 ±0,00 CV=0 ,00	12,55 ±0,00 CV=0 ,00	0,42 ±0,00 CV= 0,00	235,4± 13,21 CV=7, 94
The elements distribution in fractions depending on sum of the forms, %	Exchange	28,53	27,66	28,3 6	29,08	27,01	0,00	1,79
	Organic	26,63	34,25	28,2 2	28,43	28,29	0,00	39,11
	Carbonate	7,73	4,70	7,16	7,24	6,77	100	1,41
	Oxide	10,55	4,93	8,19	6,71	8,53	0,00	28,57
	Residual	6,99	10,03	7,02	6,77	9,16	0,00	26,24
Water- soluble	19,63	18,21	21,0 5	21,84	20,24	0,00	2,97	
Element		Mg	Mn	Mo	Ni	Pb	Sr	Zn
The sum of mobile forms, mg/kg		69,73 ±2,16 CV=4 ,37	31,67± 2,70 CV=12 ,08	15,8 4±0,0 CV= 0,00	15,71 ±0,00 CV=0 ,18	18,97 ±0,00 CV=0 ,00	0,85 ±0,00 CV= 0,00	19,08± 0,11 CV=0, 79
The elements distribution in fractions	Exchange	22,06	16,67	28,0 9	26,67	26,94	21,1 8	0.00
	Organic	28,81	60,56	26,6 4	28,07	28,73	27,0 6	0.00

depending on sum of the forms, %	Carbonate	4,63	2,84	6,69	6,75	6,80	3,53	0.00
	Oxide	11,01	6,03	11,5 5	10,06	8,28	8,24	91.30
	Residual	17,05	4,80	7,01	8,27	8,91	3,53	8.70
	Water- soluble	10,02	9,09	20,0 1	20,24	20,35	15,2 9	0.00

Note: CV – coefficient of index variation, %

Thus, the most of the elements detected are in the exchange, organic and water-soluble form, and are the direct source of plants nutrition.

The studied morphological parameters, physical and chemical indices and composition of elements are the key indicators of the certain type soil characteristics and they determine fertility and optimality of crops growing conditions in the areas with a high cryogenic load. They allow the estimation of the soil productive balance, the processes occurring in a complex dynamic system of life, as well as the probability (extent) of pollution under the certain human impact.

The results of the soil characteristics basic indices study can be used in resolving the issues of management and sustainable utilization of soil resources, taking into account the regional features of climatic factors.

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REASONS FOR THE TRANSITION TO SEXUAL REPRODUCTION

Abstract

Increasing complexity of living organisms leads to a higher probability of errors in their genomes. There was a transition to sexual reproduction in the course of evolution, the main value of which - the ability to compare gene sets of two organisms with a choice of intact genes and thus correcting of genetic errors. From this point of view, justified the ban marriages of the next of kin, the reasons explained of hemophilia and homosexuality.

Keywords: genes, genome, hemophilia, homosexuality, inbreeding.

A modern biological science thinks that the transition from vegetative to sexual reproduction, first of all, provides a substantial increase of the number of possible combinations of hereditary traits and then by means of selection the most felicitous, adapted to condition of existence organism, their unceasing improvement.

However, even a cursory glance at the history of life on earth shows, that vegetative propagation is inherent substantially to simple organisms. The mechanism of sexual reproduction at first simply appears and then to become increasingly important with theirs complication. Bacteria reproduce vegetative. Flowering plants, as a rule, use both mechanisms reproduction and vegetative and sexual. However, more complex organisms, animals, virtually all reproduce sexually.

On the other hand more complex organism have, as a rule, greater genome, although, clear correlations are not observing. With the increasing number of genes describe of the organism, the probability inevitably increases that some gene in the genome will be damaged. This puts a limit of the complexity of living organisms, sooner or later it turns out that error-free genome generation will be unlikely.

In vegetative reproduction genome of offspring is almost identical genome parents and no possibilities for their corrections, if some mutation in gene has occurred. Since the overwhelming majority of mutations are harmful to the organism, the only way to improve of such organisms is natural selection.

The transition to sexual reproduction has opened new horizons for the evolution of living organisms. Along with the dramatic rise in the number of possible combinations of genes in the genomes of descendants, the opportunity to compare the sets of two organisms and weed out having evident damage appeared. It's hard to say exactly what mechanism underlies this process, perhaps the "right" genes have a high binding energy of its molecules, and perhaps because of damage genes are random, the structure of the DNA has been disrupted itself.

A similar situation arises in practical activity of the people. Let's say, there are two copies of a defective historical text at the disposal of the scientist. Comparing them between itself he can repair the damages and restore the original text.

In much the same way, in living organisms: if gene describes an organ of the former organism fails, need to create a new organism information will be read from the gene in the genome of the second organism, and the descendant will form wholly fault-free organ, in spite of the failure is in the first genome. However, in the new organism will have hidden gene failed, hence the ban follows on marriages among of closely related people.

Suppose a mother has damaged gene. On herself it will not affect, as a human has diploid set of chromosomes - the correct information will be read from the correct gene of the second chromosome. And it will not affect her children - the right structure of the organ had been described by the damaged gene, had been described in the good gene of father of her children. Moreover, only half of number the children of this mothers will have damaged gene in the genome.

Let's assume that the brother and sister, children of this mothers, both have the failed gene conceived a child. According to the second law of Mendel with a 25% probability it will have two damaged genes describing some organ, and the birth of a monster becomes inevitable.

Continuing to talk about the problems of human genes, we note the hemophilia. The reason for it is that the mechanism of production of a protein essential for the blood clotting is described in the genes of the X-chromosome. In the men's genome has only one X-chromosome and if the gene responsible for the production of a protein that provides blood clotting is damaged, to take the right information about this protein is nowhere and such a man will have hemophilia. On the other hand, the female genome has the two X-chromosomes, what with almost 100% certainty eliminates a possibility of hemophilia.

As noted above, one-half of the offspring of such a woman would have damaged gene describing globulin that provides blood clotting. For descendants of female will not happen anything bad, the twin gene of the other parent will save of the situation, but for the sons who were not lucky with the genes, guaranteed problems with hemophilia.

There is another problem, which seems to the author, is due to problems with the genes, homosexuality. This time, the cause lies, apparently, in a man's Y-chromosome which describes everything what a man is different from a woman. In the genetic subconscious program the male behavior is written, which man seems that the young woman, for example, such are depicted on the posters, is ideal of beauty: woman is the most beautiful of all that we have in this world, he should strive for her, pleasantly to be with her, etc.

If the genes which provide a record of the program of male behavior have failed, in accordance with the general principle of sexual reproduction genetic mechanism tries to read the necessary information from the second chromosome. However, in the male organism this second chromosome is X-chromosome which is recorded quite other feminine model of the behavior to force women to seek men. There is nothing surprising in the fact that a man with such a program of sexual behavior will gravitate toward the same sex, and we will consider him a homosexual.

Quite different situation is for women. Two X-chromosomes ensures correct program of sexual behavior, even if one of them have any error. Let us assume that two X-chromosomes in which are the damaged genes described sexual behavior have

occurred in one organism. Such a woman would be equally indifferent to both men and women, since only the presence of Y-chromosome provides the love to women. It follows that genetics excludes female homosexuality. There is a "lesbian movement" nothing more than a fad, and should be studied by psychology, especially as not all gay-men are "true" homosexuals. Some of them are approximately equal to the number of "lesbians", trying to stand out in a crowd pretend to be gay, but have no any abnormalities in the male genome.

It should be said in all fairness that the theories of the origin of homosexuality is in abundance. There are searches for a special "gay gene", which have so far have not led to anything and Freud's ideas originate about the errors of education in childhood, and the hormonal theory of the origin of homosexuality which may explain some of these cases, especially lesbianism. But studies of male and female hormones in the bodies of homosexuals do not show any differences from normal people.

On the other hand, in 1952, Franz Kallman [1] published a study of 40 pairs of monozygotic and 45 pairs of fraternal twins one of each pair was a homosexual. At identical twins concordant on homosexuality was one hundred percent, that is, if one twin was gay, it turned out to be the same and the other. Such coincidences were not discovered at fraternal twin at all.

Summary. We note that along with the increase of possible options in the genomes, the process of sexual reproduction provides a significant reduction in the number of genetic error in living organisms. Moreover, this fact seems to be crucial for the transition from vegetative to sexual reproduction. In addition, the described approach allows for a newly look at the genesis of homosexuality explaining, on the one hand, to a greater number of cases of male homosexuality in comparison with female and, on the other hand, the futility of endeavor to treat it.

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**BIOINDICATION OF THE BACKGROUND MUTAGENICITY OF
SOILS**

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*In the present study, we address the background level of mutagenic activity of soils from the Lviv area using the ana-telophase method for tracking aberrations in root meristem cells of *Allium cepa*.*

Keywords: chromosomal aberrations, Allium-test, cytogenetic monitoring, mutagenicity of soils.

Introduction. Maintaining ecological stability of environment which is being constantly changed by human activity is nowadays among the global concerns of top priority. Air pollution, industrial liquid wastes and, particularly, exhaustion from vehicles are among major factors exerting direct negative impact on people. The prolonged effect of this influence manifests itself in alterations of human hereditary information, the genetic machinery governing our development and maintenance of the normal vital processes. A number of methods and approaches exist for quantifying the genotoxic, or mutagen, influence of synthetic substances on the genetic apparatus of living cells. Cytogenetic techniques of studying actively dividing cells, such as analyzing mitotic and nucleolar activities, and tracking mitotic pathologies [1], are among fast and reliable methods to address such issues. Micronuclear counts can be an example of such a test that has successfully been used for detecting pathology in pines [2, 3].

In the present study, we address soil mutagenicity using the ana-telophase method of tracking aberrations in the root meristema of *Allium cepa*.

Mutagenic activity of soils is an urgent issue in view of the extensive use of chemical compounds by humans which results in substantial accumulation of these substances in various environments, including soil. A number of studies have

addressed and demonstrated the mutagenic effects of soils revealed in plant development pathologies using assays like the pollen test or *Allium* test [4, 5]. Analysis of the effect of soils from roadside strips has also demonstrated increased micronucleus counts in the root meristem of *Tradescantia zebrina* (*Zebrina pendula* Schnizl). This value correlated with amount of toxicants and contents of trace metals in the soil. The authors assume that some part of these pollutants is washed out into the city reservoirs [6]. Besides chemicals, mutagenic effects of radioactive substances in the soil have been shown on natural populations of *Arabidopsis* (*Arabidopsis thaliana* Heynh L.) which correlated with the dose of pollution and manifested itself in karyotype abnormalities in the root meristem [7]. A connection between the dose received and abnormalities in the apical meristem of *Koeleria* (*Koeleria gracilis* Pers). And plants demonstrate no signs of adaptation to prolonged growth in the conditions of elevated radiation [8].

The central issues of cytogenetic monitoring is developing appropriate techniques to reliably infer the scale of adverse environmental impact from karyotype abnormalities. These techniques should ideally have enough power to discriminate between chromosomal aberrations occurring naturally without exposure to artificial mutagens, reflecting the natural background level of environment mutagenicity, and human activity-caused impacts, which would allow us to be able to quantify the excess pollution in the atmosphere that leads to irreversible changes in the genetic programs of living organisms.

In our study, we used mutagenic activity of air, water, soil, and bottom sediments from natural reserve areas as control values for Ukraine.

We applied the ana-telophases analysis of the root meristem of *Allium cepa* to address soil mutagenicity in the south-west economic region of Ukraine near Lviv in the reserve "Roztochye" as a model area. The reserve consists of two massifs and is located within the watershed area of the rivers Dnister Sana, and Western Bug. The territory is represented with hilly forests with sod-podzol and bog soils.

The study encompasses localities of beech forests, forest meadows, and meadows near fish farm lakes, silt from lakes, forest sites bordering agricultural fields and near an open sulfur pit (Table 1).

Table 1.

Sampling sites in the reserve "Roztochye" territory.

№№ of soil samples	Areas of the reserve	Characteristic of areas
1 ₍₁₎	22	Top of the hill
2 ₍₁₎	22	Forestry near a sulfur pit
2 ₍₂₎	22	below the hill top
2 ₍₃₎	22	Middle of the hill
2 ₍₄₎	22	foothill
3	29	Forest
4	9	Forest area bordering a farm
5	9	Silt from the lake "Gutsulka"
6	20	Beech forest on the hill
7	8	Beech forest
8	4	Meadow
9	1	Beech forest on the hill
10 _(a)	7	A site bordering a fishery
10 _(b)	7	Near a big lake with an island
18	7	Silt from the lake
11	12	Forest

Estimation of *A. cepa* seed germination in different soil samples reveals a notable slowdown of germination in tests 1₍₁₎, 2₍₄₎, 3, 7, 5 ($p < 0,001$); for tests 2₍₃₎, 10_(a) ($p < 0,01$), for tests 8 and 18 ($p < 0,05$). From literature, decreased germination is observed under the influence of different chemical compounds which affect the spindle of cell division.

The mitotic activity of cells of the root meristem in two soil samples was higher than in control ($p < 0,05$) tests №. 9, 10_(a). A notable but non-significant decrease of the mitotic index (MI) was observed in tests № 2₍₁₎ and 3. In test № 6 ($p < 0,01$) and other samples showed decreased MI ($p < 0,001$) (Fig. 1).

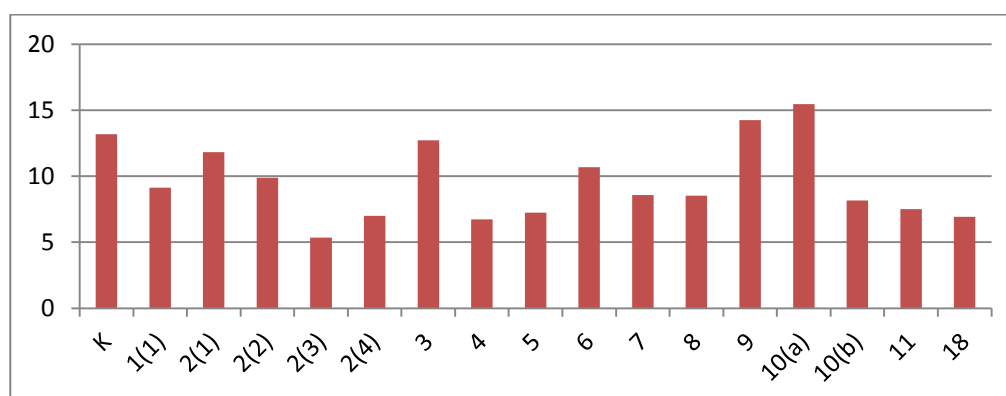


Fig. 1. Mitotic activity in the meristem of *Allium cepa* grown on test soils from the reserve "Roztochye".

The observed decrease in MI is indicative of a negative impact of the substrate on cell division processes, whereas increased MI may indicate either an elevated number of cells entering mitosis or retaining of cells in mitotic status.

The range of the observed anomalies represented all the main types of cytogenetic aberrations which can be detected by the ana-telophases analysis: chromosomal and chromatid bridges, solitary and paired fragments, lag of chromosomes, tri-poled mitoses and, complexes of these aberrations.

As a result of the analysis of chromosomal and chromatid anomalies, we revealed prevalence of the chromatid type aberrations, which suggests effects produced by factors of chemical rather than physical nature, the latter more often resulting in chromosomal aberrations.

We detected a significantly higher share of aberrant cells over control in plants grown on test soils № 1₍₁₎, 2₍₂₎, 2₍₃₎, 2₍₄₎, 4, and 18 ($p < 0,001$), and № 11 ($p < 0,05$; Table 2), which suggests the presence of mutagenic chemicals in these soils above normal levels.

Table 2.

Mutagenic effects of soils from the reserve "Roztochye" revealed by the ana-telophase analysis of the root meristem of *Allium cepa*.

№№ samples	Analyzed cells	Cells with aberration	$P \pm m$	t_d	p
C control	1005	15	$1,49 \pm 0,38$		
1 ₍₁₎	1018	47	$4,62 \pm 0,66$	4,13	** *
2 ₍₁₎	1011	22	$2,18 \pm 0,46$	1,16	
2 ₍₂₎	1015	39	$3,84 \pm 0,60$	3,32	** *
2 ₍₃₎	750	34	$4,53 \pm 0,76$	3,59	** *
2 ₍₄₎	919	38	$4,13 \pm 0,66$	3,48	** *
3	1000	26	$2,60 \pm 0,50$	1,77	
4	714	33	$4,62 \pm 0,79$	3,58	** *
5	1006	23	$2,29 \pm 0,47$	1,33	
6	1055	27	$2,56 \pm 0,49$	1,74	
7	1002	25	$2,50 \pm 0,49$	1,63	

8	1000	22	2,20 ± 0,46	1,20	
9	1005	21	2,09 ± 0,45	1,03	
10 (a)	1051	25	2,38 ± 0,47	1,48	
10 (b)	1010	13	1,29 ± 0,36	0,39	
11	1025	31	3,02 ± 0,53	2,35	*
18	1024	40	3,91 ± 0,60	3,42	**

* - $p = 0,05$

** - $p \geq 0,01$

*** - $p \geq 0,001$

Soil samples taken from the reserve "Roztochye" territory showed cytotoxic effects on the cells of the root meristem *A. cepa*: Seed viability ranged from 45% (test № 5) to 86% (test № 11). Control germination was 80%.

We also detected mutagenic effects of the sampled soils, with significantly ($p < 0.05$) higher rate of cell aberrations over control, ranging 1.29% (test # 10) to 4.62% (test # 1(1),4), the control value being 1.49%.

Germination and mitotic activity can vary considerably depending on the physical and chemical structure of soil and the presence of allelopathic interactions. Radiation effects can also not be excluded given the hypersensitivity of plant chromosomes to radioactive emission [9], and the influence of herbicides and pesticides given the close proximity of agricultural lands to the sites of sampling.

The background mutagenic activity of the territory of the reserve "Roztochye" can be classified as "warning". Unlike air and water, soils are not capable of rapidly dissipating of incoming or resident compounds. Yet washing away of some substances or their ejection with vegetative mass in cases when they are used by humans do take place.

Conclusion. Ecological forecasts of the genetic consequences of environmental pollution should not be reduced to a sanitary and hygienic assessments based solely on physical and chemical methods of identification of dangerous substances. The experience of many laboratories in the world convincingly testifies the efficiency of methods of bioindication in the assessment of the quality of environment.

Our study demonstrates that background indicators are necessary for environment monitoring. However, reliable selection of the indicators of background

mutagenic activity requires a thorough address of how particular sites are selected for sampling within any given economic region. Besides the averaged standards for reserved and protected areas, a database for technogenic zone-adjointing areas and laboratory tests of direct effects of various mutagens on mitotic processes is necessary.

Physical and chemical methods are capable of detecting various pollutants, however these methods are limited in elucidating the biological consequences of chemical contamination. This problem can be solved by employing bioindication techniques which can reveal the reaction of a biological system to a complex influence of the environment.

In the conditions of a combined influence of many factors of chemical and physical nature, only complex traditional approaches of assessing pollution by bioindication techniques can provide us with an objective picture of the status of an environment. Having reliable indicators could help predict the mutagenic effects for humans on and, perhaps, in the future coordinate human economic and nature conservation activity.

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Pyurko O.E.

**DYNAMICS OF SALT AND IMPORTANCE OF MONITORING
PHYTOINDICATION IN SALINE SOILS SOUTH UKRAINE**

Melitopol State Pedagogical University named by Bogdan Khmelnytsky

In this paper we consider the salt content in the soil during the growing season, the experimental data for the adaptation of halophytes to highest concentration of salts.

Keywords: salinity, halophytes, adaptive devices.

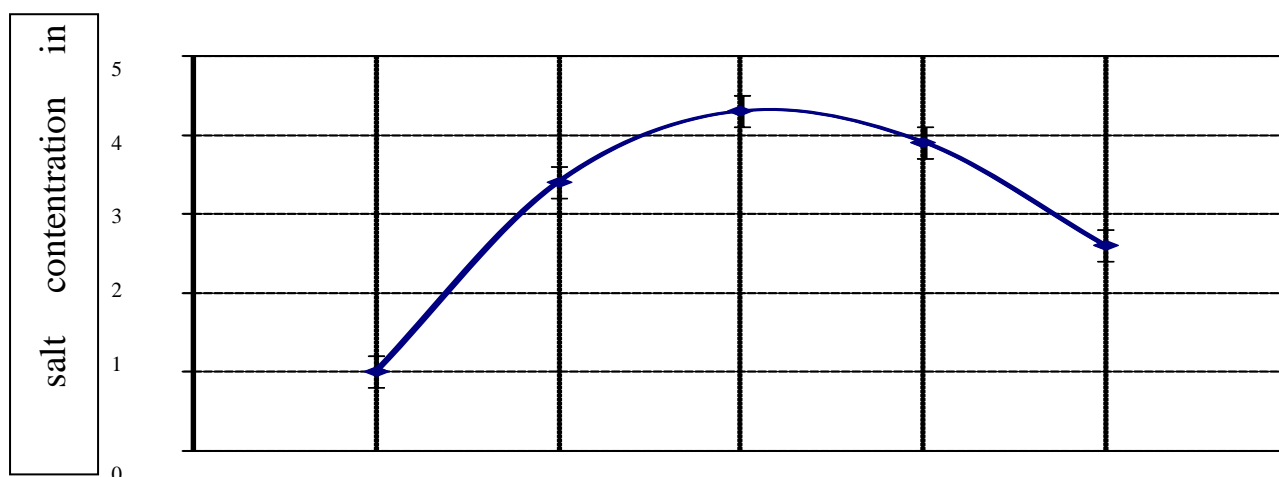
INTRODUCTION

Salinity of soil south coast of Ukraine determined mainly by evaporation of sea water immersion salts carried by the wind along with dust and rain largest fresh water to dilute soil solution. It is not difficult to predict increased concentration of soil solution during high solar [1-6]. Insolation, summer monsoon rainfall in the absence of fresh. Not the least role in this process is the intensity of transpiration of plant communities, which are mainly represented by halophytic vegetation. The purpose of the work was to determine the salt content in the soil during the growing season, and objects - plants of different ecological groups.

RESULTS

The salinity of sea water Sea of Azov is 1.6-1.8%, and dairy estuary waters after his separation from the sea - 5.5-6%. During the growing season (April to November) down 1/3 of annual precipitation, mainly in the spring, so salt content in the soil, as shown by the experimental results (figure 1) changes regularly.

Dynamics of salinity presented a bell curve with the minimum values of ($1,0 \pm 0,05\%$) in spring, maximum ($4,3 \pm 0,5$) - in the middle of summer and intermediate ($2,6 \pm 0,2\%$) - at the end of vegetation. Absolute values of the parameter vary by year, but the pattern described mostly preserved. The soils of Azov is characterized chloride-sulfate salinity with a significant advantage in sodium chloride. To determine the degree of tolerance in halophytes investigated the value increases, the ground vegetation vessels NaCl was added at a constant concentration of registration soil solution. The results of model experiments are presented in fig. 2.



15.04 01.06 15.07 01.09 15.10

Dates

Figure. 1. Dynamics of salt content in the soil during the vegetation transects.

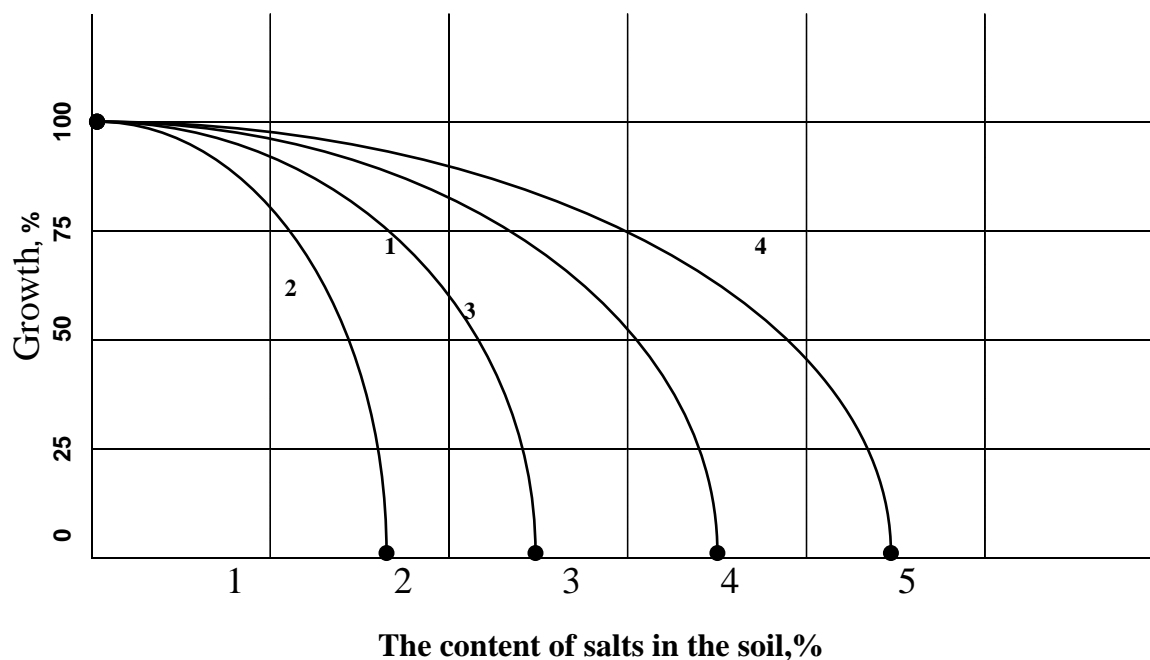


Figure. 2. Effect of salt concentration in the soil at the livelihoods of halophytes different groups: 1 - *Plantago lanceolata*, 2 - *Artemisia santonica*, 3 - *Halimione pedunculata*, 4 - *Salicornia europaea*.

They clearly indicate that increasing the concentration of soil solution affects the gain of all halophytes, but with some differentiation. At 1% salinity in this parameter is almost no difference between saline soils (4, evhalophyte) and halimione (3, krynohalophyte) unreliable - between the first two and wormwood (2, hlikohalophyte) and significant - between the first and plantain (1, methophyte). Further increase in salt content in soil significantly differentiates these plants. At 1.5% salinity *P. lanceolata* (1) virtually stops its growth slows significantly (by 50%) *A. santonica* (2) and relatively pro-actively continues to grow *H. pedunculata* (3) and *S. europaea* (4). The critical level of salinity for methophyte is $1,5 \pm 0,3\%$, hlikohalophyte - $2,5 \pm 0,4\%$, krynohalophyte - $3,4 \pm 0,5\%$ and evhalophyte - $4,4 \pm 0,5\%$ and even higher.

At high concentrations of salts in the soil last coming into the plant in the form of cations and anions [7-12]. Through selective acquisitions and semi-permeability of

biomembranes there are significant gradients in their concentrations in the environment (soil) and plant. The results are presented in Table 1.

Table 4.1.1.

Dynamics of salinity during the growing season

Objects	Chloride content during the growing season,%		
	Spring	Summer	Autumn
<i>P. lanceolata</i>	$\frac{0,9 \pm 0,03}{0,8 \pm 0,02}$	$\frac{-}{2,2 \pm 0,05}$	$\frac{0,8 \pm 0,2}{1,0 \pm 0,2}$
<i>A. santonica</i>	$\frac{2,4 \pm 0,1}{2,0 \pm 0,1}$	$\frac{3,5 \pm 0,2}{2,4 \pm 0,1}$	$\frac{3,0 \pm 0,2}{2,2 \pm 0,1}$
<i>H. pedunculata</i>	$\frac{2,8 \pm 0,2}{2,2 \pm 0,1}$	$\frac{5,6 \pm 0,3}{3,9 \pm 0,4}$	$\frac{4,1 \pm 0,4}{3,2 \pm 0,2}$
<i>S. europaea</i>	$\frac{3,1 \pm 0,2}{2,4 \pm 0,1}$	$\frac{6,2 \pm 0,5}{4,8 \pm 0,2}$	$\frac{4,7 \pm 0,3}{3,8 \pm 0,2}$

Note: The numerator - salt content in vegetative organs of halophytes, denominator - the salt content in the soil.

They allow you to ascertain that the differentiation of halophytes (salt content under the soil): the salinity increases 2,4-4,8% grows *S. europaea*; 2,2-3,9% - *H. pedunculata*, 2,0-2,4% - *A. santonica* and less than 1% - *P. lanceolata*. When the concentration of salts in the soil in mid-summer to 2.2% *P. lanceolata* dies and begins to vegetate again in the autumn, when the concentration of soil solution decreases.

On the specific effect of salts judged by anion riznoyakisnosti, which manifests itself in morpho-physiological and biochemical changes in plants [2,5,8]. Succulent leaves and structure of sulfur deficiency characteristic of plants when growing them under chloride salinity and kseromorfnist and intensive formation-ment "metabolic phosphate" - when sulfate salinity. It is believed that the action of sulfuric acid salts of anions seen in dehydration of plant cells, tissues and plants in general, while Cl- ions contribute to their wateration [9,11].

CONCLUSION

Anatomical observations show that plants under sulphate salinity are more inhibited cell spreading process than their tumors, while chloride - on the contrary, slows down to a much greater extent tumor cells than their tension. When chloride salinity reduced the number of cells in the body, and with sulfuric acid - there smallcellation. These materials indicate the possibility of using phytoindication in monitoring soil not only on the degree of salinity, but also the quality of these salts.

Thus, soil salinity initiates numerous adaptive structural and functional reorganization in plants at different levels of the organization. The undeniable fact is the accumulation of salts in the plant, which is naturally somewhat uperedzhuye growth rate of salinity in the soil. When artificial salinity for this process is characterized by an inverse relationship. To the overall increase in the content of mineral elements strikingly marked changes in sodium content, which is important in the formation of osmotic activity.

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Fedelesh-Gladynets M.I.

**BIOTECHNOLOGICAL PROCESSES GRAPE PROTECTION FROM
PESTS BY USING MICROBIOLOGICAL AGENTS IN UKRAINE**

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Were shown aspects of microbiological application to protect the vineyards from the most common pests. The results of the use of microbiological agents dendrobatsylin Lobesia botrana in industrial grape plantations Transcarpathian Institute of agricultural production.

Keywords: biotechnology process, viticulture, Transcarpathia, microbiological preparations, Lobesia botrana, bitoksybatsylin, homelin, lepidotsyd, askofit.

Among fruit plant vine holds a special place in origin, spread culture, with signs and properties, as well as is an important sector for the economy of Ukraine. Economic efficiency of growing in the world higher than sexual plants per unit area of 10 times, and most developed 15 – 20. total area of vineyards in the country is around 100, 0 thousand hectares. culture into commercial grapes grown in Crimea, southern steppe zone of Ukraine and Transcarpathia.

With losses viticulture cause pests and plant diseases, as evidenced by the numerous publications of national and foreign researchers. Neither nor important role in protecting the plant continues to play a chemical method that makes it possible to relatively quickly and effectively inhibit the development of diseases and pests prevented am harvest losses [10, 12,13, 1 4].

Among the crops EZHD of use I chemicals poison vine is one of the first places. During the growing season in the vineyards hold up to 15 sprays. In this (existing) technology processing ki vineyards there is a negative impact on the environment. Therefore in practice chemical protection of crops from pests in seventh in the world there is a trend of gradual decrease of use of the most toxic pesticides and replacing them safely drugs. creates ecological methods of viticulture industry in the U.S. France, Germany, Moldova, the Caucasus and other countries of Snow at a balanced wine. The principles of the method is to save and soil fertility, protection and environmental protection, economic cost-effectively at first centuries and avoid danger and these health's use of natural compost s and mulch and. In some countries, this method is called organic wine [5, 8].

In due to pesticide reform and the concept of environmentally sustainable agriculture in Europe there are increased interest in microbial drug that activates an intensive search, the study of biological inherent spines and selection of microorganisms [1,2,3,4].

Implemented in practice replacement of plant protection chemicals meliorants, pesticides, agrochemicals on biologics based on microorganisms and their metabolites (biological insecticides and fungicides).

Among the most dangerous pests of grapes NE lyayutsya American white moth (*Hyphantria cunea Drury*), leaves twist (*Spargano this pilleriana Den. Et Schiff*, *Clysia (Eupoecilia) ambiguella Hb.*, Especially hronova (*Lobesia botrana Den. et Schiff.*) And others.

Caterpillars feed on hronovoyi lystokrutky buds, flowers, blossoms, berries and eventually causing shortage of more than 30% of the crop. In addition, caterpillars second and third generations, feeding on berries, the spread of the pathogen *Botrytis cinerea*, which significantly affects the quality of products. Protection against these pests involves repeated spraying of pesticides during the growing season of grapes (hronova lystokrutka forms Season three generations).

One of the promising methods of pest control is the use of drugs from plants. They are based on natural biologically active plant substances and unlike pesticides, pests not formed a resistance to them. For practical applications the most important area of ecology is the study of the interaction between plants and herbivores and development based on these environmentally friendly means of regulating the number of pests in agrocenosis.

In Ukraine created and used bacterial insecticidal agents, rodentytsynoyni and fungicidal action based on entomopathogenic bacteria's sporoutvoryu binding of *Bacillus thuringiensis*, which in sporulation s promozhni parasporalni crystalline form nor the inclusion of protein nature (Bitoksybatsylin, homelin, lepidotsyd etc.) [2 , 10]. processing plants working suspensions bio products from *thuringiensis* and its toxins produces toxic effects on the intestine pests [9,11].

Search for alternative pesticides and application of S increased security protection of plants against pests of grapes, namely the use of biotechnological processes in an integrated biological crop protection products based on microorganisms – antagonists pests.

Research methodology. Studies conducted on industrial plantations x Grape Zakarpattia first institutions that agricultural production in the village. Big B and active.

Accounting Agrobiological indicators of vines was carried out by conventional method [1 1]. Study development and spread of diseases carried by conventional th 9-point scale on the leaves and 4-point – in bunches [1 2] and nalezet of pest generations – from accounting periods in catching butterflies fly with pheromone traps [1 2].

Effectiveness was determined by the number of pests before and after treatment with bushes and their mortality. Determining the effectiveness of biologics carried out by comparison with the reference option and control, where the processing is performed.

Studies. In Transcarpathia hronova lystokrutka developed in three generations. The first generation of the pest can cause significant economic losses as caterpillars, which revived, damage the buds and blossoms ovary grapes. Damaging one bud or germ, caterpillar transitions to other posts, after her obplutavshy's web. During its development one caterpillar kills 5 to 27 and more buds in the inflorescence or ovaries. Track the second and third generations of feed pulp green and maturing berries. Caterpillar second generation damage four – twelve Th berries, three – two – seven berries [1 3].

During the 2011-2012 biennium on grape plantations observed effect s biological insecticide,'s allowed to use in Ukraine on the vine (Table 1). The first treatment against I generation based on evidence pheromone monitoring conducted dendrobatsylinom, second – lepidotsydom, third – haupsynom. Against pests II generation were used lepidotsyd and dendrobatsylin.

Table 1

**Effectiveness of microbiological agents against hronovoyi lystokrut ki,
(pp. Great Bakta, variety Riesling, 2011 – 2012 years).**

Biologic	Consumption rate, kg, liters / ha	Average number of eggs and larvae per 100 clusters of grapes,%			Damaged inflorescences, clusters on average, %			Efficiency, %	
		to treatment	after treatment		to treatment	after treatment			
			7 A IB	14 days		7 days	14 A IB	7 days	14 A IB
Generation I									
Dendrobatsylin	0 2	5.8	1.0	0.7	0.5	0.8	0.7	87.0	92.5
Lepidotsyd	0, 7	6.4	1.0	0.6	0.6	0.8	0.4	87.6	94.0
Haupsyn	0, 6	6.0	1.2	1.0	1.0	1.0	0.8	84.2	89.3
Confidor (standard)	0.2	6.0	1.0	0.9	0.8	0.9	0.8	87.5	92.1
Control (no treatment)	-	6.4	8.5	10.1	1.1	6.0	9.0	-	
NIR 05	-	-	-	-	-	-	-	0.9	1.3
Generation II									
Lepidotsyd	0, 6	6.6	1.2	0.9	1.1	0.9	0.8	83.7	91.5
Dendrobatsylin	0 2	6.8	1.6	1.6	1.0	1.2	1.2	79.1	84.4
Zolon (standard)	2.8	6.9	1.8	2.3	1.1	1.5	1.8	77.8	79.2
Control (no treatment)	-	9.4	10.7	14.6	2.5	10.0	13.6	-	
NIR 05	-	-	-	-	-	-	-	4.1	3.2
Generation III									
Dendrobatsylin	0 2	7.3	1.0	1.0	1.0	0.8	0.8	88.5	91.6

Match 050 EC (standard)	0.6	5.1	1.6	1.5	0.0	1.6	1.4	74.1	82.6
Control (no treatment)	-	9.6	11.7	16.0	2.6	11.0	14.8	-	
NIR 05	-	-	-	-	-	-	-	1.7	1.0

The highest performance on the 14th d after treatment obu against the first generation of the pest showed the drug L epidotsyd – 94.0%, the lowest – g aupsyn – September 8, 3%. Efficiency dendrobatsylinu s and pray fork – 92.5% and stood at the standard (konfidor), the effectiveness of which – 92.1%. Damage to inflorescences at the 14th obu d after treatment were in the range from 0.4 to 0, 8%, versus 9.0% in controls.

Against II generating the highest performance on the 14th d after treatment showed obu drug epidotsyd l – 91.5%. Efficiency dendrobatsylinu was – 84.4%, which exceeded the performance standard – with Olona in (79.2%). inflorescences damage on the 14th d after treatment obu biological agents ranged from 0.8 to 1.2%, against 1.8% in a standard n th in the form and 13.6% for controls.

Provide efficiency in 91.6%, and n clusters oshkodzhenist s Treasure la 0.8%, while the control was 14.8% damaged clusters.

The dynamics of insects studied using pheromone traps and by visual inspection of grape bunches. For control of summer butterflies I generate hronovoyi lystokrut ki Pheromone traps for visyly in late April, and II – in late June. Home l o that males of the first generation of registered Vano 28 -30 April peak – 5-7 May.

The best period of the protective measures against hronovoyi lystokrutk and determined so im way: before catching the first male pest adding 15 days to I, 10 days – II for generations.

Pheromone monitoring is facilitated not only the probable number of records in the pest population, but yu and determine the optimal deadline protective treatments.

Conclusions. Biological Protection System vineyard pest management involves a combination of various biological products based on phytosanitary state space, weather conditions, and spectrum of action of the drug.

As a result, Biennial b microbiological study drugs dendrobatsylin, lepidotsyd and haupsyn showed high effectiveness against hronovoyi lystokrutky. grape plantings in the industry in terms of Transcarpathia s effectiveness dendrobatsylinu on hronovoyi lystokrutky for normal consumption 0.2 l / ha ranged from 9% to 92.5 1.5%.

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METABOLIC CONTROL OF THE INSECTICIDES SAFETY USE

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The results of the conducted research affirm that the phosphororganic insecticides utilization can lead to the break in the nitrogen metabolism, breaking the protein formation, reducing the protein molecules renewal, causing the amino acid and amides accumulation in the active state. And only the use of the preparation in optimal norms can influence stimulatingly the course of the process under consideration.

Key words: phosphororganic insecticides, xenobiotics, nitrogen metabolism, metabolic control.

Materials and methods. In the research aimed at determination of the connection between changes of the wheat metabolism and dynamics of absorption, distribution and accumulation of the phosphororganic insecticides, there have been used the systemic indices both at the molecular (biochemical processes) and ontogenetic (tolerance of the vegetate organisms at certain ontogenetic stages) levels of the life organization.

The objective of the investigation has been to distinguish the regularities of the impact carried out by various as for their toxicity insecticides transformational processes on the vegetate metabolism in the relations chain «insecticides – plant – crop», considering the reaction of which it would be possible to define the insecticides concentrations dangerous for agricultural ecosystem.

In the research there have been utilized such phosphororganic preparations as highly toxic Kaunter (Terbufos) and averagely toxic Phosphamide (Dimethoate). In order to distinguish the actions of different factors affecting the vital activity and

development of vegetate organisms, there has been used the vegetative method of soil crops. The object of the study is the winter wheat of 80 Poliska sort.

In order to carry out the research the preparations have been brought into the soil taking the culture according to the following scheme: control; different quantities of the insecticides preparations norm (0,25; 0,5; 1,0; 2,0 of the norm), where one insecticide norm is 0.8 kg/ha of the substance in action. The contents of the insecticides under the study in the vegetate material have been defined by the method of fine-layer chromatography [2]. The determination of the protein contents has been conveyed by the Lawry method [3]; the free amino acids have been defined by the gas chromatography method.

Discussion and results. It is well known that amidst all the metabolism processes it is nitrogen metabolism that influences greatly the proceedings of physiological and biochemical processes identifying the synthesis of protein substances. The contents of unbound amino acids are an important showing of the quality of the plants. It is of highly importance due to the fact that by the quality and contents of unbound amino acids it is possible to get the notion about the condition of the nitrogen metabolism as well as physiological condition of the plants at a whole. Non – protein fraction of the nitrogen substances, the main part of which being made up of unbound amino acids, is the most important reservoir for the synthesis and formation of protein molecules.

The phosphororganic insecticides under the study showed considerable impact on the nitrogen metabolism of winter wheat (table 1).

Table 1.

The impact of the phosphororganic insecticides on the ammonia metabolism of the crop of 80 Poliska winter wheat sort (the bushing phase)

Operating substance of insecticide, kg/ha		Common maintenance of albuminous nitrogen, %	Common maintenance of amino acid, nano-mol %	NH ₃ , nano-mol %	Part of ammonia from general nitrogen, %
Control	0,0	-	84,06±0,75	20,19±0,18	24,0
	0,4	112±5,6	51,63±0,46	1,17±0,01	2,3

Phosphamide	0,8	106±5,3	87,30±0,79	29,22±0,26	33,5
	1,6	68±3,4	158,36±1,43	110,50±0,99	69,8
Kaunter	0,2	92±4,6	147,13±1,33	72,70±0,65	49,4
	0,4	96±4,8	73,70±0,66	20,11±0,18	27,3
	0,8	96±4,3	58,02±0,52	15,98±0,14	27,5
	1,6	68±3,4	231,16±2,08	149,42±1,34	64,8

The use of just a half of the Dimethoate norm has carried out stimulant effect as for the protein synthesis owing to newly created amino acids and ammonia. The implication of only one norm of this preparation leads to the increase of both protein and non-protein nitrogen contents, and the ammonia accumulated in the plants apparently cannot be completely used for the organic synthesis; this involves intoxication of the plants. Two norms of this preparation inhibit even more significantly the renewal of protein molecules in the vegetate cells which is followed by ammonia accumulation.

The impact of the Kaunter on the nitrogen metabolism has resulted to be even more perceptible. It is the implication of this preparation that shows considerable inhibition of protein synthesis. Only under the application of just one norm of the Kaunter, the metabolism of vegetate organisms turns into more intense organic synthesis with utilization of ammonia and newly grown amino acids.

Table 2.

The influence of Phosphamide on the contents of unbound amino acids in the vegetative mass of the 80 Poliska winter wheat sort

Name of amino acids	Control	half of norm	one norm	two norms
Aspartic acid	0,63±0,01	0,82±0,01	0,83±0,01	0,58±0,01
Threonine	5,97±0,05	4,63±0,04	4,16±0,04	4,19±0,04
Serine	4,45±0,04	4,58±0,04	4,47±0,04	4,75±0,04
Glutamic acid	0,85±0,01	7,43±0,07	5,84±0,05	4,92±0,04
Proline	6,70±0,06	-	-	-
Glycine	1,61±0,01	1,35±0,01	1,50±0,01	1,34±0,01
Alanine	30,68±0,28	36,67±0,33	40,86±0,37	33,30±0,30
Histidine	-	2,55±0,02	2,55±0,02	2,54±0,02
Valine	3,45±0,03	2,92±0,03	2,85±0,03	3,02±0,03
Methionine	1,71±0,02	-	-	1,07±0,01
Isoleucine	2,05±0,02	2,57±0,03	3,12±0,03	3,33±0,03
Leucine	2,82±0,03	-	-	-

Tyrosine	1,26±0,01	3,18±0,03	4,03±0,04	4,27±0,04
Phenylalanine	8,55±0,08	1,20±0,01	-	-
Cysteine	25,81±0,23	31,34±0,28	29,02±0,26	35,89±0,32
Tryptophan	0,39±0,00	0,54±0,01	0,76±0,01	0,81±0,01
Lysine	0,21±0,00	-	-	-
Arginine	2,85±0,03	-	-	-

Table 3.

The influence of Kaunter on the contents of unbound amino acids in the vegetative mass of the 80 Poliska winter wheat sort

Name of amino acids	Control	half of norm	one norm	two norms
Aspartic acid	0,63±0,01	-	1,00±0,01	-
Threonine	5,97±0,05	3,12±0,03	3,86±0,04	5,81±0,05
Serine	4,45±0,04	2,39±0,02	4,04±0,04	4,12±0,04
Glutamic acid	0,85±0,01	2,91±0,03	5,33±0,05	0,83±0,01
Proline	6,70±0,06	-	-	2,08±0,02
Glycine	1,61±0,01	0,56±0,01	1,22±0,01	1,74±0,02
Alanine	30,68±0,28	38,29±0,35	39,48±0,36	38,80±0,35
Histidine	-	-	3,01±0,03	-
Valine	3,45±0,03	0,14±0,00	4,61±0,04	3,09±0,03
Methionine	1,71±0,02	-	-	1,06±0,01
Isoleucine	2,05±0,02	1,36±0,01	3,57±0,03	1,97±0,02
Leucine	2,82±0,03	0,89±0,01	-	3,46±0,03
Tyrosine	1,26±0,01	-	5,36±0,05	1,37±0,01
Phenylalanine	8,55±0,03	6,94±0,06	-	4,46±0,04
Cysteine	25,81±0,23	39,94±0,36	26,56±0,24	25,37±0,23
Tryptophan	0,39±0,00	-	1,05±0,01	-
Lysine	0,21±0,00	0,11±0,00	-	0,38±0,00
Arginine	2,85±0,03	1,87±0,02	-	5,48±0,05

As a result of Phosphamide and one rate of Kaunter application we can generally observe (table 2, 3) the increase of the contents of irreplaceable heterocyclic amino acids ([Histidine](#), [Tryptophan](#)) due to the decrease of the fraction of irreplaceable aliphatic amino acids ([Threonine](#), [Leucine](#), [Phenylalanine](#)). The use of the half and two rates of Kaunter changes the proceedings of the metabolism processes in an opposite way that is especially characteristic of two norms of given insecticide. Knowing the importance of these amino acids in the regulation of vegetate nitrogen balance, it is possible to make an assumption of more intensive

protein synthesis in plants with the use of a half and one norm of Phosphamide and one norm of Kaunter. The fact that the products of dissociation of the insecticides under the study take part in biosynthesis of amino acids is proved by the appearance of [Cysteine](#) as a result of their utilization, the latter being a kind of amino acid that contains sulphur (Phosphamide contains 29% of sulphur and Kaunter contains 33% of sulphur).

The Lysine contents in the plants has increased almost twice due to the use of two norms of Kaunter; this shows more intensive break in the metabolism in the considered case because Lysine is one of the amino acids that take part in regulation of this process.

As it is generally known, insufficient phosphorus nutrition of the plants leads to the abrupt increase of the contents of the major part of the amino acids, especially [Arginine](#) and [Proline](#).

Decrease and even absence of [Arginine](#) and [Proline](#) in all variants of the study apart from the implication of two Kaunter norms, affirms the sufficient phosphorus nutrition of the plants. It is possible to agree with the authors' opinion who presume the use of the pesticides to a certain extent as fertilizer. In particular, phosphorganic insecticides have turned out to be peculiar additional source of the phosphorus for the plants of winter wheat. But the application of two norms of Kaunter gives rise to the abrupt increase of [Arginine](#) and appearance of [Proline](#). It means that in this case the plants need some additional phosphorus nutrition. The introduction of double norms of phosphorus preparation however could possibly be more intensive phosphorus source for the plants. But here it is apparently found in some bound form, inapproachable for syntactic processes.

Subsequently, the use of phosphorganic insecticides in increased norms can cause the break of the nitrogen metabolism, oppression of the velocity of protein synthesis and accumulation of amino acids and amides in the unbound form at the initial phase of the ontogenetic development of the winter wheat plants which can dramatically affect the final result that is the quality of the grown grain. Exceptionally moderate use of the mentioned preparations for the plants at the

following concentrations (0,4 kg/ha of Phosphamide and 0,8 kg/ha of Kaunter) has shown the stimulating impact on the proceeding of the processes under the study.

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ADAPTIVE CAPACITY OF INTRODUCENTS IN BLACK SOIL

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The study was made about phenological characteristics of summer species as more sensitive in Black Soil Region. It has been shown an increase in the duration of flowering due to its earlier start and later at the end of the drought-tolerant plants.

Key words: phenological characteristics, introducents, duration of flowering

Introduction

Introduction and acclimatization of plants is an important theoretical and practical question of biology currently. Surviving of plants in their new areas depends on the conformity of the complex of external factors introducent's needs, on the norm of reaction to each factor and the aggregate of all stressors for the organism in introduction. Practically all annual plants in the Central Black Soil are introduced. Some plants ecological and biological features: the timing of flowering, fruiting,

reproductive capabilities, the duration of the life cycle are changed in the new climate conditions. Studies of these parameters from exotic species have neglected to evaluate their degree of adaptation to external factors. Some annuals marked by drought, frost - , gas resistance, which increase the possibility of their distribution in different climatic zones [1-3].

When you select promising species and varieties of plants for breeding and introduction to the culture should be guided by an analysis of the geographical distribution and the natural range of annual ornamental plants. The wide geographic range of the species studied includes the Central and Southern Europe, North and South Africa, all parts of America, Minor and Central Asia, and India. Types of African origin (*Lobelia erinus*, *flax macranthon*, *doroteantus margaritkovidny*) have brightly colored corolla, heat-loving enough, but drought-resistant. Individual American annuals: *Salvia brilliant*, Mexican *ageratum*, *petunia hybrid*, *marigold* and *rejected* (from Central and South America), *mimulus cardinal* (North America) and *yellow* (from South America), and *snapdragon* (Mediterranean origin) are freezing resistant. Types of American origin that grow in depleted soils are finely developed and profusely flowered as on black earth, so on urbanozem [4-6], and other infertile soils.

Analysis of phenology has showed accelerating the onset of flowering and increase its length due to the increase in the amount of effective temperatures in May and June in 2007 compared to 2006 (Figure 1-2). In some plants (with long flowering) *ageratum Mexican* (*Ageratum houstonianum* Mill.), *Snapdragons* (*Antirrhinum majus* L.), *lobelia petiolar* (*Lobelia erinus* L.), *Salvia brilliant* (*Salvia splendens* Ker Gawl.) with earlier flowering in 2007, it lasted until frosts, so increased the total duration of this phase [2]. Listed plants (with long flowering) quite drought resistant, the end and the duration of their flowering was largely determined not by moisture regime, and the timing of the first autumn frosts, so lengthened the period of their flowering. Plants of *Salvia brilliant* in our studies at sowing in mid-March have bloomed at the end of May. Marked acceleration of the onset of flowering, depending on an earlier reaching a certain sum of effective temperatures,

and the reduction of its duration due to lack of moisture in the spring and summer in 2008-2009 (Figure 1-2).

In 2008, due to more stringent weather conditions (drought and high temperature), on the one hand, there was a reduction of the duration of flowering in comparison of 2007 at *Dorotheanthus belidiformis* (Burm. f.) NE Br., *Lobelia erinus*, Mexican ageratum, petunia hybrid, *Salvia brilliant* to 30 days. A later date to achieve the required amount of effective temperatures in 2009 than in 2007-2008 and the lack of moisture in April (during planting and early planting in soil) has contributed to an even greater delay in flowering than in 2008 ageratum Mexican, snapdragon, *salvia brilliant*, petunia hybrid, *lobelia petiolar* [2].

The period from sowing to the beginning of flowering takes 2-3 months at *Lobelia erinus*, depending on growth conditions (temperature, humidity) and a seeds origin. *Lobelia* from seeds by local reproduction is characterized earlier onset of flowering: it blooms at 1.5 - 2 months after sowing. The plants grown from seeds from German are characterized the late onset of flowering (after 3 months) because of their more complex in terms of acclimatization in the Central Black Soil. Therefore, it is better to use in landscaping the plant material of local origin [7].

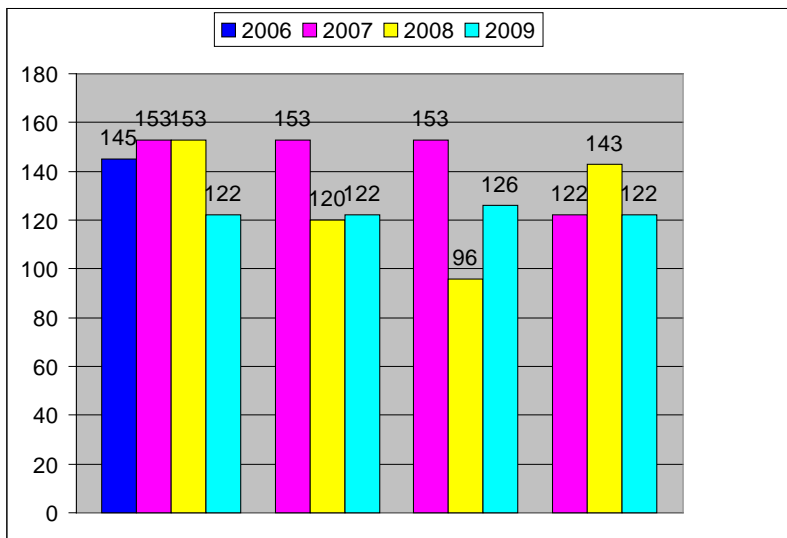


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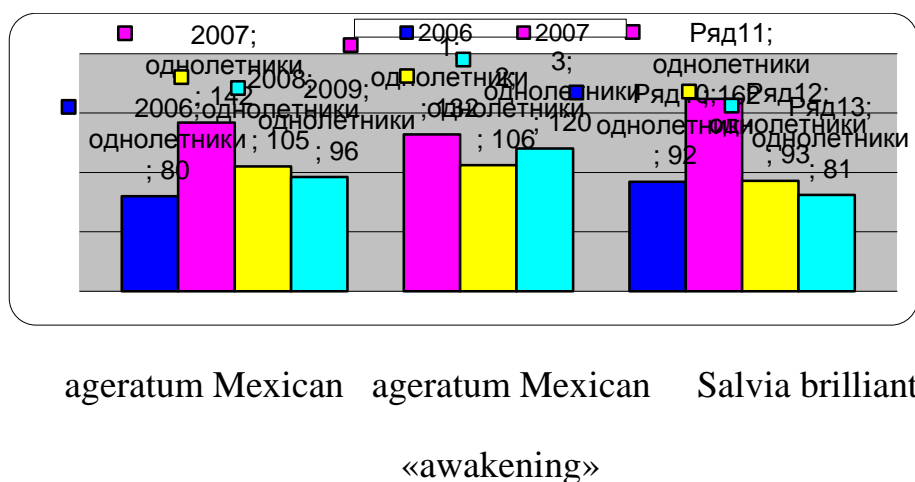


Fig. 2. Duration of flowering annuals ornamental plants

Some plants exhibit an ecological imbalance to weather conditions (high temperature, low humidity), which were occurred in 2007-2009. Petunia hybrid, salvia brilliant, snapdragon, mirabilis jalap are sufficiently responsive to changes in external factors. Mexican ageratum, salvia brilliant, lobelia erinus, petunia hybrid, snapdragons, calendula officinalis, China aster, marigold rejected, fine leaved, upright are fairly drought resistant and environmentally friendly plastic, able to blossom until the autumn frosts, can achieve their earlier flowering. Therefore these species are used in the landscaping of urban territory with areas of strong industrial pollution. Therefore they can be recommended to landscaping the grounds of industrial enterprises and areas of high development pressure and as a test object for monitoring.

Conclusion

Thus, the plant characteristics founded on the genotype (rate of reaction in each of them) were appeared phenotypically, in particular, the timing of flowering and seed maturation. Limits of normal reactions are identified by the genotype, so the new climatic conditions, the organism can not go beyond that, his adaptation occurs only in the normal reaction.

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ACTION OF COAL POWER INDUSTRY ON ENVIRONMENT

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The paper discusses the ecological problems resulting from burning of coals. Particular attention is given to the mercury content in coals and the environment pollution with it. It is proposed to minimize the use of coals by going to non-traditional sources of the thermal and electric power.

Key words: mercury, environment pollution, coal power, alternative sources of power

The power systems, utilizing coal, are thermoelectric plants, boiler houses of enterprises and organizations, as well as stoves for heating the private houses. The coal utilization results in pollution of the atmosphere, hydrosphere, soils, and biosphere. The accumulated and not utilized ash dumps pose the additional ecological problems.

The atmosphere is polluted with gases and smokes as well as with the dust from the surface of settlers and coal storages. Coal burning demands the oxygen from the near-earth layer of the atmosphere that depletes in oxygen the air space in the neighborhood of the thermal power installations. The hydrosphere and soils experience the action of waters from the ash dumps and precipitations from the atmosphere. The combined action of the polluted air, water, and soils results in the deterioration of the environment state quality.

In addition to the listed above pollutions, the coal burning liberates the heavy metals, among which mercury occupies a particular place. Mercury possesses unique properties: low melting temperature (-38.9°C) and high vapor pressure (boils at the burning temperature of 256.7°C). This indicates that at the coal burning temperatures mercury occurs only in the form of vapors of the elementary mercury Hg^0 . Due to these facts the most important property of mercury is its volatility. The removal of mercury into the gas phase from a high-temperature zone of a furnace is 98-99 % for the pulverized coal furnaces with dry removal of cinder [4]. When waste gases and dust (fly ash) pass through the apparatuses of gas scrubbing (scrubbers), the gas temperature decreases notably resulting in the precipitation of some portion of mercury. In work [1] it is noted that in this process about 50 % of mercury are retained. Similar results are reported in work [4], indicating that 50 to 70 % of

mercury are retained in the pulp and discharged into the settlers. This explains the presence of the metallic mercury in ash dumps, including those of the Far East thermal electric plants (TEP) [3].

The heating stoves of the private houses are, of course, not comparable with TEP in volumes of the coal been burned, but in them there are no apparatuses of gas purification, and all effluents from stoves enter the near-earth layer of the atmosphere. So in the period of the intensive stove stoking during the heating season it is simply difficult to respire in the districts of individual housing. It is especially characteristic of small and middle towns of Russia [2].

The average mercury content in coals of the World (so called “klarke”) is 0.1 g/t after [4]. Some coal basins and deposits are noted for higher contents of this element and are among the high-mercury ones. Such coals were discovered in Germany, USA, China, England, Ukraine, Russia, and other countries. Researchers note mercury as a highly coaliphile element. The Agency on the Environment Protection of the USA in the report on this problem notes that “the atmospheric emission of mercury from the coal burning on the territory of the country (annual supply of mercury into the atmosphere is 143.5 tons) is a real threat to the health of the USA population” [4]. The same situation has been revealed from the process of burning of the Donbas coals [4]: “As nobody cared of the ecology, when everyday burning of coals took place, the widespread dispersion of mercury in the atmosphere, soils, and waters resulted by present in the very difficult ecological problems”.

Paper [4] presents the data on the mercury content of some coals of Primorye. Brown germanium-bearing coals of Khanka basin contain mercury up to 10-15 g/t, and coals of Shkotovskoe deposit of Uglovka basin – about 6-8 g/t. It is two orders of magnitude higher than the klarke values.

On the example of Artyom Town, that for many decades has been mining and using the coals of the Uglovka brown-coal basin, we can calculate the mercury possible emission into the environment. In the Town there are the thermal electric plant that burns about 4320 tons of coal a day, small boiler houses, most of which burn fuel oil, and private houses burning about 50 000 tons of coal during the heating

season (7 months). Calculation for the TEP: with the average mercury content of 0.1 g/t burning of 4320 t of coal a day results in the mercury amount of 157680 grams a year (365 days). Dividing this value in half (one half goes to wastes) we obtain 78 kg 840 g of mercury discharged into the atmosphere. With high chimneys, dispersing pollutions over the near-earth layer of the atmospheric air, the mercury amount, settled out in the town, is by far less, but in any case it is settled out and accumulated in the environment.

The stoves of private houses discharge the pollutions without any purification directly into the near-earth layer of the atmosphere. Burning of 50 000 tons of coal during the heating season results in 5 kg of mercury emission with its average contents of 0.1 g/t. The Artyom TEP together with the private houses of the Town discharge into the environment about 84 kg of mercury a year. As it is noted in this paper, a part of the coals, used by the Town thermal power, bears high mercury contents, and then the values obtained should be multiplied by several times.

Our data and calculations show that the problem of the environment pollution with mercury, released through the coal burning, should be concerned in earnest. It is necessary to study for this matter the coals, used in the thermal power, and ash dumps and, first of all, to maximally minimize the share of the coal thermal power in Primorye and other regions that use the coals with high mercury contents.

To decrease the mercury supply to the environment from the coal burning it is necessary to improve the quality of the electric power used by the population, to convert the TEP aggregates to gas, to cool the technical water in the thermal plants and not in the water-cooling towers, to widely publicize and apply non-traditional power sources (solar, wind, and others), and to use modern warmth-keeping materials, in particular in private houses. Development of the wind and solar power is very perspective for Primorye. On the continent-ocean boundary the wind generators will always receive the necessary forces from the air mass movement, and in a number of the sunny days in the year Primorye occupies one of the first places in Russia. By the way, in neighboring China the solar power is developed rather intensively and efficiently.

Going of thermal electric plants to gas solves the problem of the progressively increasing ash settlers. With additional study of their composition and properties the question must be posed about their utilization and recreation of the territories occupied by them. This is all the more topical, because near the Artyom TEP in Muravyinnaya Bay they begin to build a gambling zone of Primorye. In the case if the ash dumps are broken, their contents will be transported by the river flow to the sea area, and this will be the deterrent for inviting the investments and tourists.

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**ABOUT ALIEN FLORAS OF THREE ADMINISTRATIVE DISTRICTS
OF THE REPUBLIC OF MORDOVIA**

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Introduction

One of the main stages of regional flora researching is the revealing of its species composition. It is difficult to achieve the complete revealing of flora that occupies a large area because it need a large team of florists and considerable time to research the whole study area. In this case, the method of local floras is most convenient and efficient. It allows you to more complete reveal the species composition in study area that as a result enables reliable compare the studied local floras.

Recently, great attention of florists is given to research of alien flora. Among them, the invasive plants are the most interesting. These are plants which most aggressively invade to natural plant communities. Black Data Book of the flora of Middle Russia [1] includes 52 most active invasive species. Later, Black Data Book of the Tver' region [2] was published; synopsis of the invasion flora of the Voronezh region was prepared [3]; biology and ecology of invasive plants are studied [4–6 [et al.](#)]; alien floras lists of natural [7] and artificial [3, 8] areas are continuously supplemented.

The Republic of Mordovia has an area of 26 121 km² and it is located in the center of the East European Plain between 42°11' и 46°45' E and 53°38' и 55°11' N. Most part of Mordovia is located in the forest steppe of Volga Uplands which is goes to the forest province of the Oka-Don Lowland in west part of the region. Republic of Mordovia includes 22 municipal districts and 1 urban district (Saransk) [9].

Results and discussion

In this paper we summarize all the presently available data that supplements information of the work "Vascular plants of the Republic of Mordovia (a synopsis)" [10] for the 3 administrative districts of Mordovia: these are Lyambir' district, Romodanovo district, Temnikov district. By 2010, alien floras of the declared above districts had included, respectively, 132 (18.1% of the all district flora), 143 (21.2%) and 179 (19.3%) of alien vascular plant species. The follow floristic studies in

Romodanovo district [11] and in Temnikov district [8, 12] have allowed to supplement these alien floras. Alien flora of the Lyambir' district not specifically was investigated.

In 2013, new alien vascular plant species for floras of the Lyambir' district and of the Romodanovo district were found. Floristic findings are confirmed by herbarium specimens (GMU – Herbarium of the Mordovian State University) and/or by the data of GPS-navigator. List of floristic findings is below.

Hordeum jubatum L. (*Gramineae*): 1) Lyambir' district, crossing loop of 46 km in Krivozerye village, on railroad embankment, 16.07.2013, E. Cherepanova, A. Khapugin (GMU; GPS); 2) Lyambir' district, on side of the highway in the 0.5 km to south-west from Khadzhi village, 30.06.2013, A. Khapugin, E. Cherepanova (GPS); 3) Lyambir' district, on the side of highway in the 1.0 km to west from Alexandrovka village, 15.09.2013, A. Khapugin, E. Cherepanova (GPS).

Hemerocallis fulva (L.) L. (*Liliaceae*): 1) Lyambir' district, Krivozerye village, in the roadside strip in 10 m from railroad embankment, 16.07.2013, E. Cherepanova, A. Khapugin (GMU; GPS).

Ulmus pumila L. (*Ulmaceae*): 1) Lyambir' district, on the side of highway in the 0.1 km to west from Alexandrovka village, 16.07.2013, E. Cherepanova, A. Khapugin (GPS).

Physocarpus opulifolius (L.) Maxim. (*Rosaceae*): 1) Lyambir' district, in the roadside strip near the highway on western border of Alexandrovka village, 16.07.2013, E. Cherepanova, A. Khapugin (GPS).

Lupinus polyphyllus Lindl. (*Fabaceae*): 1) Lyambir' district, railroad embankment in the neighborhood of Bol'shaya Elkhovka village, 22.05.2013, T. Silaeva, E. Cherepanova (GMU).

Oenothera biennis L. (*Onagraceae*): 1) Lyambir' district, crossing loop of 46 km in Krivozerye village, on railroad embankment, 16.07.2013, E. Cherepanova, A. Khapugin (GMU; GPS); 2) Lyambir' district, on side of the highway in the 0.5 km to south-west from Khadzhi village, 15.09.2013, A. Khapugin, E. Cherepanova (GPS); 3) Lyambir' district, railroad embankment in the neighborhood of Bol'shaya

Elkhovka village, 22.05.2013, T. Silaeva, E. Cherepanova (GMU).

Plantago arenaria Waldst. et Kit. (*Plantaginaceae*): 1) Lyambir' district, crossing loop of 46 km in Krivozerye village, on railroad embankment, 16.07.2013, E. Cherepanova, A. Khapugin (GMU; GPS).

Bidens frondosa L. (*Compositae*): 1) Romodanovo district, shore of the pond on western border of the Salma village, 21.07.2013, A. Khapugin, N. Gladunova (GPS).

Thus, as a result of floristic investigations, alien floras of Temnikov district, Lyambir' district, Romodanovo district supplemented presently to 186, 139 and 176 species, respectively.

Natural conditions of Romodanovo district and Lyambir' district have similar features: forests occupy a small area of the whole territory, which is a slightly hilly terrain. We attempted to compare alien floras of these districts with each other and with the alien flora of Temnikov district which is well investigated. Moreover, large proportion of "forest" species is typical for Temnikov flora unlike of the other two floras. We used the Czekanowski-Sørensen index [13] (1).

$$I_{cs} = \frac{c}{a+b}, \quad (1)$$

where a – number of species in the first flora;

b – number of species in the first flora;

c – number of species common to both compared floras.

As a result of comparison, it was shown that alien floras of Temnikov and Lyambir' districts have most similarity (fig. 1). It should be noted that adventive flora of Lyambir' district includes the smallest number of species but adventive flora of Temnikov district includes the most number of species from all compared floras.

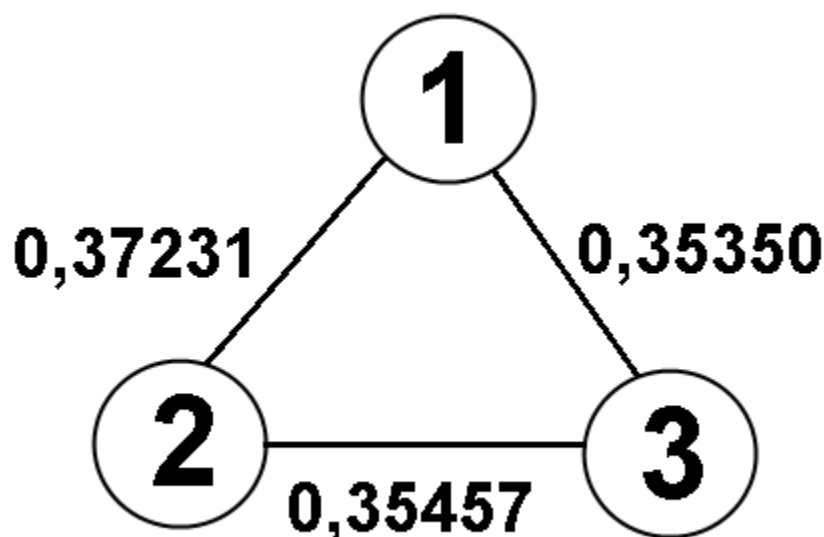


Fig. 1. Czekanowski-Sørensen index for alien floras of Temnikov district, Lyambir' district and Romodanovo district; 1 – Lyambir' district, 2 – Temnikov district, 3 – Romodanovo district

Conclusions

Thus, taking into account present supplements flora of Lyambir' district includes 139 alien species; flora of Romodanovo district includes 176 alien species; and flora of Temnikov district includes 186 alien species. It was shown that alien floras of Temnikov district and Lyambir' district are most similar in species composition ($I_{Cs}=0,745$).

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Orlova J.S.

**PHYTOPLANKTON RIVER KALYSHA. PART I. SPECIES
COMPOSITION AND ECOLOGICAL AND GEOGRAPHICAL FEATURE**

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Kalysha River begins at the northern boundary of the National Park "Smolny", divides it in two, and at the southern boundary the territory's runs into the river Alatyr. The catchment area of the river basin Kalysha make up is 41.6% of the territory of the national park. The river length is 32.7 km (including temporary stream flows), which allow for relegate her to the category of small rivers.

Samples of the phytoplankton were collected from May to July 2011 in the four cross-sections of the river Kalysha. Methods of collecting and processing the material was conformed generally accepted approaches to the study of algae [1, 2].

As a result of research in the phytoplankton of the river Kalysha detected 50 species, varieties and forms of algae from 30 genera, 20 families, 11 orders, 9 classes and 7 divisions (Chlorophyta, Bacillariophyta, Cyanophyta, Chrysophyta, Xanthophyta, Euglenophyta и Streptophyta) (table 1).

Table 1

The taxonomic composition of phytoplankton of the river Kalysha

Division	Number				
	classes	orders	families	genera	species, varieties and forms

Cyanophyta	1	1	1	1	1
Chrysophyta	1	1	1	1	1
Bacillariophyta	1	3	5	11	24
Xanthophyta	1	1	1	1	1
Euglenophyta	1	1	1	2	5
Chlorophyta	3	3	9	12	14
Streptophyta	1	1	2	2	4
Итого:	9	11	20	30	50

Among the divisions of detected algae by number of species was in the lead department Bacillariophyta, which included 48.0% of the species composition of the algae of the river. Subdominants by number of species was the department Chlorophyta, which included 28.0% of the species composition of phytoplankton of the river. Representatives of the departments of Cyanophyta, Chrysophyta, Xanthophyta, Euglenophyta and Streptophyta did not make a significant contribution to the formation of the species composition of algal flora and en bloc accounted for less than 25.0% of all detected species. The biggest species-rich is different genus *Navicula* and family of the same name *Naviculaceae*, representatives of which make for more than 20.0% of the species composition of phytoplankton of the river.

Throughout the study period, the number of species in the lead Bacillariophyta, constituted 52,8-80,0% of the species composition of phytoplankton of the river (Fig. 1). In the role of subdominants often acted Chlorophyta (22,2-30,4%) and Euglenophyta (4,3-20,0%).

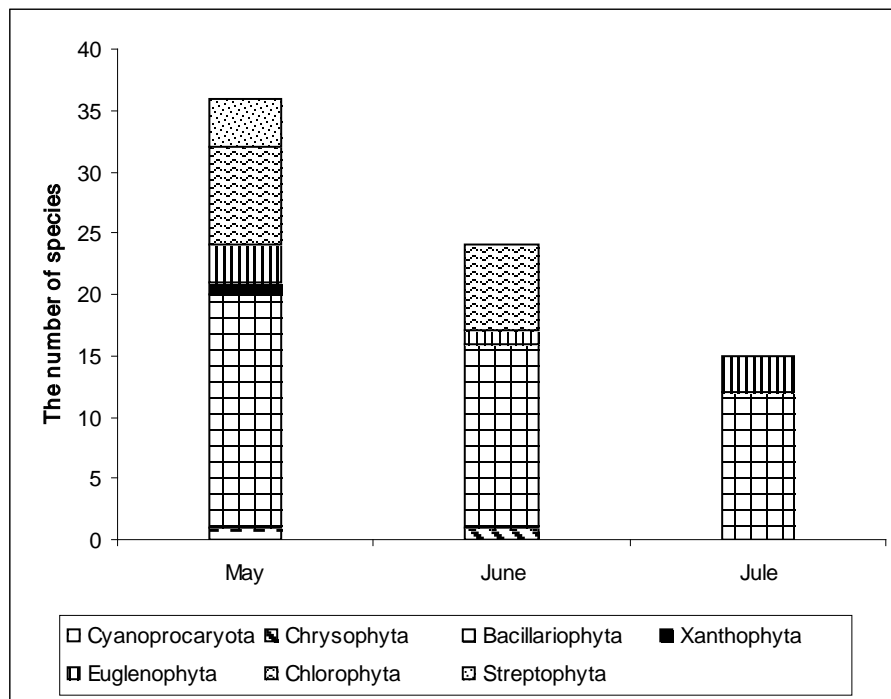


Fig.1. The ratio of divisions in number of species of algae in the phytoplankton of the river Kalysha

Taxonomic diversity and number of species of algae in the river Kalysha decreased from May to July, with the increased proportion of diatoms, which may be due to the dry summer. Thus, during the season there was a change of study diatomic-green complex on the diatomic-euglenophytes.

When driving along the river, from its source to the mouth was also a decrease of the number of species of algae and increasing the share of diatoms (39,3-90,0% of the species composition of phytoplankton). Taxonomic diversity of phytoplankton remained practically the same throughout the river, a few coming down near the village of Vasilevka (fig.2).

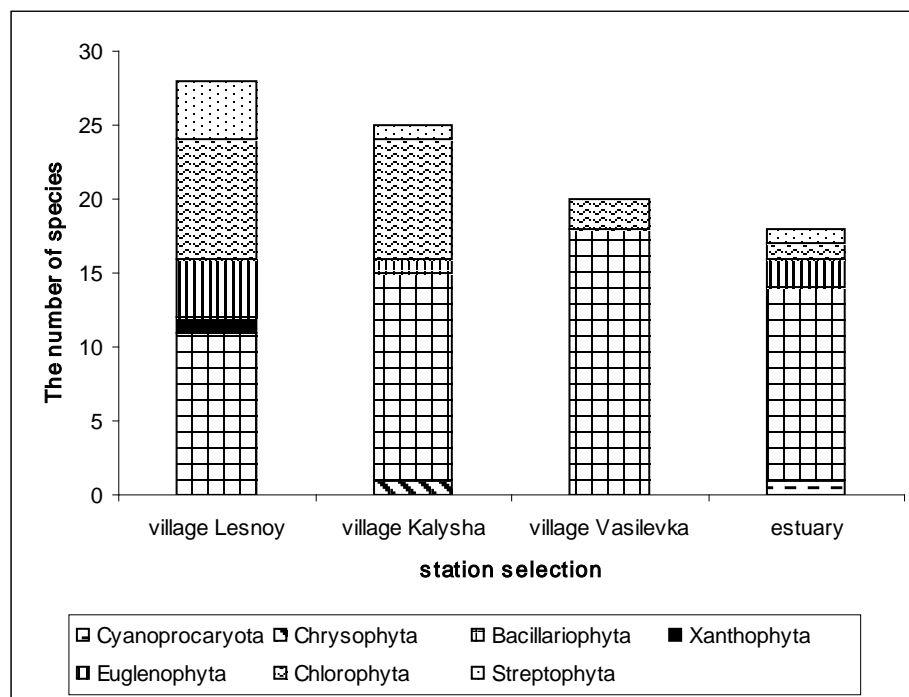


Fig.2. Relation of divisions in number of species of algae in the phytoplankton Kalysha River from the headwaters to the estuary

At the source of the river near the village Lesnoy and the middle near the village Kalysya number of species dominated by diatoms, subdominirovali Chlorophyta, while in the lower reaches of the estuary and the gradual replacement of Chlorophyta and increase the role of Euglenophyta.

When comparing the taxonomic composition of phytoplankton in the river Kalysha algal flora of the other rivers of the Republic of Mordovia revealed a difference in the ratio of green algae and diatoms. So for algal communities Alatyr rivers, Insar and Nuya preponderance in the species composition of green algae [3,4,5], whereas in the phytoplankton of the river is dominated by diatoms Kalysya. Perhaps this is due to the fact that the river flows through Kalysya forest zone and its channel is in a shadow, which negatively affects the development of green algae.

In addition to the species composition was also analyzed the ecological and geographical characteristics of phytoplankton of the river Kalysha are presented in Table 2.

Table 2

**Ecological and geographical characteristics of phytoplankton in the river
Kalysha**

Group	Number of taxonomic unit	Percent	Group	Number of taxonomic unit	Percent
Sensu ecotope			In relation to salinity		
planktonic	27	54,0	halophobe	1	2,1
benthic	9	18,0	indifferent	41	87,3
litoral	9	18,0	halophile	5	10,6
fouler	1	2,0	Bcero	47	100,0
planktonic-benthic	4	8,0			
Bcero	50	100,0			
In relation to pH			Sensu expansion		
indifferent	13	46,4	Cosmopolitans	47	94,0
alkaliphile+alkalibiont	15	53,6	Boreal	3	6,0
Bcero	28	100,0	Bcero	50	100,0

Thus, phytoplankton River Kalysha characterized as plankton, cosmopolitan, indifferent in relation to salinity and pH of the medium, part of the dedicated to the alkaline conditions of the environment. On ecological and geographical characteristics of phytoplankton of the river Kalysha similar to phytoplankton other rivers.

In conclusion we can say that the algal flora of the river Kalysha is different from the algal flora of the other rivers in the taxonomic structure, which is associated with the flow of the river landscape conditions.

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Berezhniak Ie.M., Gomenuk M.S.

**ECOLOGICAL CONDITION OF LANDSCAPES IN GOLOSIYIV
PARKLAND AREA OF KYIV**

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The paper analyses environmental condition and characteristic problems of Golosiyiv Parkland area in Kyiv. Regular events of soil erosion occurring within the area cause soil losses and gully development which in their turn instigate the silting of ponds and their overgrowth with bog plant communities.

Key words: *forest ecosystem, slopes, gullies, silting of ponds, overgrowth (filling) reservoirs with marshy vegetation, rills, soil detachment (loss), conservation structures.*

Introduction. Golosiyiv forest in Kiev is situated within Kyiv Forest-Steppe Prydniprovya (the Dnipro catchment area) in the north-western part of the Kyiv loess plateau. It is characterized by a noticeable development of soil erosion processes. Parkland geosystems are noted for the high intensity of materials migration. Local land areas suffer from gulling and are covered by sod-podzolic, light gray and gray forest soils formed under mixed forests of hornbeam and oak [1].

Parkland zone closed landscapes are characterized by the presence of numerous forest glades, isolated from each other by thick forest plantings, which ensure coolness and stillness in the summertime. Semi closed landscapes are characterized

by the combination of forest tree groups, glades, and water-filled reservoirs, but they lack certain accentuated features, like separate trees of good growth and development, blossoming shrubs, etc. Open landscapes are well exposed to sunlight, so that the eyes of an observer can envelop a large area. The glades are occupied by artificially sown grasses and have the mirrors of ponds. Such artificial grasslands are surrounded by the forest trees. Artificial plantings in such land areas (landscapes) are up to 40–50%. Water filled areas are represented by five ponds in the Gorikhovatka basin, which are connected with each other by conservation structures and streamlets. This water-filled system crosses the entire parkland area from the north west to the east and serves as a natural borderline between the natural forest and parkland areas (landscapes).

Forest landscapes in Golosiyiv area are characterized by well developed geoplasticity of gullies. The area needs the practices of land stabilization and soil amendment. Without such practices, the growth of gullies might cause the destruction of houses, roads, and conservation structures situated along the streets: Colonel Potekhin, General Rodimtsev, Heroyiv Oborony, Maxim Rylsky, Vasyl Blakytyn, and the premises of the NUBiP University of Ukraine (buildings № 2, 3, 4, and 10) (Fig.1).



Fig. 1. Stages of Gulling in Golosiyiv Forest Caused by Non regulated
Surface Runoff

Gullies are the consequences of accelerated erosion and their area is continually on the increase. The also affect the surface runoff regime and parkland hydrology in general, lowering the watertable. That is why the research activities parkland area must be complex and complimentary, capable to predict and prevent the unexpected dangerous situations.

Aim and objects of research. The aim of this research activity was to evaluate the ecological condition of forest and hydrology ecosystems in Golosiyiv parkland in Kyiv. The measurement were conducted of the processes of soil erosion on the slopes in Golosiyiv, including soil detachment (loss), silting, and overgrowth with bog vegetation of the entire cascade of Gorikhyvate ponds.

Soil and geobotanic investigations were carried out in the field and at the laboratories, employing standard research techniques and analytical procedures. The key objects of research included a complex slope of north-western aspect, and Gorikhuvate ponds were situated at the foot of the slope.

Research results. Potential soil erosion hazard (PSEH) is composed of the following agents:

$$PSEH = f(C \times R \times S \times G \times P \times U), \quad (1)$$

where C = climate conditions; R = topography (relief); S = soils, G = geologic situation; P = plant (vegetation) cover, and U = the character of land use in the area.

Climatic conditions: the destructive force of a rain in the rainfall period of the year depends on the amount, intensity, and duration of a given rainfall:

$$\Delta = i\sqrt{t} \quad (2)$$

where Δ = erosion “force” of a rainfall; i = rainfall intensity (rate) in $\text{mm} \times \text{min}^{-1}$; and t – rainfall duration in min.

According to the statistics data, the average value of Δ for Kyiv region is within 3 to 5, which corresponds a moderately heavy rain, causing moderate soil erosion damage.

Land Topography included the following indexes: slope steepness, slope shape, and erosion basis depth. Slope aspect is north-western. The slope which we investigated was of non-uniform steepness. So we divided it into several parts. On each of the parts we measured slope steepness (Brandis eclimeter), and length of the slope. The values are as follows: $l_1 = 29$ m; $\alpha = 5^\circ$; $l_2 = 26.4$ m; $\beta = 11^\circ$; and $l_3 = 163.6$ m; $\gamma = 18^\circ$. Erosion basis depth is of 34.9 m, catchment area – of 1811 m^2 .

Soil conditions. Dominating soil mapping unit was sod-slightly podzolic sandy light loam soil. Soil erosion intensity is affected by such soil characteristics as bulk density and water infiltration rate. Soil bulk density was different on different slope fragments: $1.38 \text{ g} \cdot \text{cm}^{-3}$ in the upper, $1.30 \text{ g} \cdot \text{cm}^{-3}$ in the middle, and $1.36 \text{ g} \cdot \text{cm}^{-3}$ in the lower portion. Infiltration rate was of the following values: $0.53 \text{ mm} \cdot \text{min}^{-1}$, $1.15 \text{ mm} / \text{min}^{-1}$, and $0.48 \text{ mm} \cdot \text{min}^{-1}$. Such data allow concluding, that

with rain intensity over $0.5 \text{ mm} \cdot \text{min}^{-1}$, there will be the formation of surface runoff on the slope, which might cause soil detachment and loss.

The thickness of *vegetative cover*, determined using Ramensky's frame, also affects the losses of soil and water on the slopes. On the slope under investigation, the thickness of soil covering by vegetation was low. The slope was covered by destructed forest litter – thinned out with singular grass species on the surface of the soil of *Impatiens parviflora*, *Asarum europaeum*, *Stellaria media*, and *Urtica dioica*. The vegetation is situated owing to the wide pathways formed by the recreants.

Soil detachment was measured using Sobolev's technique – by the volume of the rills (Fig.2) [6]. Along the lines of preferential flow, measuring areas were organized, perpendicular to the lines, 1 m wide and 25–100 m long, which enveloped all the portions of the slope. The distance between such areas was 50 m on the level slope, and 20–25 m on the slope inflections.

On each of the erosion measurement areas we measured the depth (h) and width (L) of each rill (a small gully) with a precision up to 0.5 cm (Fig. 2).

Further on, we calculated the transection area of a given rill and the volume of detached soil (along the measured rill length and determined the volume of detached soil (V) on each measurement profile, using the formula:

$$V = \frac{W \times h}{2} \times l \text{ (cm}^3\text{)} \quad (3)$$

where l = rill length on each measurement profile, m, W = rill width, m, and h = rill depth, m.

For the three parts of the slope, we obtained the following values:

in the upper portion: $V_1 = (1,2 \times 0,07 \times 0,1 \text{ m}) + (2,2 \times 0,13 \times 0,09 \text{ m}) + (10,7 \times 0,17 \times 0,12 \text{ m}) / 2 = 0,0084 \text{ m} + 0,0257 \text{ m} + 0,2183 \text{ m} = 0,2524 / 2 = 0,1262 \text{ m}^3$

in the middle portion: $V_2 = (9,3 \times 0,09 \times 0,1 \text{ m}) + (5,4 \times 0,17 \times 0,09 \text{ m}) + (3,3 \times 0,13 \times 0,10 \text{ m}) / 2 = 0,0837 \text{ m} + 0,0826 \text{ m} + 0,0429 \text{ m} = 0,2092 / 2 = 0,105 \text{ m}^3$

and in the lower portion: $V_3 = (2,8 \times 0,12 \times 0,28 \text{ m}) + (5,2 \times 0,36 \times 0,13 \text{ m}) + (3,0 \times 0,47 \times 0,13 \text{ m}) / 2 = 0,0941 + 0,2434 + 0,1833 / 2 = 0,5802 / 2 = 0,260 \text{ m}^3$

The volume of detached soil between the profiles is determined for each rill. Total volume soil loss from the measurement area was determined as a sum of areas between all measurement profiles. Further on we calculated the weight of the soil detached as result of soil erosion by multiplying any of the obtained soil volume by the three already mentioned portions of the slope area, the results were as follows (in tons):

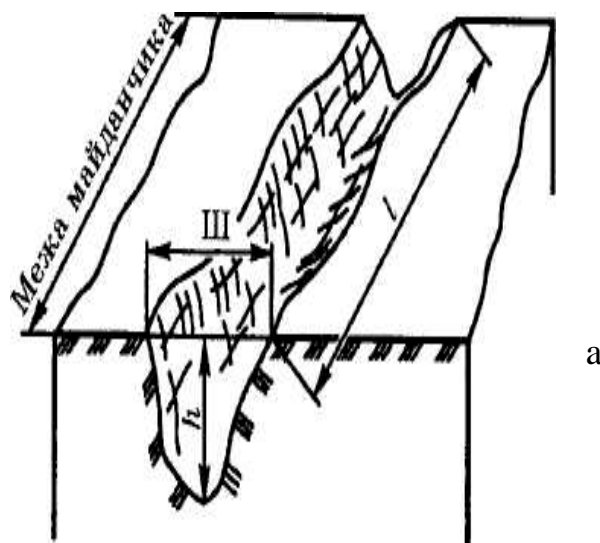


Fig. 2. Measurements of the rills

$$V_{(\text{weight})} (\text{I}) = 0,1262 \text{ m}^3 \times 1,38 \text{ t/m}^3 = 0,1742 \text{ t}$$

$$V_{(\text{weight})} = 0,105 \text{ m}^3 \times 1,30 \text{ t/m}^3 = 0,1370 \text{ t}$$

$$V_{(\text{weight})} = 0,260 \text{ m}^3 \times 1,36 \text{ t/m}^3 = 0,3536 \text{ t}$$

Total weight of the soil loss as a result of erosion soil detachment was of 0.6648 t. Catchment area corresponding to this value was: $8,5 \times 213 \text{ m} = 1811 \text{ m}^2$.

The results obtained were expressed in tons per hectare of soil loss. As one hectare equals $10,000 \text{ m}^2$, the catchment area is of 0.1811 ha. Soil loss in metric tons per hectare will be $(0,6648 \text{ m} \times 1,0 \text{ ha}) / 0,1811 \text{ ha} = 3,67 \text{ t ha}^{-1}$.

For environmental hazards assessment, the following practical scale, proposed by M.K. Shikula (1973), had been recommended [6] (Table).

Erosion Soil Loss Intensity Scale (M.K. Shikula et al, 1973) [6]

Soil loss, t/ha·yr	Grade of Soil Erosion
Less than the rate of soil formation which is 2–3 t/ha·yr	Absent
3–6	Weak
6–12	Moderate
12–24	Great
24–60	Very great
over 60	Catastrophic

We, therefore, evaluate the extent of soil erosion on the investigated slope area to be weak. According to M.M. Zaslavsky [2], soil erosion caused drought in soil environment, SOM losses, nutrient element losses, and total substantial reduction of soil productivity. Soil erosion also causes the silting of reservoirs and, as a result the desertion of small rivers and the general worsening of hydrological situation in the area. Fertile land areas may be covered by erosion sediment a material of lesser fertility. Such a phenomenon is often observed in the lower portions of the slopes and on the floodplains.

Our research activities within the parkland area, on the objects of hydrology, showed that the first pond, still ten years ago, was a real pond, with well developed characteristic features. As a result of rapid silting and water area reduction, the pond gradually began to transform into a bog area. The greater part of water area disappeared under the specific vegetation [3]. A.P. Olkhovich et al [5], have shown that the plant diversity in the vegetative cover included 16 hydrophyte species, the majority of which were represented by helophytes 12 species. The representatives of this group form larger and smaller associations, whereas uniformly distributed are only 2 species - *Scirpus lacustris* and *Butomus umbellatus* characterized by an excessive growth rate (Fig. 3).



Fig. 3. Silting and overgrowth of Gorikhuvate Ponds

The associations of *Polygonum amphibium*, which during blossoming look very aesthetically, cover the bulk area of the reservoirs. According to biotesting and ecotoxicological investigations, the water in the pond is not toxic [4]. This is accounted for by the presence in the pond's vicinity of small shallow reservoir, situated to the west of an artificially erected dam, which has been overgrown with different helophyte species – six species in all. Such vegetation creates a potent water filter which purifies the water inflowing into the first reservoir. But the vegetation itself becomes stunted as a result of this. Its viability becomes lower as it fulfills its water purifying function.

By the plant indicators present in the reservoir, the latter can be classified as slightly polluted, with low movability, overgrowing with bog plant species and silted by the bottom deposit material. A great amount of fine earth soil material detached by surface runoff fills the pond (Fig. 3). We, therefore, recommended the protection of existing phytocaenoses and the inclusion of those species which are resistant to pollution, like *Typha latifolia*, reeds *Trapa natans*, *Acorus calamus*, *Juncus bulbosus*, etc. to improve the anthropogenically deteriorated biodiversity of Gorikhuvate ponds. Such plant species will improve water quality and increase the biodiversity and environmental condition of the reservoirs.

Conclusion. To improve ecological condition and to reduce soil erosion within the area of Golosiyiv forest in Kyiv, it is necessary to introduce engineering practices, including conservation structures (drop structures, chutes, earthen dams, sediment

storage dams, grade stabilization dams, etc), which will intercept and concentrate surface runoff as well as divert it beyond the slopes.

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**CHEMOTACTIC HYPOTHESIS OF FORMATION
OF SYNAPTIC CONNECTIONS**

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*There has been proposed a hypothesis of formation of new synaptic connections,
playing the key role for long-term memory.*

Keywords: synaptic connections, a neurotransmitter, metabotropic receptor, second messengers, protein NGF, receptors LNGFR and TrkA.

Modern ideas about the molecular mechanisms of formation of long-term memory is based on the concept that the experience gained is accompanied by the expression of a wide range of new proteins with subsequent structural changes in synaptic contacts between cells. How does the formation of new synaptic connections, which play a key role in the formation of long-term memory? On the basis of the known facts we have proposed a hypothesis that can reveal one of the aspects of this complex phenomenon. For its justification were used the following data [1-6]:

1. In experimental studies on rats showed that the number of synapse increases with experience.

2. Movement of neurotransmitters in neuronal-gial cracks affect the localization of neuroreceptors. Receptors displaced from the synaptic cleft, are clustered in quasi-stationary points, forming a mosaic of metabotropic receptive neuron clusters (ISC).

3. Mediators interfering outside of synapses is controll by local conformations IRAs.

4. At introduction serotonin patients of schizophrenia mark improvement in memory and attention.

5. Changes in serotonin activity leads to disruption of synaptic plasticity of neuronal connections and imbalance as a consequence, the development of neurodegenerative diseases.

6. Serotonin receptors are metabotropic as (5 -HT 1,2,4,5,6,7) and ionotropic (5 -HT 3). Moreover, 5-HT 1.5 reduces the cellular level of cAMP , a 5-HT 4, 6, 7 - increases it. 5 - HT 2 receptors enhance the cellular level of IP3 and DAG.

7. Agonists of the 5-HT 2A receptors lead to improvements in mood, physical and mental activity, to improve associative and creative thinking.

8. Mosapride (an agonist of 5-HT 4) promotes neurogenesis in the gastrointestinal tract.

9. SSRIs eliminates the cognitive dysfunction caused by diabetes.

10. Formation in the rat alimentary reflexes accompanied by increased levels of RNA in the nucleus and cytoplasm.

11. In the formation of conditioned reflexes, increases the degree of DNA methylation of the brain. Hypermethylation of CpG- islands in promoter regions of genes leading to stable transcriptional repression. Repression of transcription in this case is mediated by the methyl CpG binding proteins that bind to methylated CpG-dinucleotides.

12. Inhibition of protein PP1 reduces memory problems.

13. CaM- kinase phosphorylates CREB (cAMP -dependent transcription factor) for a few seconds after the flow of Ca^{2+} .

14. For genes whose transcription is regulated by CREB, include c-fos, BDNF, NGF, VGF (proteins involved in the processes of memory).

15. Proved the role of CREB in neuronal plasticity and long-term memory.

16. Nerve growth factor (NGF) causes neurite outgrowth: branching and promotes their little elongation. NGF binds to, at least, two classes of receptors: LNGFR and TrkA.

17. The trophic effects of NGF can be transferred to developing neurons in the form of retrograde transport of NGF from nerve terminals in the cells. NGF actively trapped in the nerve terminals and transported retrogradely to the soma.

18. If NGF is administered to adult rats, they improve performance of spatial tasks.

19. VGF - a protein involved in regulating energy homeostasis, metabolism, and synaptic plasticity. VGF protein expression induced neurotrophic factors NGF, BDNF and neurotrophin -3. Reduced expression of VGF is noted at Alzheimer's disease, the development of which is a loss of long-term memory.

Proceeding from the above, it can be assumed that the passage of the pulse along the axon to the terminal in the synaptic cleft, the neurotransmitter is released, which interacts with the postsynaptic membrane and partially washed out in neuroglial slot. There it reacts with metabotropic receptors on neighboring neurons. Under the action of neurotransmitter receptor conformational changes occur, which increases the

sensitivity to the mediator (perhaps these changes underlie the formation of a temporary connection between the two groups of neurons in short-term memory). Metabotropic receptor sends a signal into the cell, and amplifies it repeatedly. These receptors are linked to G- protein, which can increase or decrease the concentration of second messengers (cAMP, inositol -3- phosphate (ITP), diacylglycerol (DAG)). By increasing the intracellular level of cAMP activated protein kinase A, which moves into the nucleus where phosphorylates and thereby activates CREB. Activated CREB binds to CRE- promoter portion, wherein genes are transcribed starting BDNF, NGF. With a decrease in the level of cAMP protein kinase A is inactive, does not phosphorylate CREB and triggers the synthesis of proteins. By increasing the content of ITP increases the concentration of endogenous Ca^{2+} , and DAG - exogenous. DAG and Ca^{2+} activated CaM-kinase. It phosphorylates CREB, which activates the synthesis of neurotrophins. CAM kinase also activates DNA methyltransferase.

DNA methylation is a methyl group to join cytosine in the CpG- dinucleotide cytosine at position C5 ring. Hypermethylation of CpG- islands in promoter regions of genes leading to stable transcriptional repression. By repressor proteins include methyl CpG binding proteins. Perhaps it also includes a protein PP1. Since the RNA content is increased, many of the genes disinhibited. Therefore, it can be assumed that proteins encoded by genes activated responsible for the formation of synapses. Ca^{2+} also activates phosphodiesterase which cleaves cAMP to AMP. This leads to the activation of neurotrophin synthesis is only one way. NGF is a gap in neuroglial and binds with two classes of receptors: LNGFR and TrkA. NGF actively trapped in the nerve terminals and transported retrogradely to the soma. There it acts on the expression of VGF protein and other proteins involved in the formation of synapses. VGF protein involved in regulating energy homeostasis, metabolism, and synaptic plasticity.

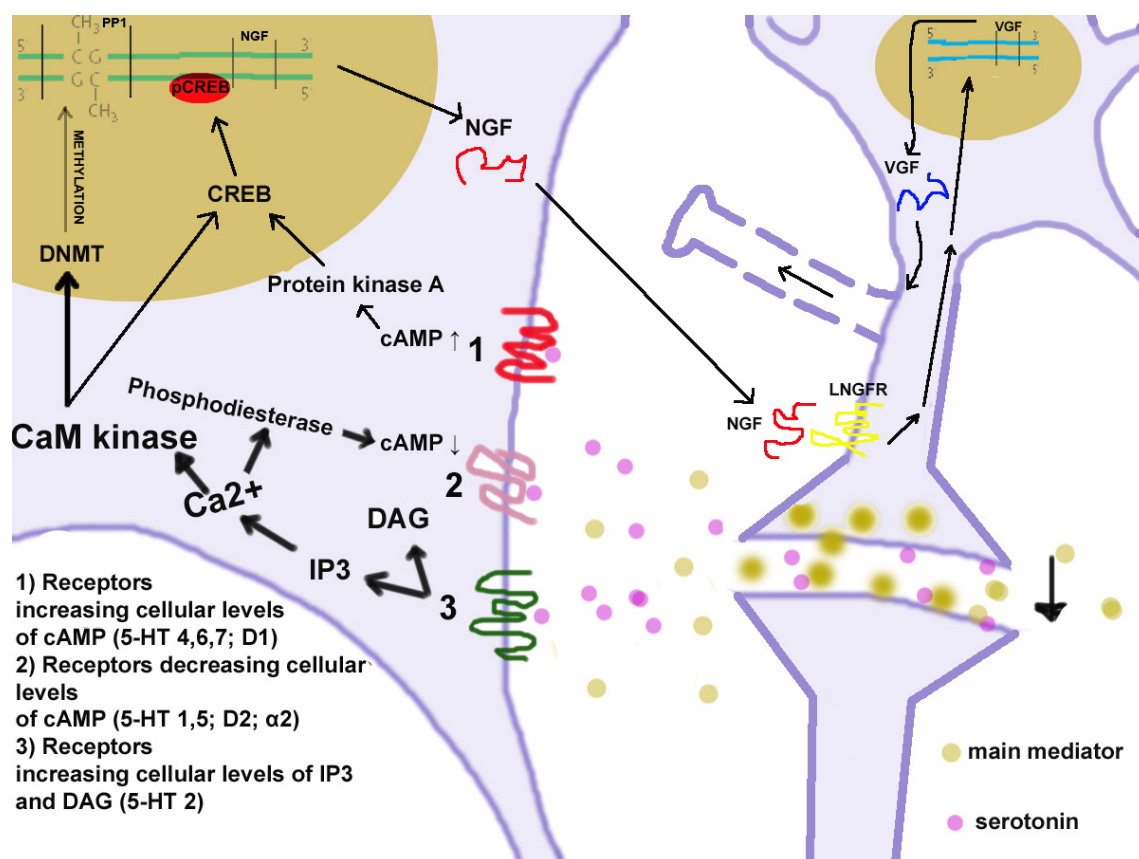


Fig. 1. The formation of synaptic connections

Thus, the neuronal membrane begins to grow to their secretion of NGF. When two membranes between them the synapse, the formation of which should be considered as the completion of the long-term memory (Fig. 1).

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**EFFECT OF ESSENTIAL OILS OF *LAVANDULA VERA* AND OF
SALVIA SCLARIA ON METABOLIC CHANGES IN THE RED BLOOD
CELLS OF MICE GRAFTED WITH MYELOMA SP 2/0 AG14
UNDER STRESS LOAD**

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*This paper considers the impact of essential oils *Lavandula vera* and *Salvia sclaria* in the mode of aromatherapy on the activity of antioxidant enzymes in red blood cells and on the level of lipid peroxidation in the liver of mice grafted with multiple myeloma under stress load.*

*Keywords: essential oil *Lavandula vera* and *Salvia sclaria*, aromatherapy, antioxidant enzymes, lipid peroxidation.*

So far there are not researched the metabolic changes promoting a progression of tumoral process and accompanying development of a cancer against stressor loading, in particular, a condition of processes of a lipoperoksidation and anti-radical protection of cells. The increased formation of free radicals can be one of pathogenetic factors of carcinogenesis [2].

It is established that development of malignant tumors is accompanied by considerable changes in lipidic structure and intensity of processes of the peroksidation of lipids (POL). Antioxidants provide binding and modification of free

radicals, prevent formation of peroxides or destroy them. The activity imbalance the POL and antioxidant system promotes emergence of an oksidativny stress.

According to the above, a research objective studying of activity of antioxidant enzymes in blood and POL level erythrocytes in a liver of mice with the imparted myeloma against stressorny loading was at effect of essential oils.

In work were used *Lavandula vera* and *Salvia sclaria* essential oils in the ratio 2:1 which sprayed in a mode of an aromatherapy (ART) to concentration in air of the room of 4 mg/m³ within two weeks for 40 min. daily. Antineoplastic activity of these essential oils investigated on mice of the BALB/c line to whom in one day prior to experiment interperitoneum injected suspension of cells (10⁶ on a mouse) myelomas of a strain of Sp 2/0 Ag14. As stressorny loading used a technique of "compulsory swimming" with the subsequent suspension for a tail. For biochemical researches took erythrocytes of blood and a liver of animals next day after end the ART. Intensity the POL estimated according to the contents malonic dialdehyde (MDA). For an assessment of activity of system of antioxidant protection used a link of fermentativny antioxidants, analyzing activity superoxide dismutase (SOD), catalases and glutathion peroxidase (GPO).

As a result of the conducted researches by us it is established that in erythrocytes of blood of mice activity of SOD – the enzyme catalyzing reactions of a dismutation of active superoxidic anions in hydrogen peroxide and oxygen, decreased from 3,69±0,18 E/mg/min to 2,14±0,68 E/mg/min at stressorny loading (p<0,05) and 1,73±0,11 E/mg/min with the imparted myeloma (p<0,05). Under action the ART activity of SOD increased to 3,12±0,28 E/mg/min (p<0,001).

Activity of a catalase – the enzyme destroying peroxide of oxygen - a source of the most destructive radical OH[•], decreased at stressorny loading from 2,57±0,18 E/mg/min to 0,71±0,06 E/mg/min (p<0,001) and 0,58±0,04 E/mg/min with the imparted myeloma (p<0,05). Under action the ART activity of enzyme increased to 2,24±0,15 E/mg/min (p<0,001).

At GPO level reduction - the enzyme serving for an inactivation of peroxide of hydrogen, resistance of an organism to oxidizing defeat that can lead to development

of free radical pathology decreases. In our researches its activity decreased at stressor loading from $0,06 \pm 0,007$ E/mg/min to $0,03 \pm 0,005$ ($p < 0,01$) and $0,02 \pm 0,003$ E/mg/min with the imparted myeloma ($p < 0,05$). Under action the ART activity of enzyme increased to $0,08 \pm 0,007$ E/mg/min ($p < 0,001$).

POL level studying in a liver showed that animals at stressor loading have statistically significant increase in the contents MDA from $15,66 \pm 0,17$ mcmol/l at intact mice to $29,74 \pm 1,27$ mcmol/l at stressor loading ($p < 0,001$) and to $48,08 \pm 2,41$ mcmol/l to the imparted myeloma ($p < 0,001$). After course ART the contents MDA decreased to $24,37 \pm 0,63$ mcmol/l ($p < 0,001$).

The strengthening fact the POL in blood with a growth of malignant new growths at animals and people doesn't raise doubts. The main indicators of it are various violations of fermentativny antioxidant protection of the fabrics oppression of activity of a catalase and violation of its synthesis can be which reasons; changes of qualitative and quantitative structure of isoenzymes of SOD, as a rule, decrease in activity of GPO and reduction of affinity of enzyme to a substratum [1]. Results of research testify to accumulation MDA in blood of animals-carriers of the tumor. The analysis of the AOS components in erythrocytes showed that their activity decreases at development of tumoral process, especially against stressor loading. It is shown that *Lavandula vera* and *Salvia sclaria* essential oils in an aromatherapy mode correct intensity of the revealed shifts.

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