

Modern scientific research and their practical application

Published by:

Kupriyenko SV on *Project SWorld*

With the support of:

Odessa National Maritime University

Ukrainian National Academy of Railway Transport

Institute for Entrepreneurship and morehozyaystva

Lugansk State Medical University

Kharkiv Medical Academy of Postgraduate Education

Volume J11401

May 2014



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Author(s), "Title of Paper," in Modern scientific research and their practical application, edited by Alexandr G. Shibaev, Alexandra D. Markova. Vol.J11401 (Kupriyenko SV, Odessa, 2014) – URL: <http://www.sworld.com.ua/e-journal/j11401.pdf> (date:...) - Article CID Number.

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J11401-001**Novicova A.A.**

THE COMPARATIVE ANALYSIS OF MASSAGE'S INFLUENCE ON AN ORGANISM

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Abstract. In work the comparative analysis of influence of manual and hardware massage on an organism is considered. The dispersion statistical analysis of results of indicators of an organism's basic systems is carried out.

Keywords: massage, cardiovascular system, nervous system, the statistical analysis.

Introduction. Earlier [1, 2] we discussed an urgency of a problem of massage's influence, in particular, a hardware, on a physiological condition of the organism. In the given work we'll analyze results of monitoring of the basic indicators of an organism at action of other type of a masseur.

The purposes, problems, research methods. The purpose of the given work is the analysis of indicators of work CVS and VNS an organism at massage action. A research problem is the comparative analysis of manual and hardware massages on organism indicators. As research methods there are statistical and empiric-theoretical analyses.

Results of experiment and their processing. The group of experiences discussed in given article has been connected with carrying out of massage with use of masseur SL308. Technical characteristics of the given masseur are presented in table 1.

Table 1**Masseur technical characteristics**

The characteristic	The Masseur
Mark	SL308
The case	Plastic
Nozzle material	Plastic

Given out capacity, Vt	150
Quantity степенем freedom	2
The size of a nozzle (a diagonal, diameter), sm	4

Data on monitoring is presented on fig. 1 - 4.

After carrying out of hardware massage the distribution type of cardiointervals has not changed. It's possible to assume that the given type of a masseur does not render any influence on CVS. Only at surveyed (1, 6, 20) it's observed parasympathetic distribution type. Earlier [1,2] it has been established that in this surveyed the reaction of an organism to various types of massage cause activity of parasympathetic nervous system.

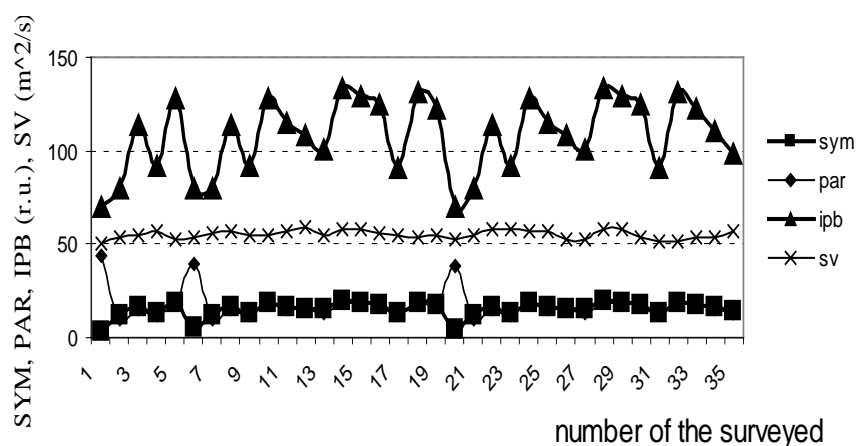


Fig. 1. Indicators of monitoring after carrying out of hardware massage

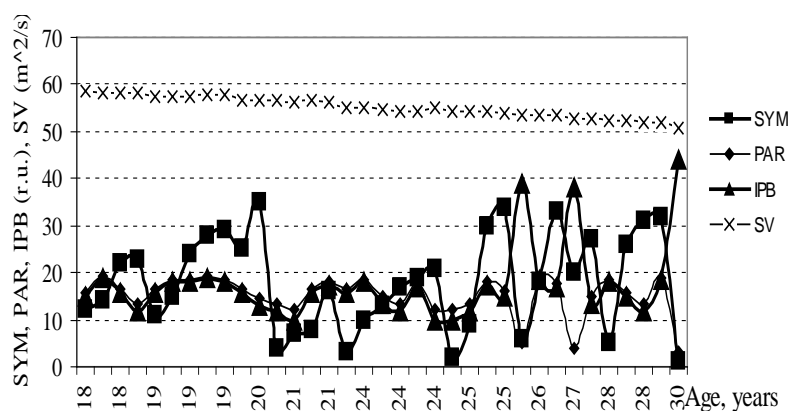


Fig. 2. Age indicators of monitoring at hardware massage

The Systolic volume, since 24 years starts to fall, it means that the organism relaxes under the influence of massage, in spite of the fact that capacity of a masseur is small. Fluctuations of indexes of PAR, IPB, SYM are visible, thus it's expedient to consider these changes more in detail.

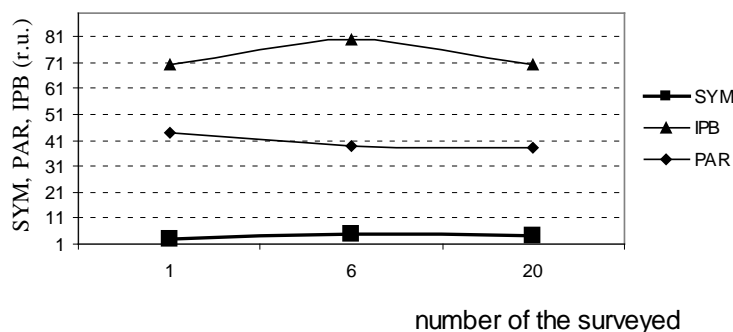


Fig. 3. Indicators of monitoring after hardware massage for sample with parasympatonic distribution type of cardiointervals

From the given schedule it is visible that monitoring indexes are in limits of norm for the given type of distribution. At the first surveyed the PAR parameter is a little above ($\Delta = 5,5$ mm hg) - PNS operates on the given surveyed more actively; IPB 6th surveyed on 10 r.u. is more than at others two surveyed, from the point of view of "norm" of IPB parameter, this's minor alteration. The SYM index on the average at all is identical. It is possible to conclude that as CVS, and the NS at this surveyed during carrying out of the given type of massage is in the weakened condition.

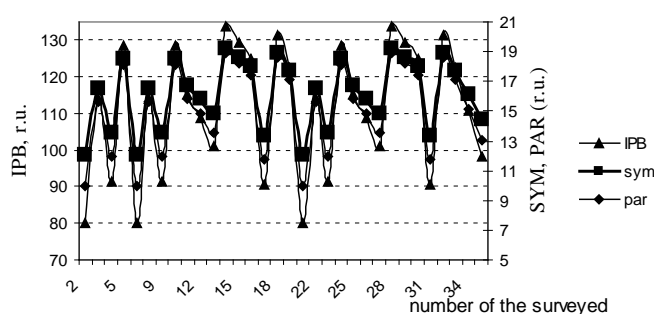


Fig. 4. Indicators of monitoring after hardware massage for sample with normal distribution type of cardiointervals

Analyzing presented schedule above, it's visible that at the surveyed 2, 7 and 21 is a low level of IPB index (80 r.u.) that is characteristic for parasympatonic, and SYM, PAR indexes are in norm. It speaks about that vascular system during massage has been weakened, and the nervous system was in a normal "working" condition.

That less, indicators changed proportionally each other at all surveyed (at growth by SYM and PAR, is visible growth of IPB and on the contrary).

Further it's necessary to carry out the comparative analysis between manual and hardware massage. Here are phase portraits of classification inside samples on SYM, PAR, IPB, SV (fig. 5, 6, 7, 8).

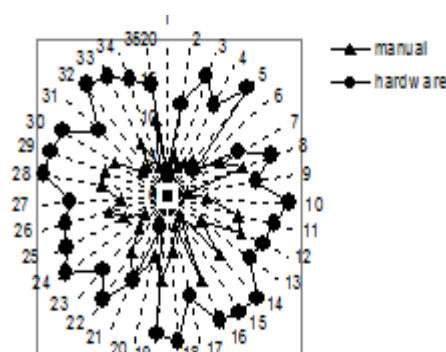


Fig. 5. A phase portrait of dispersion results of carrying out of manual and hardware massage (an SYM index)

Schedules visually show the results dispersion inside samples (fluctuations not considerable), the dispersion between two samples is small. But it's visible that SYM parameters have less for sample of manual massage, it's means that the given type of massage renders more weakening effect on an organism.

The given schedules prove to be true the statistical analysis (tab. 2).

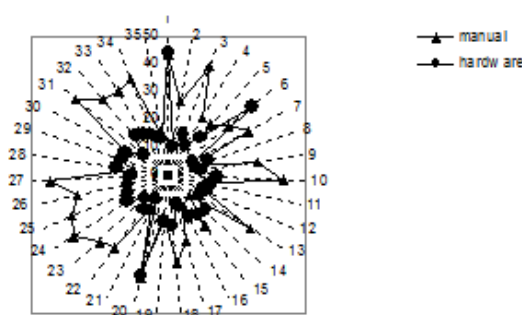


Fig. 6. A phase portrait of dispersion results of carrying out of manual and hardware massage (an PAR index)

In this case classification between two samples is visible: value of PAR parameter for sample of manual massage is more. There are emissions in sample of hardware massage, points lie in clusters of the manual massage. For this clusters it's characteristic active work of parasympathetic nervous system.

On the presented schedules (fig. 7) classification of variables in groups of manual and hardware massage on IPB index is shown. Dispersion of results practically is not visible. But, manual massage well influences functional systems of an organism. Hardware massage practically does not change a condition of an organism before massage carrying out.

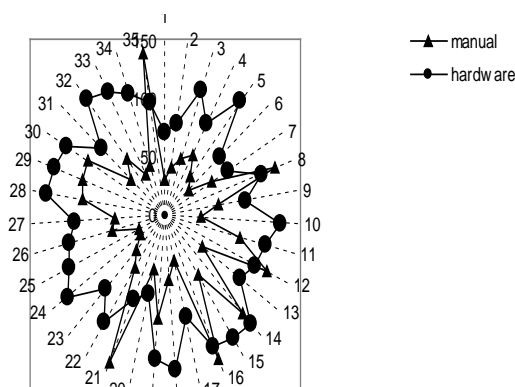


Fig. 7. A phase portrait of dispersion of results of carrying out of manual and hardware massage (index IPB)

The phase portrait of drawing 8 shows absence of dispersion of results between samples. Insignificant beneficial influence of manual massage on vascular system of an organism (blood activity raises) is visible.

All schedules are confirmed by the statistical analysis (tab. 2).

Only in SV sample isn't present the dispersion results, as has been proved above.

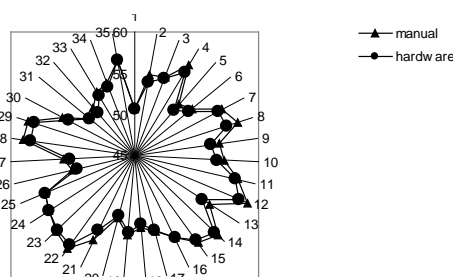


Fig. 8. A phase portrait of dispersion of results of carrying out of manual and hardware massage (an index SV)

Table 2**Wilkokson's pair criterion**

Statistical estimation	SYM	PAR	IPB	SV
Sample 1	35	35	35	35
Sample 2	35	35	35	35
Q	0,05	0,05	0,05	0,05
W_H	1075	1075	1075	1075
W	1766	949	1630	1149
W_B	1410	1410	1410	1410

Conclusions: in article the problem of massage's influence of on indicators of CVS and VNS an organism continues to be studied. Statistical processing of results of research has confirmed beneficial influence of manual massage on an organism.

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Статья отправлена: 25.11.2013

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J11401-002

Valuev VA * Semeniuk E.D.**

**COMPARATIVE CHARACTERISTICS OF MUSCULOSKELETAL of
BIRDS FAMILIES AEGATHALIDAE and PARIDAE**

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460000*

Measured the length of the tibia, tarsus, wing, tail, toes and claws of birds of two families - Aegathalidae and Paridae. The analysis of the relationships between each of the species that authority. Revealed that the length of the wing and wingspan as diagnostic feature can not be used. Length of claws as a diagnostic sign in determining bird species in these families are no less important than the length of the fingers.

Keywords: wing, wingspan, tibia, tarsus, toes, claws, birds, titmouses.

Prolegomena

Dimensions of the musculoskeletal system are quite conservative in their nature and, therefore, serve as a basis in determining the species in the event of an animal skeleton or only a part of its bones. However, we should remember that despite the fact that there is a lot of knowledge in ichthyological and theriological material, we do not have a lot of information about the birds' bones, especially the smaller species of birds. There are some works on morphology of birds of South Ural [1, 2, 5-10]. Until now, ornithologists have not come to a definite conclusion - is it possible to determine precisely on their skeletal remains belonging to a particular type or not, although precedents already exist, for example, the definition of our species of birds on the beaks of the excavation "Settlement Ufa-2" and our other work [3]. The authors of modern references and differences of bird species of birds from each other are due mainly to the color [18], the length of the tail and wing span [15, 19], or only to the length of the body. [16] It should be noted that the latter option can be used only if there is an integer, and fresh animal. More over, in the absence of rigid

boundaries (due to the large variability of neck compression), it can be used only to determine the very different-sized species, and, as practice shows, one and the same person measuring this parameter in the same bird, allows for a significant fault. Therefore, the feasibility of using morphological parameters of the musculoskeletal system is still debatable.

To answer the question whether there are significant differences in the size of the musculoskeletal system of different species of birds at the level of closely related taxa, especially labor, which is very important for the subsequent preparation of the determinant for their remains, we attempt to identify possible differences in the size of external bodies the floor unit birds of the family Paridae and closely related taxa Long-tailed Tit him. Create a determinant on morphological parameters of the final bird is very in demand as services safety airports and zoologists studying the nutrition of carnivores, as well as ornithological, tourists, professionals departments for the protection of wildlife, etc.

Material and methods.

We used 10 measurements of the skeleton: tibia , tarsus , all four fingers and claws, as well as the length of the wing and tail. Although the latter two are not actually the skeleton , but still they are definitely part of the musculoskeletal system of birds. And the developed technique allows to determine not only the species in appearance of feathers, but also by their fingerprints [4, 11-13, 17].

The names of species listed by EA Koblik et al . [14] Measurements were carried out in 62 individuals of five species of birds, we obtained in the Ural region of Bashkortostan. The family Paridae represent species – Marsh Tit, Willow Tit, Great Tit and Blue Tit; Aegathalidae family - the only species found in Russia , Long-tailed Tit. The calculations were performed using standard statistical processing program MS Excel. The significance of differences was determined using Student t-test

Results of the study

First of all, Long-tailed Tit is different from all the other tits because of the long tail (Fig. 1). With regard to other parameters Long-tailed Tit significantly different from all the other tits because of the claws' length of the first, third and fourth toes.

From the Great Tit is different in all respects. No different from all the tits (except Great Tit) along the length of tarsus and fourth toe. Further, comparisons Long-tailed Tit with Great Tit are not considered. Long-tailed Tit lower leg length was significantly different from the Marsh Tit and Willow Tit. There is a significant difference along the length of the thumb with Marsh Tit and Blue Tit, second finger – only with Willow Tit, the third - with a Willow Tit and Blue Tit. Along the length of the second toe's claw no significant difference with the Blue Tit.

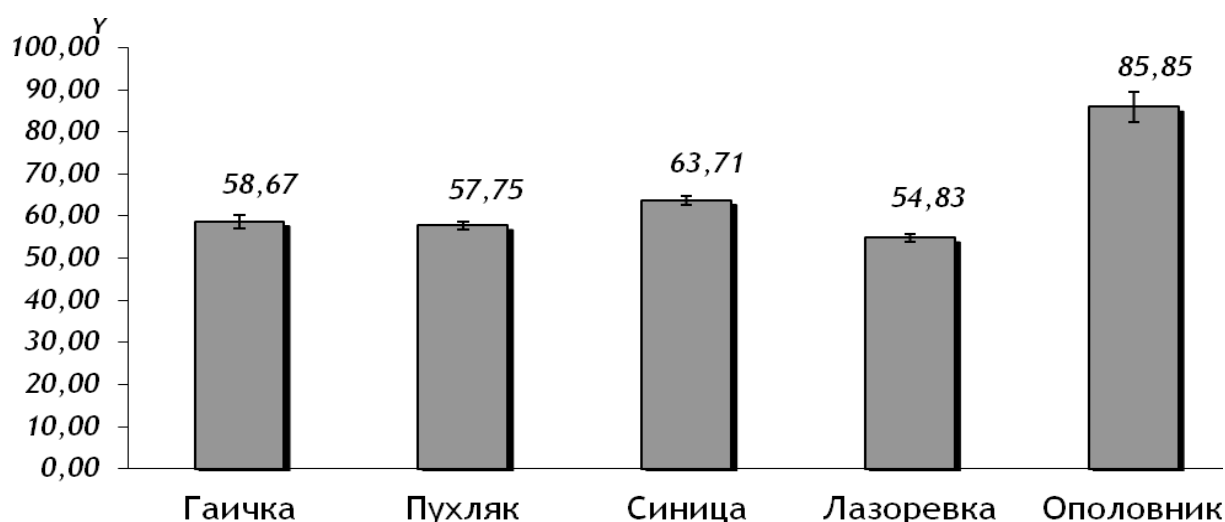


Рис. 1. Сравнение длины хвоста

Marsh Tit different from the Great Tit by all the parameters, except for the length of the thumb claw. Therefore, further comparison of parameters with this type will not be considered. There is not difference in length of the wing (Fig. 2) from the other tits, there is a difference in length of the tail only with Long-tailed Tit. Along the length of the tarsus, a difference with other tits was not identified. Along the length of the fingers, significant differences from the other types, are available for only the first of them - with Long-tailed Tit. There are significant differences along the length of the claws: by the first – with Long-tailed Tit and Blue Tit, by the second and third - with Willow Tit and Long-tailed Tit, by the fourth - only with Long-tailed Tit.

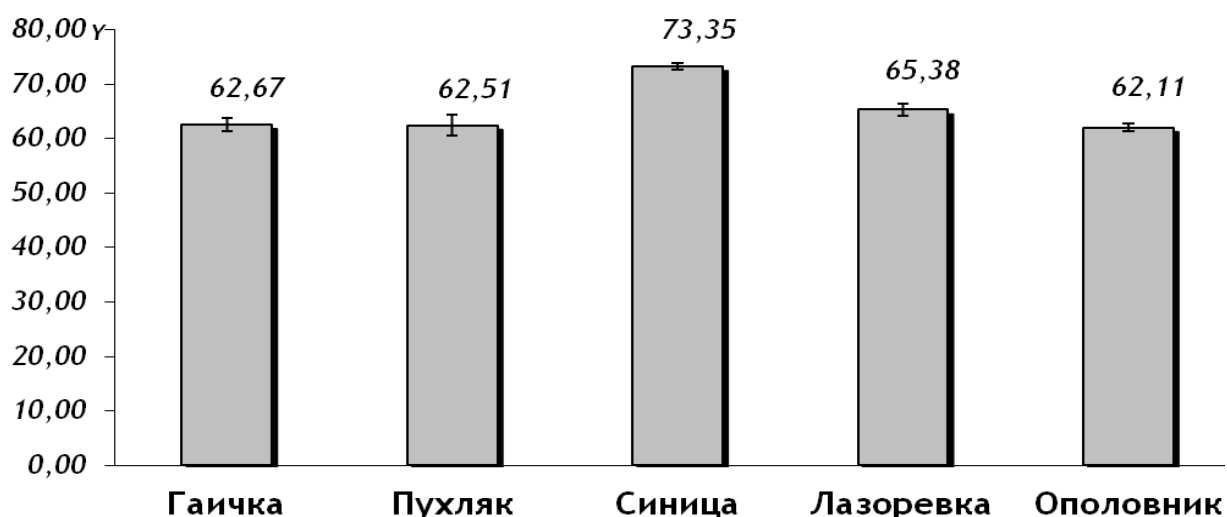


Fig. 2. Comparison of the wing

The Willow Tit with Great Tit haven't got significant differences only by the claws of the first, second and third toes. Therefore, the following comparison of parameters with this type will not be considered. There are not any differences between the Willow Tit and other species of tits along the length of the wing, tarsus, first and fourth fingers. Length of the tail, legs, 2 and 3 fingers and claws 1 and 4 fingers are different only from Long-tailed Tit. There is a significant difference between Marsh Tit and Long-tailed Tit, along the length of the claws 2 and 3 fingers.

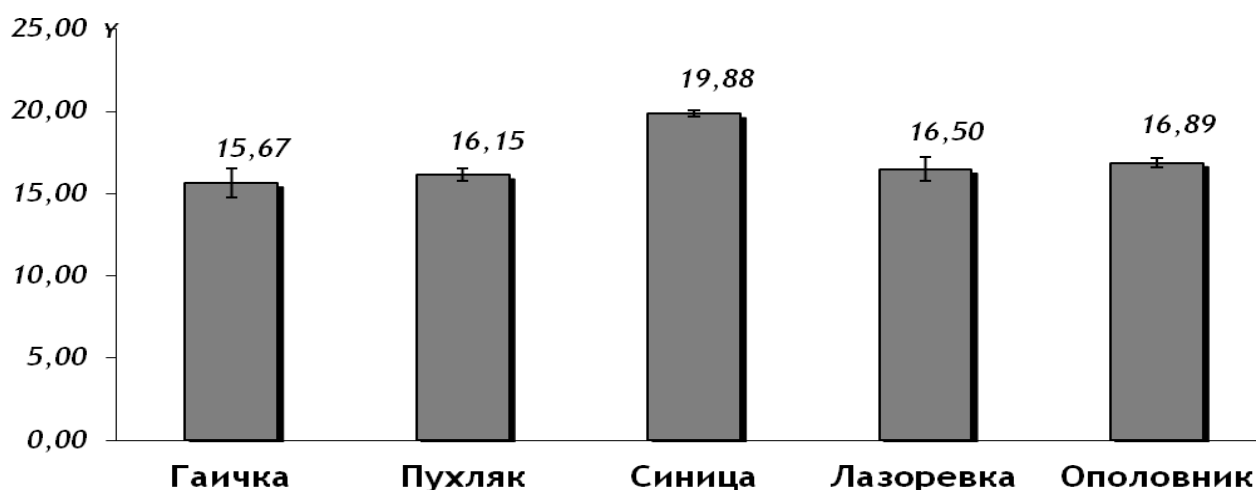


Fig. 3. Comparison of the tarsus

The Great Tit has a lot of significant differences in length of the wing, tarsus (Fig. 3), tail, legs, all fingers and claw of the fourth finger, with all kinds of the tits, which we have reviewed. Along the length of the claws of the 2 and the 3 fingers,

there is a significant difference with Willow Tit, Blue Tit and Long-tailed Tit. Along the length of the thumb claw - with Blue Tit and Long-tailed Tit.

The Blue Tit have some significant differences from all the other species of birds only in the length of the thumb claw. Is different by all the morphological parameters from the great tit. Therefore, further, comparison with it will not be discussed below. There are significant differences with Willow Tit claws' length of the 1 and the 2 of the fingers, with the Marsh Tit – only in the length of the thumb claw. There are significant differences with Long-tailed Tit in length: of the wing, tail, the 1 and the 3 toes and claws, as well as the length of the fingers' 4 claw.

Our conclusion

The data of the measurements show that there are morphological differences in locomotor of the tits. However, it should be noted that neither the length of the wing, or, especially, a wingspan as an accurate diagnostic sign of bird species considered families can not be used. The analysis showed that the length of the tarsus is less informative than the length of the tibia, and the length of the claws as a diagnostic feature in determining the species of birds in these families are no less important than the length of the fingers. Since still value in determining the length of the claws of taxa hardly at all, except in rare cases when determining the individual site (for example, Alaudidae) and species (some wagtails and skates), we can recommend the use of these parameters as additional morphological features.

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J11401-003

Platonov A. D., Snerigeva S. N.

INFLUENCE OF FIRES ON PINE WOOD MICROSTRUCTURE

Voronezh State Academy of Forestry and Technologies

Forest fires in Russia and other countries are quite common phenomenon. Their origin is mainly due to human activities, and it is exacerbated by a combination of dangerous weather conditions, disadvantaged sanitary conditions of plantations, fire prevention system deficiencies.

Study of the influence of forest fires is necessary for the rational use and development of burnt wood and development of burnt, for developing methods of fighting with forest fires and their negative consequences and for using positive role of fire in forestry. Accounting of post-fire microstructural changes, occurring in the

wood, may help to solve a practical problem - is it always necessary to fell stands urgently, experienced the impact of fires, but have not lost their life or vice versa, may contribute to the rational use of forest stands within a few years after the fire.

In assessing the type of fire terminology proposed by Mari State Technical University (MarSTU) was used [1].

Running crown fire - crown fire spreading through the forest canopy at a rate substantially advancing burning of lower tiers of forest vegetation.

Crown fire - forest fire, covering forest canopy.

Strong ground fire - ground fire with flame height on the front edge of more than 1.5 m. The velocity of propagation is over 3 m / min.

Ground fire of middle power - ground fire with flame height on the front edge from 0.5 m to 1.5 m. The velocity of propagation is from 1 to 3 m / min.

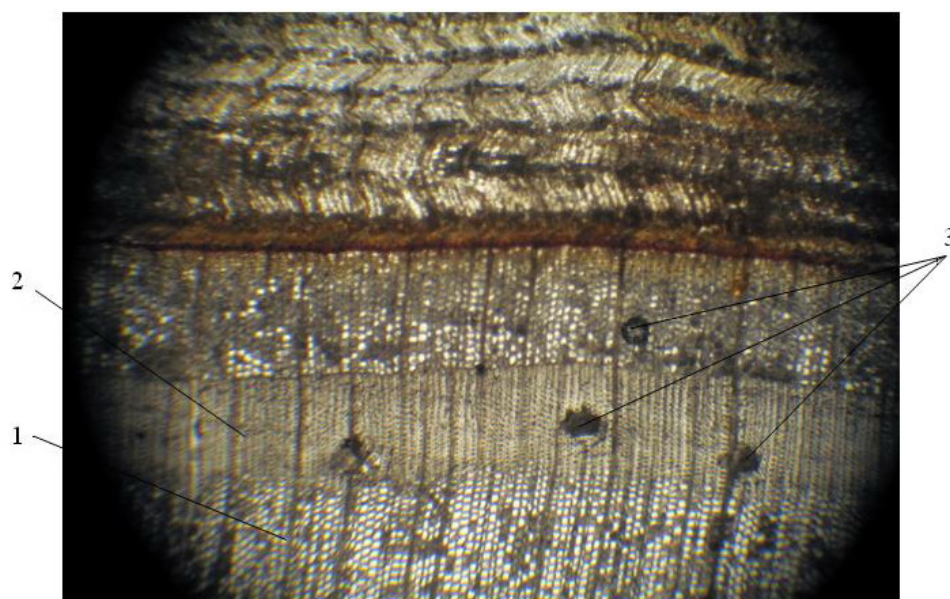
Weak ground fire - ground fire with flame height on the front edge up to 0.5 m. The velocity of propagation does not exceed 1 m / min.

Fires that took place in late July, early August 2010, were accompanied by very high record for the region's air temperature. For example, the average temperature on July 28 was +31, 2 ° C, which is an absolute record for the last few years. The same day, the daytime temperature reached +39° C, and on August 2 it was +40, 5° C, which is a new record in Voronezh.

Changes in the structure of the wood after impact of strong ground fires were studied on microsections of 0, 1 mm thick. From the cuts of the bark with wood, taken from the basis of a trunk in place of burnt crust, on the sliding microtome, microsections were made, and then temporary, enclosed in glycerol, microslides were get.

In their study under the microscope the most significant damages were observed, primarily of horizontal and vertical resin channels.

It was found that early and late tracheids even in ground fire zone have not changed their size (2). However, even in cross section it is clearly seen that bordered pores on the radial walls are dark shaped that indicates a violation of their function even at low ground fire (fig. 1).



1 – earlywood; 2 – latewood; 3 – vertical resin channel, filled with resin

Fig.1 Cross-section of pine wood, impregnated with resin after strong ground fire damages (zoomed 4th)

Torus of not damaged by fire, mechanical stress or age factors lined pair of pores occupies the central position and marginal zone is easily permeable to water [3]. The permeability of closing film of pore is due to the fact that there are perforations of 0.2 microns in diameter in the radial direction. At mechanical damage and nucleation elasticity of marginal zone is lost, and torus fits the inner aperture of bordered pore. In case of fire, significant gaps of perforations first occur under the influence of water vapor, and then fusing of the closing film of pore and torus. Bordered pores became permeable not only for water but also for resin, which invades through bordered medullar rays from vertical and horizontal resin channels (fig. 2).

At the radial section of wood destroyed pores are visible in the form of two concentric rings, and not damaged ones in the form of three. In this case all the anatomical elements of wood are impregnated with resin (fig. 3).

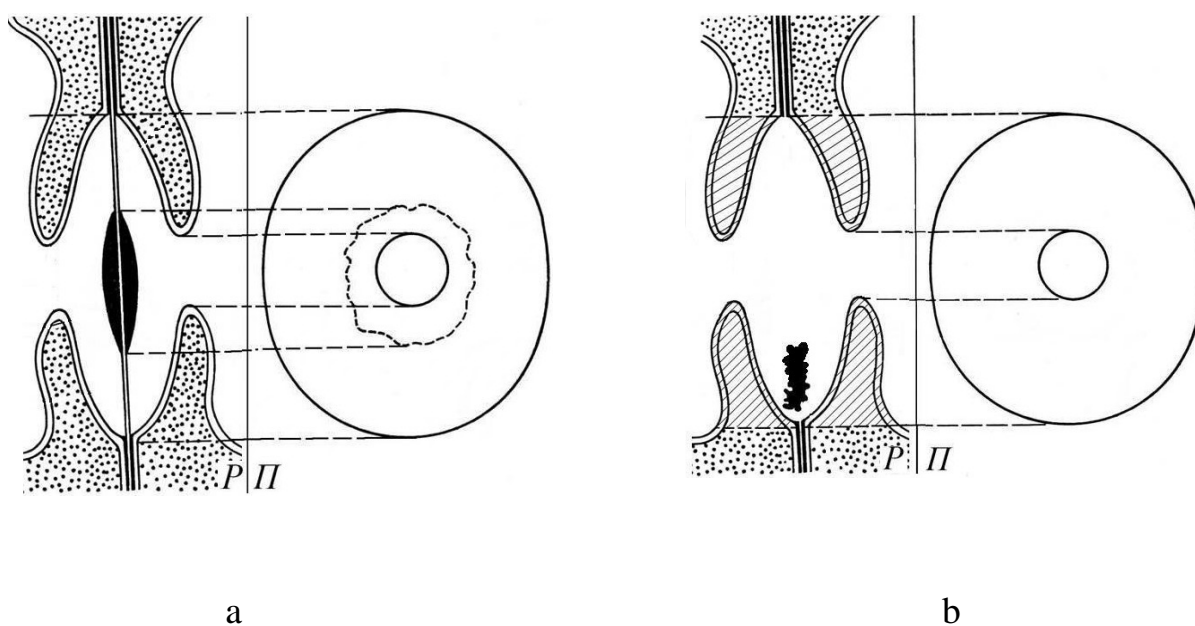
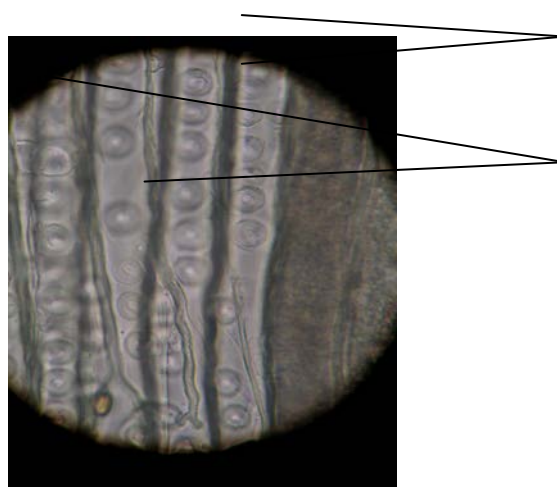


Fig. 2 Bordered pairs of pine wood pores in section (S) and in the plan (P) not damaged by fire (a) and



1 – not damaged pore; 2 – damaged pore

Fig. 3 Radial section of pine wood, damaged by fire (zoomed 20th)

Resin sparsely fills cavities of tracheids, intercellular spaces, medullar rays, and cavities of resin ducts. Resin from the upper layers flows into the butt part of the trunk, which explains the sharp increase in the density of this part immediately after the fire, until the wood is not exposed to fungal defeat.

The results of the research found that when in strong ground fire primarily damage of resin ducts takes place, which leads to the smooth resin running off and strong resinosis of wood, especially in the butt.

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J11401-004

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**INSECT MONITORING USING THE RFID TECHNOLOGY:
POTENTIAL FOR THE ALTAI BIODIVERSITY PROTECTION**

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An exact and systematic monitoring of a seasonal as well as annual spatial distribution and a species variety of insect in its natural environment is one of the key issues of modern and multidisciplinary-oriented biodiversity preservation strategy that can contribute significantly to the Altai biodiversity protection and the local environmental risk management. Following the results of pilot studies in Central Europe (the White Carpathians), the RFID (Radio Frequency Identification) technologies have proven to be a most useful and accurate tool for in-site documentation of small animals (vertebrate and invertebrate) that also provides a

major potential in the frame of preservation of endangered ecosystems of the Altai-Sayan Eco-region. Details of migration and behavior of the monitored and most indicative small faunal taxa (both flying, glider- and non-flying species) is a precondition for the applied scientific work in the field. The resulting databases are analyzed and evaluated by means of corresponding programs and represents a vital source of data for GIS-s of the monitored geographical area.

Introduction

In the recent years, an increased number of new radio-technologies have received most attention and started to be implemented in various aspects and sectors of environmental protection and natural (geo- and bio-) risk management throughout the World. In the context of modern biodiversity documentation with aim for taxonomic diversity preservation, entomology is one of the most vital biological sciences because of a pronounced environmental susceptibility of particular taxa and a high-rate of species endemism. Our goal is to investigate the possibility of insect monitoring using RFID (Radio Frequency Identification) technology in the broader Altai area following the pilot testing in the White Carpathian Mountains along the Czech-Slovak border area and combined with our preceding systematic biodiversity studies in Gorno Altai (the Kosh-Agach District) and the Katon-Karagay NP, East Kazakhstan (Fig. 1). Computer simulations deliver various scenarios of possible natural rates of extinction of some most endangered taxa that are confronted with terrain observations. The comparative results may be different to some degree, but coherently provide evidence of ongoing extinction rates that are currently much faster than the former natural rates during the preceding decades. These shifts in ecosystems evidently reflect the present global climate change (warming and increase aridization) and related transformation of mountain as well as parkland-steppe environments that are clearly observable the Altai area. The present environmental pressure and stress on the established and specific late-Holocene regional biodiversity is also apparent in comparable (mountain and lowland) ecosystems in Central and Eastern Europe. A very important role in the systematic monitoring of biodiversity plays a mutual symbiosis of individual species of flora and fauna pointing to the fragility of this

natural biotic co-existence (Fig. 2). Extinction of one species of plants usually means the disappearance of at least five insect species dependent on the particular floral taxon and a co-linked extinction of other species particularly of micro-fauna (e.g. endemic parasites). Among the most important mechanisms of a biodiversity loss is considered a termination and shift in distribution of natural, particularly mosaic alpine habitats. These processes can be successfully and very accurately monitored particularly by the applied RFID technology.

Methodology

Monitoring of insects by the RFID technology is becoming a highly beneficial and productive source of quality information on a regional multi-level (macro- and micro-) biodiversity composition. The principal contribution of this technique is accentuated by the possibility of monitoring a wide-range of branded insect, followed by a much faster identification of the specific individuals that are the subject of observation. If we label an individual (temporarily) by a tiny RFID chip with a corresponding ID, this enables us to collect and identify all data that are used for research on insects living on the particular territory with a specific biodiversity, in which "our" individual is physically located. Another advantage of this technique is that it can monitor even very small species of fauna. The smaller the animal, the more difficult it can be spotted in its natural setting. Glider-active animals represent approximately 78% of all species living on the planet. In the vast majority these include insect taxa, which are in general highly susceptible to any local ecology degradation and ongoing environmental shifts.

The innovative RFID technique that can be systematically and long-term implemented in biodiversity investigations in the broader Altai area may entail various geographical locations and specific topographic zones with the widest range of particular (and selected) species of insect (e.g. Coleoptera, Lepidoptera, etc.). The RFID monitoring procedure defines a sample of selected individuals with a subsequently allocated RFID with an ID who meet the requirements to fulfill the main objectives of the research. Only healthy and especially adult individuals are used for this purpose by receiving a tag with a tiny RFID chip on the body (Fig. 3).

These are properly documented, with an exact initial GPS location projected on a site map. All defined individuals are photographed prior to receiving the RFID tag with RFID chips. Insect is released back to the same point where it was caught. A miniature RFID chip, with which it is equipped, does not endanger life of fauna. Attachment of the chip must always be performed with caution and, as a rule, with application of natural adhesives, which do not in any way negatively affect health of the living sample. For this purpose, special natural glue was developed by the first author, which warrants a safe and secure attachment of the RFID chip throughout the study period. Tagged for deletion the tagged individual will be regularly monitored throughout the research period. Each RFID chip carries information (such as ID number). The RFID reader is connected wire-less to the PC. The resulting information is subsequently stored in the complete ID database. The spatial movement on studies locality is therefore the main point of the aerial monitoring.

Conclusion

Application of the RFID technology shows innovative ways of biodiversity monitoring in terms of a small fauna composition and its spatial migratory behavior. The method is particularly useful for collection of data about the in-site dispersal of insects as well as other small faunal species. The received information can furthermore help to predict most relevant and biotically-diverse localities, biotopes and ecosystems that can be future examined in more detail Based on an accurate identification of living faunal specimens by tiny RFID chips, introduction of the RFID monitoring technique can significantly contribute to better understanding of seasonal migrations of insect in the Altai (both Gorno Altai and Steppe Altai), and in the neighboring protected or pristine natural areas. Apart of the monitoring of taxonomically described species, this technique can provide major assistance in study of poorly known or so far non-described taxa of invertebrates recorded during our pilot biodiversity studies in the Katon Karagay NP (2006-2007) [1]. Collected data will be used for better understanding of the year-around migration of particular species within single geographic sites in terms of climate change, an overall biotic community composition and its food-procurement mobility range. Results implied

from the systematic RFID investigations can be ultimately used for a refinement of the present strategies of natural biodiversity protection and most fragile ecosystem conservation in the broader Altai. Implications of field research may also add to adjustment of national environmental policies as well as management of local sustainable development and regulation in economic exploitation of natural resources.



Fig. 1 – The Katun' Range, Katon-Karagay National Park, East Kazakhstan. *Cetonia aurata* ssp. *viridiventris* Reitter 1896. Environmentally sensitive insect species indicative of the specific Altai (steppe and mountain) biotopes may be subject of the RFID-based systematic studies.

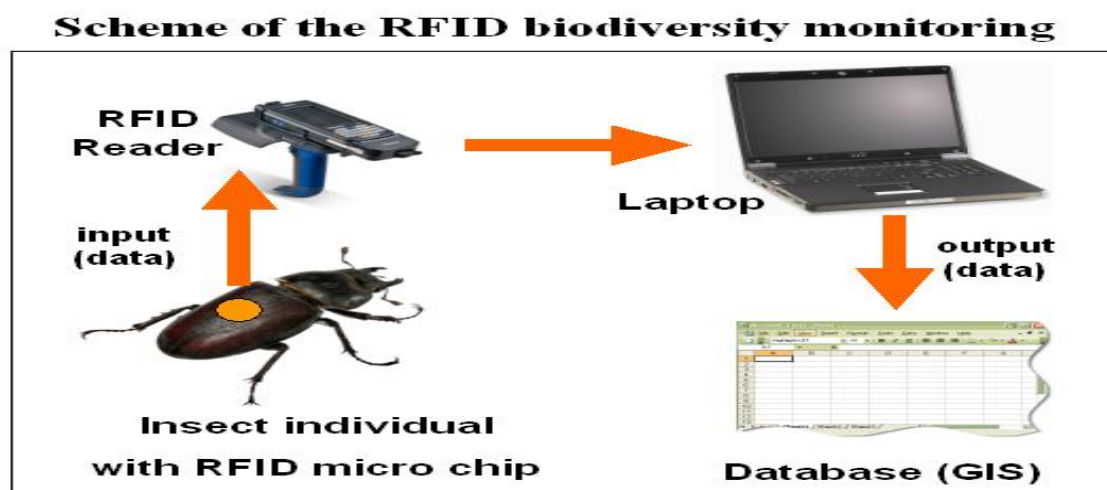


Fig. 2 – Scheme of application of the Radio Frequency Identification (RFID) technology

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J11401-005

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**COMPOSITES WITH IMMOBILIZED AMYLASES FROM MUNG
BEAN VIGNA RADIATA: SYNTHESIS AND PROPERTIES**

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Composites materials based on highly dispersed silica that introduced to the water (salt solution)/hydroaccumulating complex/homogenate of mung bean Vigna

Radiata (the source of amylase) system have been obtained. The fermentation activity both native and immobilized amylases in reaction of starch hydrolysis has been studied. The better activation of ferment by calcium ions under their introduction rather in polymeric complex than in fresh extracted homogenate has been found. The carried out researches by changing aqueous medium on the salt solution in the process of starch disintegration by amylase showed the increasing in activity of heterogeneous preparations.

Key words: amylase, composite, heterogeneous preparation

INTRODUCTION

Amylases belong to the class of hydrolases of glycosids provided hydrolysis α -1,4 glycosid's bonds in polysugars (glycogen, starch). Principally these ferments have the vegetable provenance [1]. In vegetables amylases exist in two types (α and β with different activity and selectivity). α -amylase desintegrate starch to dextrins and β -amylase chip off residues of maltose [2]. Like most of other ferments they are unstable, so the problem of their stabilization is actual. Immobilization is one of the ways decision of the problem. The aim of investigation was in creating composites based on highly dispersed silica (A300), hydroaccumulating complex (polyvinyl alcohol (PVA) : polyacrylic acid (PAA) = 10:1, pH=6), and homogenate from mung bean *Vigna radiata* and in determining the influence of ion's activation on fermentation activity. In [3,4] the formation of surrounding near to in vivo by hydroaccumulating complex for ferments the presence of silica component in such systems lowering the risk of their bacterial damage were described [5]. According to these, the attempt of creating composites with amylase activity using analogous approach was fulfilled. We confined ourselves by introduction the silica component in the species of high dispersed powder in the system water (salt solution)/hydroaccumulated complex/homogenate of mung bean *Vigna radiata*, as previous used sole-gel procedure for this purpose was accompanied by formation of mesoporous shells which create steric hindrance for the penetrating of high molecular substrate (starch) toward active site of ferment.

EXPERIMENTAL

The following reagents and materials were used for composites synthesis: highly dispersed silica A300 (Kalush, Ukraine), homogenate of mung bean *Vigna radiata*, polymeric hydroaccumulated complex (PHC) formed from PVA and PAA. Determination of activity of synthesized composites was realized in according with Klimovskaya and Rodzevich droplet method based on carrying out the reaction of starch disintegration to yielding products not coloured by iodine [6].

Synthesis procedure for composite materials with immobilized amylase *Vigna radiata*. Composite materials were obtained by highly dispersed silica A300 be suspended in dispersion PHC and homogenate. Scheme of composites synthesis shown on Fig.1.

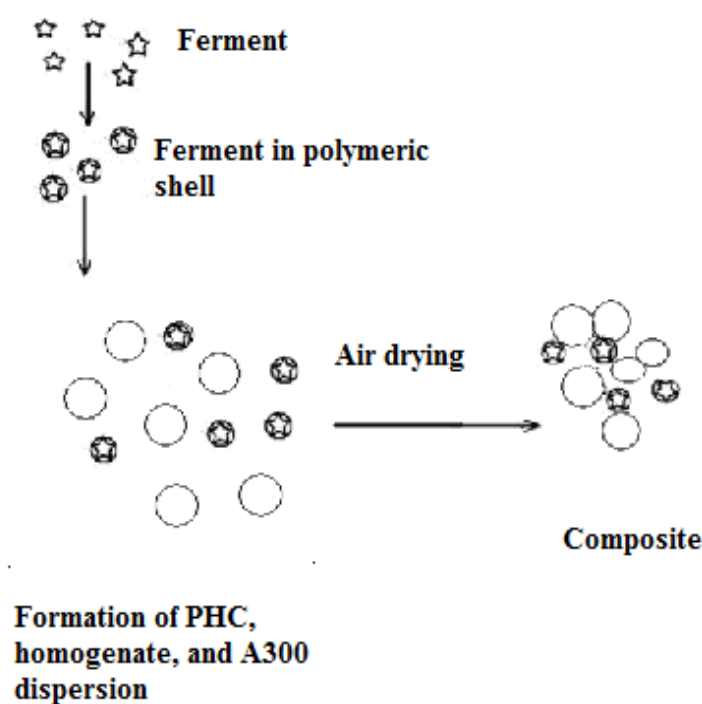


Fig.1 Scheme of composites materials obtaining.

The relationships between components are represented in Table1.

Table 1.

Conditions of composite materials synthesis

Sample	Weight of silica (A300),g	Volume,cm ³				pH
		Water	Solution of CaCl ₂	dispersion of PHC	Gomogenate	

1	0.25	15	-	-	5	6
2	0.25	5	5	-	5	6
3	0.25	5	-	5	5	6

*dispersion PHC was prepared taking to account 6g per 100g CaCl_2 solution

**pH, experimental definition

RESULTS AND DISCUSSION

The decrease of native amylase activity for a time under conservation of extract mung bean *Vigna radiata* at room temperature and its total disability after 6 hours was established (Fig.2)

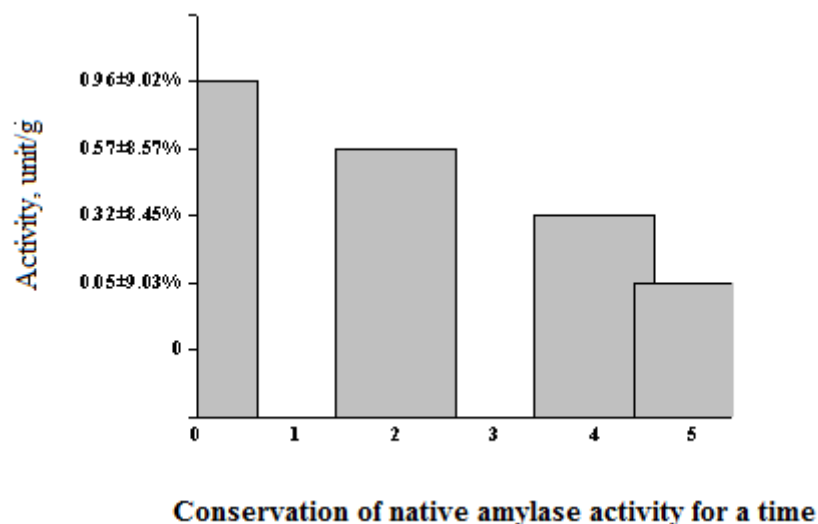


Fig.2 Conservation of native amylase activity for a time

An additional factor of increasing activity of ferments and ferment systems organism is the content of definite microelements [7-9]. Amylases are typical metal-ferments with the presence of calciumion in the active site which play role of activator during the splitting of substrates. For estimation the dependence of fermentation activity on metal content, calcium was fixed by oxalate acid with farther determination of catalytic properties.

For evaluation of micro quantities of calcium in lentil and no lentil grains *Vigna radiata*, the ashing with farther dissolving of ashes in nitrate acid was carried out.

Concentration of calcium in obtained solution was determined by trilonometry. It was established that in samples of mung bean *Vigna radiata* the concentration of calcium for lentil grains has ratio 1.86 to one as against no lentil, 13mg/100g and 7mg/100 respectively.

For estimation the influence of calcium on native amylase activity, homogenate was divided by two equal parts. Fermentation activity of one of them, taking as initial, is shown Table 2 (Sample 1). In another part of homogenate the amylase activity was determined after bounding calcium ions by oxalic acid (Sample 2). Farther, solution of CaCl_2 with number of calcium ions equivalent to bounded one was added to this part, also the replayed determination of amylase activity was done. (Sample 3 in Table 2). As to this table, under calcium bounding by oxalate acid, was fully disappeared, and may be restored only to 30% after replayed adding Ca^{2+} .

Table 2**The influence of calcium on native amylase activity**

No	Activity, unit/g
1 (initial homogenate)	0.96±9.02%
2 (after treatment by oxalate acid)	0
3 (attempt of restoring activity)	0.27 (the quantative index was not stable)

The conservation of amylitic activity for composites obtained using highly dispersed silica A300 was shown. Under drying of composites, the lowering of activity immobilized amylases was observed (Table 3), like as in the case of conserving extract of broad beans mash *Vigna radiata* at room temperature (Fig.2).

We also investigated the influence of calcium ions on the activity of immobilized amylase. To issue from that during obtaining composites CaCl_2 may be introduced on different steps, two following variants were used: in one case calcium chloride was introduced in the homogenate solution (sample 2, Table 1) and in the second case in dispersion of hydroaccumulating complex (sample 3, Table 1) as a result activity of a ferment for sample 3 near 2,35 higher in compare with sample 2 (Table 3). So, ferment is better activated by calcium ions in the presence of

hydroaccumulated complex, which may be connected with structure changes called by interaction ferment-polymer (possibly conformation nature).

Our investigations relative changing water medium on salt solution under processing of starge disintegration showed the rise of activity heterogeneous preparations such a 12 times for sample 1, 4- for sample 2; 2,29-for sample 3 (Table 3).

Table 3

Activity of immobilized amylases

Sample	Activity, unit/g	Activity, unit/g in the presence of calcium
1	0.04±9.86%	0.5±8.49%
2	0.20±9.03%	0.8±8.56%
3	0.47±8.46%	1.4±7.96%

Conclusion

Using highly dispersed SiO₂ polymeric complex and homogenate of lentil broad beans must *Vigna Radiata* the procedure of obtaining composite materials with amylase activity was created. Catalytic properties of native and heterogeneous amylases under starge desintegration was studied. The influence calcium ions on activity of native and immobilized ferment was shown.

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J11401-006

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APPLICATION TRICHOGRAMMA DENDROLIMI (*TRICHOGRAMMA DENDROLIMI* NOTS.) IN REDUCING THE NUMBER GRAPEVINE MOTH (*LOBESIA BOTRANA*) UNDER TRANSCARPATHIA

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Abstract. It was established that the efficiency of specialized forms of Trichogramma dendrolimi depends on the level of life of populations of grapevine moth and can destroy the number of eggs up to 70%.

Keywords: wine, Transcarpathia, grapevine moth, sitotroga and leaves nimble forms, pesticides phytophagous, *Trichogramma dendrolimi*.

Objective: To explore the use of *Trichogramma dendrolimi* (*Trichogramma dendrolimi* nots.) To reduce the number of grapevine moth in terms of *Transcarpathia*.

Trichogramma began to study more than 150 years ago, and practical application began once in 1985 at the convention of entomologists in England F. Enok reported their findings about the possibility of breeding for grain moth eggs. Taxonomy of this group of insects is still poorly developed. *Trichogramma* fauna in vineyards under the conditions studied Transcarpathia started in 1991.

Among plant protection products focuses on without pesticides technologies, including resettlement of *Trichogramma* in the vineyards in order to limit the number of grapevine moth. The results of our experiments on the dynamics of the fly of grapevine moth showed that this pest is found throughout the growing season of grapes and egg laying of the first and second generations. It occurs more frequently in the second decade of May and continues until the third decade of September.

Of particular interest is the dynamics of oviposition in late-autumn leaf species such as Roseanne, hawthorn. These reserves are grapevine moth natural *Trichogramma dendrolimi* in which it overwinters on pre-larva stage. If nearby vineyards are planting black currants, berries, fruit crops, the *Trichogramma* these reservations migrating the vineyards.

Keep in mind that these types of leaf developing cycle and the number of eggs laid by changes over time. Thus, the black currant bush in Beregovsky region Transcarpathia region in 2011 accounted for 5.5 batches Rosanna grapevine moth in 2012. – Only 0.5 batches of eggs and occupancy of *Trichogramma* respectively were 53 and 11 percent.

Oviposition gaudy golden grapevine moth and these years are not observed. It was established that during the high-level of life of the populations of these species grapevine moth number of eggs was negligible.

On the number of vineyards populated *Trichogramma* egg is rare and only in those areas where pesticides are not used, population of eggs is quite large and is – 14-15 percent.

We have the early studies examined the effectiveness of two forms of *Trichogramma*: *sitotroga* and *leaves nimble* forms. Every form of *Trichogramma* released at the beginning of the first generation of eggs laying of grapevine moth the rate of one female egg parasite 10 ... 5 ... 1 egg herbivores.

Leaves nimble form was found by her withdrawal from the clutches of eggs *Rosanna* grapevine moth collected in autumn, stored under a tent insectaria. Under each option were taken on 15 plants of grapes. The experiment is set to triple repetition. The standard was *Trichogramma*.

In 2011, studied the effectiveness of different forms of *Trichogramma* depending on the level of life of the population of grapevine moth. For this early in the spring of hunting zones were selected pupal weight 32 ± 4 mg. It placed separately in isolators and stored prior to oviposition grapevine moth insectaria under a tent. In spring 2012, 10 pairs of butterflies (♂ and ♀) were placed in isolators attached to individual branches of the vine. On the 7th day isolators removed, counted the number of eggs laid on buds, and produced *Trichogramma*. Dynamics of colonization of grapevine moth by *Trichogramma* egg *dendrolimi* given in Tables 1 and 2.

Table 1

Efficacy of various forms of *Trichogramma dendrolimi* against grapevine moth high-life (32 ± 4 mg), 2012

Option relation	Number of eggs populated <i>Trichogramma</i> %	
	leaves nimble form	<i>sitotroga</i> form
On the 6th day after release		
1 : 1 /	6.5	1.5
1:5	13.0	3.0
1:1	24.0	3.5
Control	0	0

On the 15th day after the release of		
1 :/ 1 /	33	17
1:5	45	29
1:1	68	39
Control	2	0

Table 2

Efficacy of various forms of *Trichogramma dendrolimi* different populations of grapevine moth on the 16th day after the issue (to the first generation), 2013

Option experiment	Number of eggs populated <i>Trichogramma</i> %	
	leaves nimble form	sitotroga form
Eggs obtained from pupae butterflies restored weight 23 ± 2 mg	69 ± 3	31 ± 4
Eggs obtained from pupae butterflies unregenerate mass of 35 ± 2 mg	14 ± 2	$3 \pm 0,5$

In 2013 also studied the efficiency of different *Trichogramma dendrolimi* forms depending on the level of life of populations of grapevine moth (Table 2) to this end, early spring hunting zones of selected pupal mass of 35 ± 2 and 23 ± 2 mg. Before the butterflies fly them, 10 pairs of gauze placed in isolators and placed on separate plants. The experiment was laid out in three repetitions of 15 plants. On the 7th day isolators removed and counted the number of eggs laid by. 16 the research and shrubs released sytotrozhnu and leaves nimble forms *Trichogramma dendrolimi*.

View inhabited *Trichogramma* egg under high magnification (500h) showed that eggs *Trichogramma* 2-3 hours in eggs of grapevine moth highly viable individuals decomposed plasma past. This phenomenon was not observed in the population of *Trichogramma* egg of grapevine moth weakened population. In some embodiments, the experiment on the application form *Trichogramma dendrolimi* against populations

with high viability of the first issue even at a ratio of 1:1 did not go beyond 4% occupancy.

We also conducted a study on the effects on *Trichogramma* applied against grapevine moth different insecticides. Established that drugs for systemic effects (rohor, fosfamid) found a strong effect on survival oviphages. Renaissance *Trichogramma* dies after processing through 14-15 days. Perethroids – ambush, sumitsydin, cymbush – do not reduce the number of *Trichogramma* after 5 days of their application.

In early October 2011 were conducted experiments with *Trichogramma* produced parties diapaused entry into diapause conducted by parasitism on eggs sitotroga. To this end, each 3-quart placed po15 g fresh-laid eggs sitotroga and 5 g inhabited dendrolimi eggs *Trichogramma*. The exhibition was set to 48 Years in standby temperature of 22 ± 2 and humidity of $80 \pm 5\%$. Then three weeks of research material was kept at a temperature of $+6-8^\circ$ and humidity of $80 \pm 5\%$. The reaction carried out in the early generations laying eggs that overwintered within 48 hours at varying temperatures $17-25^\circ$. Revived 76% of *Trichogramma*. Effectiveness of *Trichogramma* in the 1:1 ratio was within 71-77%.

Conclusions. *Trichogramma dendrolimi* need to produce at the beginning of oviposition grapevine moth first generation with respect to one female per egg pest. The second issue to spend 5-7 days after the first and only in the case when the population of *Trichogramma* egg is less than 5%. Release *Trichogramma* sitotroga form (if the party did not pass the winter diapause) gives effect only child renaissance generation (already leaves nimbly form) of parasites. It is widely used *Trichogramma* party that passed a winter diapause. It is necessary to regularly (daily) repeated material by collecting batches of eggs in nature leaf and settled them (if they are not settled in vivo) dendrolimi *Trichogramma* in vitro and in applying perethroids release can be performed after 5 days.

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J11401-007

Florensov A.N.

**CYBERNETIC APPROACH – A SPECIES AS PRODUCT OF
DYNAMICS OF BIOGEOCENOSES**

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Introduction. As is known, the species is the basic structural unit of biological systematic of living organisms. The concept emerged as a means of classifying the variety of organisms in biology and was first scientifically formulated Linnaeus as a result of constructing a hierarchical classification system. In the XIX century special attention to the biological species concept has developed under the influence of biological evolution, especially as a result of formation of Darwinism, which relied on the continuity of connection between the origins of living organisms. Since then understanding of the biological species were formed as a group of specimens with common morphological and behavioral traits that are capable of reciprocal interbreeding, which gives a number of generations fertile offspring, the sustainability of existing within a specific geographic area and similar changing under the influence of environmental factors.

Some difficulties arose on the way established approach, they led to a multiplicity of different and significantly different definitions of species. The development of genetics allowed leaning on its fundamental base in these definitions, which led to the belief that any species are closed systems and there is no exchange of genes between the gene pools of the two species. Further studies have shown that such a statement should not be overestimated.

Although it is true for most of the species studied, there are many exceptions to the above rule. First, lions and tigers can produce total offspring called tigon and

where females are fertile and can produce offspring as from tigers well as from lions. Moreover other species interbreed in artificial conditions that do not interbreed under natural conditions because of geographic or reproductive isolation. Interbreeding between different species which called in the practical aspect hybridization can occur under natural conditions under anthropogenic disturbance to infringing environmental isolation mechanisms that is especially true for plants.

Interspecific hybridization is often observed both in nature and at cultivation of by man in plurality of kinds of plants and animals. Hybrid zones can form in the nature in the areas of contact between closely related species where hybrids predominate numerically over the parental forms. At the same time be aware that when interspecific hybrid is viable and able to reproduce, generations of his descendants will contain a significant proportion of non-viable, sterile and semi sterile organisms. This phenomenon called the destruction of hybrids is a dynamic barrier between species but it is dynamic, the species are not isolated on the possibilities of production of hybrids from each other in static and the more formal aspect.

1. The main problems of the classical definition of species

It turned out that in modern science is no common understanding of the biological nature of the species, thus there is a wide range of different concepts, each of which has multiple supporters. A species is ascribed to some immutable set of qualities and characteristics in the *typological concept*, but the principal disadvantage of this approach is the fact that signs of this standard can vary greatly within a species, depending on sex, age, phenotype variability, etc. Organisms might differ within the same population significantly stronger than generally recognized representatives of various species. A striking example of this of this manifestation is the variety of dog breeds and cats cultivated by man. The species is considered as speculative notion of formal classification in concept of *nominalism* with the reservation about a certain stage of development of evolutionary branches. The latter definition is not operational concept because it refers to some contemplative "stage" that is not determined by experimental or measurement means.

Species are recognized discrete at a particular moment but in the dynamics they are changing evolutionary continuously in the biological concept. Here traditional features and the ability of individuals interbreed and produce fertile offspring are used. Thus, the genetic relationships within a species are of particular importance, and the species status is a property of the population rather than an individual. The species seems as a group of individuals that are similar in morphological and anatomical, physiological and environmental, biochemical and genetic features, occupying a natural habitat capable freely interbreed and produce fertile offspring.

The remaining species concept, often having to name respected scholar nominated them, make the main emphasis on any particular criterion listed in the definition above.

This is either the isolation of populations for reproduction or descent from a common ancestor or a declaration property to retain its identity in time and space and have their own evolutionary fate and historical trends.

Several schematic summarizing all these definitions, we find that they either declare a speculative rather than natural science to identify and really existing community or defer indefinitely eventually phase or evolution effect. In the latter case it is seen naturalistic bias, but without explicitly delineate forming concept. Several schematic summarizing all these definitions, we find that they either declare a speculative rather than natural science to identify and really existing community or defer indefinitely eventually phase or effect of the evolution. In the latter case it is seen naturalistic bias but without explicitly delineate forming concept.

It turns out that the most promising attempts to definition are appealing to no static definition but they do not give still a clear description of the defining dynamics. Note that the survival of species provides not only a change in the functionality of the individuals but also the size of the ecological niche of the species. The species adapted to any existing currently ecological niche completely occupies it by breeding.

Therefore the "improvement" of the individual organism generally can not affect the survival of the species. It was pointed out even during in Darwin's time by his opponent Fleeming Jenkin - professor of Engineering at the University of Edinburgh.

If we consider the offspring of such an improved organism as a new species coming into competition with the old one from the standpoint of the theory of probability, then in the beginning of this process when this species originating from one change a little almost no chance to reproduce the same size covering this niche before.

Neither of which are better adapted to the environment at the same time maintain speech does not make sense - the modified species occupies the same niche. That it better than in terms of survival can not be argued as in relation to the environment and other types of surrounding the entire biocenosis because it is occupying the same place! We can assume theoretically that the improvement of a single species can lead to changes in the entire biocenosis. Since the biogeocoenosis is given by geochemical and geophysical parameters to a greater extent than the internal variability of the composition.

Thus the classical model of the dynamics of global biological systems described by the theory of "evolution of species" is rather a simplified model that ignores most of the real connections and relationships between organisms and species themselves.

Pay special attention that the Darwinian theory of evolution does not account biogeocoenosis. But the biological environment can not be considered as a static "a feeding trough". Realistically this community is always interacting and feeding each other organisms. It is only in artificial conditions of experiments and human activities for change phenotypes organisms the feeding trough for the body. The competition for survival of organisms with similar functions in terms of functionality biogeocoenose is meaningless as shown above. The only exception is the non-stationary system, which is in particular the human society expanding its areal.

The behavior aimed at the elimination of the direct or indirect source of organisms of the same species or similar to it reduces the population that the dynamics can only be maintained at a sufficient number of its individuals. The local reduction in the number of individuals reduces the possibilities of grouping against the dangers and the internal genetic diversity for sustainable procreation.

2. Meaningful description of the model

The solution can be found in the way of adoption as a methodological approach of cybernetics which has long formed a general idea of quality problems in the dynamics of managed systems. Biological organisms and any stable biological communities and organization of living matter is obviously related to managed systems. Moreover the cybernetics was defined in the original formulation as the science of the general laws of management and information transmission in machines, living organisms and society.

Therefore it is natural to use the concepts of control relationships in these systems and the objective functions of global governance in them in the task of forming a biological species concept when trying to rely on the dynamics of biological systems.

It is quite obvious that the most general criterion function of global governance in biological systems is to adapt to the current natural conditions and the homeostasis of these systems.

In this direction it would be a natural assumption that the statically allocated external and behavioral forms in biological systems, observers and researchers associated with biological species, deep and functionally associated with internal manifestations of the dynamics of these systems.

Since to study the dynamics of any system much more complicated than their static state and instant composition, it is necessary to highlight the level of the dynamics as a subsystem, a relatively autonomous in relation to the entire biosphere, or rather as a subsystem in which the interaction within it prevail over interactions between sibling subsystems. It is important to take into account the hyper systemic principle which is that the local behavior of the homeostatic system fairly accurately determined by its internal structure and internal connections, but the global behavior is determined by the homeostasis of directly embracing her system, where the global behavior of the system involves the whole of its life cycle from the beginning to the termination of existence [1].

Theoretically, the choice should be stopped at one of the intermediate systems in the hierarchy: a biological cell, multicellular organism, biogeocenosis, a global

ecosystem. Note that here the biogeocoenosis specified rather than just purely biological community - the biocenosis and not just the biosphere and ecosystems that includes streams and processes of physical energy and chemical nature.

This considered hierarchy is necessary and important because of the natural science approach to biology, where instead of speculative and declarative essence present objective physical, chemical and other bases available for real research, evaluation and experimentation. An additional argument is to follow Vernadsky strategy of research who first appreciated the role of geochemical factors in biological phenomena and their importance for the existence and dynamics of the biosphere which includes both the component abiotic, biokosnyh (arising at the junction of the animate and inanimate, in particular soil) as well as purely physical components of the Earth. The practical approach developed in this paper is based largely on the position of Vernadsky to incorporate non-biological components of the biosphere, but in addition to them focuses on the built-in processes and control mechanisms in the biosphere and its subsystems.

From the above hierarchy of biological multilevel systems interacting via the internal control systems, it follows that the level of relations of interest to us in connection with the problem posed species covers a connection between an organism and a biogeocoenosis.

Thus it becomes necessary from the standpoint of cybernetics to consider and examine the relationships of biological organisms which is formed on the set of the notion of species with embracing their system of biogeocoenose.

Considering the problem of survival is not the individual organism, the role of which as shown is insignificant but the population (community one species), note that it has two aspects. First of them is an effective tool similar to the current conditions of individuals biogeocoenose which is a complex of material factors, spatially restricted natural conditions. The second aspect is the possible ousting of other species in the same biogeocoenose.

The second aspect although it seems theoretically possible actually functionally are not implemented for the species because the occupation of space in

biogeocoenose previously filled with other species requires the implementation of this system functions of the same different species. The reorganization of a species with its existence on the implementation of the initial functions in the dynamics biogeocoenose to the functions of another species is the loss of the original functional niches. For example the reorientation of the species with eating caterpillars on eating lizards would switch to a species of the preferential or exclusive consumption of lizards and niche eating caterpillars would have been free to engage in other species. Actually conceivable "improvement" of species is its switching from one ecological niche to another. Since the species is defined as its behavior, biochemistry and derived from them externally visible differences, then if desired one could say that the ecological niche was filled with the descendants of one forefather but as a result of the struggle for existence was filled later with descendants of another forefather. Where the descendants of that occupied the former foreign niche changed in appearance, biochemistry and eating habits, all except his forefather become like similar to descendants of another that were ousted.

The similar pattern is characteristic of natural and human struggle for existence, but has nothing to do with that set of qualities that embedded in in the concept of natural species. What specific organism was the forefather of the population gets through many generations are not essential to the species but to human societies are maintained through non-biological tools (human memory and writing). Therefore, the second of the above aspects may be a social but no biological significance.

More important for the survival of the species is not a single individual survival but the survival of the entire population. The struggle with similar reduces the possibility of opposition to all the dangers to the population. An exception may be just the kind of predator on top of the food pyramid. Human organisms also relate to this exception. But some populations of people that not much different biological features but many cultural and organizational (tribes, nations, states) turn out to in competition with each other for limited ecological niche food.

If artificially do not positioned on the problem of survival and adaptability of the individual organism and its descendants, the biological survival in a broader sense

close to that formed by the concept of species consists in an adaptation problem for some set of organisms. This problem is how to live at the expense of the current ecological niche, in other words it is the struggle for existence in the context of limited resources and capacity of the environment fluctuations. Necessary to consider besides that without cooperation not only predators can exist and even then not all. To reduce the whole dynamics to the dynamics of the only predators is at least a very simplified model. It is impossible without the cooperation to get for body all the necessary ingredients (chemical elements and compounds of salt consumed by the body), to provide relative safety from predators for their species (birds alarms, etc.).

After the analysis we can formulate the following tentative definition. *The species is a connected component biogeocenosis ensures reproduction and defined by common ancestors and by general genotype.*

From the point of view of cybernetics and just mathematics, *a species is a component of the biological subsystem optimizations biogeocoenosis towards ecological niche.*

Theoretical (or potential) number of environmental niche significantly (at least many orders of magnitude) greater than the power set of all possible genotypes. The latter set is finite, as measured by a combination of gene coding bases with limitation on the length of the genome. Hence it follows that the optimization as a choice by a particular enumeration or genome sequence of transitions can be achieved in a finite number of steps. In other words, the customization in the generated genomes biogeocoenose will be completed during a finite number of steps at the formation of stable species in it, and the final optimization will be achieved for each included species which is possible under the conditions of a finite set of genomes.

In some cases a species lives and operates in more than one and more than one biogeocoenose usually two. A typical example of this is insects whose larvae are fed in ponds in particular mosquitoes. For this expansion in the current definition should be noted that species living in more than one biogeocenosis that function in the latter, as a rule in the form of different phenotypes, namely in various stages of the organism. The functionality of organisms in these stages is different more than

significantly. Corresponding amendment to the definition of species should be determined following wording.

The species is a component to optimize the biological subsystem of biogeocoenosis towards ecological niche or phasic sequence of forms for the development of organisms that form parts of the optimization of several biogeocenoses.

3. Construction of mathematical model

Speaking about the optimality of something, you need to keep in mind and consider what kind of factor is optimized. If the preliminary approaches can be regarded the number of organisms of one species as a parameter optimization when these organisms are resistant as a kind of existence, then such a the number of can not be used in the dynamics of speciation because the species itself changes and can be broken down into several or replaced by others.

Note that only the integral material or energy characteristics may have functional significance as quantitative characteristics for the general dynamics in biology, considering from the standpoint of the biosphere and its relatively autonomous parts - biogeocenosis.

Energy characteristics of biogeocoenose are determined by abiotic base, the main ones are the energy flows from external sources, primarily solar radiation (heat, light and ultraviolet). The heat removal from the deep areas of the Earth (volcanic heat) and deep emissions available for the oxidation of substances (sulfur gases for "black smokers") may have a significant role in some relatively local basis. They are used by organism's derived energy from the redox reactions in which they oxidize chemical compound rich in energy such as hydrogen or sulfur.

Material abiotic factors also formed by inorganic sources or are integral results of long past performance of the entire biosphere. This includes modern composition of the atmosphere and a number of soils formed by the long-term functioning biogeocoenosis.

It turns out that the dynamic result of current activities of the biosphere is the total biomass formed and maintained at the current time in it, in particular for a single

biogeocoenosis it is result of direct and integral to it. This allows us to consider the optimization problem of the dynamics biogeocoenosis by *criterion of total biomass supported them*.

It is easy to see that all other artificially secreted factors, such as certain stable characteristics of individual species have a local character, and most importantly, they are highly unstable. Other observable characteristics of biogeocoenose are significant variability in a number of external influences for biogeocoenose - geophysical in particular climate, changes in tectonic activity, possible local astrophysical effects (the fall of large meteorites).

Therefore, a more rigorous definition of a species should include a clear indication of the optimization by biomass of biogeocoenosis. This intermediate conclusion leads to the formulation of the optimization problem, considered as a mathematical extension of Lotka-Volterra model.

This model is described in mathematical form as a system of two differential equations:

$$\frac{dx}{dt} = (a - by)x,$$

$$\frac{dy}{dt} = (-c + d)xy,$$

where x — is the number of prey, y — is the number of some predator, t — time, a, b, c, d — are parameters describing the interaction of the two species.

Extremely simple model that takes into account the mutual communication biogeocoenose system could be described by three conventional "species" organisms that consume biomass each other in a circular dependency. It can be described by a system of three equations for the three variables that determine the biomass of each of these abstract types in the following form:

$$\frac{dx_1}{dt} = (a_1 - b_1 x_2) x_1,$$

$$\frac{dx_2}{dt} = (a_2 - b_2 x_3) x_2,$$

$$\frac{d}{dt} x_3 = (a_3 - b_3 x_1) x_3,$$

where a_k gives the rate of natural increase of the biomass of the species x_k in the absence of impact (consumption) of the species $x_{(k+1) \bmod 3}$, b_k gives the rate of biological consumption (loss) of the biomass of the species x_k from exposure the species $x_{(k+1) \bmod 3}$.

A more accurate model should take into account the synthesis of biomass in the system-autotrophic organisms and loss of biomass from the disintegration to the inorganic substance heterotrophs. The synthesis of biomass of biogeocoenosis is quantitatively proportional to flow of external energy that is available for assimilation, loss of biomass can be considered proportional to the most current biomass. With a significant simplification can be assumed that biomass loss occurs in every kind of organisms and must be accounted by some value c_k , which reduces all the coefficients a_k , but such a reduction can also specify by the appropriate reduction of numerical values a_k , removing the restriction of positivity of these values. For a more explicit display the contents of real connections we temporarily shall leave different designations of the said components of dynamics. Then we obtain a mathematical model given by the equations

$$\frac{dx_1}{dt} = (a_1 - c_1 - b_1 x_2) x_1 + d,$$

$$\frac{d}{dt} x_2 = (a_2 - c_2 - b_2 x_3) x_2,$$

$$\frac{d}{dt} x_3 = (a_3 - c_3 - b_3 x_1) x_3,$$

where d — the rate of the biomass synthesis into the species x_1 , c_k — rate of loss of biomass from its transition to an inorganic substance for the species k .

More overall model should include a finite number of different types of organisms, some of which are autotrophic and heterotrophic rest; in general this model includes the theoretical possibility of synthesis of organic substances by any species. Then we obtain the system of equations, which have the form

$$\frac{d x_k}{d t} = x_k \sum_{j=1}^n (a_{j,k} - b_{j,k}) x_j + d_k x_k \left(1 - \frac{x_k}{R_k}\right) - c_k x_k,$$

where $a_{k,k} = 0$, $b_{k,k} = 0$, what is reflected by the fact that this type of organisms do not consume themselves as food and not reduced in biomass as a result of this self-consumption. In fact this limitation is not functional; because even for a real species, organisms which sometimes consume their own kind, this interaction does not lead to the loss of the total biomass of the species (a substance from one organism enters the body of the same species). Furthermore, for all indexes $a_{j,k} \geq 0$, $b_{j,k} \geq 0$, $c_k \geq 0$, $a_{j,k} \geq b_{j,k}$. The optimality criterion for the model is determined by the maximum sum $\sum_{k=1}^n x_k$.

The coefficients of equations have the following meanings. The rate $a_{k,j}$ biomass growth of species x_j as a result of an interaction between the species x_j and x_k is less than or equal to the corresponding the speed $b_{j,k}$ of loss of biomass in the species x_k at the same interaction. (Practically no all physically alien biomass consumption becomes a living organism biomass consuming and inequality must be strict, but the corresponding difference is easier to consider the member $-c_k$ that is a constant rate systematically of biomass loss resulting in the formation of products emitted by the body without utilization of other organisms (waste carbon dioxide, etc.)

The term $d_k x_k (1 - x_k / R_k)$ corresponds to the limited abiotic biogeocoenosis base. These include the limited energy resource autotrophic organisms, in particular, beam energy for photosynthesis in plants. In general, the same should be included here trace geochemical resources base. Strictly speaking, instead of scalar values x_j , should be considered geochemical vectors x_j various primary physical and chemical elements required for life (luminous energy soluble nitrogenous compounds, the main chemical elements - potassium, phosphorus, etc.).

As the initial approximation we consider a simplified model of their averages and generalized, representing a numeric parameter, particularly abiotic source parameter d_k . We emphasize that the specified member is extremely essential for autotrophic and heterotrophic dynamics is mainly provided members with coefficients $a_{j,k}$, $b_{j,k}$ and c_k .

Coefficient R_k reflect the limited abiotic resource in the biogeocoenosis.

For private and almost the simplest option considered more general mathematical model with three simulated species considered system of equations is reduced to the following:

$$\begin{aligned}\frac{d_1}{dt} &= (-b_{1,2}x_2 + a_{1,3}x_3 - c_1)x_1 + d_1x_1(1 - \frac{x_1}{R_1}) \\ \frac{d_2}{dt} &= (+a_{2,1}x_1 - b_{2,3}x_3 - c_2)x_2, \\ \frac{d_3}{dt} &= (-b_{3,1}x_1 + a_{3,2}x_2 - c_3)x_3.\end{aligned}$$

Here species x_1 is autotrophic consumed x_2 species of "herbivores" with rate $b_{1,2}$ biomass decreasing, R_1 is resource capacity of its physical and geochemical niche. It consumes the decay products of the form x_3 with rate $a_{1,3}$. The species x_2 is heterotroph ("herbivore") consumes form x_1 (autotrophic "plant") at a rate $a_{2,1}$ and consumed by form x_3 – heterotrophs "predators" with rate $b_{2,3}$. Finally, the form x_3 – "predators" consumes the form x_2 "herbivores" with rate $a_{3,2}$ and loses its biomass on consumption going autotrophic species x_1 , with rate $b_{3,1}$.

The following relations hold $b_{1,2} \geq a_{2,1}$, $b_{2,3} \geq a_{3,2}$, $b_{3,1} \geq a_{1,3}$.

The more realistic option, yet extremely simplified, given the fact that biogeocoenosis at least tens of species of microorganisms and their orders of magnitude higher is the model of the 4 components they are displayed variables x_1, x_2, x_3, x_4 , reflecting autotrophic biomass (plants) and heterotrophic, including "herbivorous", "carnivorous" (fagotrofy) and "parasites worms" (saprophytes) [2].

Solutions constructed mathematical models can be studied as independent interesting purely mathematical (but only partially applied) of the problem, as can be seen directly relative structural complexity of them (their nonlinearity). It should also be noted that all the coefficients ($b_{j,k}, b_{j,k}$ и c_k, d_k) significantly depend on the specific biochemistry components of biological species, and into the transient dynamics are not constants but will change as a result of mutation of interspecific hybridization. Mathematical model gives therefore basically only a general schematic structure which operates in the dynamics of the criterion $\max \sum_{k=1}^n x_k$.

The concretised mathematical model with numerically known coefficients may to consider the fact that in reality most of the theoretically possible interactions between species consumption is not implemented and the coefficient matrix is in fact extremely rarefied, but the general theory on the first stage of the investigation it seems to be not significant. For in particular this rarity is a reflection and discharged a steady state model.

The above mathematical model describes the dynamics of biomass for species constituting a biogeocoenosis and responds the established equilibrium speciation. In the intermediate states of the transition states of the biosphere, when due to the changed bases of biogeocoenosis occur the formation of new species, the model needs to be clarified. This clarification should reflect conceptually the appearance of reproductive hybridization between species. In mathematical form, this change provides additional members right-hand sides, which are defined as $g_{j,k}x_j$, where j is not equal k . Coefficients $g_{j,k}$ of these members define the frequency of formation of mutant organisms form k from organisms of form j . Note that in stationary conditions such members are zero because either formed hybrids are not reproducible or mutant forms are not viable because of the local nature of the mutations that give relatively small changes in genotypes insufficient for the formation of well-functioning organisms.

Most general form of the main mathematical model can be described as a system of n differential equations of the form

$$\frac{dx_k}{dt} = x_k \sum_{j=1}^n (a_{j,k} - b_{j,k} - c_k) x_j + d_k x_k \left(1 - \frac{x_k}{R_k}\right) + \sum_{j=1}^n g_{j,k} x_j,$$

where almost all $g_{j,k}$ but one equal to zero, and this coefficient $g_{j,k}$ differs from zero only in a transient state of the biosphere, corresponding stage of the formation of a new biogeocoenose, the number of n equations in the system corresponds to the number of possible combinations of genes in the genomes of the theoretically possible (it is easy to see that although this number is extremely large, but still finite). The vast majority of the coefficients are zero for any base of a biogeocoenosis in such most common system, and equations with all zero coefficients are responsible to the potential capabilities of statuses and dynamics theoretically possible biogeocoenosis.

4. Relations with alternative and close approaches

The proposed approach to the definition and understanding of the biological species is close to the investigation in [3], where the principle of optimality for the species is explored, that formulated as a principle of maximum of multiplication coefficient for the species on the potential family of close species by functions. This work draws attention to that in the steady biogeocoenosis only those creatures are presented reproduction factor for which reaches a maximum value equals one, and the itself state of the biogeocoenosis determines reproduction factors for the species of potential family, theoretically considered as introduced in specific biogeocoenosis. Especially emphasized that the function for which the dynamically generated optimality depends on other living beings biogeocoenosis to denote this dependence introduced special term "co-optimality".

In the current work, the step of forming a new biogeocoenosis is considered under the influence of abiotic qualitatively change its base - chemical and physical conditions during real though relatively short history of biological time instead of artificial model of intrusion of a species into biogeocoenosis.

The same described in this work several implicitly. In it was considered possible situation in which develops biogeocoenosis coming into it from the outside living beings change their environment and create conditions for the implementation of others. These creatures in turn change the environment and create conditions for the implementation of these and iteratively so that sets the process tending to a fixed terminal state or continued indefinitely according to the authors. This description was set model of numerical characteristics of populations living beings in the biogeocoenosis, but did not address the potential role of this process in the allocation of competing "introduced" species and their potential mutations of optimal biochemical properties and functions of sustainable behavior after termination of the process in a terminal state of biological species.

The attention was drawn in [3] also too categorical and abstract point of view, which states that all organisms must continuously improve and evolve. It was emphasized that this point of view can not be certainly true, that conclusion is based on the destruction of the living example of habitat as a result of the formation of a perfect kind of overly destroying its vital functions of the habitat and thereby destroying the objective grounds and its existence.

The proposed definition of a species is largely a development of ideas and approaches V.I. Vernadsky, in particular its deep understanding of the population of living organisms which the author calls the living matter [4]. He emphasized that is completely free of other organisms homogeneous living matter does not exist, it is the notion of abstraction and the generation of the human mind. In essence the body and based on it the traditional concept of a biological species in reality forced captures biologically related the morphological alien part [4, c. 267-268]. Therefore, the species is absolutely necessary to be regarded not as an abstract entity, separated, living and functioning on the basis of internal identity, which is determined by the inherited molecular genetic information. The organism and species more than deeply connected and are driven by the biogeocoenosis of surrounding organisms.

The species can be at best statically separated by a researcher from the others, but it will be dynamically linked to the biogeocoenosis tightly with other species.

He's just a connected component of the biosystem, it is not separation and independence, and the accessory component similar symbiosis of fungi and trees. The idea of separateness and independence of the species as well as about its development is related to socio-outlook and attitudes in shaping the idea of this form. At the heart of such a facility there is individualism and the declaration of independence of completion, progress, self-worth, attempts to deny the universal dependence and disobeying higher levels of organization of the natural world.

The above understanding of the species can be approached from different methodological aspect to, namely from the mathematical theory of sets. As the classic definition of a species of the theory of evolution is included in that less adapted forms is replaced with a more adapted ones in the course of evolution, then on the set of all species is uniquely determined attitude "more adapted" having a natural property of transitivity. (It is in this particular application to the set under consideration is determined by the fact that if the species A is better adapted than the species B , and the species B is better adapted than the species C , the species A is better adapted than the species C .)

This ratio on the set V of species makes this set in general partially ordered. The set V can be confidently assumed to be finite, premised on at least from the common beliefs about the natural character of the evolution, the evolution of limited time in the world to the current time and a limited amount of biological material of the Earth.

In the general theory of sets there is easy to prove the theorem that if a set is partially ordered and finite, then every subset of mutually-ranked elements has a minimal element, any two subsets are disjoint, and the set is a union of such subsets. (Note that for infinite sets analogous assertion is formulated as one of the equivalent variants of Zermelo's axiom because without it is became much depleted general theory of sets). Considered subsets of mutually-ordered elements handy for future reasoning may be called the connected components of the original set, referring to the bond on the specified defined relationship.

With respect to a problem, the minimum element of a connected component of all species is the most adapted to existence and to displace less adapted species in this component. It follows that in the steady state of the biosphere of the Earth when there is no apparent ousting of some species and other explicit speciation with new dynamics of ousting, the only one minimal species must be present in each such theoretical component.

If we make an assumption about the uniqueness of such a component, it turns out that in the evolution can be only one species in the entire biosphere. Since such the conclusion, as shown in the above argument does not correspond to the real facts, and then it logically follows the falsity of the parcel.

Now, note that this premise about uniqueness of the component is equivalent to the assertion of a relationship "more adapted" between any two biological species. We have thus shown that the actual state denies the assumption of a real action relationship between any two species. Hence the whole set of species must inevitably disintegrate into mutually disjoint subsets of the above theoretical components. The ratio "more adapted" operates only within such a component but does not apply to different types of components.

It remains to relate these connected components with respect to the functional components of the biogeocoenosis. Theoretically, you can review and any other real components of the biosphere but then you have to justify why specifically between species belonging to them can not be the said ratio and resulting from it the struggle for existence and the ousting of the species - competitor.

In essence, the latest model of the connected component is the set of all possible close biological forms of the species including unstable ones in the dynamics of the struggle for existence. These, in general, stable and unstable biological forms are differently adapted to the existence of specific biochemical and biophysical conditions in the nonequilibrium process of dynamics therebetween. As follows from the very concept adaptability, sooner or later, less adapted forms should become extinct and only adapted species will remain. Less adapted forms of the species are becoming extinct at the stage of nonequilibrium dynamics of generalized

unsustainable forms in the course of their adaptation to the biogeocoenosis in the theoretical model. The generalized form remaining in the component forms the species in its steady understanding of the sustainability.

Thus it is shown that the implicit assumption of the universal struggle for survival of species and the assumption of adaptability "to the whole environment" as a logical consequence was to have the formation of a single species of the fittest to the environment, which in reality is not.

For a clearer understanding of how to study the problem and the need to consider exactly the biogeocoenosis, it could be made a speculative assumption of formation of not one single perfect form but two ones. For example, at first glance it seems possible and plausible, the final formation of a single species of perfect plants and one perfect animal species using this plant as a food source. In this model you can immediately notice that the real "environment" for such a plant is not only the physico-chemical world, but the totality of the world with a variety of all living species of the animal. A real environment for this animal species is a combination of physico-chemical world with a current population of the plant. Thus, this simplified model clearly shows that even in its there is natural present and active actual biogeocoenosis and without it there is even no grounds for the formation of two different species in the biosphere.

5. Solution of existing problems

The concept of species formed in this paper allow clear to understand and for the doubters - explain the phenomenon of the known evolutionary history of the living world, which consists in short time frames of formation of real species as clearly evidenced by paleontological data. These data are in essentially reduced to the practical absence of intermediate forms being residues found between species that have emerged to replace earlier ones.

Because the species is the result of the optimization of the biogeocoenosis component and optimization in a finite and even a small number of steps, this optimization occurs practically very fast relative to the paleontological timeline after a hopping change of physical base of the biogeocoenosis. (Here the physical bases

generally mean temperature ranges biogeocoenosis area, climatic characteristics of this zone, the gas composition, the chemical components of soil, etc.)

To better understand and practically acknowledge the speed of restructuring, should look at this process from a position close analogy. The point of view on biogeocenosis prevailing hitherto was its consideration only as a natural system. From our position, it seems that such a division is artificial and subjective.

The so-called artificial selection in changing phenotypes and receipt of interspecific hybrids fits well into the scheme of biogeocoenoses set forth here as a multicomponent adaptation of system and homeostasis of the biological organization of matter. Indeed, the material basis of artificially-selection biogeocoenosis is organized selection of the soil by a person, from which the efforts of the human species extracted most of the other animals and plants, making the same kind of specific probiotic and abiotic substances (humus, ash, extra water, etc.). A significant part of living organisms in such an artificial biogeocoenosis is removed by man as hindering in his opinion to the deducing of new varieties of plants or animals. A man produces eliminating potential predators, weeds and organisms that eat organisms formed a new variety.

The variant of organisms with desired characteristics and transmitted by inheritance is formed during a historically very short period - tens or hundreds of years with the help of these approaches that are built artificially biogeocoenosis to form a new phenotype, interspecific hybrid and possibly a new species of organisms. As the study shows contemporary cultural plant species, many of them are the result of organized human selection, and no their natural biological ancestors found or they are significantly far in their characteristics. Thus, the obvious is that the combination of substantively modified new conditions as a basis biogeocoenosis, natural or artificial lead to a sharp change in the characteristics of organisms in a historically very short period.

The presented approach does not touch well studied the role of mutations in the formation of the new features of organisms. It should nevertheless be borne in mind that if the individual organism is mutated so that his descendants became optimal for

different ecological niche of biogeocoenosis, it could mean that the offspring will carry the genotype already used by another type in the same biogeocoenosis. Figuratively speaking as exaggerated example, through mutation of hare his descendants may become wolves, but no new species is not to turn out because they just fall into an existing species of wolves abruptly as separate individuals.

The principle of species improvements out of touch with biogeocoenosis is in conflict with many of the known facts. In particular, many kinds of marine organisms such as sharks formed millions of years ago and continue stable existence until now. From the standpoint of absolute improvements can not be seen, which prevented a more perfect species to oust them as less fit. One genus of more ancient family of animals of Coelacanth order appeared still exists; it is representative of Crossopterygii group called Latimeria. This is one of the living creatures that have not changed for 400 million years. The situation turns out obvious from the positions discussed in this paper, this theory and understanding of the species. Since the founding of some tropical marine biogeocoenoses virtually unchanged for hundreds of millions of years, then some of their biological components remained optimal as a biochemical component of biogeocoenosis until now.

In considering the existence of the species must be borne in mind that for this existence is completely inadequate grounds only "trophic pyramid" - food sources of organisms. For the existence of the body there are no less essential organisms that dispose of the product emitted functioning organism. In particular this applies to the atmosphere, where, without removing carbon dioxide, methane and without the formation of oxygen its composition should become unable to sustain life in its aboveground contemporary forms. Other important function of these organisms is fulfilling recycle waste of higher animals, as well as parts of plants dying.

A good illustrative example of this value is given by a little known currently organism, allowing people of ancient North African civilization maintain their pastoral power sources. This organism as a species called Scarab and was deified and worshiped by the ancient Egyptians called "sacred scarab." The functional cause of deification turned the role of scarabs for cleaning pastures. This beetle feeds on the

droppings of cattle and horses and lives in arid landscapes with hot and dry summers. Beetles crawl to piles of manure, they make balls of different sizes from it and roll back them at a distance of tens of meters in suitable locations where buried them in the ground for later eating. Without such biological treatment pastures they would quickly suppressed and destroyed as a result of active grazing domesticated livestock. The real meaning of such purification is clearly evident to those of modern humans, who had come on heavily used pasture for grazing cattle.

The presented approach to the definition and understanding of the species allows for a new approach to the problem of pseudogenes in the mechanism of heredity. Recall that pseudogenes are called non-functional analogs of the structural genes. It is believed that pseudogenes have evolved from conventional functional genes, but somehow lost the ability to perform its functions. It is found that the number of pseudogenes on average is greater than ancestral functional genes, often this number may exceed the number of relevant functional genes by several orders [5,6].

This relationship between the functioning genes and stored but explicitly not used genes raises a number of unresolved issues. The simplest hypothesis of their existence is the assumption to them as instrumental debris accumulated in the genome formed as a by-product of failed mutations, etc. But this seemingly plausible assumption is unconfirming as evolutionary mechanisms allow you to save this part of the organism structure as a large amount of unnecessary and passively interfere with the existence of organism. Convincing explanations emphasize the importance of the structural elements of the organism is to survive and adaptability. For technical reasons, it seems obvious that those organisms or other costs that are not conducive survival and adaptation will be a negative factor in competition with those organisms that do not have and do not waste a biological matter, energy and biological activity for similar purposes, as compared with the first ones.

The large-scale use of redundant internal resources of organisms in an active struggle for existence, or at least the continued operation must have some effective aspects, such as to facilitate the adaptation and homeostasis of the organism or a system comprising it.

From the positions of outlined model, pseudogenes need for active reserve biogeocoenosis adaptation of organisms to changes in the physico-chemical bases. They are natural for selection of future active phenotype of cenosis components, surviving as a useful genetic potential adjustment to the possibilities of the future organization of biogeocoenosis previously existed in the history of the biosphere.

Let us dwell briefly on the functional possibilities of adaptation of biogeocoenosis components to changing its grounds. The dynamics of formation of species as optimized components is to move biogeocoenosis to a mode of adjustment. This mode is to disclosure the broad sets of interspecific hybridization which we call *adaptation fan*. Possible to suggest a hypothesis that it is initiated the inclusion of internal mechanisms distributed in biomolecular systems or partially in biogeocoenosis that disable or weaken the insulation of species breeding. As a result, the number of interspecific hybrids sharply increases; a number of phenotypic forms of organisms also increase. The excess of variations of current diversity of organisms is practically meaningless in stable abiotic foundations of the community and of such variations are doomed to extinction in essentially steady adaptation and optimal steady-state solution (including the traditional logic of Darwinism as less fit).

These variations turn out to the source of new forms of organisms, among which turn out to forms that are more efficient by optimizing the new base in the changed bases of biogeocoenosis. The transition namely to them is essentially natural by local course of the evolution. The transition to a new steady state of biogeocoenosis completed as soon as among these variations arise the best components on the above criterion that are considered from the standpoint of external classification as new species.

It becomes clear and the role of randomness in the formation of what is called a biological species. Truly the most versatile method of mathematical optimization is the method of random search which does not require knowledge of the explicit analytical dependencies. So its practical application in the multi-task biochemical biological optimization of distribution functions in biogeocoenoses is naturally.

It can be assumed as a working hypothesis that the actual formation of the biogeocoenosis adaptation fan is closely linked with the genetic mechanisms that are used in modern genetic engineering. In particular, it is very likely most active and leading role plasmids in this. Plasmids are small DNA molecules which are physically separate from the genomic chromosome, they able to replicate autonomously and generally occur in bacteria. It was found that plasmids contain the genes normally enhancing resistance to unfavorable external factors, they transferred from one bacterium to another and even other kind, and they are a means of horizontal gene transfer.

The property set of plasmids that is active actions in a sudden change of environment clearly serves that functional factor. This factor affects the genetic restructuring of biogeocoenosis because all organisms in it strongly linked biochemically, and themselves plasmids provide gene transfer including through viral exposure to more complex organisms.

Conclusions. The problem of determining the species has been examined by means cybernetics and mathematics. The mathematical model is offered, which is a broad generalization of the Lotka-Volterra equations for the dynamics of species pairs of the "predator-prey". The cybernetic side of approach is taking into account the existing environmental factors on organisms and populations defined physicochemical bases of biogeocoenoses by means existing mechanisms of system optimization aimed at increasing the biomass of the biosystem. Since each species in the stable biogeocoenosis is accurate optimization of the potential opportunities for the current biogeocoenosis genomes, it appears that no improvement of the species in principle can not be, the optimization has been implemented. Following changes only worsen the adaptability of the species to ecological niche.

The change and "improvement" of biogeocoenoses are caused by the material conditions of the physical world; they are a set of temperature ranges, humidity, solar radiation, pressure and chemical composition of the atmosphere, the chemical composition of soil and water, etc. These factors define rigidly the basic parameters

of a core set of environmental niches for a new set of biogeocoenoses on the Earth's surface formed in the biochemical processes.

The species diversity of biogeocoenoses almost entirely caused by physical and geochemical grounds but not arbitrary or subjective by chance variations internal "self-development".

The Evolution obviously is crucial, but it is essentially the evolution of the physical universe and its corollary, the evolution of biological conditions of existence on the planet.

The biological evolution that observed limited observer always and everywhere is only natural and inevitable consequences of the physical evolution of the Universe. The biological evolution that observed limited observer always and everywhere is only natural and inevitable consequences of the physical evolution of the universe

These consequences are manifested as observable changes biogeocoenoses consisting of optimized species in them. The instability and mutability of species has and can only take place during the rebuild kits of biogeocoenosis influenced by significant changes in the material basis for the planetary life. These rearrangements occur very quickly with respect to the geological and paleontological scale, because such changes occur through the reproduction of organisms, which has a bright pronounced exponential. The genetic fluctuations lead only to the extinction of the holders of such fluctuations in all other conditions, as organisms deviated from the optimum for the current biogeocoenosis.

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J11401-008

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**EXPLORING THE POSSIBILITY OF THE USE THICK LICORICE
ROOT EXTRACT TO TREAT A VARIETY OF IMMUNE DISEASES AND
DEVELOPMENT NEW MEDICINES ON ITS BASIS**

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Introduction. Actual problem of modern medicine is the treatment of infectious and inflammatory diseases, which are based on the pathology of the immune system, the depth and direction of which varies depending on the form of the disease, the etiologic agent, etc. [3].

Along with causal therapy for the treatment of these diseases are often used medicines with immunomodulating activity. And although the range of these medicines in the pharmaceutical market is limited, experts in the pharmaceutical industry have developed medicines not only for the correction of immunological parameters, but with antiviral, anti-inflammatory and antibacterial effects [1, 4].

Today are increasingly used medicines based on plants that have complex pharmacological effect and minimal side effects. Thus, according to numerous experimental clinical studies highly effective are medicines on the basis of licorice, from the raw material of which are obtained thick and dry extracts with anti-

inflammatory, anti-allergic, expectorant, anti-ulcer, antidote, hepatoprotective, antiviral, immunomodulating effects [2, 6].

In an aspect of the foregoing, the actual task of practical medicine and pharmacy is exploring the possibility of the use thick licorice root extract to treat a variety of immune diseases and development new medicines on its basis.

§ 1. Thick licorice root extract and its application in medicine

The main biologically active substance that contributes to diverse specific activity of thick licorice root extract is glycyrrhizin acid, contained in the extract in an amount of not less than 14 % [5]. Types of pharmacological action of thick licorice root extract and ensure its mechanisms are presented in Table. 1.

Table 1

Types of pharmacological action of thick licorice root extract and ensure its mechanisms

Type of pharmacological action	Ensure its mechanisms
Mineral corticoid	Glycyrrhizin acid and its aglycone affect water and electrolyte metabolism, enhancing the delay of Na^+ , decreasing K^+ content in the body, increasing blood pressure, and reducing the amount of urine
Inhibition of the metabolism of steroid hormones	Glycyrrhizin acid has properties of a cortisol antagonist, blocking antigranulemic action of hormones, inhibits deposition of glycogen in the liver and cholesterol biosynthesis
Anti-inflammatory, anti-ulcer, anti-allergic	Glycyrrhizin acid and its aglycone have a cortisone similar effect, increase the influence of exogenous adrenal hormones, affect the arachidonic acid cascade, inhibit the biosynthesis of prostaglandins
Antidotal and hepatoprotective	Glycyrrhizin acid inhibits lactate dehydrogenase, reduces transaminase, amount of lipid peroxides in the liver
Immunotropic	Glycyrrhizin acid and its salts stimulate the secretion of antibody, proliferation T- and B-lymphocytes, enhance phagocytosis of macrophages and lysozyme activity, increased titer of antibodies
Antiviral	Glycyrrhizin acid and its derivatives are capable

	of enhancing the formation of interferon in the blood plasma
Antitumor	Glycyrrhizin acid stop the growth of tumors induced by 7,12-dimethylbenzanthracene and 12-O-tetradecanoylphorbol-12-acetate
Hypolipidemic, anti-sclerotic	Glycyrrhizin acid and its salts reduce cholesterol, lipoproteins and triglycerides and cholesterol in the liver

For many years the development of technology and standardization of thick licorice root extract outstanding scientists engaged (Muravyov I.A., Pshukov Y.G., Ponomarev V.D., Litvinenko V.I. and others). Developed several medicines with glycyrrhizin acid (Kurono M., Fukahori K., 1990, G.A. Tolstikov, 1997, Litvinenko V.I., Amosov A.S., 2004), but today with thick licorice root extract in Ukraine produced only one medicine - syrup of licorice root.

This dosage form is used in children from 1 year in the complex treatment of infectious and inflammatory diseases of the upper respiratory tract, accompanied by cough and sputum. Contraindications to the use of syrup of licorice root are diabetes, individual hypersensitivity to the medicine, hypertension, severe degree of obesity.

View of the above and the prevalence of various immune diseases, it is advisable to create new drugs on the basis of thick licorice root extract in the form of ointments and suppositories to treat them. In the present aspect valuable is not only anti-inflammatory effect of the extract, but also antiviral and immunomodulating.

§2. Development and study of ointment with thick licorice root extract for the treatment of immune dermatological diseases

Analyzing biomedical requirements for soft dosage forms for treatment of immune dermatological diseases us were developed composition and technology of the ointment with thick licorice root extract on the emulsion base [9].

Below are some results of the studies of this ointment.

To determine the effect of thick licorice root extract on structural and mechanical properties of the developed medicine were investigated its rheological characteristics (Fig. 1). As seen from Fig. introduction of thick licorice root extract into base increases the plastic strength of undamaged structure. Increasing the width of the “hysteresis loop” refers to the amplification of the thixotropic properties.

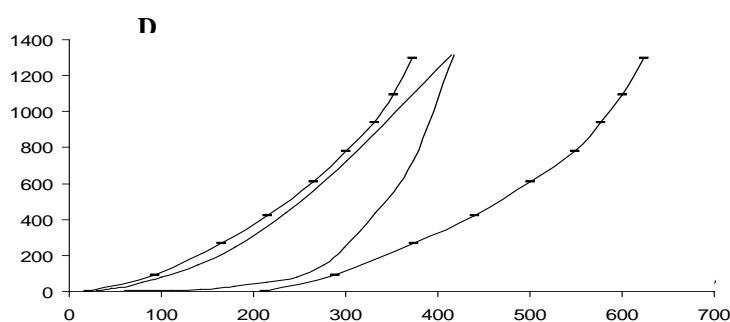


Fig. 1 “Full rheogram flow of the ointment with thick licorice root extract at 20 °C. Curves AB, CD - border of rheological optimum”

For a more complete and objective assessment of consumer properties of developed ointment, namely its ability to spread ability, held definition of shear stress in the speed range $125\text{-}275\text{ s}^{-1}$ at 34 °C (Fig. 2).

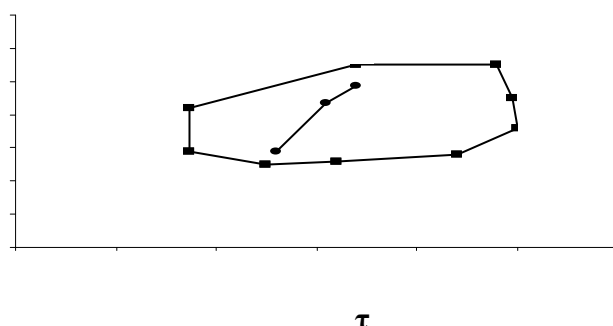


Fig. 2 “Limited rheogram flow of the ointment at 34 °C; (octagon - zone of rheological spreading optimum)”

Limited flow rheogram of the ointment characterizes its good spread ability. This fact indicates that the anointing of the medicine to the affected skin is subjectively felt as comfortable process that does not cause irritation.

To determine whether the introduction of antimicrobial preservatives in the ointment was studied its effective preservative effect (Table 2).

Table 2

Effectiveness of the antimicrobial preservative action of the ointment

Exposition	Requirements of SPU		Logarithm of the number of microorganisms		
	Log reduction	Log reduction	St. aureus ATCC 6538	Ps. aeruginosa ATCC 9027	C. albicans ATCC 885/653
Microb.load	10^6	10^6	5.30	5.39	5.39

Prim. crop	-	-	0.62	0.61	NA
2 days	2.00	-	2.05	2.07	NA
7 days	3.00	-	3.62	4.09	NA
14 days	-	-	NA	NA	NA
28 days	NP	NP	NA	NA	NA

Note: n = 5; P = 95 %;

*NP – the number of viable microbial or fungi cells do not proliferate;

*NA – viable microbial cells or fungi were not allocated.

After the contamination has been rapid death of microorganisms. Viable fungal cells were not allocated in the primary and in the succeeding crops.

On the effectiveness of the antimicrobial preservative action test samples of the ointment with thick licorice root extract meet the requirements of SPU (p. 5.1.3) of criterion “A” in medicinal products for topical application, which allowed not including in its composition antimicrobial preservatives.

Osmotic properties of the medicine were studied by dialysis through a semi permeable membrane (Fig. 3). The total mass of absorbed water was about 107.0 %, the absorption liquid is uniformly and slowly over 24 hours.

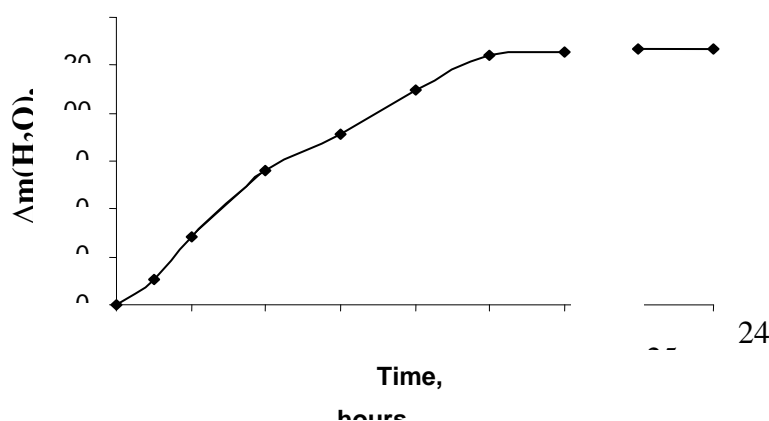


Fig. 3 “Kinetics of water absorption by the ointment with thick licorice root extract”

Ointment has a moderate osmotic activity, which allows recommending it to treat a variety of immune dermatological diseases, in both adults and children.

To standardize medicine were studied its organoleptic, physical, chemical properties, proposed quality control procedures, studied the storage stability.

For quantification of glycyrrhizin acid in the ointment was used extraction spectrophotometric method, which is the extraction of glycyrrhizin acid from the

medicine, formation of its ammonium salt and measuring the optical density of the solution at a wavelength (258 ± 2) nm (Fig. 4).

Calculation of the content of glycyrrhizin acid in 1.0 g of ointment was carried out by the standard method using a standard sample of glycyram on six parallel determinations. Glycyrrhizin acid content in 1.0 g of ointment should be not less than 0.0028 g, recalculated on glycyram.

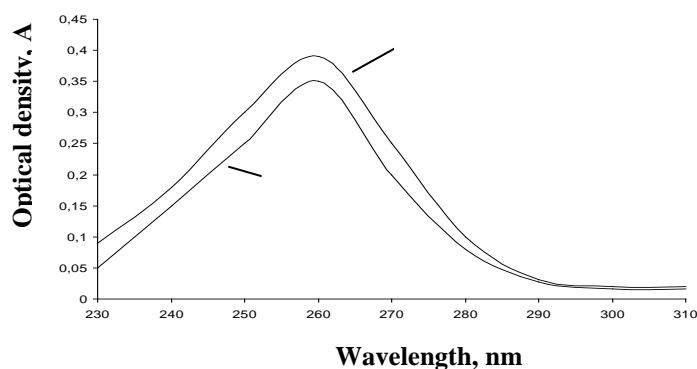


Fig. 4 “The absorption spectrum: glycyram solution - 1, ointment with thick licorice root extract – 2”

In parallel with the spectrophotometric determination of glycyrrhizin acid was carried out its identification by thin layer chromatography (TLC) in the UV - light at a wavelength of 254 nm (at standard of glycyram defined yellow spot with an R_f value of about 0.3) (Fig. 5).

Based on the studies were drafted quality control procedures of the ointment, as well as set its stability during storage for 2 years 3 months at a temperature of 8-15 °C and 15-25 °C, which gave reason to install its shelf life - 2 years.

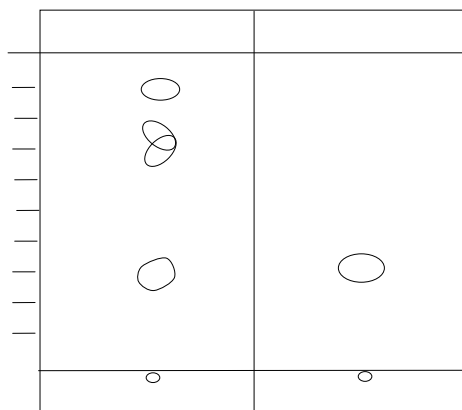


Fig. 5 “TLC scheme of the ointment with thick licorice root extract: 1 - extract of the ointment, 2 - standard - glycyram solution”

The release rate of glycyrrhizin acid from the ointment was studied in experiments *in vitro* by dialysis through a semi permeable membrane into purified water at $(37 \pm 0.5)^\circ\text{C}$.

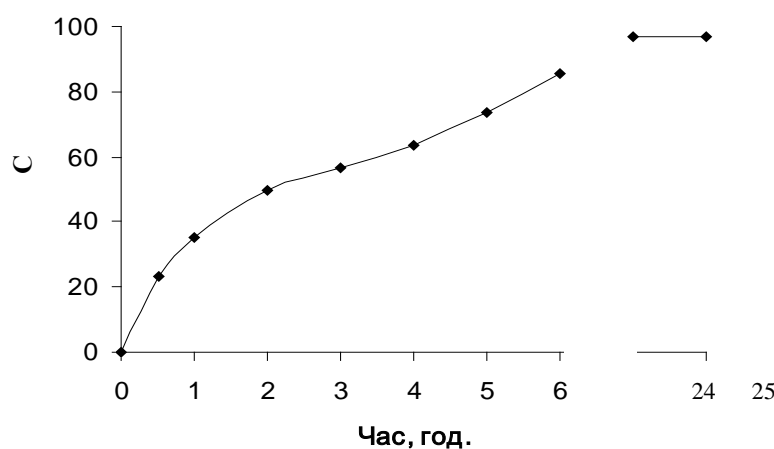


Fig. 6 “Release rate of glycyrrhizin acid from the ointment with thick licorice root extract”

Release of glycyrrhizin acid from the ointment has gradual supporting character that provides prolonged pharmacological action of the medicine within 24 hours.

Study of anti-inflammatory and anti-allergic activity was conducted on the experimental model of contact dermatitis. Pharmacological studies have shown that the ointment with thick licorice root extract exhibits a pronounced anti-allergic and anti-inflammatory effect, with a reduction of edema and hyperemia of the skin of animals in this experimental model of dermatitis.

Results of the study of acute toxicity indicate belonging of study ointment to the class of safe substances that do not exhibit locally irritating and allergenic effect.

§3. Development and study of suppositories with thick licorice root extract

In developing rectal suppositories with thick licorice root extract, first studied its antiviral properties against adeno- and corona viruses [8]. For research used a series of thick licorice root extract containing 14 % of glycyrrhizin acid. Concentration of thick licorice root extract / glycyrrhizin acid was determined based on the study of cytotoxicity and was 0.25 g / 0.035 g. Results of thick licorice root extract action on adenovirus are shown in Table. 3.

Table 3**Antiviral activity of thick licorice root extract in relation to adenovirus**

Controls	Concentration extract/ glycyrrhizin acid	Infectious viral titer before and after culture with extract	
		Adenovirus	
		before	after
	0.25 g/0.035 g	10^{-4}	10^{-2}
Control of test viruses (100 TCD ₅₀ /0.2 ml)	-	Cytopathogenic effect of test viruses (+++)	
Monitoring Tissue Culture VERO	-	No signs of cell degeneration at the time of recording the results of the experiment	

Note: $n = 5$; $P = 95\%$

As can be seen from Table 3, selected concentration of extract / glycyrrhizin acid (0.25 g / 0.035 g) delayed adenovirus reproduction on 1-2 breeding. The antiviral activity against corona virus adjusted using hem agglutination of erythrocytes of mice (Table 4).

Table 4**The results of studying the effect of thick licorice root extract on the hem agglutinating activity of corona virus**

Ingredients hem agglutination	Hem agglutinin titer corona virus Harkov/343/86	
	before	after
	1:128	1:32
Control mice erythrocytes	Lack of hem agglutination	

Примечание: $n = 5$; $P = 95\%$

According to the results of Table 4, thick licorice root extract in the selected dose reduced in 4-fold (from 1:128 to 1:32) hem agglutinating titer of corona virus by destroying structural elements of super capsid.

Studying the release kinetics of glycyrrhizin acid of thick licorice root extract from prepared by pouring method samples of rectal suppositories was performed in experiments *in vitro* by dialysis through a semi permeable membrane (Fig. 7).

Release of glycyrrhizin acid has a gradual supporting nature, which ensures long-term effect of the medicine within 24 hours.

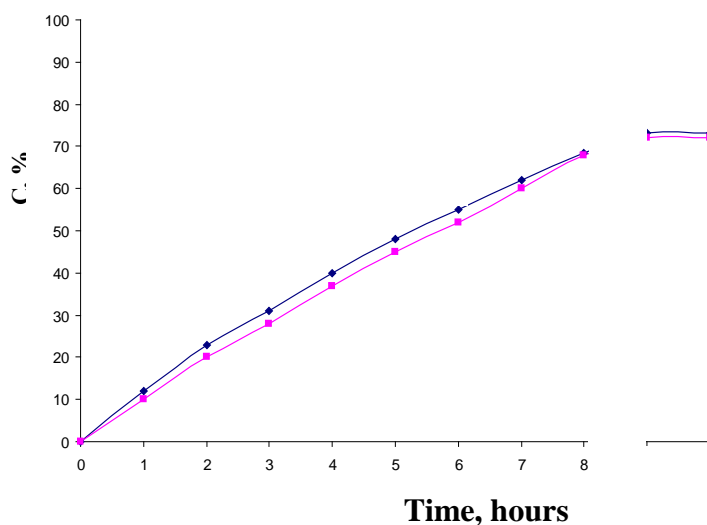


Fig. 7 “Release kinetics of glycyrrhizin acid from rectal suppositories with thick licorice root extract”

In order to solve the issue of introducing antimicrobial preservatives in the medicine was studied its preservative action (Table 5).

Table 5

Effectiveness of the preservative action of suppositories

Exposition	Requirements of SPU		Logarithm of the number of microorganisms		
	Log reduction	Log reduction	St. aureus ATCC 6538	Ps. aeruginosa ATCC 9027	C. albicans ATCC 885/653
Microb.load	10^6	10^6	5.30	5.39	5.39
Prim.crop	-	-	0.62	0.61	0.69
2 days	2.00	-	2.98	2.07	2.05
7 days	3.00	-	NA	3.62	4.09
14 days	-	2.00	NA	NA	NA
28 days	NP	NP	NA	NA	NA

Note: n = 5; P = 95 %;

*NP – the number of viable microbial or fungi cells do not proliferate;

*NA – viable microbial cells or fungi were not allocated.

On the effectiveness of the antimicrobial preservative action test samples of rectal suppositories with thick licorice root extract meet the requirements of criterion “A” set by SPU p. 5.1.3. Appropriate conditions of production and composition of the medicine

provide the necessary effectiveness of the antimicrobial preservative action, which allowed not include additional antimicrobial preservative.

Study of the osmotic activity of the medicine showed that the liquid absorption is evenly and slowly, amount of absorbed water is about 30 % by the weight of the suppository, which suggests a low osmotic activity and predict the use of the developed medicine without irritating to the rectal mucosa (Fig. 8).

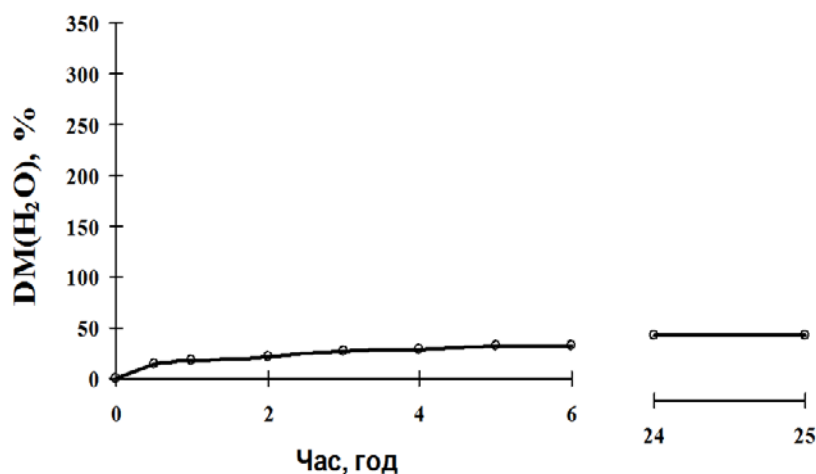


Fig. 8 “Osmotic activity of suppositories with thick licorice root extract”

Study of the dependence of structural viscosity on temperature showed that with increasing temperature from 31 °C to 34 °C value of structural viscosity of suppository mass decreases in 4 times. In this temperature range the system is in the turbid gel. In the temperature range 34-38 °C the value of structural viscosity of suppository mass is decreases in 7 times; it becomes transparent. Investigation of the structural viscosity of the base while raising temperature from 31 °C to 36 °C revealed that its structural viscosity decreases in 20 times (Fig. 9).

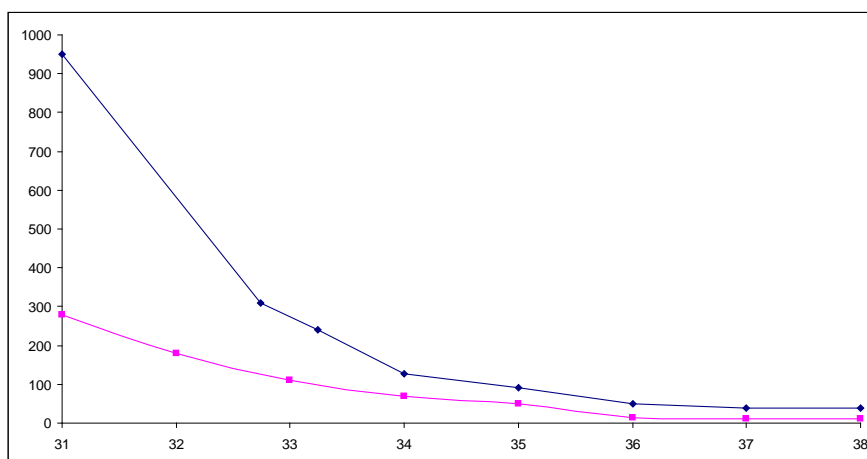


Fig. 9 “The dependence of structural viscosity of suppository mass (1) and the base (2) from the temperature

Comparison of dependence of structural viscosity of suppository mass and the base from the temperature showed that the viscosity of suppository mass at the initial temperature of measurement 31 °C is different from the structural viscosity of the base, at the maximum measurement temperature 38 °C it approaches to structural viscosity of the base at 35-36 °C (Table 6).

Таблица 6

Structural viscosity of the base and suppository mass at different temperatures

Reoparameters	Structural viscosity at different temperatures							
	31 °C	32 °C	33 °C	34 °C	35 °C	36 °C	37 °C	38 °C
suppository mass								
η , mPa \times s	950	310	240	127	91	50	20	20
base								
η , mPa \times s	280	180	110	70	50	15	10	10

When analyzing derivatograms of active ingredients, suppository base and full suppository formulations set that thick licorice root extract is stable to a temperature $(35,0 \pm 1,0)$ °C, while temperatures ranging from 36 to 94 °C results in a gradual loss of its mass (Fig. 10).

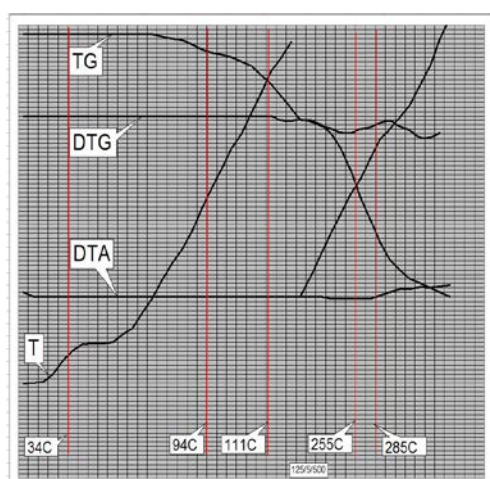


Fig. 10 “Derivatogram of extract”

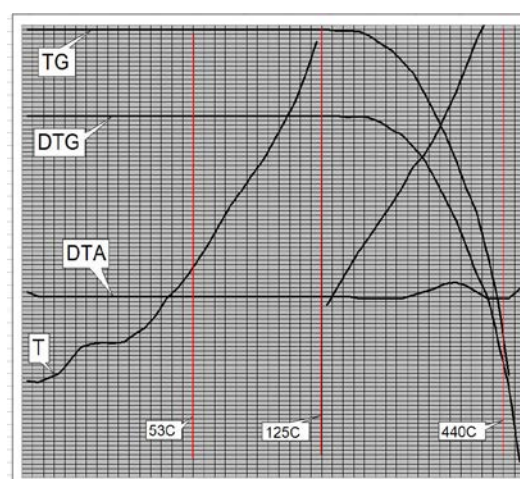


Fig. 11 “Derivatogram of suppositories”

The base begins to melt at a temperature from (36.0 ± 1.0) °C.

The suppositories decomposition process occurs in three stages (Fig. 11). In the first step - to 53 °C moisture loss is observed in the mass. The second (53-125) °C and the third (up to 440 °C) stages characterized by rapid and continuous process of destruction, accompanied by significant exothermic effects [10].

In accordance with the requirements of SPU quality control of suppositories conducted on the following parameters: description (appearance), uniformity, identification and quantification of the active ingredients, pH, average weight, disintegration, microbiological purity.

Identification of thick licorice root extract was carried out using TLC in the system of solvents: chloroform - methanol - water (26:14:3). In the chromatogram of the test solution at the level of the reference glycyram solution determined fluorescent purple spot with an R_f value of about 0.3, at the level of the reference likurazid solution - yellow spot with an R_f of about 0.5.

To determine the quantity of glycyrrhizin acid in suppositories was used method of absorption spectrophotometry in UV-spectrum. Studies have shown that the content of glycyrrhizin acid in 1 suppository is not less than 0.0350 g, recalculating on glycyram.

In order to determine the shelf life of the medicine and determine its stability medicine samples in PVC tape were laid to storage in a dry, dark place at a temperature of 8 °C to 15 °C. It was established that during the period of observation suppositories meet the requirements of SPU in all indicators of quality that has allowed establishing the shelf life - 2 years.

On the basis of "Institute of Microbiology and Immunology named after I.I. Mechnikov of Medical Sciences of Ukraine" established antiviral activity of the medicine against adenovirus type 3 (delay virus reproduction at 2 dilutions) and corona virus (reduction viral titer in 4 times).

Study of the specific activity of suppositories hosted by the Central Research Laboratory of National University of Pharmacy on nonlinear immature rats with normal immune status and subject to the immunodeficiency caused by hydrocortisone

acetate. Research of immunomodulating activity of suppositories found their expressive immunostimulating properties.

Conclusions

1. The possibility of using thick licorice root extract in the treatment of various immune diseases is studied. The prospects of the development on the basis of its new medicines are shown.

2. On the basis of pharmaco-technological, physical, chemical, microbiological and pharmacological studies developed composition and technology of ointment and rectal suppositories with thick licorice root extract for treatment of immune pathologies.

3. The influence of thick licorice root extract on structural and mechanical properties of developed ointment and the effect of temperature on the rheological, physical, and chemical parameters of suppository mass and base of rectal suppositories with thick licorice root extract are studied.

4. Experimental study on the effectiveness of the preservative action of model samples of ointment and suppositories are conducted, they allowed not to include in the medicines more antimicrobial preservatives.

5. Osmotic activity of the medicines with thick licorice root extract is studied. It is shown that they have a moderate osmotic activity and can be recommended for the treatment of various immune diseases, in both adults and children.

6. The main indicators of the quality of the medicines with thick licorice root extract are established. The methodic of their qualitative and quantitative analysis are developed. Expiry dates and storage conditions are set.

7. Specific activity of rectal suppositories and ointment with thick licorice root extract is studied - their anti-inflammatory, anti-allergic, antiviral and immunomodulating effects are proved.

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J11401-009

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**INFLUENCE OF AGRARIAN SYSTEMS ON THE
MICROBIOLOGICAL TRANSFORMATION OF ORGANIC MATTER IN
TYPICAL CHERNOZEM UNDER SUGAR BEET GROWING**

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Was investigated influence of agrarian systems and methods of soil tillage on the number of basic physiological groups of microorganisms which participate in the transformation of organic matter of typical chernozem under sugar beet growing. Was defined the direction of microbiological processes in soil under different agricultural applications.

Keywords: microorganisms, agrarian systems, soil tillage, sugar beet, typical chernozem.

Introduction. Ukraine – one of the states that has a huge reserve of fertile soil, which is one of the most valuable treasures of the world. Soil fertility is forming by a complex system of environmental factors. It is including the leading role of biochemical activity of microorganisms, which provides circulation and transformation of matter and energy of soil. Soil microbial communities involved in the formation of important soil properties that determine its taxonomic characteristics: direction, intensity and type of soil formation processes, are caused organic properties – ensures its functioning as a biochemical filter, assist with biodynamic balance of synthesis and destruction of organic matter and nutrient availability to plants [1-5].

Growing human pressure affects the properties of the soil, impairing their agrochemical and biological indexes. Thus, under the influence of anthropogenic

factors (doses, forms and norms of fertilizers, soil types, the permanent cultivation of crops and the use of crop rotation, the use of plant protection products, plant growth regulators, pesticides, etc.) is changing complex of microbiological indicators, it is occur the qualitative and quantitative changes in the structure and biodiversity of various physiological groups of microorganisms, which are not always positive for soil [2, 4].

Therefore, the study of patterns of microbial function and direction of microbiological processes in the soil will allow to forecast the possible ways to change the soil under the influence of agrosystems, to get the necessary information for adjusting used farming systems, which in turn can ensure the preservation and restoration of soil fertility and high productivity of agro-ecosystems in general [6].

The purpose of research – to determine the effect of agrarian systems and soil tillage on the number of basic physiological groups of microorganisms involved in the transformation of organic matters and to identify common patterns of directional microbial transformation processes of organic matter in the soil.

Materials and methods of research. The study of soil microbial communities was carried out on the stationary field experiment of Agriculture and Herbiology Department of Agronomy Research Station of NUBiP of Ukraine in the forest-steppe in grain and beet rotation. Soil is chernozem typical medium loamy, humus content in the plow layer is 4%, nitrogen – 4.5 mg per 100 g of soil, mobile phosphorus – 4.5-5.5 mg per 100 g of soil, exchangeable potassium – 10 mg 100 g of soil. Selection of soil samples was carried out from the top of the arable horizon (0-25 cm) before sugar beet (*Beta vulgaris*) harvesting.

The scheme of experiment is provided to study two factors: agrarian systems and measures of soil tillage: 1) industrial agrarian system – (control) – (applying $N_{92}P_{100}K_{108}$ fertilizer, 12 tons of manure per hectare of crop rotation) + surface tillage (cultivation of disk tools to a depth of 8-10 cm for all crops rotation), 2) industrial system + differentiated tillage – (hold 6 times plowing on different depth, 2 times the surface tillage under winter wheat after peas and corn silage and 1 again – tillage under barley for crop rotation), 3) ecological agrarian system (application of

N₄₆P₄₉K₅₅ fertilizer, 24 tons of organic fertilizer (12 tons of manure, 6 tons of non-commercial harvest (straw), 6 tons of green manure crop mass (radish)) per hectare of crop rotation + surface tillage, 4) ecological agrarian system + differentiated tillage, 5) biological agrarian system (24 tons of organic fertilizer) + surface tillage, 6) biological agrarian system + differentiated tillage [7].

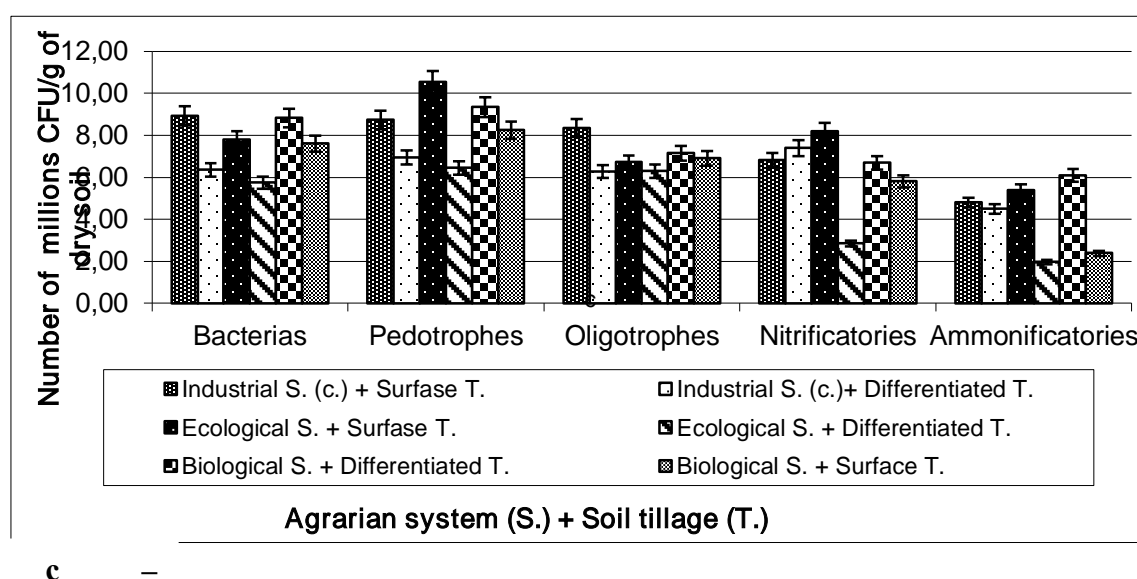
The number of basic physiological groups of microorganisms was determined by inoculation of soil suspensions on solid nutrient medium [8]. In meat-pepton agar into account the number of bacteria that metabolize nitrogen of organic compounds, on starch-ammonia agar – the number of bacteria and streptomycetes that assimilate mineral forms of nitrogen, in the Zvyagintsev – the total number of bacteria, on Czapek – micromycetes, on Ashby – oligonitrofilic microorganisms, on Menkina – phosphorus mobilization bacteria, on Hetchynson – tselyulozolitic bacteria, on soil agar – pedotrophic, on starvation agar – oligotrophic microorganisms. The direction of microbiological processes in the soil was determined by methods of K. Andreyuk. H. Iutynska et al [5]. The moisture of soil was determined by thermostatic-weight method [9].

Results. The number of the microorganisms, even for short periods of phenophase may vary change under influence of dynamics of soil moisture, temperature, composition of vegetation [10].

Microbiological studies of soil under crops of sugar beet, showed that the correlation and number of different physiological groups of soil microorganisms depends on the dose, type of fertilizer and soil tillage.

The largest group of microorganisms was representative's bacterial microflora, pedotrophes, oligotrophes and microorganisms that absorb mineral nitrogen (Fig. 1). Thus, the number of bacteria in the investigated soil samples ranged from 6.35 to 8.93 million CFU / 1 g a.d.s (absolutely dry soil). Increase the quantity of bacterial microflora on the 16-41% observed in the application of surface tillage compared with the differentiated tillage, because plant residues and fertilizer are localized in the upper soil layer. Number pedotrophes that intensive developing on depleted soils, due to their trophic specificity and lack of competition, the highest was in the application

of ecological agrarian system in conjunction with surface tillage (10.53 million), the lowest is ecological system and differentiated tillage (6, 44 million). Application of industrial agrarian system and surface tillage are contributed to the increase of oligotrophic microorganisms to 8.35 million, compared with other agrosystems (6,27-7,14 m), which had less influence on the formation of groups oligotrophes. The number of microorganisms that metabolize nitrogen of mineral compounds was lower (2,84-8,19 million). The number of the microorganisms that absorb nitrogen of organic compounds ranged from 1.96 to 6.08 million. Number of nitrification microorganisms prevailed number ammonification microorganisms by 42-65% (in the version of the experiment biological agrarian system + surface tillage – 10%), that indicate on active mineralization processes in the surface layer of soil. The highest number of the bacteria that use nitrogen of organic compounds was in the variant of the experiment biological agrarian system + surface tillage (5.38 million), due to the higher content of organic matter of plant origin compared with other variants of the experiment. Investigated samples of typical chernozem are also characterized by low proteolytic activity of microbiota because the number of microorganisms that mineralize nitrogen-containing organic compounds generally dominated the number of ammonification microorganisms by 33.5%.



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Fig. 1 The number of physiological groups of microorganisms in typical chernozem at the sugar beet growing under different agrosystems

The number of streptomycetes's, spore-forming, oligonitrophiles and phosphorus mobilization microorganisms was much smaller – 0,61-2,57 million CFU / 1 g a.d.s. (Fig. 2). Streptomycetes are important part of soil microbiological communities. They participate in the decomposition of plant and animal residues in soil, in the formation of humus and its mineralization [10]. The largest number of streptomycetes (1.6 million) is formed at the industrial agrarian system. The number of group of these microorganisms is also increasing on average 23.9% on surface tillage at all variants of the experiment compared with differentiated tillage. So, at this conditions the number of easily accessible organic compounds for streptomycetes's are greater. The number of spore-forming bacteria (0,78-1,9 million), in contrast, increase at the differentiated tillage and the highest (1.9 million) was at the biological agrarian system. The number of oligonitrophiles (0,82-2,57 m) is increased with the introduction of mineral and organic fertilizers at the minimizing tillage. Thus, the most microorganisms (2.57 and 2.55 million) were at the application of ecological and industrial agrarian systems in combination with surface tillage. This indicates the possibility of higher nitrogen fixation in these variant of experiment.

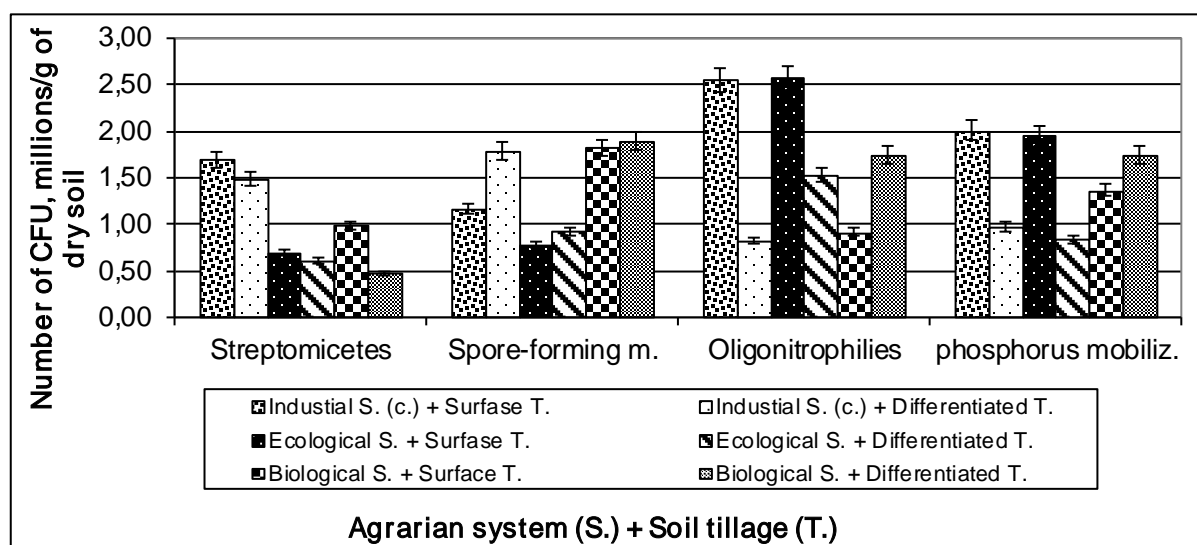


Fig. 2 The number of physiological groups of microorganisms in typical chernozem at the sugar beet growing under different agrosystems

It was studied soils which are characterized by a large number of micromycetes (7,54-18,67 thousand CFU / 1 g a.d.s.), due to localization in the upper soil layer plant residues with high fiber content, that stimulates the development of fungal microflora (Figs. 3). Minimum number of tselyulozolitic bacteria (3,9-11,3 thousand) is conditioned low rainfall and slightly thick litter. Due to energy matter localization in the upper part of the arable soil layer in the application of industrial agrarian system in conjunction with surface tillage and biological system with differential tillage are increase the number of microorganisms and intensity of tissue degradation.

The highest biogenic of soil (total number of microorganisms) in the layer 0-25 cm have three options of experiments where were conducted a surface tillage (industrial – 45.1, ecological – 44.6 and biological systems – 43.2 million CFU/1g. a.d.s.) (Fig. 4). Slight biogenic index have biological and industrial agrarian systems and differentiated tillage (36.8 and 36.5 million, respectively), the lowest biogenic level has the variant of ecological system + differentiated tillage (27, 2 million). This reduction of the total number of microorganisms in this version of the experiment due to lower revenues organic residues because of the exclusion of biomass.

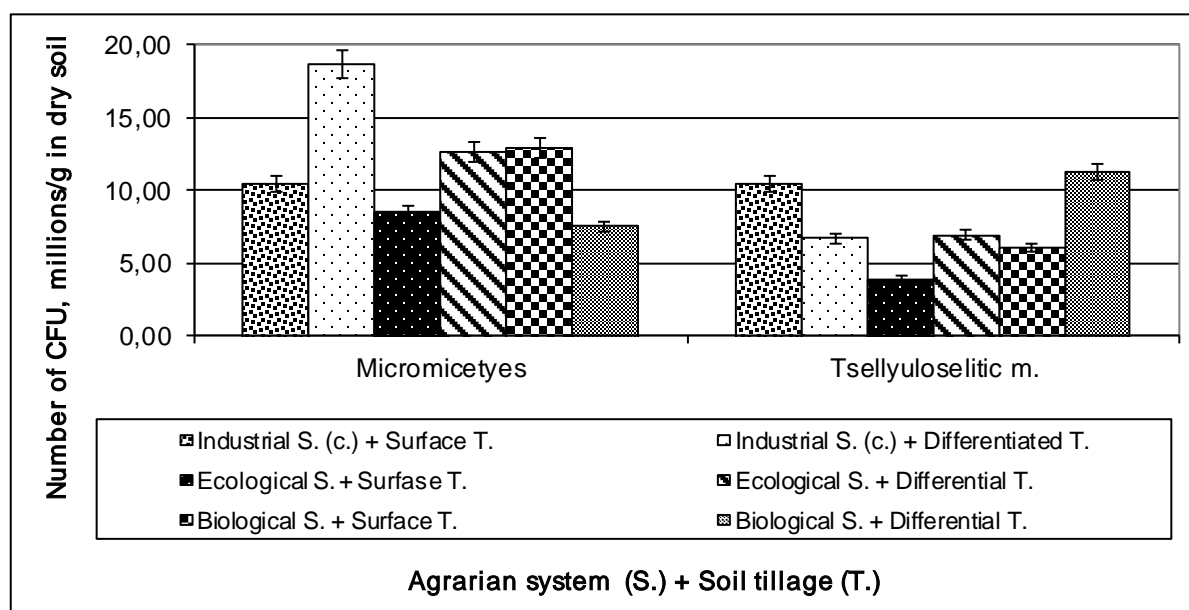


Fig. 3 The number of micromycetes and tselyulozolitic microorganisms in typical chernozem at the sugar beet growing under different agrosystems

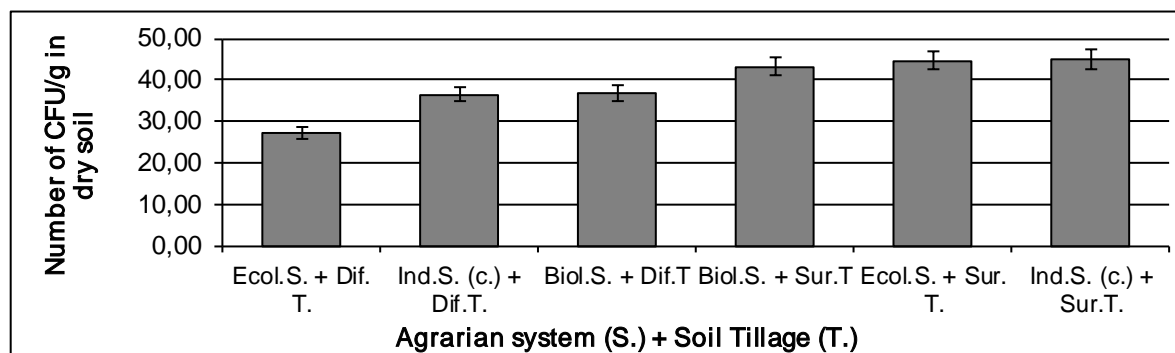


Fig. 4 Biogenic of typical chernozem at the sugar beet growing under different agrosystems

Based on the obtained data it was determined the orientation of microbiological processes in the soil by using the coefficients of mineralization, immobilization, oligotrophic, pedotrophic and microbial transformation of organic matter (Fig. 5). Coefficient of mineralization ($k_m = 1,1-2,43$) indicates the predominance of degradation processes of organic matter above the synthesis of all variants of the experiment. In the variant of biological agrarian system + surface tillage indicator value was the lowest ($k_m = 1,1$). It indicated on the direction to the balancing between the processes of mineralization and immobilization. The values of the pedotrophic coefficient were the lowest in the biological system in combination with surface tillage ($k_{ped} = 1,54$) and the industrial system with differentiated tillage ($k_{ped} = 1,55$). The highest coefficient was in the biological and ecological systems, and differentiated tillage ($k_{ped} = 3,47$ and $3,29$, respectively). Increasing the pedotrophic index shows an increase of intensity of decomposition of soil organic matter, such as humic compounds. The oligotrophic coefficient indicates on the lower content in soil nutrients at the ecological agrarian systems and differentiated tillage ($k_{ol} = 1,31$). Other variants of the experiment was characterized by a high supply of soil micronutrients ($k_{ol} = 0,49-0,84$). Transformation of organic matter in the soil is the most intensive at the variant of biological agrarian system + surface tillage ($k_{trans} = 11,61$).

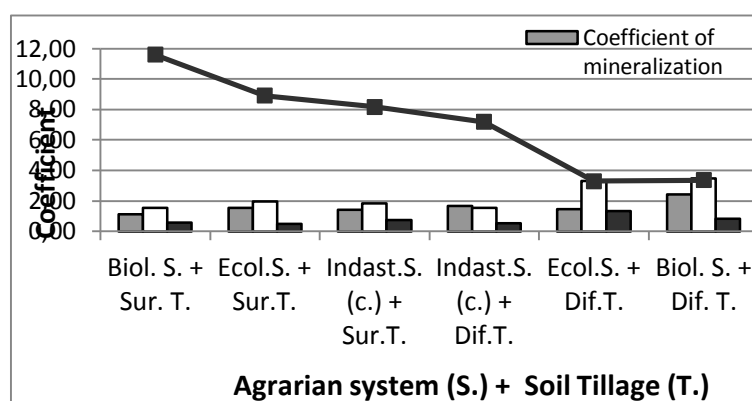


Fig.5 The direction of microbiological processes in the soil at the sugar beet growing under different agrosystems

Conclusion. Thus, the use of agrarian systems and soil tillage is influenced to the formation of different microbial communities on unequal value microorganisms of major physiological groups. It leads to the change of intensity of the flow of microbial processes. So, the use of industrial system helps the most enhance of soil biota (excluding bacteria, spore-forming and pedotrophic microorganisms', whose number was greater at the biological systems). Application of the surface tillage contributes the increase of the number of microorganisms, involved in the transformation of soil organic matter (except micromycetes, tselyulozolitic and spore-forming bacteria, most of which were found in the application of differentiated tillage). Coefficient of microbial transformation of organic matter also indicates the beneficial effects of this tillage on the state of the soil biota. Thus, microbial processes of transformation of soil organic matter were more intensivity at the using of industrial agrarian system and surface tillage.

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