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ADDRESSING THE GROWING BURDEN OF NCDS: RETURN TO ALMA-ATA AND PRIMARY HEALTHCARE APPROACH

Abstract. Last year was the 40th anniversary of the Declaration of Alma-Ata. The conference organized by WHO and the United Nations Children's Fund proclaimed the ambitious goal - Health for All by the Year of 2000 and introduced the Primary Health Care approach that was considered as the means to achieve the goal. At the same time, some authors think that the main Alma-Ata deficiency was the fault to clearly define the difference between primary medical care and PHC approach, which involves universal coverage, inter-sectoral collaboration, community-based curative and preventive services. This short report discusses the excessive alcohol consumption and its dynamics throughout years in Kazakhstan and other post USSR countries, linking it to high rates of non-communicable diseases (NCDs) within these countries. It also emphasizes the importance of intersectoral approach in tackling excessive alcohol consumption that may well lead to an improved management of NCDs.

Key words: Declaration of Alma-Ata, Primary Health Care approach, Excessive alcohol consumption, Noncommunicable diseases, mortality.

Introduction. Population health and healthcare all over the world has changed drastically within the last few decades. Since the world community has made a progress in tackling communicable diseases, people overall are now living longer both in low/middle-income countries (LMIC) and high-income countries (WHO, 2018). Along with such improved life expectancies, middle-income countries have also been experiencing demographic transition that leads to a new public health and economic problem such as ageing.(Abegunde et al., 2007) According to official statistics, by 2030, almost 71 percent of people over 60 are expected to live in low- and middle-income countries (WHO, 2018). Furthermore, more people are suffering from NCD's in LMIC. Consequently, an adequate focus on ageing populations and age associated health conditions are needed in these countries.

NCDs in the world. Rapid ageing of population is a new challenge in the management of NCD's. According to WHO reports (2014) ,71 percent of premature death is attributed to NCDs. In addition, as these data states further, 15 million people between 30 and 69 years die annually, and 85% of death from NCD occurs in Low- and Middle income countries. This could be explained by socioeconomic differences within these countries and the ways NCDs are addressed. As an example, a systematic review by Sommer et al., (2015) shows that low socioeconomic status in low and middle income countries contributes to some of the NCDs' increase including cardiovascular diseases, lung and gastric cancer, type 2 diabetes, and chronic obstructive pulmonary disease. Numbers of other risk factors such as tobacco use, physical inactivity, a harmful use of alcohol and unhealthy diets are also well known causes of high NCD mortality rates (WHO, 2018). Previous studies have demonstrated the importance of modifying such behavioral risk factors of NCDs in controlling NCD's mortality (WHO, 2013). In that sense, an inter-sectoral approach earlier declared in Alma-Ata conference can be applied as one of the promising tools in NCDs' management.Therefore, this discussion will focus on potential use of inter-sectoral approach in tackling excessive alcohol consumption, as one of the major contributors of high NCD's mortality in Kazakhstan.

Alcohol consumption and NCDs. Alcohol consumption is one of the important sectors of NCDs' management. According to the latest GDB reports, alcohol has elevated to the third highest risk factors of NCDs development among men and to the seventh among both men and women worldwide (Kisa,2018). Correspondingly, in the last WHO Global Action Plan for the prevention and control of NCDs 2013-2020, the harmful use of alcohol, was for the first time included in a list of NCDs' main risk factors and suggested to be addressed through cross-sectoral government engagement (WHO, 2013). Another action taken to tackle NCDs took place at the Alma-Ata conference; Primary Healthcare (PHC) approach was emerged from a synthesis of ideas and experiences from various geographical regions in addressing NCDs. Countries such as Sri Lanka, China, and Costa Rica have achieved substantial success in implementing this PHC approach (Tarimo, Webster and Services, 2018). However, such results are restricted to other developing countries including Kazakhstan.

Case study: alcohol use and NCDs' mortality rates in Kazakhstan. High mortality rates from NCDs have long been one of the major challenges to be addressed in Kazakhstan. For example, in 2016 NCDs were responsible for almost 86% of overall death in the country and almost 27% of them were attributed to premature NCD mortality (WHO Noncommunicable Diseases Country Profiles, 2018). However, alcohol is not only a problem of Kazakhstan and other former Soviet Union countries. The countries of so called historical vodka belt experienced similar problems and exposed high taxes on strong spirits (Doria.fi, 2018), their health indicators are among the best in the world. For example, Sweden had 46 litres of alcohol (mostly strong spirits) per capita consumption in mid-19 centuries (Vinbudin.is, 2018) but currently has only 10 litres per capita while the spirits' intake is approximately 15% (Doria.fi, 2018).

Kazakhstan, similar to Russia and other former Soviet Union countries, has experienced a significant increase in CVD and total mortality since the disintegration of USSR in 1991(WHO, 2018). This, however, was not solely a result of the collapse of the healthcare system, but rather a combination of many economic, social and behavioral factors. It has also been demonstrated that among the diverse risk factors of NCDs identified in Russia and former USSR countries, alcohol consumption has been one of the major contributors of high NCDs morbidity and mortality rates (Pomerleau et al., 2008). For example, as it can be seen in figure 1, there is an increasing gap in NCD mortality between Kazakhstan and the Czech Republic since 1990, when the health indicators were almost equal (WHO. 2018).

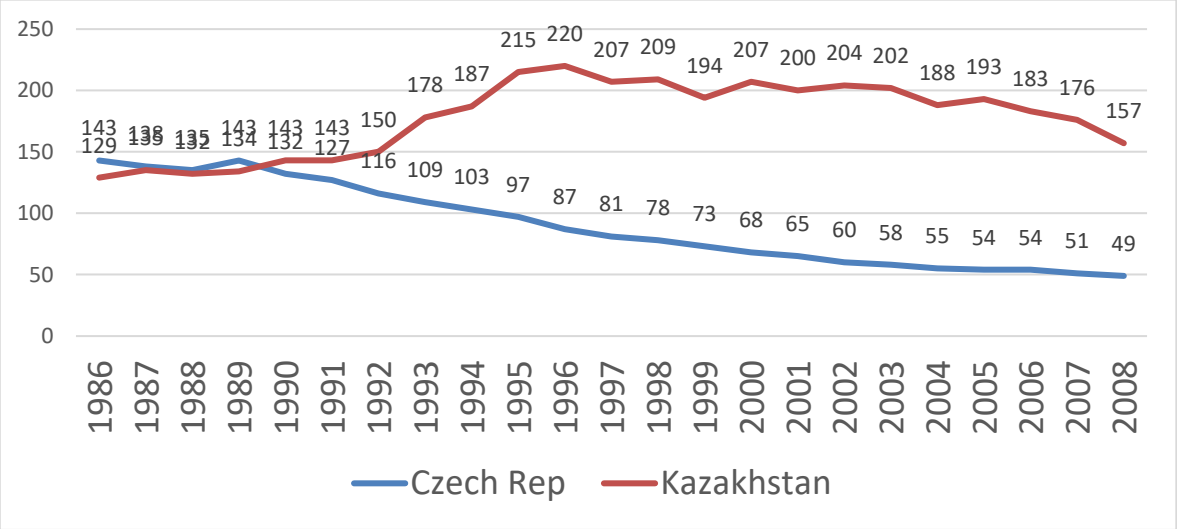

Figure 1 – Age-standardized NCD death rates per 100,000, <65 age, males, (Kazakhstan and Czech Republic)

The diagram below shows the fluctuations of age-specific all-cause mortality among males in Kazakhstan in 1985-2012. The first sharp decline happened in mid-80th , mostly in younger age groups, happened after Gorbachev's measures on alcohol but mortality soared among all age groups after the collapse of Soviet Union and following hard economic transition. Notably, that while mortality started to decline among the oldest age group after passing the hardest time of economic transition in mid-90th, mortality among younger age groups remained highly stable and even have been increasing in the time of economic growth in 2000th.

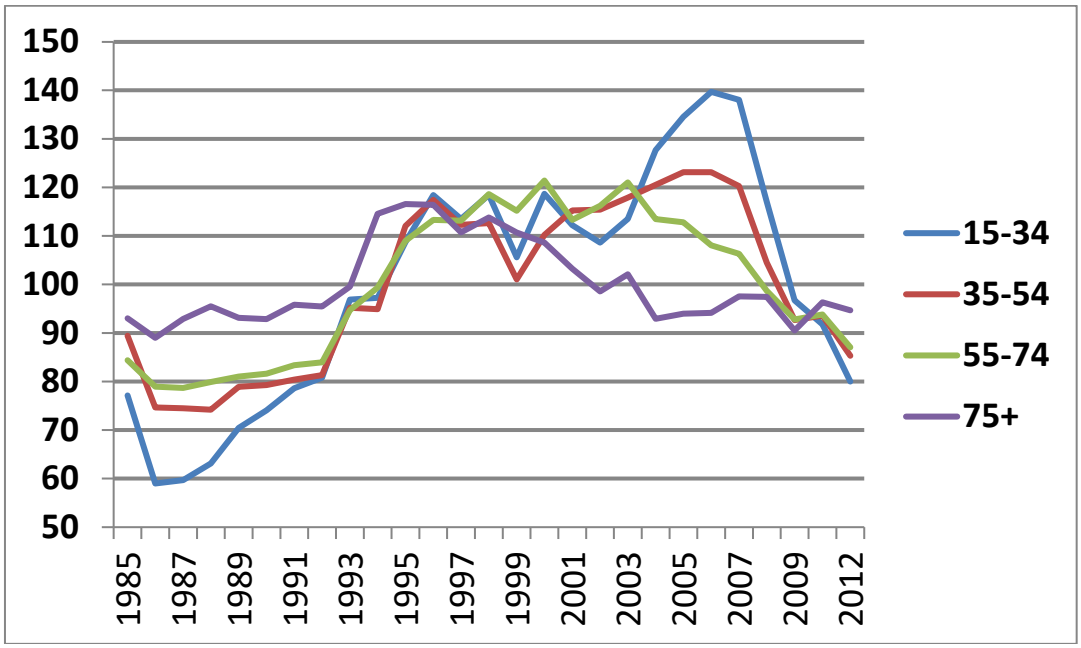

Figure 2 – Age-specific all causes mortality trends, males, Kazakhstan,1985-2012

In Kazakhstan, major changes in mortality rates have occurred within the last few years. Age-standardized all-cause and NCD/CVD mortality rates declined dramatically over the period 2008-2015 (by 29%), for both men and women (Who.int, 2018). The NCD/CVD mortality trend was mirrored by changes in mortality from accidents, traumas and poisoning (figure 3), and was accompanied by more than 20% decrease of homicides and suicides - rates which can be considered proxies for hazardous alcohol consumption (WHO, 2018).

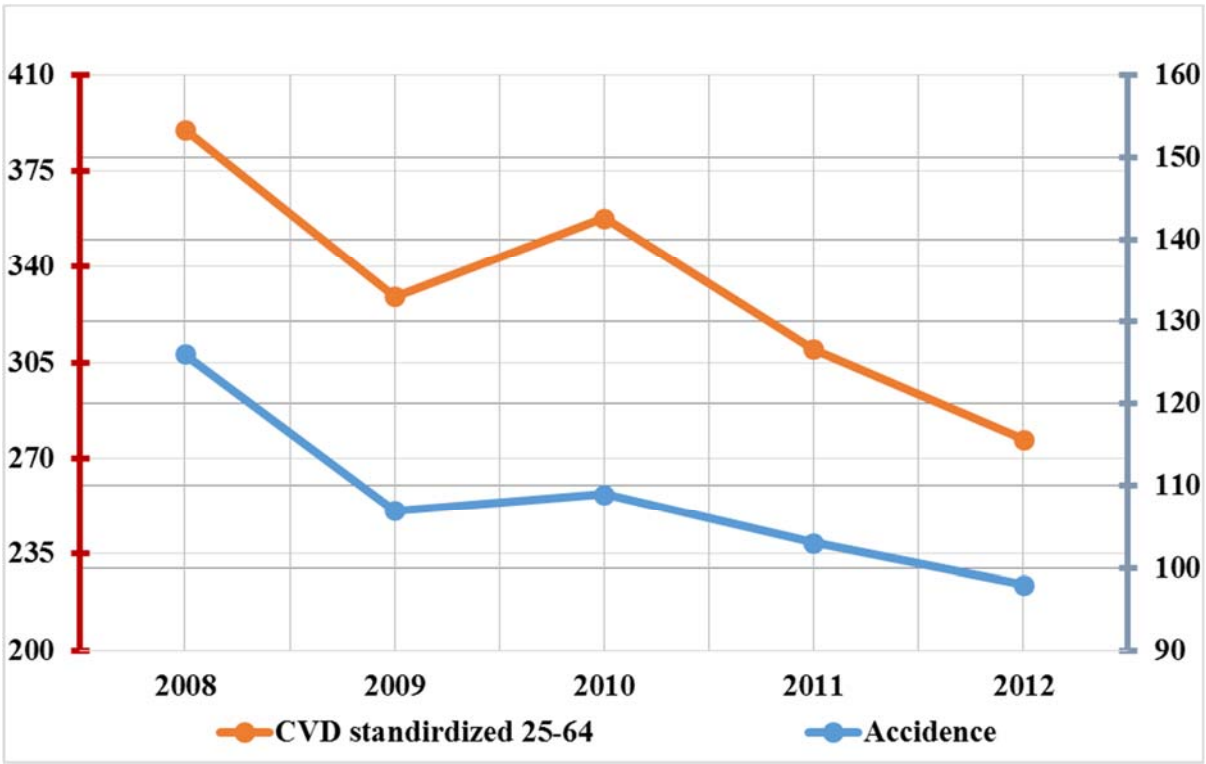

Figure 3 – CVD mortality and accident mortality trends in Kazakhstan, 2008-2012

These mortality trends also coincided with a decrease in strong spirits production and sales and an alcohol tax increase (table) (Esc365.escardio.org, 2018). There seems to be a shift from vodka in all-cause mortality was steepest among younger age groups, and much consumption towards beer and wine use, while the government has also introduced successful tax policies on various alcohol beverages (Davletov et al., 2015). The decline less pronounced or even barely detectable in older age groups. These findings are consistent with the hypothesis that alcohol consumption was the main factor influencing the decline of NCD and all-cause mortality (Davletov K. et al., 2016).

Mortality, vodka price and tobacco sales trends in Kazakhstan, 2006-2013

	2006	2007	2008	2009	2010	2011	2012	2013
CVD mortality per 100,000	408	404	377	341	348	305	275	215
All-cause mortality per 100,000	980	970	918	845	856	819	787	723
Accidents mortality per 100,000	150	145	126	107	109	103	98	91
Retail vodka sales (million litres)*	56	53	65	48	23	27	27	34
Min. vodka price, KZT	160	258	357	500	600	640	640	640
Aver. vodka price, KZT	358	496	520	618	1365	1380	1462	1507
Retail tobacco sales (thousand boxes)*	177	136	126	99	64	51	55	33
Aver. sigarettes box price, KZT	47	63	73	82	131	139	157	1940
*Estimated by dividing total sales per year to average price.								

These assumptions might indicate that excessive premature NCD/CVD mortality in Kazakhstan is driven mostly by dangerous alcohol consumption. Therefore, consistent policy measures on reduced alcohol consumption, such as sustained tax increases, should be continued to sustain mortality reduction. Intersectoral collaboration that is a part of PHC approach, first time outlined in Alma Ata declaration, may produce larger effect compared to other prevention programs.

Thus, NCDs should be seen as a challenge for all sectors and reflected in policy across sectors. In line with the spirit of Alma-Ata, government health ministries has to create partnerships with other sectors, agencies and communities to develop inter-sectoral policies which address the determinants of inequities and ill-health (Tarimo, 1997). Governments has to develop multi-sectoral national NCD plans to reduce exposure to risk factors and consider the development of national targets and indicators (NCD Action Plan)

In conclusion, by taking advantage of the 40th anniversary of the Alma-Ata declaration, it is time to revitalize the real meaning of Alma-Ata Declaration in relation to NCDs to address the situation where the most of risk factors lie outside of direct control of health sector.

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ЖЕА-ДЫҢ ӨСІП КЕЛЕЖАТҚАН АУЫРТПАЛЫҒЫМЕН КҮРЕСУ: АЛМА-АТА ДЕКЛАРАЦИЯСЫ МЕН НЕГІЗГІ ДЕНСАУЛЫҚ САҚТАУ ТӘСІЛІНЕ ОРАЛУ

Аннотация. Былтырғы жыл Алматы декларациясының 40 жылдығы болды. ДДСҰ мен Біріккен Ұлттар Ұйымы Балалар қорымен ұйымдастырған конференцияда өршіл мақсат жарияланды - 2000 жылға қарай барлығын Денсаулықпен қамту және Негізгі Денсаулық сақтау тәсілі таныстырылды. Бұл тәсіл мақсатқа жету құралы болып қарастырылды. Сонымен қатар кейбір авторлардың ойынша, Алма-Ата декларациясының басты кемшілігі алғашқы медициналық көмек пен Алғашқы Денсаулық сақтау тәсілі арасындағы айырмашылықты анық жеткізе алмауы болып табылады. Алғашқы Денсаулық сақтау тәсіліне әмбебап қамту, салааралық ынтымақтастық, қоғамға негізделген емдік және профилактикалық қызметтер жатады. Бұл қысқаша баяндамада Қазақстандағы және басқа да бұрынғы КСРО елдеріндегі алкогольді шамадан тыс тұтыну және оның жылдар бойғы динамикасы, осыған орай осы елдердегі ЖЕА-дың жоғарғы көрсеткіштері талқыланады. Сонымен қатар бұл баяндамада шамадан тыс алкогольді тұтынуды жоюда секторалық көзқарастың маңыздылығына баса назар аударылады. Бұл өз кезегінде ЖЕА-ды басқаруды жақсартуға әкелуі мүмкін.

Түйін сөздер: Алма-Ата декларациясы, Негізгі Денсаулық сақтау тәсілі, Алкогольді шамадан тыс тұтыну, Жұқпалы емес аурулар, өлім-жітім.

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ОТВЕЧАЯ НА РАСТУЩЕЕ БРЕМЯ НИЗ: ВОЗВРАТ В АЛМА-АТИНСКОЙ ДЕКЛАРАЦИИ И ПОДХОДУ ПМСП

Аннотация. В прошлом году исполнилось 40 лет Алма-Атинской декларации. Конференция, организованная ВОЗ и Детским фондом Организации Объединенных Наций, провозгласила амбициозную цель - Здоровье для всех к 2000 году и впервые представила подход первичной медико-санитарной помощи, который рассматривался как средство достижения этой цели. В то же время некоторые авторы считают, что основным недостатком Декларации Алма-Аты было четкое определение различий между первичной медицинской помощью и так называемым подходом ПМСП, который включает в себя всеобщий охват, межсекторальное сотрудничество, лечебные и профилактические услуги на уровне сообщества. В этой статье обсуждается чрезмерное потребление алкоголя на протяжении многих лет в Казахстане и других странах постсоветского пространства и обсуждается связь потребления алкоголя с высоким уровнем неинфекционных заболеваний (НИЗ) в этих странах. В статье особенно подчеркивается важность межсекторального подхода в борьбе с чрезмерным потреблением алкоголя, что должно привести к улучшению ситуации с НИЗ.

Ключевые слова: Declaration of Alma-Ata, Primary Health Care approach, Excessive alcohol consumption, Noncommunicable diseases, mortality.

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TREATMENT OF COMPLEX INTERNAL CAROTID ANEURYSMS

Abstract.

Introduction: Nowadays different treatment modalities used in the treatment of complex internal carotid artery aneurysms.

Aims: Retrospectively evaluate the results of different treatment modalities other than direct clipping at single.

Design of the study: Retrospective cohort study.

Methods and Material: Clinical presentations, radiological data and outcomes of 64 patients with complex ICA aneurysms evaluated. 15 patients were male, 49 were female with mean age 53 years old.

Results: Follow up period ranged from 3 to 96 months. Parent artery ligation was performed in 12 cases and direct proximal clip placement in 1 case. Endovascular embolization of the aneurysm by coils was performed in 6 cases. Deployment of flow diverter device done in 13 cases. Combined strategy including preliminary bypass with further parent artery occlusion applied in 23 cases. Endovascular occlusion of the parent vessel by coils was done in 9 cases. Surgical morbidity was 20,3%, mortality 3,1%. Outcomes were evaluated by Modified Rankin Scale.

Conclusion: Precise assessment of collateral cerebral blood flow is an important stage in the preoperative planning. Despite new endovascular techniques, EC-IC bypass technique has very important role in the treatment of complex aneurysm. Trapping the aneurysm is still effective and minimally invasive option in selected cases. Combined team approach, with treatment modalities other than direct clipping for complex aneurysms can minimize postoperative morbidity with good outcomes.

Key-words: complex aneurysms, internal carotid artery, EC-IC bypass, flow diverter devices.

Introduction. Despite new endovascular and surgical treatment options, complex intracranial aneurysms are still a big challenge [1-5]. Complex aneurysms recognized as big or giant size, with broad calcified neck, fusiform shape, intraluminal thrombus, branches arising from the aneurysm, atherosclerotic wall of the aneurysms, absence of collateral blood flow[1, 2, 4, 6-9]. These features make such aneurysms difficult for direct surgical treatment with high level of morbidity and mortality [10-22].

For complex aneurysms, multidisciplinary, neurosurgical and interventional neuroradiology team approach is necessary. The aim of the study was to retrospectively evaluate the efficacy, safety and outcomes by methods other than direct clipping.

Subjects and Methods. We conducted retrospective study following experience at our department, between July 2008 and December 2018 to estimate the results of treatment modalities. The review of medical records found 64 patients who underwent endovascular, surgical and multimodality treatment. We reviewed characteristics of aneurysms, treatment modalities, follow up data and results.

Patient's characteristics. Using the criteria of complex aneurysms (table 1) 64 consecutive patients with 64 aneurysms were included into the study. Among 64 patients 15(23,4%) were male, 49(76,6%) were female. Patients age ranged between 19 and 72, with mean age of 53±11,4(Me±SD) years old. Patient's demographic data, clinical presentation, size and configuration of the aneurysm evaluated respectively (table 2). Aneurysm sac size ranged between 11 to 51 mm, with mean size 30±7,9 mm (Me±SD). Size of the neck ranged between 4 to 30 mm, mean size was 10±5,3mm(Me±SD). In 7 cases

fusiform configuration of the aneurysm was revealed. The most frequent location of the aneurysms was paraclinoid (43,8%) and cavernous (35,9%) and aneurysms in the supraclinoid part were found in 20,3%. We did not found significant difference between sex and aneurysm location. In 10(15,6%) cases patients had a history of aneurysmal intracranial bleeding, in 54(84,4%) cases aneurysms were unruptured. Cranial nerves palsy was the leading symptom in clinical presentation in 24(37,5%) cases, 23(35,9%) patients suffered from headache and visual disturbance was found in 17(26,6%) cases.

Table 1 – Criteria for ICA complex aneurysm

Criteria for complex aneurysm	Features
Size	≥11 mm
Neck	≥4 mm
Shape	Regular/Fusiform
Atherosclerotic changes of parent artery, aneurysm dome and neck	Yes/No
Intraluminal thrombus	Yes/No
Absence of collateral blood flow	Yes/No
Presence of ≥3 of listed factors make aneurysm complex.	

Table 2 – Patient's characteristics

Number of patients	64
Number of aneurysms	64
Mean age	53
Headache	23
Cranial nerves palsy	24
Visual disturbances	17
Ruptured/ Unruptured	10/54
Aneurysm size giant/large	56/8
Cavernous	25
Paraclinoid	21
Supraclinoid	18

Collateral cerebral blood flow assessed by routine balloon test occlusion. Patients treated by endovascular intervention, parent artery occlusion, trapping the aneurysm by bypass surgery or combination of listed methods. Clinical, radiological and angiographic follow up was available. Follow up period ranged between 3-96 months. Outcomes of the treatment assessed by Modified Rankin Scale.

Treatment strategy. Treatment strategy was based on preoperative clinical, radiological and angiographic examination by our multidisciplinary team. Flow chart of treatment strategy presented in table 3. In our department, neurosurgeons are able to perform both microsurgical and endovascular cases. Preoperative assessment of collateral cerebral blood flow performed by double catheter balloon test occlusion. Patients who did not tolerate 30 minutes temporary parent vessel occlusion with 15 minutes drug induced hypotension selected for EC-IC bypass with further endovascular intervention or parent artery occlusion. Selection for either low or high flow bypass done according to anatomy of collateral vessels. Low flow bypass selected in cases when we had to protect of only one territory, such as middle cerebral artery. If there were no any collateral arteries and necessity to cover two main ACA and MCA territories we performed high flow bypass surgery. In some cases, during the angiography and BTO we observed elevation and compression of A1 or M1 segment by aneurysm dome. These patients also underwent preliminary low flow bypass procedures even if they tolerated BTO. This strategy used because of awareness of aneurysm thrombosis, growth and further compression of collateral arteries that could lead to insufficiency of blood circulation and ischemic complications.

Table 3 – Modified Rankin Scale at the time of discharge.

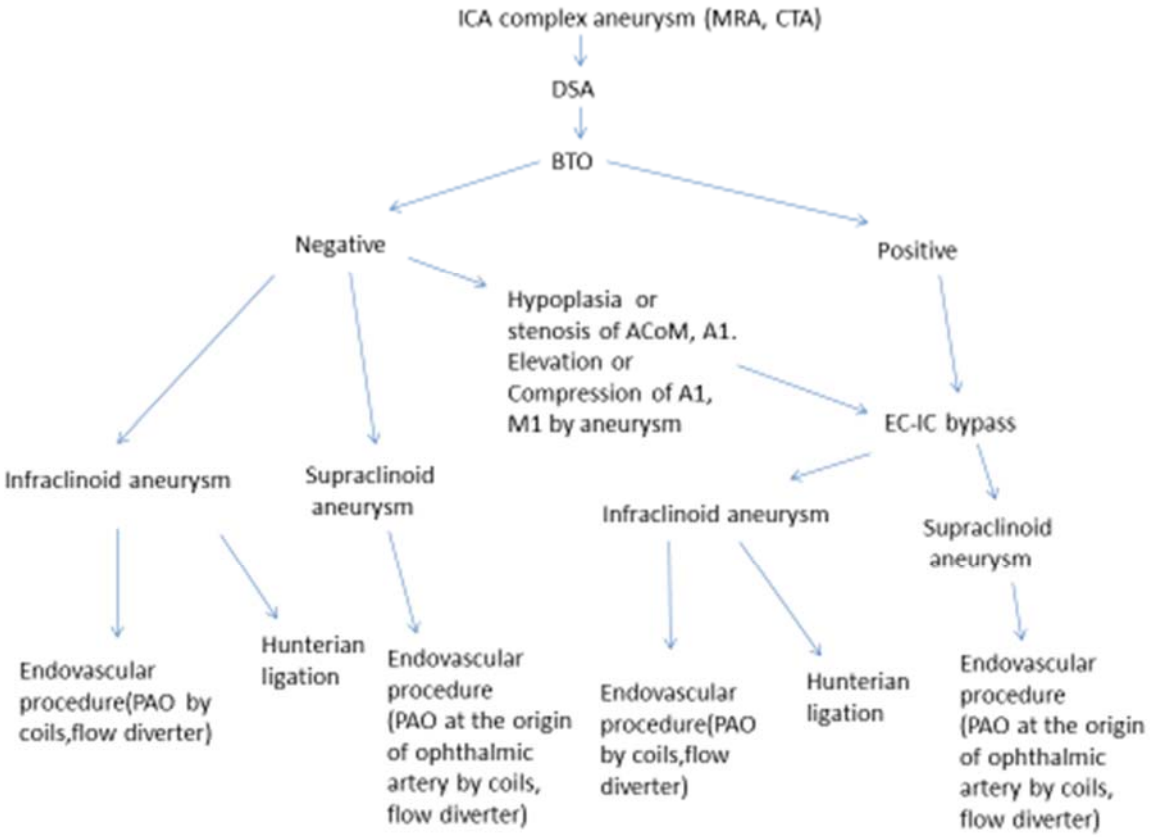
Modified Rankin Scale	Patients number
0	17
1	32
2	8
3	5
4	0
5	0
6	2
Total	64

Surgical treatment included Hunterian parent artery ligation in 12 cases and direct trapping of the aneurysm by proximal and distal clip placement in 1 fusiform aneurysm case. Endovascular embolization of the aneurysm by coils with balloon or stent assistance was performed in 6 cases. In 13 cases we deployed flow diverter devices. Combined strategy including preliminary bypass surgery with further surgical or endovascular intervention was applied in 23 cases. Endovascular occlusion of the parent vessel by coils was done in 9 cases.

Hunterian ligation performed in aneurysms located in the cavernous and paraclinoidpart of the ICA. At our later experience, we started to occlude aneurysms located at the paraclinoid and supraclinoid segments by coils at the origin of the ophthalmic artery. This technique implemented because of risk of remnant filling of the aneurysm through external carotid artery system anastomosis.

Results. At the time of data collection, 54 patients (84%) were available for follow up. Follow up period ranged between 3 to 96 months with mean period of 15 months. We observed significant prevalence of female patients among males, and mean age of male was lower than female. Immediate postoperative exclusion of the aneurysm from the circulation was achieved in 61 cases (95,3%). In two cases there was a remnant filling of the aneurysm through meningeal anastomosis from the external carotid artery. These aneurysms were located in the cavernous part of the ICA and did not require additional treatment. Third patient underwent EC-IC bypass and parent artery ligation for ICA supraclinoid aneurysm. On postoperative DSA there was a tiny retrograde filling of the aneurysm through ophthalmic artery. He suffered subarachnoid hemorrhage after two weeks of discharge. He was readmitted to the hospital and underwent additional endovascular embolization of parent artery and remnant aneurysm through the anterior communicating artery. In the group of endovascular embolization with coils, one case of giant aneurysm required second attempt due to significant recanalization of the sac. Combined strategy using bypass procedures with further surgical or endovascular options were performed in 23 cases. 16 patients underwent single STA-MCA bypass, in 6 cases we have done high flow bypass using radial artery graft, in 1 case we created double STA-MCA bypass. After creating an EC-IC bypass patients undergone parent artery occlusion in 18 cases or deployment of flow diverter in 5 cases. Because of small number of in stent thrombosis during our initial experience with flow diverter stent, we did protective bypasses before stent deployment in cases of unfavorable anatomy, insufficient collateral cerebral blood circulation and potential risk of parent artery occlusion due to stent thrombosis. Bypass patency was evaluated using digital subtraction angiography. Early bypass occlusion, during 7 days after the procedure occurred in 2 cases. The longest follow up of bypass patency is 60 months. Surgical associated permanent morbidity occurred in 13 cases (20,3%), two patients (3,1%) died after endovascular stent assistant embolization with coils due to the in stent thrombosis and severe ischemic stroke. At the time of discharge from the hospital outcomes evaluated by Modified Rankin Scale (table 4). Modified Rankin Scale 0 and 1 observed in 49 cases, score 2 was in 8, in 5 cases patients were discharged with score 3. Two patients had score 6. No new aneurysm formation detected. Among patients who were available for MRI follow up, significant aneurysm size decrease observed in cases with parent artery occlusion.

Table 4 – Flow chart of treatment strategy



Discussion. The aim of the treatment of any aneurysm is a total exclusion from the blood circulation. Treatment modalities for complex intracranial aneurysms located at the ICA are still an object for discussion. Both microsurgical and endovascular techniques faces big challenges during the management of these lesions. There are several causes, which are associated with poor outcomes, such as giant size of the dome and neck of the aneurysm, fusiform or dolichoectatic shape, calcified atherosclerotic neck, branches arising from the aneurysm. Such features make these lesions extremely difficult for direct microsurgical clipping or endovascular embolization. However, we think that more aggressive approach for complex aneurysms must be used due to the poor natural history.

According to our retrospective study, we have concluded the importance of multidisciplinary team approach, including neurosurgical and interventional points. Preoperative precise radiological and angiographic assessment of the aneurysm's dome and neck configuration, presence of intraluminal thrombus and branches arising from the aneurysm should be performed. Special attention to the cerebral collateral blood flow, especially in cases with potential risk of the parent artery occlusion. BOT is a safe and effective method to make a prognosis about tolerance in case of parent artery occlusion [23]. However, there are some reports of ischemic complications even when patients tolerate the BOT [24-28].

In recent report, we performed BOT in all cases, which were scheduled for potential parent artery occlusion. In case of absence of any collateral blood circulation BOT cancelled immediately and we created high flow bypass. Another reason for declining the BOT was hypoplasia of A1 segment of ACA, compression of the A1 or M1 segment by the sac of the aneurysm. In such cases, we decided to create protective low flow bypass. Our decision based on after the acute abruption of the flow in the parent artery and aneurysm there is an increasing volume of the aneurysm due to the thrombosis, that may cause further compression of the surrounding brain tissue and vessels, which may be the reason of ischemic complications and worsening of neurological signs [29, 30]. We have our own experience when a patient tolerated temporary balloon occlusion of the parent artery with further ICA sacrifice. Postoperatively we observed severe neurologic deficit due to the insufficient collateral circulation, emergency EC-IC bypass was performed and a patient did well after the surgery.

Volume decrease of the aneurysm is an important factor, especially in cases with mass effect causing neurological deficit. Parent artery occlusion is related with higher rate of aneurysm sac shrinkage and improvement of symptoms caused by aneurysm size [31-33]. In our experience, among patients treated with therapeutic parent artery endovascular or Hunterian ligation, we could detect significant aneurysm size reduction.

In the past decades, endovascular occlusion of the aneurysms became the first line option in many centers. Outcomes of endovascular treatment of aneurysms became better due to new instruments and devices. However, in some series endovascular management of complex aneurysms is associated with still high rates of recanalization, morbidity and mortality [34]. Introduction of new flow diverter devices promises improvement of the results of endovascular methods. Deployment of flow diverter stents is associated with low level of complications, higher occlusion rates in cases of regular shape aneurysms [35]. Higher morbidity rates of flow diverter deployment occur in cases of complex, giant aneurysms with wide neck [36-38]. In ourinitialseries we encountered technical issues, such as flow diverter migration, stent thrombosis with further occlusion of the parent artery. These complications led to severe ischemic stroke and death in 2 cases. According to this, in our later cases when we anticipated to deploy flow diverter, we created protective bypass if there are no anterior and posterior communicating arteries.

Since the introduction of EC-IC bypass by Yasargil, treatment options for complex aneurysms obtained new opportunities [39]. Trapping the aneurysm by microvascular anastomosis is commonly used worldwide. Complex anatomy of the aneurysm makes complex aneurysms impossible for clipping or endovascular methods. In such cases, EC-IC bypass with further parent artery occlusion sometimes is the only treatment option. Recent reports demonstrated safety, high occlusion rates and long term bypass patency [40]. Furthermore, described bypasses are used as rescue tool in situations of parent artery occlusion and cerebral blood flow insufficiency [41]. At our center, preliminary EC-IC bypass with parent artery occlusion was performed in 22 cases. Current report shows high rates of the aneurysm occlusion, long term bypass patency, and acceptable level of morbidity. In this group, we did not experience any mortality.

The strategy for parent artery occlusion is still controversial. In cases of ICA sacrifice, when the aneurysm is located in the paraclinoid or supraclinoid part there is a risk of remnant flow through the

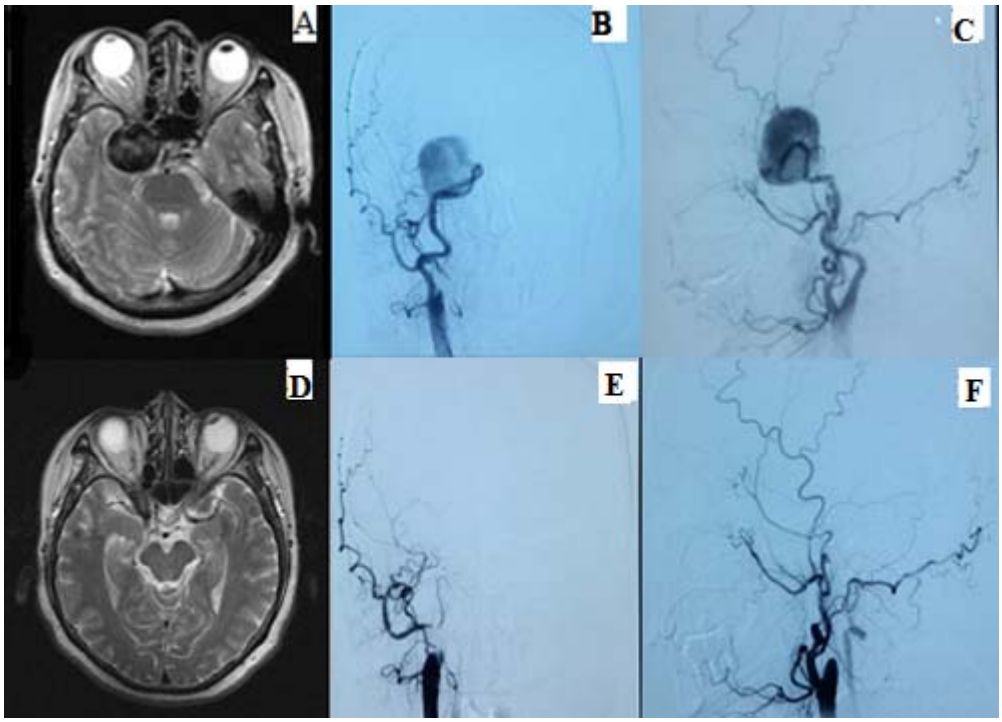


Figure 1 – Female, 58 y.o. Giant aneurysm of the cavernous part of ICA. Ligation of the ICA was performed. A, B, C preoperatively. Follow up after 6 months (D, E, F): aneurysm is occluded completely. The size of the aneurysmdecreased significantly

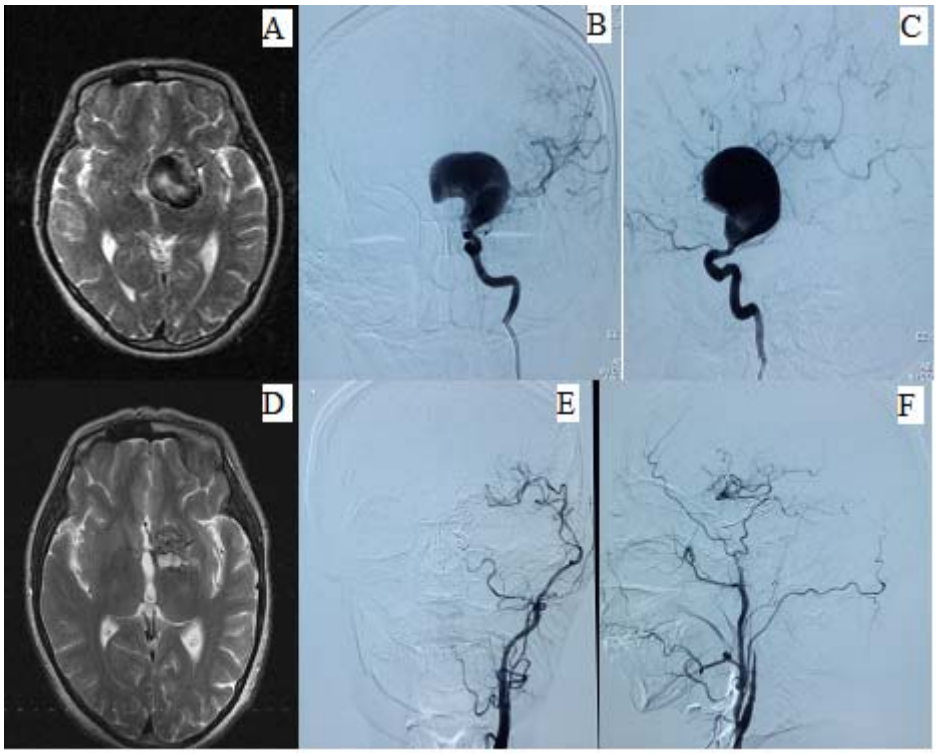


Figure 2 – Female, 36 y.o. Giant aneurysm of left paraclinoidICA (A, B ,C). STA-MCA bypass with endovascular occlusion of ICA at the level of ophthalmic artery origin. MRI and DSA after 6 months demonstrates exclusion of the aneurysm, volume decrease and bypass patency (D, E, F)

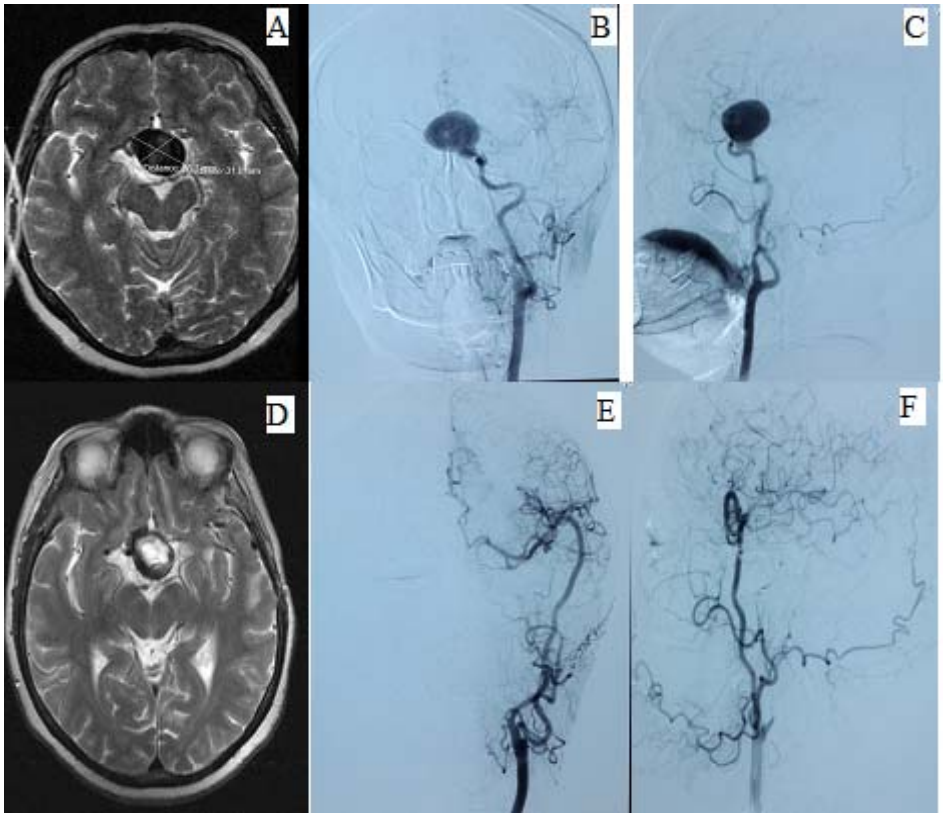


Figure 3 – Female, 51 y.o. with giant aneurysm of paraclinoid left ICA (A, B, C). High flow bypass with endovascular occlusion of ICA. Follow up after 12 months (Pictures D, E, F): exclusion of the aneurysm, bypass patency and aneurysm volume decrease

branches of external carotid artery. Vessels such as ophthalmic or meningohypophyseal trunk sometimes can lead to significant aneurysm filling, with reported cases of rupture and aneurysm growth [42]. Our experience with 15 patients when we performed parent artery occlusion in the cervical part of ICA with or without creation of EC-IC bypass showed remnant filling of the aneurysm through ophthalmic artery only in 3 cases. As described previously one of these patients suffered subarachnoid hemorrhage and underwent another surgery. However, now the mechanism of this hemorrhage is not clear. Of course, some of the paraclinoid aneurysms in our series we could perform clipping as well, but our early and midterm follow up of surgical ligation or endovascular ICA occlusion showed good results and low rates of complications.

Conclusion. Current article summarized data of patients with complex internal carotid artery aneurysms treated at single center by methods other than direct clipping. According to our results, assessment of collateral cerebral blood flow is an important stage in the preoperative planning. Major complications in our study were associated with ischemia due to the insufficiency of cerebral circulation. We conclude that whatever treatment option planned, one should pay precise attention to the potential risk of major vessels occlusion. Even in the era of flow diverters, EC-IC bypass technique has very important role in the complex aneurysm management. Parent artery occlusion is still effective and minimally invasive option, but to estimate the results, we need longer follow up and comparison with other treatment modalities. In cases with flow diverter devices risk of complications is higher in the aneurysms with very wide neck, stenosis and severe tortuosity of parent artery. Combined team approach of surgical and endovascular modalities for complex aneurysms can minimize postoperative morbidity and helps to achieve good outcomes.

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All authors have equal contribution to this article, such as data collection, evaluation of results of treatment,attendance to patient care and surgery.

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ІШКІ КҮРЕТАМЫРДЫҢ КҮРДЕЛІ АНЕВРИЗМАЛАРЫН ЕМДЕУ

Түйіндеме.

Кіріспе: қазіргі уақытта ішкі күретамырдың күрделі аневризмаларын емдеудің әртүрлі әдістері қолданылуда.

Мақсаты: бір орталықта орындалған тікелей клипстеуден басқа емдеудің әртүрлі әдістерінің қорытындыларын ретроспективтік бағалау.

Зерттеу дизайны: ретроспективті шоғырламалық зерттеу.

Әдістері мен материалдары. Ішкі күретамырдың күрделі аневризмалары бар 64 пациенттің рентгенологиялық деректері және емдеу нәтижелері, клиникалық суреті талданды. 15 пациент – ер адам, 49 пациент – әйел адам, орташа жасы 53 жасты құрады.

Нәтижелері. Операциядан кейінгі бақылау кезеңі 3 айдан бастап 96 айға дейінгі мерзімді құрады. 12 жағдайда тасымалдаушы артерияны жауып тастау және 1 жағдайда ішкі күретамырдың проксималды тікелей клипстеу орындалды. 6 жағдайда микроспиральдарымен аневризмалардың эндоваскулярлық эмболизациясы орындалды. 13 жағдайда ағынды қайта бағыттаушы стентті орнату орындалды. 23 жағдайда тасымалдаушы артерияны кейіннен окклюзиялаумен экстра-краниалды анастомазды алдын-ала салуды

құрайтын біріктірілген стратегия қолданылды. 9 жағдайда микроспиральдарымен ішкі күретамырлардың эндоваскулярлық окклюзиясыорындалды. Операциядан кейінгі асқынулар 20,3%, өлім-жітім 3,1% құрады. Нәтижелер Рэнкиннің түрлендірілген шкаласы бойынша бағаланды.

Қорытынды. Коллатералдық мидың қанағымын бағалау операция алдындағы жоспарлаудың маңызды кезеңі болып саналады.Жаңа эндоваскулярлық әдістерге қарамастан, күрделі аневризмаларды емдеуде экстра-краниалды анастомаз әдісі маңызды рөлді атқарады. Тасымалдаушы артерияны окклюзия жолымен аневризманы окклюзиялау әлі де тиімді және шағын инвазиялық емшара. Күрделі аневризмаларды клипстеуден басқа біріктірілген топтық тәсіл операциядан кейінгі асқынуларды оң нәтижелі жағдайларға дейін жеткізе алады.

Түйін сөздер: күрделі аневризмалар, ішкі күретамыр артериясы, экстра-интракраниалды анастомоз, ағынды қайта бағыттаушы стент.

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ЛЕЧЕНИЕ СЛОЖНЫХ АНЕВРИЗМ ВНУТРЕННЕЙ СОННОЙ АРТЕРИИ

Аннотация.

Введение: в настоящее время применяются различные методы лечениясложные аневризмы внутренней сонной артерии.

Цель: ретроспективно оценить результаты различных методов лечения, кроме прямого клипирования выполненных в одном центре.

Дизайн исследования: ретроспективное когортное исследование.

Методы и материалы. Были проанализированы клиническаякартина, рентгенологические данные и результаты лечения 64 пациентов сосложными аневризмами ВСА. 15 пациентов – мужчины, 49 – женщины, средний возраст составил 53 года.

Результаты. Период послеоперационного наблюдения составил от 3 до 96 месяцев. Лигирование несущей артерии было выполнено в 12 случаях и прямое клипирование проксимального отдела ВСА в 1 случае. Эндоваскулярная эмболизация аневризмы микроспиралями была выполнена в 6 случаях. Установка поток перенаправляющего стента выполнено в 13 случаях. Комбинированная стратегия, включающая предварительное наложение экстра-интракраниального анастомоза с последующей окклюзией несущей артерии, применена в 23 случаях. Эндоваскулярная окклюзия ВСА микроспиралями выполнена в 9 случаях. Послеоперационные осложнения составили 20,3%, летальность 3,1%. Результаты оценивались по модифицированной шкале Рэнкина.

Заключение. Оценка коллатерального мозгового кровотока является важным этапом предоперационного планирования. Несмотря на новые эндоваскулярные методы, метод экстра-интракраниального анастомоза играет очень важную роль в лечении сложных аневризм. Окклюзия аневризм путем окклюзии несущей артерии все еще эффективна и минимально инвазивная процедура. Комбинированный командный подход, кроме прямого клипирования сложных аневризм, может минимизировать послеоперационныеосложнения с благоприятными результатами.

Ключевые слова: сложные аневризмы, внутренняя сонная артерия, экстра-интракраниальный анастомоз, поток перенаправляющий стент.

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STUDY OF THE BARRIERS TO THE INTRODUCTION OF KAZAKHSTAN NONGOVERNMENTAL ORGANIZATIONS-BASED RAPID HIV TESTING

Abstract. This article presents the results of a conducted sociological study aimed at defining the barriers that interfere with the introduction of rapid HIV testing among nongovernmental organizations in Kazakhstan. According to the questionnaire-based survey and interviewing of a group of 478 persons, representatives of people living with HIV (PLHIV), clients of HIV prevention programs, visitors of "drop-in centers", "friendly rooms", employees and specialists of AIDS centers, NGOs (nongovernmental organizations), experts, coordinators of medical organizations, it has been established that the conditions of HIV-related medical examinations and consultations, including rapid methods, carried out in Kazakhstan are subject to the applicable legislation of the Republic of Kazakhstan and the orders of the Ministry of Healthcare of the Republic of Kazakhstan. At the same time, it should be noted that there are some barriers that interfere with NGO-based rapid HIV testing and are notable for their social and legislative nature. These are stigma and discrimination from the public and "self-stigmatization" of people living with HIV (PLHIV); misunderstanding of one's own HIV infection; a lack of communication between medical/social workers and patients; the absence of licenses for HIV testing and counseling among nongovernmental organizations. In order to effectively involve key Kazakhstan population groups (PUIDs (people who use injectable drugs), SWs (sex workers), MSM (men who have sex with men)) in the program and procedure of rapid testing and counseling, it is necessary to make amendments to the country's existing legislative and legal acts for the purpose of providing a social and legal protection mechanism for those under examination.

Key words: HIV infection, rapid tests, nongovernmental organizations, barriers, stigma, discrimination.

Importance of the Problem. The Message of the President of the Republic of Kazakhstan, Leader of the Nation, N. A. Nazarbayev, dated November 12, 2014, "The Kazakhstan's way – 2050: Common aim, common interests, common future", states that the activities associated with providing high-quality and affordable medical services for population health improvement shall become main issues for the state's health policy [1].

One of the directions of the "Nation Plan, 100 precise steps to implement the five institutional reforms" is to introduce advanced medical care standards and develop primary care services that shall be a central link of the national healthcare sector for the prevention and early control of diseases [2].

All these directions are also relevant to the sphere of services rendered to "key" population groups that are vulnerable to HIV infection and AIDS.

At the present stage, HIV infection is one of the most important medical problems as it results in large-scale social, medical, demographic, economic consequences requiring decisive and immediate measures from the state.

According to the social data of the Republican Center on Prevention and Control of AIDS, as of January 1, 2018, 32,573 cases of HIV were cumulatively diagnosed in Kazakhstan.In total, people living with HIV (PLHIV) are 20,841 persons, the prevalence of PLHIV per 100,000 people amounts to 117.7.

HIV infection is most intensively distributed among "key" population groups. According to the WHO, the term "key population groups" is used to identify groups of people who are, irrespective of HIV/AIDS epidemic types and local levels, subject to an increased risk of HIV infection due to their behavior [3]. These are people who use injectable drugs (PUIDs), sex workers (SWs), men who have sex with men (MSM), prisoners, transgender people and others. In this regard, the timely detection of HIV infection, the introduction of new and improvement of existing diagnostic methods are main directions for the HIV/AIDS counteraction system in Kazakhstan. Within this framework, for the purpose of extending the volume of HIV testing among representatives of "key" and vulnerable population groups in Kazakhstan, the attempts to introduce NGO-based rapid HIV testing among these population groups are being made. Let us note that today the Joint United Nations Programme on HIV/AIDS (UNAIDS) recommends an absolutely new 90-90-90 strategy designed to counteract the HIV/AIDS epidemic. According to this promising strategy aimed at ending the AIDS epidemic in the world, by 2020 90% of people living with HIV will be aware of their HIV status, 90% of patients diagnosedwith HIV will be provided with antiretroviral therapy, 90% of patients who receive antiretroviral therapy will have their viral load suppressed.

The purpose of this message is to study the barriers that interfere with the introduction of NGO-based rapid HIV testing in Kazakhstan.

Materials and Methods. The study was conducted by the specialists from the Republican Center on Prevention and Control of AIDS and Kazakhstan's Medical University "KSPH" on the base of the Kazakhstani Union of People Living with HIV, a nongovernmental organization.

The period of this study was 2015-2018. The work included such methods as content analysis, SWOT analysis, sociological and statistical methods.

Earlier, we preliminarily studied the diagnostic characteristics of rapid tests used for HIV diagnosis in Kazakhstan [5]. We noted that today there are 5 licensed rapid HIV diagnosis test systems that effectively function in the republic and completely meet the WHO's modern requirements (sensitivity > 99%, specificity > 98%). These are AlereDetermine^{TM} HIV ½ Ag Ab Combo; Hexagon HIV 1+2; Abon HIV 1/2; HIV 1,2 Han Medtest; Geenius HIV 1/2 Confirmatory. When assessing the qualitative parameters of rapid tests, we used the methods specified by the WHO for similar studies [6].

The field studies of the barriers that interfere with the introduction of NGO-, community-based rapid HIV testing were conducted in the following regional centers of Kazakhstan: Pavlodar, Kostanay, Ust-Kamenogorsk, Karaganda, Temirtau, Shymkent, Kyzylorda, Taraz, Almaty, Uralsk, Atyrau.

The following NGOs were involved in the study:"Ty ne odin", "Gerlita" (Pavlodar), "Kuat", "Answer" (Ust-Kamenogorsk), "Kuat" (Shymkent), "Shapagat" (Karaganda), "Pomotsch" (Kostanay).

The following assessment instruments were developed in order to collect information as per the WHO's methods: 1) questionnaires for patients of the AIDS centers; 2) questionnaires for clients of the HIV prevention program ("drop-in centers", "friendly rooms"); 3) questionnaires for activists, employees of the NGOs; 4) questionnaires for interviewing experts, specialists of the AIDS centers, NGOs, state medical institutions; 5) informed consent forms for the study's participants.

The sociological studies consisted of 2 stages:

1) The first stage (October-November 2015) was as follows: PLHIV – 12 persons; clients of the prevention programs – 141 persons; experts, coordinators, employees of the AIDS centers, NGOs – 32 persons; focus groups with clients of the prevention programs – 2 groups of 12-13 people each, participants of the focus group were among the respondents. In total, 185 people were interviewed.

2) The second stage (April-May 2018) was as follows: PLHIV – 110 persons; clients of the prevention programs – 140 persons; employees, activists of the NGOs – 18 persons; experts, coordinators, employees of the AIDS centers, NGOs – 25 persons. In total, 293 people were interviewed. Total: 478 people were covered by the sociological study.

The analysis of the results of the anonymous questionnaire survey included the following: statistical processing of the questionnaires (coding and analysis of the respondents' answers), content analysis of the focus group's results, interpretation, discussion and conclusions.

The work also analyzed the legislative and regulatory legal acts of the RoK that govern the procedure of NGO-based rapid HIV testing in the Republic of Kazakhstan. Special attention was paid to the orders of the Ministry of Healthcare of the RoK that establish the conditions of HIV infection-related medical examination and consultation, including those with the use of rapid methods:

1. Order No. 246 dated April 22, 2015, of the MoH of the RoK, "On the Approval of the Rules of Voluntary Anonymous and (or) Confidential Medical Examination and Consultation Concerning HIV Infection for Citizens and Oralmans(ethnic Kazakhs who have immigrated to Kazakhstan) on a Paid Basis";
2. Order No. 508 dated June 23, 2015, of the MoH of the RoK, "On the Approval of the Rules of Obligatory Confidential Medical Examination for HIV Infection According to Clinical Indications";
3. Order No. 115 dated February 28, 2013, of the MoH of the RoK, "On the Introduction of Amendments to Order No. 228 dated March 09, 2004, of the MoH of the RoK" on the Adoption of the Regulations on Organization of Activities of Drop-In Centers for People Using Injectable Drugs".

The statistical analysis of the study results was carried out with the use of standard biostatistics methods [8] and the SPSS program (Statistical Package for Social Science).

Results and Discussion. When analyzing the study results, we were first of all guided by the existing international experience in this problem, the best international practices of many countries where it has been convincingly established that inexpensive rapid HIV tests allowing health workers to carry out clinic-, NGO-, community-based testing under field conditions [9-13] are already introduced into medical practices. So, according to J. Wilton (2015), L. Broeckaert and L. Challacombe (2015), rapid testing with the use of blood and gingival tests is the first and most important step in the treatment of HIV-infected patients [14, 15]. Based on the representative materials of Canada, the authors used the method of literature review and presented a wide range of evidence in favor of the advantages of rapid HIV testing. Also, other works [16,17] indicate the high effectiveness and quality of rapid tests, which is especially important for our country in the context of introduction of rapid HIV testing methods.

The study results show that the conditions of medical examination for HIV-infection by Kazakhstan NGO-based rapid methods are governed by the applicable legislation and regulations. These are the above 3 orders of the MoHof the RoK (Orders No. 508 dated June 23, 2015, No. 115 dated February 28, 2013, and No. 246 dated April 22, 2015) where centers on prevention and control of AIDS are authorized bodies specialized in carrying out HIV examinations. At the same time, HIV examinations carried out in private organizations are governed by Law No. 202-V dated May 16, 2014, of the RoK, "On Permits and Notices". According to this law, all legal entities or natural persons, including nongovernmental and public organizations licensed for HIV diagnosis, are entitled to carry out examinations by any methods as the law states no restrictions in relation to diagnostic methods and materials. This means that all rapid tests, both blood and saliva ones, can be used in NGOs' activities if there are corresponding licenses and are properly governed by all the regulatory and legal documents of the RoK.

In our opinion, a way out of this situation is to obtain licenses for NGO-based rapid HIV testing and related medical activities or make amendments to existing regulatory documents that govern this procedure.

The sociological studies conducted by us reveal the different barriers that interfere with the introduction of Kazakhstan NGO-based rapid HIV testing and are notable for their social, individual, structural and systematic nature. The barriers of social nature are of special interest. They are:

- stigma and discrimination from the public and "self-stigmatization" of PLHIV;
- "misunderstanding" of one's own HIV infection;
- poor communication between medical/social workers and patients;
- shortage of state funds for HIV/AIDS prevention programs;
- unstable monetary support for NGOs.

For the purpose of introducing Kazakhstan NGO-based rapid HIV testing, we recommend the following:

- Nongovernmental organizations (NGOs) that have financial and technical resources shall obtain licenses for rapid HIV testing and related activities.
- Making amendments to regulatory documents: NGOs' articles of incorporation (for the purpose of governing organizations' activities): to Order No. 115 dated February 28, 2013, of the MoH of the RoK(for making amendments to the Regulations on organization of drop-in centers' activities in the context of rapid HIV testing); to the existing orders of the Ministry of Healthcare of the RoK (for the purpose of governing sanitary regulations and norms related to NGOs' premises, etc.
- Developing an algorithm for rapid HIV testing for different population groups with the conditions of Kazakhstan taken into consideration.
- Training medical and social workers in order to carry out high-quality HIV counseling among "key" population groups.

Conclusion. For the purpose of introducing the procedure of Kazakhstan NGO-based rapid HIV testing, it is necessary to develop a social and legal protection mechanism for those under examination. At the same time, in order to overcome the barriers that interfere with HIV testing among NGOs and communities, it is necessary to develop: a national plan aimed at decreasing stigma and counteracting discrimination, which includes results-oriented activities with the population, the medical community and NGOs.

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ҚАЗАҚСТАНДА ҮКІМЕТТІК ЕМЕС ҰЙЫМДАР БАЗАСЫНДА АИТВ-ҚА ЖЕДЕЛ -СЫНАҚТАМА ЕНГІЗУ ҮШІН КЕДЕРГІЛЕРДІ ЗЕРТТЕУ

Аннотация. Қазақстанның үкіметтік емес ұйымдары арасында АИТВ-ға экспресс-тестілеуді енгізуді көздейтін кедергілерді зерделеу бойынша жүргізілген әлеуметтік зерттеу нәтижелері берілген. Сауалнама және сұхбат жүргізу негізінде 478 адам, АИТВ-инфекциясымен (ТЖЗ) өмір сүретін адамдар өкілдері, "сенім пункттеріне", "Достық" кабинеттерге" баратын АИТВ-инфекциясының алдын алу бағдарлама клиенттері, ЖИТС орталықтарының ҮЕҰ қызметкерлері мен мамандарының, сарапшылардың, медициналық ұйымдардың кординаторларының Қазақстанда АИТВ-инфекциясы мәселелері бойынша медициналық тексеру және кеңес беру, оның ішінде АИТВ-инфекциясын алдын алу бойынша жедел медициналық тексеру жүргізу жағдайлары анықталды, Қазақстан Республикасының заңнамасына және Қазақстан Республикасы Денсаулық сақтау министрлігінің бұйрықтарына сәйкес реттеледі. Сонымен қатар, әлеуметтік және заңнамалық-нормативтік сипаттағы үкіметтік емес ұйымдар базасында АИТВ-ға сараптама-тестілеуге кедергі келтіретін жағдайлар бар екені атап өтілді. Бұл-қоғам тарапынан да, АИТВ-мен (ӨТЗ) өмір сүретін адамдардың "өзін-өзі көрсету" де стигма және кемсітушілік; АҚТҚ-ның жеке жұқтыруын түсінбеу феномены; медициналық, әлеуметтік қызметкерлер мен пациенттердің коммуникациясының жеткіліксіз деңгейі; үкіметтік емес ұйымдарда АИТВ-ға кеңес беру және тестілеу жүргізуге арналған лицензияның болмауы. Қазақстан халқының негізгі топтарының (ЛУИН, РС, МСМ) өкілдерін бағдарламаға және экспресс-тестілеу мен консультация беру рәсіміне тиімді тарту үшін тексерілушілерді қорғаудың әлеуметтік-құқықтық тетігін қамтамасыз ету үшін елдің заңнамалық, құқықтық актілеріне өзгерістер енгізу қажет.

Түйін сөздер: ВИЧ-инфекциясы, жедел-сынақтама, үкіметтік емес ұйымдар,кедергілер,стигма, кемсітушіліктер.

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ИСЛЕДОВАНИЕ БАРЬЕРОВ ДЛЯ ВНЕДРЕНИЯ ЭКСПРЕСС-ТЕСТИРОВАНИЯ НА ВИЧ НА БАЗЕ НЕПРАВИТЕЛЬСТВЕННЫХ ОРГАНИЗАЦИЙ В КАЗАХСТАНЕ

Аннотация. Представлены результаты проведенного социологического исследования по изучению барьеров, припятсвующие внедрению экспресс-тестирования на ВИЧ среди неправительственных организаций Казахстана. На основании анкетного опроса и интервьюирования 478 человек, представителей людей, живущих с ВИЧ-инфекцией (ЛЖВ), клиентов программ профилактики ВИЧ-инфекции, посещающие «пункты доверия», «дружественные» кабиенты», сотрудников и специалистов Центров СПИД, НПО, экспертов, кординаторов медицинских организаций было выявлено, что в Казахстане условия проведения медицинкого обследования и консультирования по вопросам ВИЧ-инфекции, в том числе экспресс-методами, регламентируются соответсвующими законодательствами Республики Казахстан и приказами Министерства здравоохранения Республики Казахстан. В то же время отмечено, что существуют барьеры препятсвующие эксперсс-тестированию на ВИЧ на базе неправительсвенных организаций, носящие социальный и закона-

дательно-нормативные характеры. Это – стигма и дискриминация, как со стороны общества, так и «самостигматизация» людей, живущих с ВИЧ (ЛЖВ); феномен неосознания собственного инфицирования ВИЧ; недостаточный уровень коммуникации медицинских, социальных работников и пациентов; отсутствие лицензии на проведение консультирования и тестирования на ВИЧ в неправительсвенных организациях. Для эффективного вовлечения представителей ключевых групп населения Казахстана (ЛУИНы, РС, МСМ) в программу и процедуру экспресс-тестирования и консультирования необходимо внести изменения в законодательные, правовые акты страны для обеспечения социально-правого механизма защиты обследуемых.

Ключевые слова: ВИЧ-инфекция, экспресс-тесты, неправительственные организации, барьеры, стигма, дискриминация.

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SELECTION OF OPTIMAL NUTRIENT MEDIUM FOR COLLAGENASE BIOSYNTHESIS BY ASSOCIATION *ASPERGILLUS AWAMORI 16* AND *ASPERGILLUS AWAMORI 22*

Abstract. Medium composition is the most important aspect to take into consideration when growing any microorganism. The culture medium should include all indispensable nutrients that microorganism requires. The production of collagenase enzyme have been affected by a variety of physical and chemical factors, such as inoculum concentration, time of incubation, pH, temperature, carbon, nitrogen and mineral sources etc. However, composition of the cultivation medium (carbon and nitrogen sources) play significant role in enzymes production. In this paper the effect of different carbon and nitrogen sources on collagenase production by fungal association *Aspergillus awamori 16* and *Aspergillus awamori 22* was investigated. Maximal collagenase activity (8.1 U/ml) was detected in media with 2% sucrose as a carbon source and 1% peptone as a nitrogen source. The medium had the following composition (%): KH_2PO_4 - 0.1; $MgSO_4$ - 0.05; KCl - 0.05; $FeSO_4$ - 0.001; peptone -1.0; sucrose - 2.0. Selection of carbon and nitrogen sources for *A. awamori 22* and *A. awamori 16* allowed increase the extracellular collagenase biosynthesis from 6.8 U/ml to 8.1 U/ml.

Key words: collagenase, micromycetes, carbon and nitrogen sources.

Introduction. In the Kazakhstan market, the growing consumer demand for healthier products has stimulated the development of nutritionally enhanced meat foods. In order to achieve these nutritionally enhanced meat foods, changes such as the use of improved raw materials, reformulation of products, and technological processes are necessary [1-3]. From the initial characteristics of the meat (its tenderness or rigidity) depends the organoleptic properties of the final meat products. The highest consumer properties possess meat products, developed from parts of the carcass with a minimum content of connective tissue [4-7].

At the same time, the problem of processing raw meat containing an increased amount of connective tissue characterized by stiffness and dryness remains urgent. To prevent excessive stiffness in production of meat products different approaches of treatment of raw meat with a high content of connective tissue have been used, e.g. mechanical and biotechnological methods. In this regards, the use of collagenase enzyme that cause proteolysis of connective tissue proteins of collagen-containing raw materials is of particular interest [8, 9].

Despite the fact that among microorganisms that produce collagenase there are bacteria, fungi, yeasts and actinomycetes in the recent period micromycets got wide application, particularly *Aspergillus* fungi because of high productivity [10-12]. The collagenase production has been affected by a variety of factors, such as nitrogen and carbon source, inoculum concentration, time of incubation, pH, temperature, salinity, etc. Present investigation involves studies on the effect of carbon and nitrogen sources on collagenase production by association of mixed fungi *Aspergillus awamori 16* and *Aspergillus awamori 22* in submerged fermentation.

Materials and methods. The object of the study was fungal association of *Aspergillus awamori 16* and *Aspergillus awamori 22*. The culture was maintained on potato-dextrose agar medium and stored at 4°C. For investigation if effect of carbon and nitrogen sources on collagenase production following nutritional medium was used: $NaNO_3$ - 0,5%, sucrose – 1,0; KH_2PO_4 – 0, 1; $MgSO_4$ – 0, 05; KCL – 0,05; Fe SO_4 – 0,001.

As a carbon source, glucose, maltose, fructose, lactose, sucrose, galactose and starch were used at a concentration of 1.5%. Both inorganic and organic nitrogen sources - NH_4NO_3, $NaNO_3$, $NH_4H_2PO_4$, $(NH_4)_2HPO_4$, peptone, casein, soy flour, and yeast extract were used at a concentration of 0.5%. Fungal suspension at concentration of 2% was aceptically introduced into flasks with a nutrient medium and placed on a shaker at 210-230 rpm for 72 hours. After this time, the collagenase activity of culture broth of all variants was measured. Collagenase activity was assayed by spectrophotometric method [13].

To 20 mg collagen from bovine tendon (Sigma) suspended in 3.8 ml Tris buffer (0.02 M Tris, 0.005 M $CaCl_2$, pH 7.4) was added 200 µl collagenase solution (1 mg/ml in Tris buffer) to make a total volume of 4.0 ml. The mixture was incubated at 40° C. for 3 hr or 70° C. for 30 min. The reaction mixtures were centrifuged in a microfuge for 10 min at 14,000 rpm. 1.5 ml of supernatant was mixed with 4.5 ml of 5 N HCl and kept in a drying oven at 110° C. for 16 hrs (overnight) for complete hydrolysis of soluble peptides. The hydrolysate was then analyzed for hydroxyproline content as follows: the hydrolysate was diluted 25 times with distilled water. To 1.00 ml of diluted hydrolysate 1.00 ml of chloramine-T solution is added and the mixture was allowed to stand at room temperature for 20 min. 1.00 ml of color reagent were added after this period and the reaction mixture is transferred to a 60° C. water bath and incubated for 15 min. Tubes were removed and allowed to cool down to room temperature. Absorbance at 600 nm was measured.

The fungal biomass (dry weight of mycelium) was determined as follows: the biomass obtained during cultivation of fungal association on a shaker in a liquid nutrient medium was filtered. After that the filter paper was placed in a drying oven at a temperature of 130°C for 40 min (to complete drying). The filters were transferred to a desiccator for 10-15 minutes and weighed on an analytical balance. The difference between the mass of the filter with dry mycelium and the mass of the empty filter is the mass of dry mycelium (X) formed during the period of cultivation of the fungus in the thermostat:

$$X = Mm – Mt,$$

where X is the mass of dry mycelium, g; Mf is the mass of the empty filter, g; Mm - the mass of the filter with dried mycelium.

All the analyses were performed in triplicate, and the results were expressed as mean SD values of the three sets of observations. The mean values and standard deviation will be calculated using STATISTICA 6 [14].

Results and discussion. Various carbon and nitrogen sources were supplemented in the production medium to study their effect on collagenase production. Effect of various carbon sources on collagenase production in *Aspergillus awamori 22* and *Aspergillus awamori 16* is shown in table 1.

As can be seen from the data presented in Table 1 enzyme production was maximal when sucrose was used as a carbon source. The activity of collagenase in medium with sucrose was 6.8 U/ml. All other monosaccharides and disaccharides used had a little effect on collagenase production. It is known that

Table 1 – The effect of various carbon sources on collagenase production in *A. awamori 22* and *A. awamori 16*

Carbon sources	Biomass, g/100ml	Collagenase activity, U/ml
Sucrose	1,22	6,8±0,9
Glucose	1,18	3,2±0,6
Fructose	1,35	1,9±0,3
Galactose	1,0	1,2±0,4
Maltose	1,0	4,0±0,7
Lactose	1,14	1,6±0,6
Starch	1,26	1,5±0,6

disaccharides contain a higher content of carbon atoms (4.21 mol/l) than monosaccharides when used in the same concentrations. However, none of the disaccharides used, except of sucrose, did not affect on collagenase activity. The reason for this may be that the α-D-glucopyranolyl-β-D-fructofuranoside bond in sucrose makes carbon atoms more accessible to the fungus than other sugars.

Along with carbon an important factor for enzyme biosynthesis is nitrogen source. The effect of various nitrogen sources on collagenase production is summarized in table 2.

Таблица 2 – The effect of various nitrogen sources on collagenase production in *A. awamori 22* and *A. awamori 16*

Nitrogen sources	Biomass, g/100ml	Collagenase activity, U/ml
$(NH_4)_2SO_4$	1,3	6,6±0,6
$(NH_4)_2HPO_4$	1,2	5,8±1,6
NH_4NO_3	1,1	3,5±1,4
KNO_3	1,2	1,9±0,8
Yeast extract	1,5	3,8±1,1
Peptone	1,5	7,1±0,6
Casein	1,3	5,8±0,6
Gelatin	1,4	3,3±0,4

As can be seen from the data presented in table 2, among nitrogen sources studied peptone supported moderate growth and collagenase production in *A. awamori 16* и *A. awamori 22*.

For the selection of optimal concentrations of carbon and nitrogen sources for collagenase production 64 nutrient media with different concentration of sucrose and peptone were used (table 3).

Table 3 – Effect of various concentrations of sucrose and peptone on collagenase biosynthesis in *A. awamori 22* and *A. awamori 16*

Sucrose	Peptone	Collagenase activity, U/ml
1	2	3
0,25%	0,25%	2,2±0,8
	0,5%	2,1±1,5
	0,75%	3,3±1,2
	1,0%	2,9±1,3
	1,25%	3,3±1,6
	1,5%	2,5±1,1
	1,75%	3,1±1,2
	2,0%	3,2±0,9
0,5%	0,25%	3,3±1,8
	0,5%	2,9±0,7
	0,75%	3,2±0,5
	1,0%	3,7±0,6
	1,25%	3,8±1,5
	1,5%	2,9±1,2
	1,75%	3,6±1,1
	2,0%	4,0±0,9
0,75%	0,25%	4,2±0,9
	0,5%	4,9±0,7
	0,75%	4,5±1,5
	1,0%	5,5±1,3

Продолжение таблицы 3

1	2	3
0,75%	1,25%	5,6±1,2
	1,5%	5,3±0,8
	1,75%	6,0±0,4
	2,0%	4,8±1,1
1,0%	0,25%	5,9±1,4
	0,5%	4,9±0,8
	0,75%	5,5±1,7
	1,0%	5,5±1,8
	1,25%	4,2±0,6
	1,5%	5,3±1,1
	1,75%	5,0±0,4
	2,0%	5,4±1,1
1,25%	0,25%	4,5±1,0
	0,5%	5,5±1,8
	0,75%	4,9±0,6
	1,0%	5,0±0,7
	1,25%	5,1±0,5
	1,5%	4,8±0,5
	1,75%	5,3±0,9
	2,0%	4,9±1,1
1,5%	0,25%	5,5±1,3
	0,5%	4,7±1,1
	0,75%	5,2±1,0
	1,0%	5,0±0,8
	1,25%	4,6±1,0
	1,5%	5,9±0,9
	1,75%	6,7±0,5
	2,0%	7,1±0,6
1,75%	0,25%	6,8±0,7
	0,5%	6,2±0,4
	0,75%	6,4±0,5
	1,0%	7,9±1,0
	1,25%	7,2±1,8
	1,5%	7,4±1,2
	1,75%	6,9±1,1
	2,0%	8,1±1,2
2,0%	0,25%	6,8±0,9
	0,5%	7,2±0,4
	0,75%	6,9±0,4
	1,0%	**8,1±0,6**
	1,25%	7,7±1,2
	1,5%	7,5±1,1
	1,75%	7,3±1,5
	2,0%	7,9±0,9

Studying the effect of sucrose and peptone concentrations from 0.25 to 2.0% on the biosynthesis of protease and collagenase showed that the highest enzyme activity (8.1 U/ml) was observed in the variant with sucrose and peptone at concentration of 2.0 and 1.0%, respectively. The collagenase activity was 8.1 U/ml. In other variants, collagenase activity ranged from 2.1 to 7.9 U/ml.

In conclusion, the optimal carbon and nitrogen sources in the nutrient medium were selected. Maximal collagenase activity was detected in media with 2% sucrose as a carbon source and 1% peptone as a nitrogen source. The medium had the following composition (%): KH_2PO_4 - 0.1; $MgSO_4$ - 0.05; KCL - 0.05; $FeSO_4$ - 0.001; peptone -1.0; sucrose - 2.0. Selection of carbon and nitrogen sources for fungal association of *A. awamori 22* and *A. awamori 16* allowed increase the extracellular collagenase biosynthesis from 6.8 to 8.1 U/ml.

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ASPERGILLUS AWAMORI 16 ЖӘНЕ *ASPERGILLUS AWAMORI 22* АССОЦИАЦИЯСЫМЕН КОЛЛАГЕНАЗАНЫ БИОСИНТЕЗДЕУ ҮШІН ОҢТАЙЛЫ ҚОРЕКТІК ОРТАНЫ ТАҢДАУ

Аннотация. Микроорганизмдерді өсіру процесінде қоректік орта құрамы үшін негізгі талап - оның өндірушінің өсуіне және мақсатты өнімнің синтезін қамтамасыз етуге пайдасы. Қоректік орта микроорганизмнің өсуі үшін қажетті барлық қоректік заттарды қамтуы керек. Коллагеназа ферментінің биосинтезіне инокуляция концентрациясы, инкубация уақыты, pH, температура, көміртек, азот көздері, минералды көздер және т.б. физикалық және химиялық факторлар әсер етеді. Алайда, осы факторлардың арасында ферменттердің биосинтезінде қоректік орта құрамы (көміртегі мен азот көздері) аса маңызды рөл атқарады. Бұл мақалада біз түрлі көміртек және азот көздерінің *Aspergillus awamori 16* және *Aspergillus awamori 22* микромицетті ассоциациясының коллагеназаны биосинтездеуіне әсерін зерттедік. Коллагеназдың максималды белсенділігі (8.1 U/ml) вариантта көміртегі көзі ретінде 2% сахароза және азот көзі ретінде 1% пептон бар. Коллагеназаның максималды белсенділігі (8.1 U/ml) көміртегі көзі ретінде 2% сахароза және азот көзі ретінде 1% пептон бар вариантта көрсетілген. Қоректік ортаға көміртегі мен азоттың оңтайлы көздері таңдап алынды (%): KH_2PO_4 - 0.1; $MgSO_4$ - 0.05; KCl - 0.05; $FeSO_4$ - 0.001; пептон -1,0; сахароза - 2,0. *A. awamori 22* және *A. awamori 16* ассоциациялық дақылы оңтайлы көміртекті және азот көздерін таңдау клетка сыртылық коллагеназаның түзілуін 6,8 U /мл-ден 8,1 U /мл-ге дейін арттыруға мүмкіндік берді.

Түйін сөздер: коллагеназа, микромицеттер, көміртегі мен азот көздері.

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ПОДБОР ОПТИМАЛЬНОЙ ПИТАТЕЛЬНОЙ СРЕДЫ ДЛЯ БИОСИНТЕЗА КОЛЛАГЕНАЗЫ АССОЦИАЦИЕЙ *ASPERGILLUS AWAMORI 16* И *ASPERGILLUS AWAMORI 22*

Аннотация. Основным требованием, предъявляемым к составу питательной среды в процессе культивирования микроорганизмов, является ее полноценность для роста продуцента и обеспечения синтеза целевого продукта. Питательная среда должна включать все питательные вещества, которые необходимы для роста микроорганизма. На биосинтез фермента коллагеназы влияют различные физические и химические факторы, такие как концентрация инокулята, время инкубации, pH, температура, источники углерода, азота, минеральные источники и т.д. Однако, среди этих факторов состав питательной среды (источники углерода и азота) играют значительную роль при биосинтезе ферментов. В настоящей статье было исследовано влияние различных источников углерода и азота на биосинтез коллагеназы ассоциацией микромицетов *Aspergillus awamori 16* и *Aspergillus awamori 22.* Максимальная активность коллагеназы (8,1 Ед/мл) отмечена в варианте, содержащем в качестве источника углерода 2% сахарозу и 1% пептон в качестве источника азота.

Были подобраны оптимальные источники углерода и азота в питательной среде, которая имела следующий состав в (%): KH_2PO_4 - 0.1; $MgSO_4$ - 0.05; KCl - 0.05; $FeSO_4$ - 0.001; пептон - 1,0; сахароза - 2,0. Подбор оптимальных источников углерода и азота для ассоциативной культуры *A. awamori 22* и *A. Awamori* позволил повысить образование внеклеточной коллагеназы с 6,8 до 8,1 ед/мл.

Ключевые слова: коллагеназа, микромицеты, источники углерода и азота.

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USING OF COMPUTER PROGRAMM «BD-PLANT-KZ» FOR CADASTRAL REGISTRATION OF PLANTS OF THE NATURAL FLORA OF KAZAKHSTAN

Abstract. The description of the computer “BD-PLANT-KZ” program, intended for input and storage in memory of the computer of various botanical information on plants of the natural flora of Kazakhstan is provided. 11 points of the program are a part of the Main menu: "File," "Editing," "Input," "Search," "Viewing," "Lists," "Herbarium," "Communities," "Databases," "Service," and "Reference." The program allows carrying out a quick search of data, printing, exporting to various formats, drawing up reports and lists in the set taxonomical, bioecological, decorative, and other parameters. “BD-PLANT-KZ” has undergone successful approbation in two botanical gardens of Kazakhstan (Altai and Mangyshlak). Now floristic the database of the program includes information on natural flora for 882 taxons from 4 departments, 6 classes, 12 subclasses, 26 suborders, 59 orders, 10 suborders, 80 families, and 300 genes. The approbation of the program has allowed making the summary characteristic of the natural flora of Western Kazakhstan on the example of the Mangystau, Atyrau, Aktyubinsk, and West Kazakhstan regions. Lists of taxons are determined by geographical points and floristic areas, geographical novelties are revealed.

Keywords: computer program, «BD-PLANT-KZ», cadastral, registration of plants, Data Base.

Introduction. The creation of the information databases (DB) containing a large number of accounts and variables, related to the inventory of plants, in particular, pays significant attention to the development of the instrument of formation of a DB or, in other words–the special computer program adapted with modern operating systems, graphics, and text editors. Storage and processing of botanical data are widely applied in the countries of the near and far abroad. However, such works were not carried out in Kazakhstan earlier.

In 2011-2012, RGP "Mangyshlak Experimental Botanical Garden" of CS of MES RK, within the implementation of the "Development of Scientific and Methodical and Information Database for Creation of the Inventory of Plants of the Republic of Kazakhstan" project, developed the special computer program BD-PLANT-KZ with the electron shells, allowing to enter the data on the taxonomical structure of the higher vascular plants with the description of their morphology, ecology, economic and biological properties, geographical coordinates, herbarium samples, vegetable communities, raw stocks, geographical and floristic areas, with an illustration photos and maps of areas into the databases.

The work aimed to assess a possibility of application of the made computer program for conducting an accounting of plants of the natural flora of Kazakhstan.

Materials and methods of research. The elaboration on the work required four program languages: Microsoft Visual FoxPro 9 SP2, Visual Basic For Applications 7.0, HTML 4.0, and JavaScript API 2.1.

The simplification of the input of the taxonomic units involved the use of the database, created from the list of R.K. families. Brummitt [1]. The phylogenetic system A is the basis for systematization. L. Takhtadzhyan [2, 3].

The description of vegetable communities in BD-PLANT-KZ engaged the scheme used by I. N. Safronova [4] at the geo botanical inspection of the deserts of Mangyshlak: vegetation type, a group of for-

mations, formations, associations. The volume of information on each database record is 25-30 Kbytes without drawings and the map and 150-200 – without the latter.

The Install Shield 2012 Premier Edition SP1 program was applied to the formation of an adjusting compact disk and the uniform distributive Setup.exe file.

Effective work of BD-PLANT-KZ is possible in case of the implementation of the following system requirements to computers: Microsoft Windows XP SP 2-3, Vista SP 1-2 operating system or 7, 8 and 10 (32-bit or 64-digit), existence of Microsoft Office 2007, 2010 or 2016, is also more modern than Adobe Reader 7 or more of the late version, Internet Explorer 9; Processor: Intel Pentium 4 or above; RAM of 512 MB or more, but 2048 is recommended; free disk memory - 700 MB; minimum resolution of the monitor - not less than 1024x768. The maximum use of opportunities for hardware acceleration involves the graphic video cards, compatible DirectX with the built-in video memory not less than 128 MB.

Results and discussions. Main Menu (MM) with 11 points reflects the structure of the program: "File," "Edit," "Input," "Search," "View," "Lists," "Herbarium," "Communities," "Databases," "Service," and "Reference" (figure 1).

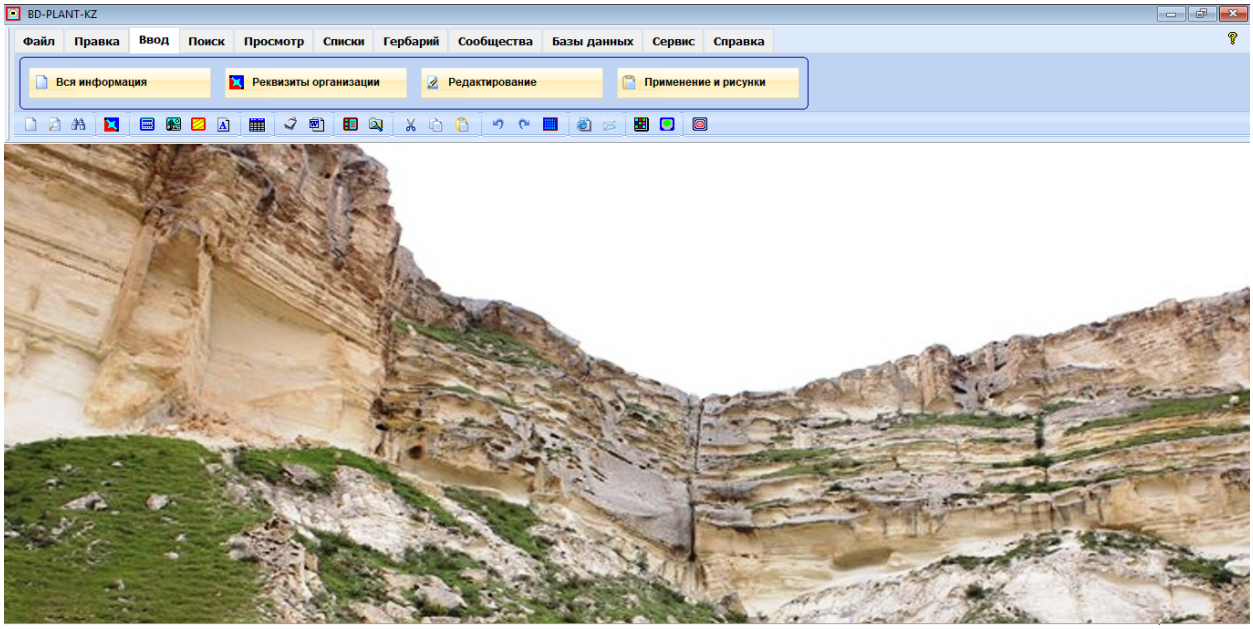

Figure 1 – Main Window of Program

The point of MM includes a standard set of sub points: "To open...," "My computer," "Press," "Filer," "Search of files," "Server," "Internet," "Mail," and "Exit" also aim for creating new and working with already available files, printings information, contacting with the server and Internet resources, sending electronic messages, and exiting the program. The point "Edit" is necessary for editing active text fields of forms of input, view of information, search and replace the words and expressions, control of font, the color of letters, and a background. "Input" point activates filling forms of a database with new and already edited information. It includes three sub points–"All information," "Requisites of the organization," "Edit," and "Apply and draw."

The Search point allows to look for plants in a database in the following options: according to the identification number; the Latin name of a taxon, the Russian name, the national name, on family, on floristic and geographical areas, and by any word or a fragment of a word from Latin, Russian, and national names. "Advanced search" integrates all above-mentioned ways. "View" is used for work with already entered information with its further printing and export in external editors and programs in various formats - doc, docx, RTF, TXT, PDF, XML, etc.

Applying "Lists" makes possible to form the most various reports on plants on taxonomical, morphological, and other characteristics.

Three commands such as "Input and View" "Reports," and "Export" of point "Herbarium" of MM realize a possibility of full work with information on Herbarium Fund of the Botanical Establishment.

"Communities" include only one sub point "Input and View" necessary for work with populations of plants.

Point of the Main Menu of Database is intended for implementation of the following commands: "Copy," "Restore," "Export," "Import," "Re-indexation," "Index Repair," and "Information on Database."

A system push-button menu for a fast call of the most often used forms of input, viewing, printing information, etc. is located below MM.

After BD-PLANT-KZ installation, the first start of the program makes mandatory the requisites of the botanical establishment with the help of the sub point "MM\Input\Requisites of the organization." The input of information to a certain organization demands to bind all taxons.

All plant data are divided between the forms of input and viewing into 11 groups (pages): Taxonomy, Names, Areas, Card, Morphology, Ecology, Application, In Addition, Herbarium, Drawings, and Text. All MM pages and buttons of the fast choice of the standard or already available in DB information for the purpose of an expeditious input (figure 2) are provided.

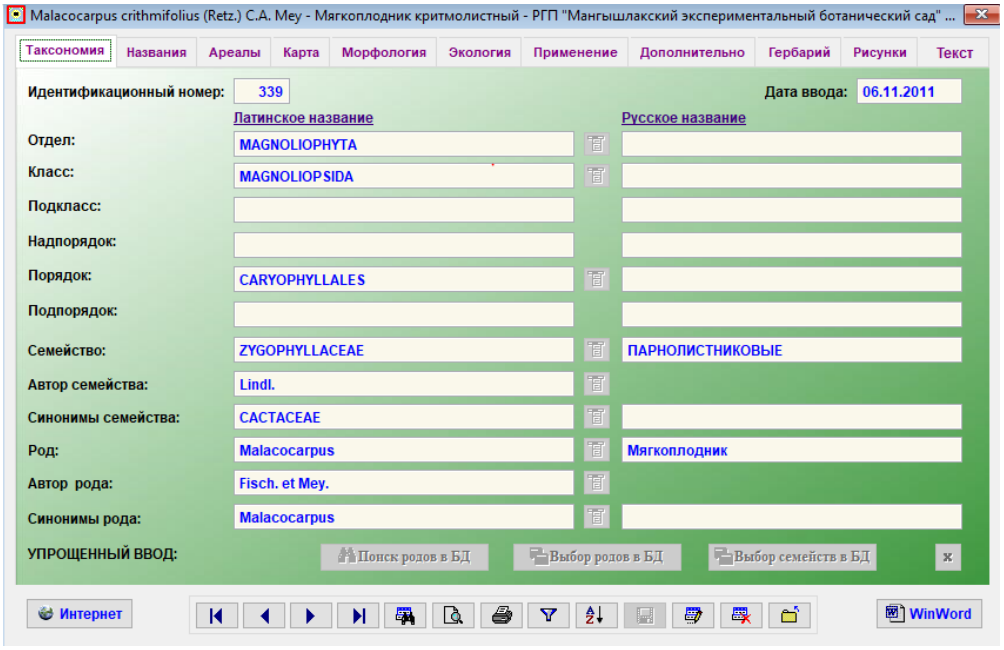

Figure 2 – Page "Taxonomy" of forms "Input" and "View"

Forms "Input" and "View" of plant data differ only functionally and according to the lower push-button menu of teams. The push-button menu on a form of "Input" includes 5 points: "Save" adds new record after all plant data is entered to Database; "Copy" serves for copying from Database of already entered data on a taxon for further editing and preservation that facilitates input of information; "Check" is necessary for searching for a plant in Database to exclude duplication; "Reset" removes all information from a form of "Input;" "Exit" closes it. A form "View" has 11 command buttons which perform various functions of work with earlier entered data, 4 of them that are placed at the left appear the parts Database navigation. Page Taxonomy provides all entered and checked systematic characteristic of a plant.

The program enters "Names" of plants automatically, adding the name of a look, a form, etc. through a gap to a sort. For authors, certain fields are provided. The fields of the section "Habitats" have included old and new names of floristic areas, administrative and geographical regions in the explored territory, the general distribution, etc. Page "Map" can display the places of occurrence of plants.

Page "Morphology" provides the description of morphological features of taxons (figure 3) on the following indicators: growth form, vital form on A. Raunkiyer, classification by frequency of bearing fruit, pollination type, terms of blossoming and dusting, coloring of flowers, fruits and leaves, characteristic of a morphological structure.

Page "Ecology" displays such ecological features as a natural area, habitats, the phyto security status, an endemicity, an aboriginality, classification in relation to light, water, fertility and salinity of the soil, etc.

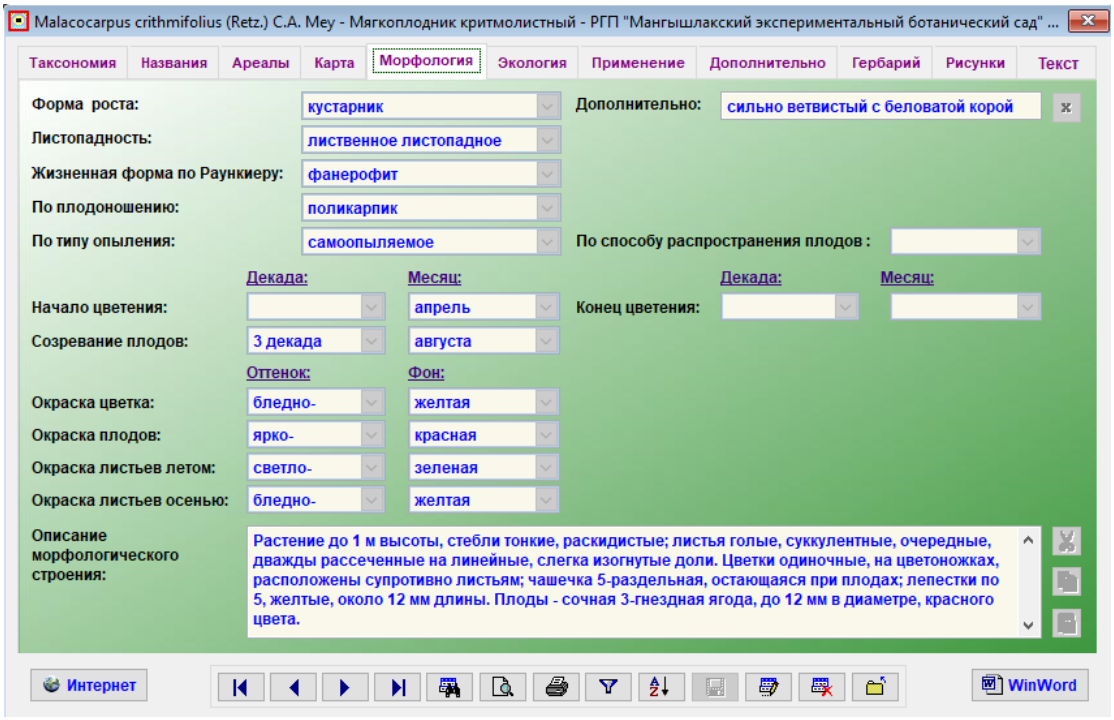

Figure 3 – Page "Morphology" of a form "Input and View"

Section "Application" collects economic and biological value as well as the reproductive ability of plants. Page "Additionally" has references and data on the organization-user. Section "Herbarium" is made for input and view of places and geographical coordinates of selection of herbarium samples (up to three). Page "Drawings" can fit up to 6 files of a plant's images with their names (figure 4). Page "Text" aims for input and storage of big text information on a taxon (including the data from the files).

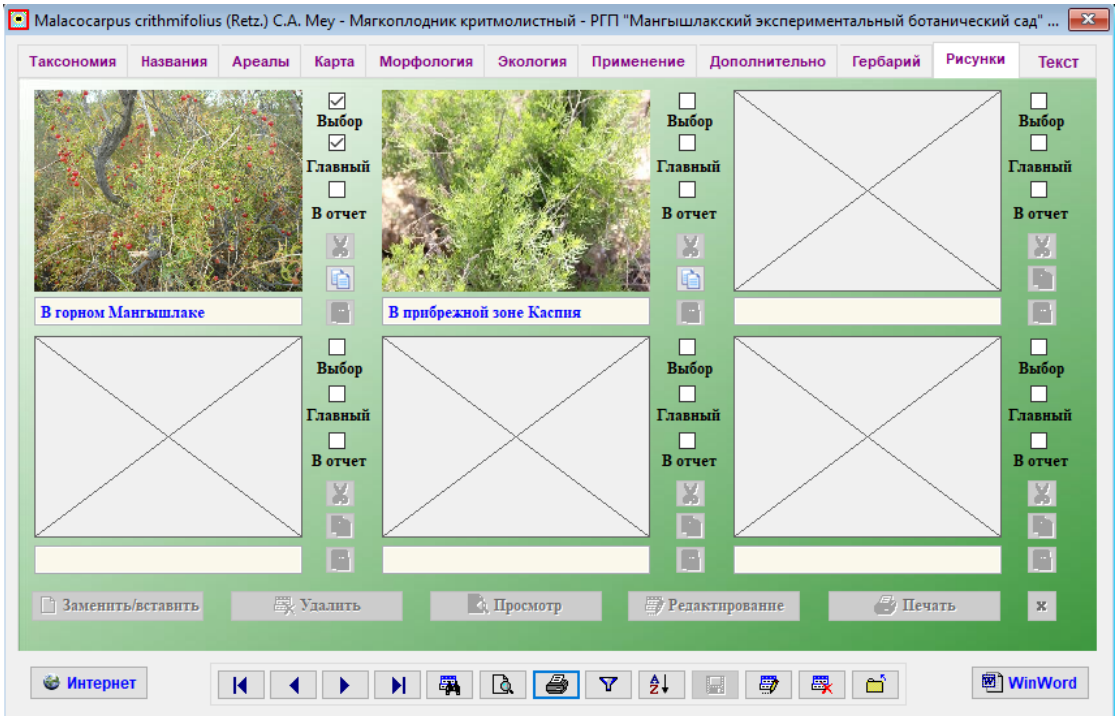

Figure 4 – Page "Drawings" of a form "Input and View"

BD-PLANT-KZ pays significant attention to the quick search of taxons. The special form allows filtering taxons on institutions, families, and childbirth or choosing a particular plant (figure 5).

BD-PLANT-KZ assists in exporting information on plants to 9 formats (txt, doc, docx, XLS, XLSX, RTF, PDF, TIF, XML) for the subsequent editing in external text and graphic editors. The call of a form of export (figure 6) is carried out through "MM\View\WinWord." Completion of the broadcast of data in the chosen format allows opening the created file in the corresponding editor. The example of export to Microsoft Word (figure 7).

Access to a form of the list of taxonomical units is carried out by Button "Systematization" in Point "View" of MM (figure 8). The choice of any unit of systematization in the right text field evokes a list of the taxons, which are its part. It is possible to obtain information not only about the taxonomy of the organization but also about Database in general.

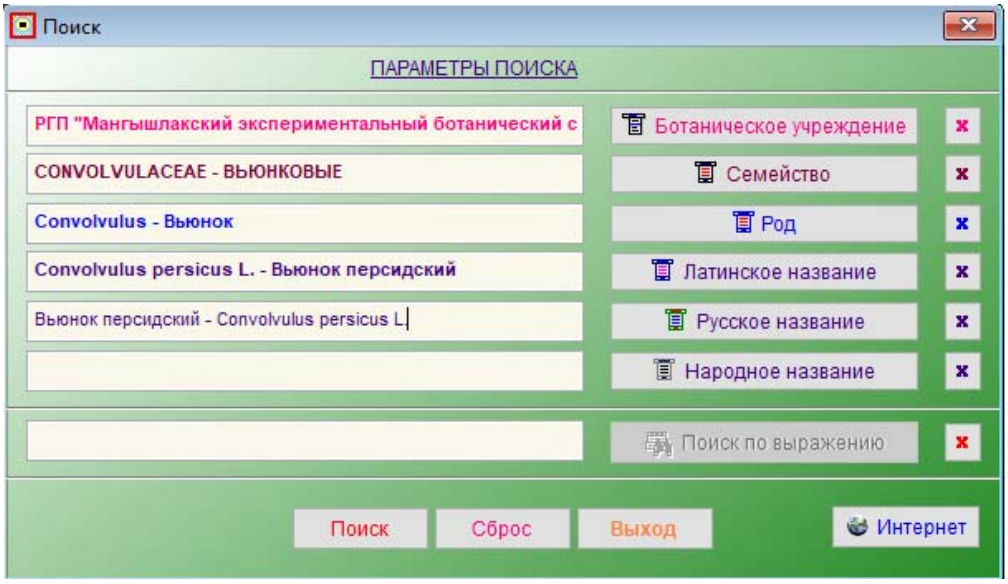

Figure 5 – "Advanced Search" Form

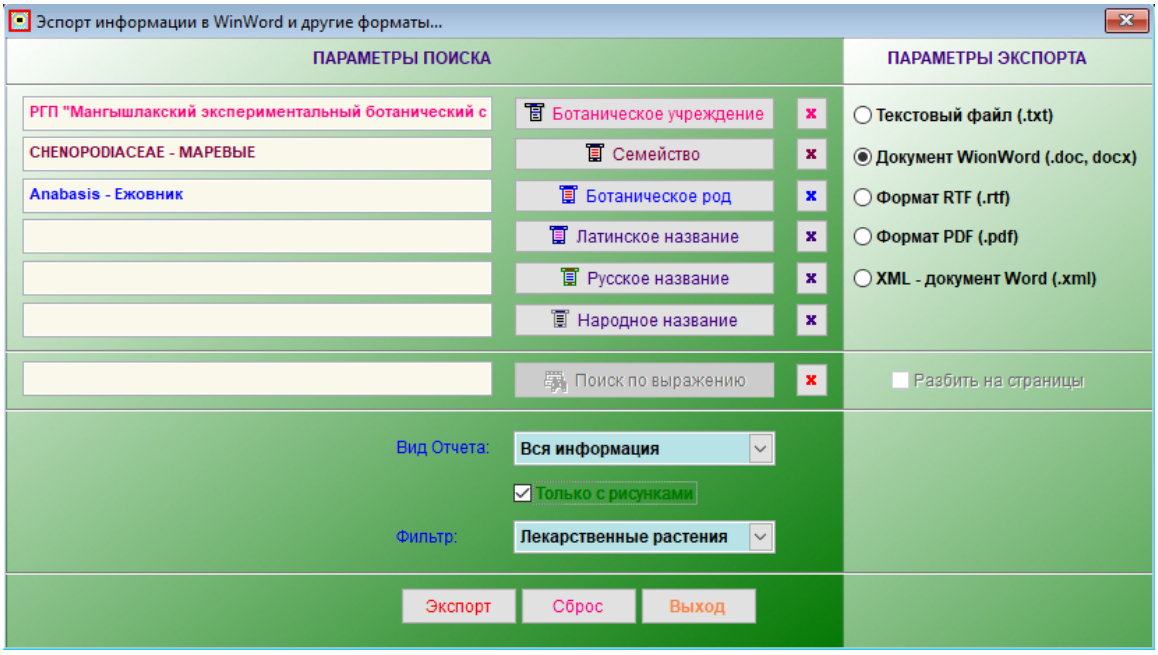

Figure 6 – "Export of Information to WinWord and Other Formats" Form

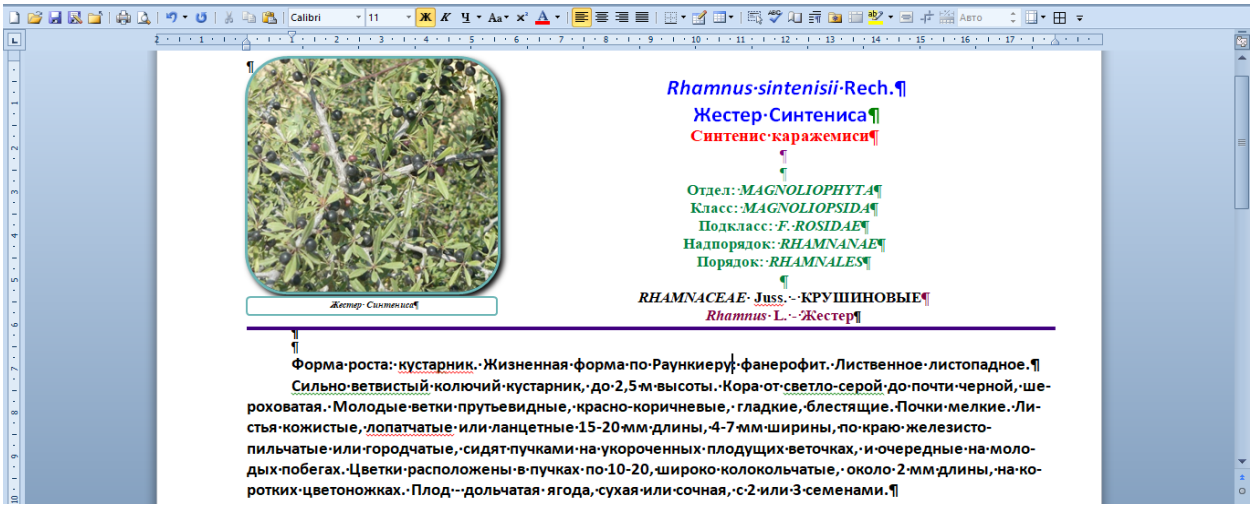

Figure 7 – An example of information export to pdf – a format

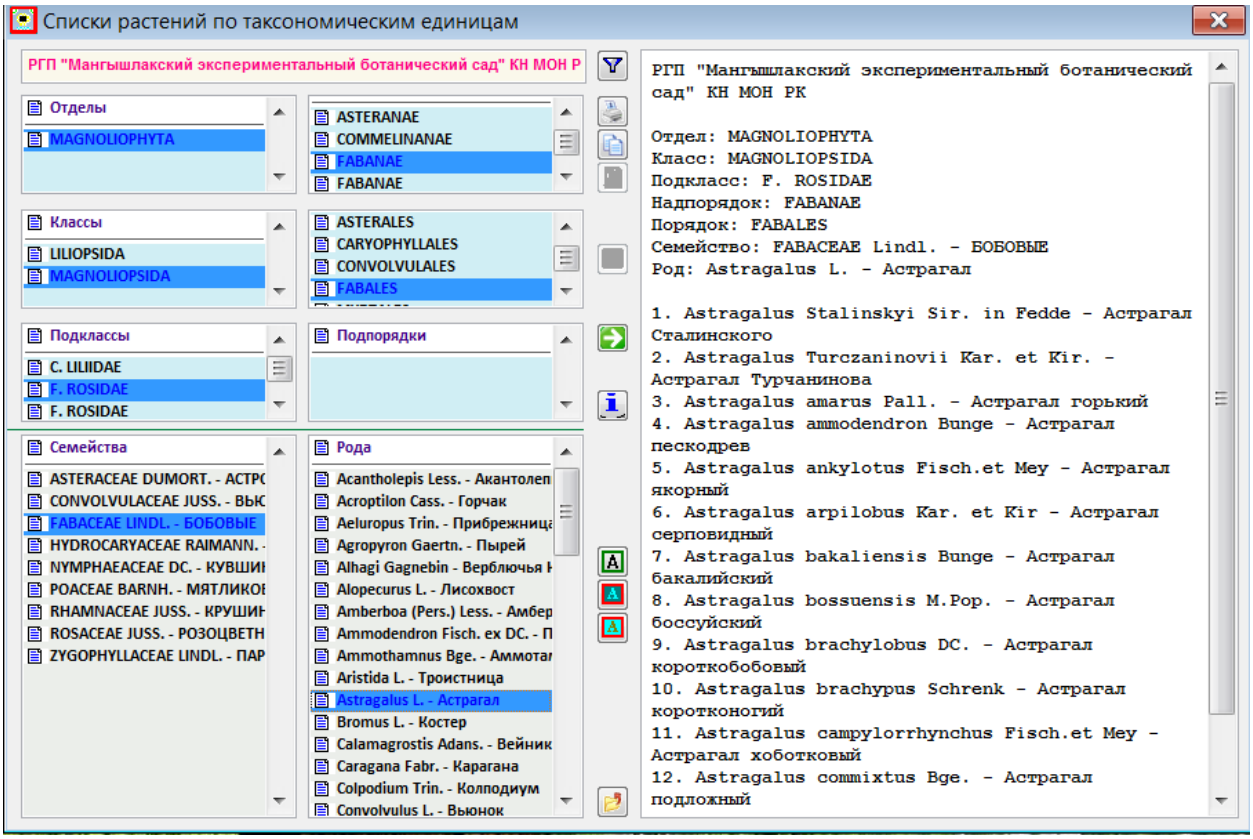

Figure 8 – Form of the list of taxonomic units

The program has provided the formation of the most various lists of plants according to taxonomic, morphological, and other characteristics.

The more detailed task of parameters of drawing up lists is possible when using a form with the similar name which is started by the commands "Choice..." from Point "List of..." of MM. The formation of Lists in Excel provides the use of Form, represented in figure 9.

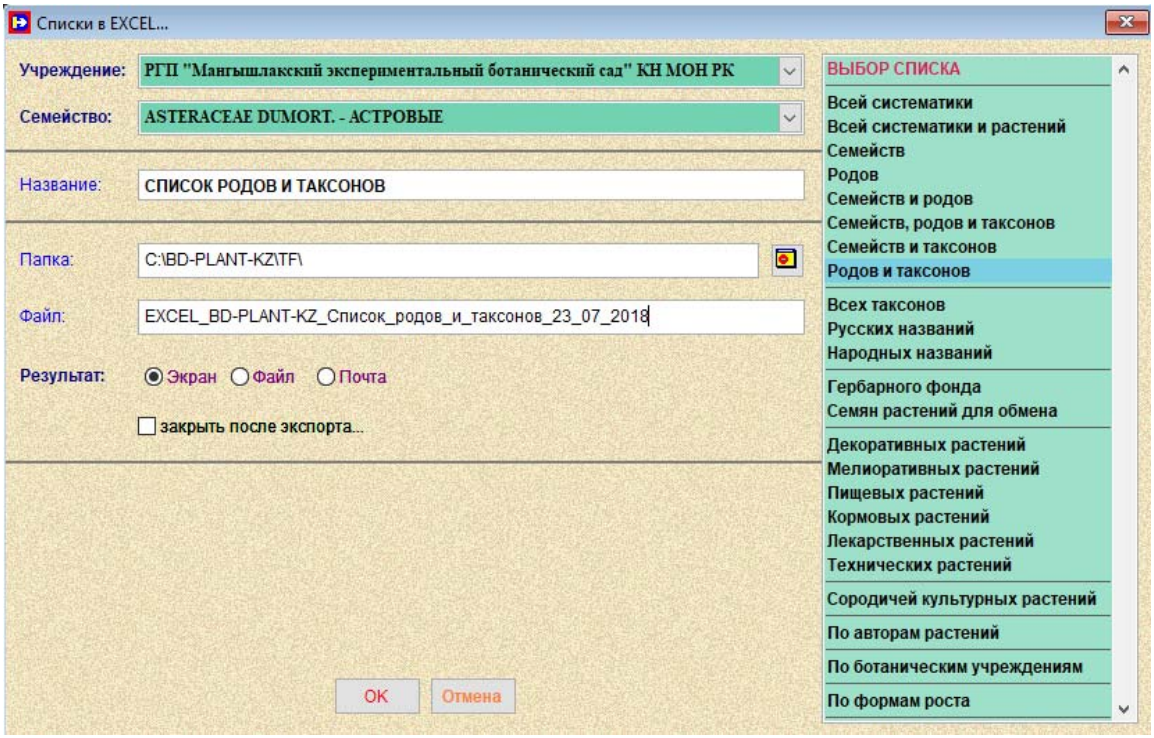

Figure 9 – "Lists in Excel..." Form

Main Menu\Herbarium command is applied to work with Herbarium fund. At the same time, a special form, including all lists of plants of the botanical establishment by default will appear on the screen. The lower Push-button menu makes possible to execute a search for the necessary taxon, to see and print out all list and also to edit it regarding inclusion or an exception of a plant of herbarium fund. If herbarium samples are available, the button "Samples," with the help of which the form intended directly for editing information is activated. The command "Edit" makes Database fields available for editing. The current record of Herbarium can be copied and removed. "Reports" and "Export" modes provide two options for a herbarium sample data withdraw: "All information" and "Labels."

For plants' communities, BD-PLANT-KZ provides a form "Input" and "View," including 5 pages (groups) of information: "Location," "Communities," "Tier," "In addition," and "Drawings" (figure 10).

Database fields characterizing an administrative and geographical location of population, coordinate, a natural zone and conditions of dwelling are concentrated on Page "Location." The group of variables of "Community" is devoted to geo botanical units.

Many of them can be chosen or created from the lists revealing the corresponding buttons. The correct connection of dominant in the name of association can be executed automatically by a combination of installation or removal of a tick to the left of the words "Other Sinusion", "Identical Value" and "Characteristic Look."

Drawing up Latin names of communities involves the first position for the name of an edifikator, whereas Russian names – on the contrary [4]. The signs such as a hyphen "-," and a plus "+" connect taxons of various synusia in the population in case plants have identical value and belong to one synusia, they are listed by a comma. Types, characteristic of the community requires the use of square brackets "[…]" to surround their names.

The page of "Tier" includes not only the general list of the plants which are a part of the population but also their level accessory with the indication of a protective covering, abundance by Drudae, occurrences, and heights. The group additionally has geo botanical districts, areas, and sub districts, the existence of raw stocks, the note of a text format of the size, unlimited on length, botanical establishment, position, degree, and full name of the performer. Drawings (page No. 5) are necessary for working with a graphic material on communities which can be looked through in three modes: "Clip," "Isometry," and "Stretched."

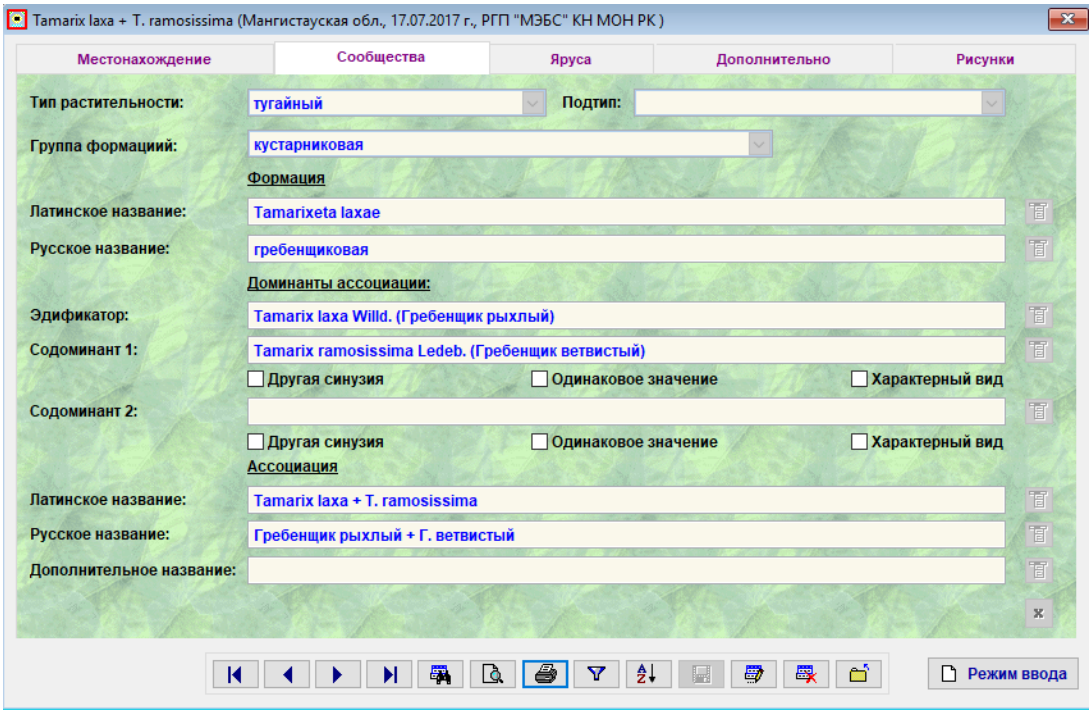

Figure 10 – Page "Community" of a form "Input" and "View" of information

Thus, regarding the structure, three main databases are a part of the program: 1) floristic, 2) herbarium and 3) geo botanical, consisting, respectively, of 211, 60, and 131 fields of numerical, symbolical, and logical types in the total length - 10,602, 2,703, and 8,161 symbols.

The commands of the point GM of a database have the following functional meaning:

1) Copying – the creation of the insurance copy of all databases, settings of the program and files of images in case of loss of information;

2) Restoration – a complete recovery of a DB and settings;

3) Export – the creation of the copy of a floristic, herbarium, and geo botanical DB for transfer on another personal computer (PC) or in another botanical establishment;

4) Import – an addition of records on plants, herbarium fund, and communities from another personal computer;

5) Re-indexing – updating the DB indexes and their packing;

6) Repair of indexes – the creation of new indexes instead of spoiled in the course of work if that happens;

7) "Information" – obtaining data on the content of a DB.

Using the first two sub points makes copying of a DB on other personal computers also possible. The folder, created in the Export mode, can be archived and sent at once to another botanical establishment by e-mail or via the server on purpose formation of a united DB according to the inventory of plants of the natural flora of Kazakhstan.

By present, the fullest taxonomical, geographical, ecological, biological, and graphic information for 882 taxons from 4 departments, 6 classes, 12 subclasses, 26 sub orders, 59 orders, 10 suborders, 80 families and 300 gena have been entered into the *floristic* database. More than a half (66.0%) of taxons (582) with the data, available in a DB, relates to the representatives of 7 families (table 1), from which the most numerous are the 4th: *Asteraceae* Dumort. (124), *Chenopodiaceae* Vent. (152), *Fabaceae* Lindl. (111) и *Poaceae* Barnh. (138). Among patrimonial complexes in the database considerably prevail gena *Artemisia* L. (53 - 6.0%), *Astragalus* L. (80 - 9.1%), *Elymus* L. (34 - 3.9%) и *Salsola* L. (20 - 2.3%). In a natural area of the dwelling, plants grow in 37 floristic regions of Kazakhstan. All territory of the republic has 96 gena of plants. The greatest number of taxons is dated for the following floristic areas: «3. Tobolsk and Ishim (101), "4. the Ural" (33), "5. Aktyubinsk" (45), "6. Turgai" 63), "16. Mangystau" (40) and "30. Altai" (119). At present, DB has 976 graphic files (drawings, images, and maps).

Table 1 – The most representative families and gena of plants of floristic database

Family	Taxons	%	Gena	Taxons	%
Asteraceae Dumort. - Астровые	124	14.1	*Artemisia* L. - Полынь	53	6.0
Brassicaceae Burnett – Капустные	26	2.9	*Astragalus* L. – Астрагал	80	9.1
Chenopodiaceae Vent. – Маревые	152	17.2	*Atriplex* L. – Лебеда	15	1.7
Fabaceae Lindl. – Бобовые	111	12.6	*Chenopodium* L. – Марь	16	1.8
Lamiaceae Lindl. – Яснотковые	14	1.6	*Elymus* L. – Волоснец	34	3.9
Poaceae Barnh. – Bluegrass	138	15.6	*Salsola* L. – Solyanka	20	2.3
Scrophulariaceae Juss. - Figwort family	17	1.9	*Suaeda* Forks. – Suaeda	14	1.6
Total	582	66.0	Total	232	26.3

The *herbarium* database of BD-PLANT-KZ program contains data recording for 765 samples of 281 species and forms of plants of natural flora from 53 families and 162 gena collected in 74 habitats of 320 geographical regions (areas) of 14 administrative regions of 4 areas of Kazakhstan now. Beyneusk, Karakiyansk, Mangystau, both Tupkaragansk, Mangystau, Zhylyoysk, Kzylkogins, and Atyrau regions collected and turned into herbariums 99, 150, 170, 65, 53, 126 samples respectively (table 2). The following floristic areas dominate regarding the number of the herbarium data entered into a database "16. Mangystau" (381 - 49.8%), "17. Northern Ustyurt" (96 - 12.5%) and "4. Ural" (256 - 33.5%). Gerbarny samples of the database are illustrated by 465 their photos.

Table 2 – Distribution of gerbarny samples of the database on the administrative and floristic regions of Kazakhstan

Administrative region (area)	Taxons	%	Floristic area	Taxons	%
Beyneusk (Mangystau)	99	12.9	5. Aktyubinsk	23	3.0
Bokeyordinsky (West Kazakhstan)	1	0.1	15. Bozasha	6	0.8
Zhylyoysk (Atyrau)	53	6.9	13a. Bukeevsk	1	0.1
Indersky (Atyrau)	39	5.1	16. Mangystau	381	49.8
Isataysky (Atyrau)	20	2.6	13. Pricaspian	1	0.1
Karakiyansky (Mangystau	150	19.6	17. Northern Ustyurt	96	12.5
Kzylkoginsky (Atyrau)	126	16.5	6. Turgai	1	0.1
Makatsky (Atyrau)	14	1.8	4. Ural	256	33.5
Mangystau (Mangystau)	170	22.2			
Makhambetsky (Atyrau)	22	2.9			
Mugalzharsky (Aktyubinsk)	1	0.1			
Munaylinsky (Mangystau)	4	0.5			
Tupkaragansky (Mangystau)	65	8.5			
Hobdinsky (Aktyubinsk)	1	0.1			
Total	765	100.0	Total	765	100.0

Conclusion. The computer program has undergone successful approbation in two botanical gardens of Kazakhstan (Altai and Mangyshlaksky) and has shown high reliability and efficiency of work with floristic and herbarium information on plants of the natural flora of Kazakhstan. Lists of taxons on the systematic accessory, ecological and biological properties, geographical points, floristic areas, etc. revealed the geographical novelties of plants.

BD-PLANT-KZ is registered in Committee on intellectual property rights of the Ministry of Justice of the Republic of Kazakhstan (the certificate on the state registration of the rights for the subject of copyright No. 1408 of December 25, 2012, IS 0009258).

Introduction of the program in the practice of the cadastral registration has considerably simplified creation information databases, has allowed to carry out quickly search of taxons and, in general, has expanded possibilities of work with information on plants and their communities.

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ҚАЗАҚСТАННЫҢ ТАБИҒИ ФЛОРАСЫНЫҢ ӨСІМДІКТЕРІН КАДАСТРЛІК ЕСЕПКЕ АЛУ ҮШІН «BD-PLANT-KZ» КОМПЬЮТЕРЛІК БАҒДАРЛАМАСЫН ҚОЛДАНУ

Аннотация. «Қазақстанның табиғи флорасының өсімдіктерінің ботаникалық алуан түрлігігі жөнінде ақпаратты компьютер жадына енгізу және сақтау үшін арналған BD-PLANT-KZ» компьютерлік бағдарламасының сипаттамасы берілген. Бағдарламаның негізгі құрылымының құрамы 11 мәтіннен тұрады: «Файл», «Өңдеу», «Енгізу», «Іздеу», «Қарау», «Тізім», «Кеппе шөп», «Қауымдастық», «Деректер базасы», «Сервис» және «Анықтама». Бағдарлама деректерді жылдам іздеуге, басып шығаруға, әртүрлі форматта экспорттауға, берілген таксономикалық, биоэкологиялық, сәндік және басқа параметрлер бойынша тізімдер мен есептерді жасауға мүмкіндік береді. «BD-PLANT-KZ» Қазақстанның екі ботаникалық бақтарында (Алтай және Маңғыстау) сынақтан сәтті өтті. Қазіргі уақытта бағдарламаның флористикалық деректер базасында табиғи флораның 4 бөлімдер, 6 класс, 12 класс асты, 26 қатарүсті, 59 қатар, 10 қатар асты, 80 тұқымдастан және 300 туыстан тұратын 882 таксон үшін ақпарат енгізілген. Бағдарламаның сынағы Батыс Қазақстанның мысалға Маңғыстау, Атырау Актөбе және Батыс Қазақстан облыстарының табиғи флорасының жиынтық сипаттамасын құрастыруға мүмкіндік берді. Географиялық нүктелер мен флористикалық аудандар бойынша таксондар мен географиялық жаңа тізімдер анықталды.

Түйін сөздер: компьютерлік бағдарлама, BD-PLANT-KZ, кадастр, өсімдік есебі, деректер базасы.

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ИСПОЛЬЗОВАНИЕ КОМПЬЮТЕРНОЙ ПРОГРАММЫ «BD-PLANT-KZ» ДЛЯ КАДАСТРОВОГО УЧЕТА РАСТЕНИЙ ПРИРОДНОЙ ФЛОРЫ КАЗАХСТАНА

Аннотация: Приводится описание компьютерной программы «BD-PLANT-KZ», предназначенная для ввода и хранение в памяти компьютера разнообразной ботанической информации о растениях природной флоры Казахстана. В состав Главного меню входят 11 пунктов программы: «Файл», «Правка», «Ввод», «Поиск», «Просмотр», «Списки», «Гербарий», «Сообщества», «Базы данных», «Сервис» и «Справка». Программа позволяет осуществлять оперативный поиск данных, вывод на печать, экспорт в различные форматы, составление отчетов и списков по заданным таксономическим, биоэкологическим, декоративным и иным параметрам. «BD-PLANT-KZ» прошла успешную апробацию в двух ботанических садах Казахстана (Алтайский и Мангышлакский). В настоящее время флористическая база данных программы включает информацию по природной флоре для 882 таксонов из 4 отделов, 6 классов, 12 подклассов, 26 надпорядков, 59 порядков, 10 подпорядков, 80 семейств и 300 родов. Апробация программы позволила составить сводную характеристику природной флоры Западного Казахстана на примере Мангистауской, Атырауской, Актюбинской и Западно-Казахстанской областей. Определены списки таксонов по географическим точкам и флористическим районам, выявлены географические новинки.

Ключевые слова: компьютерная программа, «BD-PLANT-KZ», кадастр, учет растений, базы данных.

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ECOLOGICAL MONITORING IN COATAL AREA OF CASPIAN SEA USING GEOINFORMATIONAL TECHNOLOGIES

Abstract. The objective need for environmental monitoring of soils in the coastal zones of the Caspian Sea in the areas of location of oil production defines due to the increasing anthropogenic pressure on land resources and the necessity of emitting of man-made changes in the state of soils for the adoption of environment-oriented decisions. When creating a geographic information model for soil assessment, it was found that it should be able to exchange information with other geographic information systems and technologies, as well as other applications.At the field stage, a visit to the area with a set of measuring equipment was carried out, which provides sampling of soil with fixing the location in the areas of SES.To ensure the automation of data processing, predictive and spatial analysis of the results of field studies, an electronic map of the state of the soils of the coastal zone of the Caspian sea in the GIS format was created.Project information analysis application "Monitoring and Analytics" was developed to the electronic map, which was implemented on a modular basis based on client-server technology. The MS Access database management system (DBMS) is chosen as a server for the accumulation of information about the results of field surveys of the locality, which ensures the reliability of the application and the correction of the layers of the electronic map. With the help of MSExcel attributive tables were created to collect information according the main soil condition indicators of each field. An electronic map soils' state of the Caspian Sea coastal zone in the areas where oilfields are located, on which all the results of environmental projects are applied with using MsAccess.

Key words: Caspian Sea, coastal soil, electronic chart, GIS, monitoring.

Introduction. The objective necessity for state environmental monitoring of coastal soils of the North-east Caspian Sea zones in areas of oil companies operation is due to the following main factors:

- increasing anthropogenic pressure on land resources;
- need to allocate anthropogenic changes in a soil condition on the background of natural environmental decision-making.

Solving these monitoring problems is very difficult without creation of the soils condition database, that is, an automated information system (AIS) of land monitoring. The created AIS should contain all of the above information that will allow virtually adopting and implementing correct environmental decisions. In this regard, the ever-growing amount of information on the status and use of land makes creation of information support for implementation of state land monitoring especially relevant.

The objective need for environmental monitoring of soils in the coastal zones of the Caspian Sea in the areas of location of oil production defines due to the increasing anthropogenic pressure on land resources and the necessity of emitting of man-made changes in the state of soils for the adoption of environment-oriented decisions.

When creating a geoinformation model for evaluation the nature of soils, it should be able to exchange information with other geoinformation systems and technologies, as well as other application programs, since no one modern GIS is able to be absolutely universal in performing tasks that are required in production [1-3].

Thus, with the implementation of the geoinformation model, it became necessary to use software programs that allow working with both attribute data and a graphic part of it [4, 5].

Methods and materials. The main source of facts is the materials of author's research at stationary ecological posts (SES), in the coastal zone of the Caspian Sea in areas where oilfields operate [6]. The evaluation method of negative processes was used, where rigorous approach and marking criteria of soil degradation in oil fields were applied. The software programs MapInfoProfessional, GeomaticsOffice, MicrosoftOfficeAccess, AdobePhotoshop were used, which allows working with attribute data, as well as with a graphic part of environmental projects [7].

Results. One of the main elements for the organization of information using GIS geoinformation technologies is attributive data models. To realize the tasks set by us, the relational model is used as a model of attributive data. Relational data models are displayed in the form of tables.

Such data models are available even for unskilled users, and it is possible to use high-level languages. Information systems which are formed on the basis of relational models are available for users who do not have much programming experience.

Since the main purpose of the work was to compile an electronic soil map of the coastal zone of the Caspian Sea, based on the results of soil monitoring (ecological projects), the first stage of database development was the conceptual level. At this stage of the research, a conceptual model of data with logical connections was created, reflecting the necessary composition of information on the state of soils in the coastal zone of the Caspian in the areas where oilfields are located (physical and chemical properties, heavy metals) in the form of a strictly ordered structure, but with the possibility of its development and dynamics.

In the process of conceptual design, a conceptual and logical model of data is created, reflecting the composition of data on soil monitoring results in the form of ordered structure.

In 2016-2017field studies were carried out at the 12 stationary ecological sites (SES) with soils sample collections of the coastal zone of the Caspian Sea in areas of oil fields to determine the content of heavy metals in soils (table 1).

Table1 – Coordinates of stationary ecological sites (SES)

SES	Field	Coordinates			
		Length		Latitud	
		Plan	Fact	Plan	Fact
1	Karazhanbas	51˚15'41.8032	51°16'03,6"	45˚8'51.306	45°08'56.8"
2	Karazhanbas	51˚16'37.38	51°16'32.3"	45˚8'49.6608	45°08'51.4"
3	Karazhanbas	51˚17'49.2108	51°17'48.0"	45˚8'49.4772	45°08'36.5"
4	Karazhanbas	51˚16'33.204	51˚16'35.10	45˚7'48.9144	45˚7'47.10
5	Fonovaya	51˚16'14.6676	51˚16'14.7	45˚6'25.866	45˚06'25.9
6	Fonovaya	51˚29'52.5156	51°29'43.9"	45˚18'24.3396	45°18'35.7"
7	Fonovaya	51˚41'42.3168	51°44'19.1"	45˚22'51.1248	45°22'39.3"
8	Arman	51˚44'58.5132	51°45'11.5"	45˚24'43.6176	45°24'30.7"
9	Arman	51˚45'22.464	51°45'36.1"	45˚24'5.5548	45°24'01.3"
10	Kalamkas	51˚55'3.0036	51°55'35.6"	45˚25'0.2784	45°25'03.5"
11	Kalamkas	51˚55'3.8712	51˚55'17.8	45˚23'21.8796	45˚23'28.5
12	Fonovaya	52˚9'2.5416	52˚07'55.6	45˚21'27.7524	45˚21'59.5

Map-scheme of monitoring points in the coastal zone of the Caspian Sea executed in the MapInfoProfessiomal 12.0 environment is shown in figure 1.

At the field stage, a trip to the region was carried out with a set of measuring instruments that provided sampling of soil with fixation of location in the areas of the SES.

According to the results of laboratory research, diagrams of physical and chemical features and dynamics of heavy metals in soils were carried out, and on the basis of which attribute tables were created in the MSExcel environment. A software analytic application "Monitoring and Analytics" was developed to the electronic state map.

Figure 1 – The scheme of monitoring points in the coastal part of Mangistau region
(implemented in the environment MapInfoProfessiomal 12.0)

The MicrosoftAccess database management system was used as a server, which provides the accumulation of information about the results of field surveys, the reliability of the application and the adjustment of the used layers of the electronic map [8].

For computerized loading of data in the database maintenance module, there is a special function called "Importing data from an Excel file"[9, 10]. With the help of MSExcel attributive tables were created to collect information according the main soil condition indicators (content of heavy metal in soils (TM)) of each field (SES) (figure 2).

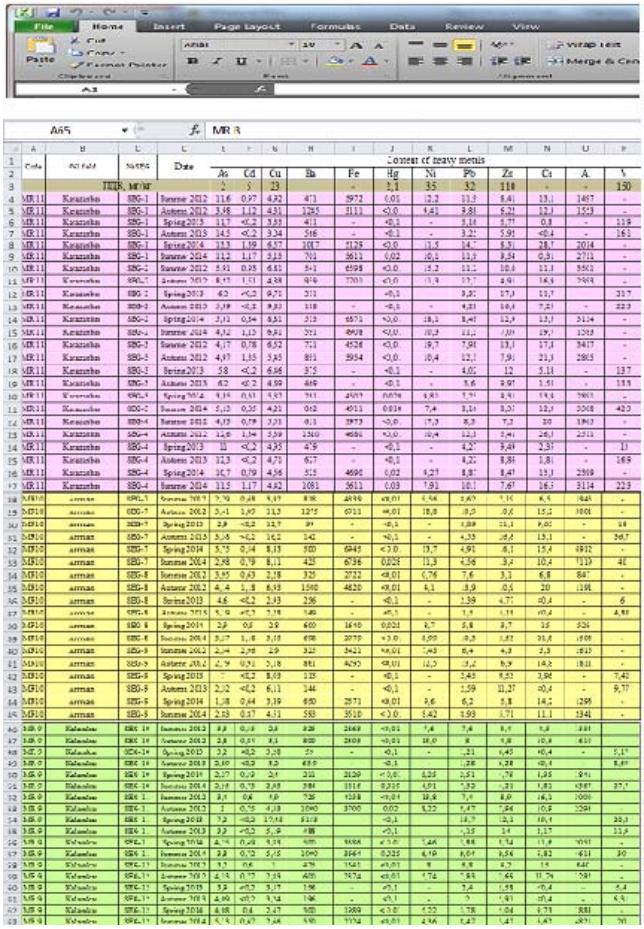

Figure 2 –
Attributive table
(the content of heavy metals in soils),
taking into account the correspondence
of field numbers of electronic maps
(Excel)

In the attributive table: hierarchical levels system organization of fields (area code + business code), name of the field (column B) and field –SES (column C) were taken into account.

As a software-tool environment for developing a physical database model, MS Access was selected, which has a high application reliability. The MsAccess program made it possible to translate this table into dbf format for the following data association to the shapefile of the electronic map of the study area. The binding of the table data to the shapefile was performed using the N_ID attribute (N_1) [11-13].

The table of results of monitoring the Caspian Sea coastal zone soils is presented in figure 3 in MS Access.

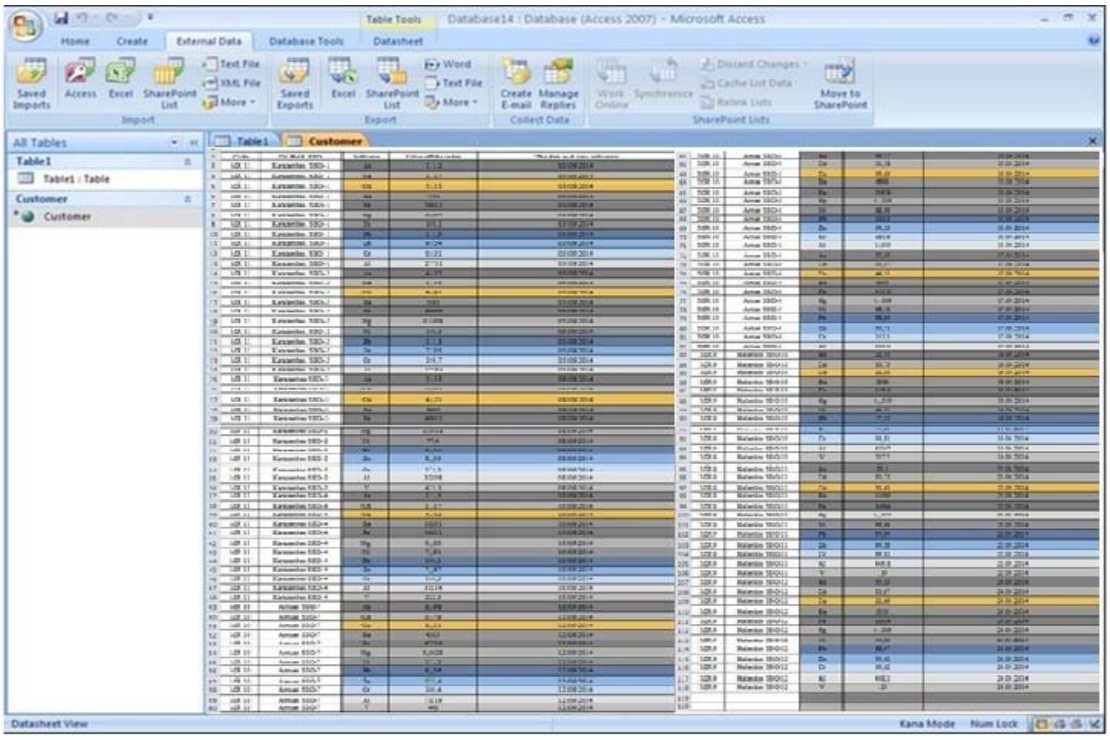

Figure 3 – Adapted in MS Access tableresults of SES monitoring

The form fields of the MsAccess of pivot Tables contain the following attributes: SES 1-15 coordinates (for oilfields, including background ones), field cipher N_ID (N_1), humus content Hum_, phosphorus content P_2O_5_, potassium content K_2O_, heavy metals As_, Cd_, Cu_ , Ba_, Fe_, Hg_, Ni_, Pb_, Zn_, Cr_, Al_, V_. indicating the date, time and year of environmental monitoring [14, 15]. The MsAccess program made it possible to translate all the above tables into the dbf format for later binding the table data to the shapefile of the electronic map of the Caspian Sea coastal zone in areas where the oilfields were located (figure 4). The binding of tabular data to the shapefile is carried out by the attribute N_ID (N_1).

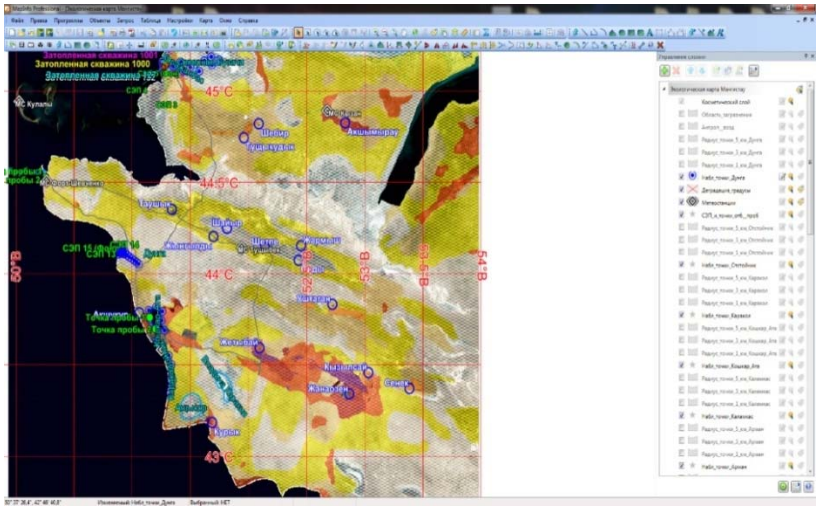

Figure 4 –
Electronic map of soils
of the Caspian Sea coastal zone

Conclusion. An electronic map soils' state of the Caspian Sea coastal zone in the areas where oil-fields are located, on which all the results of environmental projects are applied with using MsAccess.

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ГЕОАҚПАРАТТЫҚ ТЕХНОЛОГИЯЛАРДЫ ҚОЛДАНУ АРҚЫЛЫ КАСПИЙ ЖАҒАЛАУЫНДАҒЫ МҰНАЙ ӨНДІРІЛЕТІН АЙМАҚТАРДЫҢ ЭКОЛОГИЯЛЫҚ МОНИТОРИНГІ

Аннотация. Каспий теңізінің жағалау аймағының мұнай өндіру кәсіпорындары орналасқан аудандарда топырақтарының жағдайына экологиялық мониторингтің объективті қажеттілігі жер ресурстарына антропогендік қысымның артуымен және табиғатты қорғау шешімдерін қабылдау үшін топырақ жағдайында антропогендік өзгерістерді бөлу қажеттілігінен туындайды. Топырақтың жай-күйіне бағалау жүргізу үшін геоақпараттық модель құру кезінде оның басқа геоақпараттық жүйелермен және технологиялармен, сондай-ақ басқа да қолданбалы бағдарламалармен ақпарат алмасу мүмкіндігі болуы тиіс екендігі анықталды. Далалық кезеңде өлшеу аппаратурасының жиынтығымен қамтамасыз етіліп, тұрақты экологиялық алаң аудандарында орналасқан жерлерді белгілей отырып, топырақ сынамаларын алужүзеге асырылды.Деректерді өңдеу процестерін автоматтандыруды қамтамасыз ету, далалық зерттеулер нәтижелерін болжамдық және кеңістіктік талдауды қамтамасыз ету үшін ГАЖ форматында Каспийдің жағалау аймағы топырақтарының жай-күйінің электрондық картасы жасалды. Электрондық картаға клиент-сервер технологиясы негізінде модульдік тип бойынша іске асырылған "Мониторинг және аналитика" бағдарламалық ақпараттық-талдамалық қосымшасы әзірленді. Жергілікті жерді далалық зерттеу нәтижелері туралы мәліметтерді жинақтау үшін сервер ретінде MS Access деректер қорын басқару жүйесі (ДҚБЖ) таңдалды, бұл қосымшаның сенімділігін және электрондық карта қабаттарын түзетуді қамтамасыз етеді.MS Excel көмегімен әрбір алаңның топырақ жай-күйінің негізгі көрсеткіштері бойынша ақпарат жинауға арналған атрибуттық кестелер құрылды. MsAccess пайдалану арқылы экологиялық жобалардың барлық нәтижелері келтірілген, Каспийдің жағалау аймағының мұнай кәсіпорындары орналасқан аудандары топырақтарының жай-күйінің электрондық картасы жасалды.

Түйін сөздер: Каспий теңізі, жағалау топырағы, электронды карта, ГАЖ, мониторинг.

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ЭКОЛОГИЧЕСКИЙ МОНИТОРИНГ ПРИБРЕЖНОЙ ЗОНЫ КАСПИЯ В РАЙОНАХ НЕФТЕДОБЫЧИ С ПРИМЕНЕНИЕМ ГЕОИНФОРМАЦИОННЫХ

Аннотация. Объективная необходимость экологического мониторинга почв прибрежных зон Каспия в районах размещения предприятий нефтедобычи обусловлена, возрастающей антропогенной нагрузкой на земельные ресурсы и необходимостью выделения антропогенных изменений в состоянии почв для принятий природоохранных решений. При создании геоинформационной модели для проведения оценки состояния почв, было установлено, что она должна обладать возможностью обмена информацией с другими геоинформационными системами и технологиями, а также другими прикладными программами. На полевом этапе, был осуществлен выезд на местность с комплектом измерительной аппаратуры, обеспечивающей отбор проб грунта с фиксацией местоположения в районах СЭП. Для обеспечения автоматизации процессов обработки данных, прогнозного и пространственного анализа результатов полевых исследований создана электронная карта состояния почв прибрежной зоны Каспия, в формате ГИС. К электронной карте разработано программное информационно-аналитическое приложение «Мониторинг и аналитика», реализованное по модульному типу на основе технологии клиент-сервер. В качестве сервера длянакопления сведений о результатах полевых обследований местности, выбрана система управления базами данных (СУБД) MS Access, что

обеспечивает надежность приложения и корректировку слоев электронной карты.С помощью MSExcel были созданы атрибутивные таблицы для сбора информации по основным показателям состояния почв каждого поля.Создана электронная карта состояния почв прибрежной зоны Каспия в районах размещения нефтяных промыслов, на которую нанесены все результаты экологических проектов, с использованием MsAccess.

Ключевые слова: Каспийское море, прибрежные почвы, электронная карта, ГИС, мониторинг.

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SCREENING OF STAMMS OF MUSHROOMS OF THE SORT OF *TRICHODERMA* AND *MORTIERELLA* FOR THE DETERMINATION OF THE GROWTH STIMULATING ACTIVITY OF THE LEGUMINOUS AND FORAGE CULTURES

Abstract. The results of the study of the growth-stimulating action of *Trichoderma viride 22, Trichoderma album 23, Trichoderma asperellum 175, Trichoderma asperellum 1M* and *Mortierellaalpina* antigens isolated from the soils of the Almaty region on the growth and development of leguminous and forage crops. It has been established that the biologically active substances released by various species of the fungus of the genus *Trichoderma* in a certain concentration stimulate the growth and development of plants of peas, beans, alfalfa and increase their resistance to diseases. The greatest growth-stimulating activity was possessed by 3% culture fluid of the fungus *Trichoderma viride 22 and Trichoderma album 23.* Various concentrations of arachidonic acid obtained from the fungus *Mortierella sp.* Stimulated the growth of the chickpea stem, and in peas and alfalfa - except for the growth of the stem and roots. The culture liquid *Mortirella sp.* in 5% and 10% concentration had growth stimulating activity. All test crops react differently to the action of growth substances produced by the fungus *Mortierella sp.* The use of arachidonic acid reduced root growth, but stimulated stem growth in chickpeas. In alfalfa and peas, the stimulating effect of arachidonic acid on the stem and root was observed in all variants of the experiment. The purpose of the study was to study the growth-stimulating properties of the isolated fungi of the general *Trichoderma* and *Mortierella*, a producer of arachidonic acid, on legumes and fodder crops.

Keywords: arachidonic acid, legumes, microfunguss, influence of activity of growth.

Reduced growth in perennial and annual herbs, soybeans, peanuts, hawthorn and horticultural crops, reduction of soil fertility and reduction of crop cultivation culture, anddeclining productivity of growing crops. At the same time, the chemicals of plant protection and fertilizer application have led to a sharp reduction. In this case, one of the ways to overcome this problem is to switch from biological and ecologically safe farming through the widespread introduction of seedlings of bean, peanut butter plants with symbiotic activity [1-3].

Peanut cultures are one of the most important organic and biological sources of biological nitrogen, also an important source of vegetable protein, a good source of cereal crops, and increased soil fertility.

He is paying great attention to bean crops in world agriculture. The sown area of bean crops in the world is about 100 million tons. and it reaches 20% of the gross crop yield. Grain and leguminous crops take an important place in the raw material balance of the state among different agricultural crops, providing the production of high protein products in the direction of food and livestock resources [4-6].

In order to address the problem of the protection of grain and leguminous crops, it is necessary to use protective methods to reduce pathogenic potential (potential) in soil and seeds. Every year, there is a great interest in specific biological and environmentally sound methods of combating agricultural pests and diseases [7-9]. However, biological agents are widely used in agriculture on the basis of microb antagonists that inhibit the pathogenicity of cultural plants as an alternative to chemicals. Often, the blocking of such biological agents is based on biological control directly from the dominant principle of plant microflora in the environment [10-14].

Microscopic mushrooms of Trichoderma are biological control agents that provide essential antibiotics and hydrolase (chitinase and glucanase), which provide a set of antipathogenic factors, which are the basis of plant protection from pathogenic organisms. In order to improve the behavior of Trichoderma mushrooms, it is planned to create complex preparations with other fungal fungi that perform useful functions of plants.In recent years, *Mortierella sp.* Supposes that natural biologically active substances are based on the strengthening of plant protection mechanisms by using the ellipses, which suppose the other side effects that promote plant resistance to pathogens. a great deal of attention is paid to arachidic acid, which relates to unsaturated, unsaturated fatty acids that form with mushrooms [15-18].

The object of the research is the *Trichoderma* mushroom strains extracted from the rhizosphere of the cucumber cultivated in the «Алмалыбақ» farm in the Karasai district of the Karasai district of the Sarykand district of the Sarkand area and the Siberian Biochemistry of the Scriabin Microorganisms of the Russian Federation andInstitute of Physiology, *Mortierella sp.* mushrooms and arachidonic acid were used. In addition, seeds of "Ikarda", peat "Ambrosia" and "Cenernia" varieties of seeds were used in the study, each of which was used in 60 copies.

Trichoderma and *Mortierella sp.* In order to investigate the growth activity of the plants by the action of mushrooms, three methods were performed.

In the first experiment, seeds *22, 23, 175, 1M* strains of *Trichoderma* mushrooms with different biologically active ingredients grown in 7 days were fertilized for 2 hours in 50% and 3% culture fluids.

In the second practice, *Mortierella sp.* The main biologically active ingredient of the mushroom is the lipid nature of arachidonic acid. We cultivated seeds of seeds: in 10 liters of water we have processed 1.2 mg of arachidon acids, 0.6 mg and 0.3 mg.

In the third experiment - *Mortierella sp.,* Grown on day 11, in a water-treated environment at a concentration of 5 and 10%. We have determined the growth activity of the fungus cultured fluid.

Initially, the seeds were put into the Petri dish and the containers to the sterile soil, which was put into solid feeding medium by Kovrovsev, and then cultivated in a thermostat at 25 °C for two days and then for 7 days. We took distilled water as a controller [19].

We have determined the effects of the culture of fungicidal and the effect of arachidic acid on the growth of seeds, the length of sprouts and the growth of the seeds. On the 7th day, we measured the germination, biometric sightings and mass of sprouts. We used standard methods of mathematical processing of the obtained results. [20, 21].

Results and Discussion: In practice, the following results were obtained from seeds grown in the soil: The varieties of "Ambrosia" and "Oregon" were not grown, as the cultured liquids of *Trichoderma mushrooms 22, 175, 30, 1M* were poisonous at 1: 2 concentration in the water.The 1: 2 crushed concentration of the culture fluids of the *175* and *30* strains of Trichoderma mushrooms was toxic for the "Ikarda" grade of chick. However, at such concentrations, *Trichoderma viride 22* and *Trichoderma asperellum* were not very toxic to peat seeds treated by *1M* strains, because the growth of the shoots was weak.

Trichoderma viride 22, Trichoderma album 23, has been active in improving the growth of fungus when cultivating seeds with 3% culture fluid from Trichoderma mushroom. However, the strains *Trichoderma asperellum 175* only increased the root growth (table 1).

In practice, *Trichoderma asperellum* was less toxic to *1M* than the strains of *Trichoderma album 23* for root vein growth and growth. For cultivation of clover, 50% of the culture fluid of the *175, 1M, 30* and *22* strains of *Trichoderma* mushroom was not poisonous (table 1).

Significant growth activity was detected when cultivating the "Ambrosia" bean type with 3% culture fluid of *Trichoderma 22, 23, 1M* strains. These strains have improved the growth of the growth of bean veins and roots.

Table 1 – Indicators of growth activity of cultured aquatic fungi Trichoderma (chickpeas, cloves and peas)

Crop	Stamp name	Calculation of laboratory germination of seeds		Length, cm	
		a piece	%	seeds	grow up
50% culture fluid					
To Lucerne «The most beautiful»	Control	57	95	1,6±0,1	4,3±0,2
	Trichodermaviride 22	60	100	1,8±0,1	5,4±0,2
	Trichoderma asperellum 175	33	55	1,7±0,1	3,1±0,2
	Trichoderma asperellum 1M	45	75	1,6±0,1	4,2±0,2
	Trichoderma asperellum30	39	65	1,9±0,1	4,1±0,2
3% culture fluid					
Noah «Ickarda»	Control	57	95	10,0±0,4	12,9±0,8
	Trichoderma viride 22	60	100	11,7±0,8	17,2±1,0
	Trichoderma album 23	57	95	8,0±0,9	8,1±1,4
	Trichoderma asperellum 1M	51	85	6,3±0,5	21,6±1,2
	Trichoderma asperellum 175	57	95	6,4±0,9	15,7±1,2
The «Greatest» in Lucerne	Control	60	100	3,7±0,2	3,7±0,2
	Trichoderma viride 22	60	100	4,0±0,1	3,9±0,1
	Trichoderma album 23	60	100	4,1±0,2	4,3±0,1
	Trichoderma asperellum 1M	60	100	3,6±0,1	3,3±0,1
Butcher «Ambrosia»	Control	39	65	4,1±0,1	3,9±0,2
	Trichoderma viride 22	45	75	5,3±0,1	5,4±0,1
	Trichoderma album 23	48	80	4,6±0,1	6,4±0,2
	Trichoderma asperellum 1M	42	70	3,3±0,5	5,8±1,0

Table 2 – Indicators of growth of arachidon acids (chickpeas, cloves and peas)

Arachidonic acid concentration, unit of mg	The growing number of seeds		Length, cm	
	a piece	%	root	grow up
Noah «Ickarda»				
Control	60	100	11,4±0,4	4,3±0,4
1,2	60	100	7,1±0,6	6,1±0,6
0,6	60	100	8,4±0,6	6,5±0,7
0,3	60	100	4,6±0,3	3,6±0,2
The "Greatest" in Lucerne				
Control	60	100	2,9±0,1	3,0±0,1
1,2	60	100	3,7±0,2	3,5±0,1
0,6	60	100	4,3±0,2	3,9±0,1
0,3	60	100	3,1±0,1	3,9±0,1
Butcher "Ambrosia"				
Control	51	85	6,4±0,2	5,0±0,1
1,2	51	85	7,2±0,1	5,5±0,2
0,6	51	85	7,1±0,1	5,2±0,1
0,3	45	75	5,9±0,2	4,2±0,1

After 24 hours, when the peanut and lucerne were pushed with different concentrations of arachidonic acid, all seeds grew in volume and grown.

Mortierella sp. After treatment with arachidonic acid extracted from the mushroom, growth activity was observed in the concentration of 1.2 mg and 0.6 mg (table 2).

From table 3, 1.2 mg of arachidic acid; When using the concentration of 0.6 mg and 0.3 mg, the root growth activity of the "Ikarda" grade of the Knot decreased, but the growth of growth of the spleen in two concentrations (1.2 mg and 0.6 mg) increased by 1.8 - 2.2 cm controlled. In the variant of Cucumber seedlings, the activity of arachidic acid has been demonstrated in all tested concentrations.

Clover, pea and clover plants *Mortierella sp.* as a result of the study of the effects of the culture fluid, showed that plants tested significantly increased the growth of sprouts and roots in the treatment of 5% and 10% culture fluid (table 3).

Table 3 – *Mortierella sp.* Indicators of growth of fungal growth (beech, clover and peanut butter)

Crop	Strain name	The number of		Length, cm	
		germination, a piece	growing plants, %	root	grow up
Noah «Ickarda»	Control	10	100%	7,6±0,1	12,1±0,2
	Mortierellasp. 5%	10	100%	7,1±0,1	12,8±0,2
	Mortierella sp. 10%	10	100%	14,2±0,1	25,5±0,2
Butcher «Ambrosia»	Control	5	50%	2,1±0,1	10,0±0,1
	Mortierellasp. 5%	10	100%	7,2±0,1	14,6±0,1
	Mortierellasp. 10%	10	100%	6,7±0,1	16,4±0,1
To Lucerne «The most beautiful»	Control	20	100%	3,0±0,1	2,7±0,1
	Mortierellasp. 5%	20	100%	4,8±0,1	3,8±0,1
	Mortierellasp. 10%	20	100%	5,2±0,1	4,1±0,1

Mortierella sp. One of the better options for the active growth of the fungal cultivation of the fungus was the Ambrionia grade of the bean cultivated by 5% cultured fluid. This concentration showed triple the growth of the rootstock of beetles, and 50% of the growth of the sprouts. *Mortierella sp.* The 10-year-old cultured mushroom culture had an effect on 40% growth of bean sprouts and 24% of the root length. There was a concentration of 5% of the culture fluid to treat the seeds of the seeds of "Ambrionia".

Mortar spinning seeds of "Ikarda" peppers are obtained by *Mortierella sp.* 5% culture fungus fungus, the intensity of growth of sprouts and veins was within the control version, and the 10-point culture fluid showed 68.3% and 50% vascular growth activity.

Mortierella sp., Grown in nutrient medium with oatmeal, sodium citrate and zinc sulphate. when cultivating 5% and 10% fungal culture of the fungus, the spleen and roots of cranberry «the Green Quarter» showed the worst growth activity.

Mortierella sp. In the 10-point concentration of culinary fluid, cervical roots have shown increased activity by 42%, and the length of the spleen increased by 19% when cultured by a 5-well culture concentration. When cultivating 5% of the culture fluid concentration, the length of the sprout was approximately the same when the root length was 26% and 10% was treated with culture fluid.

When using arachidon acid it reduced the growth of the "Ikarda" peat's root growth, but showed an increase in growth rates of sprouting. In alfalfa and asparagus, the activity of arachidic acid has been observed in all varieties with intense activity of growth and root growth.

In this regard, as a result of the research, four *Morterella sp.* mushroom, which has a different effect on growth intensity. In fact, biologically active substances that form different types of Trichoderma mushrooms activate the growth of beans, chickpeas and cucumber plants in specific concentrations and increase the resistance to the disease. As a result of research, mushroom strains of *Trichoderma viride 22, Trichoderma album 23* and *Trichoderma asperellum 1M* (concentration of 3% culture fluid) showed considerable efficiency in growth activity. Meanwhile, arachidic acid (1.2% and 0.6%) has increased the growth of noxious beans by 72%, peanut and peppers by 30-35% and roots by 48.2-70%. *Mortierella sp.*

The concentration of 10% fungal culture of fungus has increased significantly. Therefore *Trichoderma* and *Mortierella sp.* can be used to increase the productive potential of plants in crop production and to obtain ecologically clean products, based on the culture fluid of the fungus.

The results of the study of the growth-stimulating effect of *Trichoderma viride 22, Trichoderma album 23, Trichoderma asperellum 175, Trichoderma asperellum 1M* and *Mortierella alpine* antigens isolated from light chestnut soils of the Almaty region on growth and development of leguminous and forage crops are presented. It is established that the biologically active substances released by various species of the fungus of the genus *Trichoderma* in a certain concentration stimulate the growth and development of plants of peas, beans, alfalfa and increase their resistance to diseases. The greatest growth-stimulating activity was possessed by 3% culture liquid of the fungus *Trichoderma viride 22* and *Trichoderma album 23.* . Different concentrations of arachidonic acid obtained from the fungus *Mortierella sp*. stimulated the growth of the chickpea stalk, and in peas and alfalfa - except for the growth of the stem and roots. The culture liquid *Mortirella sp*. in 5% and 10% concentration had growth stimulating activity. The use of arachidonic acid reduced root growth, but stimulated stem growth in chickpea. In alfalfa and peas, the stimulating effect of arachidonic acid on the stem and root was observed in all variants of the experiment. All test crops react differently to the action of growth substances produced by the fungus *Mortierella sp.*

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БҰРШАҚТЫ ЖӘНЕ МАЛАЗЫҚТЫҚ ДАҚЫЛДАРДЫҢ ӨСУ БЕЛСЕНДІЛІГІН АРТТЫРУ ҮШІН *TRICHODERMA* ЖӘНЕ *MORTIERELLA* САҢЫРАУҚҰЛАҚТАРДЫҢ ШТАММДАРЫН ІРІКТЕП АЛУ

Аннотация. Бұршақты және малазықтық дақылдардың дамуына және өсуіне Алматы облысының топырағынан бөлініп алынған *Trichoderma* және *Mortierella* саңырауқұлақтар-антагонистерінің өсу белсенділігі зерттелді. *Trichoderma* саңырауқұлақтарының әр түрлі түрлерімен бөлінетін биологиялық белсенді заттар нақты концентрацияда бұршақ, асбұршақ және жоңышқа өсімдіктерінің өсуін және дамуын жақсартты және олардың ауруға төзімділігін жоғарлатты. *Trichoderma viride 22* және *Trichoderma album23* саңырауқұлақтарының культуралды сұйықтығының 3%-ы өсімдіктің өсу белсенділігін арттырды. *Mortierella sp.* Саңырауқұлағынан бөлініп алынған арахидон қышқылының әр түрлі концентрациялары ноқат өсімдігінің сабағының өсуін, ал бұршақ және жоңышқа өсімдіктерінің сабағы мен тамырларының өсуін жақсартты. *Mortierella sp.* культуралды сұйықтығының 5% және 10% концентрациясы өсімдіктердің өсу белсенділігіне ие болды. Сыналған ауыл шаруашылық дақылдар Mortierella sp. саңырауқұлағымен түзетін, арахидон қышқылы өсу қарқындылығына әр түрлі әсерін тигізді. Ал *Trichoderma viride 22*, *Trichoderma album 23* және *Trichoderma asperellum 1M* (3%-дық культуралды сұйықтығының концентрациясы) саңырауқұлақтардың штаммдары өсу белсенділігі бойынша тиімділік көрсетті. *Trichoderma 22, 23* және *Trichoderma asperellum 1M* саңырауқұлақтардың штамдарында тежеу спектрі байқалды, олар барлық сыналған патогендердің өсуін баяулатты, өсудің баяулау зонасы 40-45 мм болды.

Түйін сөздер: арахидон қышқылы, бұршақты және малазықтық дақылдар, микроскопиялық саңырауқұлақтар, өсу белсенділігінің әсері.

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СКРИНИНГ ШТАММОВ ГРИБОВ РОДА *TRICHODERMA* И *MORTIERELLA* ДЛЯ ОПРЕДЕЛЕНИЯ РОСТСТИМУЛИРУЮЩЕЙ АКТИВНОСТИ БОБОВЫХ И КОРМОВЫХ КУЛЬТУР

Аннотация. Приведены результаты исследования ростстимулирующего действия штаммов – антагонистов *Trichoderma viride 22, Trichoderma album 23, Trichoderma asperellum 175, Trichoderma asperellum 1M* и *Mortierella alpine*, выделенных из светло-каштановых почв Алматинской области, на рост и развитие бобовых и кормовых культур. Установлено, что биологически активные вещества выделяемые, различными видами гриба рода *Trichoderma*в определенной концентрации стимулируют рост и развитие растений гороха, бобов, люцерны и повышают их устойчивость к болезням. Наибольшей ростостимулирующей активностью обладала 3% культуральная жидкость гриба *Trichodermaviride 22* и *Trichodermaalbum 23*. Различные концентрации арахидоновой кислоты, полученной из *гриба Mortierellasp.* стимулировали рост стебля нута, а у гороха и люцерны – кроме роста стебля и корни. Культуральная жидкость *Mortirellasp.* в 5%-ной и 10%-ной концентрации обладала ростстимулирующей активностью. Применение арахидоновой кислоты снижала прирост корня, но стимулировала рост стебля у нута. У люцерны и гороха наблюдалось стимулирующее действие арахидоновой кислоты на стебель и корень во всех вариантах опыта. Все испытуемые сельскохозяйственные культуры по-разному реагируют на действие ростовых веществ, продуцируемых грибом *Mortierellasp.*

Ключевые слова: арахидоновая кислота, бобовые и кормовые культуры, микроскопические грибы, влияние активности роста.

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CRAPHIC RECONSTRUCTION OF NACIONAL EMBLEMS OF MEDICINE AND VETERINARY MEDICINE IN TRADITION KAZAKH SOCIETY

Abstract. With the adoption of sovereignty, Kazakhstan in the choice of symbols and emblems should be guided by the cultural traditions of the Kazakh people that are left to us in the distant past.

Keywords: graphics, reconstruction, national, emblems of medicine, emblems of veterinary medicine, peoples culture, traditions, Kazakh society, worship of fire, alasta, alastau, emblem elements, solar symbols, cult of the rising sun, eight-poin-ted star, postage stamp.

Description of the symbols of medicine and veterinary medicine of Kazakhstan, inherent in the cultural traditions of the Kazakh people, remain little studied and graphically unreconstructed in the form of emblems.

The most common in the world of logos of medicine and veterinary medicine in different countries are the snake, Imhotep`s ankh, the snake wrapped around the staff of Asklepios (Aesculapius), the snake that encircles the bowl as a reminder to the physician – "Be wise, giving poison", a burning torch and a flaming lamp, mirror, heart of palm, a burning torch with a snake wrapped around in a composition with the Crescent and five-pointed star, a burning torch in with the Latin letter V, the red cross, red crescent, sword, entwined with a snake, two snakes wrapped around the cup in a composition with a blue cross, blue cross, the fire inside an eight-pointed star, two lights placed one above the other and on the same vertical line, each of which is framed by colourful arcs star of life (six-leaf clover), consisting of six rays, in the center of which are a snake and a staff of Asclepius, snakes, entwining a winged Caduceus, etc. [1-6].

The first of the Kazakh people who wrote about the worship of fire in the early second half of the XIX century, was an outstanding scientist-ethnographer Ch. Ch. Valikhanov: "Fire has a purifying quality. It purifies (when something is) between two fires. The Kirghiz` (Kazakh`) rite of purification is called alasta. Coming back from wintering, they go between the two fires». [7, p. 54-55] (picture 1).

Somewhat later, in 1911, a similar veneration of fire was described by S. I. Rudenko among another Turkic folk (quoted from Kukushkin, 1993) [8, p. 137, 197].

It is necessary to recognize the fact, that A.I.Kukushkin, in his candidate's dissertation on the cult of fire in Kazakhstan, didn`t noted Ch. Ch. Valikhanov's work about honoring of fire in the traditional Kazakh society described by him at the beginning of the second half of the XIX century, long before S. I. Rudenko [8, p. 137, 197, 7, p. 54-55].

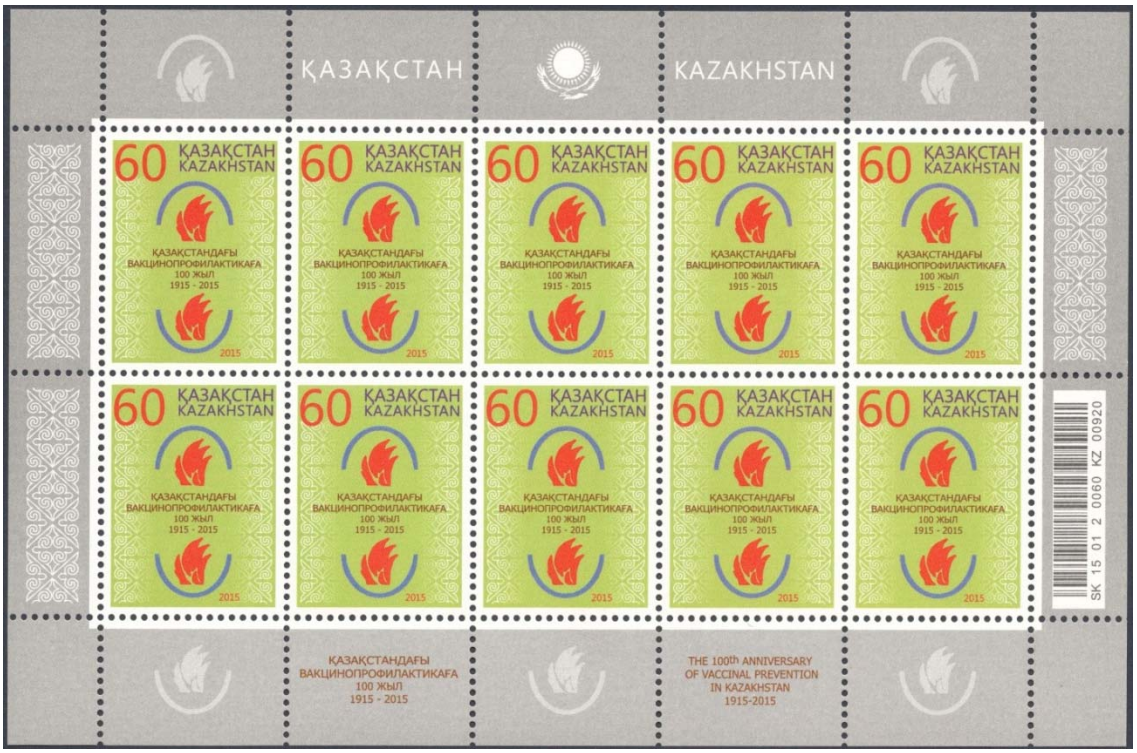
However, the work of Ch. Ch. Valikhanov in this part is cited in other works as fundamental in the graphic establishment of specific emblems of medicine and veterinary medicine in the traditional Kazakh society [9, p. 41, 10, p. 58].

It should be emphasized that another common symbolism in the traditional Kazakh society were fire-solar drawings [8, p. 66, 214], since the Kazakh orientation system is in some way connected with the cult of the rising sun [11], the role of a frame in the emblems can be represented by the solar sign in the form of divergent rays of the sun, the so-called eight-beam star. [8, p. 214].

Picture 1 – The photo of Ch. Ch. Valikhanov (ru.wikipedia.org).

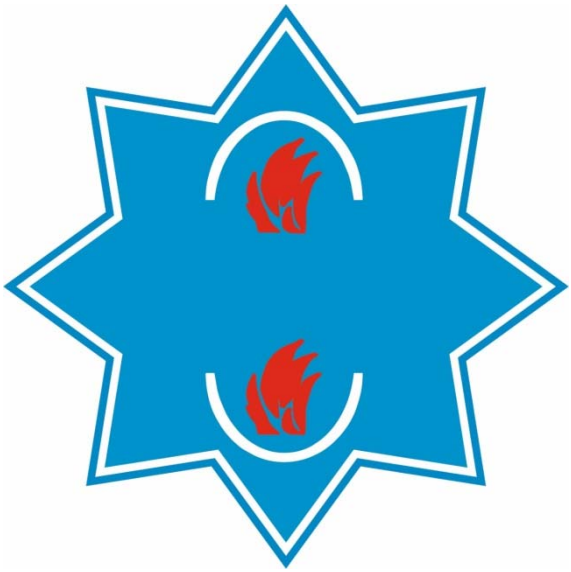
After studying the literary, archival and archaeological information about the material culture on the territory of Kazakhstan, which originated even before the Kazakh khanate, we graphically reconstructed the national emblem of medicine and veterinary medicine in the traditional Kazakh society on the basis of descriptions of Ch. Ch. Valikhanov [7, p. 54-55], A. I. Kukushkin, S. I. Rudenko [8, p. 137, 197, 214], S. K. Kazakin [9, p. 41], N.Sh.Mamedov [10, p. 52-65] M. Sembi [11, p. 91].

Previously, we have graphically reconstructed the main elements of the emblems, these were two bright scarlet flames, located above each other and on one vertical line, each of which was framed by a colored arc. The reconstructed elements of the emblems from the medical and biological field were used by us in the postage stamp of the Republic of Kazakhstan in 2015 as a national postage stamp of 60 tenge, dedicated to the 100th anniversary of vaccination in Kazakhstan (picture 2).



Picture 2 – A copy of the full mailing stamp list of Kazakhstan, 2015, № 920

In 2018, we finally carried out a graphic reconstruction of the national emblems of medicine and veterinary medicine in the traditional Kazakh society (pictures 3, 4).



Picture 3 – Graphic reconstruction of the national emblems of medicine in the traditional Kazakh society

Picture 4 – Graphic reconstruction of the national emblems of veterinary medicine in the traditional Kazakh society

Description of the claimed designation in figure 3: the color pictorial sign consists of two main elements and is presented in the form of a fiery solar symbol - a genuine Kazakh eight – beam star of bright blue color, framed at the edges and perimeter by a narrow white strip. In the center of the eight-pointed star, two bright scarlet flames are located above each other and on one vertical line, each of which is framed by an white arc; according to the description, nomads, coming back from wintering, move with the cattle between the two fires, performing the rite of purification – alastau (synonymous with hygiene); bright blue color of the star is associated with tranquility and clear sky.

Color indication: bright blue, white, bright scarlet.

Description of the claimed designation in picture 4: the color pictorial sign consists of two main elements and is presented in the form of a fiery solar symbol - a genuine Kazakh eight-beam star of bright green color, framed at the edges and perimeter by a narrow white strip. In the center of the eight-beam star, two bright scarlet flames are located above each other and on one vertical line, each of which is framed by an arc of white; according to the description, nomads, coming back from wintering, move with the cattle between the two fires, performing the rite of purification – alastau (synonymous with hygiene); the bright green color of the star is associated with the green of the Kazakh steppe.

Color indication: bright green, white, bright scarlet.

A hundred years ago, two institutions, medicine and veterinary medicine, had a common history and were parts of the Ministry of internal Affairs of the Russian Empire as a Medical Department and Council, and as an Advisory veterinary Committee, transformed in April 1901 in the Veterinary Department, such structure existed until 1919. When Kazakhstan obtained Soviet statehood, medicine was allocated to the independent people's Commissariat of health (currently the Ministry of health of the Republic of Kazakhstan), and veterinary medicine was included in the form of Veterinary management in the people's Commissariat of agriculture (currently the Committee of veterinary control and supervision of the Ministry of agriculture of the Republic of Kazakhstan), that is why both emblems, medicine and veterinary medicine, should be considered together, as they are closely related branches of human activity. It should be noted that the only country in the world that has kept medicine and veterinary medicine in one Department together is the state of Australia.

As a result of our work, protective document of the Ministry of justice of the Republic of Kazakhstan № 2484 on the work of science "Graphic reconstruction of national emblems of medicine and veterinary medicine in the traditional Kazakh society" was signed on the 31st July, 2018 (picture 5).

Авторлық құқық объектісіне құқықтарды мемлекеттік тіркеу туралы

КУӘЛІК

№ 2484 31 шілде 2018 ж.

Қазақстан Республикасы Әділет министрлігінде автордың өтініші бойынша авторы **Низами Шамильевич Мамедов** болып табылатын авторлық құқықпен қорғалатын объектіге айрықша мүліктік құқықтар **«Графическая реконструкция национальных эмблем медицины и ветеринарии в традиционном казахском обществе» (ғылыми туынды)** атауымен тіркелгені куәландырылады.

Автордың өтініші бойынша авторлық құқықпен қорғалатын объектіге айрықша мүліктік құқықтар және **2018 жылғы 15 мамырда** жасалған объекті **Н.Ш. Мамедовке** тиесілі және автор жоғарыда көрсетілген объектіні жасаған кезде басқа адамдардың зияткерлік меншік құқығы бұзылмағандығына кепілдік береді.

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Conclusion.

1. Graphic reconstruction of national emblems of medicine and veterinary medicine in the traditional Kazakh society clearly fits the framework of the state Project “Rouhani Zhangyru” regarding the "revival of spiritual values" and "modernization of public consciousness".

2. Graphically reconstructed emblem of medicine can be used in the structure of the Ministry of healthcare of the Republic of Kazakhstan, local Executive bodies on health, medical, educational and research institutions, military medical services of ministries, departments and organizations of the Republic of Kazakhstan, as well as in medical units, sanitary vehicles, ambulances, medical pharmacies, medical laboratories, enterprises and shops of medical optics, road signs of medical service, in the press and in any economic entities of the medical industry, regardless of ownership.

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4. It is necessary, as in some countries, to prohibit by law at the territory of the Republic of Kazakhstan the free use of the red cross belonging to the International movement of the red cross, red Crescent and red Crystal, including other colors and configurations of these symbols, as well as the classical symbols of medicine in the form of a bowl with a snake and a six-leaf with a staff of Asclepius.

Н. Ш. Мамедов

Қазақ ғылыми-зерттеу ветеринарлық институты, Алматы, Қазақстан

ДӘСТҮРЛІ ҚАЗАҚ ҚАУЫМЫНДА МЕДИЦИНА ЖӘНЕ ВЕТЕРИНАРИЯ ЭМБЛЕМАЛАРЫН ҰЛТТЫҚ ГРАФИКАЛЫҚ ҚАЙТА ҚҰРУ

Аннотация. Тәуелсіздікті қабылдағаннан кейін таңбалар мен эмблемаларды тандағанда Қазақстан ерте заманда бізге қалдырылған қазақ халқының мәдениеттік дәстүрлеріне сүйенуі керек.

Түйін сөздер: графика, қайта құру, ұлттық, медицина эмблемары, ветеринария эмблемары, халық мәдениеті, дәстүрлер, қазақ қауымы, отқа табыну, эмблема элементтері, солярлық таңба, көтерілу күніне табыну, сегізсәулелі жұлдыз, пошталық марка.

Н. Ш. Мамедов

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ГРАФИЧЕСКАЯ РЕКОНСТРУКЦИЯ НАЦИОНАЛЬНЫХ ЭМБЛЕМ МЕДИЦИНЫ И ВЕТЕРИНАРИИ В ТРАДИЦИОННОМ КАЗАХСКОМ ОБЩЕСТВЕ

Аннотация. С принятием суверенитета, Казахстан в выборе символов и эмблем должен ориентироваться на культурные традиции казахского народа, которые оставлены нам в далёком историческом прошлом.

Ключевые слова: графика, реконструкция, национальный, эмблемы медицины, эмблемы ветеринарии, культура народа, традиции, казахское общество, почитание огня, аласта, аластау, элементы эмблемы, солярная символика, культ восходящего солнца, восьмилучевая звезда, почтовая марка.

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STUDY OF LANDSCAPE AND BIOLOGICAL DIVERSITY OF THE CHALK DEPOSIT IN MANGISTAU REGION

Abstract. Data of a research on geomorphological areas of Mangystau Region are provided. Caspian Depression in Mangystau Region stretches to borders of the hollow of Karagiye (for 132 m below sea-level). On the Ustyurt plateau, Bozzhira's area it is incredibly fine, it can make the worthy competition to the known Valley of monuments (USA). In mountain Mangystau the highest point the mountain Beschoky – 555 of m. Studying of a biodiversity near the field of a chalk of Shetpe Southern showed that from 26 species of reptiles widespread in area, near the field of a chalk and cement works 4 views live: steppe agama, takyr round head fast lizard and Caspian gecko. There is an endemic look – a hedgehog. Steppes are used by birds as a fodder biotope. The revealed biodiversity enriches the area of a research, both ecologically, and esthetically.

Key words: researches, regional features, lowland, mountainous areas, field of a chalk, cement works, biodiversity.

Introduction. It is known that decrease in level of biological diversity is one of the main reasons for the progressing degradation of natural ecosystems.

Only on condition of maintaining optimum level of a variety creation of the ecosystems steady against anthropogenic and technogenic and also extreme influences of physical and chemical factors, wreckers and diseases is possible [1].

Preservation of a biodiversity is one of global environmental problems and every year escalates in process of disappearance of new types more and more.

Negatively pollution of the environment of their dwelling influences animals. Pollution of the environmental environment, in particular soils is especially dangerous by cretaceous and cement dust. Particles of cement dust can be transferred to distances up to 5 km and can cover the considerable territories. Cement dust contains from 10 to 40% of calcium in the form of oxide, a carbonate, to 2.5% of a potassium. Though this dust is considered non-toxic, it can become the reason of change of a number of properties of soils and vegetation and them according to their pollution as a result of accumulation of some chemical elements in high concentrations. In view of that the Cement plant Caspian Sea is placed on the Western plain with a foot of the field of a chalk of Shetpe Southern, it is necessary, to note that one of factors of negative impact on a surrounding medium is dust formation when loading and transporting a chalk. The thin dispersion is characteristic of cretaceous breeds thanks to what cretaceous dust is delivered on hundreds of meters from the place of development and transportation. Pollution of soils aero technogenic emissions causes significant changes in biogenocenoses. As a result of extraction of chalk, dust as a part of which calcium oxide within 46.12-53.21%, magnesium oxides – 1.08-11.34% contains is formed, creates an environmental problem for a surrounding medium [2].

Dust the containing lime, forms with water on a surface of leaves a firm crust of $Ca(OH)_2$ or $3Ca \cdot SiO_2$ which close all time and break the gas exchange necessary for a normal delivery of a plant and process of a photosynthesis.

It leads to processes of destruction of a vegetable cover and degradation of soils and the subsequent formation of technogenic deserts. Natural fitotsenoza are broken, there are significant changes in plants, at the same time contents and concentration of a number of chemical elements increases in sol of plants.

In this regard, studying of a biodiversity in areas of extraction of chalk and production of cement in an arid hot climate of the Mvangistausky region, are not only the fundamental directions of the modern ecological researches but also have applied character.

Methods of collecting and processing of material. Field researches are conducted in summertime 2017-2018.

The research technique, is based on the modern scientific ideas of assessment of a condition of a biodiversity in areas of production of mining operations.

All materials on a biodiversity in the territory of the field of a chalk of Shetpe Southern and around cement works are received by a method of "squares". The territory of a research was broken into squares (grids) by means of which also the quantitative are received qualitative (existence of types) (number of visits) data.

At the first stage data collection and processing necessary for a research is carried out (data on geomorphological areas of Mangystau Region and information on valuable natural objects). Share materials of Management of natural resources and rational environmental management of the Mangsitausky region (УПРиРП) and the Atlas of Mangystau, 2010) are used [5]. Information on regional features of geomorphological areas of the region is provided.

The second stage - assessment of a condition of a biodiversity around activity of the Caspian Sea Cement plant on the field of a chalk of Shetpe Southern. The assessment was carried out by observation at field researches.

Route (pedestrian) account. Birds. The norm of accounting of birds was 3 km, at a foot of hills and also on northern and east slopes and in the system of the southern gorges. The route on the western plain made from the North to the south 5 km. Data on abundance of birds and other quantitative indices were averaged (on May 15 – on July 15) [6].

For accounting of amphibians and reptiles route account is also used. More complete information on specific variety of animals is given by route accounts. At the same time for obtaining comparable data were guided by the following rules. Account was carried out on registration tapes which width for one person is equal to 1 m (on 0.5 m aside from the accountant) on strongly grassed sites or at night, and 2 m (on 1 m from the accountant aside) on open places in the afternoon. Such bandwidth of account undertakes for the best detection of types. At the same time the chosen width of a registration strip was strictly kept. When accounting Amphibia and lizards length of a route was 3 km, when accounting snakes - 5 km (the central plateau of the field of a chalk) [8,9].

For accounting of a green toad and water already the route was put on the coastline of the drying-up river and the canal around cement works.

During walking routes used GPS receiver (Garmin eTrex 30), the camera (Nikon D90), a caliper and a roulette for measurement of the met traces of animals, reptiles and mammals.

Watched birds by means of the field-glass daily in strictly particular terms: at 6 o'clock in the morning and 18 o'clock in the evening, in total 80 clocks of observations.

Classification of birds was carried out during routes with the assistance of the ornithologist [7].

Methods of geoinformation technologies (GIT). Data of remote sensing of Earth (are received in the free access from services - Google Maps, Yandex, Bing). Schematic maps are executed in the environment of Google Maps, Bing with use of the graphic Corel Draw 11 and Paint programs (Windows XP).

Results of researches and discussion. The area of researches, in particular the field of a chalk of Shetpe Southern is located in the territory of the Mangystau district game of Mangystau Region RK.

According to a technique of researches at the first stage we will provide data on geomorphological areas of Mangystau Region and we will provide information on a landscape variety and the valuable natural objects inherent only to this edge.

Mangystau Region of the Republic of Kazakhstan is located to the east from the Caspian Sea, on the Mangyshlak plateau (Mangystau), borders in the northeast on the Atyrau and Aktyubinsk regions, in the south on Turkmenistan and in the east on the Republic of Karakalpakstan as a part of Uzbekistan. The region from the West is washed by the Caspian Sea, at this pobeorezh Kenderli is given in the West in the form of the peninsula of Mangyshlak, with the deep gulfs Dead Kultuk, Mangyshlaksky, Kazakh. In the Caspian Sea - Seal islands. The majority of the territory of the area is engaged with the wormwood and saline desert with sites of shrubby vegetation at brown soils: the surface is partially covered with saline soils, takyring solonetzic soils and sands with extremely rare vegetation Climate sharp and continental, extremely droughty. Average temperature in January - 7 °C, in July of 27 °C, at the same time in separate days maximum temperature exceeds 40 °C. Osadkov drops out about 100-150 mm in a year [3].

The rivers of the Caspian Basin, the river of the basin of the Aral Sea and also many rivers flowing into small lakes or losing the drain in desert waterless areas belong to the extensive internal drainless Aralo-Caspian Basin. This pool watershed covers 23% of the territory of the CIS. For the Aralo-Kaspiysky watershed, allocate six large geomorphological regions [4].

Falls to the share of Mangystau Region four: 1. Caspian Depression. 2. The Ustyurt plateau bordered with the system of ledges of chinok (Northern, Southern and Western subdistricts). 3. Mountain Mangystau. 4. Flat Mangystau. Geomorphological areas of Mangystau Region are shown in figure 1.

Figure 1 – Geomorphological areas of Mangystau Region
(the schematic map is executed in the environment of Google Maps)

1. Caspian Depression is located in the southeast of the Votochno-Evropeysky plain, on the northern coast of the Caspian Sea (figure 2). It is called by name (каспиев), the people of Scythian origin which were once living on coast of the Caspian Sea. The area - about 200 thousand sq.km. In a northern part (The Astrakhan region of the Russian Federation, the Atyrau region) the lowland is put clay, and in southern (Mangystau Region) is put by sandy deposits. In Mangystau Region deserts and semi-deserts prevail. Caspian Depression in Mangystau Region stretches to borders of the hollow of Karagiye (for 132 m below sea-level). The low plain surface lies in the interior below sea-level on 28 m (Atyrau), to the outskirts rises up to 100 m. In the western part it is crossed by the Volga-Akhtubinsk flood plain. The largest rivers: Volga, Ural, Terek, Kuma. On Caspian Depression within Mangystau Region there is an Aktau-Buzachinsky wildlife area [3, 5].

Figure 2 – Caspian Depression (physical map Russian Federation, 2003)

2. The Ustyurt plateau (Ustyurt on tyursky - a plateau). The well-known Ustyurt plateau (figure 1 and 2) is located in Central Asia and occupies the same territory as well as Caspian Depression - nearly 200 thousand sq.m. The fact that across this plateau there pass borders of our Kazakhstan, Uzbekistan and the small site of Turkmenistan is remarkable. So, in the western part the peninsula of Mangyshlak and the gulf Kara-Bogaz-Gol (a black mouth). In the east - the drying Aral Sea and delta of the Amudarya River.

The highest the southwest part of the plateau - Bozzhyr's (figure 3) natural boundary which is located in the Mangimtausky region is considered.

Figure 3 – Bozzhir's natural boundary in Mangystau Region (a picture, 2018)

The tract consists of rocky ridges, hills (ridges) with almost flat outlines. The area Bosire incredibly beautiful, she can compete with the famous monument Valley (USA). Unfortunately, few of them have heard about the existence of this pearl of Ustyurt. It is worth studying Kazakhstan on the map of mountain chains to assess the scale of this place. It is believed that more than 21 million years ago the plateau was deep under water. Thus, sea shells are found in Ustyurt limestone, which confirms the hypothesis.

Besides, there is a huge amount of ferromanganese concretions which the size and a form remind spheres for billiards. Not everyone will guess that the spherical educations disseminated through all surface by the plateau are created in the conditions of the sea. Water gradually washed away dolomitic and calcareous breeds, but ferromanganese concretions came to light stronger, only found roundish outlines. Locals are proud of such sight.

3. Mountain Mangystau. Mountain Mangystau district. The West Karatau district with a low-mountainous terrain. Absolute marks in the area fluctuate from 250-450 m above sea level (figure 4). The highest parts of a peneplenizirovana with the certain towering hills (Mount Otpan-Tau with height of 533 m) [4].

Figure 4 – Mountain Mangystau (the schematic map is executed in the environment of Google Maps)

Northern and southern slopes of mountains very steep with dense network of gorges in the form of canyons. Slopes of mountains stony with numerous exits of radical breeds. It is put by Nizkogorye the Perm and Triassic sandstones, slates, aleurolites with pro-layers of conglomerates and limestones.

The east Karatau district with a low-mountainous terrain. Elevation marks fluctuate from 380 to 480 m. Tops peneplening hilly with the certain hills towering on 50-100 m (the highest point of area Mangystauskoy the mountain Beschoky - 555 of m (village of Zharmysh).

Northern and especially southern macroslopes steep stony with exits of radical breeds and cut up numerous by the canyon log of an ushchelyamiya. Lithologic structure of breeds the also composite (sandstones, aleurolites, slates). Severomangyshlaksky district of poorly inclined under plains (from 100 to 0 m sea-level) with a hilly uvalistym a relief.

The close podstilaniye of cretaceous breeds is characteristic of the area, is more rare than limestones and sandstones, a part them comes to a surface. Uvala krutosklonny with exits of breeds, and flat with small beams and ravines.

Differences in structure of fauna of mammals are characteristic of each of these areas. So, in Caspian Depression dwelling of 43 types, in the Northern predustyurt – 44 types, Flat Mangystau – 45 types, in Mountain Mangystau – 35 types, Northern Ustyurt – 47 types, the Southern Ustyurt – 52 types, the Western Ustyurt – the 51st species of mammals is revealed [3, 5, 9].

The originality of the Aralo-Kaspiysky watershed is traced not only in a geological structure and landscape and geographical features, but also specific structure and the nature of distribution of animals, first of all land vertebrata. Therefore the fauna of Ustyurt and Mangystau has to be considered as the self-contained zoogeographical site – the Ustyurt [3, 5].

Features of a landscape variety of the field of a chalk of Shetpe Southern.

Central plateau of the field of a chalk. Represents the flat and equal, located at the considerable height (about 17 m), above sea level, plateau, with the vegetation which fell into decay as a result of an intensive pasture of horses and to a lesser extent camels and goats [10].

Western plain. It is characterized by very limited difference of height, very smoothly going down from the West to the east, a low part is to the west from the plant territory. The northwest part of the plain is completely covered with a grass cover for a cattle pasture locals.

Hills of a foot. This area – result of slipping of breeds of the main plateau. One of the most various and strongly structured regions of a landscape of the explored territory, also harbors the considerable proportion of biological diversity of the area.

Northern slope. A northern slope – quite monotonous steep slope which designates northern border of the plateau. The top third, about 20-30 m, is almost vertical calcareous slope with erosive ravines and cuts.

From the ecological point of view, for ecotourism, two systems of gorges which are on the different ends of the field of a chalk are of huge interest:

- northern system of gorges: the wide and strongly structured system of the gorge with the steep, vertical, bouldery osypny slopes and very narrow gorges where it isn't enough, but trees and bushes meet;
- southern system of gorges: it isn't so extensive as Northern, gorges the most narrow here, but with more steep exits of breed.

Geoekologicheski important difference of this system consisting of several gorges connected by a canyon are:

- the steep steep rocks formed as a result of the severe erosion with numerous small caves and cracks;
- osypny slopes and boulders of breeds at a foot of steeps which form the system of caves and semi-caves.

Geographical isolation and generally rare vegetation does this area unattractive for the grazed pets and therefore pasturable loading is considerably reduced here. The described landscape is shown in figure 5.

Distribution of amphibians and reptiles. Gerpetofauna of Mangystau Region, in general includes 2 species of amphibians and 26 species of reptiles.

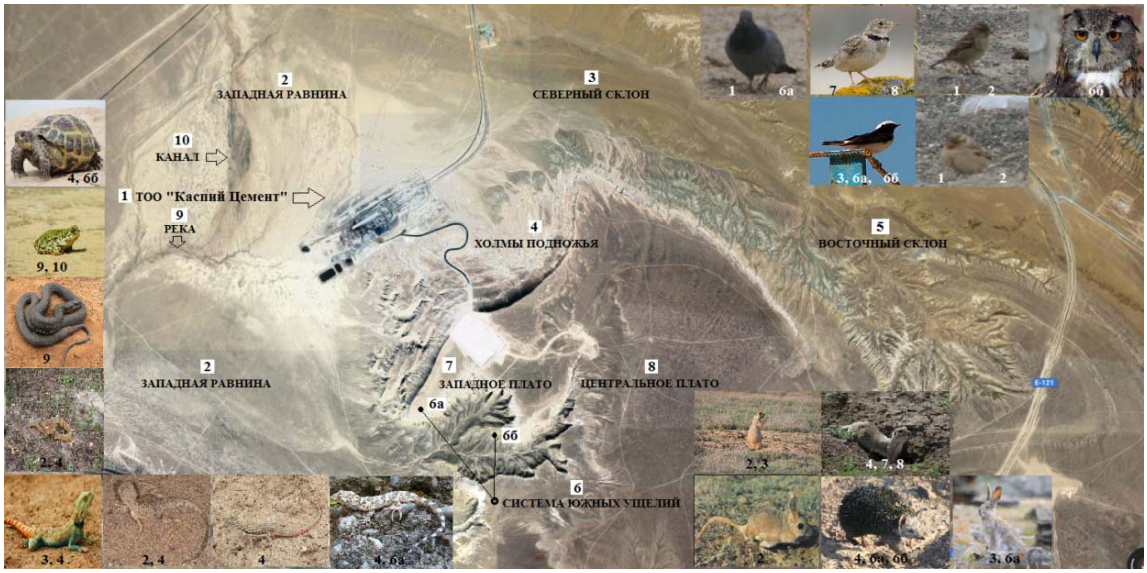

Figure 5 – The schematic map with the available species of reptiles and Amphibia, mammals and birds on the field swept also the Caspian Sea Cement plant (the card is executed in Google Maps)

All species of amphibians and reptiles widespread in area are classified on: 1 – widespread; 2 – having a limited area; the distribution 3 – having mosaic character; 4 – known on single finds.

From widespread reptiles in the territory of a research live: steppe agama (Trapelus sanguinolentus), takyr round head (Phrynocephalus helioscopus), fast yashchurka (Eremias velox). Density of their settlement of ordinary, that is 1-10 individuals on 1 hectare. From desert types – a Sarmatian runner (Elaphe sauromates). Settlement density – infrequent, less than 1 individual on 1 hectare. Also – a green toad (Bufo viridis) (1-10 individuals on 1 hectare), water (Natrix tesselata) (1-10 individuals on 1 hectare), an ordinary shchitomordnik (Gloydius halys) (1-10 individuals on 1 hectare). From routine types - the Central Asian turtle (Agrionemys horsfieldi) (1-10 individuals/hectare), the Caspian gecko (Cyrtopodion caspium) (1-10 individuals/hectare). The green toad (Bufo viridis) meets on the canal and the drying-up river, with saltish water and its number is small [10].

The number of the Central Asian turtle (Agrionemys horsfieldi) in this area is higher than 1 individual's, that is density routine that is characteristic of hilly sands and plaster and loamy decreases in Mountains Karatau (The western plain).

The steppe agama (Trapelus sanguinolentus), takyr round head (Phrynocephalus helioscopus), fast yashchurka (Eremias velox) inhabit the fixed and dispelled sands though they sometimes meet in clay, shchebenisty and stony deserts (a foot of Northern and East slopes). Density of the settlement of lizards in the territory of the field varies, being for a steppe agama – 1-3 individuals/hectare, a takyr round head – 1-6 individuals/hectare, a fast lizard – 1-11 individuals/hectare.

In the most suitable habitats – on sands for a steppe agama and a fast lizard and on the takyrovidnykh soils for a takyr round head the occurrence of lizards reaches several tens by 100 m of a route.

Snakes as a rule are more infrequent, than lizards. Water (Natrix tesselata) it is intimately bound to water during life and dated for the damp habitats.

Mammals. In the territory of a research the following, widespread desert types meet (a slepushonka). In local fauna absolutely there are no real steppe types, it isn't enough in it and semidesertic types (a small gopher, a corsac fox, a saiga). At the same time there is an endemic look – a dlinnoigly hedgehog.

It testifies to the relative antiquity and isolation of local fauna. Besides, in its structure there are representatives of an afrikano-Asian desert complex: (hare-tolay and jackal). At the same time there are almost no Turonian elements (a grebenshchikovy gerbil, Severtsov's jerboa and a small jerboa) [10]. Severtsov's jerboa was recorded only once. At the same time, now, there were two new views delivered by rail (black and gray rats).

Birds. In the territory of a research a variety of birds very low, but at the same time, the factory platform attracts types, the related to the person of wild pigeons and house sparrows, and availability of water and food attracts migratory birds.

On open plains or fruitless hills far from areas of the raised vegetation only 1-3 views usually live. While regions of the raised vegetation (the rivers and canyons) and also the factory platform attract the considerable number of birds, plains can also contain the most larger congestions of larks and sparrows. In general, the research showed that the Mangystau district also plays the significant role for migratory birds and that these birds prefer the same environments of dwelling areas, as the majority of the crossed types.

The fauna of these sites, in connection with weak protective conditions and poor fodder resources, is very poor. It is possible to go 2-3 km., and not to meet any bird.

The nesting types are presented only by a steppe lark and the field skate but both views are rare. In places of stony exposures are frequent only Kamenka-pleshanki, but they use these sites only as a fodder biotope, the eagle owl (Bubo bubo), near the southern gorge is also noticed. Steppes are used by birds more as a fodder biotope, than as the place of nesting. Only 20-25% make the types nesting there of all types met on the field of a chalk.

Buteo rufinus, steppe eagle (Aquila nipalensis), steppe kestrel (Falco naumanni), bustard beauty (Chlamydotis undulata), eagle owl (Bubo bubo), belobryukhy martin (Apus melba), green merop (Meropssuperciliosus), desert raven (Corvusruflcollis), the Spanish Kamenka (Oenanthe hispanica), desert Kamenka (Oenanthe deserti), stone sparrow (Petronia petronia), larks (Galerida cristata, Eremophila alpestris, Melanocorypha bimaculata, Calandrella brachydactyla, Crufescens) [10].

From this list the following bird species were included in the database of researches: wild pigeon (Columba livia), steppe lark (Melanocorypha calandra), house sparrow (Passer domesticus), black soiling sparrow (Passer hispaniolensis), Eurasian eagle owl (Bubo bubo) and Kamenka-pleshanka (Oenanthe pleschanka). The schematic map with the available species of reptiles and Amphibia, mammals and birds on the field swept and Caspian Sea Cement cement works is shown in figure 5.

Conclusion. The relief of the territory of the area is various. Caspian Depression borders: in the east – with ostanets of the Northern chink of Ustyurt with values of absolute heights to 152 m, in the southeast – with the Western chinok of Ustyurt which consists of ostants with heights more than 200 m, in the south – with Mangistusky uplands. The southern part of the lowland adjoins the peninsula of Mangystau. Ranges of Mangystausky uplands rise to the level of the highest point in the territory of the area – the mountain Besshoky (555 m).

Overwhelming part of the territory of the area – the deserts and semi-deserts alternated by saline soils and takyra with wormwood and rare shrubby vegetation.

There are no constant rivers in the territory of the area, the region has acute shortage of sources of sweet water. Climatic features of deserts contribute to the development of a desert relief in which erosive and aeolian processes are well shown.

At the relative variety of fauna of the Prikaspiya Desert inhabits 56 species of mammals, 278 bird species and 18 species of Amphibia and reptiles, many animal species fall into categories infrequent and disappearing and demand careful attitude to them. Among them there are 7 species of mammals, 36 bird species and 1 species of reptiles are included in the Red List of the Republic of Kazakhstan.

By results of researches, it is established that from widespread reptiles in the territory of a research live: steppe agama, takyr fillister head fast lizard. From routine types - the Central Asian turtle and the Caspian gecko.

The green toad is recorded on the canal and the drying-up river, with salt water.

Steppes are used by birds more as a fodder biotope, than as the place of nesting. The following birds were included in the database of researches: wild pigeon steppe lark, house sparrow, black soiling sparrow, Eurasian eagle owl and kamenka-pleshanka. Even this biological diversity studied as a result of researches near the field of a chalk and cement works, undoubtedly enriches this territory both ecologically, and esthetically.

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МАҢҒЫСТАУ ОБЛЫСЫНДАҒЫ БОР КЕНОРНЫНЫҢ ЛАНДШАФТЫҚ ЖӘНЕ БИОЛОГИЯЛЫҚ ӘРТҮРЛІЛІГІН ЗЕРТТЕУ

Аннотация. Мақалада Маңғыстау облысының геоморфологиялық аудандары туралы мәліметтер берілген. Маңғыстау облысындағы Каспий маңы ойпаты Қарақия ойпатының шекарасына дейін созылып жатыр (теңіз деңгейінен 132 м төмен). Үстірт жазықтығындағы Бозжыраның жері керемет, ол белгілі монументтер алқабына (АҚШ) лайықты бәсекелестік жасай алады. Маңғыстауда Бесшоқы тауының ең биік нүктесі – 555 м. Шетпе бор кен орны ауданындағы биоалуантүрлілікті зерттеу облыста кең таралған 26 рептилияның түрінің ішінен бор кен орны мен цемент зауытының ауданында 4 түрі: дала ағамы, тақыр жылбасы, жылдам аусыл және Каспий гекконынан тұратынын көрсетті. Эндемиялық түрі – ұзын қырлы кірпі. Дала құстарға жемдік биотоп ретінде пайдаланылады. Анықталған биоалуантүрлілік зерттеу ауданын экологиялық және эстетикалық жағынан байытады.

Түйін сөздер: зерттеулер, аймақтық ерекшеліктер, ойпаттық, тау аудандары, бор кен орны, Цемент зауыты, биоалуантүрлілік.

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ИЗУЧЕНИЕ ЛАНДШАФТНОГО И БИОЛОГИЧЕСКОГО РАЗНООБРАЗИЯ МЕСТОРОЖДЕНИЯ МЕЛА В МАНГИСТАУСКИЙ ОБЛАСТИ

Аннотация. Представлены данные исследования о геоморфологических районах Мангистауской области. Прикаспийская низменность в Мангистауской области простирается до границ впадины Карагие (на 132 м ниже уровня моря). На плато Устюрт, местность Бозжиры невероятно прекрасна, она может составить достойную конкуренцию известной Долине монументов (США). В горном Мангистау наивысшая точка гора Бесчокы – 555 м. Изучение биоразнообразия в районе месторождения мела Шетпе Южное показало, что из

26 видов рептилий распространенных в области, в районе месторождения мела и цементного завода обитают 4 вида: степная агама, такырная круглоголовка быстрая ящурка и каспийский геккон. Имеется эндемичный вид – длинноиглый еж. Степи используются птицами как кормовой биотоп. Выявленное биоразнообразие обогащает район исследования, как экологически, так и эстетически.

Ключевые слова: исследования, региональные особенности, низменность, горные районы, месторождение мела, цементный завод, биоразнообразие.

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THEMAIN CHEMICAL PARAMETERS OF WATER HABITAT BY BREEDING OF THE RUSSIAN STURGEON IN AGE FROM TWO-YEARS TO FIVE-YEARS IN ALMATY REGION PONDS OF KAZAKHSTAN

Abstract. The dynamic of values of pH of the aquatic environment of ponds and the oxygen content in the water of experimental fish pondsare presented in numerical execution. Descriptions of observable facts of pH dynamic values of the aquatic environment of ponds are given. The minimal and maximal values of studied parameters of water habitat, coefficients of variation of values of studied parameters of water habitat during the fish-breeding season, authenticity of differences between the values of studied parameters of water habitat during one day for the concrete periods of time are presented. The equations of regression of studied parameters of water habitat during the fish-breeding season are shown. The conclusions in which all the results of work according to the theme of this article are given. The results of comparison of database with the analogical recommendations from foreign researches are presented.

Keywords: experimental ponds, fish-breeding in ponds, pH of water habitat, number of oxygen in water, dynamic of parameters of water habitat.

Introduction. In the period between 2008 - 2011 LLP "Kazakh Research Institute of Fisheries" conducted large-scale research on the development of biotechnical methods of commercial sturgeon farming in relation to the modern conditions of the Republic of Kazakhstan, in particular, the cultivation of large fish stock of sturgeon fish and their hybrids in the adapted ponds of carp fish farms, water supplied by mountain rivers, in conditions of fish farms of Almaty region.A Russian sturgeon is recognized as the most perspective object of sturgeons-breeding from the domestic sturgeon species.

Compliance of values of the parameters by aquatic habitats of fishes normative is a prerequisite in order to recommend those or others biotechnical methods of growing fish in specific conditions.

Studies of the aquatic environment are an integral part of researches of fishery.

The purpose of the researches is to track the dynamics of the main chemical indicators of aquatic environment of the Russian sturgeon with age from two-years to five-years (pH of the aquatic environment, oxygen content in the water of fish ponds supplied by water of mountain rivers) in fish-breeding farms in Almaty region.

Material and methods. There searches were heldin the fish-breeding farm of Almaty region of Kazakhstan.The ponds adapted for breeding the russian sturgeon in ages of two-years, three-years, four-years and five-years were used as an experimental (figure).

Sources of water supplyboth for all the pond farm and the experimental part of pond farm where the works were carried out were the mountain rivers Lavar and Bala-Teskensu flowing through the territory of Enbekshi-Kazakh district of Almaty region. The database of quality of water by the water supply which was the head pond of the farm supplied by the water of named rivers are presented in table 1.

According to the databaseoftheresearchesthewaterfromwatersupplyof the "Chilik ponds farm" in June according to the parameter of pH which was 7,40 was neutral, number of organic substances was non-high.

The experimental pond in the experimental part by “Kazakh scientific and research institute of fishery” LLP

Table 1 – Hydrochemical and toxicological parameters of water from water supply of the “Chilik ponds farm”

Parameters	Unit of measure	Values	
		in June	in September
pH	–	7,40	7,56
Permanganate oxidability	mg O/dm^3	4,0	3,2
Ammoniate	mg/dm^3	0,03	0,03
Nitrites	mg/dm^3	0,088	0,006
Nitrates	mg/dm^3	2,63	0,35
Phosphorus	mg/dm^3	0,01	0,004
Iron	mg/dm^3	0,05	0,06
Rigidity of water	mg-equiv./dm^3	5,6	5,4
Hydrocarbonates	mg/dm^3	317	305
Sulfates	mg/dm^3	110	107
Chlorides	mg/dm^3	26,9	21,3
Calcium	mg/dm^3	59,3	56,9
Magnesium	mg/dm^3	32,5	31,1
Sodium	mg/dm^3	40,3	60
Potassium	mg/dm^3	3,9	
Mineralization	mg/dm^3	590	580
Copper	mg/dm^3	0,0087	1,5
Zinc	mg/dm^3	0,0057	5,5
Lead	mg/dm^3	0,077	4,0

Number of the biogenicelementsinthewaterwasenoughforthe development of water plants. The ammoniates were founded in number of 0,03-0,05 mg/dm^3, mineral phosphorus – in number of 0,010 mg/dm^3. Concentrationofnitriteswas 0,088mg/dm^3, what is more than the limited concentration 1,1 times. Thenitrateswereinnumberof 2,63 mg/dm^3,whatisthehighvalue for the natural water basins. Numberofthecopper was 8,7 mcg/dm^3 what is more that the limited concentration 8,7 times. Cadmium was no founded in the water. Concentrationofthezincandtheleadwere less than the limited concentration.

Accordingtothedatabaseoftheresearchesthewaterfromwatersupplyof the “Chilik ponds farm” in September according to the parameter of pH which was 7,56 was neutral. Contentofcarbondioxidein period of researches was on the level of limited concentration (44 mg/dm^3). Number of the biogenicelementsinthewaterwasnon high. Thenitritesandthephosphorus were characterized of less values on level of 0,004-0,006 mg/dm^3. Theammoniatesandtheironwereanalogicalaccording to content in

limits0,03 and 0,06 mg/dm^3 respectively. Thenitrateswerefoundedinnumber 0,35 mg/dm^3. The copper was foundedinlimits of 1,5 of limited concentration, zinc in limits of 5,5 mg/dm^3, leadin limits of 4,0 mg/dm^3. That is less than limited concentration. Cadmiumwasnofoundedinthewater.

Accordingtotheions, according to classification by O.A. Alyokin this water is related to hydrocarbonate class, groupofcalcium, II type. Accordingtothetechnical properties which are characterized of summa of mg-equiv./dm^3 of calcium and magnesiumthe water ismoderatery hard with common hardness 5,6 mg-equiv./dm^3.

So, the water from water supply of the "Chilik ponds farm" in summer and autumn period propertied to the regulatory requirements which are presented to fishery reservoirs. This water is fresh, middle hard, with low content of organic substances and nutrients, with neutral reaction of water, relatively weakly contaminated with heavy metals.

The database show that with such indicators the quality of water from the water of Chilik ponds farm supply channel is likely to have a low bio-mass of food organisms. The water quality of the well complied with the requirements for fisheries purposes[1].

ThematerialbycarryingouttheresearchesaccordingtothethemeofthisarticlewerethevaluespHofwater environment, content of the oxygeh of water by experimental ponds using for two-years, three-years, four-years and five-years of the russian sturgeon.

Gotdatabasewasprocessedbythemethodsofbiological statistic [2].

The results and discussion of them. Thefeatures of dynamic of the parameters of hydrology and hydro chemical parameters in basins with one-years of russian sturgeon were studied earlier [3].

The values ofcontentofoxygeninthewaterofexperimentalpondsfor4 years of carrying out of researches (2008 – 2011) by breeding the different groups of russian sturgeon are presented in table 2.

Table 2 – Content of oxygen in the water of experimental ponds for the period 2008 – 2011thyears,mg/dm^3

Month	Decade	Years of carrying out the researches, age group of russian sturgeon				
		2008, 1+	2009, 2+	2010, 3+	2011, 4+	middle value
May	II	7,57±0,15	7,66±0,23	7,35±0,41	6,71±0,28	7,32±0,21
	III	7,17±0,13	7,24±0,27	7,87±0,39	7,81±0,40	7,52±0,18
June	I	8,44±0,23	7,59±0,29	7,45±0,25	7,49±0,31	7,74±0,23
	II	8,52±0,27	8,84±0,26	7,86±0,28	7,97±0,34	8,30±0,23
	III	8,38±0,19	9,42±0,23	8,89±0,31	8,76±0,29	8,86±0,22
July	I	8,87±0,14	9,52±0,20	9,57±0,28	9,65±0,27	9,40±0,18
	II	9,67±0,21	9,53±0,22	9,76±0,22	9,71±0,24	9,67±0,05
	III	10,45±0,27	10,68±0,19	9,69±0,24	9,74±0,26	10,14±0,25
August	I	10,14±0,22	9,97±0,18	10,80±0,34	10,28±0,29	10,30±0,18
	II	9,52±0,17	9,96±0,19	10,36±0,19	10,37±0,27	10,05±0,20
	III	9,70±0,13	11,17±0,20	10,12±0,19	10,27±0,25	10,32±0,31
September	I	10,28±0,25	10,90±0,19	11,09±0,19	10,83±0,21	10,78±0,17
	II	9,83±0,29	11,88±0,15	12,06±0,15	11,10±0,19	11,22±0,51
	III	10,03±0,21	11,26±0,21	11,46±0,21	10,27±0,16	10,76±0,36
October	I	10,09±0,19	10,95±0,18	10,81±0,14	9,59±0,15	10,36±0,32
	II	9,13±0,17	9,28±0,16	9,39±0,12	9,48±0,11	9,32±0,08

Valueofthecoefficientofvariationbycontentofoxygeninthewaterofexperimentalpondsbyresearchesofperennialdynamicsofthisparameterwasless than 9,04%.

The significant differences ($p<0,001$) of valuesofoxygeninthewater of experimental ponds gotinthemorningandintheevening (1,79 mg/dm^3 (C_v = 6,59%) (IIIdecade of September - IIdecade of October) – 3,60mg/dm^3(C_v = 9,67%)(IIIdecade of July - Idecade of August)) during the period "IIdecade of May–IIdecade of September" (120 days, 60% of duration of the fish-breeding season (April – IIdecade of Octoberдекада)) was identified.

An equation of regression of the contentofoxygeninthewaterofexperimentalponds according to the database of researches of 2008th yearhas the form (R^2 = 0,842480):

$$y = 6{,}56802 + 0{,}60025\text{x} - 0{,}02602x^2 \quad (1)$$

An equation of regression of thecontentofoxygeninthewaterofexperimentalponds according to the database of researches of 2009th yearhas the form (R^2 = 0,821980):

$$y = 6{,}19955 + 0{,}75047\text{x} - 0{,}03035x^2 \quad (2)$$

An equation of regression of thecontentofoxygeninthewaterofexperimentalponds according to the database of researches of 2010th yearhas the form (R^2 = 0,824210):

$$y = 6{,}08852 + 0{,}72671\text{x} - 0{,}02789x^2 \quad (3)$$

An equation of regression of thecontentofoxygeninthewaterofexperimentalponds according to the database of researches of 2011th yearhas the form (R^2 = 0,895610):

$$y = 6{,}19214 + 0{,}72174\text{x} - 0{,}03104x^2 \quad (4)$$

Based on the kept resultsthemiddle equation of regression of thecontentofoxygeninthewaterofexperimentalponds was got (R^2 = 0,84607):

$$\text{y} = 6{,}15378 + 0{,}72409\text{x} - 0{,}03000\text{x}^2 \quad (5)$$

As a result of research was revealed afact thataccordingtotheparameterof content of oxygeninthewaterofexperimentalpondstheperiodfavorableforthebreedingofrussiansturgeoninagesoftwo-years, three-years, four-yearsandf0ve-yearsis“IIdecade of May – IIdecade of October” (150 days). Minimal value ofthecontentofoxygeninthewaterofexperimentalponds(5,0 mg/dm^3) was marked in IIIdecade of May – Idecade of June later 15 – 30 days afterapplying the organic fertilizerson a dry bed, followed after 2 days flooding the ponds.

Generally according to the researches during 4 years the values of parameter of content of oxygen in the waterofexperimentalpondswere like the base of valuesrecommended by Russian scientists [4-22].

The values ofpH of water environment inthewaterofexperimentalpondsfor 4 years of carrying out of researches (2008 – 2011) by breeding the different groups of russian sturgeon are presented in table 3.

Table 3 – pH of water environment in the water of experimental ponds for the period 2008 – 2011thyears

Month	Decade	Years of carrying out the researches, age group of russian sturgeon				
		2008, 1+	2009, 2+	2010, 3+	2011, 4+	middle value
May	II	7,90±0,16	7,87±0,09	8,17±0,03	8,09±0,04	8,01±0,07
	III	7,83±0,17	7,50±0,06	7,97±0,09	8,02±0,06	7,83±0,12
June	I	7,83±0,12	7,53±0,15	7,60±0,10	7,81±0,09	7,69±0,08
	II	8,03±0,09	7,57±0,09	7,63±0,15	7,69±0,11	7,73±0,10
	III	8,67±0,17	7,47±0,09	7,67±0,09	7,63±0,10	7,86±0,27
July	I	8,40±0,05	7,43±0,03	7,57±0,09	7,56±0,10	7,74±0,22
	II	8,18±0,08	7,43±0,09	7,63±0,09	7,54±0,11	7,70±0,17
	III	8,60±0,13	7,30±0,06	7,50±0,06	7,49±0,07	7,72±0,30
August	I	8,07±0,15	7,30±0,06	7,40±0,06	7,42±0,07	7,55±0,18
	II	7,92±0,03	7,97±0,09	8,20±0,12	7,69±0,09	7,95±0,10
	III	8,67±0,11	8,03±0,09	8,17±0,07	7,91±0,06	8,20±0,17
September	I	8,30±0,14	7,90±0,06	8,17±0,09	8,01±0,06	8,10±0,09
	II	7,97±0,12	8,00±0,06	8,33±0,17	8,14±0,12	8,11±0,08
	III	7,85±0,12	7,87±0,09	8,23±0,12	8,21±0,11	8,04±0,10
October	I	7,78±0,15	7,96±0,06	8,25±0,11	8,24±0,12	8,06±0,11
	II	7,64±0,09	7,98±0,09	8,28±0,14	8,25±0,14	8,04±0,15

ThevalueofcoefficientofvariationbythepHofwaterenvironmentofexperimentalponds by researches of perennialdynamicsofthisparameterwaslessthan 7,67%.Authentic differences by pHof water environment of experimental ponds during the fish season according to 4-year observationsnot found.

An equation of regression of thepHofwaterenvironment ofexperimentalponds according to the database of researches of 2008th yearhas the form (R^2 = 0,512910):

$$y = 7{,}58882 + 0{,}19123x - 0{,}01189x^2 \quad (6)$$

An equation of regression of thepHofwaterenvironment ofexperimentalponds according to the database of researches of 2009th yearhas the form (R^2 = 0,513890):

$$y = 7{,}70323 + 0{,}06461x - 0{,}00578x^2 \quad (7)$$

An equation of regression of thepHofwaterenvironment ofexperimentalponds according to the database of researches of 2010th yearhas the form (R^2 = 0,578960):

$$y = 8{,}04159 + 0{,}11128x - 0{,}00885x^2 \quad (8)$$

An equation of regression of thepHofwaterenvironment ofexperimentalponds according to the database of researches of 2011th yearhas the form (R^2 = 0,827960):

$$y = 8{,}21804 + 0{,}17047x - 0{,}01163x^2 \quad (9)$$

Based on the kept resultsthemiddle equation of regression of thepHofwaterenvironment ofexperimentalponds was got (R^2 = 0,608430):

$$y = 7{,}88792 + 0{,}13440x - 0{,}00954x^2 \quad (10)$$

There was no clear difference in pH of water environment of experimental ponds between the years of research and by the breeding of various size groups of Russian sturgeon.

Generallyaccordingtotheresearchesduring 4 yearsbetween thevaluesofparameterof pH of water environment of experimental ponds were like the base of values recommended by Russian scientists [4-22].

Conclusions.

1. The minimal value of the content of oxygeninmorninghoursinthewaterofexperimentalpondsused for the breeding of the russiansturgeonwhichareinagesfromtwo-yearstofive-yearsaccordingtoresultsof 4-year observations was7,32 mg/dm^3(IIdecade of May), maximal value was 11,22 (III decade of October). Valueofthecoefficientofvariationbycontentofoxygeninthewaterofexperimentalpondsbyresearchesofperennialdynamicsofthisparameterwasless than 9,04%.

2. The significant differences ($p<0{,}001$) of values of oxygenin the water of experimental ponds gotinthemorningand in the evening (1,79 mg/dm^3 (C_v = 6,59%) (IIIdecade of September - IIdecade of October) – 3,60mg/dm^3 (C_v = 9,67%) (IIIdecade of July - Idecade of August)) during the period “IIdecade of May – IIdecade of September” (120 days, 60% of duration of the fish-breeding season (April – IIdecade of Октябрьдекада)) was identified.

3. TheminimalvalueofpHofwaterenvironmentofexperimentalpondsusedforthebreeding of russian sturgeon in age from two-years to five-years, according to the database of observations during 4 years was 7,55 in Ithdecade of August, maximal value was8,20 in IIIth decade of August.

ThevalueofcoefficientofvariationbythepHofwaterenvironmentofexperimentalponds by researches of perennial dynamicsofthisparameterwaslessthan 7,67%.

4. Authentic differences by pH of water environment of experimental ponds during the fish season according to 4-year observations not found.

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ОРЫС БЕКІРЕСІН ЕКІ ЖАЗДЫҚ КЕЗЕҢІНЕН БЕС ЖАЗДЫҚ КЕЗЕҢГЕ ДЕЙІН ӨСІРУ БАРЫСЫНДАҒЫ ТӘЖІРИБЕЛІК ТОҒАНДАРДАҒЫ СУ КӨЗДЕРІНІҢ НЕГІЗГІ ХИМИЯЛЫҚ КӨРСЕТКІШТЕРІ

Аннотация. Орыс бекіресін екі жаздық кезеңінен бес жаздық кезеңіне дейін өсіру барысында тоғандардың pH, судағы еріген оттегі мәндерінің динамикалық есебі көрсетілді. Тәжірибелік тоғандарда зерттелген су көрсеткіштерінің динамикалық фактілеріне сипаттама берілді. Сулы орта бойынша зерттелген көрсеткіштердің минимальды және максимальды мәндері, барлық балық өсіру кезеңінде зерттелген көрсеткіштердің ауытқу коэффициенті, белгілі бір кезеңдерге сай бір тәулік көлемінде зерттелген көрсеткіштердің айырмашылықтары нақтыланды. Балық өсіру кезеңдерінде зерттелген сулы орта мәндерінің регрессиялық теңдігі көрсетілді. Мақаланың тақырыбына сай алынған зерттеу нәтижелеріне қорытынды жасалды және осы нәтижелерді таяу шет ел ғалымдарының зерттеулерімен салыстыру жүргізілді.

Түйін сөздер:тәжірибелік тоғандар, балықтарды тоғанда өсіру, сулы ортаның pH көрсеткіштері, судағы еріген оттегі, сулы орта көрсеткіштерінің динамикасы.

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ОСНОВНЫЕ ХИМИЧЕСКИЕ ПАРАМЕТРЫ ВОДНОЙ СРЕДЫ ЭКСПЕРИМЕНТАЛЬНЫХ ПРУДОВ ПРИ ВЫРАЩИВАНИИ РУССКОГО ОСЕТРА В ВОЗРАСТЕ ОТ ДВУХЛЕТОК ДО ПЯТИЛЕТОК

Аннотация. Представлена динамика значений pH водной среды прудов, содержания кислорода в воде экспериментальных рыбоводных прудов, занятых под выращивание русского осетра в возрасте от двухлеток до пятилеток, в числовом исполнении. Даны описания наблюдаемых фактов динамики значений изучаемых параметров в воде экспериментальных прудов. Представлены минимальные и максимальные значения исследуемых параметров водной среды, коэффициенты вариации значений изучаемых параметров в течение рыбоводного сезона, достоверность различий между значениями изучаемых параметров в течение суток за конкретные периоды времени. Показаны уравнения регрессии значений исследуемых параметров водной среды, исследуемых на протяжении рыбоводного сезона. Даны выводы, в которых представлены основные результаты работы по тематике данной статьи, сравнение полученных результатов с аналогичными, рекомендуемыми учеными ближнего зарубежья.

Ключевые слова: экспериментальные пруды, прудовое выращивание рыбы, pH водной среды, содержание кислорода в воде, динамика параметров водной среды.

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DNA EXTRACTION FROM LEAVES OF WOODY PLANTS WITHOUT LIQUID NITROGEN

Abstract. This article describes a method for the rapid and convenient isolation of genomic DNA from leaves of woody plants. In this article, there is tested a standard method of isolating genomic DNA from 45 plant species. The selected plants are rare and endemic representatives of the West Kazakhstan region flora and collectible exotic specimens of the Mangyshlak experimental botanical garden. The research involves a comparison with the modified for these species protocol for DNA extraction from plant tissues. Three methods of DNA analysis are used: visual (presence or absence of white precipitate, contamination), electrophoresis and spectrophotometry. Based on the results of electrophoregrams and spectrophotometry, a decision was made to modify the isolation protocol. Modified method of DNA extraction is based on the absence of liquid nitrogen, mercaptoethanol and RNAse A or T1 are used instead it. Due to the fact that the studied species contain a sufficiently large amount of tannins, an increase of incubation and centrifugation time had a positive effect on the result of DNA isolation. The entire process takes no more than 3 hours, and does not require the use of liquid nitrogen. This method allows to obtain high quality preparations with a DNA average concentration of 140.32 μg. The resulting DNA product can be used in plants molecular genetic identification and certification studies.

Key words: DNA, leaves, extraction, spectrophotometry, electrophoresis.

Introduction. Nowadays along with traditional methods of studying plants in breeding, genetic and taxonomic studies, methods based on elucidating the variability of DNA and its structure are becoming increasingly important. These methods make it possible to determine the nature of the variability of genetic material with high accuracy, which makes it possible to identify individuals with the most pronounced useful qualities at the early stages of plant development [1]. However, for conducting molecular genetic studies related to the study of the structure of genes, in the first stage it is necessary to obtain a pure DNA preparation without signs of degradation and impurities.

It has been experimentally established that the best results are obtained when DNA is extracted from the buds and young leaves of the plant [2], while in all dead cells (for example, in the xylem of angiosperms), DNA degradation is observed, which makes further analysis impossible. Particular attention should be given to the species mentioned down, since plants of different species are characterized by different physiological and biochemical features, such as the presence of various substances (polysaccharides, tannins, polyphenols and their quinone oxidized products), which create significant impurities in nucleic preparations. Physicochemical properties of such substances to a certain extent coincide with the properties of nucleic acids, which makes it difficult to completely separate them from DNA and causes a poor quality of samples, which makes unfit their further use.

The necessity to maintain intraspecific variability, both at inter-population and intrapopulation levels, is not sufficiently taken into account when studying rare plant species. The population approach remains the least developed in the field of plant biodiversity conservation, since there are still no generally accepted methods for identifying not only population but even specific features of gene pools.

It is also known that the Birch family (*Betulaceae*) contains diarylheptanoids, polyphenols, flavonoids, terpenoids, steroids and other compounds, and the Rose family (*Rosaceae*) contains flavonoids, tannins and ellagic acid, which must be taken into account when carrying out molecular genetic studies of plants of this kind that require the isolation of DNA [3, 4].

The purpose of this article was to investigate the possibility of using a standard technique for isolating DNA from plants on representatives of the above mentioned families and optimizing this technique for a particular object.

Methods. As objects of research, there are taken plants representing rare and endemic species of the natural flora of Western Kazakhstan Region and collectible exotic plants of the Mangyshlak experimental botanical garden.

The objects of our research were plants of the following families: 10 species of the Birch family (*Betulaceae*), 8 species of the Rose family (*Rosaceae*), 2 species of the Pine family (*Pinaceae*), 1 species of the Yew family (*Taxaceae*), 1 species of the Cypress family (*Cupressaceae*), 1 species of the Gymnosperms family (*Ginkgodaceae*), 2 species of the Soapberry family (*Sapindaceae*), 4 species of the Barberry family (*Berberidaceae*), 1 species of the Celtis family (*Cannabaceae*), 1 species of the Walnut family (*Juglandaceae*), 2 species from *Platanaceae* and *Salicaceae* families, 1 species of the Moschatel family (*Adoxaceae*), 1 species of *Peganaceae* family, 1 species of the Madder family (*Rubiaceae*), 1 species from *Nitrariaceae*, *Paulowniaceae, Acanthaceae, Fabaceae, Fagaceae, Rhamnaceae* and *Oleaceae* families.

The DNA was isolated according to the standard procedure proposed by S. Porebski [5].

The purpose of our study was the development of a protocol for the isolation of DNA from the leaves without the use of liquid nitrogen. We used the modified CTAB method. For DNA extraction there were used sample 100 mg of fresh leaves hinge was triturated in a mortar in the presence of 300 μl for extraction (120 mM Tris-HCl pH 8.0, 20 mM EDTA, pH 8.0, 1.4 M NaCl, 2.5% CTAB). Trituration options were used without liquid nitrogen. The number of replicates was 6-8 times. The resulting homogenate was incubated at 58-60°C for 60 minutes in a thermostat, vortexing alternately, centrifuged for 10 minutes at 10,000 g. An equal volume of chloroform and isoamyl alcohol was added to the aqueous phase, the mixture was centrifuged for 10 minutes at 10,000 g. The DNA precipitate was washed with 70% ethanol. The incubation was continued for 30 minutes at -20°C. The DNA was reprecipitated with propanol and dissolved in 10 μl TE buffer. The assays were performed in 8-fold replication. The qualitative and quantitative characteristics of DNA are important for molecular genetic analysis. Because possible impurities can inhibit the process of PCR.

Quantitative and qualitative evaluation of the isolated DNA was performed using a DNA-photometer (BioPhotomer Plus, Eppendorf, Germany) and electrophoretic analysis. For photometric analysis, the adsorption of aqueous DNA solutions was measured at three wavelengths: 260/280 nm and 260/230 nm [6]. The size of DNA molecules varied from 7 to 1381 ng/μl. Reusable Eppendorf cuvettes allow the measurement of samples with a volume of only 50 μl, and with the Eppendorf μCuvette G1.0 cuvette the sample volume can be reduced to 1.5 μl. To assess the purity and quality of nucleic acids in spectrophotometric measurement, the purity of the sample is determined based on the ratio of optical densities at wavelengths of 230, 260 and 280 nm. The extinction ratio of 260 nm / 280 nm allows us to judge the purity of the nucleic acid. Pure DNA preparations have a ratio of at least 1.67 [6].

The degradation of the molecules of the obtained preparations was carried out by electrophoresis in 2% agarose gel. Visualization of DNA, RNA was carried out using the Quantum-ST5-1100 Gel-Documentation System, Vilber Lournat, France.

Results and discussion. In the first series of experiments, a comparative evaluation of the DNA extraction procedure was carried out in 26 plant species (table 1). DNA of 19 plant species was isolated only by a modified protocol due to the insufficiency of plant material, since these species are endangered.

It was shown that with the use of a standard protocol for the DNA isolation from *Berberis thunbergii, Berberis iliensis, Berberis spp., Celtis caucasica, Malococarpus crithmifolius* and *Nitraria shoberi* the quantity and quality of the isolated DNA were unsatisfactory. To improve the quality of DNA, the isolation procedure was further optimized, involving the exclusion of mercaptoethanol.

Using a standard technique for DNA isolation by the CTAB method from plants (the entire isolation process takes an average of 7-8 hours) allowed us to obtain total DNA preparations. A spectrophotometric

Table 1 – DNA isolation protocols from the studied species

Sample number	Objects	Pro-tocol	Sample #	Objects	Pro-tocol	Sample number	Objects	Pro-tocol
1	*Pinus eldarica*	S&M	16	*Platanus spp.*	S&M	31	*Erythrina crista-galli*	M
2	*Pinus strobus*	S&M	17	*Sambucus spp.*	S&M	32	*Betula ulmifolia*	M
3	*Taxus baccata*	S&M	18	*Malococarpus crithmifolius*	S&M	33	*Betula tianschanica*	M
4	*Juniperus polycarpos var. turcomanica*	S&M	19	*Crataegus ambigua*	S&M	34	*Betula maximowicziana*	M
5	*Ginkgo biloba*	S&M	20	*Populus diversifolia*	S&M	35	*Betula turkestanica*	M
6	*Acer campestre*	S&M	21	*Rubia cretacea*	S&M	36	*Betula microphylla*	M
7	*Acer henryi*	S&M	22	*Nitraria schoberi*	S&M	37	*Betula pendula var. carelica*	M
8	*Berberis iliensis*	S&M	23	*Betula pendula*	S&M	38	*Betula platyphylla*	M
9	*Berberis thunbergii*	S&M	24	*Malus sieversii*	S&M	39	*Betula ajanensis*	M
10	*Berberis spp.*	S&M	25	*Malus niedzwetzkyana*	S&M	40	*Quercus spp.*	M
11	*Berberis Karkaralensis*	S&M	26	*Prunus armeniaca*	S&M	41	*Paliurus spina-christi*	M
12	*Corylus avellana*	S&M	27	*Prunus mandshurica*	M	42	*Cotoneaster melanocarpus*	M
13	*Celtis caucasica*	S&M	28	*Populus tremula L.*	M	43	*Cotoneaster multiflorus*	M
14	*Pterocarya pterocarpa*	S&M	29	*Paulownia tomentosa*	M	44	*Cotoneaster nitens*	M
15	*Platanus orientalis*	S&M	30	*Acanthus mollis*	M	45	*Fraxinus angustifolia subsp. syriaca*	M

Note: S – standard protocol; M – modified protocol.

study of the purity of the obtained samples showed that the absorption ratio at 260 nm / 280 nm was equal to an average of 1.25 (table 2). This indicates that the obtained DNA samples contain impurities in large quantities. Therefore there were a repurification with the addition 50 µl of MEK (mercaptoethanol) and 5 µl of RNAse T1 to the CTAB.

Table 2 – The amount of DNA isolated using standard protocol

Sample number	Concentration of DNA, ng/microL	A_{260}/A_{280}	Sample number	Concentration of DNA, ng/microL	A_{260}/A_{280}
1	86	2.29	14	431	1.15
2	1431	1.06	15	296	1.04
3	607	1.29	16	215	0.93
4	898	1.17	17	565	1.08
5	712	1.13	18	94	1.14
6	372	1.32	19	616	1.01
7	1455	0.98	20	13	1.36
8	28	0.84	21	283	1.57
9	914	1.09	22	881	1.08
10	766	1.07	23	52	1.32
11	520	1.25	24	42	1.86
12	131	1.44	25	73	1.30
13	429	1.72	26	526	1.05

Summarizing the data of the table, we can say that the amount of DNA in the samples is high enough, which can not be said about the ratio A_{260}/A_{280}. Only *Celtis caucasica* and *Malus Sieversii* have a pure DNA sample. The *Pinus eldarica* has big amount free nucleic acids in its DNA sample. Despite the high concentration (it varies from 13 ng/microL to 1455 ng/microL), the purity, and hence the quality of DNA, is very low, which prompted us to modify the isolation protocol for the above species.

The presence of degradation in the samples can lead to an incorrect spectrophotometric evaluation of the concentration of DNA, to its overestimation due to the phenomenon of hyperchromism. In addition, these drugs are of little use in the future to work on the study and manipulation of large DNA fragments.

Summarizing the obtained data, we can conclude that this method of DNA extraction is not effective for studied plants.

Further optimization of the standard DNA isolation protocol was performed by compilation the optimal temperature, time and buffer volume that made it possible to obtain a high concentration DNA preparation with no degradation and impurities, which is confirmed by spectrophotometric and electrophoregram in the agarose gel. The obtained samples had an absorption ratio at 260 nm / 280 nm equal, on average, to 1.88, which indicates the purity of the obtained DNA preparations. The DNA samples were measured in three replicates. The A_{260}/A_{280} ratio for pure nucleic acids should be within the range of 1.67 - 2.2 and optimally is about 1.8 and ~ 2.0 for DNA and RNA, respectively. A value of less than 1.67 may indicate contamination of the sample with polypeptides, more than 2 for possible degradation and the presence of free nucleotides. According to the data obtained with BioPhotometer Plus, it can be seen that the DNA samples of *Rubia cretacea* and *Betula microphylla* were destroyed and there are many free nucleotides in the samples (table 3).

Table 3 – The amount of DNA isolated using modified protocol

Sample number	Concentration of DNA, ng/microL	A_{260}/A_{280}	Sample number	Concentration of DNA, ng/microL	A_{260}/A_{280}
1	13	2.11	25	25	1.86
2	7	1.79	26	31	1.75
3	275	1.88	27	240	2.1
4	73	1.77	$28D_2$	24	1.67
5	10	1.93	$28D_3$	15	1.70
6	25	1.69	$28D_3$	11	1.45
7	28	1.21	28T	61	1.66
8	16	1.71	29	17	1.94
8	35	1.74	30	19	1.84
9	27	1.67	31	198	1.79
10	62	1.02	32	34	1.83
11	204	1.99	33	138	1.91
12	836	1.96	34	39	0.96
13	13	1.42	35	553	2.19
14	19	1.96	36	5	3.49
15	100	2.00	37	195	1.98
16	29	1.83	38	137	1.77
17	23	1.83	39	670	1.83
18	7	0.98	40	1381	2.23
19	14	1.03	41	485	2.16
20	8	1.77	42	587	2.07
21	7	6.17	43	40	1.68
22	45	1.87	43	37	1.66
23	15	1.60	44	49	1.75
24	24	1.74	45	110	1.94

The table shows the spectrophotometry data of all the species studied, *Berberis iliensis,* diploid *Populus tremula L.* and *Betula maximowicziana* were isolated in two replicates. This was due to a poor visual evaluation of the DNA sample. In comparison with DNA samples isolated by a standard method, the results of DNA samples isolated by a modified method are directly opposite. The DNA concentration in the samples is comparatively very small, and ranges from 5 ng/microL to 1381 ng/microL, where samples of only 15 species *(Taxus baccata, Berberis karkaralensis, Corylus avellana, Platanus orientalis, Prunus mandshurica, Erythrina crista-galli, Betula tianschanica, Betula turkestanica, Betula pendula var. carelica, Betula platyphylla, Betula ajanensis, Quercus spp., Paliurus spina-christi, Cotoneaster melanocarpus and Fraxinus angustifolia subsp. syriaca)* have a concentration exceeding the 100 ng/microL. Accordingly, the range of the remaining species ranges from 5 ng/microL to 73 ng/microL.

Ratio A_{260}/A_{280} is another indicator shown in table 3, the purity of DNA is determined by the value of this ratio. The 35 species studied have A_{260}/A_{280} ratios within the DNA purity range of S. Porebski [5]. *Acer henryi, Berberis spp., Celtis caucasica, Malococarpus crithmifolius, Crataegus ambigua, Rubia cretacea, Betula pendula,* diploid *Populus tremula L., Betula maximowicziana* and *Betula microphylla* have samples with contaminated DNA, *Rubia cretacea* and *Betula microphylla* in samples have a large number of nucleic acids, that means destruction of DNA.

To determine the degree of degradation of molecules in the resulting preparations, we performed electrophoresis in a 2% agarose gel with the addition of ethidium bromide. Figure shows the electrophoregrams of DNA isolated according to a standard and modified protocol.

Above in figure 1, the electrophoregrams of the samples isolated by the standard method and modified are shown. Comparison can be made even in a visual way. Figure 1a shows that *Platanus spp.* and *Sambucus spp.,* isolated by the standard method, are brightly expressed on the electrophoregram, whereas, *Malococarpus crithmifolius, Crataegus ambigua* and *Populus diversifolia,* isolated by the standard protocol, are weakly expressed. DNA samples of *Taxus baccata, Nitraria shoberi* and *Prunus mandshurica*, isolated by a modified method, have a very good electrophoresis result. Also these three types have good spectrophotometry: *Taxus baccata* (275 ng/microL, A_{260}/A_{280}=1.88), *Nitraria shoberi* (45 ng/microL, A_{260}/A_{280} =1.87) and *Prunus mandshurica* (240 ng/microL, A_{260}/A_{280}=2.1).

DNA samples of *Berberis thunbergii, Berberis spp.* and *Prunus armeniaca* have a small amount. However, DNA samples isolated by a modified method show fairly good results. Especially *Berberis thunbergii, Berberis spp., Berberis Karkaralensis* and *Pterocarya pterocarpa. Berberis Karkaralensis* and *Pterocarya pterocarpa* results of spectrophotometry are 204 ng/microL, A_{260}/A_{280}=1.99 and 19 ng/microL, A_{260}/A_{280}=1.96.

DNA samples of *Betula ulmifolia, Betula microphylla* and *Betula platyphylla* isolated by standard method are insignificant, oppositely DNA samples isolated by modified method show sufficiently good results. There is especially distinguished a *Erythrina crista-galli.* Its spectrophotometry result is 198 ng/microL and A_{260}/A_{280} =1.79.

The results of DNA samples isolated by the standard method are negative. As for DNA samples isolated by the modified method, the species have a pronounced result. We want to note the following samples: *Quercus spp.* (7 ng/microL, A_{260}/A_{280}=1.79)*, Piunus strobus* (73 ng/microL, A_{260}/A_{280}=1.77)*, Juniperus polycarpos var. Turcomanica* (10 ng/microL, A_{260}/A_{280} =1.93)*, Ginkgo biloba* (25 ng/microL, A_{260}/A_{280} =1.69)*, Acer campestre* (28 ng/microL, A_{260}/A_{280} =1.21) and *Acer henryi* (1381 ng/microL, A_{260}/A_{280} =2.23).

Analysis of electrophoregrams of DNA studied species shows efficiency of application of the modified DNA extraction protocol.

In general, we improved the protocol of DNA extraction as follows:

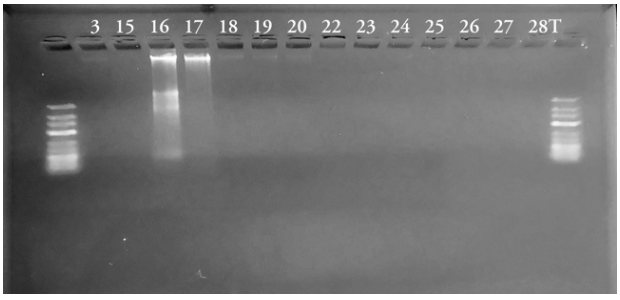
1. The tissue sample is thoroughly triturated with a pestle for 5 minutes in 1000 μl pre-heated to 65°C CTAB buffer;

2. Incubate in a thermostat at 65°C for 30 minutes, periodically mixing the solution by rotating the tube (it is not recommended to shake the tube, because the buffer foam, DNA is destroyed);

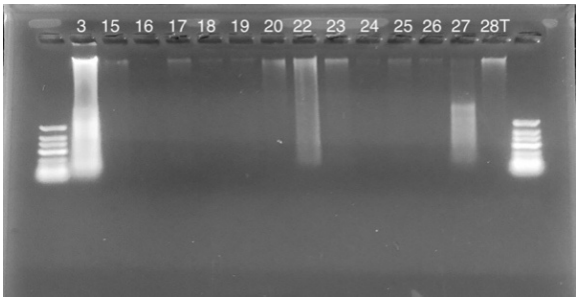
3. After cooling the tube to room temperature, add an equal volume of chloroform-isoamyl alcohol mixture and stir slowly with a shaking for 20 minutes;

4. Separate the phases by centrifugation for 15 minutes (12000 *g);

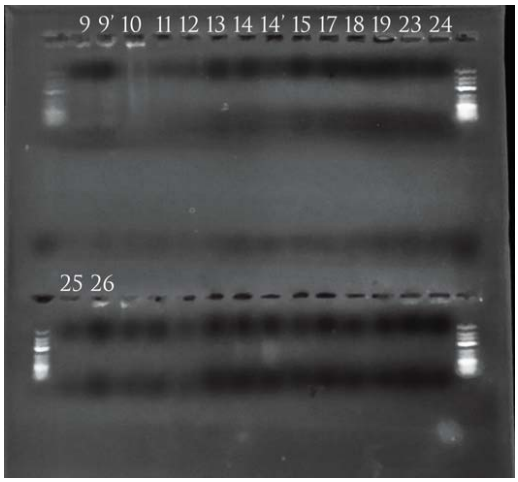
5. The supernatant is transferred to a clean 2 ml tube;



Standard protocol

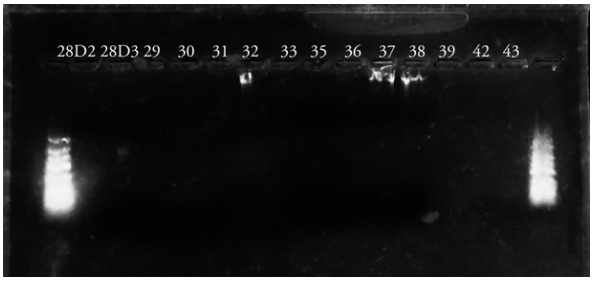


Modified protocol

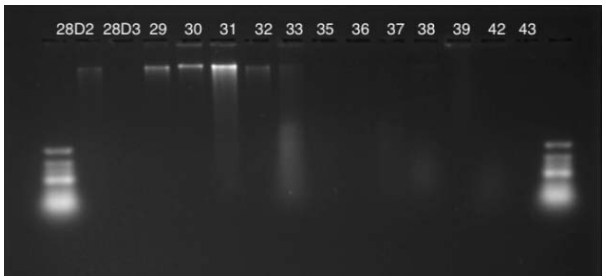


Standard protocol

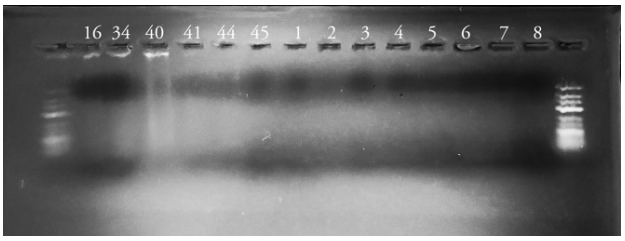
Modified protocol



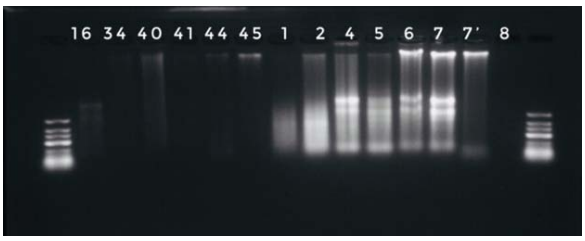
Standard protocol



Modified protocol



Standard protocol



Modified protocol

Electrophoregrams of DNA isolated according to a standard and modified protocol

6. Add 2/3 of the volume of isopropanol;
7. Leave for 1 hour at -20°C to precipitate the DNA;
8. Centrifuge for 15 minutes (13 000*g), isopropanol is taken off;
9. Add two volumes of 80% ethanol, incubate for 15 minutes, centrifuge for 15 minutes (13 000*g);
10. The DNA precipitate is dissolved in water or TAE buffer (0.01 M Tris-HCl, pH 7.4, 0.1 mM EDTA) until the precipitate disappears completely.

Conclusions. The use of a standard procedure for isolating DNA from plants (Table 1) showed the presence of a significant amount of impurities in the resulting preparations, as well as DNA degradation, which was confirmed by electrophoresis and spectrophotometrically. Incomplete removal of inhibitors, polysaccharides and polyphenols leads to inhibition of subsequent enzymatic reactions in the PCR process and causes DNA degradation after prolonged storage. For further analysis, these preparations were unsuitable.

In order to obtain a qualitative preparation of total DNA, the standard isolation procedure was modified and optimal temporal, temperature and concentration conditions were selected, some stages were changed, which allowed to fully achieve the goal.

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ДНК-НЫҢ СИПАТТАМАСЫ НИТРОГЕНДІҢ ЖАБДЫҚ ӨСІМДЕРІНДЕГІ ДЕҢГЕЙІНДІ ТАҢДАУ

Аннотация. Мақалада тез әрі ыңғайлы әдісімен ағаш өсімдіктердің жапырақтарынан геномдық ДНҚ-ны алу туралы сипатталған. Ғылыми мақалада өсімдіктердің 45 түрінен алынған геномдық ДНҚ-ның стандартты әдісімен алуын тексеріу жүргізілді. Іріктеп алынған өсімдіктер Батыс Қазақстан аумағының сирек және эндемиктері мен Маңғышлақ эксперименттік ботаниқалық бағының жинақталған экзотикалық түрлері болып табылады. Бұл жұмыста өсімдік ұлпасынан ДНҚ бөлу үшін салыстырмалы модификациялық хаттама түрін усынады. Зерттеу барысында ДНҚ талдау әдісінің 3 түрі қолданылды: визуалды (ақ тунбаның бар немесе жоқ болуы, ластаныу), электрофорез және спектрофотометрия нәтижесінде. ДНҚ-ны алудың модификациялық әдісі сұйық азотты қолданбауға негізделген. Баарлық процесс 3 (үш) сағаттан кем уақыт алады. Алынған түрлерде танинның жоғары мөлшеуде болғаны, инкубацияның уақытын көбейгені және центрифугалау ДНҚ-ның алуын жағымды әсер қалдырады. Бұл әдіс жоғары сапалы ДНҚ-дан 140,32 мкг концентрациясымен препараттарды алуға болады. Алынған ДНҚ өнімін молекулярды генетикалық сәйкестендіру және өсімдіктің сертификаттау үшін қолданұға болады.

Түін сөздер: ДНҚ, жапырақтар, алу, спектрофотометрия, электрофорез.

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ВЫДЕЛЕНИЕ ДНК ИЗ ЛИСТЬЕВ ДРЕВЕСНЫХ РАСТЕНИЙ БЕЗ ЖИДКОГО АЗОТА

Аннотация. В статье описывается метод быстрого и удобного выделения геномной ДНК из листьев древесных растений. В научной статье проводится проверка стандартного метода выделения геномной ДНК из 45 видов растений. Отобранные растения являются редкими и эндемичными представителями флоры Западно-Казахстанского региона и коллекционными экзотическими особями Мангышлакского экспериментального ботанического сада. Работа предполагает сравнение с модифицированным для данных видов протоколом выделения ДНК из тканей растений. В работе используются три метода анализа ДНК: визуальный (наличие или отсутствие белого осадка, загрязнение), электрофорез и спектрофотометрия. Основываясь на результатах электрофореграмм и спектрофотометрии, было принято решение для модификации протокола выделения. Модифицированный метод выделения ДНК основан на отсутствии применения жидкого азота. Весь процесс занимает не более 3 часов. В связи с высоким содержанием танинов в изучаемых видах, увеличение времени инкубации и центрифугирования благоприятно влияют на результат выделения ДНК. Данный метод позволяет получить препараты высокого качества с концентрацией ДНК 140.32 мкг. Полученный продукт ДНК можно использовать в исследованиях молекулярной генетической идентификации и сертификации растений.

Ключевые слова: ДНК, листья, выделение, спектрофотометрия, электрофорез.

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PURIFICATION AND BIOCHEMICAL PROPERTIES OF WHEAT ENDOCHYTINASE

Abstract. Chitinolytic enzymes are the most important components of the plant defense system against various pathogens. Chitinases hydrolyze the N-acetyl-β-glucosamine-containing polymer substrates (chitin, chito-oligosaccharides), which are part of the cell walls of fungi, nematodes and insects. The high polymorphism of chitinases in cereals, including wheat, the poor knowledge of their biochemical properties and activity regulation is one of the main obstacles in understanding the functioning of this enzyme complex.

The aim of the work was the study of some physico-chemical characteristics of wheat endochitinase. Using chromatography on a specific chitin affinity sorbent, endochitinase was purified from shoots, roots and seeds of wheat seedlings. The enzyme was represented by several isoforms with a molecular weight of about 30 kDa and pI in the acidic, neutral, and alkaline regions. There were no significant differences in the isoenzyme composition of endochitinase from different organs of the wheat seedlings. Some physico-chemical properties of wheat endochitinase were determined - pH and temperature optimum, thermal stability, the effect of different 2-valent metal cations on activity. The results can be used in the enzymology of the interaction of plants and phytopathogenic fungi.

Key words: wheat, endochitinase, isoenzymes.

Introduction. To date, a large amount of factual material has been accumulated on the induction in plants in response to the lession of specific pathogenesis related (PR) proteins by viruses, bacteria and fungi. These proteins are classified into 17 families according to their structure and properties [1]. Special attention in connection with the study of plant protection mechanisms against phytopathogens is given to chitinases (EC 3.2.1.14), capable of destroying the cell walls of fungi [2-4]. As part of the PR proteins, these enzymes form 4 families. In plants, chitinase, like other polymer hydrolases, is represented by several isoenzymes and is encoded by a family of genes. Chitinases are subdivided into constitutive and inducible forms, differ in tissue specificity of expression [5]. The significant polymorphism of the enzyme is due to the complex organization of natural substrates - chitin and its various oligosaccharide derivatives, suggesting differences in their substrate specificity and structural features of the isoenzymes [6].

According to the type of action on the substrate in the composition of chitinases, endochitinases and exochitinases are distinguished. The first enzymes cleave chitin randomly inside the polymer, producing soluble low molecular weight N-acetylglucosamine multimers, such as chitotriose, chitotetraose, and diacetylchiobiose dimer. The last enzymes are capable to cleave only the terminal carbohydrate residue of the polymer [7, 8]. Based on the primary structure, plant chitinases are divided into 7 classes (I – VII). It is shown that there is no definite correlation in the distribution of chitinases by plant species, their organs and tissues. However, it was found that only some chitinases have antifungal properties [9, 10].

The chitinase complex and its functioning are most studied in tobacco, and among cereals - in barley and rye. In wheat, the composition of this enzyme has about 10 isoforms having a wide range of pI in the acidic, alkaline, and neutral pH from 3.1 to 9.7. It has been shown that some isoforms to some extent may be involved in protecting the plant from pathogenic attack [11-13]. Despite certain successes, wheat chitinases are still relatively poorly studied, especially their physicochemical properties and activity

regulation. The main difficulties in their study is the relatively high polymorphism of the enzyme. Additional difficulties are imposed by the existence of constitutive and inducible forms of the enzyme, the tissue specificity of their expression, as well as hormonal and metabolic control of their activity.

In the present work, we studied some biochemical properties of wheat endochitinase purified by affinity chromatography on chitin.

Materials and methods of research. The objects of study were wheat (*T.aestivum* L.) seedlings and their individual organs.

Determination of chitinase activity. To determine the activity, 1 ml of colloidal chitin (5 mg/1 ml of 0.05 M acetate buffer pH 5.2) was added to a 0.1 ml sample and incubated for 4 h at T 37ºC on a shaker at a speed of 120 rpm. After incubation, the reaction was stopped with 1 ml 3,5-dinitrosalycilic acid (DNS), the mixture was boiled in a water bath for 5 min, then centrifuged for 5 min at 8000 rpm. After centrifugation, the optical density was measured at a wavelength of 545 nm [14]. The resulting amount of N-acetyl-D-glucosamine was found using the calibration curve for N-acetyl-D-glucosamine. The enzyme activity was expressed in mg of N-acetyl-D-glucosamine per 1 h in 1 ml.

Substrate Chitinase Affinity Chromatography. The endochitinase was purified by affinity chromatography on a chitin column at a temperature of +4°C. For this purpose, the shrimp chitin that was previously swollen in water (for 12 h) was placed in a column of 1.0 x 10.0 cm and equilibrated with 20 mM sodium bicarbonate pH 8.0. The extract proteins obtained after precipitation of $(NH_4)_2SO_4$ (20-80%) were transferred to the same buffer after dialysis. The sample was introduced into the column with the sorbent and washed with buffer, until the complete absence of protein at the exit. Protein fractions were collected in 5 ml at a flow rate of 30 ml/h of buffer. After washing the column with starting buffer, 20 mM sodium acetate pH 5.3 was passed. The chitinase bound to the sorbent was eluted with 75 mM acetic acid pH 3.0. 0.2 M NaOH was immediately added to the enzyme fraction and the pH was adjusted to 6.0-7.0. To obtain the maximum amount of purified chitinase, affinity chromatography was performed repeatedly. The fractions containing the enzyme were combined and concentrated at 4°C in an Amicon cell with a PM-10 filter.

Protein electrophoresis. The electrophoresis of proteins under denaturing conditions with sodium dodecyl sulfate (SDS-Na_2) was carried out in slabs of 10% polyacrylamide gel (PAG) with a size of 8x10 cm and thickness of 1 mm according to the method of Laemmly. Coomassie brilliant blue G-250 was used for staining PAG for total protein.

Isoelectric focusing and detection of chitinase in PAG. Native IEF was performed in a 6% PAG plate 9x15 cm and 1 mm thick with 1% Servalyt pH 3-10. 10 μl of the preparation was applied to each well of the applicator. Enzyme separation was performed at 600 W for 5 h on a Multiphor II (LKB instrument). Identification of chitinase activity zones was performed using a gel replica with a polymerized substrate of 0.02% glycol chitin. After IEF, the working gel and replica were incubated for 15 min in 0.05 M acetate buffer pH 5.0. Then the two gels were tightly pressed to each other and incubated as a sandwich for 2 h in an thermostat at 42°C. After that, the gel replica was transferred to 0.5 M Tris buffer pH 8.8 with 0.01% Fluorescent bridgetener 28 and held for 10 min. The gel was left overnight in water at room temperature. Bands of activity were visualized with the help of a Gel-doc Quantum ST5 (Wilber Lourmat) with a UV length of 254 nm [15].

Results and discussion. *Purification and isozyme composition of chitinases.* By their structure, chitinases are divided into forms containing a chitin-binding domain (chitinase class I) and not containing this domain (classes II and III). The presence or absence of ChBD is an important biochemical characteristic and plays a crucial role in the demonstration of the protective properties of the enzyme. A distinctive feature of class I chitinases is their ability to bind with an insoluble substrate – polymeric chitin. Chitinases that bind to chitin (ChB chitinases) are typical endochitinases.

For purification and identification of wheat seedlings chitinases, a shrimp chitin column was used. The extract proteins were preliminarily concentrated by precipitation with ammonium sulfate within the saturation range from 20 to 80%. As a result of column chromatography, it was established that all organs of the 5-day seedlings - shoots, roots and seeds contain chitinases that have an affinity for the natural polymer substrate. The results of denaturing electrophoresis in the presence of SDS-Na_2 and native isoelectrofocusing using ampholytes in the pH range of 3-10 indicate the complex polymorphism of chitinolytic enzymes in wheat and, in particular, endochitinases.

Polymer-bound chitinases from all organs of the seedling are represented by several proteins with a molecular mass of around 30 kD (figure 1A). In shoots and roots, the composition of ChB chitinases was similar and included three proteins each with masses of approximately 28, 33, and 35 kD. In contrast, two additional proteins with masses of 26 and 30 kD were present in the germinating seed.

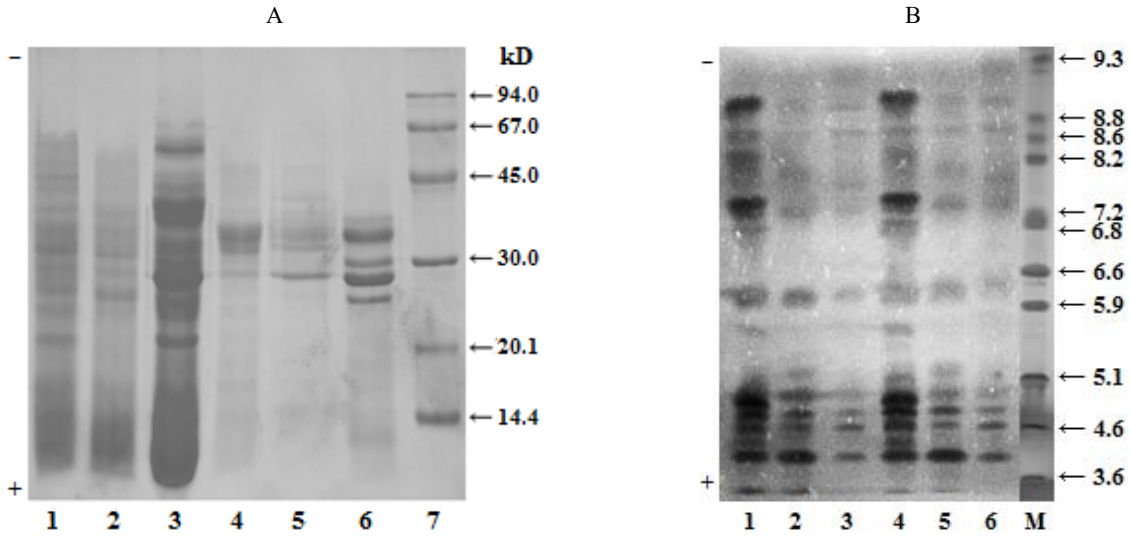

Figure 1 – SDS electrophoresis of purified ChB chitinases from different seedlings organs (A) and IEF spectra of seedlings chitinases, containing and not containing ChBD (B):
A – gel staining of the Coomassie G-250: 1-3 – shoot, root and seed protein prior to application to the chitin column; 4-6 – ChB chitinases of shoot, root and seed respectively; 7 – protein markers m.v. B –1-3 shoot, root and seed chitinase prior to application to the chitin column, 4-6 – chitinase with ChBD of shoot, root and seed respectively, м – IEF markers

The spectra of the native IEF fractions of the enzyme bound and not bound to chitin is shown in Figure 1B. Chitinases with ChBD, exhibiting affinity for the sorbent, were present in both the acidic and alkaline regions of the gel. Some of the isoenzymes had pI in the alkaline region (9.0, 8.7, 8.2, 8.0, 7.6), and in the acidic region there were components with pI 6.0, 5.0, 4.6, 4.0. It should be noted that the spectra of chitinases with ChB centers in the vegetative organs (root, shoot) and in the seed as a whole is similar. These are isozymes with pI 9.0, 8.7, 8.2, 5.0, 4.6, 4.0.

Biochemical properties of chitinases. Environmental conditions - temperature, pH, metal cations and their concentration, are among the most important factors influencing the activity of the enzyme and its interaction with the substrate. The effect of different pH values on the chitinase activity of wheat seedlings was studied. The enzyme showed catalytic activity in a broad wide range of pH - from 3.5 to 9.5 with an optimum in the range of 5-5.5 (figure 2). The wide pH effect of the enzymes on the substrate is obviously explained by the considerable heterogeneity of the isoenzyme composition, including acid, neutral and alkaline forms. As can be seen from the IEF spectra (figure 1B), ChB chitinases located in a wide range of isoelectric points. It should be noted that chitinase from germinating seeds, as compared with those of shoots and roots, retained greater activity in the alkaline region of pH.

The effect of different positive temperatures (30,40,50,60 and 70°C) on the activity of purified wheat seedlings chitinase was studied. The optimum temperature of the medium for the display of the catalytic activity of chitinase was 40°C (figure 3).

The effect of temperature pretreatment (thermo stability) on the activity of purified wheat seedlings chitinase was investigated. The enzyme samples were heated at 40, 50, 60 and 70°C for 10 min, cooled sharply, centrifuged, and the activity in the supernatant was measured. From the graphs presented in figure 4, it can be seen that chitinase is resistant to elevated temperature and partially showed activity at a maximum value of 70°C. The relative heat resistance within 60°C was characterized by the enzyme from the roots.

A very important factor in the regulation of enzyme activity are metal cations of the medium. In our work, we studied the effect of different concentrations of divalent cations Mg^{2+}, Ca^{2+}, Cu^{2+}, Mn^{2+}, Ba^{2+} on the activity of ChB chitinases of wheat.

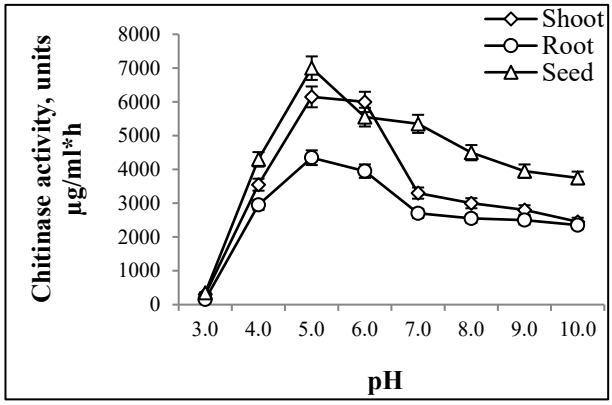

Figure 2 – The effect of pH on chitinase activity from different organs of a 5-day seedlings

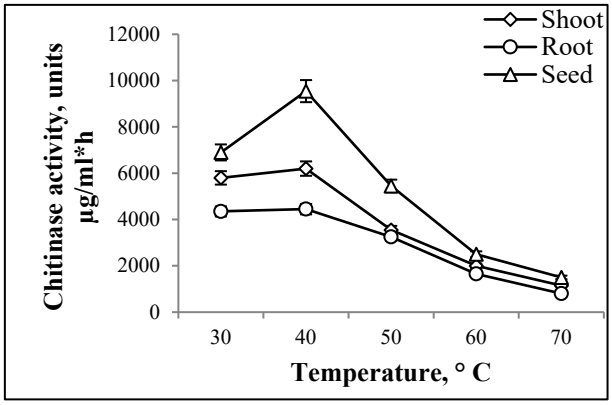

Figure 3 – The effect of temperature on the activity of chitinases from different organs of a 5-day seedlings

For this, metals were introduced into the incubation medium of the enzyme with the substrate in the form of chloride salts at a concentration of cations of 1, 5, and 10 mM. In addition, the enzyme itself was preincubated with the cation for 10 min. The data presented in figure 5 indicate significant differences in the effect of different metals on the chitinase activity of wheat seedlings.

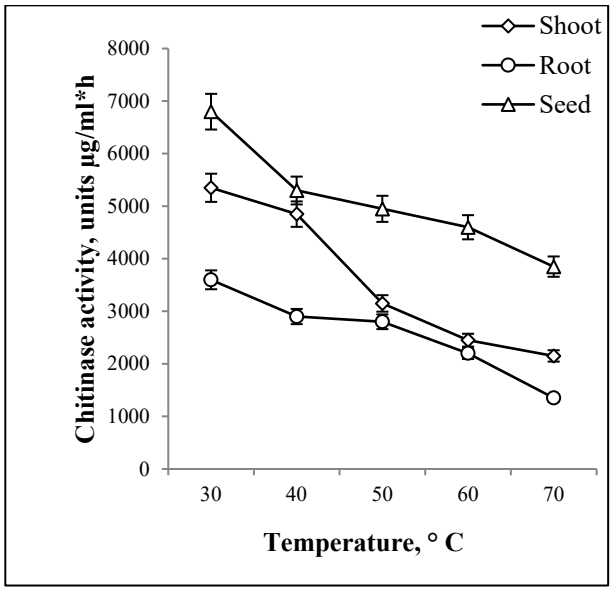

Figure 4 – Thermal stability of chitinases from different organs of a 5-day seedlings

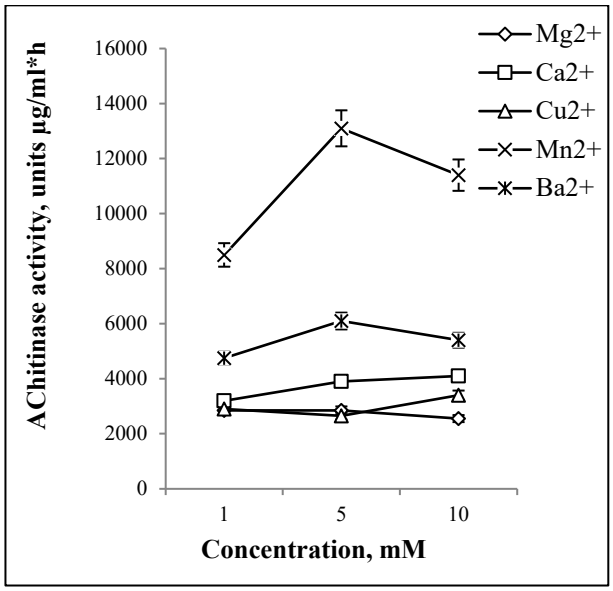

Figure 5 – The effect of metal cations on the activity of seedling chitinase

The highest inhibitory effect was observed for the Cu^{2+} cations and in the metal concentration of 10 mM the enzyme was almost completely inactivated. In contrast, the Mn^{2}+ cations increased chitinase activity (at 5 mM concentration). Ba^{2+} cations and slightly less Mg^{2+} had a similar activating effect.

Conclusion. Purification of wheat chitin-binding chitinase was carried out using substrate affinity chromatography, their composition and some physicochemical properties were determined. According to the SDS-Na_2 electrophoresis of ChB chitinases, seedlings were represented by several proteins with molecular masses in the region of 30 kD. In shoots and roots, the composition of the enzyme was similar and included three proteins with masses of 28, 33 and 35 kD, and two additional components with masses of 26 and 30 kD were present in the germinating seeds. The presence of acidic, neutral and alkaline isoforms has been established using native IEF as part of ChB chitinase. The spectrum of chitinases in the vegetative organs (root, shoot) and in the seed as a whole is similar. Major components were pI 9.0, 8.7, 8.2, 5.0, 4.6, 4.0.

A number of other physicochemical properties ChB chitinases of wheat, which are important for the demonstration of activity, have been studied. The enzyme was active in a wide pH range - from 3.5 to 9.5 with an optimum in the range of 5-5.5. The optimum temperature for the demonstration of chitinase catalytic activity is 40°C. Differences in the thermal stability of the purified enzymes were revealed. It was established that chitinase retained significant activity at 60°C for 10 min, however, heating at 70°C almost completely inactivated the enzyme. As part of chitinases, acidic isoforms are most sensitive to temperature increases. Established significant differences in the action of different metals on the activity of chitinases. The greatest inhibitory effect was exerted by the Cu^{2+} cations. In contrast, Mn^{2+} cations stimulated the activity of the enzyme. Ba^{2+} and a little less Mg^{2+} had a similar activating effect.

Authors' contributions. Zh.D. Beskempirova and A.O. Abaildaev participated in the preparation of plant material, extracts and measurement of the enzyme activity, V.A. Kuzovlev - in the protein electrophoresis and IEF, A. A. Khakimzhanov - in general guidance and preparation of the article.

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БИДАЙ ЭНДОХИТИНАЗАСЫНЫҢ БИОХИМИЯЛЫҚ ҚАСИЕТТЕРІ ЖӘНЕ ТАЗАРТУ

Аннотация. Хитинолитикалық ферменттер әртүрлі патогендерге қарсы өсімдік қорғау жүйесінің маңызды компоненттері болып табылады. Хитиназалар саңырауқұлақтардың, нематодтардың және жәндіктердің жасушалық қабырғасының құрамына кіретін полимерлі субстраттары (хитин, хито-олигосахаридтер) бар N-ацетил-β-глюкозаминді гидролиздейді. Астық тұқымдастылардағы, оның ішінде бидайдағы хитиназалардың жоғары полиморфизмі, олардың биохимиялық қасиеттерін және белсенділіктерін реттеудің нашар зерттелгендігі - бұл фермент кешенінің жұмыс істеуін түсінудегі негізгі кедергілердің бірі болып табылады.

Жұмыстың мақсаты бидай эндохитиназасының кейбір физико-химиялық ерекшеліктерін зерттеу болды. Арнайы хитинді аффинді сорбенттегі хроматография көмегімен бидайдың өскіндерінен, тамырынан және дәндерінен эндохитиназа тазартылды. Фермент молекулалық салмағы шамамен 30 кДа және ИЭН қышқылдық, бейтарап және сілтілік аймақтардағы бірнеше изоформалар көрсетті. Бидайдың әр түрлі мүшелеріндегі эндохитиназаның изоферменттік құрамында айтарлықтай айырмашылықтар анықталмады. Бидай эндохитиназасының кейбір физико-химиялық қасиеттері - pH және температура оңтайлылығы, термиялық тұрақтылығы, белсенділікке әртүрлі 2-валентті металл катиондарының әсері анықталды. Нәтижелер өсімдіктер мен фитопатогендік саңырауқұлақтардың өзара әрекеттесу энзимологиясында қолданылуы мүмкін.

Түйін сөздер: бидай, эндохитиназа, изоферменттер.

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ОЧИСТКА И БИОХИМИЧЕСКИЕ СВОЙСТВА ЭНДОХИТИНАЗЫ ПШЕНИЦЫ

Аннотация. Хитинолитические ферменты являются важнейшими компонентами защитной системы растений против различных патогенов. Хитиназы гидролизуют N-ацетил-β-глюкозамин содержащие полимерные субстраты (хитин, хитоолигосахариды), входящие в состав клеточных стенок грибов, нематод и насекомых. Высокая полиморфность хитиназ у злаковых, в том числе пшеницы, слабая изученность их биохимических свойств и регуляции активности является одним из основных препятствий в понимании функционирования этого ферментного комплекса.

Целью работы явилось исследование некоторых физико-химических особенностей эндохитиназы пшеницы. С помощью хроматографии на специфичном аффинном сорбенте хитине была очищена эндохитиназа из ростков, корней и зерновок проростков пшеницы. Фермент был представлен несколькими изоформами с молекулярным весом около 30 кД и ИЭТ в кислой, нейтральной и щелочной области. Существенных различий в изоферментном составе эндохитиназы из различных органов проростка пшеницы не выявлено. Определены некоторые физико-химические свойства эндохитиназы пшеницы – pH- и температурный оптимумы,

термостабильность, влияние разных 2-валентных катионов металлов на активность. Результаты могут быть использованы в энзимологии взаимодействия растений и фитопатогенных грибов.

Ключевые слова: пшеница, эндохитиназа, изоферменты.

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CHARACTERISTICS OF MICROSATELLITE LOCI OF ORDABASY AND KARAKUL SHEEP

Abstract. In order to accumulate data on the genetic structure of coarse wool breed sheep population, 100 heads were genotyped with respect to 7 microsatellite DNA. Biological materials (histological tissues) were brought from basic farms. DNA analysis and PCR were performed according to existing recommendations. Studies on 7 microsatellite loci are given. 81 alleles were found, of which 43 are alleles in microsatellite loci in Ordabasy sheep and 38 alleles in Karakul sheep. On average, the locus was 6.14±0.65 and 5.43±0.63 alleles, respectively. 45 informative alleles were identified. The average number of informative alleles per locus in the sheep group of Ordabasy and Karakul breeds was 3.29±0.17 and 3.14±0.13, respectively. On average, the number of effective alleles per locus in the populations was 3.11±0.13 and 2.90±0.09. 55 private alleles were identified in the studied populations. Of these, 31 alleles in Ordabasy and 24 alleles in Karakul sheep breed. The average number of private alleles per locus in the populations was 4.44±0.45 and 3.43±0.34, respectively.

Key words: Ordabasy sheep, Karakul sheep, DNA sample, microsatellite, allele, heterozygosity, population.

The most important factor in accelerating scientific and technological progress in animal breeding is the widespread introduction into production of modern advances in biotechnology. This is explained by the fact that the complex processes of interaction of genes and the whole genotype with the environment cause a high phenotypic variability of characters in populations of small sheep breeds, which makes it extremely difficult to analyze the study of quantitative characters [1].

This problem can be largely solved by studying the animal genome using methods based on DNA polymorphism analysis.

The study of the nucleotide genome sequence allows not only to assess the true genetic potential for productivity, but also to obtain highly valuable information for selection, which increase the acceleration of their rates in a given direction of productivity.

Identification of gene variants reflecting the genetic animal potential in terms of productivity allows breed out at the DNA level, i.e. according to the genotype.

Microsatellites are widely used to create genetic maps [2]. Due to their high specificity, microsatellites are the initial marker for identifying individuals [3], according to DNA control in forensic examination, in a biological/evolutionary context they are useful as markers for analyzing the origin [4-6]. The probability of a mismatch is one in a million.

Analysis of microsatellite loci was proposed by Weber et al. [7]. The authors showed the possibility of using microsatellites as genetic markers and proposed an effective method for analyzing these markers – their amplification using PCR with the subsequent separation of the reaction products in polyacrylamide gel, which allowed to sharply increase the sensitivity immunity and speed of analysis compared to traditional methods based on hybridization of genomic blots.

It should be noted that modern methods allow separate fragments that differ by only one pair of nitrogenous bases [8].

The first studies concerning the possibility of using the method of determining the microsatellite polymorphism in controlling the reliability of the origin of farm animals began in the early 90s of the last century, and almost immediately microsatellite markers showed high efficiency in controlling the origin of farm animals [8]. When using a common panel of genetic blood systems (7 blood groups, 16 protein loci and enzymes, and 8 microsatellite loci), the effectiveness in controlling the origin increases to 99.9% [10].

Currently, the success of breeding work depends on the correct identification and certification of animals. Therefore, it is relevant to study the genetic diversity of existing breeds of farm animals and carry out their certification with the use of DNA technologies.

In general, the PCR analysis showed the presence of a low polymorphism of the allelic profile in the studied sheep breeds on the studied microsatellite loci. This indicates that selection for certain signs of productivity in the studied populations is close to the biological boundaries of development. In this regard, it is necessary to assess the degree of genetic diversity of these sheep breeds using genetic markers, which more thoroughly assess the inherited abilities of animals and identify the systems of genes responsible for the development of specific signs of productivity.

Research materials and methods. Sheep of Ordabasy (50 heads, "Seraly" farm) and Karakul breeds (50 heads, "Zhomart" farm) of Arys-Turkestan region were investigated in the experiment.

The material for the study was samples of tissue (earmark) of sheep.

The research work was carried out in the laboratory of LLP "South Western Research Institute of cattle and plant breeding" and Republican state enterprise on the right of economic management "South Kazakhstan State Pharmaceutical Academy".

Sampling for DNA extraction and DNA extraction were carried out according to the Methodological recommendations for the molecular-genetic analysis of sheep using microsatellite markers, 2004 [11].

Statistical data processing was performed by standard methods.

Research results. The analysis of theoretical and practical aspects of methods for assessment and selection of farm animals using DNA technology based on existing genodiagnostics methods (perchlorate, Kawasaki and salt extraction) for sheep genotyping was carried out. An effective variant was chosen DNA extraction from the tissue by the perchlorate method.

In the base specialized farms for breeding sheep of Ordabasy ("Seraly" farm) and Karakul ("Zhomart' farm) breeding sheep, 50 samples of biomaterial were selected (histological tissue from the earmark) for DNA extraction.

Microsatellites are characterized by an unusually high level of polymorphism and Mendeleyev type of research.

In this regard, the authors carried out PCR analysis on 7 loci of microsatellites (tables 1 and 2).

Tables 1 and 2 present the DNA microsatellites used to analyze the coarse wool genotype of Ordabasy and Karakul breeds.

Table 1 – The frequency of occurrence of alleles in the microsatellite loci in sheep of Ordabasy breed

Loci	Number of alleles (unit)	Numerical code of alleles
MAF-214	9	196, 202, 205, 208, 217, 225, 230, 233, 252
DYMS-1	7	145, 148, 156, 160, 166, 174, 233
HSC	6	211, 22, 228, 241, 246, 256
TGLA-53	3	154, 158, 164
ILTS-005	5	181, 188, 192, 199, 214
INRA-23	7	199, 201, 203, 205, 215, 219, 221, 225
INRA-063	6	169, 173, 177, 185, 189, 191
Total	43	

The data in table 1 show the considerable effectiveness of the MAF-214 microsatellite locus when analyzing the coarse wool breed genotype, since this locus differed in the number of occurrence of alleles compared with other loci. A total of 9 alleles were found, with a high occurrence of alleles 196 (37.4%)

and 225 (36.0%). In the DYMS-1 locus, the number of alleles was 7, and among the identified alleles, according to the frequency of occurrence, the allele 174 was different, and made up 34.8% of the total number of alleles in the locus. In the HSC locus, 6 alleles were identified. At the same time, in this locus, the frequency of occurrence of alleles 228 and 246 was high and amounted to 37.8% and 36.6%, respectively. The TGLA-53 microsatellite locus was distinguished by a low number of alleles (only 3 units) and a high frequency of occurrence of allele 154 (40.3%). The use of the ILTS-005 locus identified 5 alleles with a high frequency of alleles 181 (37.5%) and 192 (40.9%). In the INRA-23 and INRA-063 loci, 7 and 6 alleles were found, respectively. Alleles 199 (38.7%) and 205 (44%), as well as alleles 177 (39.7%) and 185 (42.5%) are characterized by high frequency of occurrence. In total, 43 alleles were found in the studied microsatellite loci.

A similar tendency in the frequency of occurrence of alleles in different loci in Karakul sheep can be seen from the data in table 2.

Table 2 – The frequency of occurrence of alleles in various microsatellite loci in sheep of Karakul breed

Loci	Number of alleles (unit)	Rank of alleles
MAF-214	7	184, 192, 202, 210, 215, 220, 230
DYMS-1	6	145, 147, 149, 155, 158, 162
HSC	5	211, 218, 226, 234, 262
TGLA-53	3	143, 150, 165
ILTS-005	3	188, 190, 200
INRA-23	7	203, 205, 209, 211, 223, 225, 229
INRA-063	7	167, 171, 177, 179, 187, 189, 195
Total	38	

For example, the MAF-214, INRA-23 and INRA-063 loci were characterized by a higher genetic diversity. In these microsatellite loci, 7 alleles were identified in each locus. It should be noted that alleles 215 (0.424%), 220 (30.3%), 209 (39.0%), 223 (39.0%), 167 (37.5%) and 179 (38.9%) in the studied loci were encountered with relatively high frequency. The number of alleles in the DYMS-1 and HSC loci is varied within 5-6. The studies showed that the frequency of occurrence of alleles 149, 158, 218, 226 were considerably higher and ranged from 32.3 to 43.5%.

The TGLA-53 and ILTS-005 loci were characterized with a lower frequency of occurrence of alleles, i.e. only 3 alleles were identified per each locus. Such a number of fragments in the microsatellite markers indicate homozygosity of the studied genotypes by this locus.

In general, the number of identified alleles in Karakul sheep population was 38 and varied from 3 to 7 alleles in loci.

When studying the allelic profiles of various genotypes of Ordabasy and Karakul sheep breeds, the following indexes were determined: minimum, maximum and average number of alleles and frequency of occurrence of informative, effective and private alleles.

The results of the analysis of Ordabasy and Karakul sheep breeds' genetic diversity according to the number of total allele and types of alleles per locus of microsatellites are presented in table 3.

The data in table 3 show that, in the above sheep breeds, the average total allele per locus is 6.14±0.65 and 5.43±0.63 alleles.

The total number of informative alleles in sheep of Ordabasy and Karakul breeds on average per locus was 3.29±0.17 and 3.14±0.13, respectively. At the same time, the number of highly informative alleles in Ordabasy breed populations was 30.2±9.5%, and in Karakul breed populations was 34.2±10.1%.

The number of average informative and low informative alleles in the studied populations ranged from 23.3±8.8% and 21.1±8.7% to 46.5±10.4% and 44.7±10.6%.

On average, in populations, the number of effective alleles per locus was 3.11±0.13 and 2.90±0.09%.

In all studied populations, 55 private alleles were found in 7 microsatellite loci. Of these, 31 private alleles were diagnosed in Ordabasy breed and 24 alleles were found in Karakul breed.

The average number of private alleles per locus in the studied populations was 4.45±0.45 and 3.43±0.34, respectively.

Table 3 – The frequency of occurrence of different types of alleles in the studied sheep populations

Types of alleles	Sheep breed	
	Ordabasy	Karakul
Number of alleles, total	43	38
per locus	6.14±0.65	5.43±0.63
Types of alleles: informative, total	23	22
per locus	3.29±0.17	3.14±0.13
including: highly informative, %	30.2±9.5	34.2±10.1
average informative, %	23.3±8.8	21.1±8.7
low informative, %	46.5±10.4	44.7±10.6
effective, total	21.79	20.3
per locus	3.11±0.13	2.90±0.09
private, total	31	24
per locus	4.45±0.45	3.43±0.34

The studies showed that in the populations of Ordabasy sheep breed, the allele 154 of the TGLA-53 locus (40.3%) and the allele 185 of the INRA-063 locus (42.5%) are distinguished by the maximum frequency of occurrence.

In the populations of Karakul sheep breed, 5 alleles have the maximum frequency of occurrence. This is the allele 149 (41.7%) of the DYMS-1 locus, the allele 150 (45.2%) of the TGLA-53 locus, the allele 200 (50.0%) in the ILTS-005 locus, and also the alleles 209 (42.2%) and 179 (41.7%) in the INRA-23 and INRA-063 loci.

The remaining private alleles are found with average and low frequency.

In general, the PCR analysis showed the presence of a low polymorphism of the allelic profile in the studied sheep breeds on the studied microsatellite loci. This indicates that selection for certain signs of productivity in the studied populations is close to the biological boundaries of development. In this regard, it is necessary to assess the degree of genetic diversity of these sheep breeds using genetic markers, which more thoroughly assess the inherited abilities of animals and identify the systems of genes responsible for the development of specific signs of productivity.

Data on the genetic heterogeneity of a population is extremely important for an objective assessment of the genetic diversity and correction of breeding programs. As an index of heterogeneity is a reflection of mutational processes occurring in populations.

As a criterion for assessing the genetic variability in the studied sheep breeds, heterogeneity of allelic variants identified in various microsatellite loci was used.

Table 4 – Level of heterogeneity of various populations

Indexes	Sheep breed	
	Ordabasy	Karakul
Actual degree of heterozygosity, %	0.405±0.029	0.380±0.032
Expected degree of heterozygosity, %	0.675±0.028	0.652±0.031
Lack of heterozygosity, %	-0.270	-0.272

As follows from the data in Table 4, sheep of Ordabasy and Karakul breeds are characterized by a low actual degree of heterozygosity (0.405±0.029 and 0.380±0.032%), which is a consequence of less genetic diversity in these populations.

Heterozygosity does not fully reflect the degree of genetic variability in populations, especially where inbred mating often occurs. Therefore, for an accurate assessment of population variability, the expected heterozygosity index is used, which reflects the level of allelic diversity. And the expected heterozygosity itself is determined on the basis of the allele frequencies obtained from random crossing in a population.

As a result of the study, it was established that the level of the actual degree of heterozygosity in the tested sheep breeds considerably differs from the level of the expected heterozygosity. For example, the expected degree of heterozygosity in the populations of Ordabasy sheep breeds was 0.675±0.028%, and in the populations of Karakul sheep breeds was 0.652±0.031%.

At the same time, the lack of heterozygotes in the studied sheep breeds was 0.270 and 0.272%, which indicates the static reliability of these indexes.

This suggests that in the tested populations, the process of homogenization of allelic variants intensifies and indicates the need to maintain the polymorphism of their allele pool, taking into account various selective values of the genotypes encountered.

As is known, as a result of mutations in all populations, there is a hereditary heterogeneity that creates genetic prerequisites for variability. The law put forward by Hardy-Weinberg, according to which the frequencies of genotypes in a population can be predicted from the frequencies of genes, provided that they are randomly crossed.

The results of the analysis of Ordabasy and Karakul sheep populations' genetic structure by seven microsatellite loci are shown in table 5.

Table 5 – Genetic structure of Ordabasy and Karakul sheep breeds

Indexes	Sheep population	
	Ordabasy	Karakul
Heterozygosity test	-0.321	-0.381
Homozygosity ratio	0.518	0.529
The degree of realization of possible variability,%	56.2	54.9
The level of polymorphism of alleles	1.93	1.89
The average homozygosity of the population, %	59.5	62.0
x^2	40.7	38.5
df	6	6
Reliability	P>0.001	P>0.001
Genetic equilibrium	no	no

Analysis of the genetic structure of various populations showed that the index in the heterozygosity test, reflecting the state of the population in relation to heterozygous genotypes, is characterized by a negative value and indicates a lack of heterozygotes. This index in the populations of Ordabasy breed was -0.321, and Karakul breed was -0.381.

The homozygosity coefficient of Ordabasy sheep population was 0.518 and of Karakul sheep population was 0.529, and the degree of realization of possible variability was 56.2 and 54.9%, respectively.

The level of polymorphism of active effective alleles in the studied microsatellite loci is 1.93 and 1.89, and this value indicates that the number of active alleles in the population for loci is less than the possible one.

The average homozygosity index in the studied populations was 59.5% and 62.0%, respectively.

The gene state was studied by seven microsatellite loci and a significant disruption of gene equilibrium due to the saturation of homozygotes was found and a considerable lack of heterozygotes was observed in the studied populations.

For example, the chi-square (x^2) in the populations of sheep was: in Ordabasy breed -40.7 (P>0.001) and in Karakul breed -38.5 (P>0.001).

In general, the obtained data indicate that the choice and selection carried out has a considerable impact on the genetic state of the population, increasing its "homozygosis".

In this regard, it is necessary to use microsatellites as genetic markers when adjusting the crossing pattern of the genotypes of these sheep breeds.

Assessment of the part of intra-breed and inter-population variability in the total genetic diversity of the studied sheep breeds was carried out on the basis of calculation of the index of the total inbreeding coefficient (Fis) and weighted average Fis and Fit by the studied microsatellite loci.

Table 6 – F-statistics index

F-statistics index	Sheep breed	
	Ordabasy	Karakul
Fis index	0.401±0.131	0.417±0.132
Fit index	0.409±0.058	
Fst index	0.084±0.033	

The Fis index serves as a measure of decrease in the level of heterozygosity of an animal unit caused by non-random mating within each group of genotypes in populations.

This fixation index in the populations of Ordabasy and Karakul sheep breeds was 0.401±0.131 and 0.417±0.132, respectively, and indicates a lack of heterozygotes in the studied breeds.

The Fst index shows a decrease in the level of heterozygosity in a breed, caused by random genetic drift of genes.

The Fst index was calculated as the weighted average by the populations, and it was 0.084±0.033. This indicates that 91.6% of all variability is due to intra-breed diversity and only 8.4% is due to inter-breed diversity.

The index of the total inbreeding coefficient Fit was calculated as the average by the studied populations. Its average value was 0.409±0.058%, which indicates a considerably large lack of heterozygotes (40.9%) in the studied sheep in relation to the total population.

Thus, the indicators of F-statistics indicate a high probability of inbreeding in the studied sheep breeds by microsatellites.

This indicates that the genetic diversity in the studied populations is far from optimal. Selection in such small populations of sheep in the future will not give a perceived effect. Therefore, for the effectiveness of the breeding process in the studied populations of sheep, the choice and selection of highly productive species should be carried out in compliance with strict genetic monitoring. Therefore, the control of the genetic diversity in Karakul and Ordabasy sheep populations will be a considerable factor increasing the expected effect in their selection.

Conclusion. The studies on 7 microsatellite loci were carried out. 81 alleles were found, of which 43 are alleles in the microsatellite loci in Ordabasy sheep and 38 alleles in Karakul sheep. On average, the locus was 6.14±0.65 and 5.43±0.63 alleles, respectively.

45 informative alleles were identified. The average number of informative alleles per locus in the sheep group of Ordabasy and Karakul breeds was 3.29±0.17 and 3.14±0.13, respectively. On average, the number of effective alleles per locus in the populations was 3.11±0.13 and 2.90±0.09. 55 private alleles were identified in the studied populations. Of these, 31 alleles in Ordabasy and 24 alleles in Karakul sheep breed. The average number of private alleles per locus in the populations was 4.44±0.45 and 3.43±0.34, respectively.

The level of observed heterozygosity in each studied sheep breeds was statistically considerably different from the level of expected heterozygosity, which indicates a high probability of inbreeding in the populations by microsatellites.

The inbreeding coefficients Fis and Fit indicate a lack of heterozygotes in the studied breeds. The Fst index indicates a high intra-breed diversity (91.6%) and a low interbreed diversity (8.4%).

A considerable disturbance in the gene equilibrium due to the saturation of homozygotes in the studied populations (x^2=40.7 and 38.5) was found, which require correcting the crossing patterns and selection methods that contribute to the stabilization of the gene frequencies in their allele pool.

The created “Animal Database” system stores data on genotyped animals. Currently, this system stores information about identified and certified 100 animal heads, including 50 heads of Ordabasy breed and 50 heads of Karakul breed.

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ОРДАБАСЫ ЖӘНЕ ҚАРАКӨЛ ҚОЙ ТҰҚЫМДАРЫНЫҢ МИКРОСАТЕЛЛИТТІ ЛОКУСТАРЫНЫҢ СИПАТТАМАСЫ

Аннотация. Асыл тұқымды қойлардың популяциясының генетикалық құрылымы туралы мәліметтерді жинау мақсатында 7 микросателлиттік локус бойынша 100 бас қой генотиптелді. Биологиялық материалдар (гистологиялық ұлпалар) шаруашылықтардан алынды. Ордабасы және қаракөл қой тұқымдарының құлақ шеміршегінен бөлініп алынған ДНК фрагментін электрофорез тәсілі арқылы жіктелінді. 81 аллелдің ішінде 43 аллелдер ордабасы қойлардың микросателлиттік локусында және 38 аллелдер қаракөл қойлар популяциясында анықталған. Орта есеппен локусқа 6,14±0,65 және 5,43±0,63 аллелдер тиісінше құрады.

45 ақпараттық аллельдер анықталынды. Ақпараттық аллельдер локусқа шаққанда орта есеппен ордабасы мен қаракөл қойларында 3,29±0,17 және 3,14±0,13 болды. Популяциялар бойынша тиімді аллельдер көрсеткіші орта есеппен 3,11±0,13 және 2,90±0,09 құрады. Зерттелген популяцияларда 55 өзіне тән аллельдер анықталынды. Олардың ішінде 31 аллельдер ордабасы қойларында және 24 аллельдер қаракөл қойларында болды. Популяцияларда бір локусқа шаққанда өзіне тән аллельдер саны тиісінше 4,44±0,45 және 3,43±0,34 көрсетті.

Түйін сөздер: Ордабасы қой тұқымы, қаракөл қой тұқымы, ДНК үлгі, микросателлит, аллель, гетерозигота, популяция.

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ХАРАКТЕРИСТИКА МИКРОСАТЕЛЛИТНЫХ ЛОКУСОВ ОРДАБАСИНСКОЙ И КАРАКУЛЬСКОЙ ПОРОД ОВЕЦ

Аннотация. С целью накопления данных о генетической структуре популяции грубошерстной породы овец были генотипированы 100 голов по 7 микросателлитным ДНК. Биологические материалы (гистологические ткани) были привезены из базовых хозяйств. Анализ ДНК и постановку ПЦР выполняли согласно существующим рекомендациям. Приведены исследования по 7 локусам микросателлитов. Обнаружено 81 аллелей, из них 43 аллелей в микросателлитных локусах у овец ордабасинской породы и 38 аллелей у популяции каракульских овец. В среднем на локус составил 6,14±0,65 и 5,43±0,63 аллелей соответственно. Выявлено 45 информативных аллелей. Среднее число информативных аллелей на локус в группе овец ордабасинской и каракульской породы составило 3,29±0,17 и 3,14±0,13 соответственно. В среднем по популяцием число эффективных аллелей на локус составил 3,11±0,13 и 2,90±0,09. В исследованных популяциях выявлено 55 приватных аллелей. Из них 31 аллелей у ордабасинской и 24 аллелей у каракульской породы овец. Среднее число приватных аллелей на локус в популяциях составило 4,44±0,45 и 3,43±0,34 соответственно.

Ключевые слова: Ордабасинская порода овец, каракульская порода овец, образец ДНК, микросателлит, аллель, гетерозиготность, популяция.

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