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INFLUENCE OF PASTEURELLOSIS ON THE SAIGA TATARICA POPULATION IN THE REPUBLIC OF KAZAKHSTAN

Abstract. Saiga (Saiga tatarica) – gregarious animals that live in the desert and semidesert zones of Eurasia. The international Union for conservation of nature and natural resources (IUCN) classified this species as «within the limits of extinction» in its red list. In the Republic of Kazakhstan, the incidence of infectious diseases in saigas has been poorly studied.

The mass death of the saiga population has shown the relevance of this issue and the need for a comprehensive study of the problem. In this regard, it is necessary to study the cause-and-effect factors of diseases among wild animals in order to preserve saiga populations. To solve this problem, it is necessary to conduct comprehensive research on infectious, parasitic and protozoal diseases, to find out the natural sources of disease spread, and the influence of domestic animals as sources of infection. In addition, it is necessary to take into account the possible carrier of infections among saigas, as sources of disease spread among farm animals.

Increasing the importance of infectious pathology of saiga as a factor leading to the mass death of this species of animals, the lack of means and methods of specific prevention indicates the feasibility and relevance of this work.

Until now, it is not known what problems of infectious pathology in animals are relevant. In the literature there are only some reports of diseases that occur in saigas, whose mass death in different years is associated with the development of pasteurellosis. Therefore, taking measures to prevent this epidemic is a crucial step.

Key words: saiga, vaccine, population, pasteurellosis, territory, mammals, migration.

Introduction. The saiga is an animal that belongs to the genus of saigas of the order sailing, large, convex, ruminant. Saiga excavations were found from a Pleistocene layer at a distance from Western England to Eastern Alaska. Saigas are preserved only in Mongolia, the Kalmyk steppe, and Kazakhstan. They are juvenile animals with mammoths and woolly nasopharynx that passed the ice age 20 thousand years ago. The most common saiga in the Republic of Kazakhstan among wild hooves is Saiga tatarica L. currently, three groups of saigas have been preserved. The largest of them are the Betpakdala-Arys group. These are places of saigas, deserted plains of Karaganda, Aktobe, Kyzylorda and Zhambyl regions. At the same time, in the steppes of Kalmyk, you can see good herds of saiga, because of the small pasture lands, their head does not increase. A small number of the Mongolian saiga inhabits the earth [1].

Saigas feed on vegetation of 12-23 kg / ha per year (about 1.5-2% of the crop), compared to domestic animals of 100 or more kg/ha (12-18%). This means less strain on pastures. According to scientists, feed losses of the Republic's pastures can feed up to 1-3 million saigas annually without damage to the environment. Thanks to their hooves, many rare endemic plants are sprayed.

According to the data, the existence of steppe steppes in Kazakhstan is possible not only as an element of diversity, but also as a professional type of ungulates.

In Kazakhstan, under the influence of anthropogenic and environmental factors, saigas have been threatened with extinction in the last decade. For the first time in the 20s of the XX century, only hundreds of individuals of these animals were preserved in the most remote places of the Betpakdala-Arys, Ustyurt and Volga-Ural deserts. In this regard, the production of saiga was completely banned in 1919, which was taken under protection as a rare and endangered species. In the 40s on the territory of Central Kazakhstan,

each of the saiga herds did not have more than a few hundred heads, only in one herd more than 1000 animals were identified. During this time, about 2-3 thousand saigas lived in the Republic [2].

Results and discussion. The purpose of this article is to analyze the dynamics of the saiga population in the Republic of Kazakhstan and describe the factors of anthropogenic, genetic and environmental factors that may affect their number and justify ways to preserve the Kazakh population of these animals.

The main part of saigas (80-85%) is concentrated in Kazakhstan. Small parts of the range are found in the Russian Federation, Uzbekistan, Turkmenistan, and Mongolia. Three geographical populations of saiga in the Republic of Kazakhstan are shown in figure 1, which include: Betpakdala-Arys (between Balkhash and the Aral sea), Ustyurt (between the Aral and Aral sea), and Ural (between the Ural and Volga rivers).

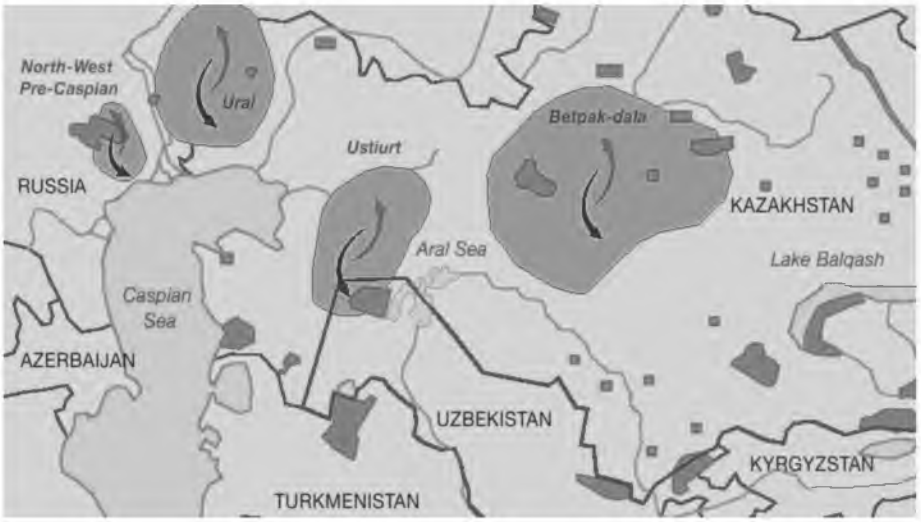

Figure 1 – The zone of distribution of the saiga population

In winter, part of the Ustyurt population moves South to neighboring Uzbekistan, while small groups move to Turkmenistan. Part of the Ural population reaches the border regions of Russia. With the onset of spring, it returns to the territory of Kazakhstan.

Over the past two decades, the prevalence of saigas has decreased significantly. These animals are found in very small numbers in the moynkum desert, in Northern and southern Balkhash, as well as in the Aral buckwheat and Mangistau regions.

All three Kazakh populations are located on a territorial scale significantly isolated from each other, and their distribution in the territory is distinguished in the form of numerous small groups. They do not regularly stop in the same region [3].

The dynamics of sharp changes in the saiga population is observed. In 1991-1993, if there were 800-900 thousand heads in Kazakhstan, their number has decreased over the past six years.

Since 2015, there has been a sharp decline in the number of saigas, and in 2016, their number dropped to 108,300.

In 2005-2009, compared to 2003, the number of these ungulates increased slightly, which is a result of increased protective measures and relatively favorable climatic and climatic factors during this period (table 1).

Table 1 – General according to the statistics Committee of the MNE of Kazakhstan,
14 facilities are planned to be commissioned in Kazakhstan from 1999 to 2015. dynamics of the saiga population by section

Years										
2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Total number, thousand heads										
61.073	81.0	89.6	102.0	137.5	187.0	256.7	295.4	108.3	152.6	215.1

Thus, the number of Betpakdala population in 2008-2009 increased from 32.3 thousand to 45.2 thousand, i.e. by 39.9%. During this period, the number of the Ustyurt population decreased by 1.2 thousand and is gradually decreasing. The main reason is ineffective protection and pressure on poaching in Uzbekistan, where saigas move in the winter. On the contrary, the number of the Ural population increased from 18.3 thousand in 2008 to 26.6 thousand in 2009, i.e. by 45.3%. This trend has been observed in recent years, for example, by 2015 their number has doubled (figure 2).

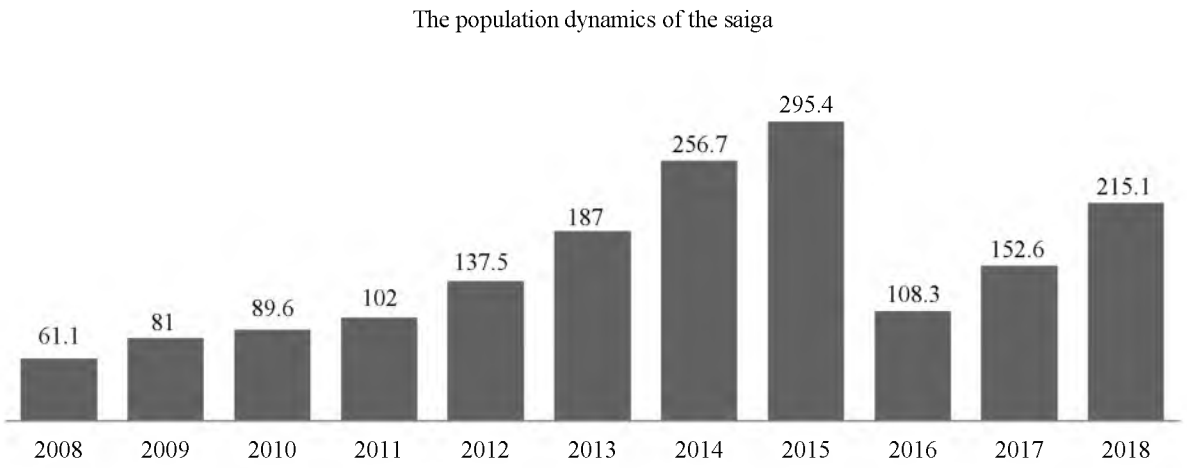

Figure 2 – Dynamics of the saiga population over ten years

Since 2010, the absolute number of saigas has increased significantly. For example, if in 2002-2009 their number changed from 30.0 to 81.0 thousand, then in 2015 they reached 295.5 thousand, that is, an increase of 3.6 times.

The main localities where saigas live, including Kystau and Otel, are currently the lakes Torgai, Zhylanshyk, Baikonur, Akkol, Shalkar-Teniz, Aralo-Grechikha, Northern Ustyurt and North-Western Volga, Pribalkhashye. In General, the farm is developed and located at a distance from settlements and pastures. The main population of saigas on the Volga-Ural in recent years is located on lake Aralsor. On the plateau, these ungulates are concentrated in the Sands of the greater and lesser Borsuk. On the slopes of this zone grow grassy and grassy plants that have a high nutritional value of pastures [4].

With the exception of Betpakdala (due to a sharp decline in the number of) portions of the calving of saiga remained mostly unchanged. The main areas of excitement moved to the North-West, along the Zhylanshchyk river and along the Torgai river on the Shalkar-Tengiz lake.

In Ustyurt, as in previous years, the main breeding sites are bass tassai, in the villages of Asmantai-Matai, Kosbulak, Koshkara and the manesai and Shagan rivers. The main places of mass calving of the Volga-Zhaiyk saigas moved to the North: from the area of lake Aralsor and Borsy moved to the North-East.

Due to the stress of the saiga's range, there was a reduction in its migration routes and duration.

Like any biological object, the saiga population is affected by limiting factors, which are divided into abiotic (climatic, natural), biotic (predators, parasites, diseases) and anthropogenic (poaching, human economic activity). All these factors lead to a significant decrease in the number of ungulates examined to a certain extent or to another degree. Over the past decades (70 years), there are serious reasons that contribute to the widespread decline of saigas, including cold, snowy winters, as well as epizootics of foot-and-mouth disease and pasteurellosis. Poaching, mainly in recent decades, has played a crucial role in reducing the number of saigas. This is especially true in the Ustyurt population, where the number of ungulates in 2015 slightly exceeds 1.0 thousand heads and has decreased by 200 times compared to 1999. It is obvious that it is impossible to objectively determine the size of poaching, however, according to information about the detention of poachers with the corpses and horns of saigas in the media, this phenomenon is widespread today. By shooting male cattle (in years of depression, their share in the herd does not exceed 3.0-6.0%), poachers violate optimal sexual relations, thereby changing the reproductive

abilities of the population. As a result, fertilization is reduced, since many females remain single, while the annual growth rate and reproduction rate of the species are reduced.

Among infectious diseases of saigas, foot-and-mouth disease and pasteurellosis are the most dangerous. The presence of pathogens of foot-and-mouth disease and pasteurellosis was confirmed by bacteriological method by isolating pure cultures from those that fell in 1956, 1958, 1967, 1969, and 1974. Among the antelopes dominated by females and young animals. In may 1981, there were about 100 thousand saigas on the territory of Kostanay region. in 1988 and 2015, respectively, 440.0 and 148.8 thousand saigas were killed. The last epizootic took place in the Akmola and Aktobe regions, with the exception of the Kostanay region, which is the most widespread cause of the death of saigas.

The last large-scale epizootic of pasteurellosis was registered in may 2015 on the territory of three regions at once. The first case of saigas was registered on may 11 in the village of Zholaba in the Dzhangelda district of Kostanay region.

In General, during the 60-year observation period in Kazakhstan, about 100.0 and 805.7 thousand saigas were destroyed from foot-and-mouth disease and pasteurellosis, respectively.

During this time, a mass murder occurred in the Aktobe and Akmola regions. In total, on June 22, 2015, 148,800 saiga heads were eliminated, including 127775 in Kostanay region, 10358 in Aktobe region and 10667 in Akmola region.

The extensive epizootic of pasteurellosis (may 2015) caused an intense public outcry. There were numerous assumptions about the reasons for the mass death of the saiga. Some of their variants:

– tympanic shortening of the saiga's stomach, the shrinking of the stomach as a result of fermentation of green grass.

– anaerobic enteroxemia, it is also formed under the influence of oxygen juicy green grass soaked by animals in heavy precipitation. When opening saiga feeds in the digestive system, bacteria multiply widely and secrete toxins, the toxin penetrates all internal organs through blood vessels, and affects the nervous system.

– a group of variants that try to explain saigas with infectious (bacteria and viruses) and parasitic diseases, namely: intestinal clostridiosis; hemolytic sepsis; epizootic hemorrhagic disease of a viral nature that transmits blood-sucking mosquitoes; teeliosis caused by protozoan blood parasites, which are carriers of hiccodid mites of the Hyalomma breed; hemorrhagic septicaemia or pasteurellosis.

– the heptyl hypothesis, according to which rockets are formed as a result of poisoning with toxic components containing heptyl during launches from the Baikonur cosmodrome and other polygons.

– poisoning in Soviet times from the remnants of biological weapons with pathogenic microorganisms.

The researchers denied that some assumptions were not confirmed. For example, the heptyl hypothesis, according to which the death of saigas could not find a scientific basis and poisoning with rocket fuel and waste of biological weapons. The last accident of the proton-M launch vehicle occurred on may 16, and the first cases of saiga deaths were observed on may 11, 2015. A pet that spreads in saigas does not die from tympanic scarring of the stomach and anaerobic enterotoxemia for any reason. Namely, from bacteria and protozoa detected only pasarelele culture. In particular, according to the Rosselkhoznadzor, the pathogen of hemorrhagic septicemia or Pasteurella multocida b was detected in all samples in the reference laboratory of particularly dangerous diseases on June 1-2, 2015 in Akmola, Aktobe and Kostanay regions [5].

With a sharp decrease in animal immunity, the risk of developing pasteurellosis in animals (pasteurellosis; synonym for hemorrhagic septicemia) increases.this is an infectious disease that belongs to the group of zoonoses and occurs mainly as septic conditions. The causative agent of pasteurellosis is bacteria of the genus Pasteurella of the Brucellaceae group, which are pathogenic for many animal species. Pasteurellosis is accompanied by acute or chronic infection, the incubation period is from 1 to 9 days. The disease is accompanied by septicaemia, symptoms of upper respiratory tract infection and enteritis. With the same types of sick animals, the severity may be different. The disease can be one of the types of animals, different in severity. Transportation of Bacillus is very common.

Thus, among the totality of abiotic, biotic and anthropogenic factors that limit the impact on saiga reproduction, the biotic impact of the pasteurellez epizootic is important first of all. Epizootics of pasteurellosis occurs in may. Calving females, as well as their newborn offspring, are physically weak for some time. The weakened gene pool of the population contributes to the weakening of the General

immunity of this species. Reducing the body's resistance to microflora, in particular, the most common pasteurelles of healthy animals in the body, causes a rapid increase in the virulence of these microbes, which increases the death of saigas (females and young).

According to scientists, the depletion of the saiga's gene pool is associated with tight inbreeding. In the late 40s of the XX century, the original Kazakh population of saigas did not exceed 2-3 thousand heads. Geneticists call this phenomenon in the animal population the "bottle neck" effect. Widespread epizootics of pasteurellosis and other infections (foot-and-mouth disease) as a result of exposure to the "bobbin neck", there is a probability of recurrence among saiga populations with weakened immunity. In the coming decade, their number may be reduced to a minimum. To date, there is little experimental work on the sensitivity and immunity of animals to pasteurellosis.

In order to test this assumption, experiments were conducted, as a result of which they did not cease to exist during alimentary infection of rodents, only when bathing in cold water, 3 people (20.0%) of 15 sandblasters died. Cultures of all organs of the pathogen of pasteurellosis, as well as urine and excrement were isolated from them. Adverse conditions for sandstones, such as cooling, can contribute to the rapid flow of the infectious process, which ends in death. During the spring period, the amount of precipitation increases sharply for saigas, and when the weather is cool, they become weak and lead to the development of pasteurellosis. The mechanism of action is a genetic syndrome named as the initiator. Therefore, if in may they have cold and rainy weather in the trenches, then saigas can be killed from pasteurellosis [6].

Conclusions. Scientists believe that on the basis of the conducted research, the following urgent measures should be taken:

Vaccination against pasteurellosis should be carried out in April, the time of saiga lambing, by air vaccination. After feeding animals with vaccinated herbs, their body forms a stable immunity from pasteurellosis for up to several months. This will allow saigas to experience adverse periods of the year.

In places of mass calving, it is necessary to create favorable conditions for the breeding stock, especially to strengthen the protection of the "rest zone". In these zones, 10-15 days before the lambing and 15-20 days before the lambing, all economic activities are prohibited (grazing, driving vehicles, etc.), as well as the fight against predatory animals is an urgent task.

To study the course of the infectious process, it is necessary to conduct an experiment of infection with the pathogen pasteurellosis under normal conditions and at different temperatures and humidity.

Only by taking these measures will it be possible to preserve the saiga as a species in the mammalian fauna of Kazakhstan.

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ҚАЗАҚСТАН РЕСПУБЛИКАСЫ ТЕРРИТОРИЯСЫНДА ПАСТЕРЕЛЛЕЗ АУРУЫНЫҢ КИІК (SAIGA TATARICA) ПОПУЛЯЦИЯСЫНА ӘСЕРІ

Аннотация. Ақбөкен *(Saiga tatarica)* – Еуразияның шөл және жартылай шөлейт аймақтарында мекендейтін табынды жануарлар. Халықаралық табиғат және табиги ресурстарды қорғау одағы бұл түрді өзінің қызыл тізімінде «жоғалу шегінде» деп жіктеді. ҚР-да киіктердің жұқпалы аурулармен ауыруы аз зерттелген.

Әр жылдары ақбөкен популяциялары көптеген факторлардың әсерін бастан кешірді: климаттық, биологиялық және антропологиялық. Олардың әрекеті жануарлардың тікелей қырылуына да, олардың репродуктивті әлеуетін төмендетуге де әсер етті. Бұл факторлардың ақбөкен популяциясына әсер ету дәрежесі әртүрлі уақыт кезеңдерінде бірдей емес. Бұрын ақбөкен санының динамикасында климаттық факторлар болды. Кейбір жылдары ақбөкендер аусыл және пастереллез ауруларынан жаппай қаза тапты. Кейінгі қолайлы жылдары олардың саны қалпына келтірілді. Сонымен қатар осы түрдің сүтқоректілер популяциясының соңғы жылдары ресми деректер бойынша жұқпалы аурулармен байланысты.

Осылайша, проблеманың қазіргі жай-күйіне талдау көрсеткендей, популяциясы Қазақстан аумағында мекендейтін киіктердің инфекциялық ауруларын зерттеу жүргізілмейді. Ақбөкен популяциясының жаппай қырылуы бұл мәселенің өзектілігін және проблеманы кешенді зерттеу қажеттігін көрсетті. Осыған байла-

ныcты киік популяцияларын сақтау үшін жабайы жануарлар арасында аурулардың пайда болуының факторларын зерттеу қажеттілігі туындады. Осы міндетті шешу үшін инфекциялық, паразиттік және протозойлық аурулар бойынша кешенді зерттеулер жүргізу, аурулардың таралуының табиғи көздерін, үй жануарларының инфекция көздері ретінде әсерін анықтау қажет. Сонымен қатар, ауыл шаруашылығы жануарлары арасында аурудың таралу көзі ретінде киіктер арасында инфекция жұқтыруды ескеру қажет.

Жануарлардың осы түріниң жаппай қырылуына әкелетін фактор ретінде киіктердің жұқпалы патологиясы мәнінің артуы, ерекше алдын алу құралдары мен әдістерінің болмауы осы жұмысты жүзеге асырудың мақсатқа сай екендігін және өзектілігін куәландырады.

Зерттеу нәтижелері негізінде ақбөкендердің аса маңызды жұқпалы ауруларына қарсы арнайы алдын алу құралдары мен әдістері, сондай-ақ дала жағдайында жабайы жануарларды жаппай иммундау әдістеріне қойылатын талаптар әзірленетін болады.

Қазіргі уақытқа дейін жануарлардың жұқпалы патологиясында қандай мәселелер өзекті екені белгісіз. Әдеби дереккөздерде ақбөкендерде кездесетін аурулар туралы тек қана жеке хабарламалар бар, олардың жаппай қырылуы әртүрлі жылдары пастереллездің дамуымен байланысты. Сондықтан осы індеттің алдын алу бойынша шаралар қабылдау шешуші қадам болып табылады.

Түйін сөздер: киік, вакцина, популяция, пастереллез, территория, сүтқоректілер, қоныс аудару.

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ВЛИЯНИЕ ПАСТЕРЕЛЛЕЗА НА ПОПУЛЯЦИЮ САЙГАКА (SAIGA TATARICA) НА ТЕРРИТОРИИ РЕСПУБЛИКИ КАЗАХСТАН

Аннотация. Сайгак *(Saiga tatarica)* – стадное животное, обитающее в пустынных и полупустынных зонах Евразии. Международный союз охраны природы и природных ресурсов в своем красном списке классифицировал этот вид как «в пределах исчезновения». В РК заболеваемость сайгаков инфекционными заболеваниями мало исследована.

Популяции сайгаков в разные годы испытывали воздействие многих факторов: погодно-климатических, биологических и антропологических. Их действие вели как к прямой гибели животных, так и к снижению их репродуктивного потенциала. Степень воздействия этих факторов на популяции сайгаков в разные временные периоды неодинакова. Ранее ведущими в динамике численности сайгака были погодно-климатические факторы. В некоторые годы сайгаки в массе гибли от болезней ящура и пастереллеза. В благоприятные последующие годы численность восстанавливалась. В то же время значительный урон популяции млекопитающих данного вида в последние годы по официальным данным связан с инфекционными заболеваниями.

Таким образом, анализ современного состояния проблемы показывает, что изучение инфекционных болезней сайгаков, популяции которых обитают на территории Казахстана, не проводится. Массовая гибель популяции сайгаков показала актуальность этого вопроса и необходимость комплексного изучения проблемы. В связи с этим для сохранения популяций сайгаков назрела необходимость изучения причинно-следственных факторов возникновения заболеваний среди диких животных. Для решения этой задачи необходимо проведение комплексных исследований по инфекционным, паразитарным и протозойным заболеваниям, выяснения природных источников распространения заболеваний, влияния домашних животных как источников инфекции. Кроме того, необходимо учесть о возможном носительстве инфекций среди сайгаков как источников распространения заболевания среди сельскохозяйственных животных.

Повышение значения инфекционной патологии сайгаков как фактора, приводящего к массовой гибели данного вида животных, отсутствие средств и методов специфической профилактики свидетельствует о целесообразности и актуальности реализации данной работы.

На основании результатов исследований будут разработаны средства и методы специфической профилактики против наиболее значимых инфекционных заболеваний сайгаков, также требования к массовым методам иммунизаций диких животных в полевых условиях.

До настоящего времени неизвестно, какие проблемы заразной патологии у животных актуальны. В литературных источниках имеются только отдельные сообщения о заболеваниях, встречающихся у сайгаков, массовая гибель которых в разные годы связана с развитием пастереллеза. Поэтому принятие мер по профилактике этой эпидемии является решающим шагом.

Ключевые слова: сайга, вакцина, популяция, пастереллез, территория, млекопитающие, миграция.

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