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Innovative Research and Training Center for Human and Animal Health Protection in Kyrgyzstan

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Abstract

According to the results of an experimental study in the zones of ecological trouble in the Chui region of Kyrgyzstan for the trophic purpose: - soil - water - plants - animals on the content of macro- and microelements and heavy (toxic) metals in them, the so-called biogeocenotic pathologies in animals are widespread. For the purpose of constant national monitoring of the ecosystem in Kyrgyzstan, it is necessary to create an innovative scientific and educational center for the protection of human and animal health (INAC).

Keywords: Experiment; Center of innovation; Heavy metals; macro- and microelements; Ecological situation; Soil, Water; Plant.

Originality of Research and Novelty

It lies in the fact that a comprehensive study of the ecological situation in the Chui zone of Kyrgyzstan in terms of the content of macro- and microelements and heavy (toxic) metals in the system: - soil - water - plants - animals has become the main task of this study. And, the result of experimental studies showed that in soil, water, plants, as well as in the blood (organism) of animals, there is a serious imbalance in the content of macro- and microelements and heavy elements, namely, the amount of arsenic exceeded 8.0 times, essential trace elements (iron, copper, manganese, zinc, selenium, cobalt and iodine) were extremely low in relation to the normative indicators.

Kyrgyzstan is a developing mountain country, they occupy more than 95% of the total territory of the country. Climate sharply continental: the air temperature in winter sometimes reaches -53,6^{0}C, in summer, up to +44^{0}C, the annual precipitation rate is from 150 mm up to 750 mm, snow cover is constantly changing from 4 cm to 200 cm, eternal permafrost covers an area of 67 thousand km^2, i.e., 34% of the area of the Republic with the highest solar radiation is 136 kcal cm^2 to 161 kcal / cm^2 [1].

In this regard, Kyrgyzstan supported the agreement of seventeen goals Sustainable Development Goals (SDGs) until 2030, adopted in Paris. As noted in his speech, Ex-President of the Kyrgyz Republic S.Sh. Jeenbekov on the 73rd sessions of the UN General Assembly (18-September, 2018), which for one of the national priorities of Kyrgyzstan is ecology [2]. It should be noted that Kyrgyzstan is particularly concerned about intensive melting of glaciers, by 2025 the total area of glaciers and the Republic may be reduced by an average of 30-40%, Hereupon reduce the volume of water in Kyrgyz rivers by 20-35%. This of course, sharply they enhance the processes of erosion and degradation of mountain ecosystems [1,2].

Currently, more than 60-70% of arable land is under threat of erosion and degradation, and irrigated arable land per inhabitant is reduced from 0.18 ha to 0, I by 2030. Also on these lands under the influence of anthropogenic there is also a loss of soil quality, such as the loss of humus in arable land it is from 16 to 50% in comparison with virgin counterparts [3].

The Republic has a great potential for natural forage lands that currently amounts to 9.2 million hectares, or 86% of total agricultural land, but more than 60% of it they were subjected to various types of degradation [2]. So deplorable the situation is developing for the protection of human and animal health [4]. Changing the ecosystem in Kyrgyzstan was the impetus for the emergence of a new, previously unknown disease-called biogeocenotic pathology. Biogeocenotic pathology is a mass plant disease, animals and humans that occur as a result of adverse weather conditions changes in ecosystems [5-8].

Based on the above, it can be noted that a sharp change in ecosystems in Kyrgyzstan, especially in recent years requires scientists to a new, innovative approach to solving this problem, since the old methods have become ineffective. Therefore, timely study of the biogeocenotic environment (ecosystem) and earlier warning of changes, is very current issue [1], [9-11], [16].

To solve this problem, it is necessary to createan innovative research and training center for human and animal health in the Republic, and regularly monitor the ecosystem in Kyrgyzstan.

The purpose of the study is to develop science-based on measures to optimize the ecosystem in Kyrgyzstan with the creationof an innovative research and training center for human andanimal health, and the tasks are;

- Conduct comprehensive environmental monitoring in the Chuizone of Kyrgyzstan on the content of macro-and microelements and heavy metals in the system: - soil-water-plants-animals;
- Develop and offer a model of an innovation center for human and animal health.

Methods

Complex study of biogeocenotic (environmental) conditions in the Chui zone and their impact on the occurrence of biogeocenotic pathology. For this purpose, scientific and non-research and special laboratories equipped with state-of-the-art equipment. Scientific and experimental research in animals was carried out in "Kyrgyz MIS", SHK "Vetka", SKH "Chabret" and GPP "Sokulukskiy" (in the period from 2000 to 2019). Experimental farms were located 2-3 km from industrial cities such as Bishkek, Tokmok, Kant, and Kara-Balta. In these cities are concentrated most large (more than 1,000) industrial organizations, as well as in the Chui region there are several the tail storages as AK-Tuz, Kara-Balta, Orlovka and through the territoryregion is the main interstate highway South-North. Environmental monitoring was carried out in different biogeocenoses of the Chui zone for the content of macro-and microelements and heavy metals in the system: - soil-water-plants-animals. The content of macro-and microelements and heavy metals in soil, forage plants, and animal blood was studied using an atomic emission spectrophotometer with inductively coupled plasma ICP-ATSOPTIMA 5300 DVU-JCP-MS Elan DRC.

Sampling of experimental and control samples of soil, water, and forage plants and the blood of animals was pronounced, according to the existing GOST and software unified methods recommended in medicine and veterinary medicine. Experimental experiments were conducted onblack-and-white cows in the last month of pregnancy, as well as their calvesup to ten days of age. For control animals, studies were performed using the same methods and method as for the experimental group, butonly from well-off zones (regions) of the Republic on clinically healthy animals. Hematological blood tests (experimental andcontrol) of animals were performed according to unifiedmethods used in veterinary medicine [17,18].

Results

In as a result of complex research of biogeocenotic (ecological) the situation in Kyrgyzstan, especially in the different areas of Chui region, we came to the conclusion that the environment in the Republic in recent years are changing dramatically, so timely study of the ecosystem and earlier prevention of its changes is a very urgent task modern science and practice. In this regard, wehave studied soil, water and feed as a component of a particular biogeocenosis. They are of great importance, especially in the study of biogeocenoticpathology in cattle. Soil, water, feed as components of a certain biogeocenosis are of great importance, especially when studying biogeocenotic pathology in cattle. It has been established that the main cause of causing biogeocenotic pathology in cattle is the imbalance of a certain biogeocenosis of macro- and microelements and heavy metals in the soil, water, feeds (plants) [9,10], [11,13,15].

Comparative results of the content of macro- and microelements and heavy metals in soil, water, feed and blood of animals in experimental farms show that the number of individual macro- and microelements in the soil of an ecologically unfavorable biogeocoenosis is significantly different compared to the basic indicator, e.g. the content of manganese, copper, cobalt, gland, selenium and iodine is much lower, and the amount of calcium, phosphorus and magnesium, on the contrary, is greater than the threshold concentration. If we take the water data, we can conclude that the content of some elements, like calcium, magnesium, phosphorus, iron, copper, manganese, selenium, molybdenum, cobalt, iodine is reduced, and the other, like zinc, is slightly increased from 0.005 mg/l to 0.007 mg/l.

The content of macro- and microelements in the feed indicates that some indicators, for example, the amount of calcium and magnesium became larger, respectively, by 24.2% - 39.3% compared to the norm. Other biogenic elements, such as phosphorus, iron, copper, manganese, zinc, selenium, cobalt and iodine in the feeds (plants), of this

biogeocenosis were significantly lower than the control samples. This difference in the content of macro- and microelements in soil, water, and plants (feed) affects, in turn, the number of these elements in the blood of animals. The total calcium in the blood of experimental cows and their calves is at the lower limit of the physiological norm, and the amount of phosphorus decreased from 6.9 mg% to 2.9 mg%. This indicates a possible violation of the ratio of calcium to phosphorus (normal ratio- 2:1). From the analysis of blood results on the content of macro - and microelements, it can be noted that almost all indicators were extremely low compared to the control indicators. This is to say that in experimental animals, metabolism, especially mineral metabolism, is disrupted [8], [14,16], [19].

Also within the experimental research, we studied the contents of toxic elements (Pb, Hg, Cd, Ni, As) in soil, water, plants (feeds) and animals bloods (cows and calves). According to the results of the research in the soil, water, feed and blood the toxic elements (heavy metals) like lead, mercury, cadmium, nickel are within the permissible norm with the exception of arsenic (see the table).

Table 1. The content of heavy metals in soil, water, plants (feeds) and blood in experimental animals

№	Chemical element	Researched samples					Control sample (maximum permissible concentration)				
		soil, mg / kg	water, mg / l	Feed mg / kg	blood, mg / l		soil, mg / kg	water, mg / l	Feed mg / kg	blood, mg / l	
					cow	Calves				cow	Calves
1.	Lead (Pb)	0,1	0,02	1,07	0,03	0,016	0,3	0,03	3,0	0,1	0,1
2.	Mercury (Hg)	0,05	0,01	0,08	0,0005	0,0003	0,1	0,0001	0,05	0,005	0,005
3.	Cadmium (Cd)	0,01	0,002	0,25	0,0006	0,0005	1,0	0,001	0,3	0,03	0,03
4.	Nickel (Ni)	0,05	0,005	0,99	0,05	0,05	4,0	0,1	2,0	0,12	0,12
5.	Arsenic (As)	0,2	0,04	0,23	0,40	0,40	0,15	0,05	0,25	0,05	0,05

The arsenic concentration exceeds 8.0 times, or up from 0.05 mg/l to 0.40 mg/l in experimental animals. The results of experimental studies have shown that there is a serious imbalance in the content of macro and microelements and heavy metals in soil, water, feed, and also in blood in experimental animals. This leads to a disruption in the circulation of substances in the biogeocenosis, i.e. there is a change in the biogeochemical trophic (food) chain: - soil - water - feed - animal. As a result, various biogeocenotical pathologies occur in animals [5-7], [10,18,20].

To solve this problem, it is necessary to create in the Republic innovative research and training center for human health and animals. The center is designed to unite the old (Soviet) still separately operating organizations (institutions) in the field of education ecology in Kyrgyzstan, as the Department of environmental monitoring (OEM),NGO "Preventive medicine", soil and agrochemical stations (RAPS), veterinary, toxicological and medical laboratories responsible for monitoring the environmental situation in the Republic, also some laboratories and departments of scientific research institutes in one, research and training center for human health and animals. And quickly solve the issues that are coming to optimize the ecosystem in Kyrgyzstan.

The innovation center (INUC) mainly consists of the following departments that meet the main tasks of the center, but if necessary, you can also open other departments.

So, the first department for conducting educational work, that is training and retraining of specialists is carried out here biogeocenologists in the field of ecology, soil science, medicine, veterinary medicine, hydrology, anthropology, agronomy, toxicology, etc. The second division for the conduct of research work. In it the environmental situation in a particular area is regularly studied (district, region, city, etc.), i.e. soil resources, vegetation resources, air, water, anthropogenic factors, biogeocenotic pathologies in plants, animals, and humans.

In the next department for information, consultation and preparation of textbooks. Preparation and printing are performed here manuals, textbooks, monographs, booklets, recommendations, brochures, as well as public awareness and information through the mass media. Preparation of scenarios and filming, demonstrations of short films, video ads, and scientific reports on issues environmental situation of the Republic.

In the Department for international cooperation and training international projects, conduct international collaborations international partners such as UNDP, VOZ, UNESCO, SIDA, SNF, INTAS, SCOPES, FAUN, ICARDA, SIMMIT, ISTC, LOGO, BBV, TEMPUS, OIE, etc. Joint training is also being implemented international projects,a specifically dedicated to soil, plant, water, air resources, anthropogenic factors, climate change, also on the study of biogeocenotic pathologies in plants, animals, and humans.

Discussion

Many scientists who conducted a similarstudy term existence of biogeocenoses as elementary structural units of the earth's biosphere. They concluded thatthere is an ecological balance between animals and their fooditems that prevents the occurrence of enzooties (diseases). If this balance is disturbed, then certain biogeocenotic pathologies occur in animals [7,8].

Therefore, a comprehensive study of the environmental situation in the Chuizone on the content of macro-and microelements and heavy metals inthe system: - soil-water-plants-animals became the main task of ourresearch. The results of experimental studies have shown that in the soil, water, plants, as well as in the blood of experimental animals, there is a serious imbalance in the content of macro - and microelements and heavymetals. Some other scientists also came to this result [8-10], [13,14], [16,20].

In order to solve such problems, it is necessaryto create innovation centers (INUC) in the Republic, similar centers with suchfunctions and tasks are not yet available not only in Kyrgyzstan, but also outside the country [5,11].

Innovative research and training center for the protection of human health and the organization will be a state institution, guided by in its activities, the Constitution of the Kyrgyz Republic, regulatory and legal acts in the field of education and science.

INUC represents by yourself creative community highly qualified specialists and researchers, based on professional interests and affirming humanistic values education and science. At the beginning to implement the goals and objectives of this project a group of scientific non-researchers will work, and in the future with the creation of innovation center in districts, regions, cities and the Republic at the expense of optimization of national centers, organizations and institutions, a completely new creative community is being created-biogeocenologists. Their in the future, as new highly qualified specialists, it is necessary to prepare in higher educational institutions of the Republic.

Conclusion

- It has been experimentally proven that the soil, water, plants and blood of experimental animals in the Chui region of Kyrgyzstan contains extremely low levels of individual macro- and microelements, such as iron, copper, manganese, zinc, selenium, cobalt and iodine, and the content of a highly toxic element, as arsenic exceeds the norm by 8.0 times.
- It is necessary to organize an innovative scientific and educational center for the protection of human and animal health in Kyrgyzstan for the timely development of evidence-based measures to optimize the ecosystem, as well as to prevent in advance biogeocenotic pathologies common to humans, plants and animals.

Strong side

- For the first time it has been experimentally proven that in the Chui region of Kyrgyzstan, individual microelements are contained at an extremely low level, and the level of a highly toxic element, like arsenic, exceeds the norm by 8.0 times, according to the trophic purpose: - soil - water - plants - animals.
- On the basis of comprehensive scientific research, it is recommended to organize an innovative scientific and educational center for the protection of human and animal health in Kyrgyzstan to optimize the ecosystem in the republic, as well as to prevent in advance biogeocenotic pathologies common to humans, plants and animals.

Weak side

- Poor knowledge of the influence of negative environmental factors on the occurrence of biogeocenotic pathologies in humans and plants in Kyrgyzstan.
- INTC is intended to unite the old (Soviet) still separately operating organizations (institutions) in the field of environmental studies in Kyrgyzstan.
- Further comprehensive study of the situation in other regions of Kyrgyzstan, but the impact of negative environmental factors on the system: - soil - water - plants - animals.

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