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INTRODUCTION

The unregulated use of genetic resources of the Holstein and other improving breeds causes the acute problem of conserving the gene pool of domestic breeds, the extinction of which will lead to a decrease in the biological diversity of genetic resources and, most importantly, to the loss of the cultural heritage of the nation. Domestic cattle populations retain significant individual variability in their genetic structure compared to commercial breeds. They have their own allele combinations and may be an important reserve of genetic variability for commercial animal breeds. Obviously, such alleles should be detected, conserved, and used in breeding work.

An important issue is a significant number of genetic abnormalities, which are the manifestation of the genetic load in populations, and should be eliminated from the breeding process.

For the conservation and rational use of breeding (genetic) resources of cattle at the cellular level, it is necessary to create cryobanks of gametes for long-term storage in order to further sell them for reproduction.

Therefore, the conservation of genetic resources in animal husbandry is a requisite that follows from the possibilities and reality of the diversity of the gene pool available in the country, which determines the productive and adaptive capabilities of individual cattle breeds. Domestic breeds are carriers of unique genes and gene complexes, which cannot be restored if they disappear. Therefore, they should be considered as a valuable cultural, intellectual and genetic heritage of all mankind.

The uniqueness of autochthonous cattle breeds lies in the fact that the quality of their dairy products is unique. It is this property that creates conditions for the competitiveness of such breeds as Lebedyn, Ukrainian Brown dairy, Brown Carpathian, in comparison with specialized dairy breeds. The unique genotype of these animals enables to get milk with a high content of components and their high quality. An example may be the high frequency of the desired kappa-casein genotype in cattle of the Lebedyn breed. One of the new ways to improve the quality of milk is to determine the genotype of cattle based on beta-casein that is due to the impact on human health.

This is what shows a clear need for the study of cattle genotypes and the creation of herds and micropopulations with the desired genotypes for kappa- and beta-casein.

1. RATIONAL FOR THE RESEARCH DIRECTION

1.1. Scientific and methodological, and organizational aspects of preserving the cattle genetic resources

Today, scientists state that the process of improving the productive qualities of farm animals leads to the substitution of uncompetitive breeding material of native breeds. At the same time, non-commercial breeds, primarily local, are the carriers of valuable gene complexes [1, 2, 3, 4, 5, 6].

The problem of preserving existing biodiversity has become global on the planet. This is due to the fact that reserves of genetic variability in the animal world are considered in the light of increasing requirements for livestock breeds in terms of their compliance with disease resistance, long-term economic use in industrial technology for the manufacture of livestock products [7].

At the same time, the globalization of food production, including agricultural production, has led to the fact that agricultural producers, keeping uncompetitive aboriginal cattle breeds, risk losing the profitability of production [8].

The loss of natural diversity has contributed to the development of measures for joint efforts of the world community in terms of preserving cattle breeding resources [9]. In recent decades, documents have been adopted that will help create conditions for the preservation of existing genetic material [10, 11].

The scientists [12] believe that the preservation of genetic diversity in animal husbandry is an integral element and a full-fledged component of the overall process of managing the genetic resources of animals. The main element of animal biodiversity preservation is the breed.

Continuous work with specialized highly productive breeds of cattle is the basis for meeting the needs of society with livestock products. 29 breeds of cattle are developed in Ukraine. It is generally known that animals of each breed are characterized by specific biological and economic features [14]. In dairy cattle breeding, the most used breeds are the Ukrainian Black-and-White, Ukrainian Red-and-White and Ukrainian Red dairy, Holstein [13].

Local breeds of farm animals, in the process of intensifying the breeding process, are replaced as uncompetitive material [15, 14]. This process results in the gradual substitution of their breeding

material. This reduces the amount of livestock. As a result, scientists note a rapid decrease in the natural diversity of cattle. Therefore, they believe that the solution to this problem covers theoretical and practical issues.

Because of this, the problem of preserving the gene pool of farm animals covers a wide range of theoretical and practical issues that are multifaceted. The researchers believe that the genes that determine the original traits of breeds, regardless of their role in shaping the genetic potential of livestock productivity, are of the greatest value [15].

Most countries of the world have their own local animal breeds, whose contribution to the manufacture of food and agricultural products could potentially be much greater and more significant [16].

In Ukraine, the following breeds of cattle are on the verge of complete extinction: Gray Ukrainian, Whiteheaded Ukrainian, Brown Carpathian, Lebedyn. A small number of animals of these breeds creates a real threat of their extinction. The absence of livestock farms for breeding the Brown Carpathian cattle leads to a significant risk of their extinction in general. Therefore, according to the scientists, breeding few in numbers of domestic breeds is very problematic and requires not only the government support for maintenance, but also a special conservation program [13, 14].

According to the researchers, the actual measure that may be used to preserve local breeds is the creation and operation of gene pools, collectible herds. Pure breeding should be provided for and carried out with this purpose. To do this, under the guidance of scientists, it is essential to develop and implement on these farms special selection schemes, which are aimed at reducing the negative consequences of a limited number of breeding materials. All these measures are aimed at preserving the specific features of livestock characteristic of local breeds [13, 15].

The researchers note that the goal of working with native breeds is to preserve their valuable biological characteristics due to unique genes and their combination [17].

When developing a system for preserving the few breeding resources of farm animals, according to breeders and scientists, it is expedient to plan a survey and inventory of available breeding resources [13].

In addition, the scientists [15] suggest using absorption crossing with related breeds in order to increase the number of endangered breeds. At the same time, they argue that a mandatory element of the

accumulation of genetic material for the preservation of the gene pool of animals is the gene pool banks, in which semen, oocytes, embryos, and DNA samples are put for long-term storage.

In confirmation of this, I. V. Huzev [18] notes that it is advisable to consider the gene pool herd primarily as a producer of gene pool products (sexual and somatic cells), taking into account all the features of its use at various stages of a set of measures for regulated preservation of genetic diversity. Maintaining genetic variability at the appropriate level is an essential prerequisite for the modern cattle breeding process. The preservation of the gene pool of local, small-numbered and native animal breeds by the in situ method should be balanced with the preservation of the desired hereditary material by the ex situ method [19].

According to the scientists [6], gene pool subjects need financial support from the government. The lack of such support may lead to a significant loss of the gene pool of herds of native cattle breeds.

The scientists [20] substantiate and apply in practice the following approaches: modern methodology for preserving the diversity of genetic resources of animal husbandry in Ukraine; a set of biotechnological methods for the use or storage of biological objects ex situ, in vitro; a system for selecting a breeding stock in micro populations with a limited number of cattle; molecular genetic monitoring of domestic genetic resources.

O. V. Berezovskyi et al. [21] believe that the introduction of modern methods of molecular genetics makes it possible to identify molecular markers that can influence the formation of economically useful traits of dairy cattle. This enables to analyze hereditary information at the gene level. This makes it possible to increase the effectiveness of traditional breeding methods.

According to the scientists [22, 23, 24, 25], the disappearance of local breeds will lead not only to the loss of objectively invaluable genetic diversity, but also to a decrease in the genetic potential, which will fundamentally limit the possibilities of breeding work in the future. It is the development of theoretical foundations and improvement of organizational forms of cattle breeding in the context of conservation and careful study of the genetic structure of native and local breeds that is now very important. Modern methods of biochemical and molecular genetics can solve this issue.

Modern molecular genetics makes it possible to identify genes associated with economically useful traits of farm animals [26, 27, 28, 29, 30, 31].

According to the scientists, the study of polymorphism of structural genes with known functions of their products and various processes of general metabolism has recently become particularly important. The polymerase chain reaction (PCR) methodology is actively used to study the genetic variability of domestic animals, including control of origin; determination of genetic kinship between groups of animals, etc. [32, 33, 34, 35, 36].

In addition, at present, the issue of timely detection of hidden genetic abnormalities is important in animal husbandry. This is due to the fact that in modern conditions of animal breeding using artificial insemination, embryo transplantation, and the exchange of genetic resources of farm animals between countries and regions, various mutations can quickly spread in breeds and cause the spread of genetic abnormalities. Modern molecular genetic methods can help solve this problem. They make it possible to conduct early diagnosis and identify abnormalities in animals that do not show genetic disorders, but can be inherited by their offspring [23, 37, 38, 39]. I. V. Huzev [18] notes that breeding stock, before use, should pass the examination of origin, cytogenetic and phenogenetic control, genotyping for known QTL and DNA Diagnostics of genetic abnormalities, in particular in cattle – BLAD, complex spinal defects, DUMPS citrullinemia, factor XI deficiency, syndactyly.

D. M. Basovsky et al. [40] note that previously the main element of preserving local breeds has been the creation of purebred gene pool herds. Today, the main task is to reproduce specific genetic material in the form of replacement livestock, cryopreservation of gametes and embryos. In their opinion, the preservation and reproduction of the breed gene pool in Ukraine requires, first of all, the introduction of a set of measures aimed at the rational use of the existing gene pool.

The rapid development of biotechnology, which uses biological processes to produce highly efficient forms of organisms with the required properties, does not reduce, but rather increases the value of what has been created by evolution over thousands of years [41].

Biotechnology of animal reproduction is part of the general biotechnology, the methods of which are now used in many branches of the national economy. The biotechnology of reproduction contributes to:

- acceleration of the rate of genetic progress in animal husbandry;
- preservation of the animal gene pool in the form of semen bank, embryo bank and cryobank of oocytes;
- multiple replication of valuable genotypes, etc. [42].

In case of difficulties or impossibility of using conventional methods of reproduction of endangered animal breeds, the use of biotechnological methods of reproduction to preserve genetic information and transmit it to the next generations becomes relevant [43].

The development and implementation of the integrated use of biotechnological methods of reproduction of farm animals is an important issue. Taking into account the regularity of genetic processes in limited populations is particularly relevant in the development of methods and programs for preserving their gene pool.

The scientists [44] believe that one of the methods of rational use and preservation of the gene pool of local, small-numbered and native animal breeds is the formation of banks for long-term storage of biological material.

D. M. Basovskiy et al. [45] believe that modern biotechnology based on methods of embryological genetics is widely used for the conservation and rational use of animal genetic resources. The introduction of a superovulation stimulation system into cattle breeding practice with subsequent transplantation of the resulting embryos provides a significant increase in the number of offspring from genetically valuable breeding cows and a reduction in the generation interval.

According to the scientists [46], long-term storage of semen is of great importance due to the possibility of preserving small breeds. The conducted studies have shown that long-term storage of semen slightly reduces the motility, survival and integrity of the acrosome of the cell. In their research, some authors [47] drew attention to the need to study the morphology of bull spermatozoa, as one of the important indicators in assessing the semen fertilizing capacity. In addition to the main characteristics, it is important to study indicators related to the integrity of spermatozoid membranes. The researchers [48] believe that sperm testing using the Hypo-osmotic Swelling Test (HOST) can further predict the semen fertilizing capacity.

According to the results of research by A. O. Liashenko [49], it was found that the semen of bulls of the Simmental breed, with a shelf life of 31–45 years, was characterized by high values of pathological forms (more than 24%). Therefore, the author considers it a necessary element to conduct periodic monitoring of morphological and physiological parameters of semen. This will provide an answer about the feasibility of its further storage and the possibility of using it for the conservation of endangered breeds.

As a result of studying the scientific works of domestic and foreign scientists, it can be argued that solving the issue of preserving the gene pool of local breeds in our country requires solving certain tasks. One of the main ones is to constantly monitor the genetic resources of local breeds. It is important to continue scientific research on the genetic characteristics of endangered breeds and the possibility of improving them through the use of related breeds. An essential element is the improvement of biotechnological methods of their conservation. One of the areas that will improve the situation with endangered breeds is to provide information to the public about the specificity of our original breeds, their national significance and “cultural value”.

1.2. Features of the formation of the gene pool of Brown cattle breeds in the North-East of Ukraine

According to N. B. Mokhnachov [50], one of the risks of agricultural industrialization is the reduction of national genetic resources or gene pools of animals and plants. The loss of breed diversity, along with the disappearance of unique genetic combinations, leads to a limitation of the possibility of breeding work.

Modern Brown cattle of the North-East of Ukraine, which is mainly represented by the Ukrainian Brown dairy and Lebedyn breeds, are characterized by a double direction of productivity, with a bias towards dairy. The high genetic potential of milk productivity of the world-bred Swiss breed, according to the scientists, is due to a significant share of heredity of the American Swiss breed used to improve the Lebedyn and create the Ukrainian Brown dairy breeds [51].

The use of the Swiss breed to improve local brown cattle has been carried out not only in Ukraine. Thus, in the Republic of Kazakhstan, a new intra-breed type “AK Iris” was tested in 2007 by using stud bulls of the Swiss breed of the American breeding for the pedigree stock of the Alatau cattle. When creating a new type, special attention in breeding was paid to increasing the bovine milk productivity that gave positive results. However, no standards for linear measurements of animals were defined in the process of testing, and apparently for this reason in many herds there was heterogeneity of animals in conformation characteristics [52].

When creating the Ukrainian Brown dairy breed, special attention was paid to the formation of the desired type. Therefore, according to the scientists, a comparative analysis of primiparous measurements

confirmed their significant interlinear differentiation within farms and lines. Thus, in the former breeding farms of Ukriktravy BF SOE and Kolos PAF of Sumy Region, the first-borns of the Elehant 148551 factory line had a higher height at the withers compared to animals of other breeding farms, while the animals of the Stretch 143612 factory line in the Experimental Farm SOE of the Institute of Agriculture of the North-East and Peremoha SOE were characterized by the greatest chest width. The smallest metacarpal girth was characteristic of animals of the Distinkshna 159523 line in the three farms – Mykhailivka Stud Farm PJSC, the Experimental Farm SOE of the Institute of Agriculture of the North-East and Peremoha SOE. The authors note that these features, respectively, were reflected in the values of body structure indices [53].

V. I. Ladyka, L. M. Khmelnychy [54] note that the evaluation of the Brown cows of various origins using measurements and linear classification has enabled to establish the phenotypic diversity of cattle by a conformation type.

Over the past decade, scientists and specialists of breeding farms have carried out important measures to improve breeding work aimed at improving the economic and useful characteristics of the Brown cattle.

1.2.1. Lebedyn breed

As noted by A. A. Tyrin [55, 56, 57, 58], at the end of the 19th – beginning of the 20th century, several breeds of cattle were developed on the territory of modern Sumy Region, which was due to the natural, historical and economic conditions. The Gray Ukrainian cattle were bred in the southern districts of the region, and Great Russian cattle – in the northern districts. A. S. Vsiakykh [59] noted that in 1900–1903, among the breed cattle of Lebedyn uyezd, the main mass was the Gray Ukrainian cattle. In 1913, there were more than 50% of non-descript cattle there. Simmental and their crossbreeds were bred in many villages.

Most researchers [60, 61, 170, 280, 320, 325] noted that for the first time in Ukraine, the Swiss cattle began to be bred in the herd of Kharkiv Zootechnical Institute, which was established in 1881. V. I. Yeremenko [60] noted that until 1889 the herd consisted of only Alhaus cattle. Until 1924, cattle of the Alhaus and Swiss breeds were purchased from Switzerland as well. Later, stud bulls began to be purchased from Mainiv Agrarian School. In the latter, a well-known herd was created by purchasing the Swiss cattle from Switzerland.