РАЗВЕДЕНИЕ, СЕЛЕКЦИЯ, ГЕНЕТИКА И БИОТЕХНОЛОГИЯ ЖИВОТНЫХ / BREEDING, SELECTION, GENETICS AND BIOTECHNOLOGY OF ANIMALS

ANALYSIS OF GENETIC CHARACTERISTICS OF THE CHUKCHI, EVEN BREEDS AND INTRABREED TYPE "VOZROZHDENIE" OF THE FAR NORTH OF THE FAR EAST

Research article

Vitomskova E.A.[1], *
[1] ORCID : 0000-0003-3161-2475;
[1] Magadan Scientific Research Institute of Agriculture, Magadan, Russian Federation

* Corresponding author (ekaterinaseymchan[at]mail.ru)

Abstract

The work consisted of analyzing the genetic characteristics in populations of reindeer of the Chukchi, Even breeds and the intra-breed type of the Chukchi breed "Vozrozhdenie". The research was carried out during 2017 – 2021 in the herds of reindeer breeding enterprises "Vozrozhdenie", "Vaezhsky" of the Chukotka Autonomous Okrug and "Irbychan" of the Magadan Region. The work used 273 samples of deer tissue. In 100% of the animals studied, intermicrosatellite DNA regions with a length of 240-330 bp are present. (locus 3), 350-430 bp. (locus 5) and 440-520 bp. (locus 6). Out of the eleven loci, seven (63.6%) are informative. The homozygosity parameters in the Vaezhskaya populations are significantly lower – 0.108, than in the Vozrozhdenie and Irbychan populations – 0.132 and 0.118, respectively. High heterozygosity (0.882) of the Irbychan population was noted. The practical significance of the work being carried out is the monitoring of the DNA gene bank as a promising material for breeding purposes and for the conservation of reindeer biodiversity.

Keywords: reindeer husbandry, Chukchi breed, Even breed, intrabreed type "Vozrozhdenie", genetic structure, ISSR method.

АНАЛИЗ ГЕНЕТИЧЕСКОЙ ХАРАКТЕРИСТИКИ ЧУКОТСКОЙ, ЭВЕНСКОЙ ПОРОД И ВНУТРИПОРОДНОГО ТИПА «ВОЗРОЖДЕНИЕ» КРАЙНЕГО СЕВЕРА ДАЛЬНЕГО ВОСТОКА

Научная статья

Витомскова Е.А.[1], *
[1] ORCID : 0000-0003-3161-2475;
[1] Магаданский научно-исследовательский институт сельского хозяйства, Магадан, Российская Федерация

* Корреспондирующий автор (ekaterinaseymchan[at]mail.ru)

Аннотация

Работа заключалась в проведении анализа генетической характеристики в популяциях северных оленей чукотской, эвенской пород и внутрипородного типа чукотской породы «Возрождение». Исследования проводились в течение 2017 – 2021 гг. в стадах племенных оленеводческих предприятий Чукотского автономного округа – генофондном хозяйстве «Возрождение», племенном репродукторе «Ваежский», оленеводческом хозяйстве «Ирбычан» Магаданской области. В эксперименте использовано 273 проб ткани оленей – выщипа части ушной раковины. Животных отбирали рандомным методом, разных половозрастных групп – важенки (матки старше 2-лет), третьяки и хоры (быки-производители), молодняк до 1 года. Аналитические работы проводились в лаборатории ДНК-технологий Всероссийского научно-исследовательского института племенного дела. У исследованных животных (100%) присутствуют межмикросателлитные участки ДНК длиной 240-330 п.н. (локус 3), 350-430 п.н. (локус 5) и 440-520 п.н. (локус 6). Локус 7 выявлен у 76% оленей. Из одиннадцати локусов семь (63,6%) являются информативными, поскольку имеют частоту встречаемости более 5%. Параметры гомозиготности в популяциях Ваежской, существенно ниже – 0,108, чем в популяциях Возрождение и Ирбычан - 0,132 и 0,118 соответственно. Высокая гетерозиготность (0,882) популяции Ирбычан эвенской породы связана с объединением трёх субпопуляций, генетически отличавшихся составом животных. Практическая значимость выполняемой работы состоит в мониторинге генетического банка ДНК как перспективного материала для селекционных целей и для вопросов сохранения биоразнообразия северных оленей.

Ключевые слова: северное оленеводство, чукотская порода, эвенская порода, внутрипородный тип «Возрождение», генетическая структура, ISSR-метод.

Introduction

Reindeer husbandry retains its economic importance in the Arctic and subarctic regions of Russia. In the north of the Russian Far East, the most numerous is the Chukchi breed, whose livestock currently exceeds 230 thousand heads. It is characterized by a number of valuable economically useful traits, such as high growth energy, meat quality, and adaptability to the conditions of the area [1].

Currently, 15 farms, including one gene pool and 7 breeding reproducers and branches, are engaged in breeding deer of the Chukchi Autonomous Okrug.

Even breed deer are adapted to grazing conditions in the mountain-taiga and forest-tundra zones of the Magadan region, and have valuable economically useful traits, such as early maturity, meat and working qualities (fig. 1).

Four breeds of reindeer are included in the state register of selection achievements approved for use, including those bred in the North-East of the Russian Federation – Even and Chukotka [2].

It is necessary to constantly conduct breeding work with the breed, otherwise it will degrade. Factory breeds consist of lines, families, production and zonal types, etc.

Figure 1 - Even breed deer of the Magadan region
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Until now, reindeer breeds have not had officially recognized intra-breed structures [3], [4]. In order to create such, when planning breeding work with reindeer breeds, it is important to identify local populations in their composition that are of interest for economic and biological characteristics in order to use these qualities in breeding and genetic work [4], [5], [6], [7].

Currently, there are conditions for improving breeding work in reindeer husbandry, in particular, the identification of zonal ecotypes, the creation on their basis and the inclusion in the State Register of new intra-breed types will form the structure of reindeer breeds. This will contribute to the improvement of economically useful traits of animals, increase the productivity of reindeer herds, since the combination of hereditary features of various genotypes in breeding work is accompanied by the phenomenon of heterosis.

The genetic structure of the Chukchi and Even breeds has not been studied enough. In order to improve breeding work in reindeer husbandry, the most complete genetic and economic characteristics of the reindeer populations of the Northeast are required, concentrated in a certain database, which are necessary for the rational conservation and effective use of the deer gene pool of the extreme Northeast of Russia in the breeding process.

The purpose of the work was to analyze the genetic characteristics in populations of reindeer of the Chukchi, Even breeds and the intra-breed type of the Chukchi breed "Vozrozhdenie".

For the first time, information has been obtained on the genetic characteristics of the populations of breeding enterprises of the Chukotka Autonomous Okrug, the "Irbychan" population of the Magadan region and the intra-breed type of the Chukchi breed "Vozrozhdenie", which has a certain scientific and practical significance for the further improvement of selection and breeding work in northern domestic reindeer husbandry.

The research was carried out during 2017 – 2021 in the farms: "Vozrozhdenie", "Vaezhsky" in Chukotka and "Irbychan" in the Magadan region. The total number of deer was 55,132 individuals.

The experiment used 273 tissue samples from deer from different sex and age groups. The tests were performed in accordance with the methodological recommendations for the use of the polymerase chain reaction method in animal husbandry [8], [9], [10].

Main results

At the Vozrozhdenie farm, 10 marker DNA fragments were identified in the studied animals (Table 1). Six fragments are represented more often than others: 1, 3, 5, 6, 7 and 8, the occurrence of each of which exceeds 0.1. In 95% of the studied deer there is an intermicrosatellite DNA region of 240-330 bp in length. (locus №. 3). Locus №. 6 was detected in 99% of animals, locus №. 1 – in 98%, locus №. 5 – in 100% of the studied individuals. Analysis of the variability of DNA fragments showed that each individual has from 1 to 10 intermicrosatellite DNA fragments, with an average of 6.68.

In the Vozrozhdenie deer genotype, seven out of 10 loci (70%) are informative with a frequency of occurrence exceeding 5%. The genotype containing loci №. 1, №. 3, №. 5, №. 6, №. 7, №. 8 is more common in this population (occurrence 30%). About 6% of deer have unique genotypes.

It was established that each individual of the Vaezhskaya population has from 1 to 9 DNA fragments, the average number per animal was 6.02. In this sample, 11 marker DNA fragments were found, five fragments were more common: 3, 5, 6, 7 and 10, the total frequency of which was 0.647 (Table 1). 90% of the animals studied have a DNA section 240-330 bp long. (locus №. 3), characteristic of the Chukchi breed of reindeer. Locus №. 6, also characteristic of the Chukotka breed, was detected in 91% of individuals, locus №. 5 – in 77% of animals in this sample. About 50% of animals have unique genotypes.

In a sample of the Even breed "Irbychan" deer, 551 DNA fragments were identified. According to the analysis of variability, each individual has from 1 to 9 intermicrosatellite DNA fragments, the average number of which per animal is 6.56. The identified loci are polymorphic. 11 marker DNA fragments were identified, among which the most common are the first, third, fifth, sixth and seventh. Their total frequency was 0.685. (Table 1). The studied animals (100%) have intermicrosatellite DNA regions of 240-330 bp in length. (locus 3), 350-430 bp. (locus 5) and 440-520 bp. (locus 6). Locus 7 was detected in 76% of deer. Out of the eleven loci, seven (63.6%) are informative.

Table 1 - Frequency of ISSR markers in reindeer populations

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№	Fragment length (nucleotide pairs)	Population		
		Vaezhskaya n=89	Vozrozhdenie n=100	Irbychan n=84
1	180-210	0,033±0,013	0,147±0,025	0,109±0,034
2	220-230	0,065±0,018	0,024±0,011	0,045±0,022
3	240-330	0,150±0,027	0,142±0,025	0,152±0,039
4	330-350	0,043±0,015	0,075±0,019	0,076±0,028
5	350-430	0,129±0,025	0,150±0,025	0,152±0,039
6	440-520	0,151±0,027	0,148±0,025	0,152±0,039
7	520-570	0,121±0,024	0,141±0,025	0,120±0,035
8	650-690	0,062±0,018	0,136±0,024	0,045±0,022
9	700-770	0,097±0,022	0,036±0,013	0,098±0,032
10	850-980	0,101±0,023	0,001±0,002	0,040±0,021
11	1100-1300	0,052±0,017	0,000±0,000	0,009±0,010

The homozygosity parameters in the Vaezhskaya populations are significantly lower – 0.108, than in the Vozrozhdenie and Irbychan populations – 0.132 and 0.118, respectively. In the Vaezhskaya and Vozrozhdeniye populations, the expected heterozygosity is high – 0.891 and 0.868, respectively (Table 2).

Table 2 - Indicators of the genetic structure of deer

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Index	Population		
	Vaezhskaya	Vozrozhdenie	Irbychan
Number of ISSR DNA markers	11	10	11
Average number of alleles per locus (μ)	10,4	8,56	9,950
Number of effective alleles per locus (Ne)	9,25	7,57	8,496
Homozygosity coefficient (Ca)	0,108	0,132	0,118
Heterozygosity expected (He)	0,891	0,868	0,882

The high heterozygosity (0.882) of the Irbychan population of the Even breed is associated with the unification of three subpopulations that were genetically different in the composition of the animals.

Conclusion

As a result of crossing unrelated groups of deer of the Chukchi breed, selecting and breeding individuals of the desired type over a number of generations, the highly productive type of reindeer "Vozrozhdenie" was developed.

Analysis of the genetic structure revealed the most common loci №. 3 (240-330), №. 5 (350-430), №. 6 (440-520), №. 7 (520-570), which determined the similarity of the Even population with the Chukotka and intrabreed type "Vozrozhdenie".

The level of expected heterozygosity confirms the high degree of genetic diversity of the Chukotka breed of deer of the Vaezhskaya population (0.891), the intrabreed type "Vozrozhdenie" (0.868) and the Irbychan population of the Even breed (0.882), which is fully confirmed by the interfarm exchange of producers.

The practical significance of the work being carried out is that, based on the DNA genetic bank, promising material will be selected both for breeding purposes and for the conservation of reindeer biodiversity.

Рецензия

Все статьи проходят рецензирование. Но рецензент или автор статьи предпочли не публиковать рецензию к этой статье в открытом доступе. Рецензия может быть предоставлена компетентным органам по запросу.

Review

All articles are peer-reviewed. But the reviewer or the author of the article chose not to publish a review of this article in the public domain. The review can be provided to the competent authorities upon request.

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