

On Adapting Domestic Even Reindeer to the Mountain-Taiga Zone of The North-East of Russia

V. I. Fedorov¹, E. S. Sleptsov¹, N. V. Vinokurov¹, I. I. Grigoriev¹, O. I. Zakharova², A. N. Maksimova²

¹Yakut Research Institute of Agriculture named after M.G. Safronov, Bestuzhev-Marlinsky St., 23/1, Yakutsk, Republic of Sakha, 677001, Yakutia,

²Yakut State Agricultural Academy, Sergelyakh highway 3 km, 3, Yakutsk, Republic of Sakha, 677007, Yakutia

Abstract

The most important element of the ecosystems of the North and an integral part of life and culture of indigenous peoples of the North-East of Russia is reindeer, a.k.a. Rangifer tarandus. This breed is the only member of genus reindeer (Rangifer), belonging to the family of deer suborder of ruminants, and one of the few breeds of animals whose wild form coexists with the home form. Out of the 4 approved breeds of domestic reindeer (Even, Evenk, Chukot and Nenets) in the North-East of the Russian Federation in the Republic of Sakha (Yakutia), 3 breeds are cultivated: Even, Evenk and Chukot (Hargin). These breeds differ in their productivity, exterior-and-constitution peculiarities, and adaptability to specific climatic conditions. Purebred breeding is widespread, the task of which is strengthening of constitutional type of the animals, their adaptation to local conditions, and further productivity enhancement.

The Even breed of reindeer is the most numerous breed of the domestic reindeer bred in the Republic of Sakha (Yakutia). As on 01.01.2016, their number was 87,579, or 56.1% of the total reindeer population of the Republic. The Even breed of reindeer features the meat-and-transport body type; in terms of the exterior, these deer are quite long-legged animals with long, relatively narrow body. The live weight of adult males reaches 135 to 145 kg, that of females - 91 to 110 kg, and the slaughter yield is 48 to 50%.

Conventionally, the Even reindeer may be classified into ecotypes, depending on the climatic breeding zones - tundra, forest-tundra and mountain-taiga reindeer; the largest population is located in the mountain-taiga and forest-tundra climatic zones. Each ecotype of the Even reindeer was formed under the influence of certain natural and economic conditions, feeding and keeping conditions, livestock breeding conditions, and features high adaptive and reproductive ability, and the level of individual viability. Despite the relative knowledge about the ecological and ethological features, issues of reindeer thermoregulation and bioenergy, and ecological and physiological adaptation, the scientific-methodical information about the deer adaptation reactions to the climatic zones is extremely limited, and remains virtually unstudied. In this regard, the zootechnical parameters were studied, such as adaptive response of the Even domestic reindeer bred in the mountain-taiga zone.

Keywords

Domestic reindeer, he-reindeer, she-reindeer, baby-deer, adaptation, the Even breed, valuation, reproductive qualities.

INTRODUCTION

The Even domestic reindeer are bred in the taiga, the mountain-taiga, the forest-tundra and the tundra climatic zone of Yakutia. Certain natural and economic conditions of feeding and maintenance and zootechnical operation resulted in the formation of animals characterized by high adaptive and reproductive abilities, and high viability level.

In this respect, there is an opportunity to assess the results of Even domestic reindeer adaptation to the mountain-taiga climatic zone of the Republic of Sakha. The accumulated data will provide a possibility to clearly define the goal of breeding work, and the combination of methods of Even deer inbreeding in different climatic zones will efficiently improve genetic potential of animal productivity [1, 2, 3].

METHODS

The material for the study were statistical data from reports of the Territorial body of the Federal State Statistics Service in the Republic of Sakha (Yakutia), and the State Committee of the Republic of Sakha (Yakutia) for the problems of the Arctic, as well as the Even domestic reindeer at FSUE (Federal State Unitary Enterprise) Yuchugeiskoye located in the mountain-taiga zone of the Republic of Sakha (Yakutia), settlement Yuchugey of the Oimyakon ulus.

RESULTS

Statistical data have been collected about reindeer herding at farms in the mountain-taiga zone of the Republic of Sakha (Yakutia) between years 2011 and 2016 for the following indicators: the total population of the Even domestic reindeer bred in the mountain-taiga zone of the Republic of Sakha (Yakutia), herd structure, dynamics of final calf accretion, preservation of adult population. Deer herd No. 2 of FSUE Yuchugeiskoye has been studied, and a new zootechnical characteristic of the Even reindeer of the mountain-taiga ecotype has been compiled; the adaptive response and morphofunctional parameters of Even deer

that contribute to the existence of the breed as a whole system have been studied: the time of heat, norms of load per male during the heat, time of calving, and time of losing antlers. The material was biometrically processed using the Microsoft Excel computer program.

ANALYSIS AND DISCUSSION

As on 01 January 2016, the number of all breeds of the domestic reindeer in the republic was 156.0 thousand heads, of which the population of Even reindeer was 87,579 heads.

The Even domestic reindeer are bred in 11 uluses of the Republic - the Tomponsk, the Kobayaysk, the Oimyakon, the Mom, the Verkhoyansk, the Eveno-Bytantaysk, the Abyysk, the Bulun, the Ust-Yana, the Srednekolymsk and the Verkhnekolymsk uluses. In the taiga zone, 446 deer (0.5% of the number of Even reindeer) are bred, in the mountain-taiga zone of the Republic - 57,494 deer (65.6%), in the tundra zone - 7,987 deer (9.1%), and in the tundra zone - 21,652 deer (24.7%). Table 1 shows the dynamics of Even reindeer population over the last 6 years.

Paint Unlike wild reindeer, which are characterized by predominantly reddish-brown paint, home reindeer have quite a variety of colors: from white and light-gray to brown and dark-brown. Even reindeer bred in the mountain-taiga zone of Yakutia, in the Oimyakon ulus in particular, are animals of various shades of brown (80-90%), sometimes light-brown, dark-gray and light-gray; white and piebald deer are rarer; very rare are deer with markings on the neb, with white head and "stockings". In winter, the coat of Even reindeer of the mountain-taiga ecotype gets compacted due to regrowth of underhair and guard hairs. Neck, shoulder and sides are covered with long white guard hair, therefore, in the winter, this paint of reindeer becomes more uniform and acquires lighter color, with well-marked layering, than in the summer.

Table 1 – Even reindeer population in all categories of farms in the Republic of Sakha (Yakutia)

	2011	2012	2013	2014	2015	2016
Total for the Republic of Sakha (Yakutia)	126,708	123,695	116,468	106,493	90,596	87,579
Taiga zone	460	453	524	626	683	446
Abyysk ulus	460	453	524	626	683	446
Mountain-taiga zone	92,321	88,522	80,906	70,811	60,427	57,494
Verkhnekolymysk ulus	1,085	1,178	1,122	1,203	1,121	1,016
Verkhoyansk ulus	4,771	4,717	5,036	4,275	4,350	3,459
Kobyay ulus	14,753	15,092	10,103	9,352	8,205	7,711
Mom ulus	16,838	15,581	15,901	13,904	12,955	11,371
Oimyakon district	16,025	16,926	16,934	13,237	8,927	8,438
Srednekolymysk ulus	3,174	3,261	3,164	2,304	2,155	2,019
Tomponsk ulus	18,249	15,887	12,007	10,354	10,564	8,405
Even-Bytantaysk ulus	17,426	15,880	16,639	16,182	12,150	15,075
Tundra zone	33,927	34,720	35,038	35,056	29,486	7,987
Bulun ulus	17,095	16,850	15,821	14,153	9,665	6,244
Ust-Yan ulus	16,832	17,870	19,217	20,903	19,821	1,743
Forest-tundra zone	-	-	-	-	-	21,652
Bulun	-	-	-	-	-	2,007
Ust-Yan ulus	-	-	-	-	-	19,645

Table 2 – Variations of reindeer live weight at FSUE Yuchugeiskoye by seasons

Group of animals	June	August	October
He-reindeer	121.7± 3.41	150.2± 2.1	132.74± 3.7
She-reindeer	84.9± 1.92	122.6± 9.1	113.5± 6.3
2-year-old deer	104.4±1.74	123.3± 1.7	119.4±5.32
Does	76.4±2.04	95.5± 4.53	112.4±2.4
Bulls	81.4±1.62	102.7±4.26	115.7± 4.1

Table 3 – Periods of deer calving and insemination in herd No. 2 of FSUE Yuchugeiskoye bred in the mountain-taiga zone in 2015

Periods of calving (5 days)	Number	%	Periods of heat (5 days)
April 10-15	4	1.1	September 01-05
April 16-20	14	3.9	September 06-10
April 21-25	35	9.7	September 11-15
April 26-30	79	22.1	September 16-20
May 1-5	109	30.5	September 21-25
May 6-10	94	26.3	September 26-30
May 11-15	18	5	October 01-05
May 16-20	5	1.4	October 06-10
Total	358	100	40 days

Seasonal changes in the structure of the coat of reindeer of the mountain-taiga zone, and, hence, the seasonal coloration, are adaptive to the environment. According to some researchers, dark paint of reindeer in the summer and light paint in the winter, contributes to maintaining the temperature of reindeer body. According to academician A. A. Grigoriev [4], dark paint in the warm period consumes a lot of incoming radiation, and thus improves body heat balance; while in the winter, heat loss from the body of white paint is less intensive, compared to dark paint.

Body type The size of adult Even reindeer varies substantially; males are much larger than females. The exterior of deer of this breed have well developed body with significant length and depth, and small width.

Even reindeer of the mountain-taiga ecotype have lightweight clear-cut body with compact muscles, strong build, proportional physique, without distinct meat qualities, the head is typical for the breed, the horns are well developed, the genital attributes are well developed and belong to the shallow type.

For judging about reindeer growth and development in the mountain-taiga zone in recent years, measurements of reindeer in herd No. 2 of FSUE Yuchugeiskoye were taken and compared

to the measurements of Even reindeer made by Pomishin S. B. [5].

Measurements (cm) of the Even reindeer were (according to the data of the authors/Pomishin): withers height of males – 113.3/110.8, that of females - 105.2/100.5; oblique body length of males - 119.3/119.6, that of females - 107.3/106.8; metapodium of males - 14.4/13.7, that of females - 11.3/11.7; depth of chest of males - 48.6/46.5, that of females - 42.1/40; chest width of males - 24.5/25.5, that of females - 21.8/20.9, chest girth of males - 128.4/127.7, and that of females - 113.5/110.9.

Hence, one can see that Even reindeer of the mountain-taiga ecotype have metapodium smaller by 0.4 cm, while for the rest of the measurements they are noticeably superior. Thus, chest girth of Even she-reindeer of the mountain-taiga ecotype was larger by 2.6 cm, chest width behind shoulders - by 0.9 cm, depth chest - by 2.1 cm, elbow height - by 3.1 cm and withers height - by 4.7 cm. In stud bulls of the Even reindeer, the results of measurements, compared to the data of Pomishin S. B., both for metapodium and chest girth were larger by 0.7 cm, chest depth - by 2.1 cm, elbow height - 2.9 cm, withers height - 2.5 cm, and only one measurement – chest width behind shoulders – according to the data of the authors was smaller by 1.5 cm. With the overall enlargement of the body, measurements of chest and withers height increased to a greater extent, compared to the rest of the body.

Comparison of the body build indexes (%) has shown that in males (authors' data/Pomishin's data), the body is stretched, the index being 105.4/100.3, the withers in males is raised above the back, is wide and well filled with muscles; the blockiness index is 107.5/116.7; chest is well developed to the depth, the index being 49.5/39.6; the massiveness index is 113.4/117.1; the index of leg length is 61.7/57.6; boniness index is 12.7/12.5; in females: the index of stretching is 102/102.2, blockiness index - 105.9/113.5, breast width - 51.9/36.2, massiveness index - 108/116.1, the index of leg length - 61.2/56.7, and boniness index - 10.8/12.4.

The live weight of reindeer varies with the seasons, as shown in Table 2; in June, live weight of she-reindeer decreases due to calving and feeding of calves; the highest live weight of stud bulls and 2-year-old bulls is noted in August, before the heat, and decreases after the heat in September and October.

Based on the considered measurements, indices and body weight, one can conclude that in the process of adaptation to the mountain-taiga zone, Even reindeer grow in withers height

faster than in the body length, and greater compactness and lightweight body build of deer, with increasing chest girth, indicates healthy body of the deer and successful adaptation to the mountain-taiga climatic zone of Yakutia, good organization of breeding work, without which it is impossible to improve productive qualities of animals.

Reproduction Even deer of the mountain-taiga ecotype, as well as deer in other ecological zones feature highly seasonal reproduction. The nature of biological rhythms in deer is most pronounced during the breeding season, in growth and development of young animals. In the deer, sexual maturity, or the ability to reproduce, comes much earlier than physiological maturity.

Unlike males, germ cells in the glands of reindeer females are laid during the fetal period, and at the moment of birth in females are present in their ovaries at various stages of development, while mature follicles appear around the age of 5-6 months [5].

Even deer are early-maturing animals; females usually have their first mating during the second year of life. By this time, their live weight reaches 89-98% of the weight of adult animals. Annually, in deer herds, there are frequent cases of half-year (baby-deer) female fertilization, accompanied by normal gestation. Herder Evens call such females "Ennies." In favorable years, the number of 1-year-old first-calf heifers reaches 10-11% of the number of all females of this age in the herd. This is the evidence of the fact that in good conditions of feeding, calves not only grow vigorously, but mature rapidly.

The times of heat and calving are prone to annual fluctuations; this is due to the time of spring onset and plants' vegetation, as well as to the conditions of summer feeding and deer keeping. The sooner the deer switch to green feed, and the more favorable the conditions of their summer keeping and feeding are, the faster they fatten, and the sooner heat occurs in the herd. The main way of mating is "free mating". During this method of heat, human intervention is limited to only selection of stud bulls. In planned calculations for determining the need in stud bulls for the herd, the following ratios are adopted: 12 to 18 (on the average 15) dams per one stud bull. The load depends on the age, state of the stud bull and the way of mating. For mating, 2.5-year-old stud bulls (2-year old deer) and adult males being 4.5 years old and older (he-reindeer) are used, and young 1.5-year-old males, being present in the herd during free mating, participate at the end of the heat. Usually, he-reindeer are used until 6-7 years of age, when they ensure high fertility of she-reindeer, and high-quality offspring. During the heat, adult males may inseminate 17 to 20 females, after which, due to depletion, their activity decreases.

To determine the time of heat and calving of the reindeer bred in the Oimyakon ulus, the method of M. P. Vinogradov was used [6]. The results of the analysis are shown in Table 3.

Thus, the heat of Even reindeer in the second herd of FSUE Yuchugeiskoye in the Oimyakon ulus (the mountain-taiga zone) in the autumn of 2015 started from the 1st decade of September and ended in early October. Activity of males was observed in the morning hours and the evening, while in the daytime, activity decreased. Most actively, he-reindeer were active in the first 7-10 days of the heat, inseminating on the average 3-4 she-reindeer per day.

The periods of calving directly depend on the time of mating. The results of monitoring the process of calving have

shown that in the last 5 days of April, 79 baby-deer (22.1%) were obtained, while during the first 5 days in May - 109 baby-deer (30.5%), and during the 2nd 5-days period in May - 94 baby-deer (26.3%) of the total number of parturition in 2015 [7].

CONCLUSION

As a result of the studies, experimental data have been obtained in 2015 about the breed-specific features of adaptive reactions, zootechnical and morphofunctional parameters of Even reindeer of the mountain-taiga ecotype in the Republic of Sakha (Yakutia). The accumulated data will provide an opportunity to clearly define the direction and location of the Even breed by the zones, will allow forming the optimal structure of the herd with high adaptive and reproductive properties of animals, and will create the scientific basis for correct breed zoning.

To assess the current status of population and to understand the trends of its further development, it is necessary to study the structure of the population. Currently, with the advent of the methods of using single-nucleotide polymorphism (SNP) analysis, there is a possibility to accurately determine the genetic characteristics of populations [8-11].

REFERENCES

- [1] Baskin, L. M. Reindeer. *Ecology and behavior*. Moscow: Nauka, 1970, 150.
- [2] Davydov, A. V. *Morfologicheskaya i geneticheskaya differentsiatsiya populyatsii severnogo olenya Evrazii* [Morphological and genetic differentiation of reindeer populations in Eurasia]. Moscow State Academy of veterinary medicine and biotechnology, Moscow 1997.
- [3] Kushnir, A. V. *Ekologo-fiziologicheskie adaptatsii severnogo olenya* [Ecological-physiological adaptations of reindeer]. Novosibirsk: Publishing House of the Siberian Branch of RAS, 2003, 105.
- [4] Grigoriev, A. A. *Subarktika* [Subarctic region]. Moscow: Publishing house of the USSR Academy of Sciences, 1946.
- [5] Pomishin, S. B. *Problema porodi i ee sovershenstvovaniya v olenevodstve* [The problem of the breed and its improvement in reindeer herding]. Yakutsk: Book publishing house, 1981, 180.
- [6] Vinogradov, M. P. *O srokahtelaigona v olenevodstve* [Calving and heat periods in the reindeer herding]. 1936, 6, 9-22.
- [7] Fedorov, V. I. *Vliyanie chislennosti samtsov v gruppe na vosproizvodstvo olenievenskoj porody* [The influence of the number of males in the group on Even reindeer reproduction]. Bulletin of the Buryat Agricultural Academy n.a. V. R. Filippov, 2014, 1(34), 67-70.
- [8] Kharzinova, V. R., Dotsev, A. V., Okhlopov, I. M., Gladyr, E. A., Fedorov, V. I., Brem, G. G., Zinoveva, N. A. Genetic diversity and population structure of wild and semi-domesticated reindeer (*rangifer tarandus*) inhabited in northeastern siberia based on single nucleotide polymorphism markers. *Journal of Animal Science*, 2016, 4(94), 110-111.
- [9] Kharzinova, V. R., Dotsev, A. V., Okhlopov, I. M., Laishev, K. A., Fedorov, V. I., Shimit, L. D. O., Brem, G. G., Wimmers, K., Reyer, H., Zinoveva, N. A. Genetic characteristics of semi-domesticated reindeer populations from different regions of Russia based on SNP analysis. *Journal of Dairy Science*, 2016, 1(99), 162.
- [10] Kharzinova, V. R., Karpushkina, T. V., Dotsev, A. V., Soloveva, A. D., Romanenko, T. M., Brem, G. G., Zinoveva, N. A. Association of microsatellite profile with phenotypic traits of semi-domesticated reindeer. *Journal of Animal Science*, 2017, 4(95), 105-106.
- [11] Kharzinova, V. R., Sermyagin, A. A., Gladyr, E. A., Brem, G., Zinovieva, N.A., Okhlopov, I.M. A study of applicability of SNP chips developed for bovine and ovine species to whole-genome analysis of reindeer *rangifer tarandus*. *Journal of heredity*, 2015, 6(106), 758-761.