

Adaptogens in animal husbandry of Yakutia

Anna Cherkashina*

Arctic State Agrotechnological University, Department "Traditional Industries of the North",
Yakutsk, Russia

Abstract. Sable breeding is a new promising branch of animal husbandry in Yakutia. Since the end of 2019. Caged sables are imported from the Irkutsk region and the Republic of Tatarstan to the "Pokrovskoye Zverokhozyaystvo" (eng.: Pokrovsk Animal Farm) of the Republic of Sakha (Yakutia). The initial goal is to preserve imported breeding sables for their further reproduction. In the period from 2020 to 2022, 891 animals participated in the experiment to study the effect of adaptogens on the safety of caged sables. The influence of Eleutherococcus, succinic acid and pine buds was studied. The best indicators were noted in the experimental group treated with pine buds, safety ranged from 73.33-86.61%. A positive effect of pine buds on the participation of female sables in the rut was also established - 60.58%.

1 Introduction

Cage fur farming is a unique and important branch of the agro-industrial complex, which performs two important environmental roles: the preservation of wild populations of fur animals and the disposal of food and biological waste. By-products of fur farming rarely go unused. For example, manure, due to its high phosphorus content and low percentage of foreign seeds, is an excellent raw material for organic fertilizers. [4]

From time immemorial, fur products obtained by hunters-traders were in demand not only in the country, but were also supplied to foreign countries. Among them, fur from Yakutia has always been in high demand. This testifies not only to the significant quantities of furs supplied, but also to the high quality of the skin products obtained in the harsh natural and climatic conditions of the Republic of Sakha (Yakutia).

At the same time, due to natural and climatic conditions, breeding of caged sables is extremely promising in the Republic of Sakha (Yakutia). Low temperature conditions contribute to the development of the highest commercial qualities of fur in sable, such as lightness, softness, splendor and silkiness. And this is confirmed by the results of sales of commercial sables obtained on the territory of our republic at international fur auctions. According to the results of international fur auctions in St. Petersburg, Yakut sables are in demand and are sold at 82-100%.

The intensive development of the resources of the wild population of sables in Russia, including in the Republic of Sakha (Yakutia), can affect a significant decrease in the total volume of harvesting of branded furs in the country. In some years, Yakutia supplied up to

* Corresponding author: ecag@mail.ru

half of the total production of high-quality Barguzinsky Ridge. According to experts, the population of wild sable in Yakutia is declining, and in the future, restrictions on its production will be introduced. And this is confirmed by the fact that in recent years in Yakutia, an average of 60,000 licenses have been allocated per year for sable hunting, and 45 thousand licenses for sable hunting have been issued for the 2019/2020 hunting season.

Cage sable breeding has a lower industrial population compared to commercial ones. This creates a certain shortage of supply at international auctions, which is covered by hunters. And this means that natural sable populations are currently under the influence of anthropogenic pressure. [13]

The development of cage sable breeding will help to reduce the volume of hunting sable without reducing the supply of this valuable type of fur to the market, which will ensure the preservation of the wild sable population.

At present, the Republic of Sakha (Yakutia) is the only region in the Far East in which the cage fur farming industry has been preserved. Yakutia is a region with extreme frosts, where the harsh climate makes fur clothing not a luxury, but a necessity. [1]

To enter the international market of Yakut furs produced in Yakutia, it is necessary to expand the range of skin products. To this end, the Ministry of Agriculture of Yakutia since November 2019, acquires breeding cage sables from the leading fur farms of the country of the Irkutsk region and the Republic of Tatarstan. In the coldest time of the year - December in the Republic of Tatarstan - minus 11 degrees; in the Irkutsk region - minus 17 degrees.

It is a well-known fact that Yakutia has a sharply continental climate, in summer the air temperature reaches 33 ° C and above, and in winter it is minus 55 ° C and below. No animal breeds in the world are subjected to such pressure during the period of ontogenetic development as farm animals in the conditions of the Republic of Sakha (Yakutia).

Undoubtedly, sables that arrived in Yakutia from more favorable climatic and other food conditions experience severe stress. Which will negatively affect economically useful traits and the realization of their genetic potential.

For the successful introduction of a new industry - sable breeding into the animal husbandry of Yakutia, it became necessary to improve the adaptive qualities of the arrived caged sables. Therefore, measures are needed to mitigate the extreme factors in the life of breeds through the organization of proper care and nutrition during the critical seasons of the year. [11]

One of the solutions to the problems is the use of feed additives to improve the productive health, increase the adaptive capacity and stress resistance of the livestock. [15]

The accelerated development of sable breeding and the increase in the production of caged sable pelts should be considered as a problem of national importance, the solution of which will allow in the future to develop the fur farming industry as a whole more efficiently and satisfy the demand for fur products at the expense of domestic production. [5]

Thus, the organization of sable breeding in Yakutia, based on innovative achievements, will provide a reliable basis for solving a larger strategic goal - the preservation of the commercial sable population in Russia.

Long-term work of scientists in the field of feeding farm animals shows that the use of biologically active substances has a positive effect on the development and productivity of farm animals. [10, 17, 18, 19, 20, 21]

Science in cage fur farming is primarily aimed at breeding animals that are capable of adapting to new changing feeding conditions in a short time. Since the increase in the efficiency of the production of skin products depends not only on the use of the genetic potential of cellular fur animals, but also on full-fledged feeding. [3] And animal welfare is seen as an indicator of the sustainability of the system and is considered cost-effective. [6]

At the same time, a positive effect of biologically active substances on the digestibility of dietary nutrients was established, and it also increased feed conversion. [9]

Most biologically active substances do not have energy properties, but contribute to the activation of adaptive abilities and immunobiological reactivity of the animal organism.

The effect of adaptogenic drugs lies in the fact that, unlike antibiotics, they indirectly affect the entire body, facilitating the activation of its hidden reserve mechanisms in the event of adverse conditions. Therefore, they are not prescribed constantly, like vitamins, but by courses worked out in each case.

The discovery of reserves for increasing the production of skin products and improving its quality on the basis of the full realization of the genetic potential of caged fur animals by improving the technology of breeding animals and ensuring proper feeding is relevant for zootechnical science and practice.

The power of adaptogens lies in the fact that they help the body adapt to physical (heat, cold, and exercise), chemical (toxins and heavy metals), and biological (bacteria and viruses) types of stress. This contributes to a quick recovery after the stress. They contain the so-called active substances: resin, oils, tannins, pectins, etc.

In nature, sable lives mainly in the taiga, where coniferous trees mainly grow. And this is a pine, a cedar elfin. And undoubtedly in the spring she eats fresh pine buds. Pine buds are the ends of young shoots. The components included in their composition contain resin, vitamin C (up to 300 mg%), vitamin P, K, B, carotene (60-130 mg%), tannins (up to 5%), bitter substance pinipicrin, phytoncides and essential oil.

Tannins have a bactericidal effect, restore damaged tissues and help stop bleeding. Phytoncides are known for their antifungal, antibacterial and antiviral effects. Resin fights pathogenic bacteria.

The most famous healing property of coniferous trees, which was used in antiquity, is antiscorbutic. Scientists note that the needles of northern trees (pine, spruce, Siberian cedar, elfin cedar, fir) in terms of vitamin C content can be equated to lemons and oranges. Ascorbic acid increases the body's defenses, restores the walls of blood vessels.

The essential oil in its composition has the following components: Alpha-pinene - the main component of turpentine. It improves memory, works as an antibiotic against staphylococcus and a number of other bacteria, stops bronchospasm, relieves inflammation. Limonene is a hydrocarbon that can be used as an antibiotic, antidepressant and immunomodulator. There is evidence that the substance has carcinogenic properties. Borneol is a precursor to camphor but is non-toxic. It has a general tonic, antidepressant effect, improves blood circulation, stimulates cardiac activity and digestion, and is suitable for treating cough in colds and bronchitis. Topical application for rheumatism is allowed. Bornyl acetate is an ester with a coniferous-camphoric odor. It is used in pharmaceuticals for the production of cholinergic drugs, which are widely prescribed by neurologists for the treatment of diseases of the central nervous system. In pine buds, tannins are determined. They have an astringent taste, help to cope with intestinal disorders, and have a bactericidal and anti-inflammatory effect. Resinous substances are effective in inflammation. Pinipicrin gives a bitter taste, stimulates appetite.

Biologically active substances of pine buds contribute to the restoration and strengthening of weakened immunity, and are also an excellent multivitamin remedy for the treatment and prevention of beriberi hypovitaminosis in all types of farm animals. [7, 16]

2 Research methodology

The purpose of this work is: Adaptation of cellular sables in the natural, climatic and food conditions of Central Yakutia.

In accordance with the goal, the following tasks were formed:

- To study the influence of various adaptogens on the safety of sables and their reproductive potential.

Scientific and economic experiments were carried out on caged sables of the Saltykovskaya -1 breed. Eleutherococcus at a dose of 0.1 mg was used as adaptogens; Succinic acid - 40 mg; Pine buds - 0.16 g / head. Since December 2021, Pine buds have increased the dose - 0.2 g / head per day for a month. All preparations were added to the feed mixture and fed once a day for 30 days [7, 12].

The methodology was based on the scientific provisions of domestic scientists dealing with the problems of improving the feeding of farm animals. In the course of the experiments, generally accepted classical research methods were applied.

3 Research results and discussion

To organize cage sable breeding on the basis of the Pokrovskoye animal farm, 300 sables of the Saltykovskaya-1 breed were brought from the Bolsherechensky animal farm of the Irkutsk region in November 2019 (Table 1).

Table 1. Delivery of pedigree sables to Pokrovskoe Zverokhozyaystvo (eng.: Pokrovsk Animal Farm), Khangalassky district.

Year	2019	2020	2021
Quantity	300	325	400

In total, in the period 2019-2021, 1,360 breeding sables from breeding plants and breeding reproducers of the Russian Federation were brought to the Republic of Sakha (Yakutia), of which 1,025 heads were brought to the Pokrovskoye Animal Farm of the Khangalassky District.

In June, the formed experimental groups were fed with adaptogens: succinic acid (II experimental group) and Eleutherococcus (III experimental group) for the safety of sables. In November, safety by groups was as follows: in the I control group - 77.77%; in group II - 83.33%; in group III - 72.22%. The safety was higher in the group that received succinic acid by 5.56-11.11% than in the control group and in the III experimental group, which received Eleutherococcus.

Analysis of the results of hematological studies of their blood indicates that the content of leukocytes, erythrocytes and hemoglobin in the blood was the lowest in the control group that did not receive adaptogens. In the control group, leukopenia is also noted, in the third experimental group, leukocytosis. Leukopenia is evidence of ongoing stress in sables in the period of adaptation to new climatic and food conditions. Feeding with succinic acid had a positive effect on the morphological parameters of the blood.

In December 2020, in two departments for breeding sables in the Pokrovskoye Fur Farm, we conducted research to study the effect of adaptogens (Eleutherococcus and pine buds) on the safety of sables during the period of adaptation to new climatic and forage conditions. Created 4 groups of animals with 30 animals each.

The following adaptogens were used: in group 1 - Eleutherococcus 0.1 mg once a day for a month; in group 2 - pine buds at 0.16 g per 1 head 1 time per day for a month.

In November 2021, the safety by groups was as follows: in group I - 77.77%; in group II - 83.33%; in group III - 72.22%. The safety was higher in the group that received succinic acid by 5.56-11.11% than in the control group and in the III experimental group, which received Eleutherococcus.

In November 2021, it was found that when fed with food, the survival rate of sables in the experimental group (Eleutherococcus) was 20.0% higher than in the control group. And when fed with pine buds, the safety of sables in the experimental group was 16.66% higher than in the control group.

We also studied changes in live weight and body length when fed with pine buds for 30 days in the onset of severe frosts from December 2020. Analysis of the obtained results indicates that the index of fatness in the experimental group of sables was higher than in the animals of the control group by 5.78-9.11%. This is because under stress factors such as adaptation, appetite is often reduced and they eat less food. The result is their lower fatness.

In general, the index of fatness in animals of both groups increased from the summer period (June) to the winter period (November), which confirms the correctness of the recommended feeding of sables by the periods of the year.

In June 2021, the blood of sables was examined in terms of morphological parameters. The content of erythrocytes and hemoglobin in the blood was within the physiological norms. In the blood of animals of the control (1.7x10⁹/l) and experimental (3.75x10⁹/l) groups, leukopenia is observed, as well as lymphocytopenia of 21.93% and 36.32%, respectively.

Leukopenia and a low content of lymphocytes in June in the blood of animals of both groups are evidence of ongoing stress in sables that are in the period of adaptation to new climatic and food conditions. The experiments were carried out in the department of sables arriving in 2020.

Leukocytes play an important role in the protective and regenerative processes of the body.

Specific (immunity) and non-specific (mainly phagocytosis) protection of the body is associated with the presence of white blood cells - leukocytes in the blood. In addition to protective enzymes, there are always many enzymes in the blood that take part in the intermediate metabolism in the body.

Leukopenia is less common and may indicate oppression or depletion of the hematopoietic organs, observed in viral diseases and depletion of the body's defenses. If such stress lasts for a long time and becomes chronic, the opposite effect appears - leukopenia. [14]

Lymphocytes are involved in the formation of humoral and tissue immunity; produce serum gamma globulins; contain a number of enzymes (lipase, amylase, lysozyme, etc.), and also participate in intestinal digestion. [2]

In the blood of animals in October 2021, the content of leukocytes increased, the average content of lymphocytes is below the physiological norm in the control group. This indicates the continuation of the adaptation of caged sables that arrived in new natural, climatic and food conditions. In the blood of sables of the experimental groups, the average percentage of lymphocytes was within the lower limit of the physiological norm, which indicates a positive effect of the adaptogen on the body of sables and their initial positions of adaptation to new conditions. According to researchers, antioxidants affect the physiological and biochemical parameters of the blood of productive animals. [22]

When pine buds were added to the diet of sables, the composition of leukocytes in the blood changed in the direction of increasing the number of lymphocytes to the lower limit of the physiological norm in animals of the experimental group. At the same time, leukocytosis is observed in the blood of animals of the experimental group. The high safety of sables of this group indicates the manifestation of physiological leukocytosis due to an increase in the number of lymphocytes by 10.28% in the experimental group of animals, compared with June 2021.

According to researchers, biologically active substances affect the physiological and biochemical parameters of the blood of productive animals. The effects of increasing the number of erythrocytes and hemoglobin lead to intensive growth, good health, and an improvement in the quality of the fur of fur animals. We also note the increase in the content of erythrocytes, leukocytes and hemoglobin indicates the role of pine buds as an antioxidant. The observed changes were associated with an increase in the nonspecific resistance of animals under the influence of adaptogens. [8]

Table 2. The effect of succinic acid and pine buds on the safety of sables in Pokrovsk Animal Farm, 2022.

Indicators	I group Control		II group Succinic acid		III group Pine buds	
	Dec. 2021	Feb. 2022	Dec. 2021	Feb. 2022	Dec. 2021	Feb. 2022
Quantity	238	193	240	175	239	207
Survivability, %	81,09		72,91		86,61	

An analysis of the giving of adaptogens in December 2021 (Table 2) indicates that the safety by groups was as follows: in the control group - 81.09%; in the II experimental group receiving succinic acid - 72.91%; pine buds - 86.61%. Safety in group III, treated with pine buds, was greater by 5.52-13.7% than in I control and II experimental groups.

In the period from 2020 to 2022, 891 heads of breeding sables that arrived at the Pokrovskoye Fur Farm participated in the experiment to study the effect of adaptogens on the safety of caged sables. Analysis of the obtained results shows that in the experimental groups that received pine buds, the survival rate was 73.33-86.61%.

Table 3. The effect of succinic acid and pine buds on the participation of females in the rut at the Pokrovsk Animal Farm, June 2022.

Indicators	I group Control		II control Succinic acid		III group Pine buds	
	All females	Participated in the rut	All females	Participated in the rut	All females	Participated in the rut
Quantity of females	158	-	114	43	137	83
%	-		37,71		60,58	

In June 2022 (Table 3), we studied the effect of adaptogens on the reproduction of females that received succinic acid and pine buds in December 2021 and June 2022. According to the results of the rut, the results were as follows: in the control group, who arrived to the “Pokrovskoe Zverokhozyaystvo” (eng.: Pokrovsk Animal Farm) at the end of 2021, not a single female participated in the rut. The females of the experimental groups receiving adaptogens participated in the rut. Females of group II arrived in 2019, group III - at the end of 2020. The results showed that in the II experimental group, which received succinic acid, 37.71% of females participated in the rut, in the III group - 60.57% of those who received pine buds in June 2022, which is 22.86% more than in the II experimental group.

4 Conclusions

In order to increase the safety of caged sables with the onset of severe frosts from the beginning of December, we recommend adding pine buds to diets at a dose of 0.2 g/head once a day for a month. To increase the reproductive potential before the rut in female sables, we recommend adding pine buds to the diets from June at a dose of 0.2 g/head once a day for a month.

References

1. E. Abasheva, Fur production survived only in Primorye, Chukotka Autonomous Okrug and Yakutia (Golden Horn, Vladivostok), <https://zrpress.ru/>
2. D. R. Amirov, B. F. Tamimdarov, A. R. Shageeva, *Clinical hematology of animals* (Kazan, 2020)

3. N. A. Balakirev, Rabbit breeding and fur farming **3**, 4-7 (2019)
4. N. A. Balakirev, O.V. Trapezov, Veterinary, Animal Science, and Biotechnology **19**, 66-71 (2018)
5. N. A. Balakirev, M. V. Novikov, V. S. Belogorodsky, E. G. Andreeva, M. A. Guseva, “The main trends in cage fur farming”, in *On Sat. Modern engineering problems of key industries. Sat. scientific papers Int. scientific and technical symposium and Int. Kosygin Forum* (2019)
6. V. A. Bekenev, Agricultural biology **4(54)**, 655-666 (2019)
7. L. Yu. Konovalenko, *Use of forest fodder resources in animal husbandry* (Rosinformagrotech, M., 2011)
8. B. A. Kulichkov, N. T. Portnova, *Russian sable* (Kolos, M., 1967)
9. T. N. Lenkova, I. A. Egorov, V. A. Manukyan, V. G. Vertiprakhov, Agricultural biology **2(55)**, 406-416 (2020)
10. I. S. Lugovaya, T. O. Azarnova, I. I. Kochish, S. Yu. Zaitsev, M. S. Naidensky, A. A. Antipov, Agricultural biology **2(54)**, 269-279 (2019)
11. *Productive animal husbandry of Yakutia* (Kolos, M., 2009)
12. B. I. Protasov, I. M. Komissarov, Agricultural biology **47(6)**, 12-23 (2012)
13. M. M. Somova, The genetic structure of the sable population of the Southern Territory
14. range. Analysis of the consequences of species domestication. Diss. for the application Art.
15. cand. biol. Nauk (M., 2022)
16. T. M. Ushakova, T. N. Derezhina, O. N. Polozyuk, *Pathological physiology* (Don GAU publishing house, pos. Persianovsky, 2017)
17. Yu. P. Fomichev, N. V. Bogolyubova, R. V. Nekrasov, M. G. Chabaev, R. A. Rykov , A. A. Semenova, Agricultural biology **4(55)**, 750-769 (2020)
18. Pine cones medicinal properties and contraindications, <https://ekolekar.com/sosnovye-pochki-lechebnye-svoystva-i-rotivopkazaniya.html>
19. A. V. Ivanova, E. L. Gerasimova, E. R. Gazizullina, Analytika Chimika Acta on Science Direct **1111**, 83-91 (2020)
20. M. Shazaib Ramay, Sakine Yalçın, Poultry Science **99**, 479–486 (2020)
21. N. Welson, R. Rofaeil, S. Ahmed, Life sciences **267**, 48-53 (2021)
22. Yong Cheng, Wei Quan, Tao Qu, Yujie He, Zhaojun Wang, Maomao Zeng,
23. Fang Qin, Jie Chen, Zhiyong He, Food Chemistry **345** (2021)
24. T. Zhanga, N. Zhanga, X. Wu, Animal nutrition **1**, 60-64 (2015)
25. M. Carochi, I. C. F. R. Ferreira, Food and Chemical Toxicology **51(1)**, 15–25 (2013)