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ANNUAL DYNAMICS OF SPERM PARAMETERS IN ASKANIAN MERINO RAMS

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Aim. *To research the dynamics of changes in the kinetic and physiological parameters and quality of the fresh sperm of Askanian Merino rams during the year.* ***Methods.*** *Semen of 5 adult sexually active Askanian Merino rams was obtained 2 times a week with an interval of 1–4 weeks from May 2021 to May 2022, except for July. Ejaculates were obtained into artificial vagina and immediately evaluated.* ***Results.*** *Parameters of ejaculate volume, total number and number of motile spermatozoa had showed a tendency to seasonal change with the lowest values in December–February. The value of spermatozoon concentration had revealed a tendency to 2 cycles of change with low values in August and December–February. Sperm motility did not show a clear relationship with the change of season, but showed low values in December–February.* ***Conclusion.*** *Rams of Askanian Merino breed retain the ability to produce sperm of sufficient quality throughout the year.*

Keywords: *sheep breeding, reproduction, sire, sperm, seasonality*
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РІЧНА ДИНАМІКА ПОКАЗНИКІВ СПЕРМИ БАРАНІВ АСКАНІЙСЬКОЇ ТОНКОРУННОЇ ПОРОДИ

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Мета. *Дослідити динаміку зміни кінетичних та фізіологічних показників та якість нативної сперми баранів асканійської тонкорунної породи протягом року.* ***Методи.*** *Сперму від 5 дорослих статево активних баранів асканійської тонкорунної породи отримували 2 рази на тиждень з інтервалом 1–4 тижні з травня 2021 року по травень 2022 року, окрім липня. Еякуляти отримували з використанням штучної вагіни та оцінювали негайно.* ***Результати.*** *Показники об'єму еякуляту, загальної кількості та числа рухливих сперміїв в еякуляті виявили тенденцію до сезонної зміни з найменшими значеннями у грудні–лютому. Значення концентрації сперміїв і еякуляті виявило тенденцію до 2 циклів зміни з низькими значеннями у серпні та грудні–лютому. Активність сперми не виявила помітного зв'язку зі зміною сезону, але мала низькі значення у грудні–лютому.* ***Висновок.*** *Плідники асканійської тонкорунної породи здатні виробляти сперму достатньої якості протягом усього року.*

Ключові слова*: вівчарство, відтворення, плідник, сперма, сезонність*
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Seasonality of reproduction is characteristic of almost all animals. Among farm animals, this phenomenon is most clearly manifested in sheep. To overcome seasonal anestrus, numerous schemes of hormonal stimulation of the sexual function of sheep have been developed. But the lambing results of stimulated animals are often low that requires further study of the nature of all possible negative factors. One of these factors may be a seasonal change in the physiological and kinetic parameters of the sperm of sires that needs to be studied.

Analysis of recent research and publications. The annual dynamics of sperm quantitative parameters was studied in rams of Suffolk, Hampshire and Rambouillet [Cupps P.T. et al., 1960], Awassi [Azawi O.I., Ismaeel M.A., 2012], Hungarian Black Racka [Sarlós P. et al., 2013] breeds. Comparison of the characteristics of samples obtained in different months and different seasons of the year was carried out for rams of different breeds, including the Chios [Ntemka A. et al., 2019], Zulu [Ngcobo J.N. et al., 2020], Pelibuey [Aké-López J.R. et al., 2016;

Aké-Villanueva J.R. et al., 2022], Poland [Kozłowska N. et al., 2022], Cross-breeds [Moghaddam G.H., Pourseif M.M., Rafat S.A., 2012]. Some authors observed a difference in sperm parameters obtained in different months, other researchers did not find such a difference.

The Askanian Merino breed was created in the 30s of the 20thcentury with the use of Rambouillet sires and is successfully bred in the southern regions of Ukraine to this day. Animals of this breed are characterized by clear mating seasonality (August–January). At the same time, studies of the features of the effect of seasonality on the reproductive qualities of sheep of this breed were conducted only on ewes [Steklenyov Ye.P., 1960; Lobachova I.V., 2016], while there is no information on changes in the quantitative and qualitative parameters of sperm of sire-rams.

Purpose. To research the dynamics of changes in the kinetic and physiological parameters of the fresh sperm of Askanian Merino rams during the year.

Material and methods. The experimental animals were 5 adult sexually active Askanian Merino sire-rams aged 3–6 years. The animals were kept in the physiological yard of the Institute of Animal Husbandry "Askania-Nova", where in the separate paddock ewes and young animals of the same breed were also kept. The physiological yard is located at 46°27′ north latitude. The climatic conditions of the place of animal holding are comfortable in spring and autumn, but with high temperature and low air humidity in July-August. Throughout the experiment, the experimental sires were kept under a canopy in the same pen together with other adult rams and were provided with the same balanced diet. The study was begun in May 2021 and ended in May 2022. Sperm was obtained 2 times a week with an interval of 1–4 weeks, but not in July. Ejaculates were collected into an artificial vagina and immediately evaluated for motility visually under a microscope (on a 10-point scale), ejaculate volume metrically, and cell concentration colorimetrically, total number of spermatozoa, motile spermatozoon number. The statistical calculation of the data was carried out according to the generally accepted ANOVA-algorithms, the probability of difference (p) was estimated according to the Student's criterion (t_d).

Results. Figure 1 shows the change of the quantitative parameters of the sperm of experimental rams during the experiment.

The ejaculate volume showed multidirectional fluctuations in May–November, a gradual decrease until January and then a return to initial values. The highest value of this parameter was recorded on June 15, 2021 – 1.28±0.19 ml, the lowest on January 18 and 21, 2022 – 0.51±0.24 and 0.51±0.16 ml. The difference between the extreme values is non-significant. In December–March, the values of this parameter were lower

than in other months.

Sperm motility showed multidirectional value fluctuations with a noticeable deterioration in June and December–February. The highest motility value was noted on April 12, 2022 – 8.60±0.54 points, the lowest on January 21, 2022 – 5.50±1.03 points, the difference is non-significant.

The spermatozoon concentration had showed 2 decreasing trends - in May–August and in November–January, and 2 increasing trends - in September–October and in February–April. The highest concentration of sperm was observed on March 15, 2022 – 3.57±0.28 cell/ml, the lowest on August 13, 2021 – 1.94±0.60 cell/ml, the difference is non-significant.

Parameters of the total number and the number of motile spermatozoa in the ejaculate showed a tendency to low values in November–February. The highest total number of spermatozoa was recorded on June 15, 2021 – 3.64±1.02 billion/ml, the lowest on January 18, 2022 – 1.31±0.47 billion/ml, the difference is non-significant. The number of motile spermatozoa in the ejaculate was the highest on August 10, 2021 – 2.85±1.02 billion/ml, the lowest on January 21, 2022 – 0.71±0.23 billion/ml, the difference is unlikely. Compared to the value at the beginning of the experiment, the number of motile spermatozoa in the ejaculate between December 17, 2021 and January 21, 2022 was significantly lower ($p<0.05$).

In general, it was summed that the Askanian Merino rams retained the ability to produce sperm of sufficient quality during the all year, but at the same time demonstrated a tendency to seasonal changes in some parameters. In particular, the ejaculate volume, total number and number of motile sperm had showed a same tendency to high values in June–August and low values in December–February. It can be assumed that the main influencing factor was the length of the daylight hours. Concentration of spermatozoa revealed two cycles of changes. The first cycle fell on May–October, the second – on October–March. If in the second cycle, the minimum concentration values fell on December–January and this can be explained by a change in lighting, then the minimum values in the first cycle are most likely due to the negative impact of high air temperature, which was fixed on July and August. The air temperature in the winter months of experiment almost did not drop below 0 degrees and there is no reason to explain the low values of concentration in the winter months by negative influence of low temperature. It should also be noted that at the same time as from the experimental ones, semen was being obtained from the other rams of the same breed, which were kept together with the experimental ones. Frequent cases of lack the desire to ejaculate were observed in these another rams in June. In the autumn and winter months, the refusals to

ejaculate were recorded neither by experimental nor other rams. As for sperm motility, we did not find a clear connection of this parameter with the change of season, and we can only note a long period of its reduced values in December–February and quite high values in March–May.

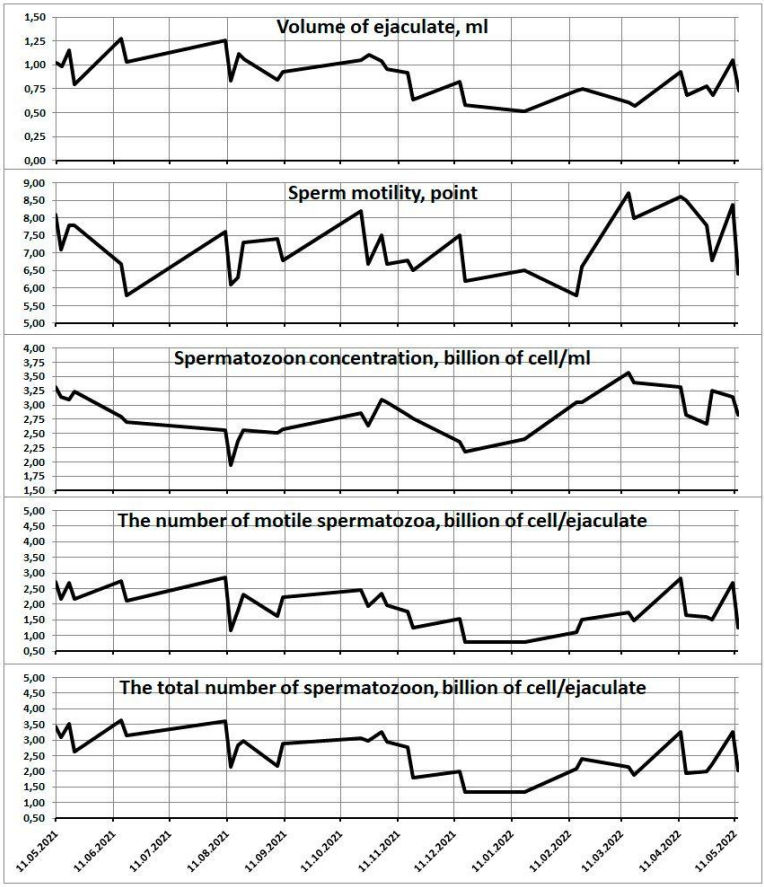

Fig. 1 – Changes in ram sperm parameters during the experimental time.

In some cases, the parameters changes dynamics were determined by us are similar, and in others it differs from the results of other authors. For example, the similarity of the dynamics of ejaculate volume and spermatozoa number that we found is similar to the results of the Cupps P.T. et. al., conducted on Suffolk, Hampshire and Rambouillet rams. The authors had associated this change in

spermatogenic function with change in the length of lighting and maximum daily temperature [Cupps P.T. et. al., 1960]. But these authors did not find a bicyclic change in the concentration parameter. The feature of low sperm concentration in the winter months that we found is similar to the data of Sarlós P. et al., but the dynamics of changes in ejaculate volume and the total number of spermatozoa is different [Sarlós P. et al., 2013].

Our results differ from the data of the authors, who did not find differences in the motility values of ram sperm for samples obtained in the asexual and breeding season [Ntemka A. et. al., 2019]. Other differences were also revealed. So, in Zulu rams, the values of sperm concentration and progressive motility in samples tested at the beginning of the anestrous period were lower to those of sperm obtained at the beginning of the mating season [Ngcobo J.N. et al., 2020]. Quantitative values of the volume of ejaculate in the autumn months (September–December) in Polibuei rams were significantly lower to the values obtained in the winter days (December–March), but the total and progressive motility were almost the same [Aké-López, J.R., 2016]. In the experiments of Kozłowska N. et al. the difference between the parameters of sperm obtained before, during and after the sexual season was observed for spermatozoa concentration, total cell number and motility, while the volume of ejaculate did not differ [Kozłowska N. et al., 2022]. A possible reason for the difference between our results and the data of the cited authors may be the time of semen collection. In our experiment, a noticeable decrease in the values of all parameters occurred in December–January, that is, in months that, although winter, are still within the natural mating season of the Askanian Merino breed. At the same time, the difference between the values scored in the truly anestral period (May–July) and at the beginning of the breeding season (August–September) is almost absent. Therefore, a possible reason for the difference between our results and data of other authors could be the difference in the natural boundaries of the sexual season of the comparative breeds. Thus, Ghezel×Baluchi crossbred rams showed a significant difference between autumn and winter values of ejaculate volume, total number and concentration of sperm, while Arkharmerino×Ghezel hybrid sires did not revealed such differences [Moghaddam G.H., Pourseif M.M., Rafat S.A., 2012]. Therefore, when comparing the results of different studies, it is important to take into account such factors as the month of the experiment and its relation with the boundaries of the natural estrous season of a comparative breed.

Conclusions. 1. Rams of Askanian Merino breed retain the ability to produce sperm of sufficient quality throughout the year.

2. Parameters of ejaculate volume, total number and number of motile spermatozoa showed a tendency to seasonal change with the lowest values in December–February.

3. The spermatozoa concentration revealed a tendency to 2 cycles of change with low values in August and December–February.

4. Sperm motility did not reveal a significant relationship with the change of season, but showed low values in December–February

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