INFLUENCE OF SOME NATURAL–CLIMATIC FACTORS ON THE SPERM PRODUCTION OF NORTH-EAST BULGARIAN FINE-FLEECE BREED

R. Stefanov¹, M. Sabev¹, I. Nikolov¹, G. Anev², M. Ivanova-Kicheva¹, K. Miteva¹, K. Lazov¹

¹Institute of Biology and Immunology of Reproduction, Bulgarian Academy of Science, Sofia, Bulgaria
²Experimental Station of Agriculture, Targovishte, Bulgaria
Corresponding author: stefanovrossen@gmail.com

Original scientific paper

Abstract: The investigations related to the effect of some natural –climatic factors-temperature, humidity, precipitations and duration of light day on the ram sperm production of north-east Bulgarian fine fleece breed, are carried out. The studies are conducted during the reproductive season (preparatory and generative period). Seventeen clinically health ram sperm donors under the selection control, are used. The differences are established in the values parameters of sperm studies, related to the sperm motility (p < 0.05), presence of pathological spermatozoa (p < 0.05) and their thermo resistance (p < 0.01), comparing to those during the generative period. The results are interpreted by the natural-climatic factors influence on the sperm production. The data are informative, related to the possibilities, related to the quality ejaculates selection, related to the high fertility achievement.

Key words: ram, natural–climatic factors, sperm production

Introduction

The high productive breeds in regard to the climatic and economic conditions are reared in all regions of the Bulgaria. That is due to the complex of natural geographic factors, characteristic for the unique regions. The use of optimal genetic potential and characteristic for sheep qualities in their breeding is important condition. The role of valuable rams used as sperm donors is important upon the introduced biotechnology of artificial insemination (Nikolov et al., 2008). The convenient preparation of the breeds before the insemination company, in regard to the collection of qualitative ejaculates with high sperm fertilizing ability are necessary for the selective activity and effective use of the genetic material.
The problems referred to the breeding preparation for the insemination company and the impact on the sperm production are well studied (Anev et al., 2005; Nikolov et al., 2008; Lucidi, 2009). The studies related to the impact of environmental factors on the breed sperm production from different breeding animals and in different climatic conditions are less studied (Nivsarcar et al., 1978; Mittal 1980, Güuzel et al., 1982). There are also data about changes in the seminal plasma composition of ram ejaculates during the different seasons (Cundogan 2006; Perez et al., 1997). One of the largest bred sheep in Bulgaria is the northeastern fine fleece Bulgarian breed and this data are limited (Hristev et al., 2007).

The influence of some natural-climatic factors temperature, humidity, precipitations and duration of light day on the sperm production of northeastern fine fleece Bulgarian breeds motivated this investigations.

Materials and Methods

68 ejaculates obtained from 17 healthy clinically rams used for selective tribal activity in farms from the region of Targovishte, northeast Bulgaria are included into the experiment. The breeds are equilibrated by age (3 years old), placed in the similar conditions of food and sexual use, conform to the normative claims. The sperm is obtained by the method of artificial vagina and investigated according to the accepted methods of evaluation of the parameters: ejaculate volume (см$^3$), sperm concentration (number in 1см$^3$·h$^{-1}$·10$^6$), pH, sperm motility (%), pathologic spermatozoa (%) and thermo resistance after incubation at 39ºC for 300 min (%) (Nikolov et al., 2008).

During the reproductive season (preparatory on June and generative on July periods), the values of some natural climatic factors: average temperature, frequency and intensity of precipitations, relative humidity of the air and duration of light day, according to the zoohygiene parameters are determined (Hristev, 2008).

The data are submitted to the variation-statistic analysis of Student.

Results and Discussion

68 ejaculates are obtained during the reproductive season and during the complex evaluation of biological parameters of the sperm, 66 are normozoospermic from them (Table 1).
Influence of some natural-climatic factors ...

Table 1. Biological sperm ram parameters during the reproductive season

<table>
<thead>
<tr>
<th>Ejaculates, collected during the reproductive season (by periods)</th>
<th>n</th>
<th>Used parameters</th>
<th>Useless ejaculates</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>volume (cm³)</td>
<td>Motility (%)</td>
</tr>
<tr>
<td>Preparatory period</td>
<td>34</td>
<td>0.08±0.09</td>
<td>74.58±1.42</td>
</tr>
<tr>
<td>Generative period</td>
<td>32</td>
<td>0.93±0.08</td>
<td>83.67±1.13</td>
</tr>
</tbody>
</table>

Two ejaculates, obtained from one breed, show deviations in values parameters of spermogram and it is not included in the experiment. The semen liquid obtained during the preparatory period has lower parameters values that those during the generative period. The significant differences to the some values parameters are established as sperm motility (p<0.05), pathologic spermatozoa (p<0.05) and sperm thermal resistance(p<0.01)

The trend of some increasing of sperm concentration during the generative period is observed. The obtained ram ejaculates during the generative period have higher motility as well before as well after the incubation compared to those during the preparatory period(Figure 1).

![Figure 1. Motility of spermatozoa from ejaculates obtained, before and after incubation for 5 hours during Generative period (A) and Preparatory period (B)](image)

The percent of pathological spermatozoa in the investigated ejaculates is significantly lower during the generative period (Figure 2). The presence of spermatozoa with damage configuration is established, but their values are in the limits of norms.
Regarding the spermatozoa’s structure, the most frequent impairments are found in the tail (Figure 3).
The average month temperature is 22.43°C during the preparatory period and its values vary within the limits from 19.4°C to 26.7°C (Table 2). The slightly higher value (with 1.04°C) of this parameter is registered during the generative, compared to this one of the preparatory period. Essential difference related to the frequency and the intensity of the precipitations is established during the both periods and during the preparatory period this values are higher (relatively with 3 days and 12.18 L.).

Table 2. Parameters of some natural–climatic factors during reproductive season, from the region of Targovishte, northeast Bulgaria

<table>
<thead>
<tr>
<th>Parameters of some natural–climatic factors during reproductive season (by periods)</th>
<th>Average month temperature (°C)</th>
<th>Frequency of precipitations (number of days)</th>
<th>Intensity of precipitations (L)</th>
<th>Relative humidity (%)</th>
<th>Duration of light day (h)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Preparatory Period</td>
<td>22.43±0.12</td>
<td>7</td>
<td>13.61±6.73</td>
<td>68.50</td>
<td>16.30</td>
</tr>
<tr>
<td>Generative Period</td>
<td>23.47±0.14</td>
<td>4</td>
<td>1.43±0.80</td>
<td>67.80</td>
<td>15.80</td>
</tr>
</tbody>
</table>

The relative humidity of the air as well as the duration of the light day are approximately similar during the both investigated periods and the slightly higher values are registered during the preparatory period. The data from the conducted investigations on the sperm production and the biological qualities of spermatozoa give foundation to accept the investigated breeds produce ejaculates with high biological parameters as well during the preparation as well during the AI company and can be used as sperm donors.

The preparation of the breeds for the AI company claims knowledge of physiological and biochemical particularities as well the reaction of organism to the complex of natural climatic factors characteristic for the region of breeding. It is necessary to do the evaluation of external factors which with their fluctuations stipule the adaptive mechanisms of animals and contribute to the maintenance of good fertility (Hristev, 2007). Independently on the adaptive mechanisms, the conducted investigations show that during the preparatory period when the frequency and the intensity of the precipitations are higher, compared to those to the generative period, the quality of the ejaculates related to some spermogram parameters (sperm motility, pathologic spermatozoa, sperm thermo resistance are significantly lower (p≤0.05; p≤0.05; p≤0.01) The difference during the both
periods are negligible, related to the factors: temperature and duration of the light day and do not influence sperm biological parameters. Making analysis of the obtained results, we suggest that it's necessary during the reproductive abilities evaluations of the breeds from the investigated race to have in mind the natural climatic factors impact during the reproductive season.

**Conclusion**

During the preparatory period the differences of the parameters values of the spermograms: sperm motility ($p<0.05$), presence of pathologic spermatozoa ($p<0.05$) and thermo resistance ($p<0.01$), in comparison to those during the generative season, are established.

The data referred to the discovering of possibilities in view the selection of ram qualitative ejaculates from the northeast fine fleece and achievement of high fertility, are informative.

**Uticaj nekih prirodnih-klimatskih faktora na proizvodnju sperme ovnova severno-istočne bugarske finorune rase**

*R. Stefanov, M. Sabev, I. Nikolov, G. Anev, M. Ivanova-Kicheva, K. Miteva, K. Lazov*

**Rezime**

Istraživanja su se bavila uticajem nekih prirodno-klimatskih faktora – temperatura, vlaga, padavine i dnevne svetlosti na proizvodnju sperme ovnova severno-istočne bugarske finorune rase. Ispitivanja su izvedena tokom reproduktivne sezone (pripremne i reproduktivne) na 17 klinički zdravih ovnova koji su prijavljeni kao kontrolni donatori sperme. Tokom pripremnog perioda utvrđene su razlike u vrednostima indeksa koji se odnose na pokretnjivost sperme ($p<0.05$), prisustvo patoloških spermatozoida ($p<0.05$) i toplotnu otpornost ($p<0.01$), u poređenju sa vrednostima tokom reproduktivne sezone.

Trend povećanja koncentracije sperme tokom generativnog perioda je zabeležen. Dobijeni ejakulati ovnova tokom generativnog perioda imaju veću pokretnjivost pre i posle inkubacije u poređenju sa preparativnim periodom. Procenat patoloških spermatozoida u ispitivanim ejakulatima je signifikantno niži tokom generativnog perioda. Prisustvo spermatozoida sa oštećenom konfiguracijom je takođe zabeleženo, ali njihove vrednosti su u granicama normativa.
Rezultati se objašnjavaju prirodno-klimatskim faktorima koji utiču na proizvodnju sperme.
Dobijeni podaci su veoma informativni u smislu mogućnosti koje se odnose na selekciju ejakulata prema kvalitetu kako bi se postigla bolja plodnost.

References


Received 31 May 2009; accepted for publication 15 August 2009