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On the Influence of Certain Natural Factors on the Sperm Quality and Sexual Behaviour of Rams

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Abstract**—**In the Northern hemisphere, sheep reproduction is seasonal (September-November). Among several natural factors influencing the reproduction status of rams, we studied the daylight length and temperature. Rams from different breeds were studied: Merinos de Palas (half-precocious), Karakul de Botosani (half-belated) and Turcana (belated breed, low reproductive plasticity). In Merinos de Palas, ejaculate volume during sexual repose is 51.3% from normal quantity. When autumn climate was experimentally induced, ejaculate volume reached 98.45% (Merinos), 94.97% (Karakul) and 97.59% (Turcana). Semen density increased from 1.031-1.033 till 1.035 after exposition to artificial light and temperature conditions. Spermatozoids mobility and sperm pH improved, passing over 82% and 6.75, values identical to those in the natural reproduction season. Behaviour analysis after photoperiodicity indicated that over 83.3% Merinos and Karakul males and all Turcana rams exteriorised normal and intense sexual reflexes. Certain effort and reduced expenses brought rams in good condition, producing higher quantity and quality sperm.

Keywords**—**natural factors, photoperiodicity, sexual behaviour, Romanian sheep.

I. INTRODUCTION

THE rising of sheep for meat production is economical and biological efficiently and is influenced by reproduction activity of animals from each races, populations or farms. The reproduction function have to aim at the increasing of intensifying level, but it is necessarily to be elaborated and applied depending on peculiarities of each populations, because the success of this activity is directly influenced by reproduction characters value [5, 6, 9, 11]. For intensifying of sheep reproduction, the ways and solutions without material and financial resources are induction of puberty for using the female lambs to the reproduction since first autumn and using the influence of natural factors for induction and synchronization of heats in extra season to rams and adults sheep [5, 10].

Taking as reference point the obtained results on national level [6, 8, 9, 10, 11] and international level [1, 2, 12, 13, 14, 15] effected on other breeds and populations of ovine, during researches we have been study the determination of mode and sense which natural factors, light and temperature, could be using for intensification of the reproductive function of ovine rising in northern-eastern part of Romania.

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II. MATERIAL AND METHOD

The biological material was represented by reproductive rams belonging to Merinos de Palas, Karakul de Botosani and Turcana. The research meant to identify the means and the practical and economical possibilities to identify the reproduction, the accent being on several aspects and major ways such as:

- The influence of a day's length and of the temperature in starting and intensifying the ram's sexual activity;
- The quantity and the quality of the sperm;
- The sexual behaviour of the ram out of season.

The influence of a day's length and of the temperature was followed on a period considered to be out of season, such as between March and May. This period is totally different from the point of view of the thermal behaviour and the length of the day light compared to October-November, which is considered to be normal in the reproduction of the sheep from the northern hemisphere.

In the case of the first aspect in research, in order to have clear results concerning the practical possibility to intensify the reproduction of the rams, they were subject to a program of controlled temperature and light duration/exposure. In the first 15 days gradual growing of temperature and light exposure to 30°C and 16 hours of light (corresponding to June 22nd) then going to gradual reduction of the two parameters, in order that after 18 days the groups of rams be exposed to a 23°C temperature and 11,30 hours of light (multi-yearly values for October in the north-eastern part of Romania).

When all the elements have been synchronized, researches, sperm collects and observations have been made for the quantity and quality analysis of the sperm, but also for direct observations for the sexual behaviour of the reproductive ram in out-of-season periods.

The means of work were adapted to these determinations [9], and in order to establish every studied parameter the adequate technique was chose, the information was collect, statistically processed and analysed.

II. RESULTS AND THEIR DISCUSSION

The influence and the role of the natural factors in starting of the sheep ovulate heats was the subject of several researches, that differences of the normal reproductive period from different places of the world were noticed. It is known that in tropical and subtropical parts, where there is plenty of

vegetation, the oestrus can occur all year long at sheep and goats [9, 10, 15].

It is different in places with moderate temperatures such as in Romania, were the reproductive activity is split in two season linked to the day's duration. The first season considered the most important, is the one in autumn, when the day is shorter and the light – dark ratio is 1:1, and the second season is in the spring when the day is longer before it reaches the same ratio. In the second season, the reproductive activity is still reduced. Considering this, we tried to study the possibility to use the natural factors to ease the reproductive process in spring.

The influence of the seasons for the seep sexual periods for reproduction represents a characteristic of the species inherited from the wild species, being genetic. This aspect proves that the end of the domestication process useful for the breeder was never reached [3, 14]. In the present years, when it is accentuated to increase the production and the income, it is necessary that the use of the natural factors in reproduction be intensified, having economic efficiency with low costs.

The use of the natural factors can offer possibilities to increase the sheep and goats reproduction period. In this case, the time for the germinative cycle, for the sexual cycles and for the reduced pregnancy period could plan two births every year, unless we eliminate the lactation anoestrus by an artificial rising of the lambs. The planning of two reproduction periods per year is harder to obtain because in the case of sheep usually, after giving birth a long period of anoestrus installs, which is caused by maternal factors (lactation anoestrus) and by climatic factors (seasonal anoestrus). The role of both groups of factors is a major one of which depends on the bio-economical efficiency of breeding sheep, but using them for this purpose and at the intensity desired by the breeder, is a difficult task because in many moments the effects might overlap.

The influence of the day light and of the temperature over the reproduction and over the quality of the seminal material to reproductive rams. At this species, as well as at goats, the reproduction is determined by the interaction genotype/environment (represented by photoperiod- the day light and the influence of other factors: food, temperature, humidity, social factors etc.).

The photoperiodic information (light or obscurity) is receipted by sheep at the level of the eyes through the retina, and it is transmitted through the nervous system to the pineal gland (epiphysis) which produces the melatonin hormone. Through the hypothalamus and the hypothesis, the duration of the secretion and the quantity of melatonin obtained compared with the might time influence the appearance of sexual hormones FSH and LH [1, 2, 3, 5, 9, 11, 14, 15]. Having these remakes and scientific discoveries as a starting point, the experimental protocol of inducing sexual manifestations at out-of-season rams had the following steps:

- The stimulation of the log days, in this case the one having more than 12 hours of light, corresponding to late spring and the beginning of summer;
- The stimulation of short days, considered of having less than 12 hours, corresponding to autumn-winter months.

From this point of view, in order to establish the difference between races, they were the subject of the some effect of photoperiods, and the experiment took place, in both years, between 10th of March and 20th of May, meaning when the light-dark ratio is closer and bigger than 1/1 and the possibility that the belated, semi-belated and semi-precocious races to have sexual cycles is reduced.

At the beginning of every experimental period during these consecutive two years, the rams were the subject of a special light program during 15 days, because it is known that during the24 hours of a day there is a period in which the animals are disturbed by the light. This is called photosensitive phase and it occurs after 16-17 hours after sunrise, considered to be an example of circadian rhythm.

In order to obtain an exposure to the light program, established by the experimental protocol, the rams are exposed to two light fractions daily (flash). The first flash was in the first two hours in the morning and during 3-4 hours by exposure to artificial light. The second daily flash was 16 hours after the first and during 2-4 hours. Between the two flashes, the rams were placed in a paddock or on the field exposed to the natural light. By doing this, we had a progressive exposure of the rams to 16 hours.

From the moment in which the maximum of 16 hours exposure was obtained, corresponding to June 22nd, the rams have been the subject of a reversed process of light exposure. This happened during 18 days of artificial simulation of changing to short days, by making dark shelters, consequently not permitting the rams to stay longer than 10-12 hours into the light. This thing was possible by covering the windows and the skylights with opaque materials. During the last 8 days, the rams stayed only 11 hours and 30 minutes into the light. During both stages, the thermal program reached the medium multi-yearly temperature of June in 15 days and regressively, in 18 days, to reach the temperature specific to the normal reproduction period, corresponding to October. In June, the yearly thermal amplitude is about 30°C and in October is about 22.5°C, fact that justifies the idea of continental temperate climate.

From the moment there reached the settled parameters there turn to the second stage of the researches, seminal material collect, qualitative and quantitative sperm analysis and observation about the rams' behaviour. In order to have a good evaluation of the results, they were compared with others obtained from the rams in the reproductive season, but in the normal season.

Table 1 contains data about phenothypical and biological features of the sperm obtained from the rams after photoperiodicity and from the sexual active rams in normal reproductive season or from rams in sexual repose.

The ejaculate volume represented a first aspect to research. In the speciality literature is mentioned the fact that at the rams in normal reproductive season, the ejaculate volume has average values between 1 and 1.5 ml [6] and at the rams in sexual repose the ejaculate volume is more reduced. The determinations show that at the rams from the same breed in sexual repose had minimal value as 0.98 ml and at the rams after photoperiodicity the average volume was more 90%

from the average quantity collected from the rams in full sexual season. The lowest values of the ejaculate volume were at the rams in sexual repose.

In addition, the obtained data confirm that the secretive activity took place, even off-the-season, in optimal condition at the rams influenced by photoperiodicity. From this point of view, it is possible to affirm that using a light controlled schedule in accordance with a proper thermal regime, could be stimulated the sexual activity of the rams in sexual repose period. This fact could have important economical and practical implications when the goal is to have an intensive reproductive activity at ovine. Regarding the ejaculate volume, Kuznetov quoted by N. Luca [6] showed that at rams situations when the ejaculate level was more than 6 ml. The analysis of the obtained data from the three batches shows that at the rams in sexual repose the ejaculate volume is lower and very close as value at the rams after photoperiodicity and in normal reproductive season.

The sperm response or acidity rank is estimated by pH value. The values of this parameter depend by the spermatozoon concentration. As long as the density is higher, the pH goes to acidity, determined by the grown metabolism and by the highest level of the lactic acid. The data from the speciality literature show that for the rams in full reproductive season, the pH average value is 6.8 [1, 5, 6, 8, 10, 12, 14, 15].

After determinations there find differences between sperm response values. The average registered values were very close only at the rams influenced by photoperiodicity and at the rams in normal reproductive season. This fact allow us to conclude that between epididymal content and annexed glands secretions it's an almost constant ratio, meaning spermatogenesis process is normal at the rams from the first experimental batch (subdued at the natural factors influence).

TABLE I
THE MAIN BIOPHYSICAL AND BIOLOGICAL FEATURES OF RAMS SPERM

Period	Race	Biophysical and biological features			
		Volume (ml)	Sperm reaction pH	Density	Mobility (%)
P_1	MP	1.91 ± 0.02	6,76 ± 0,11	1.037 ± 0.09	83.68
	KB	1.89 ± 0.03	6.75 ± 0.23	1.035 ± 0.08	84.35
	T	2.03 ± 0.20	6.91 ± 0.16	1.036 ± 0.06	82.87
P_2	MP	0.98 ± 0.06	5,92 ± 0,09	1.032 ± 0.10	79.66
	KB	1.30 ± 0.05	6.10 ± 0.25	1.033 ± 0.07	80.02
	T	1.12 ± 0.08	6.11 ± 0.14	1.031 ± 0.02	80.15
P_2	MP	1.94 ± 0.03	6.95 ± 0.20	1.037 ± 0.08	84.44
	KB	1.99 ± 0.09	7.08 ± 0.13	1.036 ± 0.04	82.15
	T	2.08 ± 0.05	6.98 ± 0.22	1.035 ± 0.07	83.22

Notice: P_1 = Rams influenced by photoperiodicity;
P_2 = Rams in repose period (off-the-season);
P_3 = Rams in reproductive normal season
MP = Merinos de Palas; KB = Karakul de Botosani; T = Turcana

Density and mobility are features vary from a species to other, and in a lower level, from an individual to other belong to the same breed or population. Andersen and col. [2] have been analyzed the sperm specifically weight depending on interrelationships between the physical features and biological value and they find out that on a specific weight correspond a particular density and mobility of spermatozoon. After Lindhal and Kihlstrom, quoted by Bonadonna [4], the sperm specifically weight is also depending on the ratio between mature spermatozoon (heavier) and immature spermatozoon (lighter) from the seminal liquid. Mann [7] shows that the sperm specifically weight is directly influenced by the osmotic pressure and is related with cryoscopy point of the sperm.

The determined values from the researches show that when the samples of the sperm collected from the rams in light treatment and in normal reproductive season have average specifically weight values at the samples from the rams in sexual repose and in off-the-season, average values of the same parameter is lower. This fact allow us to declare that under the photoperiodicity influence the quality of the seminal material from the rams with the same treatment have similar features with the rams in full reproductive season and in full sexual activity including an optimal density and mobility of the spermatozoon.

The rams' sexual behaviour represents a very important aspect in the reproductive quality evaluation. Generally, at the ovine species many authors [4, 5, 6, 8, 15] recommend for the nursery candidate rams an intensification of the activity in order to develop the sexual reflexes and on the right time to be able to be used for reproductive activity.

Along the research period, the rams have been control about sexual behaviour, with rhythmical initiation and formation activities in order to accustom them with seminal material collecting using the artificial vagina. Sexual behaviour evaluation was made regarding the reflexes intensity and the interest of each ram for jumping in the sheep presence, marking them on a scale from 1 to 5 (table 2).

At the end of the study the marks were utilised in rams classification related with the sexual reflexes intensity, proved by them inclusion in the sheep herd and for the seminal liquid collecting. At the photoperiodicity subdued rams it was demonstrate that for the Merinos de Palas and Karakul de Botosani breeds were manifested normal sexual reflexes and intensive sexual reflexes over 83.3%. The Turcana breed rams were included totally in the evaluation batch 4 and 5. In comparison with the data from the same rams evaluated in normal reproductive season, the data have similar values. This fact allows us, to affirm that natural factors utilisation as light and temperature could determine the sexual activity prolongation along one-year period. Also, traversing a minimum 30 days growing period and than reducing light and temperature program and a supported program for getting and fixing the sexual reflexes offer all the circumstances for the valuable rams to manifest a sexual behaviour for all year. The importance of this aspect is generated by the fact that an intensive reproductive activity of the rams will influence directly the selection activity and the reducing of the interval between the generations for this species, justifying for technical and economical reasons, natural factors using in reproductive activity intensification for sheep. The obtained results are convergent like sense, but are superiors compared with other data published in international speciality publications [14].

TABLE II
THE MAINS BIOPHYSICAL AND BIOLOGICAL FEATURES OF RAMS SPERM

Period	Race	n	Behavior (evaluation on 1 to 5 rank) 1 (without reflexes)		2 (very wick reflexes)		3 (wick reflexes)		4 (optimal reflexes)		5 (intense reflexes)	
			n	%	n	%	n	%	n	%	n	%
P_1	MP	6	-	-	-	-	1	16.7	3	50.0	2	33.3
	KB	6	-	-	-	-	1	16.7	2	33.3	3	50.0
	T	6	-	-	-	-	-	-	1	16.7	5	83.3
P_2	MP	6	1	16.7	1	16.7	1	16.6	3	50.0	-	-
	KB	6	-	-	1	16.7	3	50.0	2	33.3	-	-
	T	6	-	-	1	16.7	3	50.0	1	16.7	1	16.6
P_3	MP	6	-	-	-	-	-	-	3	50.0	3	50.0
	KB	6	-	-	-	-	-	-	1	16.7	5	83.3
	T	6	-	-	-	-	-	-	1	16.7	5	83.3

Notice: P_1 = Rams influenced by photoperiodicity;
P_2 = Rams in repose period (off-the-season);
P_3 = Rams in reproductive normal season
MP = Merinos de Palas; KB = Karakul de Botosani; T = Turcana

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IV. CONCLUSIONS

1. The determinations made on batch with rams influenced by photoperiodicity show that the total average ejaculate volume controlled in two successive years was over 90% from the average collected quantity from rams in full sexual activity in normal reproductive season, the differences being insignificant.

2. Because the sperm response give by pH values shows that at the rams influenced by natural factors and at the rams in sexual activity in normal season is registered similar values, result that between the epididyme content and annexed glands secretions it is an almost constant ratio.

3. The rams influenced by the photoperiodicity have the density and mobility of spermatozoon similar features with the rams in full and intensive sexual season, justifying the natural factors using.

4. For the rams subdued at photoperiodicity influence there find out that Merinos de Palas and Karakul breeds manifested normal and intensive sexual reflexes over 83.3%. The Turcana breed rams were included in 4 and 5 evaluation ranks.

5. The adequate utilisation of the natural features could generate many possibilities to extend the reproductive season along a calendar year, with special economic results.

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