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The terrain, abiotic factors, and the available grassland had an impact on the quality and quantity of grazing, hence the ethological reactions of the calves.

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I. INTRODUCTION

There are differences among breeds and individuals within a species (Gonyou and Lou, 2000), and the environment is a main factor determining its behavior and development. The behavioral reactions of female calves allow prognosticating the temperament of herds (groups) as an indicator of their adaptation and co-existence over a definite period. A lot of studies in Bulgaria and abroad (Motyska et al., 1995; Krastev et al., 1999; 2002; Kudrin et al., 2008; Varlyakov et al., 2011; Stoycheva, 2014) noted the relationship between the ethological reactions of cattle and the various systems characterizing the breeding regime.

According to Medvedski (1983), the breeding of calves is a planned and guided process with a defined purpose and focus. Every young organism is very plastic and can be used to form the individuals in the desired direction. Zimmerman (2000), Grandin (2001), Yonikovski et al. (2008), and Kudrin et al. (2016) assumed that by a variety of factors such as breed, sex, breeding technology, live weight produced the behavior of cattle and the same is a relation between productivity and environmental performance

There are two types of grasslands: natural and cultivated (Malay, 2012). Cultivated pastures have been

sown with grass species of high productivity and nutritional value for breeding and feeding the livestock. Kirilov et al. (2013) reported that according to the proposed technology, the average annual yield of artificial grasslands was 7500 kg/ha of hay, 9000 kg/ha of haylage (from the hay harvests) and 22500 kg/ha of green matter (of the pasture areas).

The number of studies, related to the behavior of female calves under pasture technology, is relatively small.

The purpose of the present study is to observe the ethological reactions of female calves of 'Bulgarian Rhodope Cattle' and 'Montbeliarde' breeds during the spring and summer period under the conditions of artificial pasture at the foothill of the mountain.

II. MATERIALS AND METHODS

We conducted the study in the late spring and early summer (May, June, and July) in 2017, at a foothill area of the Balkan Mountains, at an altitude of 386 m. Two technological groups of animals were observed of 'Bulgarian Rhodope Cattle' and 'Montbeliarde' breeds. We followed the norm for their number (six female calves intended for breeding), at the same age (180 days) and live weight (107 kg on average for 'Bulgarian Rhodope Cattle' and 129 kg of 'Montbeliarde') by the method of analogs. The average daily growth during the grazing period was 294 ± 2.45 g for calves of 'Bulgarian Rhodope Cattle' and 387 ± 3.71 g for calves of 'Montbeliarde' breed. We identified the breeds with a different spray color and individual numbers (from 1 to 6).

Until May, the animals were bred in a covered cattle-shed (free), fed with a day ration mixture of coarse and concentrated fodder. Fourteen days before the grazing period, the ration was reduced by 25% to restrict the behavioral and physiological stress of the animals in the first days of the free pasture farming.

The artificial pasture is situated on flat terrain (Bukovets locality), typical for the conditions of the Central Balkan Mountains and isolated with an electric fence. All calves started grazing in the morning at 6.30 a.m., which lasted for 14 hours (until 8.30 p.m.) in an area of 1.5 ha. Calves slept and had a rest in natural conditions on the pasture under a group of tall trees. The watering was carried out in a trough connected to the plumbing system.

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The study on ethological reactions of calves was conducted by continuous observations (24 hours per day) according to the group timing technique in 10 minutes by zootechnical methods. We have observed six main behaviors: grazing, resting (standing, lying down), rumination, movement, water intake, and defecation. We reflected the results in daily records.

We indicated meteorological data given from regulated observations in a meteorological observation post, located on the territory of the pasture. Measurements are three times: daily readings of $t^{\circ}\text{C}$ (dry and wet thermometer), humidity (thermohydrograph apparatus), wind (kata thermometer), cloudiness and precipitation.

Grass samples from the experimental pasture were analyzed in the analytical laboratory of RIMSA using a classic Weende method for establishing nutrients and chemical composition. *In vitro* enzyme dry matter digestibility (DMD) was determined by a two-phase pepsin-cellulose method of Aufrere (1982).

We calculated the relative feed value – RVF by dry matter digestibility and consumption in comparison with RVF for alfalfa (Jeranyama & Alvaro, 2004; Ward & de Ondarza, 2008).

III. RESULTS AND DISCUSSION

a) The influence of the environment on the behavior of female calves of 'Bulgarian Rhodope Cattle' and 'Montbeliarde' breeds

The abiotic indicators characterizing mainly the climate conditions in the experimental area – the average air temperature ranging from 14.4°C (01-10.05) to 22.9°C (21-30.06) are typical for the region (Table 1). The lowest minimum air temperature (9.9°C) was in the period of the third ten days of May and the highest maximum (31.1°C) in the third ten days of June.

The average relative humidity of the atmospheric air was highest during the first ten days of June (83.0%). In the period of 01-10.05, the lowest average values (75.0%) of the indicator were when the average air temperatures were the lowest.

The third ten days of June were relatively warm, sunny, with the least clouds, wind, and rainfall. We observed the highest cloudiness at the end of May and the highest precipitation (70.3 mm) in the first ten days of July.

Table 1: Abiotic ecological characteristics of the environment

Period	Temperature, $^{\circ}\text{C}$			Humidity, %			Cloudiness	Wind, m/s	Precipitation, mm
	Min	Max	Average	Min	Max	Average			
01-10.05.17	8.3	20.4	14.4	58.0	92.0	75.0	5.8	1.5	55.4
11-20.05.17	14.9	22.4	18.7	65.0	88.0	76.5	5.5	1.8	8.0
21-30.05.17	9.9	20.4	15.2	71.0	92.0	79.0	6.4	1.5	69.7
01-10.06.17	13.7	24.5	19.1	72.0	94.0	83.0	5.6	1.5	30.1
11-20.06.17	12.1	24.4	18.3	71.0	92.0	81.5	4.8	2.0	51.7
21-30.06.17	14.6	31.1	22.9	64.0	75.0	69.5	1.5	1.4	1.3
01-10.07.17	13.7	29.0	21.4	66.0	94.0	80.0	2.4	1.8	70.3
11-20.07.17	14.6	27.4	21.0	71.0	94.0	82.5	4.4	1.4	62.0
21-30.07.17	13.7	28.9	21.3	71.0	91.0	81.0	3.2	1.5	54.3

Given the values of abiotic environmental indicators in the area of experimental pasture, the ethological reactions of the female calves are of interest.

The data reported in Table 2 show that calves of 'Bulgarian Rhodope Cattle' use 17.7% (436 min) of the twenty-four hours for grazing and those of 'Montbeliarde'

breed spend 18.6% (453.24 min). The hours between 6.30-10.30 a.m. and 2.30-8.30 p.m. are the most active grazing period for both groups of animals. The results obtained are similar to those found by Krastev et al. (2001), Yonikovsky et al., (2008) and Kudrin et al., (2008), in pasture breeding of calves and heifers.

Table 2: Correlation and trends in the behavior of female calves

Elements of behavior	Breeds			
	Bulgarian Rhodope Cattle (I group) n=6		Montbeliarde (II group) n=6	
	min	%	min	%
Grazing	436.0	17.7	453.2	18.6
Total time spent in rest	710.8	28.9	670.6	27.6
Standing	187.5	7.6	179.4	7.4
Lying	523.3	21.3	491.3	20.2
Rumination	308.7	12.6	318.4	13.1
Movement	279.0	11.4	301.7	12.5
Water intake	8.5	0.3	9.1	0.4
Defecation	5.7	0.2	5.4	0.2
Total	1440.0	100.0	1440.0	100.0

During the grazing period, the average time spend in lying position for calves of 'Bulgarian Rhodope Cattle' is 523.3 min or 21.3% of the day, and for those of 'Montbeliarde' – 491.26 min or 20.2% of the time within twenty-four hours (Table 2). The animals spend the longest time in lying position from 10:30 p.m. to 1.30 a.m. – 43.71%, a decrease is observed after that to 4.12% till 6.30 a.m. (Fig. 1).

For a 24-hour period, the female calves of 'Bulgarian Rhodope Cattle' spend 187.5 min in a standing position, which is 8.1 min longer than the representatives of 'Montbeliarde' breed. Calves are most active during a definite period in the morning (6.30 a.m. - 10.00 a.m.), before noon (11.30 a.m. to 2.00 p.m.) and evening hours (from 6.30 p.m. to 9.30 p.m.).

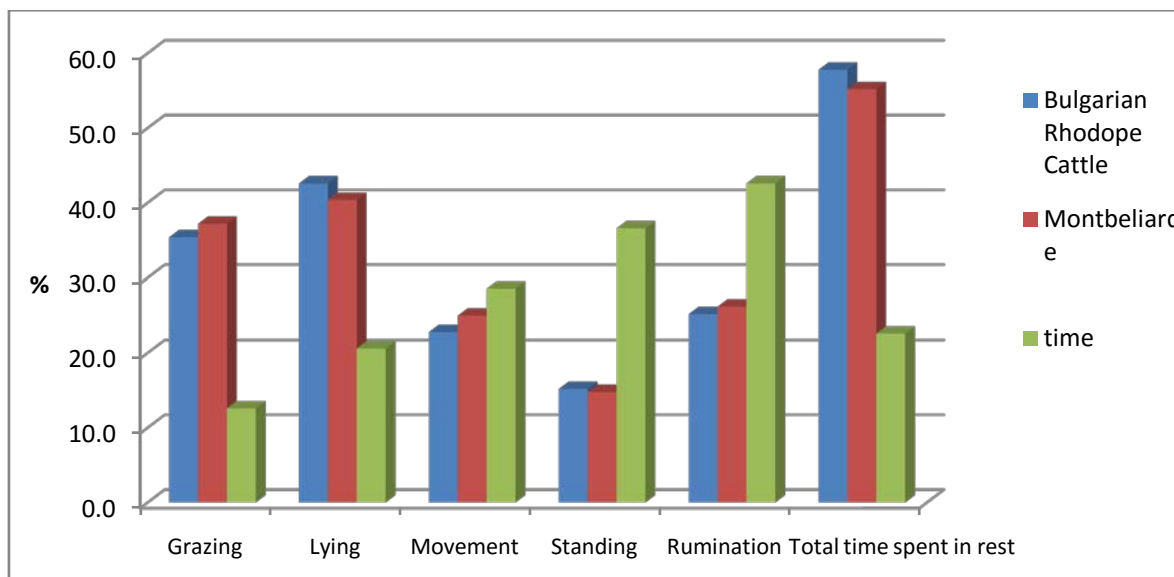


Fig. 1: Ethological reactions in dynamics for 24 hours

During the study, we observed sporadic instances of sexual aggression. Diseases in experimental calves were not allowed.

b) Productivity and qualitative characteristics of artificial grassland

Artificial grasslands for grazing (under non-irrigated conditions) form their yields mainly in April, May, and June. In the summer months, because of the lower soil and air humidity, grass growing is weaker. Proper use of the pasture ensures the maximum yield per unit area and a slight change in grass quality.

The average fresh and dry matter yield of the artificial grassland included in the experiment is 17066.8 kg/ha and 3625.3 kg/ha, respectively.

The group of motley (38%), in which 17% are weeds, followed by grasses (36%) and legumes (26%) – Fig. 2, formed the density and productive potential of the pastureland. The plants of *Dactylis glomerata* L. and *Phleum pretense* L. predominate in the botanical composition of the grassland. The share of legumes (*Lotus corniculatus* L. and *Trifolium repens* L.) is considerably more limited in the grass association. The feeding value of the sward in the grassland is high because the grazing does not allow grasses to become coarse hence the quality of plant biomass does not deteriorate.

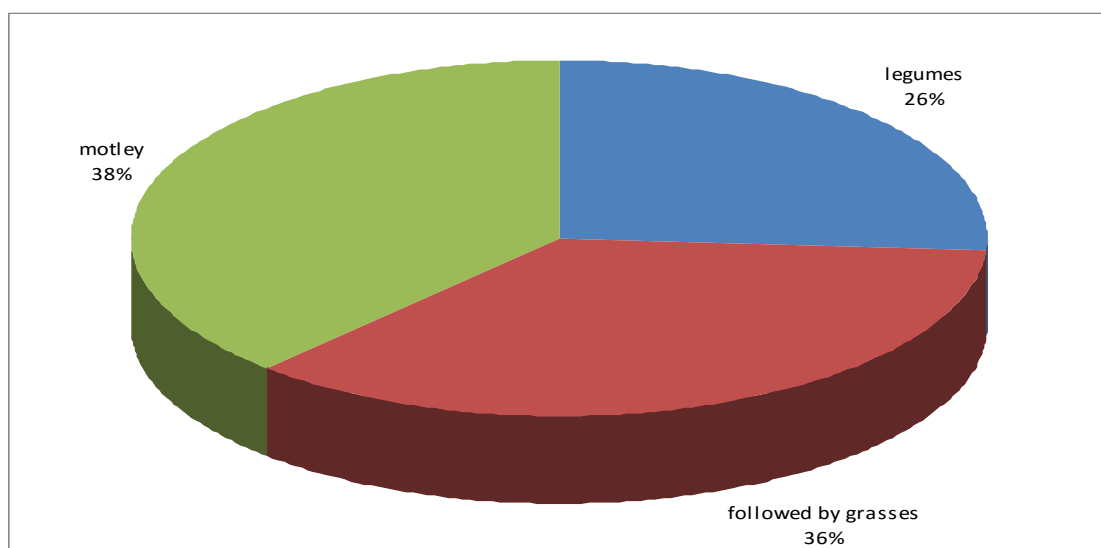


Fig. 2: Botanical composition of artificial grassland (weight, %)

The chemical characteristics of fodder determine to some extent the quantity of feed intake.

Table 3 and 4 show the basic chemical composition and structural fibrous components of cell walls in forage dry matter, where the crude protein (CP)

values – 159.4 g kg⁻¹ DM, crude fiber (CFR) – 384.7 g kg⁻¹ DM, nitrogen-free extractable substances (NFE) – 330.6 g kg⁻¹ DM and the fully digestible hemicellulose – 193.2 g kg⁻¹ DM are high. They correspond to the high dry matter digestibility (653.5 g kg⁻¹ DM).

Table 3: Basic chemical composition of dry matter of artificial grassland (g kg⁻¹ DM)

CP	CFr	CF	Mineral substances	NFE	Ca	P
159.4	384.7	24.3	101.1	330.6	25.6	1.83

In biochemical cycles, the amount and ratio of Ca and P elements in the forage mass composition are interrelated and affect the feeding of young cattle. In this instance, the calcium/phosphorus ratio in the dry matter of the analyzed feed is 2.3: 0.2%.

The relative feed value (RFV – 120.2), used for the comparison of biomass quality, compared to alfalfa biomass in the blooming phase shows that grass biomass has a slightly better nutritional value because of the lower content of acid detergent fibers (ADF).

Table 4: Structural fibrous components and *in vitro* dry matter digestibility of an artificial grassland (g kg⁻¹ DM)

NDF	ADF	ADL	Hemicellulose	Cellulose	Degree of lignification	DMD	DMI	RVF
505.8	312.6	107.7	193.2	205.0	199.6	653.5	2.37	120.2

The grass composition of the pastures is a factor determining the nutrient composition, feed consumption and productivity of animals (Komarek et al., 2007; Thomas et al., 2010).

The total energy nutrition value of dry biomass is 18.41 MJ/kg DM (GE) and the energy required to

meet the physiological needs of the animal organism – 7.75 MJ/kg DM. Feed units of growth (0.64) in kg of dry matter allow the optimum regrowth and development of female animals (Table 5).

Table 5: Energy nutrition value of dry matter of artificial grassland

GE	EE	FUM	FUG
18.41	7.75	0.71	0.64

IV. CONCLUSIONS

The main ethological reactions of female calves of 'Bulgarian Rhodope Cattle', intended for breeding, with a live weight of 217 kg, are distributed as follows: grazing – 17.7% (436 min), time spent in a lying position – 21.3% (523.3 min), time spent in a standing position –

7.6% (187.5), time spent in movement 17.13% (279 min), time spent in water intake – 0.3% (8.5 min), and time for defecation – 0.2% (5.7 min).

The main ethological reactions of female calves of 'Montbeliarde' intended for breeding, a live weight of 294 kg were: grazing – 18.6% (453.24 min), lying

position – 20.2% (491.26 min), a standing position – 7.4% (179.43), movement – 12.5% (301.7 min), time spent in water intake – 0.4% (9.1 min) and time for defecation – 0.2% (5.4 min).

Periods of increased activity were morning, afternoon and evening hours.

The terrain, the abiotic factors, and the available grassland had an impact on the quality and quantity of grazing, hence the ethological reactions of the calves.

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