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ANALYSIS OF SOME BEHAVIORAL REACTIONS OF KARAKACHAN HORSES

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Abstract

The observation was made on a herd of Karakachan horses, bred freely in the area of the village of Prisadets, Southern Bulgaria. The study covers a period of one year, with 24-hour field surveys conducted every month. The analysis shows that horses drink water relatively rarely. Although not statistically proven, the highest percentage of horses drink water at moderate ambient temperatures - about 22°C, while at high temperatures around 36°C, when standing in the shade, the percentage of horses drinking water drops to 46.15%. Karakachan horses spend most of their time grazing. Most horses graze at noon (91.28%), and the least at night (40.90%). The factor time of the day had a significant effect on the following traits of behavior: grazing (P <0.001), sleeping / resting lying down (P <0.001), sleeping/resting standing (P <0.01), standing on alert (P <0.01) and standing in the shade (P <0.01). Ambient temperature affects resting behavior: lying down (P <0.01) and standing (P <0.01), chasing insects with a tail and head (P <0.001), and standing on alert (P < 0.001).

Key words*: autochthonous breed, behavior, Karakachan horse.*

INTRODUCTION

The Karakachan horses are an old Bulgarian autochthonous breed, preserved in relatively the same form in which it existed over the centuries (Petrov, 1940; Sabeva, 2009; Popova & Etarska, 2020). In addition to use for typical agricultural and commercial purposes, with careful management, the Karakachan breed is suitable for use and maintaining habitats and supporting rare and protected bird species, such as the Imperial Eagle and Lesser Kestrel (Krastev et al., 2020). In this regard research on the behaviour of the karakachan horses will enable us to collect data on a breed that has preserved genes from ancient times.

Horse breeding is a specific branch, and the ethological knowledge in the field is mainly empirical in nature. This knowledge is of great importance, but its drawback is that it is not scientifically substantiated for a number of phenomena, as well as for a number of regularities, which should serve as a basis for creating an optimal growing environment (Petkov et al., 1999; Hoffmann et al., 2012; Yarnell et al., 2015; Löckener et al., 2016; Rochais et al., 2016; Sigurjónsdóttir & Haraldsson, 2019).

For this reason, the intervention of a person who does not know the behavioral manifestations of horses can lead to serious failures. Conversely, if man is familiar with their ethological features, he can discover new ways to increase their productivity and discover new benefits from their use (Hausberger & Muller, 2002; Hausberger et al., 2008; Thompson et al., 2015; Hall et al., 2018; Butler et al., 2019; Kelly et al., 2021).

The purpose of the research is to study basic ethological, functional signs of karakachan horses from the national gene pool in ecological and biocompatible breeding.

MATERIALS AND METHODS

The study was conducted in the area of the village of Prisadets (on the Bulgarian/Turkish border - within Bulgaria) falling within SPA Sakar (BG0002021), which overlaps with SCI (BG0000212), part of the ecological network NATURA 2000 (MOEW, 2013). In biogeographical terms, the area falls into the Southern biogeographical region and, more specifically, according to the biotic basis, it refers to the "Dolnomarishko - Dolnotundzhansky" sub-region (Gruev &

Kuzmanov, 1999), as Mediterranean influence penetrates the sub-region along the Maritsa and Tundzha rivers. This defines the climate as milder and allows the horses to be kept outdoors all year round.

Object of observation was a herd of horses of the Karakachan breed, which are free-range horses all year round - 29 mares, 1 stallion and 10 foals. The observations were carried out periodically within 12 months. Spring, summer, autumn and winter 12 and 24-hour field observations were conducted. Both the periods with the most typical climatic and forage conditions for the given season, as well as the days with extreme temperatures, humidity, etc., were chosen.

The behavioral indicators we monitored were selected during the first few months of the project. A farm was chosen for breeding free-roaming animals of the Karakachan horse breed. Based on the research, we identified the following signs and factors influencing them, which will be included in the study:

- ✓ Grazing;
- ✓ Drinking water;
- ✓ Rest - sleeping/resting while standing up, sleeping/resting lying down;
- ✓ Mares in heat - frequent urination, covering of mares by stallion;
- ✓ Insect protection - rolling, self-cleaning, tail wagging/head tossing to remove insects;
- ✓ Seeking shelter and comfort - standing with back to trees/bushes that stop the wind, back to the rain and head down, cuddling (horses are under mothers), sun bathing, standing in the shade;
- ✓ Standing alert.

Seven thousand seventy-six (7076) recordings of various behavioral responses were processed for all observations.

The data from the field observations of the horses' behavior were processed variationally-statistically, by using multivariate analysis of variance according to models with the following structures:

Yijk=μ+Zi+Ko+Wv+SXvi+MNoi+eiov(vi)(oi) (M1);
Yijk = μ+Mi+Tj+ZFji+eij(ji) (M2),

where: Yijklm - observation vector; μ - general average constant; Zi is a fixed effect of the season (i = 4); Ko - climate (o=5); Wv - time of day (v = 5); SXij - time of day in the season (ji = 5); MNoi - climate in the season (oi = 5); Mi - month (n = 11); Tj - enviromental temperature (n = 43); ZFji - temperature in the month (n = 42); eijk .. - residual variant.

Statistical processing was performed with the SPSS 21 program.

RESULTS AND DISCUSSIONS

Native breeds of horses are free-range in herds, and increasing the number of horses in the herd leads to changes in both individual and group behavior.

Based on the records collected and processed from the observations, the influence of some paratypical factors on the behavior of the horses was calculated (Table 1 and Table 2).

Table 1. Influence of some paratypic factors on the animal behavior - Model 1

Animal Behavior Activities	Factors, F-criteria and degree of statistical sig-nificance									
	Model 1									
	df	season	df	climate	df	time of the day	df	time of the day in the season	df	climate in the season
Grazing	3	3.433*	4	10.931***	4	6.785***	10	8.133***	5	1.376
sleeping /resting lying down	3	2.906*	4	6.377***	4	8.753***	5	0.202	2	2.715*
Sleeping /resting standing up	3	23.144***	4	13.838***	4	4.734**	9	3.138**	5	7.841***
chasing insects with tail and head	3	4.538**	4	2.745*	3	8.985***	6	3.970**	4	4.787***
standing on alert	3	1.213	2	0.876	3	5.305**	1	0.745	3	1.524
standing in the shade	1	0.796	2	0.646	3	3.480*	1	0.659	1	1.962
drinking water	3	22.665***	2	25.424***	3	0.778	3	0.197	1	0.362
salt licking	2	19.653***	2	1.992	2	9.346**	2	0.185	1	0.245
hiding in the woods	2	7.524***	3	3.111*	3	9.511***	1	4.565*	1	0.752
sunbathing	1	17.821***	1	7.692*	1	10.256*	1	1.321	1	1.023
mutual cleansing	3	16.188***	4	1.119	3	0.259	1	0.383	2	1.913
mares in heat	2	5.009*	4	0.616	2	2.214	2	0.978	1	1.232

***P< 0.001; **P<0.01; *P<0.05

From the obtained results, it can be seen that all factors have a reliable influence on the trait of chasing insects with a tail and a head. Only the factor climate in the season has a reliable influence on the grazing sign. The factors month, season and climate have a reliable influence on the drinking water (P<0.001). The time of day in the season significantly affected

only the traits grazing (P<0.001), sleeping/resting while standing up (P<0.01), tail wagging and head tossing to remove insects (P<0.01), and hiding in the forest (P<0.05). The factors time of day (P<0.01), temperature (P<0.001) and temperature in the month (P<0.01) have a reliable influence on alertness. The sign drinking water is reliably influenced by the factors season (P<0.001), climate (P<0.001) and temperature (P<0.001). The factors season, month and temperature have a reliable influence on the signs of grazing and mutual cleaning, and on the sign of salt licking - the season (P<0.001) and time of day (P<0.01).

Table 2. Influence of some paratypic factors on the animal behavior - Model 2

Animal Behavior Activities	Factors, F-criteria and degree of statistical sig-nificance Model 2					
	df	месец	df	температура	df	температура в месеца
Grazing	8	13.116***	42	3.771***	41	2.773***
sleeping /resting lying down	9	1.412	29	3.254***	9	5.009***
Sleeping /resting standing up	9	4.715***	37	2.568***	19	0.996
chasing insects with tail and head	9	2.597**	37	2.679***	21	1.321
standing on alert	7	9.770***	33	7.684***	19	4.117***
standing in the shade	6	1.396	22	3.382***	2	4.932**
drinking water	1	1.817	16	3.620***	1	0
salt licking	6	11.543***	15	1.516	3	0.385
hiding in the woods	3	8.123***	29	1.353	8	0
sunbathing	4	3.676*	14	3.037**	1	0.655
mutual cleansing	7	5.311***	13	9.498***	3	4.154*
mares in heat	3	7.789**	11	3.935**	2	2.625

***P< 0.001; **P<0.01; *P<0.05

Figure 1 shows the dynamics of the different behavioral responses during the different periods of the day. Of the observed horses, 31.25-38.44% graze in the morning until the afternoon, with this percentage decreasing to 25.98% in the evening and 19.52% at night. From these results we can draw the conclusion that horses graze around the clock. Horses stand in the shade most during the hot hours of the day, namely in the afternoon - 49.89%, while in the morning and at noon this percentage varies from 21.53% to 27.34%. The highest percentage of horses standing alert is during the evening hours - 40.59%, when it starts to get dark and the jackals start howling. After midnight, this percentage decreases to 38.65% and by morning it reaches 7.50%.

Thanks to the special construction of the tendon apparatus of their limbs, horses can sleep while standing up (Petkov et al., 1999). In the herd observed by us, the horses sleep/rest while standing up throughout the day, with the lowest percentage in the noon and afternoon (16.64-17.05%) and morning (23.37%) hours, and in the evening and night it rises slightly to 30.66% respectively and 39.40%. The percentage of horses sleeping/resting while lying down is highest in the afternoon - 8.11%, in the evening and night it decreases to 1.9%, and in the morning and noon hours it increases to 6.36% and 6.76%, respectively, especially on warm days. From the obtained results, it can be seen that a greater percentage of the observed horses are awake during the day, and at night they rest more, taking turns in groups that stand alert.

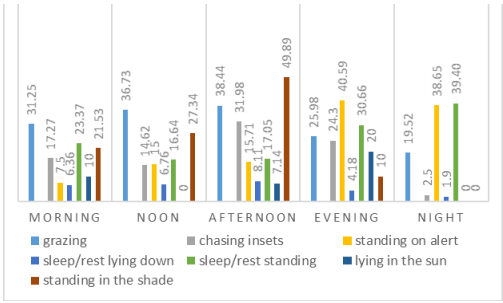

Figure 1. Dynamics of different behavioral reactions during different periods of the day, %

Figure 2 shows the dynamics of the different behavioral responses during the different seasons. From our field observations, it can be seen that in the spring season, when the weather starts to warm up and the end of winter has come, as well as the lack of grazing, the highest percentage of horses perform the activities of grazing (37.95%), drinking water (45.56%), sleeping/resting lying down (10.37%) and licking salt (51.67%). In addition, in the spring season, the highest number of mares in heat are observed - 8.36%.

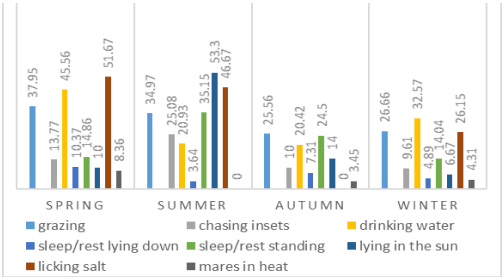

Figure 2. Dynamics of different behavioral responses in different seasons, %

In the remaining seasons, the percentage distribution of these behavioral reactions gradually decreases, with the lowest percentage in the fall of grazing - 25.56%, salt licking - 0%, water drinking 20.42% and mares in heat - 3.45%. During the summer months, due to high temperatures and warm weather, the percentage of sun-bathing horses (53.3%), sleeping/resting while standing up (35.15%) and tossing their heads and wagging their tails to chase away insects increases - 25.08%.

In the spring and summer season, horses hide in the forest more often than in autumn and winter. From our observations, we found that on extremely hot days when there is no wind, the horses prefer to hide in the forest. The most likely cause is not the heat, but the presence of insects. The wind brings a cool feeling and reduces insects, which makes the horses more comfortable and able to graze more of the day. It can be concluded that horses are relatively more resistant to high temperatures, strong wind and sunny days than to the presence of insects.

In their study, Górecka and Jezierski (2007) tracked the defensive behavior of Konik horses in response to insect harassment. They found that horses stood closer together (bunched, head-to-tail position) in hot weather and windless days when insect harassment was apparently stronger. In our study, we found no such correlation in Karakachan horses.

Figure 3 shows the effect of temperature on the dynamics of insect chasing and water drinking. Although it has not been statistically proven (Table 1) the highest percentage of horses drink water at moderate ambient temperatures - around 22^{0}C, while at high temperatures around 36^{0}C, when standing in the shade, the percentage of horses drinking water drops to 46.15%. Due to the high temperatures and presence of more insects in summer, 93.96% of horses wag their tail or toss their head to repel insects when temperatures rise to around 37^{0}C.

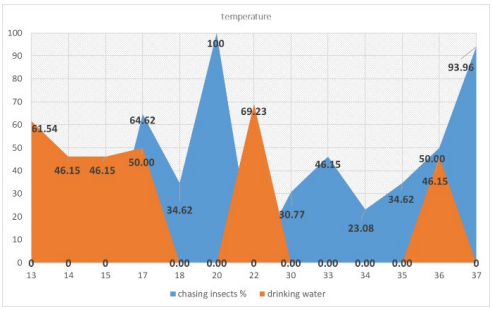

Figure 3. Effect of temperature on the dynamics of chasing insects and drinking water, %

Analogously to the greater presence of insects in the summer months, the largest percentage of horses protect themselves from insects in August, while in the autumn months this behavior decreases with a decrease in environmental temperatures and a decrease in insects, reaching 39.13% in the month of November.

The observed influence of weather conditions on insect pestering activity was similar to those observed by Strickman et al (1995), Górecka and Jezierski (2007), i.e. more frequent defensive behaviors such as tail wagging, head tossing, etc. with the Karakachan horses, we observed during hot, sunny and windless days.

According to Parvanov et al. (1997) horses are seasonal-polycyclic animals, where the breeding season in our latitudes lasts from February to June, and sometimes in August-September. In some mares, the sexual cycle repeats throughout the year, and in others for a short period of the year, depending on the climate, geographical location, environmental conditions, work load, etc. Sex functions in the spring bear the imprint of the conditions of rearing and feeding in the winter, the length of daylight and temperature. Ginter (1974) indicated that mares raised in northern latitudes were in heat from early May to October.

As can be seen from the present study (Figure 4), in freely bred horses we observe mares in heat in the temperature range from -5^{0}C to 33^{0}C, with the highest percentage of mares in heat between 15^{0}C and 21^{0}C. The earliest we observed mares in heat was at the end of

February, and the latest was until the middle of November. During the too cold (December, January) and too hot months (June, July, August) no coverings and mares in heat were observed.

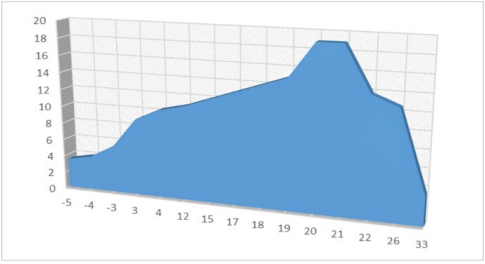

Figure 4. Influence of temperature on the mares in heat, %

From the field observations, we found that on very windy days and during precipitation (rain, snow) the horses do not enter the forest, but find bushes or individual trees to stand next to and turn their croup towards the wind and/or rain /snow (Figure 5). If the snowfall is light, it does not prevent the horses from sleeping/resting lying down.

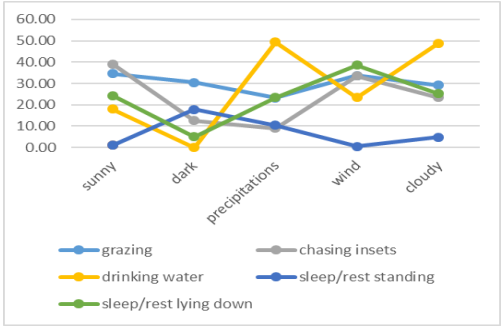

Figure 5. Influence of the climate on some behavioral reactions of horses, %

In the social behavior of herds, the individual distance between individual animals is also important. The term "individual distance" refers to the normal distance between two individuals of a given animal species. Observance of individual distance in the group of animals living together is one of the basic conditions for harmonious existence. The primary biological reason for this is assumed to be the provision of sufficient food space. (Petkov et al., 1999).
In unfavorable climatic conditions, we observed a shortening of the distance between the horses themselves (they stand closer to each other or huddle together), the purpose of which is to keep a bond and keep warm. Despite the weather conditions, we never once saw the horses using the sheds available. From this, it can be judged that the horses (especially the Karakachan horses), which are bred freely all year round, do not feel comfortable confined in buildings or under sheds. When there is no wind or rain, at too short a distance, the horses start biting and kicking each other. In good weather conditions, the horses in the herd maintain a greater distance from each other and spread out over the pasture. During the spring and summer observations, and less often during the winter, the horses approached unfamiliar objects (a car) and began to lick it. The most likely reason is their need for salt and they lick the stuck salt on the unknown object, which in this case is a car (Figure 6). At the watering place there are many large blocks of salt scattered around the field, but apparently the horses don't go there that often or spend enough time there. Because this herd is raised on a very large area and there is no way to throw salt blocks around, the horses get it by licking objects (the car) or by licking each other, especially in the warmer months.
Because horses are social animals, even free-range horses are curious and use sniffing, groping, and approaching unfamiliar people/objects as a way to learn about their surroundings.

Figure 6. Horses licking a foreign object for the purpose of familiarization and obtaining salt

In every single field observation, despite our efforts to keep a distance so as not to disturb their usual activities, after 2-3 hours of observations, the horses came to us. With each subsequent visit, the approach time shortened.

The horses got used to the human presence relatively quickly and there was no presence of aggressive behavior on their part.
The results of the present study correspond with those indicated by Jastrz˛ebska et al. (2021), who studied the behavior of stabled and free-range Konik geldings and mares during standard behavioral tests considered as determinants of willingness to explore. According to the authors, free-range horses were not only less likely to stray from the herd, but were also more likely to let their muzzles be stroked than stabled horses. In addition, they showed their curiosity to learn by approaching new objects overcoming their fear. This may further indicate that free range horses demonstrate a greater willingness to explore than stabled horses.

CONCLUSIONS

From the observation we can draw a conclusion that the horses graze around the clock.
A greater percentage of the observed horses are awake during the day and rest more at night, taking turns in alert groups.
It has been found that horses are relatively more resistant to high and low temperatures, strong wind and precipitation than to the presence of insects.
In bad weather conditions, a shortening of the distance between the animals themselves is observed. Despite the weather conditions, we never once saw the horses using the sheds available. From this, it can be judged that the Karakachan horses, which are bred freely all year round, do not feel comfortable enclosed in buildings or under sheds.
Due to the high temperatures and presence of more insects in summer, 93.96% of horses flick their tail or head to repel insects when temperatures rise to around 37^0C.
In free-range horses, we observe mares in heat in the temperature range from -5^0C to 33^0C, with the highest percentage of mares in heat between 15^0C and 21^0C.

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