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Behavior and interactions in and between herds of Polish Konik horse and Uhruska sheep during mixed-species grazing practice

Zachowanie i interakcje w stadach oraz pomiędzy stadami konika polskiego i owcy uhruskiej podczas wspólnego wypasu

Summary. The mixed daily grazing (5 hours before and after noon) of the Polish Konik horses and Uhruska sheep was carried out in July (10 days) and September (6 days) 2011 in The Roztocze National Park, the Centre for Farm Breeding in Florian. The studies involved a Polish Konik horse herd of 8 animals (3 adult mares with foals-colts and 2 fillies aged 2 years) and a sheep herd, which in July included 29 mated for the first time, pregnant ewes and 2 herd rams. In September, the sheep flock included 69 animals (ewes and lambs) without rams. The studies recorded the behavior of animals and duration of daily activities (in minutes), i.e. grazing, resting, movement, water drinking, etc. and other interactions (friendly, aggressive) occurring between the animals of both species. The dominance hierarchy in the horse herd was determined using the dominance index (ID). The data analysis showed marked similarities in species-specific behavioral patterns of horses and sheep pastured together. The animals spent most of their time foraging and resting. In July, the horses grazed for 54.60% of the total time at pasture, in September – 60.50%, while the sheep flock – 57.11% and 59.45%, respectively. Significant differences were noted between the average time devoted to each daily routine before and after mid-day. Higher motor activity was observed in horses, especially in a foal group (26.45% in July and 29.40% in Sept.). It was found that the amount of time spent on each daily activity (mainly grazing and resting), particularly in July, was affected by the weather conditions (chiefly temperature and air relative humidity). The established hierarchical structure in the horse herd was stable (age-dependent), while within the sheep flock it was not so clearly observed. Horses bigger in size, more active and mobile than sheep obviously dominated the pasture. A mixed-species grazing practice made both herds gradually acquainted and it decreased the between-herds distance till the animals mingled and felt safe together. However, in the first instance, the animals contacted within their own species. The horse/sheep mixed grazing system allows for the rational use of a pasture if managed under appropriate animal stocking rate and pasture carrying capacity.

Key words: behavior, Polish Konik, Uhruska Sheep, mixed grazing, weather conditions

INTRODUCTION

Functioning of a herd is based on an organized social animal group grounded on innate and acquired relationships between its members [Molik and Milewska 2012]. All animals display species-specific behavioral patterns affected by genetic and environmental factors, e.g. access to pasture, presence of other animal species, weather conditions. Some authors suggest that abilities and diet preferences of horse and sheep contribute to active conservation of nature resources [Borkowski 1997, Chabuz 2011, Gruszecki *et al.* 2011].

The studies of ethologists indicate some behavioral differences between horses and sheep arising from, among others, different anatomy of the gastrointestinal system, feed preferences, the importance of herd hierarchy and its manifestation as well as leadership roles in herd [Nowicki and Zwolińska-Bartczak 1983].

Taking into account the significance of both animal species in active protection of nature and the mixed grazing system introduced (e.g. in organic and agri-tourist farms), the present paper aims to determine the behavioral patterns and interactions between horses and sheep grazing together at a pasture as well as show the impact of some weather conditions on animal daily living activities.

MATERIAL AND METHODS

The research material comprised two herds of animals under the mixed grazing system on the same pasture paddock in The Roztocze National Park, in Florian. The daily observations were performed at two following dates: 10 days in July and 6 days in September 2011. The observation was performed 10 hours per day (5h before and after noon), yet in July due to high temperatures and great numbers of noxious insects whose presence evidently impaired objectivity of the research results, the monitoring lasted from 6.00 till 11.00 with a 2h grazing break when the animals were driven from the pasture) and then from 13.00 till 18.00. In September, the grazing time was from 7.00 till 17.00. The pasture area was divided into four paddocks 0.5 ha each. In July the animals used three plots, whereas in September the entire pasture because of lower quality sward at that time. The herds had *ad libitum* access to water in a fixed trough in the first paddock. The monitoring focused on a Polish Konik horse herd of 8 animals (3 adult mares with foals, colts and 2 fillies aged 2 years) and a sheep flock that in July included 29 in-lamb ewes aged 2 years mated for the first time and 2 two-year-old rams of Polish Lowland sheep breed Uhruska variety. In September, after the August sheep lambings, the herd numbered 69 sheep without rams that were kept out of the herd at the lamb raising period.

The studies consisted in recording the behavior of animals and amount of time, in minutes, devoted to activities performed by both groups of animals at the time of day. For the sake of the more accurate recording of the horses and sheep behavior, the observational study was conducted in two-person groups that changed every two and a half hours. The animals were watched for the amount of time spent on grazing grass, resting (standing or lying down), movement (travelling or free-running of juvenile animals) and drinking water. Contacts with other animals, nursing activities, playing or suckling was grouped together and termed "others". At the same time, all the interactions (friendly, aggressive) noted between the mixed-species animals were documented. Animal social interactions considered as friendly behavior was a common cohabitation of mixed animal

species to e.g. perform nursing activities, drive insects away etc. Whereas aggressive actions, often related to dominance hierarchy, included threats and/or an attack with biting and kicking. The hierarchical structure within the Polish Konik horse herd was determined using the dominance index (ID) [Geringer and Kowalska 1995]. Considering the fact that the foraging behavior of animals pastured together may be influenced by changing weather conditions, the effect of some weather variables (temperature, relative humidity and air motion) on animal behavior was estimated using single and multiple correlations. Data on the course of weather conditions in a given location was obtained from the Base Station for Integrated Monitoring of Natural Environment System Roztocze in Zwierzyniec.

The collected material was analyzed statistically calculating basic indices (arithmetic mean, standard deviation) and Student's t-test applied to assess significance of differences between means (Excel 2007).

RESULTS AND DISCUSSION

The pastured horses and sheep showed marked variability in the amount of time spent on each daily living activity, as also reported by Kamieniak *et al.* [2002] who studied mutual social interactions between horses and cattle. Everyday behavioral patterns of both herds in July and September displayed repeatability. In the observed horse herd, alike the studies of Sasimowski *et al.* [1987], the amount of time devoted to a given activity was animal age-dependent as evidenced by the statistical differences between the means for each group, i.e. foals, 2-year olds and adult mares (Tab. 1, 2). The longest grazing time was recorded for adult mares raising foals (64.64% of time at pasture in July and 70.31% in September) followed by 2-year-olds (62.53% and 68.38%, respectively) and finally, foals (36.64% and 42.94%). In July, the horses grazed pasture sward altogether for 54,60% ($S = 14.19$) and 60.50% ($S = 3.75$) in September. The results obtained agree with the research data reported by Geringer *et al.* [2010] illustrating the Hutzul horse herds grazing in the same months (July – 52,8% and September – 59.8% time on the pasture, respectively). Comparing the average grazing time of Polish Konik horse and Uhruska sheep in July, it is clear that adult horses spent the longest time grazing the pasture (387.82 min), then the 2-year-olds (375.20 min), sheep (342.68 min) and foals (219.84 min). The same order was established in September, notably the parameter reached higher values. That could arise from changing sward quality (for worse) in September and higher nutritional needs of lactating ewes. In all the studied animal groups, the before mid-day grazing times were shorter than after mid-day ones and in most cases the significant differences between means were determined (Tab. 1, 2). Similar statistical relationships occurred for the other behavioral forms of both animal species before and after noon, however, in the July observations, more highly significant differences were established.

Both, horses and sheep showed the highest feed intake, especially in July, in the morning hours (immediately after animals enter the pasture) from 6.00 till 9.00 and in the afternoon, 16.00-18.00. In September, the animals stayed out on pasture all day grazing for most time with short breaks for resting. The sheep herd at both research time spent more time resting as compared to horses (33.52% in July and 30.61% in September). While the horses, as against the sheep, devoted more time to moving. In the horse group, foals were found to show the highest average mobility (26.45% in July and 29.40% in September).

Table 1. Average time of herds' daily activities recorded during the before and after noon observations in July
Tabela 1. Średni czas poświęcony na wykonywanie poszczególnych czynności przez stada w obserwacjach przed- i popołudniowych w lipcu

	Observation hour Godziny obserwacji	Statistical index Wskaźniki statystyczne	Grazing Pasienie		Resting Odpoczynek		Movement Ruch		Drinking water Picie wody		Other Inne	
			min.	%	min.	%	min.	%	min.	%	min.	%
Adults Dorośle (n = 3)	6-11	x	185.74 A	61.91	87.42 a	29.14	21.03 A	7.01	1.40	0.46	4.41 A	1.48
		SD	14.46	4.82	14.33	4.07	6.58	3.11	0.50	0.12	1.12	0.36
	13-18	x	202.08 B	67.36	82.91 b	27.63	11.01 B	3.67	1.30	0.42	2.70 B	0.92
		SD	11.03	3.67	10.21	3.28	2.98	1.11	0.42	0.09	0.89	0.18
	total day dzień razem	x	387.82 A'	64.64	170.33	28.39	32.04 A'	5.34	2.70	0.45	7.11 A'	1.18
		SD	13.49	4.49	13.42	4.47	5.45	2.87	0.49	0.10	1.09	0.31
2-year-olds 2-latki (n = 2)	6-11	x	182.65 A	60.88	90.35 A	30.12	22.50 a	7.50	1.55	0.52	2.95 A	0.98
		SD	11.54	3.13	10.43	4.01	7.11	3.08	0.76	0.17	0.91	0.26
	13-18	x	192.55 B	64.18	77.45 B	25.82	20.00 b	6.67	1.40	0.47	8.60 B	2.87
		SD	10.07	3.08	9.89	3.64	4.44	2.12	0.60	0.11	2.78	1.01
	total day dzień razem	x	375.20 B'	62.53	167.80 A'	27.97	42.50 B'	7.08	2.95	0.49	11.55 B'	1.93
		SD	18.76	3.02	11.01	3.98	6.05	2.98	0.69	0.15	1.99	0.78
Foals Zrebaki (n = 3)	6-11	x	101.67 A	33.89	91.16 A	30.39	80.24	26.75	1.10	0.37	25.83 A	8.61
		SD	9.21	3.06	8.62	2.87	2.71	14.8	0.58	0.09	9.24	3.30
	13-18	x	118.17 B	39.39	82.00 B	27.33	78.44	26.15	1.20	0.40	20.19 B	6.73
		SD	11.33	3.77	8.80	2.93	4.63	18.23	0.61	0.10	5.51	2.97
	total day dzień razem	x	219.84 C'	36.64	173.16 B'	28.86	158.68 C'	26.45	2.30	0.38	46.02 C'	7.61
		SD	18.76	3.92	12.96	4.31	6.77	17.90	0.59	0.10	6.89	3.21
Sheep herd Owce (n = 31)	6-11	x	165.70 A	55.23	110.02 A	36.67	14.80 A	4.93	5.01 A	1.67	4.47	1.49
		SD	11.80	6.40	9.24	5.53	5.43	1.99	0.57	0.61	1.86	0.54
	13-18	x	176.98 B	58.99	91.12 B	30.37	19.87 B	6.62	6.37 B	2.12	5.66	1.89
		SD	14.20	7.93	8.00	2.66	7.02	2.54	0.62	0.64	2.98	0.57
	total day dzień razem	x	342.68	57.11	201.14	33.52	34.67	5.78	11.38	1.90	10.13	1.69
		SD	13.86	10.20	13.51	3.96	6.78	2.32	0.60	0.62	2.25	0.60

Values denoted by different letters differ significantly in columns: small (a, b,...; a', b'...) at $P \leq 0.05$, capital (A, B,...; A', B'...) at $P \leq 0.01$

Wartości oznaczone różnymi literami różnią się w kolumnach statystycznie istotnie: małymi (a, b,...; a', b'...) przy $P \leq 0,05$, dużymi (A, B,...; A', B'...) przy $P \leq 0,01$

Table 2. Average time of herds' daily activities recorded during the before and after noon observations in September
Tabela 2. Średni czas poświęcony na wykonywanie poszczególnych czynności przez stada w obserwacjach przed- i popołudniowych we wrześniu

	Observation hours Godziny obserwacji	Statistical index Wskaźniki statystyczne	Grazing Pasienie		Resting Odpoczynek		Movement Ruch		Drinking water Picie wody		Other Inne	
			min.	%	min.	%	min.	%	min.	%	min.	%
Adults Dorośle (n = 3)	7-12	x	208.07 a	69.36	62.33 A	20.78	24.05	8.02	1.90	0.63	3.65 A	1.22
		SD	12.10	3.32	9.52	3.90	7.35	2.67	0.55	0.21	1.09	0.27
	12-17	x	213.77 b	71.26	55.46 B	18.49	26.90	8.97	2.10	0.70	1.77 B	0.59
		SD	13.11	4.98	6.70	3.23	7.65	3.89	0.59	0.12	0.45	0.11
	total day dzień razem	x	421.84 A'	70.31	117.79 A'	19.63	50.95 A'	8.49	4.00 a'	0.67	5.42 A'	0.90
		SD	12.98	4.02	8.40	3.37	7.54	3.12	0.57	0.27	0.87	0.19
2-year-olds 2-latki (n = 2)	7-12	x	201.50 A	67.17	64.71 a	21.57	27.00	9.00	2.08	0.69	4.71	1.57
		SD	7.60	4.21	8.20	3.01	5.12	2.10	0.67	0.24	1.23	0.33
	12-17	x	208.78 B	69.59	59.24 b	19.75	26.11	8.70	2.42	0.81	3.45	1.15
		SD	9.12	5.32	7.21	2.88	4.34	1.98	0.51	0.28	1.08	0.12
	total day dzień razem	x	410.26 B'	68.38	125.95 B'	20.99	51.11 A'	8.52	4.50 A	0.75	8.16 A'	1.36
		SD	9.10	4.78	7.99	2.98	4.89	2.07	0.61	0.26	1.17	0.22
Foals Zrebaki (n = 3)	7-12	x	129.00	43.00	65.22	21.74	85.34 a	28.45	1.40	0.47	19.04	6.35
		SD	10.32	3.43	10.44	3.48	11.01	10.23	0.58	0.14	3.32	0.89
	12-17	x	128.61	42.67	62.11	20.70	91.07 b	30.36	1.30	0.43	16.91	5.64
		SD	8.79	2.93	9.77	3.25	6.64	12.03	0.61	0.18	4.34	1.43
	total day dzień razem	x	257.61 C'	42.94	127.33 B'	21.22	176.41 B'	29.40	2.70 b'B'	0.45	35.95 B'	5.99
		SD	9.45	3.15	10.12	3.38	4.89	11.25	0.59	0.22	4.02	1.23
Sheep herd Owce (n = 69)	7-12	x	176.34	58.78	96.56 A	32.19	15.27 A	5.09	7.10	2.37	4.73 A	1.58
		SD	8.06	4.23	6.93	5.53	5.56	0.99	1.99	0.98	1.21	0.54
	12-17	x	180.33	60.11	67.09 B	29.03	22.02 B	7.34	7.98	2.66	2.58 B	0.86
		SD	7.91	5.34	4.11	2.66	7.98	1.87	2.10	1.01	0.96	0.57
	total day dzień razem	x	356.67	59.45	183.65	30.61	37.29	6.22	15.08	2.51	7.31	1.22
		SD	7.56	8.80	7.08	3.96	6.02	1.67	2.08	1.09	3.01	0.60

Denotations as in Table 1 – Objasnienia jak w tabeli 1

Comparing the average time of daily activities in “altogether” for an animal group at both study dates (July – Tab. 1 and September – Tab. 2), significant differences did not occur in only two cases. The first considered the average time of movement in July and September for the sheep group, whereas the other, the average drinking time for foals in these months. The common occurrence of statistical differences (between mean values) may evidence the effect of a season on pasture behavior of the animal groups under investigation.

Table 3. Correlations between each herd’s daily activity under study and some weather conditions
Tabela 3. Korelacje pomiędzy poszczególnymi zachowaniami badanych stad zwierząt a wybranymi warunkami pogodowymi

Specification Wyszczególnienie	Air temperature Temperatura powietrza (°C)	Air relative humidity Wilgotność względna powietrza (%)	Air motion Ruch powietrza (m/s)	Total weather conditions Czynniki pogodowe razem	
July – Lipiec	konie – horses (n = 8)				
	grazing pasienie	-0,80**	0,74**	0,45	0,65
	resting odpoczynek	0,77**	-0,71**	-0,40	0,70
	drinking water picie wody	-0,28	0,06	0,17	0,30
	owce – sheep (n = 31)				
	grazing pasienie	-0,71**	0,64*	0,48	0,83
	resting odpoczynek	0,68*	-0,62*	-0,39	0,51
	drinking water picie wody	-0,06	-0,01	0,07	0,04
September – Wrzesień	konie – horses (n = 8)				
	grazing pasienie	-0,49	0,34	0,25	0,36
	resting odpoczynek	-0,14	-0,23	-0,05	0,34
	drinking water picie wody	-0,78**	0,50	0,32	0,91
	owce – sheep (n = 69)				
	grazing pasienie	-0,47	0,66	0,01	0,78
	resting odpoczynek	0,27	-0,51	0,25	0,84
	drinking water picie wody	-0,19	0,62	0,08	0,97

*significant at $P \leq 0,05$ – istotne przy $P \leq 0,05$

**significant at $P \leq 0,01$ – istotne przy $P \leq 0,01$

The horses and sheep frequently grazed and rested all near one another. However, in the initial observation days, in July and September, they kept a distance of 15–20 m, which gradually decreased over time and finally, both herds got all mixed up which proves increased sense of mutual safety [Chabuz 2001, Skrijka 1984]. The sites of fecal deposition were not passed round by the animals and the entire available pasture land was grazed by horses and sheep.

The daily activities performed by horses and sheep under the mixed grazing system were analyzed to calculate correlations between the behavior patterns and some weather conditions (Tab .3). The highest significant influence on the animal activities had two climatic factors, i.e. temperature and air relative humidity. The factors, especially in July, were correlated to the time spent on grazing and resting. The correlations were also confirmed by other authors [Geringer *et al.* 2010, Sasimowski *et al.* 1990]. While the third factor – air motion did not affect animal behavior. Grazing, resting and drinking water by animals of both species were more influenced by weather conditions in July than September. The sum of weather variables against individual behavior of animals obtained substantial multiple correlation values, though the effect was not statistically significant.

The dominance hierarchy in the horse herd in July and September was stable, identified by dominance index and presented in Table 4. Although mare Trzykrotka was the oldest (6 yrs), it was submissive to a year younger mares Hybryda and Miazga, which was likely to result from its moving to the present stud group from the reserve in spring 2011. Then two 2-year-old mares Hirpa and Troka of the equal hierarchical position (ID = 0.57) followed by two 6 month-old colts – Hucuł and Marmur (ID = 0.28). The bottom rank was occupied by colt Trep which alike its mother Trzykrotka, gave in to peers – the offspring of Hybryda and Miazga. Table 4 summarizes a number of friendly and aggressive responses from each horse to other horses and the sheep herd. Out of a total of 530 (100%) recorded reactions, friendly ones accounted for over 80%, in that 233 (43.96%) directed at animals of their own species and 195 (36.80%) towards sheep. The highest number of such behaviors (responses) was determined for colt Hucuł (40) and colt Marmur (39). Evidently the least friendly reactions were noted from two mares: Miazga (16), exclusively towards its foal (Marmur) and the highest-ranking – Hybryda (21). During the observation in July, more friendly responses (ca. 65%) were recorded than in September, which may be associated with the need for mutual help to repel annoying insects. Friendly behaviors of horses towards sheep (195–36.80%) were usually of an exploratory nature, direct contact (smelling), approaching and following the sheep flock. This behavioral pattern comes from horse's natural curiosity, willingness to get to know other grazers and test mutual safety. The most responses like that were recorded for mare Hybryda (56–28.71% out of 195 responses) then two-year-old Hirpa (55). Miazga hardly ever made such interspecies contacts (3–1.53%) just like colt Trep (2) whose mother Trzykrotka did not come into such contacts at all. Hybryda, the most frequent initiator of contacts with the sheep flock, usually approached it in walk and when the sheep made way for it and left, the mare trotted with lowered head, outstretched neck and ears pinned back to manifest its dominance. There were only 7 (1.32% of total behaviors) aggressive responses of horses to sheep and initiated just by this mare (Tab. 4). The other horses did not exhibit aggression toward sheep. Whereas in the horse band, 95 (17.92%) aggressive behaviors were recorded, in that 46 (nearly half – 48.42%) by the herd leader Hybryda, then Trzykrotka (35), Miazga (7), Hirpa (5) and Hucuł (2). Three horses did not display any signs of aggression. Actually, the sheep flock did not develop a firm "pecking order" and there was not any consistent leadership by the same sheep. However,

that may result from the same age of all sheep (2 yrs) while a leader is usually the oldest ewe in the flock [Molik and Milejska 2012]. Therefore, the sheep did not compete, like horses did, for the order while moving out to pasture or best access to water trough. No aggression was observed toward the other herd members. In July, rams did not fight but peacefully grazed next to each other. Lack of agonistic behavior was attributed to the presence of only pregnant ewes in the herd [Nowicki and Zwolińska-Bartczak 1983].

Tabela 4. Zestawienie wieku, indeksu dominacji oraz liczby reakcji przyjaznych i agresywnych koni za cały okres obserwacji w lipcu i wrześniu

Table 4. Comparison of horse age, dominance index, number of friendly and aggressive behaviors throughout the July and September observation study

Horse`s name Nazwa konia	Age (years) Wiek (lata)	Dominance index (ID) Indeks dominacji	Responses toward horses Reakcje wobec koni		Responses towards sheep Reakcje wobec owiec	
			friendly przyjazne	aggressive agresywne	friendly przyjazne	aggressive agresywne
Hybryda	5	1	21	46	56	7
Miazga	5	0,85	16	7	3	0
Trzykrotka	6	0,71	25	35	0	0
Hirpa	2	0,57	32	5	55	0
Troka	2	0,57	30	0	45	0
Hucuł	5–7 month mies.	0,28	40	2	19	0
Marmur	5–7 month mies.	0,28	39	0	15	0
Trep	3–5 month mies.	0	30	0	2	0
Razem Total			233 43,96%	95 17,92%	195 36,80%	7 1,32%
			530 100%			

There were identified 5 exploratory behaviors toward the horse herd. Especially one sheep (997 identification number) willingly and courageously approached horses smelling them (and vice versa) indicating that the horses did not pose any threat to it. The observation clearly displayed that horses dominated at the pasture being actually outnumbered by sheep (horses in July and September – 8, sheep – 31 and 69, respectively). Kamieniak *et al.* [2002] reported a contrary situation, when the bigger size herd of 131 Simental cows dominated over the 14 Hutzul horse herd and that occurred, according to the authors, simply because of the large number of cattle. Sheep, especially in July, grazed close to each other and in cases where sub-grouping occurred, e.g. when one or several horses got mingled into the herd, the sheep tried to turn them out quickly to re-form their mob. In September, more

often than in July, the herds readily mixed and the animals evidently felt safe and comfortable together. Horses did not direct any aggressive behavior toward lambs.

RESUME AND CONCLUSIONS

1. Substantial similarities in behavioral patterns of horse and sheep herds were observed at mixed grazing practice in July and September. The animals devoted most time to grazing and resting activities. Both species animals used the entire available pasture area.

2. There were determined significant differences between average time spent on daily routines (grazing, movement, drinking water, etc performed before and after noon). More differences were noted in the July observations.

3. It was found that amount of time devoted to each daily activity, especially in July, was affected by the weather conditions. High and highly significant correlation was established between the grazing and resting vs. temperature and air relative humidity.

4. A dominance hierarchy in the horse herd was stable and age-dependent, while it was not so clearly visible in the sheep flock.

5. The mixed-species grazing made animals gradually acquainted and finally, mixed up. This inter-species behavior of herbivores was imposed by the need to maintain mutual safety.

6. Common grazing practice of both species has benefits for rational use of pasture if managed under proper animal stocking rate and pasture carrying capacity.

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Streszczenie. Wspólny dzienny (5 godz. przed południem i po południu) wypas koników polskich i owiec uhruskich był prowadzony w lipcu (10 dni) oraz wrześniu (6 dni) na terenie Roztoczańskiego Parku Narodowego w Ośrodku Hodowlanym we Floriance. Obserwacjami objęto stado koników składające się z 8 osobników (3 klaczy dorosłych ze źrebiętami – ogierkami – i 2 dwuletnich klaczek) oraz stado owiec, w którym w lipcu było 29 ciężarnych przystępek i 2 tryki stadne. We wrześniu stado owiec liczyło 69 osobników (maciorki i jagnięta) bez tryków. Rejestrowano zachowania zwierząt i czas trwania (w minutach) poszczególnych czynności (pasienia się, odpoczynku, ruchu, picia wody i in.) w ciągu dnia oraz wszelkie interakcje (przyjazne, agresywne) występujące pomiędzy przedstawicielami obu gatunków. Dla koników określono hierarchię stada za pomocą indeksu dominacji (ID). Z analizy danych wynikają duże podobieństwa w zachowaniu się na wspólnym pastwisku stad koni i owiec. Najwięcej czasu zwierzęta poświęcały na pasienie oraz odpoczynek. Konie na pasienie przeznaczały w lipcu 54,60% czasu przebywania na pastwisku, we wrześniu 60,50%, a stado owiec odpowiednio: 57,11% i 59,45%. Pomiędzy średnimi czasu poświęconego na wykonywanie poszczególnych czynności przed i po południu, zanotowano istotne różnice. Większą aktywność ruchową zaobserwowano u koni, w szczególności u źrebiąt (26,45% w lipcu i 29,40% we wrześniu). Stwierdzono, że na czas wykonywania poszczególnych czynności (głównie pasienie i odpoczynek), zwłaszcza w lipcu, wpływ miały warunki klimatyczne (głównie temperatura i wilgotność względna powietrza). Hierarchia w stadzie koni była stała (zależna od wieku), w stadzie owiec nie była silnie zaznaczona. Konie są większe od owiec oraz bardziej aktywne i ruchliwe, co powodowało, że na pastwisku były wyraźnie gatunkiem dominującym. Przebywając wspólnie, stada stopniowo przyzwyczajały się do siebie, zmniejszały dystans aż do wzajemnego mieszania się ze sobą, czując się coraz bezpieczniej, jednak zachowywały w pierwszej kolejności kontakt z przedstawicielami swojego gatunku. Wspólny wypas koni i owiec przy przestrzeganiu obsady oraz obciążenia pastwiska umożliwia jego racjonalne wykorzystanie.

Słowa kluczowe: behavior, koniki polskie, owca uhruska, wspólny wypas, warunki klimatyczne