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SOCIAL RELATIONSHIPS EXISTING AMONG GELADA (*THEROPITHECUS GELADA*) MALES IN THE ZOO ZLÍN

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Abstract

HANULÁKOVÁ ŠÁRKA, MÁCHAL LADISLAV, HLOUČALOVÁ PAVLÍNA, HORSKÝ ROMAN, CHLÁDEK GUSTAV: *Social relationships existing among gelada (Theropithecus gelada) males in Zoo Zlín.* Acta Universitatis Agriculturae et Silviculturae Mendelianae Brunensis, 2013, LXI, No. 6, pp. 1653–1659

This study was focused on the monitoring of behaviour and complex social relationships existing among gelada (*Theropithecus gelada*) monkeys. The study involved a group of five males that were raised in captivity in the Zoo Zlín – Lešná. Ethological monitoring was performed by means of photographing of the group behaviour of these animals. Studied were the basic forms of social behaviour, i.e. food collection (foraging), free movement, (locomotion) observing of the neighbourhood (watching), grooming, climbing on trees, playing, aggressive behaviour (fighting), and resting. The temporary point of view, foraging was the most important time-consuming activity (55.3 ± 2.0 % of the study time); its maximum frequencies occurred in time intervals of 9 and 11 a.m. and 1 to 3 p.m.. The second place was occupied by the locomotion (15.3 ± 4.1 % of the study time) and its maximum frequencies were recorded between 9 and 11 a.m. and between 2 and 3 p.m. Grooming was the third most important activity (8.5 ± 4.8 % of the study time). The distribution of periods of rest (7.5 ± 3.1 % of the study time) was relatively uniform and its maxima were observed between 10:30 a.m. and 4 p.m. Observing of the neighbourhood and climbing on trees occupied 5.6 ± 3.3 % and 3.6 ± 3.0 % of the time, respectively and playing was the least frequent activity (2.2 ± 9.0 % of the study time), similarly as the aggressive behaviour (2.0 ± 23.0 % of the study time).

gelada, *Theropithecus gelada*, behaviour, grooming, playing, aggressivity, interspecies communication

1 INTRODUCTION

Geladas (*Theropithecus gelada*) are classified as members of the family cercopithecids (*Cercopithecidae*), genus gelada (*Theropithecus*). Geladas the only primates that are primarily graminivores and grass blades make up to 90% of their diet. Because of their appearance, physique (body plan) and patterns of behaviour (habits), geladas represent a hypothetical transition between macaques and baboons (Anděra, 2000). The main reason why geladas are classified as members of a separate genus is the fact that they have some typical morphological traits e.g. a hairless spot on the chest and anatomical traits on the skull and dentice that are known under the name T-complex. Changes in the conformation of the oral cavity were caused by a change in the feeding conditions and, according to Jolly (1970), together with other changes (above all in the fine motoric, i.e. small movements and coordination of finger muscles) played a decisive role in the process of the development of humans. In contradistinction to other apes, geladas do not climb on trees bud cope with steep cliffs and rocks. They avoid direct sunshine and prefer to stay in the shade. On plains, they live in numerous groups that can sometimes consist of as much as 600 individuals; however, the most frequent are groups with about 100 members. It is estimated that the overall number of geladas living in wildness ranges from 100,000 to 200,000 animals (Morell, 2002). The social structure of this species consists of two major social units –

troop and reproductive units. The reproductive unit is considered to be the basis of the troop and usually consists of 1–4 males and 1–12 females with offspring. If the reproductive unit involves more than one adult male, only one of them is sexually active. The troop consists of 2–60 reproductive units and an all-male group of young males that create a specific "bachelor band" (Gron, 2008). Geladas live in in a complex multilevel society that is extremely flexible and shows a dynamic system of splitting (Snyder – Mackler *et al*., 2012). In spite of their extremely changing social organisation of geladas, the individual social levels of this species can be clearly identified and quantified. The society of geladas represents an unusual example for the understanding of evolution of complicated animal societies. For example Veselovský (2005) mentioned that the social hierarchy may concern either all individuals within a group or can be specific for individual sexes. Among primates, the most frequent is a specific form of social organisation is called triumvirate and corresponds with the situation when the position of dominant male is supported by females. This dominant male expels younger males to the margin of a group and forces them to protect the group against predators. However, under extreme conditions and in extreme environments even the relatively stable groups may become disintegrated (Mori *et al*., 1999). As far as the social behaviour within a group of geladas is concerned, the following activities occupy important positions: playing, grooming, and (also) aggression. Mancini and Palagi (2009) described that among infants the social behaviour is manifested as a game that influences the capacity to regulate emotional reactions of an individual. In adults, it is often necessary to face up to new situations and new social problems so that the social play is a very important form of activity in this stage of life. Mancini and Palagi (2009) found out that in solitary species of primates the courtship occurs predominantly as a form of social play while in species with a higher degree of social aggregation the so-called non-sexual play is predominating. Geladas show a marked sexual dimorphism and their social structure is dominated by one alpha male. In this species it is also expected that the level of social play is more important among young males than among young females. Barrett *et al*. (1992) reported that the occurrence of a playful behaviour among infant baboons may be considered as a certain indicator of environmental conditions. So, for example, results of several studies enabled to formulate a hypothesis that individual components of their plays (e.g. the number of virtual fights per hour) as well as the quality of these plays (i.e. either a high or a low output of energy during the action) were significantly correlated with rainfalls and with the quality of the environment. Lehmann *et al*. (2007) reported that in primates the time spent for grooming increased in dependence on the size of their group. Similarly Dunbar (1991) also mentioned that in greater social groups (and, thus, with the increasing number of social partners) the time devoted to grooming was longer.

Aggression is also a part of the social behaviour of these monkeys. According to Veselovský (2005), the intraspecific aggression plays a certain role and enables that the whole herd is uniformly dispersed within the whole grazing area. Within a closed group, fights taking place between individuals result in the establishment of a social hierarchy. However, injuries and wounds sustained during these mutual combats represent a certain disadvantage of this kind of behaviour. Intimidations are used as a means for the discouraging and deterrent of enemies. To prevent the occurrence of a fight, geladas use their white eyelids as a warning gesture. McCovan *et al*. (2008) wrote that aggression was often used by both sexes to establish the social position of the animal within a group. This means that it is possible to observe some elements of aggression (e.g. spanks, pulling the hair, pulling the tail, biting and some other forms of hostile behaviour). From the ethological point of view, the aggressive behaviour may consist of attacks and escapes, although in some behavioural models of mammal social interaction even more modalities are distinguished (Machalova *et al*., 2012). However, Leone and Palagi (2010) mentioned that after the finished attack the gelada aggressors tried to re-establish friendly contact more frequently than the targets (victims) of these attacks.

2 MATERIAL AND METHODS

Observations were focused on a group of five gelada (*Theropithecus gelada*) males. All these animals were born and raised in the captivity in Zoo Zlín – Lešná. A seven-year-old male that was the oldest member of this group was the dominant individual that controlled the movement of the group, the rate of grazing, and the moment of return to the shelter. A male, younger by one month, was the second oldest individual and, if necessary, took over the role of the dominant male. A five – year – old male was the youngest member of this group and it is of interest that he was the most frequent initiator of plays and/or conflicts. This all – male group was located in an enclosure with the total area of 3 000 m^2 and with one internal shelter. This enclosure is located on a slope with a brook connecting the river that flows along the southern border of the enclosure with a small lake situated near the northern glazebo terrace. The layout of the enclosure and its arrangement enable a free movement of males throughout the whole territory. Trees, branches and ropes can be also found there.

The object of monitoring and data collection

Observations took place in March 2012 and lasted 5 days (i.e. on 16/03; 22/03; 23/03; 29/03 and 30.3.). Individual dates are mentioned as Monitoring 1–5. Each observation period started at 8:30 a. m. and finished at 4:30 p.m. The ethological observation

was performed as a survey of collective behaviour recorded by means of group photographs. Because of a short duration of some activities, photographs of the group were taken in five-minute intervals. Data about ambient temperatures and the current weather situation were recorded as supplementary information. In the course of this monitoring, the place of observation was changed in dependence on the movement of geladas within the enclosure. Recorded were the following basic forms of social behaviour: food collection (foraging), free movement (locomotion), observing of the neighbourhood (watching), grooming, climbing on trees, playing, aggressive behaviour (fighting), and resting. Locomotion was defined as a movement of the group to greater distances and/or running caused by a disturbing stimulus. Although geladas do not climb on trees to much in the wildness and move only overland; in zoos, however, the situation is quite different. For that reason this activity was also monitored.

Statistical processing

The statistical processing and analysis were performed by means of the package STATISTICA 9.0.

3 RESULTS

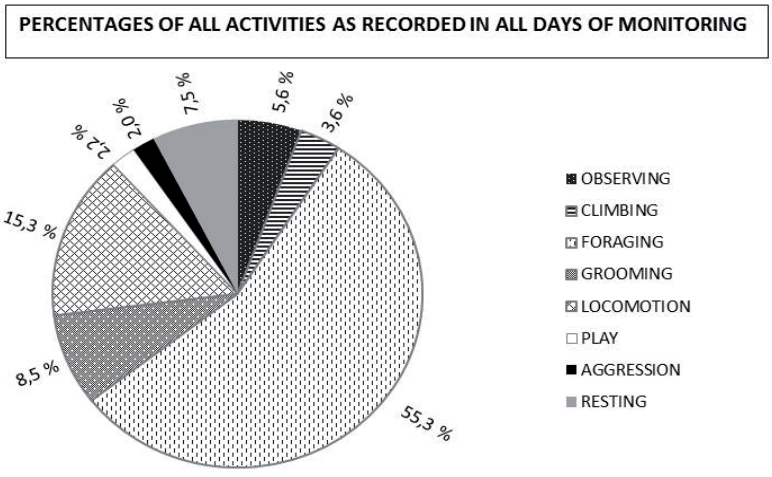
During the study period, results of ethological observations performed in intervals of five minutes were collected and subsequently evaluated. Frequencies of the aforementioned diurnal activities were graphically presented in individual time intervals of monitoring.

Locomotion and resting

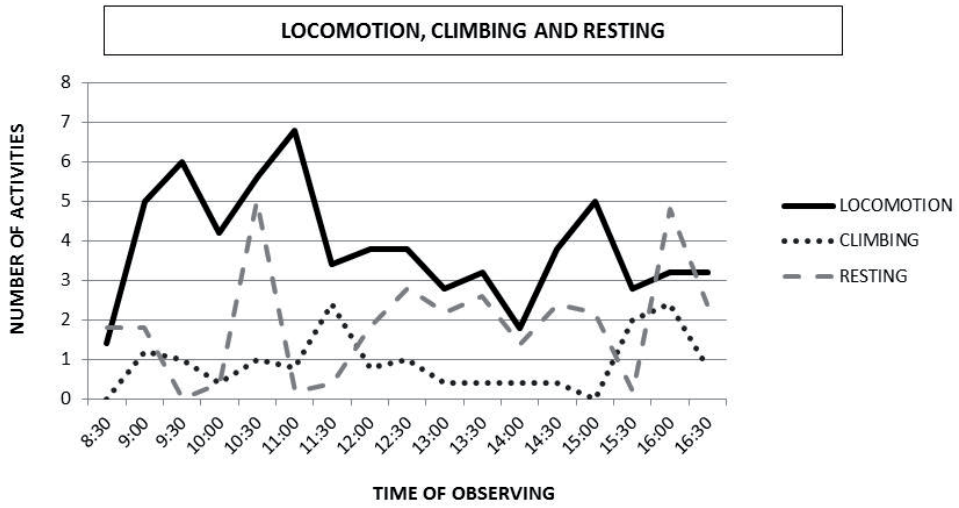
Percentages of locomotion and resting are graphically presented in Fig. 1. Locomotion activities of geladas involved free movement and climbing on trees in the enclosure. Although it is written in literature that geladas do not climb on trees and move only overland, in zoos the situation is a little different and they climb even in relatively great heights. In this experiment, geladas spent approximately 3.6 ± 3% of the total time of observation just to this activity. The free movement around the enclosure occupied 15.3 ± 4.1% of the monitored time. As shown in Fig. 2, the most frequent locomotion's activities were recorded between 9:00 and 11:00 hour's a.m. and between 2:00 and 3:00 p.m., respectively. Climbing on trees had three peaks: the first one was recorded between 9:00 and 9:30 a. m., the second between 11:00 and 12:00 a.m. and the third between 3.30 and 4.00 p.m., respectively. The increase in locomotion activities in morning hours can be explained by the fact the animals were released and could move freely within the enclosure while in the afternoon this was more probably the result of looking for new, not overgrazed places. The percentage of resting was only 7.5 ± 3.1% of the total monitoring time; this was very probably caused by the fact that the experiment did not involve also monitoring of night activities of geladas. As shown in Fig. 2, a continually higher percentage of resting was recorded between noon and 3:00 p.m.; there were two peaks of resting, one about 10:30 a.m. and the other about 4:00 p.m.

Foraging and observing

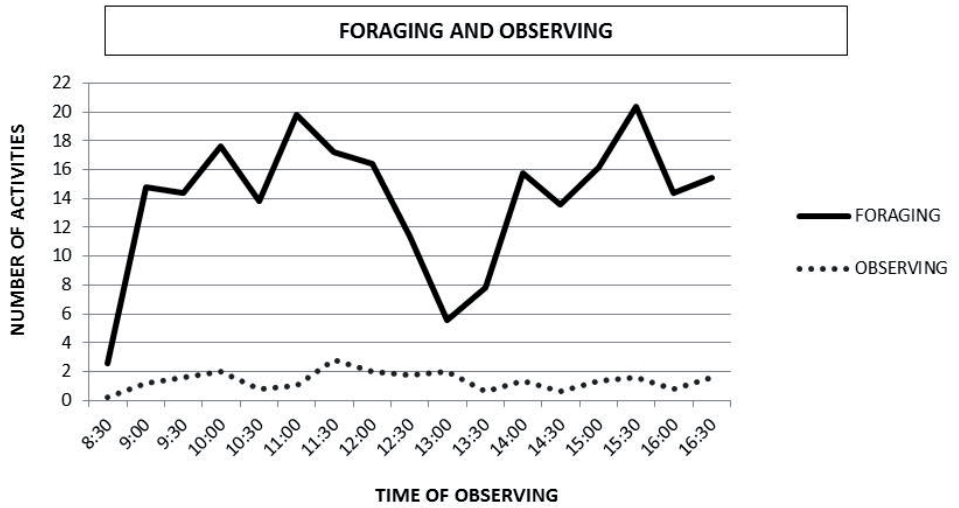
As shown in Fig. 1, foraging (food collection) is the most important diurnal activity. In this study, it occupied 55.3 ± 2.0% of the total monitored time. An increased foraging activity was recorded between 9:00 and 12:00 a.m. (Fig 3); thereafter, there was a short period of resting. The second peak of food collection was recorded between 1:00 and 3:00 p.m. The observing of the neighbourhood was the activity that in zoos was induced either by the presence of visitors or by some atypical sounds. In the wildness, this activity was usually more frequent. In this study this behaviour occupied 5.6 ± 3.3% of the total monitoring time (Fig. 1). The frequency of neighbourhood observation is presented in Fig. 3



1: *Percentages of all activities as recorded in all days of monitoring*



2: *Percentage of locomotion and resting in all time of monitoring*



3: *Percentage of foraging and observing in all time of monitoring*

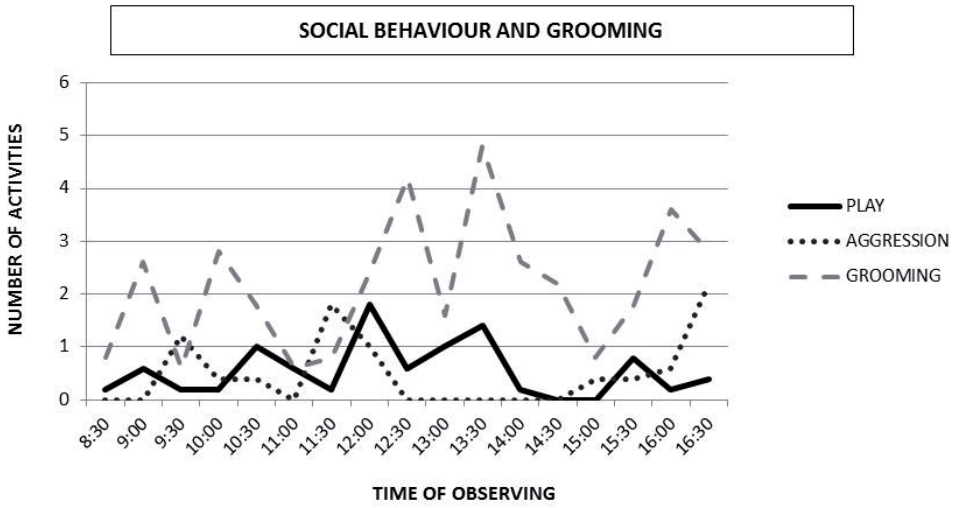
and it is possible to see that this activity did not change (i.e. increase) too much within the study period.

Social behaviour and grooming

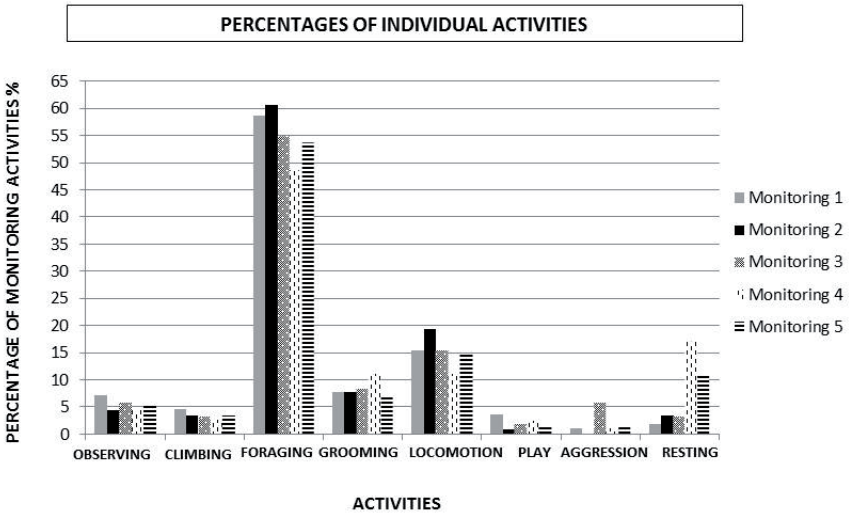
In this study, the category of social behaviour involved the occurrence of playing behaviour and aggression. As shown in Fig. 1, the percentage of playing was only 2.2 ± 9.0%. A low percentage of this activity was most probably caused by a specific composition of the observed group of animals. As shown in Fig. 4, there were several peaks of this activity during the day. This means that geladas played during the whole period of monitoring. The aggressive behaviour occupied 2.0 ± 23.0% of the total time. This very low occurrence of aggressive behaviour was caused above all by the absence of females in the observed group. A high value of the standard deviation was caused by an uneven distribution of this activity in individual days of the study period. The number (i.e. the frequency) of manifestation of aggressive behaviour is presented in Fig. 4. The maximum increase in manifestations of aggressive behaviour was recorded between 9:00 and 10:00 a.m. and between 11:00 and 12:00 a.m. In the afternoon, an increase occurrence of aggression was recorded after 4:30 p.m. Grooming occupied 8.5 ± 4.8% of total activities under study. As shown in Fig. 4, the course of grooming curve is similar to playing activities. This was probably caused by the fact that, similarly as playing, grooming is one of very important social activities and that's why these forms of behaviour very often complete each other.

Percentages of individual activities as recorded in individual days of monitoring

As shown in Fig. 5, individual activities changed in the course of individual days of observation and besides influenced each other. Marked differences occurred in foraging because a marked increase in this activity was recorded in two days of observation; most probably this change was influenced by



4: *Percentage of social behaviour and grooming in all time of monitoring*



5: *Percentage of individual activities as recorded in individual days of monitoring*

a sunny weather that existed during the whole day. An increase in foraging activities was associated also with an increased locomotion because grazing geladas moved from one place to the other, i.e. a new, not overgrazed one. In the third day of monitoring, an increase in manifestations of aggressive behaviour was observed. However, this increase in aggression had no apparent cause. An increase in the percentage of resting to the detriment of grazing and locomotion was recorded on the fourth day of monitoring; this was probably caused by bad weather conditions that existed during the whole day of monitoring. Other activities were relatively balanced during all observation periods.

4 DISCUSSION

This study deals with the behaviour, life activities and complicated social relationships existing among gelada (*Theropithecus gelada*) monkeys. As far as the life activities of these monkeys in wildness and in captivity are concerned, there were significant differences between them. Anděra (2000) wrote that the whole herd of wild geladas move together during the day and, depending on the season and possibilities of grazing, they cover about 2 km per day. They climb the trees only exceptionally so that they live mostly on the ground. Yang *et al.* (2007) studied life activities of Francois' langur (*Trachypithecus francoisi*) in wildness and found out that – in spite of the fact that their locomotion activities of these monkeys are nearly the same as those of geladas – the share of foraging was nearly by one half lower (31.6 ± 7.86%) than that our experimental group that was raised in captivity (55.3 ± 2.0 %). Problems concerning social relationships existing among adult baboons were dealt with by a number of authors (Noser *et al.*, 2003; Yang *et al.*, 2007; Mancini and Palagi, 2009). Playing is considered as one of the most important forms of social behaviour. Among adults, the role of playing is very important, namely during the process of facing up to new situations

and when solving social problems (Palagi, 2006). Nevertheless, it is quite improbable that alfa males would play with males of the same age but with a lower position in the social hierarchy (Mancini and Palagi, 2009). This fact was corroborated also by results of this study because the average percentage of playing was only 2.2 ± 9.0% of the total time of observations. Social relationships of baboons involve not only playing but also a scale of other activities (e.g. grooming, courting, aggression etc.). The period of grooming increases in dependence on the size of the group (Dubnar, 1991; Lehmann *et al*., 2007). This hypothesis was corroborated also by results of a study performed with Francois' langurs (*Trachypithecus francoisi francoisi*); in this case it was found out that the time spent for grooming represented only 0.33% ± 0.31% of the whole time of monitoring (Yang *et al*., 2007). Nevertheless, results of observations performed within the framework of this study did not supported this observation because the grooming occupied altogether 8.5 ± 4.8% of the total time of monitoring. Considering this result and the time of observation, it can be concluded that this percentage was relatively high for such a small group of animals. Aggression is also an important component of the social behaviour because it enables that the whole herd is uniformly dispersed within the whole grazing area. In a close society, conflicts between individuals result in a better establishment of hierarchy and in a strengthening of the social position of individual animals (Veselovský, 2005; McCowan *et al*., 2008). In the monitored group of geladas, however, the occurrence of aggression was relatively very low (2.0 ± 23.0 %), probably due to the absence of females in the group. A high value of standard deviation was a result of an uneven distribution of this activity in days of monitoring.

5 CONCLUSIONS

The presented result indicate that the behaviour of gelada baboons was very influenced by the composition and size of a given group, method of raising, surrounding area and, last but not least, also by weather conditions. It is quite obvious that results of this study do not enable to draw general conclusions about the behaviour of this species in general. In spite of this, however, geladas represent a very suitable model of behavioural studies just because of their high social clannishness. Using this model it is possible to study the behaviour that gradually contributed to the humanisation of our ancestors.

SUMMARY

The community of geladas is an unusual example that enables to understand and explain the evolution of complex societies. In spite of an extremely flexible social organisation of gelada monkeys it is possible to say that individual social levels of these animals are clearly identified and that they can be easily quantified. For that reason this study was focused to the investigation concerning life manifestations of gelada baboons (*Theropithecus gelada*) because they represent a suitable model for studies on the behaviour that gradually resulted in the humanisation of our ancestors. The study was performed with a group of five males reared in the Zoo Zlín – Lešná. The group was kept in an enclosure with the total area of 3000 m^2 and with only one shelter. Ethological monitoring was performed as a survey of collective behaviour recorded by means of a camera in March 2012 and lasted altogether 5 days. Because of a very short duration of individual types of activity, the monitoring was performed in five-minute intervals. Data about ambient temperatures and the current weather situation were recorded as supplementary information. Studied were the basic forms of social behaviour, i.e. food collection (foraging), free movement, (locomotion) observing of the neighbourhood (watching), grooming, climbing on trees, playing, aggressive behaviour (fighting), and resting. Frequencies of individual activities were presented graphically in individual time intervals of the monitored diurnal periods. Obtained data were processed and analysed statistically using the package STATISTICA 9.0. Foraging was the most frequent diurnal activity and occupied 55.3 ± 2.0% of the total monitored time; its highest frequencies were recorded between 9:00 and 12:00 a.m. and between 1:00 and 3:00 p.m. Locomotion was the second most frequent social activity (15.3 ± 4.1% of the time) and its peak frequencies occurred between 9:00 and 11:00 a.m. and 2:00 and 3:00 p.m. The next were grooming (8.5 ± 4.8%) and resting (7.5 ± 3.1%) with peaks between 10:30 a.m. and 4:00 p.m., watching (5.6 ± 3.3%) and climbing (3.6 ± 3.0 %). The lowest frequencies were recorded in case of playing and aggressive behaviour (2.2 ± 9.0% and 2.0 ± 23.0% of the time, respectively). The obtained results also demonstrated that the percentages of individual diurnal activities changed above all in dependence on weather. The most pronounced fluctuations were observed in case of foraging (above all on sunny days). On the other hand, the percentage of resting was the highest on days with bad weather.

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