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A preliminary study of the rutting behaviour of Tatra chamois *Rupicapra rupicapra tatrica*

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Abstract. The behaviour of Tatra chamois (*Rupicapra rupicapra tatrica*) during the rut was studied in the Belianske Tatry Mts., Slovakia. Observations were carried out on a total of 16 days between the 2nd of November and the 12th of December 2013, during which 35 animal hours were recorded using portable camcorders. The study focused on behavioural patterns of rutting males. A comparison of rut behaviour pattern frequencies between *R.r. tatrica* and *R.r. rupicapra* suggests the existence of certain behavioural differences between these subspecies. Further studies are needed to confirm the differences and understand their significance.

Key words: mating, ethogram, reproduction, subspecies

Introduction

Chamois have a rich rut behavioural repertoire, which includes chasing each other, harem control behaviour, marking etc. (Lovari 1985). Recent studies proved territorial behaviour of male Alpine chamois (Hardenberg *et al.* 2000; Corlatti *et al.* 2012) as well as existence of alternative mating tactics (Corlatti *et al.* 2013). For achieving dominance, male chamois use mainly indirect forms of aggression (Krämer 1969; Lovari and Locati 1991), which reduces the risk of injury. Patterns for Alpine chamois *R.r. rupicapra* were described by Krämer (1969) and some more were observed by Corlatti *et al.* (2013). The rutting behaviour of *R.r. tatrica,* however, has been mentioned in the literature only marginally (Blahout 1976) and there have been no quantitative studies. Long-term isolation of individual populations may have created differences between species and subspecies of chamois (Chovanec *et al.* 2005). Comparative studies of chamois rut behaviour analyzed possible kinship (Lovari and Locati 1991), but also suggested differences (Brun and Garcia-Gonzales 1988) and even barriers which could have inhibit interbreeding of different chamois species (Lovari 1985). A comparative study of rut behaviour for *R.r. tatrica* has not been made yet. Comparing the mating behaviour of *R.r. tatrica* and *R.r. rupicapra* may help to understand the maintenance of mating strategies and their adaptation to specific environments, as well as providing data to support conservation management in Slovakia Mountains which are inhabited by both *R.r. rupicapra* and *R.r. tatrica* living in close proximity.

The present study aimed to:
1. Quantify the behavioural repertoire of male rutting *R.r. tatrica*;
2. Compare the rutting behaviour of *R.r. tatrica* and *R.r. rupicapra*.

Material and Methods

An autochthonous population of *R.r. tatrica* (Blahout 1971) occurs in the alpine zone of the Tatra Mts., including the Western, High and Belianske Mts.

Despite positive trends in population growth in recent years, the endemic *R.r. tatrica* remains threatened (Temple and Terry 2007; Corlatti *et al.* 2011). A recent count in both the Slovak and Polish parts of the Tatra Mts. revealed a total of approximately 963 individuals (www.spravatanap.sk 2013). Factors suggested to have a negative impact on Tatra chamois abundance include unregulated tourism, alpine skiing and mountain climbing; low-flying aircraft (both motorised and un-motorised); poaching; habitat contamination; climatic conditions; change in trophic conditions; health status; increased predation pressure (Janiga and Švajda 2002). However, Rigg and Ondruš (2007) showed that population dynamics appear to have been driven mainly by fluctuations in reproductive success, rather than by variation in mortality of adult individuals.

Study area

The study was carried in the Belianske Tatry Mts., which are separated from the High Tatry Mts. to the west by Kopské saddle (1,776 m.a.s.l.). They are the highest calcareous mountains of the Western Carpathians, containing dolomites, dark limestones and quartzites as well as shales and sandstones (Biely *et al.* 2002). The 14 km-long main ridge has a mean height of 1,964 m, the highest peaks being Havran (2,152 m) and Ždiarska vidla (2,146 m). In the subalpine and alpine zones, 69% of the sur-

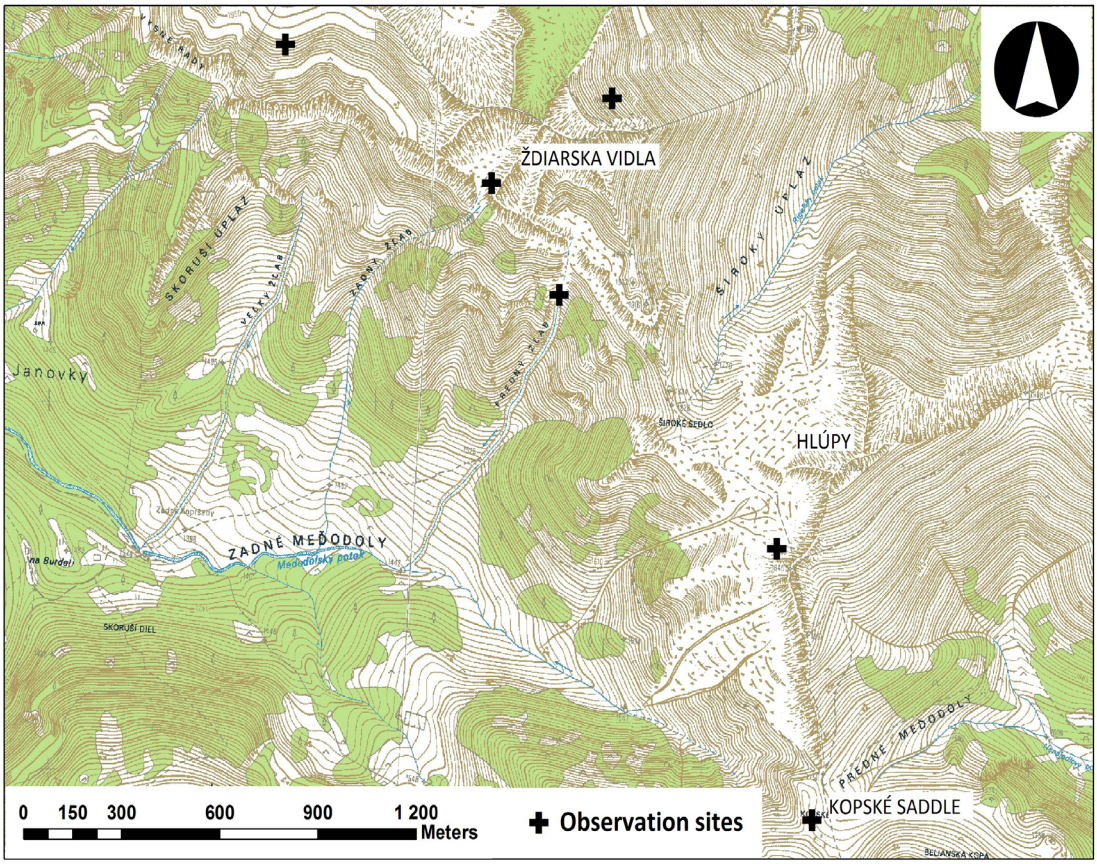

Fig. 1. Localities where chamois were observed during the 2013 rut in the Belianske Tatry

face area has a slope of 30–40%. The rich flora of the Belianske Tatry includes many oligo- to monotropic species.

Two distinct herds of chamois have been described in the Belianske Tatry: "Bujačia" and "Havrania" (Ksiažek and Sedláková 2006). Our observations were focused on the "Havrania" herd, which inhabits the western part of the range (Fig. 1).

Data collection

Data were collected in the Belianske Tatry Mts. between the 2nd of November and the 12th of December 2013, during the chamois rutting period, between 10 am and 16 pm. During 16 days of focal animal sampling (Altman 1974) at six localities, a total of 35 animal hours were recorded with portable camcorders (Sony DCR-VX2100E, Canon XA10) with at least 42x zoom.

Each observation session lasted 1.5–3 hours (limited by weather and visibility). Males were identified using binoculars (10x42). The rest of the herd was also observed from a distance of 50–300 m. This distance allowed focal animals to be observed in sufficient detail whilst also enabling us to record other individuals (subordinate males, females).

We used an ethogram of chamois behaviour based on the work of Krämer (1969) and Corlatti *et al.* (2013). The rutting behaviour of males was divided into three categories: courtship behaviour; direct forms of aggression; indirect forms of aggression (Lovari and Locati 1991; Corlatti *et al.* 2013). Vocalisations were not included as these were not always apparent to the observers. Frequencies of different rutting behaviours observed in Tatra chamois were calculated per hour and compared with those reported for Alpine chamois (Corlatti *et al.* 2013).

The rut was divided into three periods of 11 days each which enabled us to examine temporal variation in behaviour over the rut (Corlatti *et al.* 2013). Observations from the 12 of December were not included in these analyses because the rut had apparently ended, with no rutting behaviour seen on this day.

Results

During 35 hours of focal observations on 16 different days, 24 different male rutting behavioural patterns of *R.r. tatrica*, including rutting calls, were observed (Table 1). The most frequently seen behaviours were a form of indirect aggression, Marking (observed 45 times), as well as two types of courtship behaviour: Mild head down (N=19) and Head up (N=27).

The rutting behaviour of males peaked between the 13-23rd of November (Fig. 2). In this period most courtship behaviour and indirect aggression were observed (Fig. 2). Mounting was observed twice during the first period, between the 2–12th of November, and four times during the middle period.

In general, indirect forms of aggression, particularly Marking, were observed more frequently than direct aggression (Table 1, Fig. 2). Indirect (but not direct) aggression increased

duringthe period with more frequent courtship behaviour. During the final period of the rut observed, between the 24th of November – 4th of December, courtship and direct aggression were rare or absent.

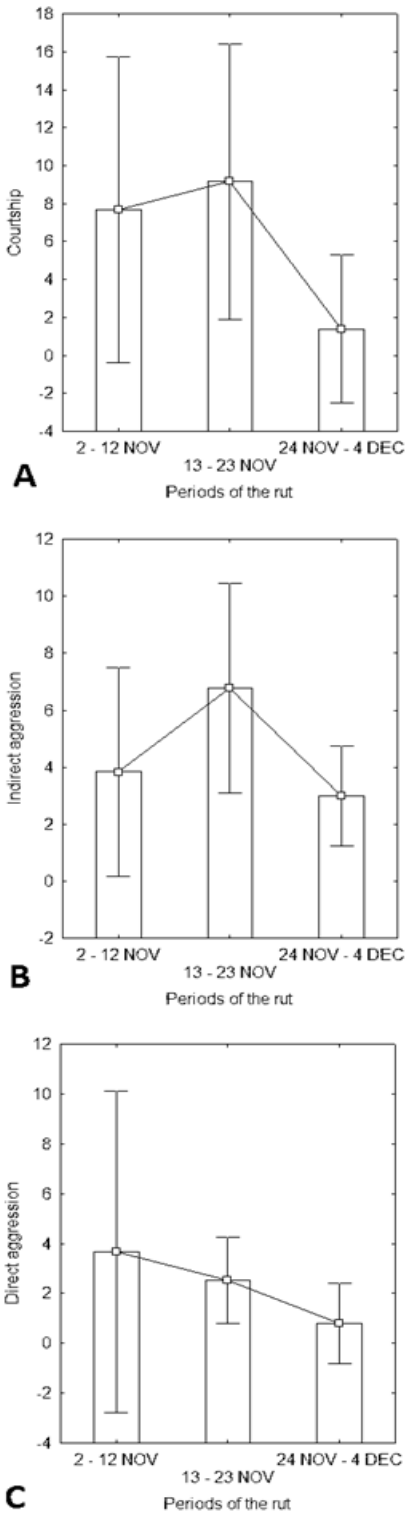

Fig. 2. Frequency of occurrence (mean ± SD) of three categories of rutting behaviour observed in male Tatra chamois (N=28) during consecutive 11-day periods; A – Courtship, B – Indirect aggression, C – Direct aggression

Behavioural pattern	% of mean total rut behaviour/ hour	
	R.r. tatrica	*R.r. rupicapra*
Courtship		
Static head down	3.95	0.48
Dynamic head down	4.55	1.18
Approach	4.30	0.13
Foot stamping	4.94	0.03
Herding	2.08	1.60
Rush	5.46	0.14
Stare	3.29	2.51
Lip curl	1.73	4.05
Mild head down	6.99	7.90
Head up	9.49	18.99
Poke	–	0.55
Flank stroke	0.35	0.16
Croup touch	–	0.03
Hook	0.49	0.52
Mount	2.08	1.34
Indirect aggression		
Marking	16.98	26.90
Horning	–	0.41
Neck up	4.45	10.41
Head flagging	2.36	0.50
Penile display	1.38	0.16
Standing	4.50	6.64
Body-head shake	3.61	5.88
Gambol	1.09	0.07
Direct aggression		
Stare	1.38	0.74
Approach	0.69	0.89
Static head down	0.35	0.83
Dynamic head down	3.21	1.12
Head butt	0.84	0.05
Hook	0.40	0.66
Rush	4.00	1.43
Chase	3.61	2.29
Lip curl	1.04	1.13

Table 1. The mean frequency of individual rutting behavioural patterns observed in male Tatra chamois *Rupicapra rupicapra tatrica* in comparison with data reported for Alpine chamois *R.r. rupicapra* (Corlatti *et al.* 2013)

Discussion

For Alpine chamois 31 behavioural patterns have been described (Krämer 1969; Corlatti *et al.* 2013). During our relatively limited observations we observed only 24 rut behavioural patterns of *R.r. tatrica* and no new patterns were identified. Three behavioural patterns reported for Alpine chamois were not seen in Tatra chamois: Poke, Croup touch, Horning (Table 1). In addition, Head up (courtship

behaviour) and Marking (indirect aggression) were seen less frequently in *R.r. tatrica* than has been reported for *R.r. rupicapra* (Corlatti *et al.* 2013), although they constituted the two most common patterns of rutting behaviour in both subspecies.

Lovari (1985) and Lovari and Locati (1991) identified several behavioural patterns, all relevant to courtship, discriminating the Northern from the Southern chamois species as well as two subspecies of the latter. At the beginning of the Würm glaciations, the two species of chamois already existed: the Southern chamois was geographically split into the Apennine and the Iberian subspecies (Masini and Lovari 1988). The Northern chamois must have formed a nearly continuous population during the Würm eventually splitting on separate mountain groups at the onset of the last interglacial (Lovari and Scala 1980). Thus, it may not be surprising if behavioural differences have developed among *R. rupicapra*, *R. pyrenaica* and subspecies of the latter, but not within *R. rupicapra* ssp. because of their recent separation.

On the other hand, there are several possible explanations why we did not record all forms of rutting behaviour in the Alpine chamois ethogram. Our sample size (number of hours of observation) may have been insufficient to observe all the less frequent forms of behaviour. In addition, we carried out all our observations at approximately the same time of day, which might have had a bearing on our results. We therefore recommend further, more substantial, studies to address this issue as well as to test the possible differences we identified between subspecies in terms of the relative frequency of different forms of behaviour.

We registered rutting behaviour of males on the 2nd of November and we assumed that the rut in Belianske Tatry Mts. finished around the 12th of December. The highest frequencies of total rutting behaviour were observed on the 14th and 16th of November, which is earlier than what reported for Alpine chamois. Krämer (1969) mentioned that the majority of female *R.r. rupicapra* were in oestrus in the second half of November and Corlatti *et al.* (2013) observed a peak in the courtship behaviour of territorial males between the 16th and 25th of November. No individuals were marked in our study: we observed different herds, varying in size from 10 to 60 individuals to decrease the probability of pseudoreplication of data. If the activity level of dominant males is influenced by the number of nearby females, this may account for some of the fluctuation we observed in rutting intensity. However, the peak in male rutting behaviour may be influenced not only by the timing of oestrus in females but also by weather conditions (Blahout 1976).

We observed a greater use of indirect aggression: indirect aggression (34%), direct aggression (16%). Our observations are consistent with studies of Alpine chamois (*R.r. rupicapra*) (Corlatti *et al.* 2013). Male chamois are probably unable to estimate the opponent´ s fighting abilities because of their solitary way of life outside the rut period (Locati and Lovari 1990) and also a direct fight increases the risk of injury.

Males showed an increase of courtship behaviour and indirect aggression between the first and the second period, meanwhile direct aggression was the highest in the first period and decreased gradually during the other parts of the rut. One could estimate that males of *R.r. tatrica* make their rank clear on the beginning of the rut using direct forms of aggression (threats) and later on they use mainly dominance displays, i.e. indirect forms of aggression. However our study can only suggest such a phenomenon because of limited observation hours which can bias our results. On the contrary, a study of Alpine chamois *R.r. rupicapra* (Corlatti *et al.* 2013) reported an increase of direct aggression between the first and the second periods of the rut. Direct aggression was minimal at the beginning of the rut and it did not show significant difference between second and third period of the rut. Males started competing aggressively especially from the onset of female oestrus until the end of the rut.

During our observations, we recorded several events which disturbed the rut and can be the topics of future studies – tourists' occurrence, low flying aircraft, golden eagle (although no case of successful predation was observed).

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