Rutting behaviour in an enclosured group of wild forest reindeer (*Rangifer tarandus fennicus* Lönnb.)

Ilpo Kojola[1]

Abstract: The rutting behaviour of wild forest reindeer (*Rangifer tarandus fennicus* Lönnb.) was studied 1981 - 83 in a 15 ha enclosure located in Kivijärvi, Central Finland (63° N). The group consisted of two old stags, 6 - 9 hinds and their calves and yearlings. The main sections of the study were social structure, social signals, time budget and daily activity. In early September the aggressiveness of the stags towards females concentrated on those individuals which had last dominated them. Adult females were more aggressive to young females than to each other. The proposed aggressiveness of the hinds towards yearlings may be explained by the lower predictability of the hierarchial status of the young animals. The main character of observable social signals seemed to be similar to those described in earlier studies concerning the genus *Rangifer*. Stags often made snapping-like movements with their mouths during agonistic behaviour. Low-stretch displays and investigation of the urine of the females concentrated on the estrous hind during the day preceeding the pre-copulatory period (which commenced when the hind did not yet avoid the stag). The stag always sniffed at the vulva of the female after copulation. The harem stag did not stop grazing during the peak of the rut. Differences in the time budget between the dominant and subdominant stag as between estrous and anestrous hinds were clear. Mating occurred most often during the 3 hours after sundown. In the dark the old stags often sparred and their activity towards females seemed to be weaker than in the daylight hours. During the peak rut the stags were observed to spar only while the females were resting.

Key words: wild forest reindeer, rut, social behaviour, time budget, daily activity.

[1] Finnish Game and Fisheries Research Institute, Game Division, Reindeer Research, Koskikatu 33 A, SF-96100 Rovaniemi, Finland.

Rangifer, Special Issue No. 1, 1986: 173 - 179

Introduction

The wild forest reindeer (*R. t. fennicus* Lönnb.) is at present classified as a subspecies of genus *Rangifer* (Siivonen, 1975, Nieminen, 1980), and its present numbers and distribution 8000 individuals in Soviet Karelia (Danilov and Markovsky, 1983), about 600 individuals in eastern Finland (Pulliainen, 1983) and about 50 individuals as an introduced population, in Central Finland (Kojola *et al.*, 1985).

The aim of this presentation is to describe the rutting behaviour of wild forest reindeer and, in some respects to compare the behaviour with other *Rangifer* subspecies and other ungulates.

Thomson (1980) has found differences in the rutting behaviour between reindeer and caribou as has Skogland (1981) between Norwegian wild reindeer (*Rangifer tarandus tarandus* L.) and Svalbard reindeer (*R. t. platyrhynchus* Vrolik). Previously Montonen (1974) and Helle (1982) have presented some observations of the behaviour of wild forest reindeer. The main section of this study are social structure, social signals, time budget and daily activity.

Adult reindeer observed in this study were transported from eastern Finland to Central Finland (distance about 300 km) into an enclosure prior to subsequent introduction. The enclosurement period offered a chance to observe the details of the rutting behaviour in a small group of this reindeer.

Study area and methods

The wild forest reindeer were observed in 1981 - 83 in a 15 ha enclosure (Fig. 1) located in Kivijärvi, Central Finland (63°N, 24'E). The constantly enclosured group consisted of two adult stags, 6 - 9 females and their calves and yearlings. The reindeer were daily fed with lichens (*Cladonia* spp.), molasses and fresh hay. The natural vegetation was quite abudant on the bog and fen areas, but in the forests the coverage of the undervegetation was only 20 - 30% of its original.

The early observation period was initiated on the first day of September and finished at the beginning of November. This period was divided into seven periods each lasting 10 days. The field examination took 368 hours altogether (302 h in 1981, 110 h in 1982 and 44 h in 1983), usually lasting 2 - 3 hours at a time (scale from 10 minutes to 24 hours). A spot light was used in the dark.

The behaviour displays, individual distances and the activity of the animals (at intervals of 60 sec in the males and 5 min in the females) were recorded on tape or directly into a notebook using abbreviations. The distribution of observations between different subgroups or individuals was tested using the chi-square test.

Results

Timing of the rut

The dates of the off-rubbing of the antler velvet deviated at most one day in the same individual in successive years (stag 1: 31 Aug. 30 Aug. and 30 Aug.; stag 2: 9 Sept., 9 Sept. and 8 Sept.; hind 1: 15 Sept. (1981) and 16 Sept. (1982); hind 4: 25 Sept. (1981) and 25 Sept. (1982); hind 10: 17 Sept. (1981) and 16 Sept. (1982). On average yearling males (n=5) rubbed the velvet off on the 10th of September (S.D.=1.5). In the year 1981 6 females removed the velvet on the average on the 21st of September (S.D.=4.2) and the mean interval from the velvet removal to their first estrous took 15.5 days (S.D.=3.9).

In the year 1981 seven of nine adult females had their first heat during 1 - 10 October (defined to be «the peak of the rut»). In 1982 I could determine the timing of two heats (both on the 2nd Oct.) and in 1983 none. The calving dates in 1982 - 84 were nearly the same from year to year (Kojola, unpublished data).

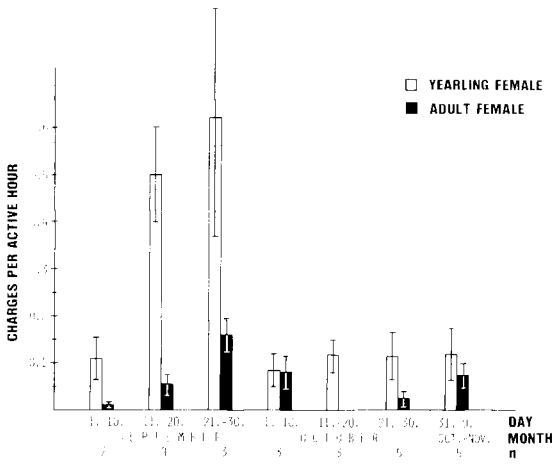

Fig. 1. The charges of the hinds towards the yearling females and towards each other at the feeding site (means with S.E.)

Social structure and agonistic behaviour

The hinds rested more often as a single group during 21 September - 10 October than between 1 - 20 September or between 11 - 30 October. The average lying distances between hinds seemed to be smaller from 21 September to 10 October (11.5 ± 0.65 m) (x ± SE), n=575) than during 1 - 20 September (16.2 ± 0.92 m, n=237) or during 11 - 30 October (22.2 ± 1.16 m, n=290). Average lying distance between the estrous hind and the dominant stag was 3.7 ± 0.72 m (n=15), while the corresponding value between the stag and anestrous hinds during the peak rut was 11.2 ± 0.86 m (n=88). Yearling males followed the harem while the subdominant old stag moved individually. Stag 2 rose over stag 1 on the 6th (1982) and 4th (1983) October.

During the pre-rut (see Espmark, 1964) the agonistic behaviour of the stags concentrated on those females that had last dominated them (two females dominated both stags in early September). One of five yearling males rose over the hinds and this occurred in late October. During every autumn one yearling male was found towards which the dominant stag behaved more aggressively than towards the subdominant old stag or other yearling males.

Charging, chasing and snorting characterized the agonistic behaviour of the stags. They also often made small, rapid snapping - like movements with their mouth during agonistic behaviour. First symptoms of herding (see

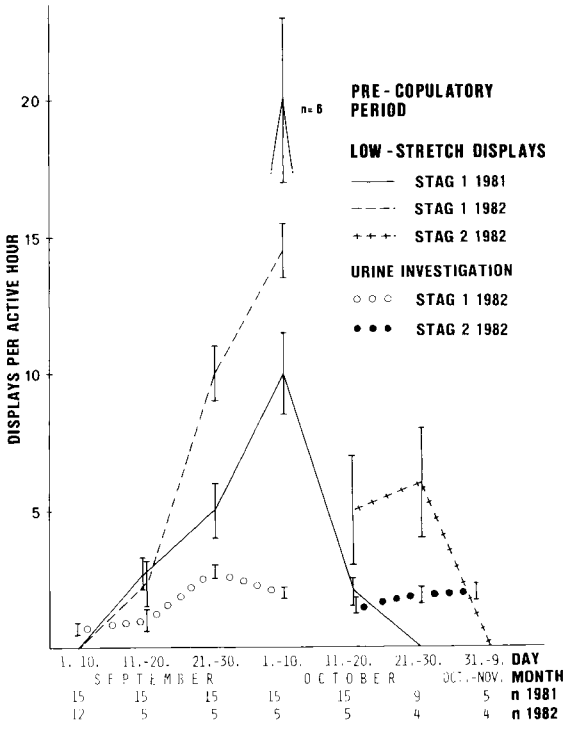

Fig. 2. Frequency of the low-stretch displays and investigating of the urine by the dominant stags (means with S. E.; urine investigation was not recorded in 1981).

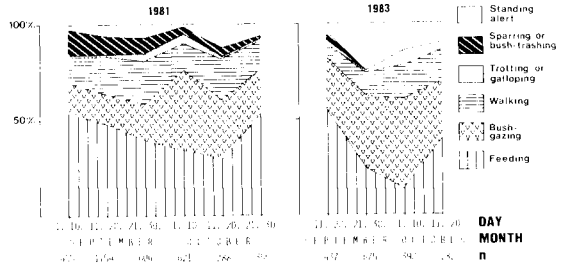

Fig. 3. Activity budget of the harem stag on his feet in 1981 (two subordinated males) and in 1983 (five subordinated males).

Bergerud, 1974) were observed at the beginning of the period 21 - 30 Sept. The harem stag herded the hinds most intensively during 1 - 10 October. During this period only single, mated females were observed for longer times (several tens of minutes or so, 5 obs.) outside the harem. When the subdominant stag tried to herd them they vigorously ran towards the harem. The hinds charged young males more often than young females ($P<0.001$, $n=82$), young females more often than calves ($P<0.001$, $n=34$). Aggressiveness of the hinds towards young females and towards each other seemed to be most intensive in late September (Fig. 1). The hinds seemed to behave more aggressively towards young males after the peak rut than before it.

Behaviour observed in both sexes

The bush-trashing was most frequent during 21 - 30 September in both sexes. The females usually thrashed those trees and bushes the stags had earlier rubbed bare. The reindeer frequently interrupted the bush-trashing for licking and sniffing at the tree.

«Yawning» was here defined as a wide mouth-open display lasting 2 - 3 secs (distinguished from slight mouth openings which were seen while the animals were stretching after getting up, from more rapid displays which occasionally stopped feeding on the molasses and from the flehmen display (see Schneider, 1930; Fraser, 1968) which frequently followed olfactory stimulus. Yawning display was preceeded by antler contacts in 67% ($n=39$) of males (with tree or another reindeer) and 56% ($n=12$) in females (with tree). The lying animals usually yawned after licking their hooves.

During 11 - 30 September the hinds were observed to be grazing in five and lying in seven cases while the old stags sparred with each other. During 1 - 10 October these stags were seen to spar with each other only while the females were lying ($n=5$). When the hinds become active, the dominant stag began to threaten the subdominant. The sparring was most often ($P<0.001$, $n=29$) commenced upon the initiative of the dominant stag.

The sparring was very frequent among yearling males. Yearling females sparred with calves, yearling males or with each other. Adult females were observed to spar in eight cases with their calves, twice with a yearling male, but never with each other or with a yearling female.

Male rutting behaviour

The low-stretch displays (see e.g. Walther, 1974) were most frequent during 1 - 10 October even if the pre-copulatory periods (see chapter «Mating behaviour») are ignored (Fig. 2). Displaying activity was less frequent after the peak rut in 1981 than in 1982, when the dominance relationships between the stags

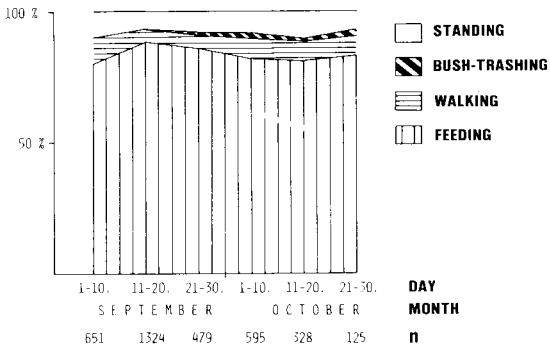

Fig. 4. Activity budget of anestrous hinds on their feet.

changed during the peak of the rut. The low-stretch displays and investigation of the urine concentrated ($P<0.001$, n=32 and 30) during the day before the pre-copulatory period of the estrous female. During 11 - 15 October the harem stags made advances more frequently ($P<0.001$, 1981: stag 1, n=43; 1982: stag 2, n=27) to the unmated than mated females. Yearling males (43% of observations, n=28) and male calves (46%) were most active in mounting on anestrous females. A subordinate male (male calf) was once seen to mount the estrous female. Other females did not mount the estrous hind. The urine investigation was followed by the flehmen response, which usually lasted 20 - 30 sec at a time. Yearling males, male calves and hinds showed the flehmen occasionally.

The dominant stag hunched during 21 - 30 September more frequently ($x^2=18.7$, $P<0.001$, n=55) after other activity had been directed towards males than towards females. During 1 - 10 October this kind of difference was not observed ($x^2=0$, n=55). Complete erections (penis fully extended and horizontal) followed antler contact with another reindeer in 72% observations (n=18). During sparring the penis of males was often semi-erect.

Mating behaviour

The pre-copulatory period prior to mating was defined to commence when the estrous female did not yet avoid the displaying stag. That period took, on average, 74 ± 7.3 min (6 estrous females). During the pre-copulatory period the stag made 4.5 ± 1.09 (n=6) mounting efforts on the hind. Mean duration of the mating was 8.4 ± 1.2 sec (n=7). The stag always sniffed at the vulva of the hind immediately after mating.

Time budget and daily activity

The same stag used a considerably smaller proportion of the time resource for grazing in 1983 than in 1981 (Fig. 3). The were four yearling males inside the enclosure in 1983 and one in 1981. The dominant stag grazed 5 - 15% and subdominant 45 - 55% during the peak of the rut. The hinds used 80 - 88% of the time for grazing while on their feet (Fig. 4). During estrous the proportion of time the hind spent feeding tended to decline and the proportion of time she spent in bush-trashing or inactive standing tended to increase (Fig. 5).

During 24-hour observation periods (18 - 19 Sept., 15 - 16 Oct. in 1981 and 10 - 11 Sept. in 1982) long resting periods took place during the hours before midnight. (Figs. 6 and 7). The proportion of lying tended to differ slightly between the dominant stag and hinds (46.2/49.6 % in 10 - 11 Sept. 1981 (6 females), 42.1/43.2 % in 18 - 19 Sept. 1982 (9 females) and 50.0/61.8 % in 15 - 16 Oct. 1981 (1 female)). In the dark the stags sparred more frequently and the activity towards the hinds was weaker than in the daytime (Table 1). During 1 - 10 October in 1981 five matings (n=7) took place during 3 hours after sundown.

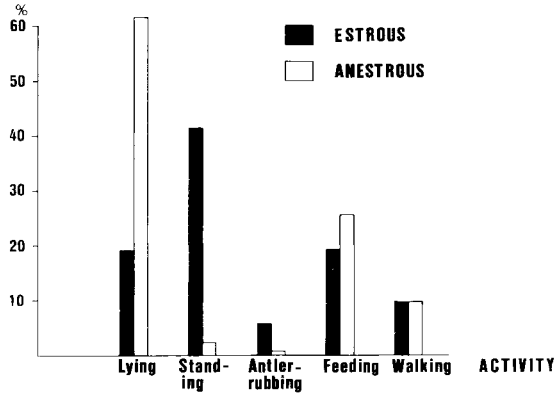

Fig. 5. Comparison of the proportion of time during 5 hours prior to mating by estrous (No. obs. 172) versus anestrous hind (No. obs. 616).

Discussion

The peak of rut of wild forest reindeer takes place in the middle of October (see Helle, 1977). Kojola *et al.* (1985) suppose that the transition of 1 week earlier in the timing of the main estrous season occuring in the enclosure from 1980 to 1981 (concluded from the subsequent calving

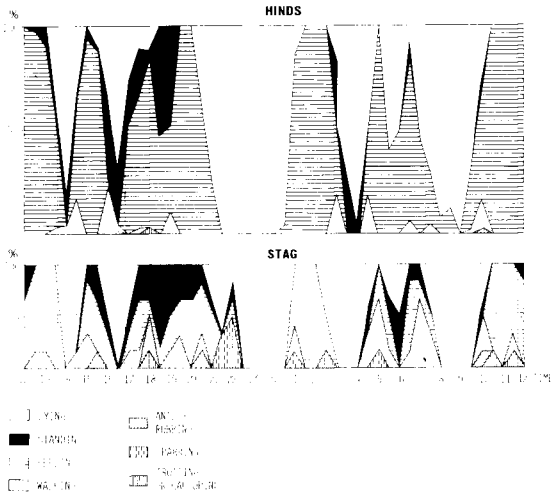

Fig. 6. Activity budget of the harem in 18 - 19 Sept. 1981.

dates) was due to the intensification of the artifical feeding. The amount of fresh hay especially had been increased.

According to Bergerud (1974) the proposed aggressiveness of the stags towards the hinds during the pre-rut confirms the male dominance. My findings on the distribution of aggressiveness at the individual level tend to support this suggestion. The rise in the aggressiveness of the hinds took place at the same time as the final ossification of the antlers and the removal of the antler velvet. The proposed aggressiveness of the hinds towards yearlings in this small group may be explained by the lower predictability of the hierarchial status of the young animals from the point of view of the hinds (see e.g. Lindsay *et al.*, 1976).

The main character of observable social signals for wild forest reindeer seemed to be similar to those described in earlier studies concerning the genus *Rangifer* (see Espmark, 1964; Bergerud,

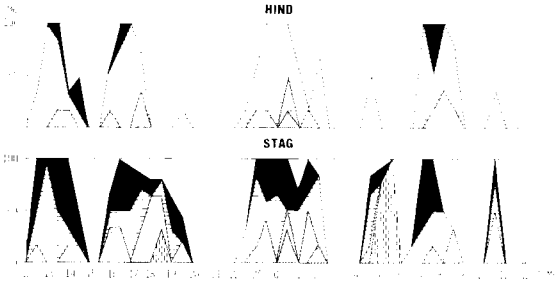

Fig. 7. Activity budget of one unmated hind and the dominant stag in 15 - 16 Oct. 1981.

Table 1. Nocturnal and diurnal activity of dominant stag in sparring and presenting low-stretch displays.

Date	Time	Sparring (min)	Low-stretch display (n)
18 - 19 Sept.	2200 — 0500	30	4
	1000 — 1700	4	32
15 - 16 Oct.	2200 — 0500	59	0
	1000 — 1700	5	15

n Legends to figures

1974; Thomson, 1977). The prevalence of those communicative signals which Thomson (1980) mentions seems to be similar to Norwegian mountain reindeer (*R. t. tarandus* L.) apart from the excitation jump, which is more common and better developed in wild forest reindeer (see Helle, 1982). Small snapping-like oral movements are common in the aggressive behaviour of females of the semi-domestic reindeer (*R. t. tarandus*) (Kojola *et al.* 1985). I had seen the males of wild forest reindeer of various age classes present it, but never the female.

My observations indicate that one evolutive purpose of the odour marking (here urinating) may be threatening (see Espmark, 1964; Geist, 1966). Herding is the most common activity directed towards the females before the hunching (Kojola, unpublished data). During the peak of the rut, which was characterized with the intensive herding the sex-related differences observed in the distribution of the objects of the preceeding activity of the dominant stag, disappeared.

According to Reinhardt (1983) the flehmen may be a male olfactory test of the females' reproductive stage, and helps in the detection of oestrus. In contrast to flehmen, mounting behaviour towards anestrous hinds was more frequent in young males than in the adult stag. This observation makes it unlikely that mounting serves as a demonstration of dominance in reindeer in the way it does it mountain sheep (*Ovis canadensis*) (Geist, 1968); Grant's gazelle (*Gazella grantii*) (Walther, 1965) and American buffalo (*Bison bison*) (Lumia, 1972). In cattle (*Bos indicus*) the low ranking animals had a tencency to mount more often than high ranking ones (Reinhardt, 1983). In contrast to this examination, the other females were seen to mount the estrous female e.g. in cattle (Fraser,

1968), in red deer (*Cervus elaphus*) (Clutton-Brock *et al.*, 1982) and in caribou (Bergerud, 1974).

Espmark (1964) and Thomson (1977) have mentioned that the stags stop grazing during the rut. In the enclosure the well-fed stags of wild forest reindeer did not completely stop grazing even during the estrous of the hinds. The longest grazing periods took place in the dark. The number of subordinate males might have an impact on the time budget of the harem stag. On the other hand the stag may invest more heavily in the rut as it aged (see Leader-Williams, 1979; Clutton-Brock *et al.*, 1982). Estrous caused changes in the time-budget of the female. The observed changes tended to be similar to those in white-tailed deer (*Odocoileus virginianus*) (Ozoga and Verme, 1975) and in red deer (Clutton-Brock *et al.*, 1982).

The semi-domestic reindeer mated most often at sunrise and at sundown (Espmark, 1964). In this examination the wild forest reindeer was most frequently observed to mate from 1 to 2 hours after sundown. The Newfoundland caribou also commonly mates in the afternoons (Bergerud, 1974). Although the reindeer has a polyphasic activity pattern it is essentially a diurnal animal (Erikson *et al.*, 1981). Rutting activity of the stags tended to be weak in the night (see also Espmark, 1964). If the female is more frequently inactive in the dark the concentration of his rutting activity with other daytime activities is obviously relevant for the fitness of the stag.

Acknowledgements

I would like to acknowledge Dr. Matti Helminen for arranging the field working facilities and Dr. A. T. Bergerud, Dr. Y. Espmark and Dr. Mauri Nieminen for their critical reviews of this manuscript.

References

Bergerud, A. T. 1974: Rutting behaviour of Newfoundland caribou. — *In: Geist, V. and Walther, F. (eds.), The behaviour of ungulates and its relation to management IUCN Publications New Series No. 24: 395 - 435.*

Clutton-Brock, T. H., Guinness, F. E. and **Albon, S. D.** 1982: Red deer. Behaviour and ecology of two sexes. — *The University of Chicago Press, Chicago. 378 p.*

Danilov, P. I. & Markovsky, V. A. 1983: Forest reindeer (*Rangifer tarandus fennicus* Lönnb.) in Karelia. — *Acta Zoologica Fennica 175: 33 - 34.*

Erikson, L., Källquist, M. and **Mossing, T.** 1981: Seasonal development of circadian and short-term activity in captive reindeer, *Rangifer tarandus* L. — *Oecologia (Berl.) 48: 64 - 70.*

Espmark, Y. 1964: Rutting behaviour in reindeer (*Rangifer tarandus* L.) — *Animal Behaviour 12: 159 - 163.*

Fraser, A. F. 1968: Reproductive behaviour in ungulates. — *New York. 202 p.*

Geist, V. 1966: Ethological observations on some North American Cervids. — *Zoologica Beiträge 12: 219 - 251.*

Geist, V. 1968: On the relationship of external appearance, social behaviour and social structure of mountain sheep. — *Zeitschrift für Tierpsychologie 25: 199 - 125.*

Helle, T. 1977: Raportti metsäpeuratutkimuksesta. — *Suomen Luonto 36: 149 - 152.*

Helle, T. 1982: Peuran ja poron jäljillä. — *Vaasa. 159 p.*

Kojola, I., Nieminen, M. and **Helminen, M.** 1985: Successful reintroduction of wild forest reindeer in Finland. — *Transactions of the 17th Congress of the International Union of Game Biologists, Brussels, Belgium: 125 - 132.*

Lumia, A. R. 1972: The relationship between dominance and play behaviour in the American buffalo, Bizon bizon. — *Zeitschrift für Tierpsychologie. 30: 416 - 419.*

Lindsay, D. R., Dunsmore, D. G., Williams, D. J. and **Syme G. J.** 1976: Audience effects on the mating behaviour of rams. — *Animal Behaviour 24: 818 - 821.*

Nieminen, M. 1980: The evolution and taxonomy of the genus *Rangifer* in northern Europe. — *In: Reimers, E., Gaare, E.* and *Skjenneberg, S. (eds.). Proc. 2nd Reindeer/Caribou Symposium, Røros, Norway. Direktoratet vilt og ferskvannsfisk, Trondheim. 379 - 391.*

Ozoga, J. J. and **Verme, L. J.** 1975: Activity patterns of white-tailed deer during estrus. — *Journal of Wildlife Management. 39: 679 - 683.*

Pulliainen, E. 1983: Third international Reindeer/Caribou Symp. Conveners opening remarks. — *Acta Zoologica Fennica 175: 5.*

Reinhardt, V. 1983: Flehmen mounting and copulation among members of a semi-wild cattle herd. — *Animal Behaviour 31: 641 - 650.*

Schneider, K. M. 1930: Das Flehmen. — *Zoologica Garten, 3, 183 - 198.*

Siivonen, L. 1975: New results on the history and taxonomy of the mountain, forest and domestic reindeer in northern Europe. — *In: Luick, J. R. Lent, P.C., Klein, D.R., White, R. G. (eds), Proceedings of the First Reindeer/Caribou Symposium, Fairbanks, Alaska 1972. Biological Papers of the University of Alaska, Special Report No. 1, 33 - 40.*

Skogland, T. 1981: Comparative social organization of alpine-arctic wild reindeer during rut. — *Memoranda Societas Fauna Flora et. Fennica 57: 17.*

Thomson, B. 1977: The behaviour of wild reindeer in Norway. — *Ph. D. thesis. University of Edinburgh, Scotland. 479 p.*

Thomson, B. 1980: Behaviour differences between reindeer and caribou (*Rangifer tarandus*). — *In: Reimers, E. Gaare, E. and Skjenneberg, S. (eds.). Proc. 2nd International Reindeer/Caribou Symposium, Røros, Norway. Direktoratet vilt og ferskvannsfisk, Trondheim. 545 - 549.*

Walther, F. 1965: Verhaltenstudien an der Grantgazelle (Gazella granti Brooke, 1872) im Ngorongoro-Krater. — *Zeitschrift für Tierpsychologie. 22: 167 - 208.*

Walther, F. 1974: Some reflections on expressive behaviour in combats and courtship of certain horned ungulates. — *In: Geist, V. & Walther, F. (eds.), The behaviour of ungulates and its relation to management. IUCN Publ. New Ser. 24: 56 - 98.*