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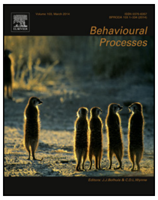

Object-horning in goitered gazelle: Agonistic or marking behaviour?

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ABSTRACT

We studied object-horning behaviour in goitered gazelles in the natural, arid environment of Kazakhstan over a 6-year period. We found that object-horning was used by adult males mostly as a threat display during territorial conflicts. Therefore object-horning was observed most frequently in territorial single males during the rut in November–December. Object-horning, though, also had a marking effect, with the males' use of this behaviour leaving visible traces that advertized the location of preorbital and urination–defecation scent marks. Therefore, this pattern also was observed linked with preorbital marking and urination–defecation marking behaviours, especially during the rut. Goitered gazelle males chose the most abundant and eatable shrubs for object horning. In contrast to other gazelle species, object-horning in goitered gazelle was observed much more frequently and at the same rate as preorbital and urination–defecation scent markings. This, then, proved a more vigorous and aggressive level of rutting behaviour of the goitered gazelle compared to tropical gazelles, and most likely connected to the short rutting period in the studied species. We concluded, therefore, that object-horning was a manifold phenomenon that played a very important role in goitered gazelle agonistic displays, but without loosing the marking intention of this behaviour.

1. Introduction

Object aggression, or pushing, beating, goring non-animal objects with horns, has been observed in males of all hoofed mammals and has been described by a variety of different terms, such as redirected aggression, object aggression, thrashing, and horning (Walther et al., 1983; Estes, 1991). Object aggression means that an animal attacks objects like bushes, small trees, branches, rock, grass, and the ground, with the clearest examples provided by animals that possess horns and antlers – i.e., the bovids and cervids (Walther, 1984). The function of object horning has been defined in various ways: as an outlet of aggressive surplus energy (Leuthold, 1977), a redirect response (Moyniham, 1955), a threat to an intruder (Walther et al., 1983), the synchronization and priming of estrus in females (Adams et al., 2001), a part of scent-marking through deposition of secretions from facial (Kingdon, 1982) and preorbital glands (Dubost and Feer, 1981), and even moistening of horns to avoid desiccation and breakage (Kitchener, 1987). Young males of some species perform object-horning quite frequently, giving the impression of being in training to improve their fighting skills for serious combat in the future. Graf (1956) rejected this hypothesis for mule deer (*Odocoileus hemionus*) and Wronski et al. (2008) for bushbuck (*Tragelaphus scriptus*), because the animals' displays were interrupted by intensive sniffing, which was thought to be an indication of a marking intention.

The most widely accepted definition of object aggression is its marking effect through visible traces left in the environment, such as disturbed soil, broken twigs, and/or debarked shrubs and trees (Walther, 1984; Coppedge and Shaw, 1997; Wronski et al., 2008). The point is that signalers advertise the location of their marks for better detectability by their intended receivers, depositing marks in sites that are locally conspicuous. In the absence of environmental features, signalers actively create visual anomalies near their scent marks by disturbing and damaging vegetation and tearing off strips of bark or creating visible wounds to trees at scent-marking sites. Such behaviours have the effect of enlarging the distance over which scent marks are detectable (Roberts and Gosling, 2001). So, it is very possible that object-horning with its visible traces is not a goal in itself, but rather an "attention" signal used as an invitation to check the olfactory signals left from the animal's preorbital glands or urination–defecation scent markings (Gosling and Roberts, 2001; Roberts, 1997). Olfactory signals made by territorial owners during the rut provide intruders with information about the status and identity of the owner to avoid the risk of serious combat (Gosling, 1982, 1990; Wronski et al., 2006). Though some

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inherent attribute, the scent signals intimidate intruders and usually result in their withdrawal from the owner's territory (Geist, 1965; Johnson, 1973; Richardson, 1993).

The movements associated with object aggression have become ritualized and interpreted as dynamic-visual marking. In some *Antilopinae* species, alternate pushing to the right and left has become a rhythmic performance for up to 15 min. This behaviour is very pronounced and frequent in Grant's gazelle (*Nanger granti* – Walther, 1965), but it has been observed also in Thomson's gazelle (*Ecodorcas thomsoni*), dorcas (*Gazella dorcas*) and mountain gazelles (*Gazella gazella*) (Walther et al., 1983), as well as in the eland (*Taurotragus oryx* – Hillman, 1974), nyala (*Tragelaphus angasi* – Estes, 1991), and pronghorn (*Antilocapra americana* – Gilbert, 1973). In general object aggression can be considered a visual display in many situations; however, since many ungulate species have special scent glands in the skin covering their heads, the possibility that they spread secretions from these glands during object aggression cannot be rejected (Kingdon, 1982; Walther, 1984).

Object-horning has been considered for a number of gazelles and African antelope species, but this phenomenon and its function have not been clearly understood until now (Wronski et al., 2008). Object-horning also has been observed for goitered gazelles (Blank, 1985; Marmazinskaya, 1996), however published information has been heavily descriptive with limited quantitative data. The task of our paper is to give a detailed statistical analysis of object-horning activity in goitered gazelles, and define the function of this behaviour.

Based on object-horning behaviour observed for other species, we can propose several hypotheses for this activity in the goitered gazelle (*Gazella subgutturosa* Guld, 1780). Object aggression in some gazelle and antelope species is a typical behaviour for males, although occasionally it also can be seen in females. When territorial and non-territorial males occur, object aggression is more frequent in the owners of territories (Estes, 1967; Walther, 1984; Wronski et al., 2008). Goitered gazelle males have individual territories only during the rutting period in November–December and their "false" rut in April-early-May, while outside of the rut they are non-territorial (Blank and Fedosenko, 1983; Blank, 1998). From here, we can suggested our first hypothesis that males would show their object aggression most often, and the pattern duration of this behaviour would be longer, during the rut compared to other seasons. Additionally, adult males would perform object-horning more often and for a longer time than sub-adults.

Since object aggression is more frequent for the owners of territories (Walther et al., 1983), we proposed our second hypothesis that during the rutting season in November–December, single males would show this behavioural pattern more often than males in groups.

Walther (1978, 1984) found that for the males of Thomson's gazelle (*E. thomsoni*), the presence of other males in the vicinity of an owner male's territory incites intensive object aggression on the part of the territory owner, even if these other males do not cross the territorial borders. In this case, object-horning has a visual display function and the male owner advertizes not only his presence and position but also his very aggressive state, so that these acts can be considered as threats to the potential intruder. We thought that the same phenomenon would be true for goitered gazelle males, and suggested our third hypothesis that territorial males during rut would show object horning most often in the vicinity of and during territorial conflicts with their neighbours, while considerably less often when alone or in the company of females.

Object aggression is also related to marking behaviour and sometimes occurs before, after or intermittently combined with preorbital gland marking of the same object (Walther et al., 1983). We can propose our fourth hypothesis, then, that the male goitered gazelle would demonstrate object aggression more often when coupled with preorbital and urination–defecation marking than as a single act.

Plant species that are preferred food items of antelopes have been found to be preferred also for scent marking, with scent marks most likely situated on the desired food plants for easier detection by conspecifics (Walther et al., 1983). In this regards, we propose our fifth hypothesis that goitered gazelles would choose the most desirably eatable plants for displays of their object-horning aggression.

The horning marks of some antelopes were often found placed within a narrow vertical distribution, in spite of the fact that they were physically able to mark above or below this preferred height (Gosling, 1981; Roberts, 1997). So based on this observation, we proposed our sixth hypothesis that a goitered gazelle male would produce horning marks at a height close to his own height.

Walther (1978) found for males of Thomson's gazelle (*E. thomsoni*) that object-aggression is observed significantly less often than other behavioural patterns, such as marking with preorbital glands and urination–defecation acts for males irrespective of their social status (territorial, non-territorial and migrating). In addition, Marmazinskaya (1996) observed a similar phenomenon for a semi-captive population of goitered gazelles in Uzbekistan. From this, we suggested our seventh hypothesis that this would be the same for our population as well and object-aggression behaviours would be observed more rarely than scent markings with preorbital gland secretions and urine and faeces.

2. Materials and methods

Our observations were conducted in the Ili Depression (southeastern Kazakhstan) over a six year period from 1981 to 1986. We collected our data during the gazelles' rutting period in November–December, their less significant "false" rut in April-early-May, as well as out of rutting season from mid-May through August (Kingswood and Blank, 1996; Blank, 1998). Our main method of study was through continued focal observations over long periods of time (up to 9 h) using binoculars (magnification 8×) and a telescope (magnification 30×, 60×). Observation posts were usually established on elevations. We measured the frequency of markings, the time and duration of the acts, and the intervals between separate acts with a stop-watch, and noted the sex (male or female), age (adult, sub-adult and young) and status of the performer (territorial or non-territorial male). In total, for the entire period of our investigations, we had 181 h of focal observations in April, 470 h in May, 374 h in June, 173 h in July, 224 h in November and 148 h in December.

Goitered gazelle once occupied a continuous range that was spread widely throughout the vastness of Middle and Central Asia, Iran, Afghanistan, Turkey, and Caucasus (Kingswood and Blank, 1996). At present, however, the gazelles' natural habitat has been fragmented into many small areas, drastically decreasing the number of individuals in the overall population. As a result, the goitered gazelle has been classified as Vulnerable (VU) on the IUCN Red Data List (Mallon and Kingswood, 2001). The goitered gazelle is a mid-sized species of ungulate and most of the year, goitered gazelles lived in small groups of 2–3 individuals, single males became more numerous during the rut in November–December, when they established individual territories, and single females became more abundant during parturition in May (Blank, 1985; Blank et al., 2012), when adult females usually birthed two young (Blank, 1985). Apart from the real rut in autumn (November–December), goitered gazelles were found to have a second or "false" rut in spring (April-early May), when males also established their territories and courted females, but young were generally not produced (Tsapluk,