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Flank rubbing in genets (*Genetta genetta* L.): Histological correlates

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Abstract

Studied was the histological structure of skin sections of various body regions in genets *(Genetta genetta)*. Genets exhibit two main scent marking behaviours: anogenital marking which involves specialized glands (perineal) and flank rubbing which does not imply well delimited external glands. The aim of this study carried out on one adult female, was to determine whether enlarged cutaneous glands are present in the body regions involved in flank rubbing. Histological sections of various body regions were analyzed with an image analysis computer. Results indicate that increased density and size of sebaceous glands can be found in body regions involved in flank rubbing compared to other body regions. These results are related to previous behavioural data showing that certain olfaction related behaviours could have evolved to act as visual displays.

Introduction

Body rubbing is a widespread phenomenon in carnivores and can be divided into:

1. Scent rubbing: rubbing movements on odoriferous substances such as chemical substances, food or scent marks (e.g. in wolves, Peters 1974; Ryon et al. 1986);
2. Rubbing movements not oriented on scented substrates. Such behaviours have generally been described as comfort (Gangloff 1975) or as scent marking behaviours (e.g. in stoats, Erlinge 1982).

Several hypotheses concerning the significance and origin of such rubbing movements have been proposed (for review see Rieger 1979) but the functions of such behaviours remain poorly understood. In genets *(Genetta genetta)*, flank rubbing has generally been considered as a scent marking behaviour in the same way as ano-genital marking (Gangloff and Ropartz 1972; Roeder 1978). It consists of rubbing the cheek, neck and dorsal parts of the flank against unscented vertical substrates (Roeder 1980). But whereas ano-genital marking is associated with specialized localized glands (perineal glands), flank rubbing does not involve such well delimited skin glands. However, previous studies (Roeder 1980) have shown that both types of marking could convey olfactory information about individual identity and physiological status. The aim of the present study was to determine whether enlarged cutaneous glands are present in the body regions involved in flank rubbing and therefore whether this behaviour can be considered as a scent marking behaviour.

Methods

Skin samples (N=11 from right and left body parts of the animal) were collected from one dead adult female genet. These samples were taken from different body regions involved in flank rubbing (cheek, neck, anterior flank, median flank) or not involved (ventral flank, forelegs). After 8 days exposure to Bouin's picroformol fixative, tissue blocks were embedded in paraffin and cut into 7–10 micron thick sections. Sections tangent to the surface of the skin and providing from these samples were stained with haematoxylin and eosine. Samples were analyzed with an image analysis computer (Ibas 1, Zeiss)

coupled with a camera microscope system (magnification from microscope to graphic screen giving a value of 151 for 1 mm). The data were recorded for 40 histological sections from each body area.

The parameters recorded were: Density (number of sebaceous glands shown on the screen), areas (mean area of the sebaceous glands on each section), perimeter (mean perimeter of the sebaceous glands on each section), and D max. (mean distance between the two furthest points located on the perimeter of the sebaceous glands).

The number of acini for each section varied from 17 to 34. Results were analyzed with an analysis of variance considering 10 (for density) or 20 (for areas) samples chosen randomly for each body region.

Results

No specialized glands comparable to the perineal glands were found in the different skin sections. Skin sections show sebaceous glands which are found in association with hair follicles (Fig. 1). No structural differences were observed between the different body regions.

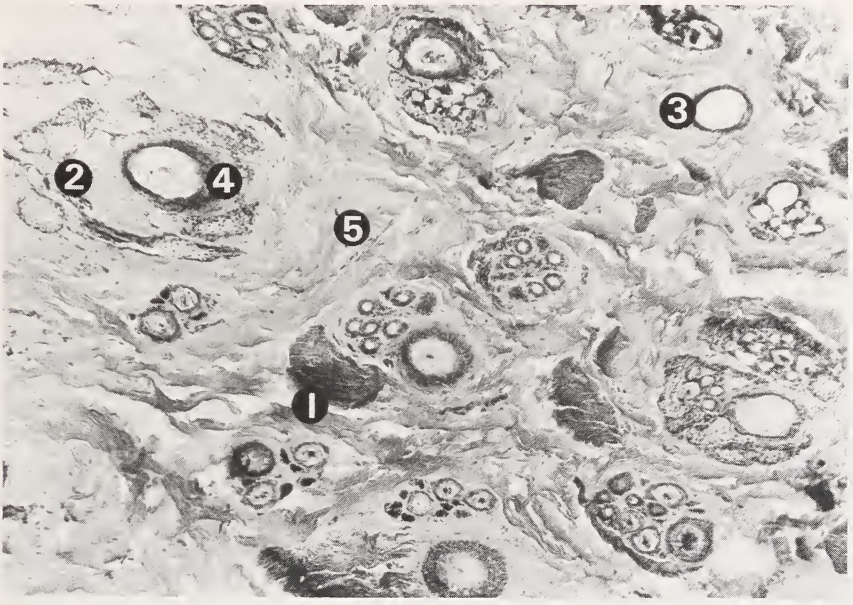

Fig. 1. Histological section of the skin from the medial flank (×75). 1 = muscle fibres, 2 = sebaceous glands, 3 = blood vessel, 4 = hair shaft, 5 = connective tissue

Results are shown in table 1. The highest density of sebaceous glands is found in the cheek area, although it does not differ significantly from those found in the two flank regions (anterior and median flank). The only statistically significant difference between body regions involved in flank rubbing, concerns cheek and neck areas (Table 2). The most striking result is that all body regions involved in flank rubbing have a significantly higher density compared to body areas which are not involved in flank rubbing.

The same result emerges for the mean areas of sebaceous glands in various body regions. No statistically significant differences appear between the two flank regions. The highest mean areas are found on the neck. This phenomenon can be explained by the lower sebaceous gland density in this region compared to the other body regions involved in flank rubbing. Perimeter values are correlated to the mean areas values. Dmax are indicated

Table 1. **Densities and sizes of sebaceous acini from various body parts**

Body regions	Density	Mean areas	Mean perimeters	D. max
Cheek	13.8 (1.8)	549.9 (61.1)	91.4 (6.7)	32.5 (2.5)
Flank anterior region	13.4 (2.6)	646.6 (81.9)	101.5 (11.5)	32.3 (5.9)
Flank medial region	12.8 (2.7)	657.7 (82.9)	100 (9.3)	32 (3.5)
Neck	11.4 (1.8)	861 (109.2)	111.9 (7.8)	37.4 (3)
Forelegs	9.6 (1.4)	507.4 (10.5)	91 (11.5)	–
Flank ventral region	9.3 (1.4)	394.6 (109.1)	81.5 (9.9)	32.8 (4.3)

( ) = S.D.

Table 2. **Statistical comparison on densities and mean areas of sebaceous glands from various body regions**

Body regions	Density F1/18	Density P	Area F1/38	Area P
Cheek/Forelegs	33.07	<.001	22.59	<.001
Cheek/Flank medial	.94	N.S	21.91	<.001
Cheek/Flank anterior	.16	N.S	17.69	<.001
Cheek/Flank ventral	36.67	<.001	30.82	<.001
Cheek/Neck	8.64	=.008	123.44	<.001
Flank anterior/Flank medial	.253	N.S	.20	N.S
Flank anterior/Neck	3.88	N.S	49.49	<.001
Flank anterior/Flank ventral	18.34	<.001	67.89	<.001
Flank anterior/Forelegs	16.08	=.001	18.5	<.001
Flank medial/Neck	1.84	N.S	43.89	<.001
Flank medial/Flank ventral	12.86	=.002	73.70	<.001
Flank medial/Forelegs	10.97	=.004	21.3	<.001
Neck/Flank ventral	7.86	=.011	182.4	<.001
Neck/Forelegs	5.97	=.023	12.13	=.001
Flank ventral/Forelegs	.21	N.S	21.4	<.001

in order to give a representation of the shapes of sebaceous glands. The only difference is found in the neck area where the acini seem to be more elongated than in other body regions.

Figure 2 gives a representation of density and size of the sebaceous glands on the genet's body.

Discussion

Although our data have to be verified, the present preliminary study shows a higher density of sebaceous glands in the body regions involved in flank rubbing. These histological results confirm previous behavioural data showing that such rubbing movements could convey olfactory information. According to Johnson's (1973) definition of scent marking ("Scent marking is a behaviour by which glandular secretions are deposited on the ground or onto objects in an animal's environment"), flank rubbing in genets can be considered as a true scent marking behaviour comparable to perineal marking.

Nevertheless, previous studies (Roeder 1983) have demonstrated that:

1. Spontaneous flank rubbing appears very rarely in isolated animals (less than 0.1 episode per hour) compared to perineal marking (F = 0–50 per hour)

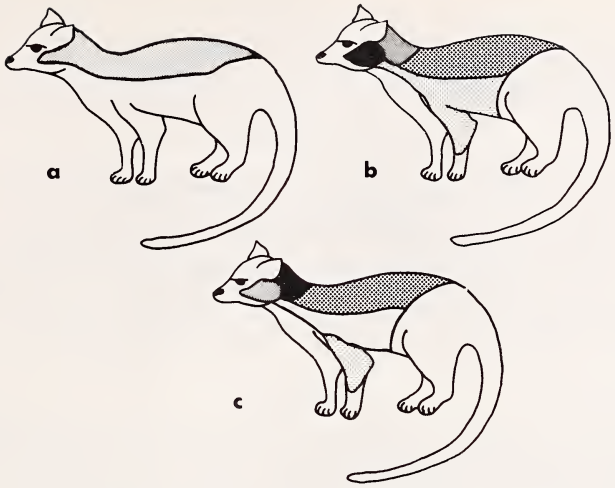

Fig. 2. Schematic representation of (a) body regions involved in flank rubbing, b: sebaceous glands densities in various body regions, c: sebaceous glands mean areas in various body regions; the darkest regions correspond to the highest density or area, the lightest regions to the lowest density or size

2. Flank rubbing frequencies increase markedly during agonistic encounters (2.4 to 3.2 episodes per hour), and
3. During agonistic encounters flank rubbing is generally associated (more than 60 % of all cases) with a visual signal: piloerection of the dorsal crest and the tail which acts as a threat signal. Conspecifics respond to this signal by exhibiting a piloerection even when they are only under visual contact with the emettor (pers. obs.).

Such olfactory related rubbing movements used as threat signals have been described in other carnivores. For example, in stoats *(Mustela erminea)*, body rubbing is used in close aggressive contacts between conspecifics and seems to be a threat signal (Erlinge et al. 1982). In the same way, in dwarf moongooses *(Helogale undulata rufula)*, cheek rubbing also acts as a threat signal: in the presence of an active or a passive threat, marking with the cheek glands increases in frequency and intensity (Rasa 1973). But neither of these authors indicate that such rubbing movements are associated with visual displays.

The present study suggests that some olfactory related behaviours have been ritualized during evolution and seem to function as visual displays. Although data dealing with this problem are scarce, it appears that some marking behaviours can be associated with visual signals (appeasement or threat) in carnivores (Rieger 1979) and primates (Schilling 1980). Phylogenetically, flank rubbing in genets could have evolved from a primary scent marking behaviour (deposition of skin gland secretions) to a visual signal (flank rubbing associated with piloerection) through a physiological response to the social environment. In fact the secretions of cutaneous glands reach the skin surface as a result of rubbing and contraction of the arrector muscles of hair (Flood 1986). Therefore, this scent marking behaviour could have been related to a visual display in order to increase skin gland production. It would be interesting to carry out comparative studies to improve understanding of such evolutionary phenomena.

It remains to complete the present data by extending this histological study to other female and male subjects. However it appears that to combine histological substrates and correlated behavioural events could bring out a new understanding of some behaviours whose function remains unexplained.

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Zusammenfassung

Flankenreiben bei Ginsterkatzen (Genetta genetta): Histologische Untersuchung

Es gibt zwei wesentliche Markierungsarten bei Ginsterkatzen *(Genetta genetta)*: Markierungen mittels perinealer Drüsen und Flankenreiben. Die vorliegende Arbeit beschreibt die Histologie von Talgdrüsen, die sich in Höhe der Flanken befinden und beweist, daß Dichte und Größe der Talgdrüsen in den entsprechenden Regionen bedeutsamer sind als in anderen Körperteilen. Die Ergebnisse werden auf Grund der zuvor beschriebenen Verhaltensweisen analysiert.

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