

Behavioural Responses of the Indian Desert Gerbil, *Meriones Hurrianae* Towards Conspecific and Interspecific Sebum Odour

Mohd. Idris

Central Arid Zone Research Institute, Jodhpur 342 003, India

Abstract Live Indian desert gerbils, *Meriones hurrianae*, trapped from sandy habitat, were exposed to conspecific and interspecific sebum odours of *M. hurrianae* and *M. unguiculatus*, respectively, in multiple choice tests. The experimental gerbils were released in the middle of the glass cage (90x30x30 cm) and its behavioural responses like sniffing, licking, scent marking, urination and defecation were observed. Exposure of conspecific and interspecific sebum odours in five combinations to *M. hurrianae* indicated that these gerbils perceive not only conspecific odour of the ventral scent marking gland but also that of another species which is not sympatric i.e. *M. unguiculatus*. *M. hurrianae* preferred⁺ ($P < 0.05$) uni-sex odour, even that of *M. unguiculatus*, and also enhanced its own scent marking frequency in the presence of scent marking gland odours of the strange gerbils.

Key words Behaviour, conspecific, hierarchy, interspecific, *Meriones hurrianae*, *M. unguiculatus*, sympatric

Many species of the genus, *Meriones*, possess a distinct mid abdominal sebaceous gland complex, larger in males than in females (Idris & Prakash 1982, Sokolov & Skurat 1966, Thiessen & Yahr 1977). Gerbils rub the exudation of the scent gland on objects as they move about in their home range (Thiessen & Yahr 1977) for olfactory communication. It has been found that the Indian desert gerbil, *Meriones hurrianae*, of either sex prefers the odours of ventral scent marking gland of others of its own sex, even in the presence of odour from the glands of both the sexes (Kumari & Prakash 1981). It is also observed that addition of conspecific body odour, urine (0.4%) and sebum (0.03%) increases the food consumption of male as well as female *M. hurrianae* (Kumari 1982, Kumari & Prakash 1980). Idris & Prakash (1986) observed that scent marks of sebum exudation of the ventral marking gland and urine of the nocturnal gerbil, *Tatera indica*, are perceived by the diurnal *M. hurrianae*. The Merion gerbil responds to the odours of *T. indica* by significantly shrinking its home range and by significantly enhancing its own scent marking activity (Idris & Prakash 1986) in a way to saturate the area with its own odours.

The role of interspecific odours within the genus *Meriones* was studied by exposing the Indian desert gerbil, *Meriones hurrianae* to the conspecific sebum odour of its ventral scent marking gland, as well as that of the Mongolian gerbil, *Meriones unguiculatus*, in various combinations. The Mongolian gerbil is distributed in the Baikal region and in northern China and Mongolia. Hence, it is expected that the Indian desert gerbil, *M. hurrianae*, will ordinarily have no opportunity in nature, to respond to odours of *M. unguiculatus*.

Materials and Methods

M. hurrianae (body weight: 67.50 \pm 3.46 g male; 63.58 \pm 3.14 g female) were live trapped in the sandy habitat around Jodhpur (26 $^{\circ}$ 18'N-73 $^{\circ}$ 01'E). After acclimatising them to the laboratory conditions, the experimental gerbils were lodged singly in glass cages (90x30x30 cm). Each used cage was thoroughly washed and dried before releasing a gerbil into it.

One glass slide (75x25 mm) smeared with the sebum of the Mongolian gerbil, *M. unguiculatus*, or that of *M. hurrianae* of one sex, was wrapped in tissue paper and was placed on one side of the cage, and blank slide was

Table 1 Olfactory responses of male and female *M. hurrianae* towards conspecific and interspecific odours

	Male		Female	
	No. of visits per 30 min.	Time (min.) spent investigating stimuli	No. of visits per 30 min.	Time (min.) spent investigating stimuli
Sebum odour of Male, <i>M. unguiculatus</i> V/s	30.45±1.80	16.80±0.77***	26.47±0.45	17.35±0.17***
Blank slide	29.80±1.06	12.50±0.66	25.85±0.35	13.30±0.25
Sebum odour of Female, <i>M. unguiculatus</i> V/s	24.20±1.21	17.30±1.30***	19.45±0.25	18.10±1.30***
Blank slide	23.90±0.75	12.40±0.70	18.25±0.14	12.00±1.05
Sebum odour of Male, <i>M. hurrianae</i> V/s	22.45±0.75	18.30±2.05**	22.40±1.40	17.40±0.85*
Sebum odour of Male, <i>M. unguiculatus</i>	22.40±0.40	12.40±1.40	23.00±0.85	14.15±0.65
Sebum odour of Female, <i>M. hurrianae</i> V/s	21.40±1.40	16.40±1.05*	18.70±1.00	19.30±1.41***
Sebum odour of Female, <i>M. unguiculatus</i>	21.05±0.85	13.20±0.70	17.80±0.40	10.36±0.20
Male sebum odour of <i>M. unguiculatus</i> V/s	22.56±1.43	17.50±0.76**	16.35±0.63	16.20±0.55**
Female sebum odour of <i>M. unguiculatus</i>	22.05±0.85	13.54±0.76	17.40±0.50	13.85±0.70

Level of significance (student's t test)

* = $P < 0.05$; ** = $P < 0.01$; *** = $P < 0.001$

similarly kept on the other side of the cage to avoid new object reaction (Mathur & Prakash 1980). In multiple-choice tests, slides smeared with the gland exudate from the same or opposite sex, either of *M. unguiculatus* or *M. hurrianae*, were placed on the opposite sides of the cage. The experimental gerbil was released in the middle of the cage, and its behavioural responses to the introduced stimuli like sniffing, licking, scent marking, urination and defecation, were observed for 30 minutes. The number of visits and duration of stay on each side of the cage was recorded. Each animal was given the five odour choices, (i) sebum odour of male *M. unguiculatus* vs blank slide, (ii) sebum odour of female *M. unguiculatus* vs blank slide, (iii) sebum odour of male *M. hurrianae* vs sebum odour of male *M. unguiculatus*, (iv) sebum odour of female, *M. hurrianae* vs sebum odour of female *M. unguiculatus*, and (v) sebum odour of male *M. unguiculatus* vs sebum odour of female *M. unguiculatus*. Each combination of odours was tested on 10 freshly caught desert gerbils.

Results

A comparison of the mean number of visits and duration of stay in the two sections of the glass cage, with sebum odour in five combinations, and the blank sections indicated that both the male and female desert gerbils visited the sebum odour side of the cage more ($P < 0.001$) than the other side, when single odour choice—either male or female, or that of single species choice, *M. hurrianae* or *M. unguiculatus*, was provided (Table 1). However, in multiple odour choice combinations, the gerbils preferred conspecific sebum odour significantly ($P < 0.05$, < 0.001) more than the interspecific sebum odours. When only male and female sebum odour of *M. unguiculatus* were provided, both the sexes of *M. hurrianae* preferred ($P < 0.01$) uni-sex odours (Table 1). The frequency of visits to the two sections of the cage was, however, remarkably similar.

When male and female *M. hurrianae* were exposed to the sebum odour of male and female

Table 2 Behavioural responses of male and female *M. hurrianae* per 30 min. in presence of conspecific and interspecific sebum odours (Mean±SE)

Stimuli	Behavioural acts/30 min. (M±SE)				
	Sniffing	Licking	Ventral scent marking	Urination	Defecation
MALE					
Sebum odour of Male, <i>M. unguiculatus</i> V/s	4.50±0.32 ^{***}	2.10±0.21 ^{NS}	15.30±2.40 ^{***}	1.80±0.35	1.17±0.25
Blank slide	1.22±0.20	1.35±0.45	8.25±1.45	1.66±0.25	1.20±0.41
Sebum odour of Female, <i>M. unguiculatus</i> V/s	10.12±2.33 ^{***}	1.80±0.40 ^{NS}	9.35±1.40 ^{***}	0.85±0.45	1.35±0.15
Blank slide	4.80±2.14	1.27±0.35	5.45±1.35	0.60±0.20	0.89±0.35
Sebum odour of Male, <i>M. hurrianae</i> V/s	7.45±1.36 [*]	0.95±0.20 ^{NS}	11.45±2.46 [*]	0.40±0.20	1.12±0.45
Sebum odour of Male, <i>M. unguiculatus</i> V/s	4.95±1.12	1.25±0.50	8.20±3.00	0.63±0.30	1.00±0.30
Sebum odour of Female, <i>M. hurrianae</i> V/s	6.45±1.25 [*]	1.16±0.66 ^{NS}	7.36±2.11 [*]	1.05±0.60	0.85±0.45
Sebum odour of Female, <i>M. unguiculatus</i> V/s	4.20±1.31	1.26±0.70	4.35±1.66	0.85±0.35	1.00±0.47
Sebum odour of Male, <i>M. unguiculatus</i> V/s	8.30±2.42 [*]	2.50±0.60 ^{NS}	7.90±2.40 [*]	0.78±0.40	1.80±0.62
Sebum odour of Female, <i>M. unguiculatus</i> V/s	6.45±2.16	1.50±0.80	4.15±1.40	1.00±0.46	1.00±0.56
FEMALE					
Sebum odour of Male, <i>M. unguiculatus</i> V/s	6.35±0.95 ^{***}	1.26±0.18 ^{***}	5.77±1.50 ^{***}	0.90±0.40	1.10±0.56
Blank slide	2.15±0.35	0.85±0.65	2.35±0.85	0.70±0.30	1.20±0.70
Sebum odour of Female, <i>M. unguiculatus</i> V/s	9.50±2.15 ^{***}	0.35±0.15	6.00±1.50 ^{***}	1.50±0.65	0.76±0.20
Blank slide	3.40±0.65	—	3.30±0.40	0.97±0.40	1.60±0.45
Sebum odour of Male, <i>M. hurrianae</i> V/s	5.20±1.02 [*]	3.72±1.50	7.35±1.70 [*]	0.85±0.30	1.80±0.70
Sebum odour of Male, <i>M. unguiculatus</i> V/s	2.51±0.62	1.75±1.20	4.50±1.05	1.06±0.55	1.00±0.45
Sebum odour of Female, <i>M. hurrianae</i> V/s	6.73±1.35 [*]	2.15±0.85 ^{NS}	7.45±2.00 [*]	1.66±0.63 ^{NS}	2.15±0.95 ^{NS}
Sebum odour of Female, <i>M. unguiculatus</i> V/s	4.05±1.60	1.66±0.70	3.15±1.50	1.35±0.75	1.50±1.00
Sebum odour of Male, <i>M. unguiculatus</i> V/s	8.60±2.72 [*]	3.15±1.55 ^{NS}	6.77±2.15 ^{NS}	0.85±0.40 ^{NS}	2.30±0.85 ^{NS}
Sebum odour of Female, <i>M. unguiculatus</i> V/s	5.15±1.45	2.60±0.95	4.10±1.65	1.45±0.65	1.65±0.75

Level of significance (Student's t test)

NS = Not significant * = P<0.05; *** = P<0.001

M. unguiculatus as well as blank slides, both sexes of the experimental gerbils sniffed the sebum odour slides more times ($P < 0.001$; Table 2). However, in conspecific and interspecific odour choices tests, the gerbils sniffed conspecific odour significantly ($P < 0.05$) more times (Table 2), but in interspecific male and female odour combination tests, the Indian desert gerbil sniffed the male sebum slides of *M. unguiculatus* more times ($P < 0.05$) than the female sebum slides (Table 2). There was no statistically significant difference in the frequency of licking behaviour, in all the combinations.

The frequency of scent marking by male *M. hurrianae*, was significantly more ($P < 0.001$) on the cage side carrying the female sebum odour of *M. unguiculatus* (Table 2), but the magnitude of preference was of a lower order in respect of female odour of *M. unguiculatus* by female Indian desert gerbil (Table 2). However, when conspecific and interspecific odours were tested in different combinations, *M. hurrianae* preferred ($P < 0.05$) uni-sex conspecific sebum odours. Male Indian desert gerbils, however, preferred male *M. unguiculatus*'s odour in comparison to that of female *M. unguiculatus* when conspecific sebum odour was not offered.

More frequent urination was observed, on the small pegs in single odour choice tests, on the side of the cage, in which sebum odour was kept (Table 2). When interspecific and conspecific odour choices were given, both the sexes of experimental Indian desert gerbils marked frequently towards the conspecific odour side of the cage. However, the difference was not statistically significant (Table 2). A similar pattern of defecation was shown by the Merion gerbil.

Discussion

The findings indicate that the merion gerbils perceive not only conspecific odour of the ventral scent marking gland but also that of another species, which is not even sympatric. Surprisingly, *M. hurrianae* prefers uni-sex odour even that of *M. unguiculatus* and also enhances its own scent marking frequency, in the presence of scent gland odours of other strange rodents. It was earlier observed (Prakash & Idris 1987) that ro-

denents scent mark their burrow openings most frequently while entering in and also after coming out. The burrow openings remain saturated with sebum, as well as urine of an individual. Other exploring rodents of the same species or another, is thus able to detect the occupation of the burrow (Prakash & Idris 1987). It is quite likely, therefore, that odours help in the rodents spatial distribution. This finding is supported by our observations in the Indian desert, that colonies of various gerbils, viz., *Meriones*, *Tatera* and *Gerbillus*, are spatially distributed, and they do not occur in close proximity of each other.

The uni-sex preference of odours is interesting from the point of view of olfactory communication. This behaviour of *M. hurrianae* tends to indicate that there is a significant sex difference in the chemical composition of the sebum exudation of this species. It does not, however, indicate that scent marking does not play a role as a sex attractant in this species. Experiments have clearly shown, that the scent marking frequency of male *M. hurrianae*, when exposed to the odour of oestrus and pro-oestrus females, enhances significantly ($P < 0.001$), as compared to the situation when they are associated with dioestrus females (Kumari & Prakash 1984). It may, therefore, be conjectured that the enhancement of male scent marking activity is related to the perception of odours of ready-to-mate females (Kumari & Prakash 1984).

The preference of *M. hurrianae*, for uni-sex odours of *M. unguiculatus*, may also be linked to the former's dominance behaviour. In a social group of *M. hurrianae*, the dominant male and female rodent maintain social hierarchy over other members of either sex which is distinctly exhibited by male-male and female-female aggressive acts (Kumari & Prakash 1981). It seems likely that some of the chemical components in the sebum of the two species is common, and that enables *M. hurrianae* to maintain a uni-sex preference even for an alien *Meriones* species.

Acknowledgements

I am indebted to Dr. Ishwar Prakash, Emeritus Professor of Eminence, formerly of the Central Arid Zone Research Institute, Jodhpur for su-

pervision and guidance in the course of this study and to Dr. J. Venkateswarlu, Director of this Institute, for providing necessary facilities for this work.

References

- Idris M & Prakash I 1982 Behavioural responses of the Indian gerbil, *Tatera indica* to conspecific sebum odour of the ventral scent marking gland. *Proceedings of the Indian Academy of Sciences (Anim. Sci.)* **91** (3) 259-265
- Idris M & Prakash I 1986 Influence of odours of Indian gerbil, *Tatera indica* on the social and scent marking behaviour of sympatric desert gerbil, *Meriones hurrianae*. *Proceedings of the Indian National Science Academy* **B52** 333-340
- Idris M & Prakash I 1987 Scent marking activity in the Indian gerbil, *T. indica* in relation to population density. *Animal Behaviour*, London **35** 920-922
- Kumari S 1982 *The structure and functional significance of the ventral scent marking gland in the three rodent species (M. hurrianae, T. indica and R. miltada)*. Ph. D. Thesis, pp. 1-197. University of Agra, India
- Kumari S & Prakash I 1980 Role of conspecific urine in enhancing food consumption and masking shyness behaviour in the desert gerbil, *M. hurrianae* (Jerbon). *Indian Journal of Experimental Biology* **18** 730-732
- Kumari S & Prakash I 1981 Scent marking behaviour of *Meriones hurrianae* during oestrus. *Animal Behaviour* **29** 1269-1271
- Kumari S & Prakash I 1984 Relative efficacy of male and female conspecific urine in masking shyness behaviour in Indian gerbil, *Tatera indica*. *Proceedings of the Indian Academy of Sciences (Anim. Sci.)* **93** 431-436
- Mathur RP & Prakash I 1980 New food reaction among desert rodents. *Saugetier Mitteil* **28** 28-30
- Sokolov W & Skurat I 1966 A specific mid ventral gland in gerbil. *Nature*, London **211** 544-545
- Thiessen DD & Yahr P 1977 *The Gerbil in Behavioural Investigation*. University of Texas Press, Austin and London