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Relative efficacy of male and female conspecific urine in masking shyness behaviour in Indian gerbil, *Tatera indica*

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Abstract. In a choice test, the Indian gerbils, *T. indica* preferred urine-mixed food over ordinary millet indicating a phago-stimulant nature of conspecific urine. The experiments also revealed that addition of conspecific urine mitigates the poison aversion and bait shyness behaviour significantly, as a result of which zinc phosphide poisoning can be attempted a second time in a sequence, thus enhancing the control success. *T. indica* showed a clear preference for urine of the same sex which suggests that the active attractant in the urine has no sex attraction.

Keywords. Bait-shyness; behaviour; conspecific urine; *Tatera indica*; poison-aversion; zinc phosphide.

1. Introduction

The role of urine in reproductive activity of mammals and social interactions of rodents has been worked out in detail (Bruce 1959; Whitten 1969; Dominic 1978) but very little information is available on the phago-stimulant nature of urine and body odours. Our preliminary observations have revealed that one-day exposure of urine-mixed millet mitigates poison shyness among the desert gerbils, *Meriones hurrianae* (Kumari and Prakash 1979, 1980). This paper describes the results of our experiments to evaluate the efficacy of male and female conspecific urine in accentuating the poison shyness behaviour in the Indian gerbil, *Tatera indica.*

2. Material and methods

Experimental animals were acclimatized for six days to laboratory conditions after capture from the field. All experiments were carried out on sets of six male and six female Indian gerbils, *Tatera indica indica* Hardwicke which were maintained in individual laboratory cages. They were provided with a choice test to indicate their preference between ordinary millet grains and millet + 0·4% conspecific urine of male and female in separate experiments (table 1). Consumption of both the foods was recorded nearest to 0·1 g. In other experiments, weighed quantities of millet (*Pennisetum typhoides*) and jowar (*Sorghum vulgare*) were provided to experimental rodents in two separate containers. Water was available *ad libitum.* After recording consumption of millet and sorghum for 3 days, a sublethal dose of (0·05%) zinc phosphide and 1% arachis oil were added to preferred food (millet). On the 5th day animals were divided in two groups. Urine (0·4%) was added to millet in group A

Table 1. Differential consumption of ordinary and urine mixed millet by *T. indica*.

Sex of rodents	*n*	Mean daily intake g/100 g body weight ± S.E.	
		Ordinary millet grains	Millet + 0·4 % urine of male *T. indica*
Female	16	2·05 ± 0·42	3·62[a] ± 0·48
Male	16	1·23 ± 0·44	4·81[b] ± 0·44
Pooled	32	1·64 ± 0·24	4·22[b] ± 0·34
			Millet + 0·4 % urine of female *T. indica*
Female	24	1·38 ± 0·45	4·45[b] ± 0·78
Male	18	1·44 ± 0·37	4·11[a] ± 0·86
Pooled	42	1·41 ± 0·33	4·30[b] ± 0·57

[a] $P < 0{\cdot}01$, [b] $P < 0{\cdot}001$.

animals but group B animals continued to feed on millet + oil + zinc phosphide. On the 6th day both the groups received bajra + 0·4 % urine of male and female in separate tests. Jowar was available to them on all the days. Similar sequence was repeated on the same animals from day 7 to 12.

3. Results

The addition of conspecific urine of female and male *T. indica* to millet grains significantly enhanced ($P < 0{\cdot}001$) the food consumption by male as well as female Indian gerbils (table 1). The enhancement of intake of urine mixed millet was, however, more pronounced when urine was from the same sex.

Out of the two foods provided to the gerbils, they significantly ($P < 0{\cdot}01$) preferred millet (tables 2 and 3) but no sooner a sub-lethal dose of zinc phosphide was added (day 4), the consumption of bajra declined significantly ($P < 0{\cdot}01$, tables 2 and 3) and that of jowar increased ($P < 0{\cdot}01$). On day 5, 0·4 % conspecific urine of male (table 2) and female (table 3) gerbils was added to millet + zinc phosphide (0·05 %) and was exposed to animals of group A. Group B animals continued to feed on millet + zinc phosphide and jowar. It is apparent that due to addition of urine, the consumption of millet increased slightly on day 6 when it was male urine but addition of female urine (table 3) increased the intake of poisoned millet significantly ($P < 0{\cdot}01$). Consumption of millet + poison in which urine was not mixed (group B, day 6, tables 2 and 3) further declined as compared to that on day 4. It is evident, therefore, that addition of urine enhanced the acceptability of poison bait to *T. indica* on the 2nd day of exposure.

On day 6, when millet + 0·4 % urine of male (table 2) and female (table 3) was provided along with jowar as alternate food choice, the intake of the former was significantly more ($P < 0{\cdot}01$) than that on day 5. On days 7, 8 and 9, ordinary millet was preferred over jowar whereafter rodents were again subjected to tests as that on days 4 and 5. Addition of urine increased the intake of poisoned millet but the differences were not statistically significant.

In the former experiment (table 1), *T. indica* had shown a clear preference for own-sex

Table 2. Mean daily intake (g/100 g body weight ± SE) by *Tatera indica*, exposure to conspecific male urine.

Day	Millet	Jowar	Day	Millet	Jowar
1	4·23 ±0·76	1·41 ±0·51	7	4·60[a] ±0·87	2·57 ±0·77
2	4·11 ±0·81	2·85 ±1·04	8	5·21[b] ±0·77	2·70 ±0·71
3	4·70[b] ±0·86	1·83 ±0·68	9	4·43[b] ±0·62	2·49 ±0·45
4 (0·05% Zn_3P_2 + 1%			10 (addition		
oil were mixed with millet)	2·13 ±0·35	3·80[b] ±0·72	as on day 4)	1·45 ±0·39	4·55[b] ±1·00
5 (0·05% Zn_3P_2 + 1%	A	B	11 (addition	A	B
oil were mixed with	2·40 ±0·41	1·46 ±0·89	as on day 5 but	1·14 ±0·59	2·13 ±0·87
millet in both groups			0·4% urine was		
0·4% urine was also	3·32[a] ±0·78	3·52[b] ±0·95	added to millet	6·66[c] ±1·04	3·26[a] ±0·79
added to bajra in group A)			in group B)		
			12 (addition as on day 6)	5·40[b] ±0·93	3·26 ±0·75
6 (0·4% urine was added to millet)	4·67[b] ±0·89	2·15 ±0·67			

Student's t test, level of significance between the consumption of millet and jowar [a] = $P < 0·05$; [b] = $P < 0·01$; [c] = $P < 0·001$.

Table 3. Mean daily intake by *Tatera indica*, exposure to conspecific female urine.

Day	Millet	Jowar	Day	Millet	Jowar
1	3·68 ±0·90	1·81 ±0·59	7	2·30[a] ±0·58	1·27 ±0·41
2	2·80 ±0·79	1·72 ±0·55	8	4·20[a] ±0·71	3·08 ±0·91
3	4·70[b] ±1·20	2·07 ±0·77	9	7·31[b] ±1·20	3·26 ±1·44
4 (0·05% Zn_3P_2 + 1% oil were			10 (addition as on day 4)	1·93 ±0·59	3·55[a] ±0·81
mixed with millet)	1·29[a] ±0·48	2·50 ±0·77	11 (addition as on day 5	A	B
5 (0·05% Zn_3P_2	A	B	but 0·4% urine was added	1·22 ±0·15	3·11[b] ±0·20
+1% oil were mixed	2·30 ±0·33	1·08 ±0·37	to millet in group B)	4·11[b] ±1·60	2·83 ±1·44
with bajra in both groups 0·4%	4·58[b] ±0·77	2·25[a] ±0·62	12 (addition as on day 6)	4·14[b] ±0·93	2·22 ±0·60
urine added to millet in group A)					
6 (0·4% urine was added to millet)	2·83[b] ±0·66	1·09 ±0·46			

Students *t* test, level of significance between the consumption of millet and jowar [a] = $P < 0·05$; [b] = $P < 0·01$.

urine. With a view to analyse this preference, the data on consumption of millet and jowar on days 5 (group A) and 11 (group B, tables 2 and 3) were analysed separately for male and female rodents (table 4). On the second exposure to poison bait, when male urine was mixed, its consumption by male animals (2·2 g) was significantly more ($P < 0·05$) than by female *T. indica* (1·33 g). Likewise in male rodents, the consumption of jowar did not increase whereas female animals consumed significantly ($P < 0·001$) more quantity of jowar (day 5, group A, table 4) when female urine was mixed with the poison bait (table 4). The female rodents consumed the poison bait (2·54 g) in significantly more ($P < 0·05$) quantity than male animals (1·55 g). In both the cases, however, intake of jowar was significantly more than the poison bait + urine.

During the second sequence of exposure to male and female urine on day 11 (table 4), the male *T. indica*, however, showed a clear preference towards female urine ($P < 0·05$) but females were consistent in their earlier choice of own-sex urine (table 4).

4. Discussion

Results of this study have clearly brought out that addition of conspecific urine mitigates the poison aversion and bait shyness significantly on first exposure and slightly on the second exposure to sub-lethal dose of zinc phosphide.

Another point brought out through the results of these experiments is that *T. indica* prefers the urine of same sex (table 4). However, the magnitude of attraction is more in male urine as compared to that of female. This agrees with the results of our previous study when the conspecific sebum of ventral sebaceous gland was evaluated showed that *M. hurrianae* had preferred same sex odours (Kumari and Prakash 1981).

In an earlier study, it was indicated that after a single exposure of sub-lethal dose to

Table 4. Sexwise analysis of consumption of urine-mixed millet on days 5 and 11 (tables 2 and 3).

			Mean daily consumption (g/100 g body wt.) ±S.E. of millet + 0·05% zinc phosphide + 0·4% conspecific urine and jowar by male and female *T. indica*	
Additive			Male	Female
Day 5				
Male urine	Group A of table 2	Millet	2·20** ±0·33	1·33 ±0·08
		Jowar	0·91 ±0·05^{++}	3·08 ±0·79^{++}
Female urine	Group A of table 3	Millet	1·55 ±0.09	2·54* ±0·44
		Jowar	4·08 ±0·84^{+++}	5·09 ±0·53^{+++}
Day 11				
Male urine	Group B of table 2	Millet	1·66 ±0·04	2·58* ±0·32
		Jowar	4·31 ±0·55^{++}	2·21 ±0·08NS
Female urine	Group B of table 3	Millet	2·81 ±0·10	3·70* ±0·73
		Jowar	3·57 ±0·38^{+}	4·93 ±0·41^{+}

Level of significance, Students' t test; $^{+}$, * = $P < 0·05$; $^{++}$, ** = $P < 0·01$; $^{+++}$ = $P < 0·001$; NS = not significant; * = t test between male and female millet consumption; $^{+}$ = t test between millet and jowar consumption.

T. indica, the bait shyness persisted till 115 days (Prakash and Jain 1971) and the consumption of the bait in which poison was mixed remained at a significantly low level as compared to that on initial days. In the present study, however, even after one day exposure to urine mixed millet (in which zinc phosphide was added, days 4 and 5, tables 2 and 3), the bait shyness totally vanished and on days 7, 8 and 9 the intake of millet by *T. indica* was comparable to that of days 1, 2 and 3 *i.e.* prior to exposure to zinc phosphide. This confirms that addition of urine to poison bait mitigates the shyness behaviour in *T. indica.*

The findings that mixing of conspecific urine to poison bait mitigates shyness behaviour and poison aversion have opened a new line of thinking. We are now identifying the active chemical in urine which is responsible for such a change in rodent behaviour so that it could be manufactured inorganically for mixing in poison baits used in large scale rodent control operation which would significantly enhance the control success.

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References

Bruce H M 1959 An exteroceptive block to pregnancy in the mouse., *Nature* (*London*) **184** 105

Dominic C J 1978 Mammalian reproductive pheromones; *J. Anim. Morphol. Physiol.* (Silver Jubilee volume) 104–127

Kumari S and Prakash I 1979 Conspecific odour as a phagostimulant for the Indian gerbil, *Tatera indica indica* Hardwicke; *Indian J. Exp. Biol.* **17** 981–982

Kumari S and Prakash I 1980 Role of conspecific urine in enhancing food consumption and masking of shyness behaviour in the desert gerbil, *Meriones hurrianae* Jerdon; *Indian J. Exp. Biol.* **18** 730–732

Kumari S and Prakash I 1981 Behavioural responses of *Meriones hurrianae* (Jerdon) to conspecific sebum of ventral sebaceous gland; *Biol. Behav.* **6** 255–263

Prakash I and Jain A P 1971 Bait shyness of two gerbils, *Tatera indica indica* Hardwicke and *Meriones hurrianae* Jerdon; *Ann. Appl. Biol.* **69** 169–172

Whitten W K 1969 Mammalian pheromones in *Olfaction and Taste* (ed.) C Pfaffmann (USA: Rockfeller University Press) 252–257