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Laboratory evaluation of bait base for the control of sand coloured rat, *Rattus gleadowi*

MOHD IDRIS, A P JAIN and B K SONI
Coordinating and Monitoring Centre for Rodent Research and Training, Central Arid Zone Research Institute, Jodhpur 342 003, India

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Abstract. Since *Rattus gleadowi* replaces *Meriones hurrianae* and *Tatera indica* after a control operation, studies were planned on the bait preferences of this minor pest species. Results tend to reveal that bajra (*Pennisetum typhoides*) whole grain, bajra flour and wheat grain + 2% arachis oil may be used as effective poison carriers for this sand coloured rat. Additives like sugar and salt did not improve the palatability of the candidate bait material. Average energy requirement of experimental rodents ranges from 70·9 Kj/100 g body wt/24 hr in multiple choice tests to 72·6 Kj/100 g body wt/24 hr in single choice tests.

Keywords. Bait preference; *Rattus gleadowi.*

1. Introduction

Introduction of high yielding varieties and multiple cropping patterns have led to general increase in pest-complex in an agro-ecosystem. Besides this, replacement of major rodent pest (Prakash 1975) by the sympatric rodents in an ecosystem, particularly after a control operation (Brown 1971; Joule and Jameson 1972), creates problem to pest control operators who are unaware of rebuild of population of codominant and less dominant rodent pests. In the Indian arid zone *Meriones hurrianae* and *Tatera indica* are major rodent pests whereas, *Rattus gleadowi* represents only 0·6% of the rodent population (Prakash *et al* 1971). This sympatric species replaced dominant gerbils after a control operation and represented 70% of the rodent population (Mathur R P, unpublished results). To manage this upsurge in the population of *R. gleadowi*, studies were carried out on the bait preferences of this sand coloured rat.

2. Materials and methods

The experimental animals were captured from Ber, *Zyzyphus nummularia* fields at CAZRI Farm, Jodhpur. *R. gleadowi* were acclimatized to laboratory conditions for 3 weeks. Each trial was conducted on individually caged 10 adult (5 ♂♂ and 5 ♀♀) animals and the procedures followed are Jain *et al* (1974) and Prakash *et al* (1975).

The average body weight of test animals was 25·2 g.

3. Results and discussion

3.1 *Texture*

R. gleadowi has preferred whole grains to cracked grains and flours. This indicates that these rats are grainivore rodents and therefore, they have rejected the same food grain

in other forms (i.e. flour and cracked form) as they had not previous experience of feeding on them in the field (Barnett 1966; Jain and Prakash 1983). When only flours were provided, they have preferred bajra flour and wheat flour to flours of other grains (table 1). Probably taste has played some role in selection of the baits. However, this is a tiny rodent and therefore, it has discarded large sized grains of cowpea being difficult to handle, as compared to bajra and wheat grains. Further, urad has been rated lowest in preference, which may be due to (i) its hardness, (ii) less familiarity since it is in the desert tract and (iii) its high protein content which requires more water for its metabolism.

3.2 *Selection of bait*

These rats have been selecting bajra and wheat constantly at first and second positions, respectively (tables 1–5). In the final test also when best baits from each test were exposed together, these rats clearly made a choice in the following order: (i) bajra grain, (ii) bajra flour and (iii) wheat grain + 2% arachis oil. Hence these items can be used as baits for poisoning *R. gleadowi* populations. These observations also suggest that

Table 1. Consumption of food grains (g/100 g body wt; Mean ± SE) by *R. gleadowi*.

Baits	Whole grains	Kj	Cracked grains	Kj	Flours	Kj	Roasted grains	Kj
Bajra	5·63 ± 0·81	84·68	5·16 ± 0·58	77·64	5·96 ± 0·78	89·68	4·10 ± 0·40	61·59
Chana	2·51 ± 0·69	35·67	1·96 ± 0·41	27·85	2·51 ± 0·46	35·67	2·80 ± 0·52	39·19
Cowpea	1·78 ± 0·56	24·03	1·83 ± 0·34	24·70	2·23 ± 0·63	30·10	1·88 ± 0·53	24·30
Jowar	4·92 ± 0·78	71·97	2·63 ± 0·52	38·47	2·50 ± 0·37	36·57	1·94 ± 0·36	28·38
Maize	2·15 ± 0·46	31·45	3·26 ± 0·72	47·69	2·50 ± 0·63	36·57	2·79 ± 0·53	40·79
Moong	3·31 ± 0·67	45·65	3·55 ± 0·66	48·96	4·90 ± 0·53	67·59	2·09 ± 0·48	28·80
Moth	2·63 ± 0·61	36·31	1·83 ± 0·45	25·24	2·62 ± 0·52	36·11	2·03 ± 0·47	27·96
Til	2·56 ± 0·51	59·90	2·04 ± 0·61	47·73	3·21 ± 0·43	75·11	1·94 ± 0·50	45·39
Urad	1·92 ± 0·40	28·34	1·05 ± 0·37	15·36	1·02 ± 0·29	14·92	2·44 ± 0·45	35·69
Wheat	5·56 ± 0·69	81·34	4·85 ± 0·81	70·95	4·01 ± 0·62	58·64	1·76 ± 0·45	25·74
Av. Kj/100 g body wt/24 hr		49·90		42·45		48·09		35·78

Table 2. Consumption (g/100 g body wt; Mean ± SE) of different forms of food grains by *R. gleadowi*.

	Whole grain v/s cracked grains				Whole grains v/s flour			
Food items	Whole	Kj	Cracked	Kj	Whole	Kj	Flour	Kj
Bajra	4·34 ± 0·79	65·27	2·35 ± 0·58	35·34	6·81 ± 0·85	102·42	3·83 ± 0·67	57·60
Jowar	2·86 ± 0·42	41·84	2·28 ± 0·46	33·35	3·41 ± 0·77	49·88	4·04 ± 0·84	59·10
Moong	2·57 ± 0·40	35·44	2·15 ± 0·48	29·64	2·13 ± 0·71	29·37	3·26 ± 0·89	44·95
Moth	2·27 ± 0·52	31·30	2·33 ± 0·57	32·13	3·54 ± 0·60	45·81	2·86 ± 0·87	39·43
Wheat	3·00 ± 0·56	44·32	2·41 ± 0·46	35·26	5·09 ± 0·96	74·46	1·01 ± 0·44	14·77
Av. Kj/100 g body wt/24 hr		43·63		33·14		60·98		21·57

Table 3. Food consumption (g/100 g body wt; Mean ± SE) with oils by *R. gleadowi.*

Food items	Whole grains + 2%				Flours + 10%			
	Arachis oil	Kj	Sesame oil	Kj	Arachis oil	Kj	Sesame oil	Kj
Bajra	3·31 ± 0·60	49·78	3·23 ± 0·69	48·57	3·35 ± 0·49	50·38	2·62 ± 0·61	39·40
Jowar	2·14 ± 0·19	31·50	2·27 ± 0·53	33·21	2·17 ± 0·55	50·79	2·32 ± 0·54	54·30
Moong	3·15 ± 0·24	43·43	2·29 ± 0·44	31·57	3·33 ± 0·70	48·71	2·05 ± 0·54	29·99
Moth	2·03 ± 0·43	27·99	2·97 ± 0·45	40·95	2·80 ± 0·57	38·61	2·12 ± 0·52	29·23
Av. Kj/100 g body wt/24 hr		42·22		36·85		45·13		36·02

Table 4. Food consumption (g/100 g body wt; Mean ± SE) with salt and sugar by *R. gleadowi.*

Food items	Whole grains + 2% Arachis oil				Flours + 10% Arachis oil + 1%			
	Salt	Kj	Sugar	Kj	Salt	Kj	Sugar	Kj
Bajra	2·46 ± 0·45	37·02	3·85 ± 0·52	57·90	5·21 ± 0·38	78·35	2·26 ± 0·54	33·99
Jowar	3·09 ± 0·52	45·20	3·23 ± 0·48	47·30	1·67 ± 0·59	24·43	1·00 ± 0·39	29·26
Moong	2·81 ± 0·41	30·74	2·28 ± 0·55	31·44	4·63 ± 0·36	63·64	2·58 ± 0·50	35·57
Moth	2·05 ± 0·43	28·26	2·65 ± 0·27	20·26	—	—	—	—
Til	—	—	—	—	3·16 ± 0·54	73·96	0·95 ± 0·33	22·23
Wheat	1·22 + 0·28	17·85	2·15 + 0·38	31·89	4·73 + 0·54	69·19	1·40 + 0·33	20·48
Av. Kj/100 g body wt/24 hr		33·41		37·75		61·95		28·30

Table 5. Relative consumption of best ranking food items from each test.

Baits (best from each test)	Average daily intake (g) (Mean ± SE)	Rank	Kj (100 g body wt/day)
Bajra, whole grains	6·11 + 0·32	1	91·91
Bajra, cracked	2·24 ± 0·32	10	33·69
Bajra, flour	4·63 + 0·55	2	69·63
Bajra, roasted	2·82 ± 0·44	7	42·42
Bajra, flour + 10% arachis oil	3·80 ± 0·60	3	56·97
Bajra, flour + 10% arachis oil + 1% salt	2·72 + 0·46	8	40·92
Jowar, flour	3·55 ± 0·48	5	51·91
Wheat, whole grains	2·41 ± 0·34	9	35·23
Wheat, whole + 2% arachis oil	3·89 ± 0·64	4	56·88
Wheat, whole + 2% arachis oil + 1% salt	2·91 ± 0·41	6	42·55

R. gleadowi is a selective feeder and is a pest of bajra and wheat. In nature, it is associated with *Tatera indica* and *Meriones hurrianae* (Prakash *et al* 1971) which are recognised pests of wheat and bajra (Advani *et al* 1982).

Desert rodents depend mostly on preformed water in food and metabolic water (Maloiy 1979). Ingestion of high protein food may adversely affect their water budget. Therefore, least preference for high protein food (urad 24% and cowpea 24·1% protein) as compared to bajra (11·6%) and wheat (11·8%) (Gopalan *et al* 1977), is an expected adaptation to xeric condition (tables 1–5).

3.3 *Food preference in no-choice and choice tests*

There was no significant difference in the average daily intake of same food when provided singly or in multiple choice (table 6). This leads to selection of superior food and therefore, *R. gleadowi* preferred bajra 9, 3 and 2 times at first, second and third positions, respectively whereas, wheat was liked 2, 5 and 2 times on similar positions (tables 1–6). Interestingly bengal gram (once) and moong (twice) attained second position whereas, jowar (thrice), moong (twice), maize and moth (once) also appeared at 3rd position in preference tests (tables 1–6). This indicated dietary variability and it is expected in desert ecosystem for survival.

3.4 *Role of additives*

Addition of arachis oil as well as sesame oil retarded the average daily intake of most of the whole grains to the extent that the difference attained statistical level of significance in case of bajra and jowar ($P < 0{\cdot}05$, table 3). Similar case with flours but the difference in consumption attained statistical level of significance only in case of bajra ($P < 0{\cdot}05$, table 3). It is also observed that this difference is elaborated in cases of moong and wheat with addition of sesame oil only ($P < 0{\cdot}05$) and not with addition of arachis oil. Further, addition of sugar and salt also reduced average daily intake of all the food grains tested (table 4), but the difference attained significant level in case of bajra with salt ($P < 0{\cdot}05$) only. In case of flours though reduction in average daily intake is observed (table 4) but significant difference is noticed when sugar is added to bajra, moong, til and wheat ($P < 0{\cdot}05$). It is therefore, pertinent to conclude that role of additive may be visualised in perspective of this foregoing analysis. Since addition of oils and salt and sugar have adversely affected the average daily intake, their use in any management strategy should be done with utmost care. Under field conditions, therefore, the role of oil is not more than a binder of poison to the grains. More quantities of oil than the desired ones, may have deterrent effects on the consumption of baits (Fitzwater and Prakash 1978; Jain and Prakash 1983). Moreover, use of sugar and salt may be avoided for all practical purposes.

Table 6. Calorific value and palatability indices of various food items in choice and no-choice tests.

Baits without additives	Average daily intake (g)/100 g body wt Multiple food choice (Mean ± SE)	Kj	Average daily intake g/100 (g) body wt single food choice (Mean ± SE)	Kj	Palatability index Values between multiple and single food choices
Bajra	5·63 ± 0·81	84·68	5·87 ± 0·29	87·90	0·28 NS
Jowar	4·92 ± 0·78	71·97	5·06 ± 0·29	74·02	0·16 NS
Moong	3·31 ± 0·67	45·64	3·90 ± 0·10	53·79	0·88 NS
Wheat	5·56 ± 0·69	81·34	5·17 ± 0·19	75·61	0·78 NS
Av. Kj/100 g body wt. 24/hr	4·85	70·92	5·00	72·83	

NS, Not significant.

3.5 *Energy budget*

The energy requirement of these rats ranged from 53·8–87·9 Kj (av. 72·8 Kj)/100 g body wt/24 hr in single food choice to 45·6–84·6 Kj (av.. 70·9 Kj)/100 g body wt/24 hr in multiple choice tests (table 6). The low energy budget of this rodent as compared to other desert rodents (*T. indica*—Jain and Prakash 1983; *Meriones hurrianae*—Prakash and Kumbkarni 1962; *Rattus c. cutchicus*—Jain *et al* 1975; *Gerbillus gleadowi*—Prakash *et al* 1975; *Rattus meltada*—Jain *et al* 1974), probably indicated that its range of movement is small and it prepares very simple burrows (Advani and Jain 1983) which does not warrant high energy budget.

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