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Evaluation of Bait Carrier for Rattus Rattus L. Infesting Commercial Poultry Facilities in India: A Step Towards Sustainable Poultry Management

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Abstract: Rodents cause significant economic loss to poultry by feeding on poultry feed, contaminating it, damaging eggs, attacking chicks and transmitting/carrying several diseases. The house rat, *Rattus rattus* is the most abundant rodent pest infesting the commercial poultry facilities in Haryana (India). So the study was designed to evaluate bait carrier for controlling *Rattus rattus* L. infesting poultry farms. The bait preference was studied by offering five foods namely cracked wheat, wheat flour, cracked maize, poultry feed and fish meal to rats under no-choice, bi-choice and multi-choice feeding trials. Significant ($P<0.05$) differences were recorded in daily intake of different foods in no-choice feeding trials. The average daily intake of different foods was recorded to be 4.20 to 12.80 g / 100 g of body wt. Taste and texture of food were found to influence the feeding response of *R. rattus* .The addition of additives (sugar and groundnut oil) significantly enhanced the palatability of the test foods in bi-choice feeding trials. In multi-choice feeding trials the five foods were eaten in the following order of preference; cracked maize>cracked wheat > wheat flour > poultry feed > fish meal. Furthermore, in multi-choice feeding test, *R. rattus* appeared to establish a particular order of preference of foods on the first day of feeding itself and that was maintained on the subsequent days by daily exploration and sampling of all foods. The present findings indicated that cracked maize mixed with suitable additives such as 2% sugar and 2% ground nut oil should be used as a bait base for controlling *R. rattus* in poultry farms either using traps or using poison bait in protected bait boxes.

1. Introduction

Poultry is one of the important meat industries of India. Rodents pose a serious threat to poultry operations by feeding on poultry feed, contaminating it with their excrements, damaging eggs, attacking and killing chicks, causing structural damage to buildings, doors, windows, feed containers and transmitting or carrying several diseases (Ahmad *et al.*, 1984; Khatri and Veda 1984; Parshad *et al.*,1987; Soni and Rana, 1988; Gora *et al*., 1995; Gomez Villafane *et al*., 2001; Hussain *et al*., 2006; Chopra *et al*., 2008). Even poultry buildings with fibre glass or polystyrene insulated walls are vulnerable to rodent damage as they have been found to attack and nest in fibre glass or polystyrene insulated walls (Turner, 1986). In addition, rodents also cause general nuisance for birds in the poultry house due to their noise and movements. The birds may be frightened, which results in poor performance.

In recent years, the state of Haryana has emerged on the national map of poultry industry. In this state, commercial poultry is a very rich business and involves millions of rupees of annual turn over. Many poor and middle class farmers in Haryana taking up poultry to supplement their income and this industry has become a

major income source to them. However due to financial limitations many farmers build poor quality sheds inside the crop fields and close to villages which naturally attracts both field and commensal rodents leading to considerable financial losses (Chopra, 1992; Gora *et al.*, 1995; Munjal, 2000; Chopra *et al.*, 2008). Therefore, there is an immediate need to manage these pests effectively for sustainable development of poultry.

The most common methods for controlling rodents are trapping and poison baiting. The use of rodenticides, in the form of poison bait, is the most common means of rat control in India as it is inexpensive and effective. The success of this programme is, however, based on the type of poisons and their formulations (Prakash and Mathur, 1992). Usually it is recommended that poultry feed may be used as baiting medium to contain rodent menace in poultry farms (Bhardwaj, 1983). But poultry raisers often reported that desired results are not obtained if poultry feed is used as bait. The house rat, Rattus rattus is the most abundant rodent species infesting the poultry facilities in India (Ahmad *et al.*, 1984; Khatri and Veda, 1984; Chopra and Dhindsa, 1987; Parshad *et al.*, 1987; Sridhara and Krishnamurthy, 1992; Gora *et al.*, 1995; Hussain *et al.*, 2006; Chopra *et al*.,2008).

Till date, little is done to procure quantified information on various aspects of ecology of rodents, pattern and extent of rodent infestation and management of rodents in commercial poultry facilities in Haryana. Hence a preliminary investigation was carried out to study the bait preference of the house rat, *Rattus rattus* L. in the laboratory to ascertain the most favored bait to be ultimately used for preparing poison baits for the management of rodents in poultry facilities.

2. Materials and Methods

Adult speciemen of house rat, *R. rattus* L. were live trapped from commercial poultry facilities located in and around Jind (29° 19' N latitude and 76° 19' E longitude), Haryana. The animals were sexed, weighed and individually caged in wire mesh cages. Sick, injured and pregnant animals were discarded. The animals were acclimatized for 10 days under laboratory conditions prior to the experiment. During this period, rats were provided with laboratory diet (cracked wheat, powdered sugar and groundnut oil, 96:2:2) and water *ad libitum*. For each set of experiment 5 animals of each sex were used. Before the start of these trials, weight of each house rat was recorded. In no-choice feeding trial, five food items namely, cracked wheat, wheat flour, cracked maize, poultry feed and fish meal were provided to acclimatized rats for five consecutive days. 50 gm of each food item was offered daily to each rat and water was provided *ad libitum*. Average daily intake (ADI) was recorded by weighing the remnant baits provided to individual rat. Consumed baits were replenished daily with a fresh series of baits. For comparisons all ADI were converted to g/100 g body weight**.** In bi-choice feeding trials, five foods cracked wheat, wheat flour, cracked maize, poultry feed and fish meal were offered to rats with additives (2% sugar and 2% groundnut oil) and without additives in separate bi-choice trials. Each combination was offered for five consecutive days to singly caged rats. 20 gm of each

food item was given to each rat and water was provided *ad libitum*. To avoid food preference by rats, the position of containers was rotated daily.

In multi-choice feeding trials, five food items were presented simultaneously to rats. Each rat was offered 20 gm of each food in separate bait containers for five consecutive days. The position of the food containers was changed clockwise daily to avoid place preference by the rats.

2.1. Statistical analysis

Significance of differences among average daily intake of five foods in no-choice and multi-choice feeding tests was determined by analysis of variance (ANOVA). To determine the significance of difference between any two means within a combination of foods, critical difference (CD) was calculated at 5% level of significance following Gupta (2001). To test significance of differences between mean daily intake of foods with and without additives, student‘t’ test was applied at 5% level of significance.

3. Results and Discussion

The average daily intake of five foods i.e. cracked wheat, wheat flour, cracked maize, poultry feed and fish meal by Rattus rattus L. offered in no-choice feeding test are presented in Table 1. Although, all the bait materials were consumed by the rats but they showed significant ($P \leq 0.05$) differences in the daily consumption of different foods. The average daily intake of five foods ranged from 4.20 to 12.80 g / 100 g body wt. Earlier studies have also reported average daily intake of *R. rattus* inhabiting poultry farms ranging from 6.04 g/ 100g body wt. to 11.70g/100g body wt.(Chopra and Dhindsa, 1987; Mathur *et al.*, 1992; Kaur, 1996; Munjal, 2000). In no-choice feeding trials, the order of preference of five food items was recorded to be cracked maize > poultry feed > cracked wheat > wheat flour >fish meal. The pattern of daily variations in the average food intake of rats for different foods over different days of exposure is illustrated in Fig.1.

The comparison of average daily intake of rats between foods with and without additives (2% sugar and 2% groundnut oil) are presented in Table 2.The analysis of the results revealed that the rats showed significant($P<0.05$) preference for food items with additives over their plain alternatives in most of the cases. This preference for foods with additives was maintained over different days of exposure (Fig.2). However, non-significant difference ($P \geq 0.05$) in the average daily intake of fish meal was observed when it was offered to the rats with and without additives (Table 2).Taste of food has already been reported to influence feeding response of *R. rattus* both in laboratory conditions and poultry farms (Khan, 1974; Prakash *et al.*, 1980; Munjal, 2000).

The preference of rats for a particular food depends upon its flavour more than its nutritional value (Naganuma *et al*., 1973).Additives like sugar and vegetable oils at 1% to 3% concentration increase the food intake of rodents as they make foods more

acceptable and palatable to rats (Brookes and Lavoie, 1990; Malhi and Kaur, 1995). Moreover, selection of sweat food has also an adaptive value as in natural food, bitter taste is associated with occurrence of toxic alkaloids or poisonous foods while sweetness indicates presence of starch and carbohydrates and latters forms the major component of diet of rodents (Barnett and Prakash, 1975; Rana *et al*., 1992).

Results of food preference in multi-choice test are presented in Table 3. The rats showed significant ($P \leq 0.05$) differences in their average daily intake of different food items when offered to them in multi-choice feeding trial. These differences were maintained on different test days (Fig.3). Based on overall mean daily food consumption, different foods were eaten by *R. rattus* in the preference order of cracked maize > cracked wheat > wheat flour > poultry feed > fish meal. Maize is a major constituent of the poultry feed but during the present study *R. rattus* showed high preference for cracked maize than poultry feed This contradicts previous report that poultry feed may be used as bait in poultry farms (Bhardwaj,1983). Interestingly, cereals and pulses have been recorded with more consumption than that of poultry feed in Punjab and Rajasthan (Parshad et al. 1987, 1991; Mathur et al., 1992).Thus, high preference of rats for cracked maize than poultry feed appeared to relate to its texture and taste qualities. Earlier studies have also reported preference of *R. rattus* for soft and flavoured food in laboratory conditions (Khan, 1974; Prakash *et al*., 1980) as well as in poultry farms (Ahmad *et al*., 1984; Chopra and Dhindsa, 1987).

Daily responses of rats to individual food items are illustrated in Fig. 3. Apparently, the rats visited and sampled each food daily but consumed the food items in order of their preference. However, occassionally the least preferred food (fish meal) was completely rejected. This sampling of food is well known in *R. rattus* (Barnett, 1966), *R. norvegicus* (Cowan, 1977; Barnett *et al*., 1978) and *Bandicota bengalensis* (Parshad and Jindal, 1991).Even in natural habitats, this sampling behaviour has survival value as it enables the rats not only in finding new sources of food but also in avoiding toxic baits (Barnett, 1966; Siddiqui and Khan, 1982; Chopra *et al*., 1984). The present findings indicated that cracked maize mixed with suitable additives such as 2% sugar and 2% ground nut oil should be used as a bait base for controlling *R. rattus* in poultry farms either using traps or using poison bait in protected bait boxes.

The studies are required to access the effectiveness of training programmes in chemical methods for rodent control along with applications of second generation anticoagulants to reduce the rodent populations in commercial poultry facilities.

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Table 1: Food preference by *Rattus rattus* L. in no-choice test

Sr. No.	Food items	Daily intake (g/100 g of body wt.) Mean ± S.E
1	Cracked wheat	9.04 ^{c} ± 0.58
2	Wheat flour	8.00 ^{cd} ± 0.52
3	Cracked maize	12.80 ^{a} ± 0.21
4	Poultry feed	10.46 ^{b} ± 0.44
5	Fish meal	4.20 ^{e} ± 0.19

Ranks a to e are given on the basis of critical difference (1.38) at 5% level of significance.

Table 2: Average daily intake of house rat *Rattus rattus* L. in bi-choice test

Sr. No.	Food items	Daily intake (g/100 g of body wt.) Mean ± S.E	t-value
1	Cracked wheat Cracked wheat+Oil +Sugar	4.40 ± 0.08 *6.16 ± 0.12	24.44
2	Wheat flour Wheat flour + Oil +Sugar	3.70 ± 0.11 *5.80 ± 0.18	19.92
3	Cracked maize Cracked maize + Oil +Sugar	5.10 ± 0.16 *7.80 ± 0.25	18.17
4	Poultry feed Poultry feed + Oil +Sugar	4.80 ± 0.07 *6.20 ± 0.14	17.86
5	Fish meal Fish meal + Oil +Sugar	2.10 ± 0.05 2.15 ± 0.15	N.S.

* Significant at 5% level of significance

N.S. = Non Significant at 5% level of significance

Table 3: Food preference by *Rattus rattus* L. in multi-choice test

Sr. No.	Food items	Daily intake (g/100 g of body wt.) Mean ± S.E
1	Cracked wheat	3.08 [b] ± 0.26
2	Wheat flour	2.30 [c] ± 0.31
3	Cracked maize	4.70 [a] ± 0.27
4	Poultry feed	1.40 [d] ± 0.12
5	Fish meal	0.40 [e] ± 0.13

Ranks a to e are given on the basis of critical difference (0.76) at 5% level of significance.

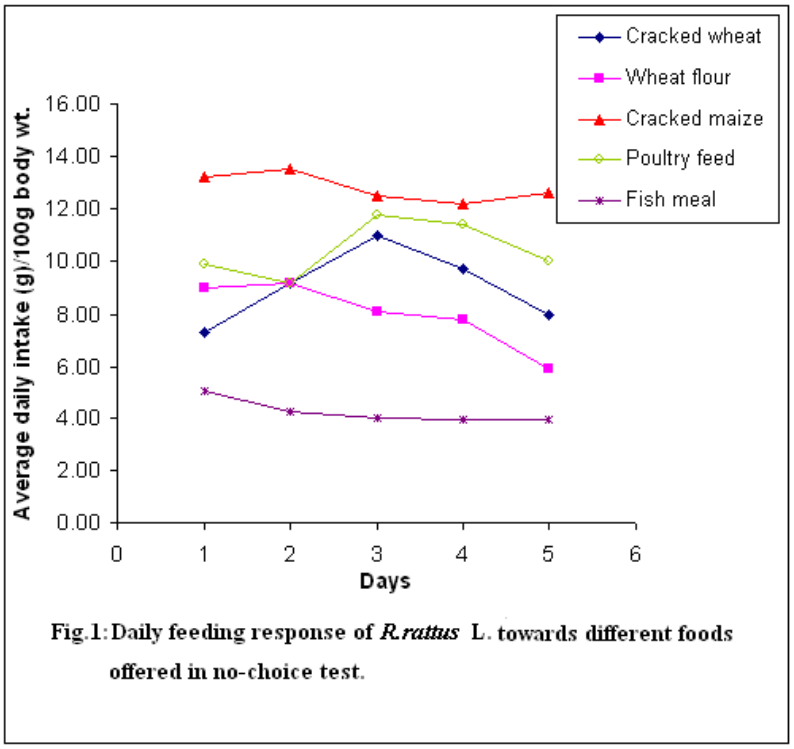

Fig.1: Daily feeding response of *R.rattus* L. towards different foods offered in no-choice test.

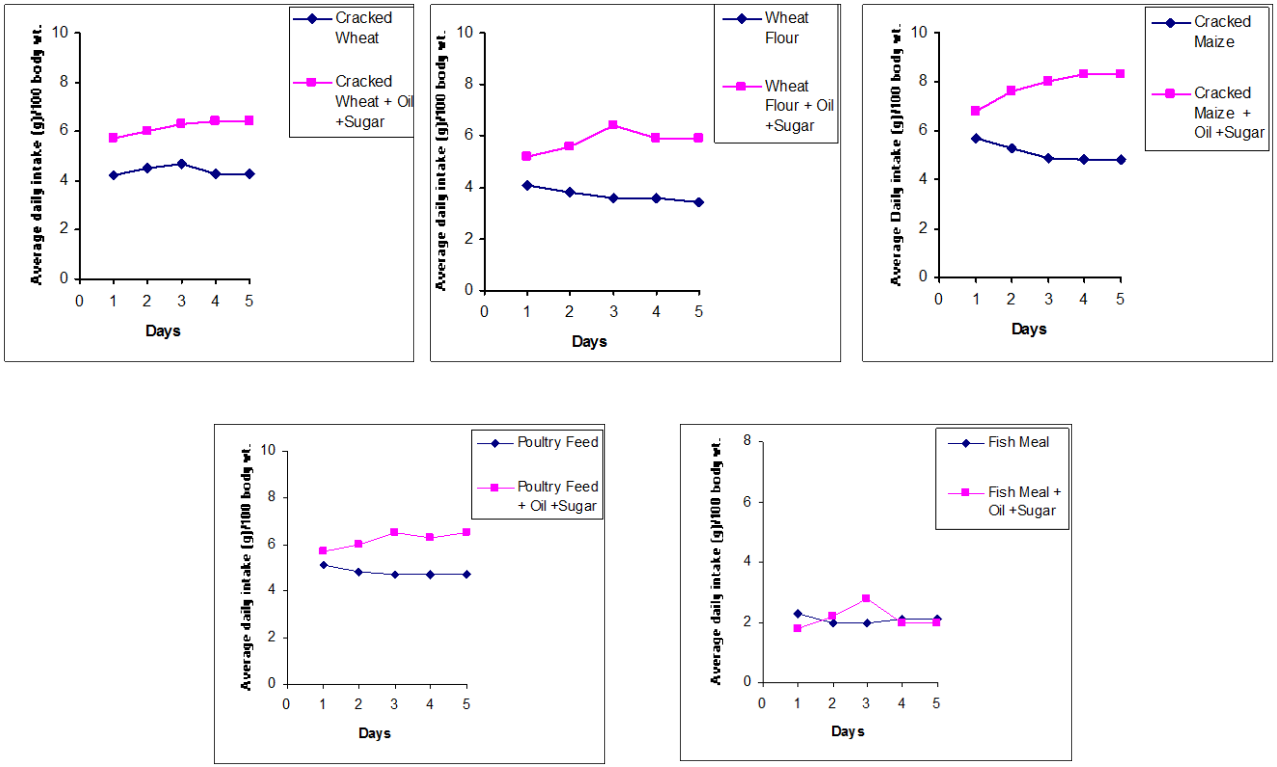

Fig.2: Daily feeding response of *R. rattus* L. towards different foods offered in bi-choice test.

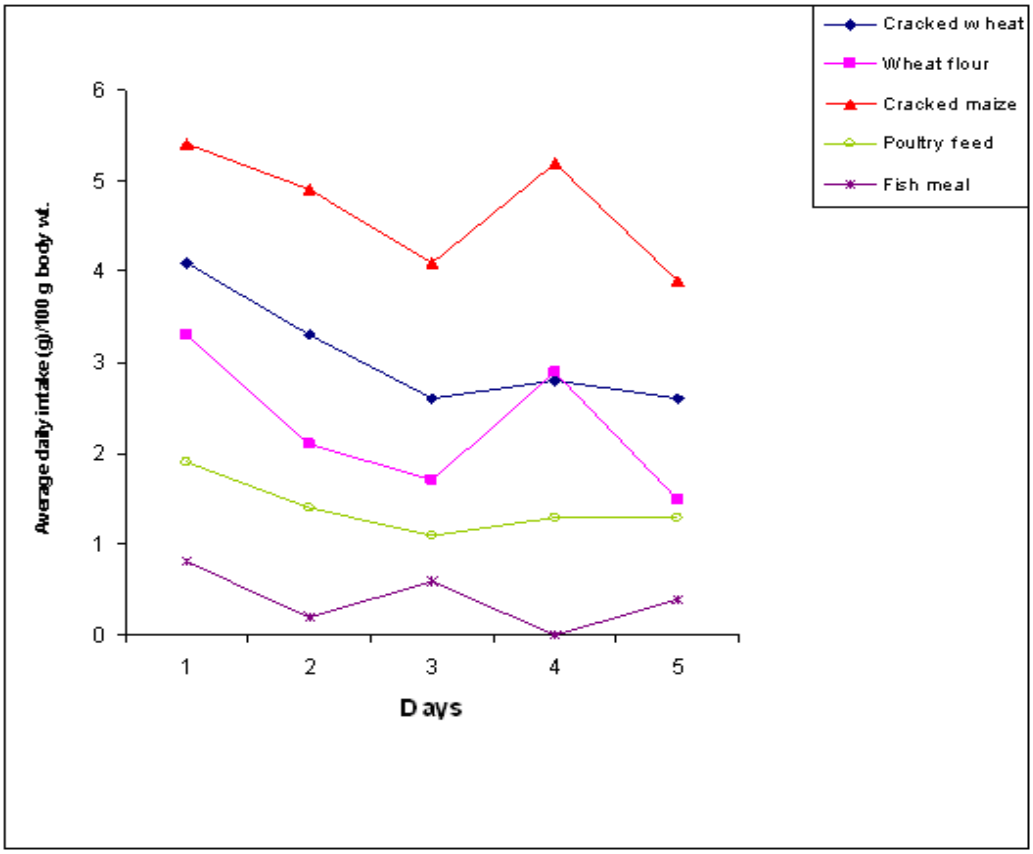

Fig.3: Daily feeding response of *R. rattus* L. towards different foods offered in multi-choice test.