



Incidence and damage assessment of rats (Mammalia: Rodentia) infesting poultry and animal farms and their stores in Upper Egypt

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Abstract

Survey of rodents, revealed the presence of the white bellied rat, *Rattus rattus frugivorus* (Rafinesque), the Norway rat, *Rattus norvegicus* (Berkenhout) and the Nile grass rat, *Arvicanthus niloticus* (Desmarest) in poultry and animal farms at Assiut Governorate, while *R. r. frugivorus*; the grey-bellied rat, *Rattus rattus alexandrinus* (Geoffray) and *R. norvegicus* were recorded in stores of poultry farm at Sohag Governorate. The white bellied rat was the most common species (1.4 rats/ day), followed by the Norway rat (0.7 rat/day) and the Nile grass rat (0.6 rat/day) at Assiut Governorate. At Sohag Governorate the grey-bellied rat was the most common species (4.9 rats/ day), followed by the white bellied rat (3.7 rats/ day) and the brown Norway rat (2.5 rats/day) at. The results of differences among rodent species in the droppings were recorded. The percentages of consumption at Assiut Governorate were significantly lower than that at Sohag Governorate. The percentages of poultry and animal feed and sacks contamination at Assiut Governorate were lower than that at Sohag Governorate.

Keywords: Rodent, Survey, Food Consumption, Food Contamination, Poultry Farm, Animal farm and Stores.

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Introduction

The white bellied rat, *Rattus rattus frugivorus* (Rafinesque), the grey-bellied rat, *Rattus rattus alexandrinus* (Geoffroy), the black bellied rat, *Rattus rattus rattus* (Linnaeus), the Nile grass rat, *Arvicanthis niloticus* (Desmarest) and the Norway rat, *Rattus norvegicus* (Berkenhout) were recorded in animal and poultry farms at Assiut Governorate, (Younis, 2006), *Rattus rattus frugivorus* (Rafinesque), *Arvicanthis niloticus* (Desmarest) and the lesser gerbil *Gerbillus* sp (Desoky et al., 2014) in Kathur region at Sohag Governorate, in Egypt. The shape and size of any droppings can often indicate the species which may be present, Meehan (1984), Bakri-Eman and Al-Gendy (2008) and Kaleal (2015). These rodents were the most destructive pests which cause damage directly to the poultry structures by their burrowing nature, gnawing habits and consumption of poultry feed, eggs and chicks. Their indirect impact include contamination of the poultry feed through their urine, feces and hair (Desoky, 2006) and (Rao & Sakthivel, 2015). It has been recognized at a global scale that rodents cause problem in poultry farms (Ashton & Jackson, 1986) and (Corrigan & Williams, 1986). Commercial poultry farms provide ideal habitats to large populations of rodents, which inflict significant economic losses to poultry operations (Corrigan & Williams, 1986). Reports from India, Nigeria and Canada reveal that rodents pose serious threats to poultry production by feeding on poultry food, contaminating food with their excreta and feed on stored foods (Berry, 2008; Parshad et al., 1987; Funmilayo, 1982). Our study aims to identify, the rodent species, description of common rodent species droppings and estimation the damage caused by rodents in stores

from poultry and animal production farms at Assiut and Sohag Governorates, Upper Egypt.

Materials and methods

This study was carried out on three stores in poultry and animal farms, Faculty of Agriculture Al-Azhar University at Assiut Governorate and in poultry farm, in El Kawamel, distract at Sohag Governorate, Upper Egypt.

Identification of rodent species: In each area 25 wire-box traps (10x12x25 cm.) were placed around the stores and distributed every day at 6pm and collected at 7am for the duration of the experiment. This study was conducted at the beginning of April 2016 until the beginning of May 2016 at Assiut Governorate and in mid-April 2016 until the end of April 2016 at Sohag Governorate. Sites were separated by at least 3m. Traps were baited with chicken meat and checked each morning during consecutive day. The captured rodents were classified into species and sub species and recorded.

Description of rodent species droppings: This study was conducted in feed stores of poultry farms and recorded data droppings in terms of length, shape, color, weight and number. These physical characters led to the classification of rats and mice. The shape and size of any droppings can often indicate the species which may be present (Meehan, 1984). The droppings were collected daily for the duration of the experiment and then separated on the basis of length, shape, color, weight and number.

Estimation of the damage: To estimate the damage caused by rats from the stores in the two locations at Assiut and Sohag Governorates, Upper Egypt. Three stores for each location containing 7.5 Tons' (150 sacks) of stored poultry and animal's feed and maize grains. Before sampling, stored feed in each storage container was weighted. Samples were taken from the middle and the periphery from each storage structure. After every sampling the remaining maize in the storage container was re-weighted., undamaged seeds. The percentage of feed consumption, the percentage of feed and sacks contamination were calculated daily. Five bags were taken out of each store daily to feed the animals and poultry. Percentage grain damage and amount of weight loss were calculated as described by Buckle (1994). Samples taken each day were also used to assess the level of contamination and counting the rodent droppings in each sample.

Statistical analysis: All obtained data were subjected to statistical analysis of variance and treatment means were compared for significant differences using the Duncan's Multiple Range Test (significant differences at $p=0.05$) according to the MSTAT- C Statistical software (Russell, 1986). Computer program was used to perform all the analysis of variance in agreement with the procedure outlined by Duncan (1955).

Results and Discussion

Identification of rodent species: Data in Tables (1 and 2) showed that, the white bellied rat, *R. r. frugivorus* the brown Norway rat, *R. norvegicus* and the Nile grass rat, *A. niloticus* were recorded in stores from poultry and animal farms at Assiut Governorate, while *R. r.s frugivorus* , *R. r. alexandrinus* and *R. norvegicus* were recorded in stores from poultry farms at Sohag Governorate. The grey-bellied rat was the most common species (4.9 rats/ day), followed by the white bellied rat (3.7 rats/ day) and the brown Norway rat (2.5 rats/day) at Sohag Governorate. At poultry and animal farm in Assiut governorate the white bellied rat was the most common species (1.4 rats/ day), followed by the brown Norway rat (0.7 rat/day) and the Nile grass rat (0.6 rat/day).

Description of rodent species droppings: Data in Tables (1 and 2) describe the number and weight of feces of *R. r. frugivorus* , *R. norvegicus* and *A. niloticus* recorded at Assiut Governorate, while *R. r. frugivorus* , *R. r. alexandrinus* and *R. norvegicus* recorded in stores at Sohag Governorate. *R. norvegicus* , about 40 droppings a day, and *Mus musculus* Linn., about 80 noticed that, *R. norvegicus* . These results agree with Meehan (1984), Brown et al. (1992), Bakri-Eman and Al-Gendy (2008) and Kaleal (2015).

Table 1: Rat index, and number and weight feces of rodents recorded in poultry and animal farm stores at Sohag Governorate, during April, 2016.

Date	Stores mean								
	Mean no. of rats/ traps	Rat index			Total number of feces	Feces weight/gm	Number and weight of feces		
		<i>R. rattus alexandrinus</i>	<i>R. rattus frugivorus</i>	<i>R. norvegicus</i>			<i>R. rattus alexandrinus</i>	<i>R. rattus frugivorus</i>	<i>R. norvegicus</i>
April, 14	13.3	6.3	4.3	2.7	694.7	309.7	322.3	223.3	149.0
15	11.0	5.0	3.3	2.7	659.0	280.0	317.3	182.3	159.3
16	10.3	4.3	3.3	2.7	528.7	223.3	234.7	175.3	118.7
17	9.3	3.7	3.7	2.0	489.3	212.7	188.3	174.7	126.3
18	10.7	5.7	2.7	2.3	570.0	261.3	273.0	203.3	93.7
19	12.0	5.7	3.7	2.7	704.3	322.3	339.7	267.0	97.7
20	12.0	5.3	4.0	2.7	656.0	262.0	348.0	239.0	69.0
21	10.3	4.0	3.7	2.7	562.7	248.0	236.0	201.3	125.3
22	11.7	5.3	3.7	2.7	775.0	330.0	370.3	292.7	112.0
23	11.3	4.7	3.7	3.0	730.7	307.0	307.0	270.7	153.0
24	9.7	4.3	3.7	1.7	518.7	213.0	288.7	165.7	64.3
25	11.0	4.7	3.7	2.7	599.0	248.7	224.7	277.3	97.0
26	11.7	4.3	5.0	2.3	647.0	272.7	276.0	308.0	63.0
27	12.3	5.7	4.3	2.3	748.7	305.3	350.0	284.7	114.0
28	9.7	4.3	2.7	2.7	470.0	186.0	216.7	130.0	123.3
Mean	11.1	4.9	3.7	2.5	623.6	265.5	286.2	226.4	111.0

Table 2: Rat index, and number and weight feces of rodents recorded Identification in poultry and animal farm stores at Assiut Governorate, during April and May, 2016.

Date	Stores mean								
	Mean no. of rats/ traps	Number of rats for each species			Number of feces	Feces weight/g	Number of feces for each rats species		
		<i>A. niloticus</i>	<i>R. norvegicus</i>	<i>R. rattus frugivorus</i>			<i>A. niloticus</i>	<i>R. norvegicus</i>	<i>R. rattus frugivorus</i>
April, 9	2.7	0.3	1.0	1.3	38.0	16.0	8.7	11.3	18.0
10	2.7	0.7	0.7	1.3	38.0	15.0	10.7	10.7	16.7
11	2.0	0.3	0.3	1.3	35.3	12.7	9.3	10.0	16.0
12	3.0	0.7	0.7	1.7	36.7	15.0	8.0	10.7	18.0
13	2.0	0.3	0.3	1.3	36.0	15.3	8.7	8.7	18.7
14	2.0	0.7	0.7	0.7	34.7	13.0	8.0	10.0	16.7
15	3.0	0.7	0.7	1.7	47.3	20.0	14.0	12.0	21.3
16	3.3	0.7	0.7	2.0	36.7	16.7	8.0	10.7	18.0
17	3.0	1.0	0.3	1.7	31.3	14.7	7.3	5.3	18.7
18	3.7	1.0	0.7	2.0	49.3	22.0	14.0	12.7	22.7
19	3.7	0.7	1.3	1.7	45.3	20.3	10.7	13.3	21.3
20	2.7	0.3	1.0	1.3	44.0	18.7	10.7	13.3	20.0
21	4.0	1.3	0.7	2.0	54.7	22.0	13.3	16.0	25.3
22	2.7	0.7	0.7	1.3	51.3	20.3	10.7	12.7	28.0
23	2.3	0.0	0.7	1.7	30.7	12.3	7.3	8.7	14.7
24	3.7	0.7	1.3	1.7	60.0	26.0	15.3	17.3	27.3
25	3.0	0.7	0.3	2.0	70.7	29.0	19.3	19.3	32.0
26	2.0	0.7	0.7	0.7	46.7	18.7	10.7	15.3	20.7
27	2.7	0.3	1.0	1.3	40.0	19.0	8.0	14.7	17.3
28	3.0	0.7	1.0	1.3	41.3	19.0	9.3	11.3	20.7
29	3.7	1.0	0.7	2.0	73.3	30.0	22.0	20.0	31.3
30	4.0	1.0	1.0	2.0	80.7	33.7	19.3	23.3	38.0
31	2.0	0.3	0.7	1.0	32.7	13.0	8.7	8.0	16.0
May, 1	2.3	1.0	0.3	1.0	33.3	14.7	10.0	9.3	14.0
2	2.0	0.3	1.7	0.0	22.0	9.7	4.0	10.0	8.0
3	2.3	0.7	0.7	1.0	37.3	16.0	10.7	12.0	14.7
4	1.7	0.3	0.7	0.7	26.0	11.3	4.7	8.7	12.7
5	1.7	0.3	0.0	1.3	25.3	10.7	5.3	6.7	13.3
6	1.3	0.3	0.3	0.7	21.3	9.3	4.7	6.0	10.7
7	1.7	0.3	0.0	1.3	22.0	9.7	4.0	2.7	14.7
Mean	2.7	0.6	0.7	1.4	41.4	17.5	10.2	11.7	19.5

Estimated damage caused by common rodent species in stores from poultry and animal farms: Feed consumption: results in Tables (3 and 4) showed that, the total population of the white bellied rat, the grey-bellied rat and the brown Norway rat in poultry and animal farm stores consumed between 0.90 and 1.89% with an average 1.21% per day of poultry and animal feed daily at Sohag Governorate. Whereas, at Assiut Governorate the consumption ranged between 0.15 and 0.52%, with an average 0.29% per day. These results revealed that, the percentage of consumption at Assiut Governorate was significantly lower than that at Sohag Governorate. This may be attributed to the availability of food in neighbored field crops and vegetables plantations at Assiut Governorate. In Sohag Governorate, some of rodents have to enter poultry and

animal farm stores in the absence of food and shelter in the fields, especially in periods of pre-harvest and harvest. Poultry and animal feed stores are also heavily infested with rodents (Parshad, et al., 1987). According to one estimate, 309–359 rodents may occur in 100m² of the feed store (Ahmad, et al., 1993). On average, one adult house rat eats 8.6 g of poultry feed per day (Parshad, et al., 1991). Different estimates reveal that the total population of rodents in poultry farms may consume between 2 and 50 kg of poultry feed daily and also damage the gunny bags used for its storage and transport (Rosario, 1987; Malhi et al., 1991). In India, during storage, rats are considered responsible for 2.5% loss of the total food grains produced (Krishnamurthy et al., 1967; Krishnamurthy, 1968).

Table 3: The percentage of animal and poultry feed consumption and contamination by rodent species at Sohag Governorate, during April, 2016.

Date		Store I			Store II			Store III			Average		
		Food consumption (%)	Food contamination (%)	Sacks contamination (%)	Food consumption (%)	Food contamination (%)	Sacks contamination (%)	Food consumption (%)	Food contamination (%)	Sacks contamination (%)	Food consumption (%)	Food contamination (%)	Sacks contamination (%)
April,	14	1.16	9.00	3.33	0.75	6.00	4.44	1.33	12.70	1.70	1.08	9.23	3.16
	15	1.60	11.20	2.97	1.40	10.00	2.97	0.80	8.80	2.97	1.26	10.00	2.97
	16	1.16	8.00	3.80	1.30	12.00	1.90	1.50	10.00	2.60	1.32	10.00	2.77
	17	1.50	10.50	2.80	2.00	18.00	1.40	1.00	11.30	2.08	1.50	13.27	2.09
	18	1.75	11.50	2.50	1.70	12.70	2.30	1.00	8.00	3.03	1.48	10.73	2.61
	19	1.33	9.70	3.00	2.00	14.00	2.50	0.75	7.50	3.33	1.36	10.40	2.94
	20	1.14	7.70	5.00	1.00	9.00	3.70	0.80	8.40	4.60	0.98	8.37	4.43
	21	1.66	13.30	3.00	3.00	24.00	2.08	1.00	16.00	2.08	1.89	17.77	2.39
	22	1.00	7.50	9.50	1.00	12.70	3.60	1.00	11.50	4.80	1.00	10.57	5.97
	23	1.16	9.33	8.30	0.80	8.30	8.30	0.75	11.00	5.60	0.90	9.54	7.40
	24	1.00	8.33	10.00	1.50	17.00	3.30	1.00	11.30	5.00	1.17	12.21	6.10
	25	0.88	6.50	16.70	1.00	9.50	8.30	2.00	18.00	4.20	1.29	11.33	9.73
	26	1.14	8.30	19.40	0.80	7.70	16.70	1.33	11.30	8.33	1.09	9.10	14.81
	27	1.00	7.75	33.30	0.90	7.10	29.16	1.50	15.00	8.33	1.13	9.95	23.60
28	1.20	8.80	66.70	1.00	12.00	25.00	0.70	10.70	25.00	0.97	10.50	38.90	
Mean		1.25	9.16	12.68	1.34	12.00	7.71	1.10	11.43	5.58	1.23	10.86	8.66

Table 4: The percentage of animal and poultry feed consumption and contamination by rodent species at Assiut Governorate, during April and May, 2016.

Date		Store I			Store II			Store III			Average			
		Food consumption (%)	Food contamination (%)	Sacks contamination (%)	Food consumption (%)	Food contamination (%)	Sacks contamination (%)	Food consumption (%)	Food contamination (%)	Sacks contamination (%)	Food consumption (%)	Food contamination (%)	Sacks contamination (%)	
April,	9	0.30	3.00	1.33	0.15	1.00	3.33	0.18	1.33	2.00	0.21	1.77	2.22	
	10	0.70	5.00	0.69	0.20	1.33	2.06	0.50	2.00	0.69	0.47	2.77	1.15	
	11	0.26	1.67	2.14	0.20	1.50	1.43	0.20	1.33	2.14	0.22	1.50	1.90	
	12	0.32	2.00	1.48	0.23	1.00	1.48	0.58	3.00	0.74	0.38	2.00	1.23	
	13	0.25	2.50	1.53	0.20	1.50	1.54	0.40	2.00	0.77	0.28	2.00	1.28	
	14	0.66	3.00	0.80	0.18	0.67	2.40	0.30	1.50	1.60	0.38	1.72	1.60	
	15	0.25	1.50	1.67	0.15	1.25	3.33	0.17	1.33	2.50	0.19	1.36	2.50	
	16	0.30	1.00	1.73	0.50	4.00	0.87	0.35	3.00	1.74	0.38	2.67	1.45	
	17	0.60	2.00	0.90	0.40	2.00	0.91	0.56	4.00	0.90	0.52	2.67	0.90	
	18	0.32	1.50	1.90	0.60	4.00	0.95	0.60	3.00	0.95	0.51	2.83	1.27	
	19	0.19	1.50	4.00	0.33	2.00	2.00	0.60	2.00	1.00	0.37	1.83	2.33	
	20	0.20	1.75	4.21	0.19	1.67	3.16	0.48	2.00	1.05	0.29	1.81	2.81	
	21	0.16	1.60	5.65	0.16	1.25	4.44	0.20	1.00	2.22	0.17	1.28	4.10	
	22	0.18	1.67	3.53	0.20	1.33	3.53	0.30	2.00	1.18	0.23	1.67	2.75	
	23	0.20	1.33	3.75	0.20	1.00	2.50	0.20	1.00	1.25	0.20	1.11	2.50	
	24	0.20	1.50	5.33	0.25	2.00	2.67	0.20	1.50	2.67	0.22	1.67	3.56	
	25	0.21	1.75	5.71	0.12	1.00	4.28	0.25	2.00	2.86	0.19	1.58	4.28	
	26	0.20	1.67	4.62	0.40	4.00	1.54	0.18	1.50	3.08	0.26	2.39	3.08	
	27	0.18	1.00	6.67	0.15	1.00	3.33	0.18	1.33	5.00	0.17	1.11	5.00	
	28	0.20	1.33	5.45	0.17	1.00	5.45	0.30	1.50	3.64	0.22	1.28	4.85	
	29	0.30	2.00	6.00	0.15	1.25	8.00	0.20	1.00	4.00	0.22	1.42	6.00	
	30	0.23	1.75	8.89	0.17	1.00	4.44	0.56	3.00	2.22	0.32	1.92	5.18	
	31	0.20	1.00	7.50	0.26	2.00	2.50	0.30	1.60	2.50	0.25	1.53	4.17	
	May,	1	0.19	1.33	8.57	0.38	2.00	2.86	0.26	1.50	5.71	0.28	1.61	5.71
		2	0.25	1.50	6.67	0.30	3.00	3.33	0.20	1.50	3.33	0.25	2.00	4.44
		3	0.50	4.00	4.00	0.40	4.00	4.00	0.24	1.60	4.00	0.38	3.20	4.00
		4	0.40	2.00	5.00	0.50	4.00	5.00	0.15	1.00	10.00	0.35	2.33	6.67
		5	0.30	2.00	6.67	0.40	3.00	6.67	0.40	3.00	6.67	0.37	2.67	6.67
		6	0.14	1.20	20.00	0.12	1.00	20.00	0.20	2.00	10.00	0.15	1.40	16.67
		7	0.44	2.00	20.00	0.20	2.00	20.00	0.26	1.60	20.00	0.30	1.87	20.00
	Mean		0.29	1.90	5.21	0.26	1.93	4.27	0.32	1.87	3.55	0.29	1.90	4.34

Feed and sacks contamination: rodents contaminate the poultry and animal feed with their urine, fecal droppings and hair. Our results in Table (4) indicated that, the percentage of poultry and animal feed contamination by rodent was between 8.37 to 17.77% with an average 11.10 % per day at Sohag Governorate. Also, the rodents contaminated the gunny bags used for storage the feed. The percentage of sacks contaminated was between 2.09 to 38.90% with an average of 8.64% per

day. At Assiut Governorate, the percentage of poultry and animal feed contaminated by three rodents was between 1.11 to 3.20% with an average percentage 1.90% per day (Table 4). In addition, the percentage of sacks contaminated was between 1.15 and 20% with an average of 4.34% per day. These results showed that, the percentage of poultry and animal feed contamination and the percentage of sacks contamination at Assiut Governorate

were lower than that at Sohag Governorate. Several studies reported that, the level of contamination varies by rodents in different situations in relation to the type of packing and storing facility (Rosario, 1987; Malhi et al., 1991; Parshad, et al., 1994). They also indicated that, less than 0.1% samples of wheat grains collected from gunny bags and metallic bins had signs of rodent contamination compared to 4.7% samples of spilled grains collected from flour mills, grain stores and rural houses. Parshad et al. (1987) reported that 0.4–3.3% samples of feed had signs of contamination. Damage to poultry feed is a major cause of economic loss as feed accounts for 50–75% of the operational cost of a poultry farm (Parshad, 1999). The estimated annual losses caused by rodents alone were about 4-10% in weight of stored grains, and the rate of damage to bags was between 10-26% (El-Lakwah, 1984 and El-Lakwah et al., 1993) and the total quantity of wheat loss (in the various shounas of Principal Bank for Development and Agricultural Credit), were 18769.6 tons during the storage period 1993/94, and its economic value was equivalent to 9.8 million Egyptian Pounds (El-Lakwah and Laborius, 1995) in Egypt.

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