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Distribution Pattern of Commensal Rodents in Shops of Urban Rawalpindi, Pakistan

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Abstract.- Distribution patterns and relative abundance of the commensal murids in different types of shops of urban areas of Rawalpindi, Pakistan were recorded from February to October 2011 using cage traps. A total of 165 rodents (89 *Ratttus rattus*, 68 *Rattus novegicus* and 8 *Mus musculus*) were captured during 955 trap nights (trap success: 0.17). Regression of daily captures on cumulative captures revealed an estimate of 228 rodents from all the sampled structures with an average of 5.18 rats per shop. House rats (*R. rattus*; 54% of captures) were numerically dominant in almost all types of structures sampled, but were not significantly different than the Norway rats (*R. norvegicus*; 41% of captures). The Norway rats are now more abundant than some 20 years ago in the area. Both species of *Rattus* spp. were found together in some shops (36.4%), while they were mostly trapped from the separate shops (63.6%). The sex ratio revealed that males outnumbered the females in both the major species.

Key Words: Commensal rodents, *Rattus rattus*, *Rattus norvegicus*, *Mus musculus*, Norway rat.

INTRODUCTION

Rodentia is the largest mammalian order (42% of all mammals), comprising some 2700 species (Aplin *et al*., 2003) and the pest rodent species have been present in different situations of the urban and rural habitats (Fall and Jackson, 1998; Dolbeer, 1999). These rodent pest species cause severe economic losses, both in rural and urban environments (Buckle *et al.,* 1985; Prakash, 1988; Stenseth *et al.*, 2003). The economic losses are reported in millions of dollars in the countries which have been surveyed (Dolbeer, 1999). As for public health, rodents play an important role in the transmission of diseases. They also act as vectors or reservoirs of a number of pathogens, such as *Salmonella* spp., *Campylobacter* spp., *Leptospira interrogans* and *Toxoplasma gondii* (Meerburg and Kijlstra, 2007; Mushtaq-ul-Hassan *et al*., 2008; Meerburg *et al*., 2009). A permanent epidemiological growth has been recorded in the number of zoonoses bound to rodents (Mills and Childs, 1998).

The house rat (*Rattus rattus*), Norway rat (*Rattus norvegicus*) and house mouse (*Mus musculus*) are the most common commensal rodents, throughout the world (Aplin *et al*., 2003; Cavia *et al*., 2009). The house rat, also called the black rat, has its origin in South East Asia. It is a cosmopolitan species and has spread as a result of international trade (Meehan, 1984). It is purely an indoor species in Pakistan and is mostly confined to the towns and villages, throughout the country (Roberts, 1997). Ahmed *et al.* (1995) reported a heavy population of the house rat (*R. rattus*) in the grain markets of Rawalpindi city but there was no mention of the presence of Norway rat in the area. The house rat is not only a serious pest of food items, it also tends to destroy what it is unable to consume. It also contaminates consumable items with their feces (Mushtaq-ul-Hassan, 1993). Ahmed *et al*. (1995) estimated that on the average, a grain shop contained up to 40 rats and estimated annual loss of 4000 metric tonnes of grain in Punjab (Pakistan). According to Roberts (1997), the Norway rat was thought to have a limited distribution in Pakistan, being confined to the sea port areas but recently it has been reported from Lahore, Faisalabad, Rawalpindi and Islamabad cities (Roberts, 1997; Zareef *et al*., 2009). Information regarding its distribution pattern and abundance is lacking in Pakistan.

The present study attempts to provide some basic information on the distribution patterns of the commensal rodents in different types of shops in Rawalpindi city, where studies are lacking regarding the dispersal pattern and abundance of rodent pests

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in urban environments. The knowledge generated will help in making a decision regarding the implementation of measures for controlling rats in order to protect the food and property.

MATERIALS AND METHODS

Study area

This research study was conducted in different types of shops (grocery stores, rice and other cereal shops, cake oil godowns, sweet shops/bakeries, poultry/meat shops and fruit shops) in different areas of Rawalpindi city (33° 36' N, 73° 04' E) of about 14.6 million people, which is located in northern part of the province of Punjab. The study was conducted from February through October 2011.

Trapping of rodents

Locally available, commercial wire mesh live traps (32 x 12 x 12 cm) were used for capturing of the commensal rodents. The traps were baited with fresh seasonal vegetables and/or fruits, which are readily acceptable by the commensal rats. At each locality, 4 - 5 shops were selected randomly (and as per willingness of the shopkeepers) for indoor trapping. At each shop, fixed numbers of traps (4 – 8, depending upon the surface area) were set for 4-6 nights, consecutively. Traps were placed on the floor against the wall where signs of rodent movements were recorded; shopkeepers did not want traps set off the floor. The captured specimens were removed early the following morning. Each specimen was euthanized for the body measurements and species identification. The body measurements (taken in mm) were the head and body length, tail length, ear length and hind foot length, while the body weight was taken in g. Aplin *et al*. (2003) was followed for identifying the captured specimens.

Relative abundance and distribution

The relative abundance of the commensal rodents was estimated by using the method of regression of daily captures on cumulative captures (removal regression method; Blower *et al*., 1981). In this method, daily decline in rodent captures was plotted against the cumulative captures and a regression line was worked out using the MS Excel programme 2007. The intercept point of regression line with X–axis gave the estimated population. The variance of regression estimates was calculated following Otis *et al*. (1978); 95% confidence interval (C.I.) was calculated as: N (estimated population) ± 1.96 x standard error. Populations of *R. rattus* and *R. norvegicus* from the different sites were compared using Student's t test (Steel and Torrie, 1980).

RESULTS AND DISCUSSION

A total of 165 rodents were captured from 44 different types of shops (3.75 per shop) using 955 trap nights with a trap success of 0.17 (Table I). The highest rodent population was recorded from general stores of Sadiqabad followed by general stores of Saidpur road, rice/pulses shops of Ganj Mandi, rice/pulses shops of Pir Wadhai area, sweet shops/bakeries of Tench Bhatta, poutry / meat shops of Kohinoor mills area, cake oil godowns of Ganj Mandi, rice/pulses shops of Gawal Mandi, fruit shops of Adiala road, while the minimum population was recorded from the general stores of Ketchery/Scheme III. Regression of daily captures on cumulative captures (Fig. 1) revealed a negative

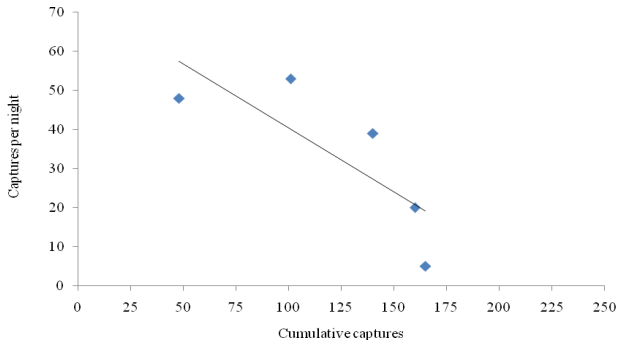

Fig. 1. Estimate of the population size of indoor rodents in six different types of structures located in different parts of Rawalpindi city, during 2011.

and significant correlation, between the captures over time (nights) ($y = -0.32x + 73.2$; $R^2 = 0.63$). The total population size was estimated to be 228 (C. I. = 210.24–245.76) commensal rodents from the 44 shops (5.18 per shops; C. I. = 4.78–5.58).

Table I.- Distribution pattern and relative abundance of commensal rodents in different types of the shops situated in various localities of Rawalpindi city, during 2011.

Shop type	Locality	Timing of trapping	No of shops	Total trap Nights	Trap success	Captures per night						No. of rats captured per locality	No. of rats captured per structure
						1	2	3	4	5	6		
Grocery stores	Sadiqabad	April 2011	4	100	0.22	6	6	6	3	1	0	22	5.5
	Saidpur road	June 2011	5	110	0.18	6	9	5	0	0	-	20	4.00
	Scheme III/Ketchery	July 2011	4	90	0.08	3	2	2	1	0	-	8	2.00
	Total	-	13	300	0.13	15	17	13	4	1	0	40	3.07
Rice and pulses shops	Pir Wadhai area	May 2011	4	90	0.21	6	6	4	3	0	-	19	4.75
	Ganj Mandi	February 2011	5	95	0.21	8	7	4	1	0	-	20	4.00
	Gawal Mandi	March 2011	4	80	0.15	4	3	2	1	2	0	12	3.00
	Total	-	13	265	0.19	18	16	10	5	2	0	51	3.92
Sweet shops/ Bakeries	Cantt/Tench Bhatta	August 2011	4	90	0.21	3	7	6	3	0	0	19	4.75
Cake oil godowns	Ganj Mandi	February 2011	5	105	0.13	4	4	4	1	1	-	14	2.80
Poultry/meat shops	Kohinoor mills area	August 2011	4	85	0.22	5	5	3	5	1	-	19	4.75
Fruit shops	Adiala road	October 2011	5	110	0.10	3	4	3	2	0	0	12	2.40
Grand Total			**44**	**955**	**0.17**	**48**	**53**	**39**	**20**	**5**	**0**	**165**	**3.75**

The relative abundance of the house rat (n = 89) was greater than the Norway rat (n = 68), but was not statistically different (t = 1.51, df =1, P = 0.08). Only eight specimens of *M. musculus* could be captured in the current trials. It was also observed that there was overlapping of both the *Rattus* spp. in some shops (16 out of 44 shops; 36.4%) while in other cases, both the species were recorded from the separate shops (63.6%). *Rattus rattus* (53.94%) had a higher relative proportion than *R. norvegicus* (41.21%) and *M. musculus* (4.84%; Table II). As regards the sex-ratio of the captured specimens, males were more frequently captured than the females, in all the three species (sex ratio = *R. rattus*: 1.0:0.5; *R. norvegicus*: 1.0:0.7; *M. musculus*: 1.0:0.6) and in all kinds of structures sampled.

Table II.- Relative (%) proportion of commensal rodents in the samples taken from different shops in Rawalpindi city Miscellaneous structures consists of bakeries/sweet shops, cake oil godowns, poultry/meat shops and fruit shops.

	R. rattus	*R. norvegicus*	*M. musculus*
Grocery stores	23	25	5
Rice/pulse shops	26	17	3
Miscellaneous structures	40	26	0
All structures	89	69	8

According to Brooks *et al*. (1994) Rawalpindi grain markets consisted of several hundred dealers, mostly doing the business of rice, cereals and groundnut and none of the shops was rat proof. A similar situation was observed during the current study; shops are heavily loaded with the goods, which provided excellent hiding places for the commensal rodents, in addition to the food resources. Another problem for the increase of rodent population could be the lack of sanitation, improper stored food materials and the deposition of refuse. Similar observations have also been reported by Childs *et al*. (1998), Lambropoulos *et al*. (1999) and Pocock *et al*. (2004) in different countries of the world. The nature and severity of the rodent problem would be directly associated with population and its localization. The transmission of disease to human would be most likely to occur when the focus of rodent infestation is close to the human dwellings (Castello *et al*., 2003).

The Norway rat has been recorded from Rawalpindi recently (Zareef *et al*., 2009); but no information about the distribution pattern of this species was available. Our study confirmed that *R. norvegicus* is present in many locations in the city in similar abundance to *R. rattus*. It indicates a rapid dispersal potential of this rat species in the current study area; it was not found in the area almost 20 years back (Ahmed *et al*., 1995). Norway rats may dominate the house rat, which will be more dangerous, as Norway rat is more voracious, dirtier and heavier than all other commensal rodents (Brooks *et al.,* 1990). The current study provided the basic information regarding the distribution and abundance of *Rattus* spp. in the urban environments of Rawalpindi. Further studies are required to investigate the impact of these rats on the human life.

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