

SMALL MAMMALS' DIVERSITY OF SELECTED VILLAGES OF POTHWAR (PUNJAB), PAKISTAN

A. H. Faiz^{1*}, F-I-Abbas¹, Z. Ali² S. Nadeem¹, M. Mushtaq¹ L. Zahra³ and L. Safder

¹Bio Resource Research Centre (BRC) Islamabad

²Environmental Health & Wildlife, Department of Zoology, University of the Punjab, Lahore-54590, Pakistan

³Department of Zoology, Women University, Bagh

Corresponding Author's Email: sabulhussan@gmail.com

ABSTRACT

Distribution of the rodents in different areas of pothwar regions was recorded from January to October, 2014 using snap traps. A total of 179 rodents viz. *B. bengalensis* (n = 2), *M. musculus* (n = 50), *M. booduga* (n = 10), *M. ameltada* (n = 3), *S. smurinus* (n = 10), *G. ellioti* (n = 2), *T. indica* (n = 22), *R. rattus* (n = 50), *R. norvegicus* (n = 30) were captured during 468 trap nights with (trap success: 0.38). Simpson Index was (0.2), Shannon Winner Index (2.54), and Berger-Parker Dominance Index was (0.27). Averages of 3.3 rats per farm house were recorded with Rodent Index values (0.011).

Key words: biodiversity, *Millarda meltada*, *Bandicota bengalensis*, Rodent index.

INTRODUCTION

With urbanization, natural habitats are being replaced by urban areas and the process of urbanization causes modification of habitats, alter natural ecosystem into urban ecosystem (Morello *et al.* 2000). The development of urban ecosystems produces anthropogenic habitat due to the newly created patchiness in the landscape which alter the structure and dynamics of biological communities (plant, bird and insect communities) and homogenized environment with similar species (Shochat *et al.* 2004). Urban ecosystems support limited population of animals and plants which provide ecosystem services (Morello *et al.* 2000). The fauna of urban ecosystem is poorly studied and animal community structure depend on local landscape conditions (Wiens *et al.* 1997). Rodents are the largest group of animals and are represented by 29 families and 2700 species which are widely distributed in different parts of the world (Aplin *et al.* 2003). Worldwide distribution of rodents is due to their small size and short breeding cycle with diverse food habits (Wolf and Sherman, 2007). Rodents in urban and rural areas have been present in different situations in the world and with few ever studies on small mammal communities (Delattre *et al.* 1996). Muridae is the largest family of rodents in Pakistan which is represented by 43 different species, out of which 12 are confined to Pothwar region (Robert, 1997).

Major species of commensal rodents reported are *Mus musculus*, *R. rattus* and recently *R. norvegicus* (Zareef *et al.* 2009). In village areas, during drought conditions, rodents come out of houses and feed on grains however when food is deficient in fields, these rodents move indoor (Parshad, 1989). When plenty of food is

available, the population of rodents goes to increase because rodents have a high breeding rate and many show periodic increase in the population (Pradhan and Talmale, 2011). Rodents can be used as environmental indicators, are important members of terrestrial food chains and their distribution indicates health of biotic systems. The present study was therefore planned to estimate population size, distribution and species composition in rural areas of farm houses of Pothwar to predict biodiversity of small mammals.

MATERIALS AND METHODS

The Pothwar Plateau is northern part of Punjab (32° 33' and 34° 3' N, 71° 89' and 73° 37' E). It is a large expanse of rugged land, bounded on the north by the Hazāra Hills and on the south by the Salt Range residual hills, with deep ridges. Topography consists of hard, resistant rock and steep hills. Its elevation varies from 1,000 to 2,000 ft. The climate of the area is semiarid with less than 25 centimeters (cm) of rainfall per year. The greatest peaks in the Pothwar area are located in the Hazara Range where elevations commonly exceed 1,200 m above sea level. The lowest elevations in the area are associated with the Indus and Jhelum River Plains, where river levels are lower than 300 m. plateaus, flood plains.

Trapping of Rodents: The small mammals were trapped from randomly selected farm houses of five district of pothwar with the help of steel snap traps (17.5cm x 8.5cm) baited with bread with application of vegetable ghee. For trapping the rodents, fixed numbers of traps (3 traps per structure) were set farm houses. Trapping was done for a period of 6 nights long. The rat and mouse traps were set in 2:1 ratio. Each captured specimen was

assigned a field number and put in ice box identified to the species level following keys (Roberts 1997; Aplin *et al.* 2003).

Population estimation: The population size of commensal rodents in different types of structures of the Pothwar rural areas farm houses was estimated by using the method of regression of daily captures on cumulative captures (Blower *et al.* 1981). A graph is plotted between daily capture and cumulative capture to get regression line. 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) and approximate 95% confidence limits will be calculated as under:

$N \pm 1.96 \times S. E.$, where, N = estimated population and S. E. = Standard Error.

Rodent Index: Rodent index = No. of mice caught in all traps ÷ No. of useable traps ÷ No. of trapping days X 12 X 7 by following Karsten (1997)

Simpson's Diversity Index: To find number and relative abundance of species in sampled community Simpson diversity index (1949) was applied. $D = \sum n(n-1) / N(N-1)$.

Shannon – Wiener diversity index: To find the proportion of each species in sampled community was applied Shannon wiener index (1949) Diversity index = $H = - \sum P_i \ln P_i$ where $P_i = S / N$

Berger-Parker Dominance Index: The dominance of species in sampled community was calculated by Berger-Parker Dominance Index equation (1970). $d = N_{max} / N$

RESULTS AND DISCUSSION

A total of 179 rodents were captured during 468 trap nights (Table 1), with a captures rate 0.38 per night. The maximum number of rodents was captured from sampling site Toba while the lowest population was trapped from sampling site Khunda and Chabb villages. Nine species of rodents, viz., the house rat (*Rattus rattus*), house mouse (*M. musculus*), pygmy mouse (*M. booduga*), soft furred field rat (*M. melstada*) and Indian Bush Rat (*G. ellioti*), common house shrew (*Suncus murinus*), Norway rat (*R. Norvegicus*), Indian mole-rat (*B. bengalensis*), field rat (*T. indica*) were recorded from farm houses) of 14 randomly selected villages of the rural Pothwar (Table 2).

The distribution of species is indicated by trapping of sample in particular village (Table 2). The species (*B. bengalensis*) was trapped from four villages. *R. rattus* and *M. musculus* was reported from 12 villages and *M. booduga* were reported from the two village. *M. melstada*, *R. norvegicus*, and *Tetra indica* were trapped from two villages. The species (*S. murinus*) from three villages, and *G. ellioti* from trapped from one village (Table 2).

Table 1. Overall trapping Summary Farm houses trapping different villages of Pothwar

site		farm houses	no. of nights	Capture per night						Total	Capture per night	Trap success%
				1	2	3	4	5	6			
Jhelum	Toba	1	36	6	4	3	3	2	1	19	0.53	52.8
	Mandhar	1	36	3	4	3	3	3	2	18	0.50	50.0
Chakwal	Pipli	1	36	6	2	6	1	1	1	17	0.47	47.2
	Bekhri	1	36	3	2	3	3	4	1	16	0.44	44.4
Rawalpindi	Daultala	1	36	3	2	3	3	1	3	15	0.42	41.7
	Dhudial	1	36	3	1	3	1	3	3	14	0.39	38.9
	Kallar syedan	1	36	3	2	3	3	2	0	13	0.36	36.1
Islamabad	Nilore	1	36	3	2	3	3	0	2	13	0.36	36.1
	Tarlai Kalan	1	36	3	2	3	3	0	1	12	0.33	33.3
Attock	Qutbal	1	36	3	2	3	3	0	0	11	0.31	30.6
	Khunda	1	36	3	2	3	2	0	0	10	0.28	27.8
Jand	Pindigheb	1	36	3	2	3	3	0	0	11	0.31	30.6
	Chabb	1	36	3	2	3	0	2	0	10	0.28	27.8
Total		13	468	45	29	42	31	18	14	179	0.38	38.2

Table 2: Distribution of small mammals in fourteen villages

Habitat type	Species name	Study villages													
		Khunda	Chabb	Padhrar	Kot Qazi	Pind Gheb	Tobah	Bekhri	Padhrar	Daultala	Gulyana	Qutbal	Mithial	Tarlaikalan	Nilor
Farm houses	<i>Bandicota bengalensis</i>	X	X	√	X	X	√	√	√	X	X	X	X	X	X
	<i>Mus musculus</i>	√	√	√	√	√	√	√	√	√	√	√	√	X	X
	<i>Mus booduga</i>	X	x	x	√	√	x	√	√	x	X	X	x	X	X
	<i>Millarda meltada</i>	X	x	x	X	X	X	x	√	√	X	X	x	X	X
	<i>Suncus murinus</i>	√	x	√	x	X	X	x	√	x	X	X	x	X	X
	<i>Golunda ellioti</i>	X	x	x	x	x	√	x	x	√	x	x	x	x	x
	<i>Tetra indica</i>	X	x	√	x	x	√	x	x	x	x	x	x	x	x
	<i>Rattus rattus</i>	√	√	√	√	√	√	√	√	√	√	√	√	X	X
	<i>Rattus norvegicus</i>	X	x	x	x	x	x	x	x	x	x	x	x	√	√
GPS coordinates															
	Khunda	Chhab	Padhrar	Kot Qazi	Pind ghaib	Tobah		Bekhri		Daultala		Gulyana			
"N	33°27'41.82	33°14'29.64	32°39'17.03	32°49'15.61	33°13'31.61	32°34'25.89		32°57'41.00		33°11'34.81		33°12'11.45			
"E	72°23'45.31	71°53'51.37	72°29'40.91	72° 0'29.52	72°16'27.98	72°49'15.92		72°52'32.91		73° 8'25.80		73°16'7.31			
	Qutbal	Mithial	Tarlai kalan	Nilor											
"N	33°35'46.47	33°31'9.62	33°38'27.62	33°39'16.01											
"E	72°45'41.03	72°15'6.89	73° 9'2.08	73°14'57.45											

Regression of daily captures on cumulative captures revealed a negative and significant correlation, between the captures over time (nights) ($y = -0.058x + 20.00$; $R^2 = 0.981$). The total population size was estimated to be 350 (C. I.95%). The relative abundance of species are

Mus musculus and *Rattus rattus* has same value 27.93% followed by *Rattus norvegicus* 17%, *Tetra indica* 12%, *Suncus murinus* 6%, *Millarda meltada* 2%, and *Golunda ellioti* 1% (Table 3, fig 1).

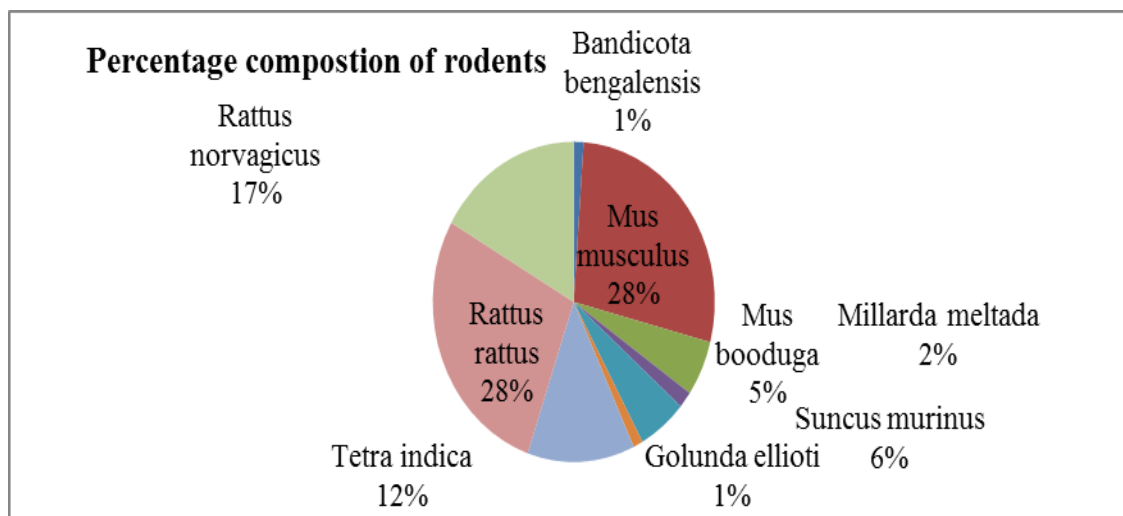


Fig 1: Percentage composition of rodents

The calculated values of different diversity index are Simpson Index (0.2), Shannon Winner Index (2.54) and Berger-Parker Dominance Index (0.27)

(Table 3). The distribution of Norway rat has not been reported in rural of Islamabad.

Table 3. Species Composition, relative abundance and diversity indices

Species	N	Relative abundance	Diversity Indices	Values
<i>Bandicota bengalensis</i>	2	1.12	Simpson index	0.2
<i>Mus musculus</i>	50	27.93	Shannon index	2.54
<i>Mus booduga</i>	10	5.59	Berger-Parker Dominance Index	0.27
<i>Millarda meltada</i>	3	1.68		
<i>Suncus murinus</i>	10	5.59		
<i>Golunda ellioti</i>	2	1.12		
<i>Tetra indica</i>	22	12.29		
<i>Rattus rattus</i>	50	27.93		
<i>Rattus norvegicus</i>	30	16.76		

Our study revealed that *R. norvegicus* was present in rural areas of Islamabad city (Nilor). The (*R. norvegicus*) is exotic species, dispersal potential and dominate other native rodent fauna (Brooks *et al.* 1990). *B. bengalensis* is first time reported in rural farm houses in Pakistan, although its distribution in houses is reported in many studies in India (Chakraborti *et al.* 1992, Jain *et al.* 1993). *G. ellioti*, *M. ameltada*, *T. Indica* are field rat but these rats are trapped from farm houses. The farm houses are located in field area and without free boundary walls and allow free movement of rodents into field and farm houses. Rodent Index values (0.011) indicate low population of rodents in these areas. Small mammals are important food source for reptiles, mammals and predator

bird species (Mahmood ul Hassan *et al.* 2007). The flora and fauna of each and every landscape play a crucial role in the dispersal, richness and preservation of species (Rushton *et al.* 2004). In the circumstances of food shortage, sowing and harvesting remove shelters, food and tillage destroys burrows, the small mammals dwelling in agricultural landscapes are at the risk of several risks. During the last decades, the escalation of agriculture activities throughout the world has substantially reduced the carnivore populations and their predators (Tew and MacDonald, 1993). Thus, the intensification in the agricultural activities is the reduction in the habitat of small mammals. In this regard, the community should be educated to save other

predators by saving biodiversity of small mammals (Aschwanden, 2005). The practice of subsidies should be boosted if harbor areas show a ridiculous mammalian biodiversity (Oppermann and Gujer, 2003). Field margins in agriculture land and the wild plants on field margin can serve as refuge habitat and as a food source of small mammals (Shore *et al.* 2005). However, field margin plants are burnt and used for fuel purposes in Pakistan which consequently results in the eradication of the population of small mammals. To save and establish carnivore in food chain awareness program should be lunched.

REFERENCES

- Aplin, K.P., P.R. Brown, J., Jacob, C.J Krebs, and G.R. Singleton (2003). Field methods for rodent studies in Asia and the Indo-Pacific. ACIAR Monograph No 100: 223.
- Karsten, A.W (1997). Pork Industry Handbook, PIH107.
- Aschwanden, J., S Birrer and L. Jenni (2005). Are ecological compensation areas attractive hunting sites for common kestrels (*Falco tinnunculus*) and long-eared owls (*Asio otus*)? - Journal of Ornithology 146: 279- 286.
- Berger, W. H and F.L. Parker. (1970). Diversity of planktonic Foraminifera in deep sea sediments. Science 168: 1345–1347.
- Blower, L. G., L. M. Cook, and J. A. Bishop (1981). Estimating the size of animal populations. George Allen and Unwin Ltd. London.
- Brooks, J. E., E. Ahmad, I. Hussain, S. Munir and A. A Khan (1990). A training manual on vertebrate pest management. USAID/DWRC/PARC, Islamabad, Pakistan, pp. 206.
- Chakraborty, S. (1992) .The Indian ‘mole-rat’ or lesser bandicoot rat, *Bandicota bengalensis* (Gray). In: I. Prakash and P.K. Ghosh (eds) Rodents in Indian Agriculture. pp. 173–92, Jodhpur: Scientific Publishers.
- Delattre, P., Giraudoux, P., Baudry, J., Quéré, J.P. and Fichet, E. (1996). Effect of landscape structure on Common Vole (*Microtus arvalis*) distribution and abundance at several space scales. Landscape Ecol. 11: 279–288
- Jain, A. P., R. S. Tripathi, and B. D. Rana, (1993) Rodent Management: The State of Art, Technical Bulletin No. 1, Indian Council of Agricultural Research, New Delhi, 38 pp.
- Mahmood-ul-Hassan, M., M. A. Beg and M. Mushtaq-ul-Hassan (2007). Locality related changes in the diet of the Barn Owl *Tyto alba* in agro-ecosystems of central Punjab, Pakistan. The Wilson J. Ornith., 119: 479-483.
- Morello, J., G.D. Buzai, C.A. Baxendale., A.F Rodriguez., S.D., Matteucci, and R.E., Godagnone (2000). Urbanization and the consumption of fertile land and other ecological changes: the case of Buenos Aires. Environ. Urbaniz. 12, 119–131.
- Oppermann, R. and H.U. Gujer (2003). Artenreiches Grünland, bewerten und fördern - MEKA und ÖQV in der Praxis. - Ulmer, Stuttgart, 199 pp.
- Otis, D. L., K. P., Burnham, G. C. White and D. R. Anderson (1978). Statistical inference from capture data on closed animal populations. Wildl. Monogr. 62: 1-135.
- Parshad, V. R. (1989). Ecological and agricultural considerations in the management of rodent pests. 5th International Theriological Congress, Rome, Italy.
- Pradhan, M. S and S. S Talmale (2011). A Checklist of valid Indian rodent taxa (Mammalia: Rodentia) (updated till May, 2011-online version), 1-13pp.
- Roberts, T. J (1997). Mammals of Pakistan. Oxford University Press, Karachi. pp. 525.
- Rushton, S. P., S. J., Ormerod, and Kerby, G (2004). New paradigms for modelling species distributions? J. Appl. Ecol. 41 (2): 193–200.
- Shannon, C., E. and W. Weaver (1949). The mathematical theory of communication Univ Illinois Press Urbana 117 p.
- Shochat, E., W.L Stefanov, M. E. A. Whitehouse and S. H. Faeth (2004). Urbanization and spider diversity: influences of human modification of habitat structure and productivity. Ecol. Appl. 14 (1): 268–280.
- Shore, R.F., W.R. Meek, T.H. Sparks, R.F. Pywell and M Nowakowski (2005). Will Environmental stewardship enhance small mammal abundance on intensively managed farmland? - Mammal Review 35: 277-284.
- Simpson, G. G (1964). Species density of North American recent mammals. Syst. Zool. 13: 5773
- Tew, T. E and D. W. MacDonald (1993). The effects of harvest on arable wood mice *Apodemus sylvaticus*. – Biological Conservation 65: 279-283.
- Wiens, J. A. 1997. Metapopulation dynamics and landscape ecology. Pages 43-62 in Metapopulation biology: ecology, genetics, and evolution (I. A. Hanski and M. E. Gilpin, Editors). Academic Press, San Diego, CA, USA.
- Wolf, J and P.W. Sherman, (2007). Rodent Societies: An ecological and evolutionary perspective. Chicago, University of Chicago press. 610 pp.
- Zareef, S., S. Nasim, S. Kalsoom, S. F. Jabeen, Z. Javed, S. M. Nadeem, and M.A. Beg, (2009). Occurrence of the Norway Rat (*Rattus norvegicus*) in Rawalpindi and Islamabad. Pakistan J. Zool. 41: 415-416.