



Short Communication

A Baseline Study on the Diversity of Rodents in Rural Mountain Areas of the Gilgit District, Pakistan

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ABSTRACT

Rodents are the largest group of small mammals and are abundantly distributed in diverse types of habitats, all over the world. In Pakistan, 43 species of rodents have been reported from different types of environmental conditions and habitats, the majority being rats and mice. The study was conducted in rural areas of district Gilgit, which is a representative of the northern mountainous areas of Pakistan. Locally made metallic snap rat traps and mouse traps were used to trap rodents in different types of habitats in five specific study sites, viz. Haramosh, Bagrot, Danyore, Jalalabad and Nomal rural areas for three consecutive nights and the trap index was calculated. A total of three (3) species and 110 individuals of rodents (*Rattus turkestanicus*, *Mus musculus* and *Apodemus rusiges*), all belonging to the family Muridae were recorded from the study area in 2588 trap nights. *Rattus turkestanicus* was found to be more dominant with $D=0.762$, followed by *Mus musculus* with $D=0.01$ and *Apodemus rusiges* with $D=0.001$. In general, rodent diversity on the Simpson Scale was 22% and on the Shannon Scale it was 52%. The captured specimens were brought to the laboratory of the Department of Zoology of the PMAS Arid Agriculture University, Rawalpindi and the total body weight, body length, head and body length, tail length, ear length, hind foot length and the sex of the sample were recorded and identified at the species level. The proposed study provides baseline data on the faunal diversity of small rodent fauna in the study area.

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Authors' Contribution

TMM and MM contributed to the idea, and research design. UR conducted the field surveys. SAH, R, and HA developed the zero draft of the SC. RT performed the statistical analysis. SA contributed to finalizing the draft and correspondence with the editor of the journal.

Key words

Small mammals, Snap traps, Mouse traps, Rodents, Specimen

Mammals are the most diversified group of vertebrates and those mammals which are having less than 1 kg of the total body weight are generally called as small mammals and are generally include the rats, mice, marsupials, shrews, and bats (Gopal and Krishnamurthy, 1993). Rodents are the largest mammalian order comprising about 2700 genera and 28 families 42% of all mammals are rodents (Alpin *et al.*, 2003).

The rodents occupy a wide range of natural habitats, including grasslands and forests, as well as the human world of agricultural landscapes, villages and even the cities. Most of the rodent species are very rapid breeders

and represent a highly significant amount of biomass in the natural habitats and so play a very important role in the food webs, both as consumers of vegetation and for food source for many of the large predators. The success of these mammals, in part, is due to their ability to exploit new food resources, habitats, and brief reproductive cycles (Grzimek, 2003). Rodents, as seed predators, consumers of invertebrates, small vertebrates, and their eggs, and as a prey for carnivorous snakes, mammals, and birds, play a major role in the ecology of almost all tropical habitats. (Gascon *et al.*, 1999; Pardini, 2004). In Pakistan, 43 species of rodents have been reported from different types of environmental conditions and habitats, the majority being rats and mice. Although 15 species of rodents in Pakistan are regarded as pests of different levels, only 5 of them are of great importance and cause damage to field crops, including rice, wheat, sugarcane, and groundnuts, and are also responsible for losses in stored products. Furthermore, some commensal rodent species are also responsible for the transmission of ectoparasites and endoparasites in humans and their livestock (Ali *et al.*, 2003).

Studies are lacking on the diversity of rodents in the

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rural environment of Gilgit district, which is an important ecological part of Pakistan. Keeping in view, the current study was designed to explore the diversity of the rodents in rural areas of district Gilgit. The specific objectives of the proposed study were to explore the diversity and abundance of small rodents in the rural areas of the Gilgit district.

Materials and methods

Gilgit-Baltistan, formerly called the Northern Areas of Pakistan, falls at the boundary between the Palearctic and Oriental zoogeographical realms (Sindaco and Jerem, 2008), and is the junction point of the world's three greatest mountain ranges viz., Himalayas, Karakoram, and Hindu-Kush (Khan, 2004). The Karakorum-Pamir Mountain area, located in the extreme north of Gilgit-Baltistan, is highly rugged, remote, and challenging. Hence, despite having bio-geographically unique features, the area is poorly studied for biodiversity (Xu *et al.*, 2009). This research study was conducted from December 2012 to July 2013 in rural areas of District Gilgit (36° 22 N, 74° 14 E) to investigate the occurrence, abundance, and distribution of different rodent species in the villages of Haramosh, Bagrot, Jalalabad, Danyore, and Nomal. The total area of the district Gilgit is 3991 km² and total population of district is 145,272 individuals (GoP, 2000).

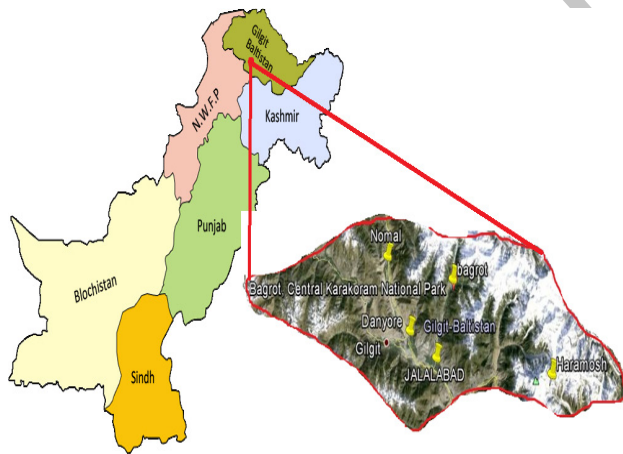


Fig. 1. Map of Pakistan showing the specific study areas in the district Gilgit.

The trapping of rodents was carried out at five study sites viz., Haramosh, Bagrot, Danyore, Jalalabad, and Nomal villages with GPS readings taken at each site. Locally made metallic snap rat traps (17 x 9.5cm) and mouse traps (11.5 x 4.5cm) were used for trapping of rodents in the rural areas. In each village, traps were placed at two different sites, that is, houses and fields in

a ratio of 4:2 and 14:7 rat and mouse traps, respectively. The traps were applied in a 2:1 ratio (2 rat and 1 mouse trap). The traps were baited with peanut butter or bread soaked in vegetable oil, depending upon the availability in the local areas. At each site, a fixed number of traps were set in the evening, collected early the following morning, and processed on site. In the field, traps were placed on the ground along linear transects (trap lines) for four consecutive nights in each selected habitat.

The captured specimen was assigned a number on the tag, along with the relevant information like locality, date of capturing, sex of the animal etc. The samples were brought to the laboratory of the Department of Zoology of the PMAS Arid Agriculture University, Rawalpindi, for further processing. After taking the body weight in grams of captured rodents with a spring balance, different measurements like total body length (BL), head and body length (HBL), tail length (TL), ear length (EL), hind foot length (HFL), and the sex of the specimen were recorded to identify the species of the specimen according to Aplin *et al.* (2003). The skull was cleaned from the skin and tissues by boiling, allowing species identification by examination of the structure of the tooth and skull. The reproductive condition was externally evaluated. Females were considered sexually active if the vagina was perforated, and in males if the testes descended, it is called scrotal. (Wirminghouse and Perrin, 1993; Sejoie, 1999).

The diversity of different small mammalian species on the Simpson and Shannon indices was worked out according to Simpson (1949) and the Shannon-Weiner function (Odum, 1975). Mean, standard deviation, and standard error were applied for the data belonging to the same sex. The trapping campaign was carried out for four consecutive nights and the trap index was calculated as follows.

$$\text{Trap index} = \frac{\text{Total no. of small mammals}}{\text{No. of trapping nights} \times \text{No. of traps}} \times 100$$

Results and discussion

A total of 3 species and 110 individuals of rodents were recorded in 2588 trap nights during the study period extending from December 2012 to July 2013 from five different villages in the Gilgit district of Gilgit-Baltistan (Pakistan). Out of them, one species belonged to *Rattus* (*R. turkestanicus*), and two species belonged to *Mus* (*M. musculus* and *Apodemus rusiges*). Most of the individuals were caught during the winter than in summer. The most abundant species was found to be *R. turkestanicus* (Turkestan rat). Ninety-six specimens of this species were collected from houses and the field. Eleven *M. musculus* specimens were captured during the study period. Among them, only one individual was captured from the field and

all others were collected from houses. Three *A. rusiges* samples were also collected from houses, although it is called a field mouse and lives in the field, but in the study area, it was collected from houses.

A. rusiges is a medium-sized mouse with a bicolored tail roughly equal to head and body length. There is variation in the coloration of the fur. Some specimens from the Murree Hills and Hazara district showed a middorsal strip of darker hairs. This dark strip was not seen in any specimen collected from Gilgit and Chitral districts (Roberts, 1997) while in the present study it was noticed that there was no dorsal strip of dark dorsal hairs in specimens collected from rural areas of district Gilgit. Only three specimens of *A. resiges* (two females and one male) were found in the summer and winter survey. The house mouse (*M. musculus*) is a commensal rodent, which is closely associated with human activities. Of the 11 *M. musculus* specimens, four were captured during winter and seven during the summer season.

Regarding the general comparison of the capture of house and field rodents during the winter season, the highest capture of rodents was recorded from Haramosh village (21 individuals), followed by 13 rodents from Nomal and three from Danyore village, and no specimens were caught in the field of these two villages. Seventeen rodents were trapped from Jalalabad out of which only one individual was captured from the field. Eleven specimens were collected from Bagrot, nine from houses and only two from the field area (Fig. 2).

The results on the diversity of small rodents in rural habitats (Human dwellings and fields) of the Gilgit district revealed that three species of rodents were recorded, all belonging to the family Muridae. Simpson and Shannon diversity index was applied to estimate the diversity index of all recorded species (Table I). By using Simpsons (1949) equation of C (index of dominance), *R. turkestanicus* with a value of 0.762 was more dominant than the other two species. In general, rodent diversity on the Simpson Scale was 22% and on the Shannon Scale, it was 52% (Table I).

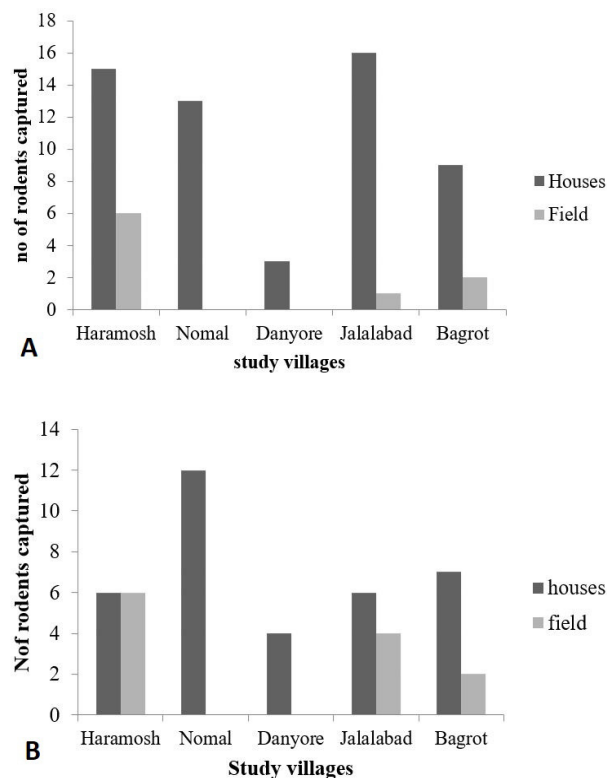


Fig. 2. Number of rodents captured from houses and fields in the winter (A) and summer (B) seasons of the Gilgit district during 2012-13.

Conclusion

According to the current results, the Turkistan rat is the dominant rat of the area, in both the types of habitats, i.e., human dwellings and the field area. The other species, i.e., *M. musculus* and the *A. rusiges* are having minor populations. Studies are lacking on the distribution and diversity of rodents in Pakistan, in general, and specifically in the Gilgit district, so there is an urgent need to study the dietary habits, reproductive patterns, and population status of Turkistan rats in the area, which will provide the basic information about the species.

Table I. Diversity index of rodent species trapped from five different villages in the Gilgit district during 2012-13.

Species	No of rodents	p_i	Simpsons index $D=1/p_i^2$	Shannons index $p_i (\log p_i) \times S$
<i>Rattus turkestanicus</i>	96	0.873	0.762	0.1544
<i>Mus musculus</i>	11	0.1	0.01	0.3
<i>Apodemus rusiges</i>	3	0.027	0.001	0.127
Total	110	0.91	$D=0.773$ $1-D=0.22$	0.581

$$E=H/\log S=0.581/1.099=0.528$$

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Ethical statement and IRB approval

In conducting this research on rodents in Gilgit-Baltistan, ethical considerations were prioritized to ensure the humane treatment of the animals involved. The study strictly adhered to ethical guidelines and principles, with approval obtained from the relevant local authorities. The welfare of the rodents was safeguarded, and all procedures were carried out in accordance with ethical standards to minimize any potential impact on the animals' well-being.

Statement of conflict of interest

The authors have declared no conflict of interest.

References

- Aplin, K.P., Brown, P.R., Jacob, J., Krebs, C.J., and Singleton, G.R., 2003. *Field methods for rodent studies in Asia and the Indo-Pacific*. ACIAR Monograph No., 100, pp. 223.
- Ali, R., Mahdi, S.F. and Khan, M.F., 2003. *Pak. J. Biol. Sci.*, **6**: 1050–1053.
- Gascon, C., Lovejoy, T.E., Bierregaard, R.O.J., Malcolin, J.R., Stouffer, P.C., Vasconcelos, H.L., Laurance, W.F., Zimmerman, B., Tocher, M. and Borges, S., 1999. *Biol. Conserv.*, **13**: 2567-2586.
- GOP, 2000. *District census report of Gilgit*. Statistics Division, Govt. of Pakistan, Islamabad, Pakistan.
- Gopal, B. and Krishnamurthy, K., 1993. Wetlands of South Asia. In: *Wetlands of the world* (eds. D.F. Whigham, D. D. Kyjova and S. Hejny), Kluwer Academic Publishers, Netherlands, pp. 345-414.
- Grzimek, B., 2003. *Grzimek's animal life encyclopedia: Mammals* (eds. N. Schlager, D. Olendorf and M. McDade). Order: Rodentia, Vol. 16. Farmington Hills, MI.
- Khan, M.S., 2004. *Pakistan J. Zool.*, **5**(Suppl.): 1–25.
- Pardini, R., 2004. *Biodiver: Conserv.*, **13**: 2567-2586. <https://doi.org/10.1023/B:BIOC.0000048452.18878.2d>
- Odum, E.P., 1975. *Ecology*. Holt Rinehart and Winston, London, UK.
- Rajab, A., Mahdi, S.F., and Khan, M.F., 2003. *Pak. J. Biol. Sci.*, **6**: 1051-1053. <https://doi.org/10.3923/pjbs.2003.1051.1053>
- Roberts, T.J., 1997. *The mammals of Pakistan* (Revised eds.). Oxford Univ. Press, Karachi, Pakistan, pp. 525.
- Sejoe, T.B., 1999. *Small mammals of the mixed upland African teak woodland habitat*. Agricultural University of Norway, Chobe National Park, Northern Botswana.
- Sindaco, R. and Jeremčenko, V.K., 2008. *The Reptiles of the Western Palearctic*. 1. Belvedere, Latina.
- Simpson, G.G., 1949. *The meaning of evolution*. Yale University Press.
- Wirminghouse, J.O., and Perrin, M.R., 1993. *J. Zool. Lon.*, **229**: 303-318. <https://doi.org/10.1111/j.1469-7998.1993.tb02638.x>
- Xu, J., Grumbine, R.E., Shrestha, Eriksson, M., Yang, X., Wang, Y. and Wilkes, A., 2009. *Conserv. Biol.*, **23**: 520–530. <https://doi.org/10.1111/j.1523-1739.2009.01237.x>