

## A Critical Analysis of *Capra falconeri cashmiriensis* Habitat from Kazinag National Park of Jammu and Kashmir, India

Suhail A. Lone<sup>1</sup>, Milind Kale<sup>2</sup> and Ashwin Atkulwar<sup>3</sup>

<sup>1</sup>Research Scholar, Department of Zoology, Govt. Vidarbha Institute of Science and Humanities, Amravati, Maharashtra, INDIA.

<sup>2</sup>Associate Professor, Department of Zoology, Govt. Vidarbha Institute of Science and Humanities, Amravati, Maharashtra, INDIA.

<sup>3</sup>Department of Zoology, Amolakchand Mahavidyalaya, Yavatmal, Maharashtra, INDIA.

<sup>1</sup>Corresponding Author: [lonesuhail1819@gmail.com](mailto:lonesuhail1819@gmail.com)



[www.jrasb.com](http://www.jrasb.com) || Vol. 5 No. 4 (2026): August Issue

Received: 23-07-2026

Revised: 30-07-2026

Accepted: 13-08-2026

### ABSTRACT

The habitat and ecology survey of *Capra falconeri cashmiriensis* commonly called as "Markhor" was to explore their habitat choices, diet preferences, and human-wildlife conflicts, in its distribution range. In India, the distribution range of Markhor is mainly confined to Kashmir. It is listed as "Near Threatened" by the IUCN Red List and it is a genetically unexplored and data-deficient goat. During survey, we identified the potential habitat of Markhor in Kazinag National Park of Kashmir by repeated observance and photographic approaches and also collected the faecal samples of Markhor from different locations within the National Park to obtain the genomic DNA (fig.3). Approximately 150 specimens were recorded during the survey. Diet analysis reveals flexible food preferences. Study revealed that Markhors are found to explore steep mountains areas exhibiting a flexible diet preference which ensures its continued survival during the harsh winter seasons. The successful extraction of genomic DNA using faecal samples will provide opportunities to generate molecular database and its implications on conservation genetics of this robust wild goat in future.

**Keywords-** *Capra falconeri cashmiriensis*, habitat survey, DNA extraction.

### I. INTRODUCTION

The *Capra falconeri cashmiriensis*, commonly referred to as Markhor in India, is a resilient wild ungulate that belongs to the zoological family Bovidae within the order Artiodactyla. The term "markhor" is believed to have its origins in the Pashto and Persian languages, specifically Mar-akhar, which translates to "snake-eater" (Sharma, 1990). Among the various species of wild goats, the Markhor stands out as the largest. Its distribution range encompasses the regions of Central Asia, the Karakoram, and the Himalayas, extending across India, Pakistan, and Afghanistan. This wild goat exhibits exceptional adaptability to mountainous terrains, thriving in elevations ranging from 600 to 3600 meters (IUCN, 2015). Based on their geographical location and horn shapes, the wild goats have been categorized into three

subspecies of the species *Capra falconeri*, namely *C. f. falconeri*, *C. f. heptneri*, and *C. f. megaceros* (Grubb, 2005; Wagner, 1839; Zalkin, 1945; Hutton, 1842). Additional subspecies such as *C. f. jerdoni* (Hume, 1875) and *C. f. cashmiriensis* (Lydekker, 1898) have been identified by other sources. Various sources have recognized different subspecies, including the former Astor Markhor (*C. f. falconeri*) and Kashmir Markhor (*C. f. cashmiriensis*), while considering the Flare-horned Markhor (*C. f. falconeri*), Kabul Markhor (*C. f. megaceros*), and Sulaiman Markhor (*C. f. jerdoni*) as one subspecies (Schaller and Khan, 1975). In India, the markhor is exclusively found in the Union Territory of Jammu and Kashmir, which provides an ideal habitat for these animals. The region is characterized by the presence of Oaks (*Quercus ilex*), Pines (*Pinus gerardiana*), Junipers (*Juniperus macropoda*), Deodar Cedar (*Cedrus*

*deodora*), as well as Spruce (*Picea smithiana*) and Fir (*Abies spectabilis*, *A. pindrow*) in certain areas (Grubb, 2005). The Union Territory of Jammu and Kashmir in India has been identified as a crucial habitat for markhor, particularly the Pir Panjal markhor *Capra falconeri cashmiriensis*. Throughout history, the markhor has been known to inhabit the regions spanning from the Banihal pass in the Pir Panjal to the Shamshabari range across the river Jhelum. A study conducted by Bhatnager et al. in 2009, based on the current population survey of markhor, revealed the existence of only two viable populations in Kashmir. Furthermore, the study also identified several other areas in the state where markhor populations dominate. The markhor has been categorized as "Near-threatened" by the IUCN since 2015, and the global population of markhor is estimated to be approximately 5800 mature individuals. Another survey conducted by Ranjitsinh et al. in the Hirpura and Kazinag ranges of the Pir Panjal Mountains in Jammu and Kashmir, between October 2004 and April 2005, recorded a total of 35 herds of markhor, comprising 155 individuals.

The elusive nature of a particular species poses difficulties when attempting to study it, primarily due to the challenging terrain it inhabits. Consequently, this leads to a lack of available data regarding the organism. The current study endeavors to explore the distribution of the Markhor species within the Kazinag National Park, while also examining its habitat and ecology. Additionally, this research aimed to identify the instances of conflict between humans and Markhor in this specific region. To gain a better understanding of the population genetics and phylogeny of this elusive species, genomic DNA was extracted from fecal samples collected within the study area. Compared with nuclear DNA, most mammalian mitochondrial DNA (mtDNA), especially in the D loop region, have a faster evolution rate. Thus, mammalian mtDNA can be used to study the genetic diversity and phylogeny of species (Bruford et al. 2003). Mitochondrial DNA (mtDNA) has been an extensively exploited tool for assessment of genetic diversity and evolutionary relationships across species (Sharma et al., 2015). Popularity of mtDNA for phylogeographical studies has been attributed to its remarkable properties such as maternal inheritance, clock-like nature of its substitution rate, high copy number and higher mutation rate without any recombination (Luikart et al. 2001; Gissi et al. 2008). The Displacement region (D-loop), which is characterized by highly polymorphic regions (Hypervariable region I and II) has been particularly informative in explaining the origins of many livestock species Bruford et al. 2003. First attempt to delineate mitochondrial DNA diversity in goats was made by Luikart et al., 2001, wherein 88 breeds of domestic goats from the old world were analyzed. Mitochondrial DNA is commonly used for the study of domesticated species. The control region has been especially used for describing the genetic polymorphism of goats Luikart et al., 2001, because it is variable and structured enough across the

geographical range of the species, and evolves at a constant rate Bruford et al., 2003. Moreover, it allows maternal lineages to be followed and is less sensitive to introgression from wild species than nuclear DNA Luikart et al., 2001. Luikart et al. conducted the first study of the overall genetic structure of domestic goats at the worldwide scale.

## II. MATERIALS AND METHODS

### Study area

The study was carried out in the Kazinag National Park (34.1990° N to 74.3499° E) of the Kashmir region (Fig. 1) extending over an area of 160 km<sup>2</sup>. It is situated on the north bank of Jhelum close to the line of control in district Baramulla 70 km away from the capital city of Srinagar, with an altitude of 1800 to 4300masl (Department of Wildlife Protection, J&K, 2007). Kazinag is a temperate system with warm summer and cold winters and temperature range of -20°C to +30°C. The national park is home to various species of wild fauna, around 20 species of mammals, and 120 species of birds. It is a major habitat for markhor and is found abundantly in the national park. Kazinag is very important for livestock herding, about 12000 sheep, goats and other livestock belonging to migratory Bakkarwals and local herders occupy the region between May and September. Livestock is one of the sources of income for the local people and the only source of income for migratory Bakkarwals, however; these livestock occupy much of the potential habitat of markhors.

### Habitat Survey

A survey was carried out to study the habitat of markhor by walking because no vehicle can go through the national park as it is a mountainous area. A significant distance was covered starting from Kootkassi to Manjawali by moving and observing in various directions. Many visits were carried out in this area from October 2017 to January 2018 and December 2023. as in these months markhor is easily sighted and spotted. Observations were made on markhor groups with the aid of 8X40 binoculars by selecting various mountain clefts, cliffs, and rocky outcrops as vantage points to extensively cover the study site. The number, sex, and age group of the groups sighted were recorded (Table 1). The data regarding the food preferences of Markhor were also recorded from the different regions of Kazinag National Park.

### Non-invasive sampling approach

The faecal samples of Markhor were collected from the major pockets of national parks i.e. Pandria, Churasipodi (Malangan Nala), and Manjawali (Wangan was Nala) (Local names) with prior permission by the Chief Wildlife Warden, Jammu and Kashmir (Letter No: WLP/Res/2017-18/ 674-77 and vide letter No: WLW (N)/Esstt /2023-24/ 1872-76). We also collected samples randomly as per the availability and feasibility, from the areas lying in between these locations. The samples were

collected with separate hand gloves in separate zip-lock bags to avoid cross-contamination. As far as possible, only fresh samples were taken in order to avoid environmental degradation of DNA. Proper labelling of the collected sample including the sample code, date of collection, and geo-coordinates was done. From the collected faecal samples genomic DNA was extracted using Nucleopore® Stool DNA Kit.

### III. RESULTS AND DISCUSSION

The study revealed wide distribution of Markhor in various areas of Kazinag National Park which is also confirmed by previously published studies (Bhatnagar *et al.*, 2009; Ranjitsinh *et al.*, 2005). The frequency of markhor individuals was observed more in places like Khari-top, Kunjinar-top, Dari-top, and Kotkassi, etc. (local names of the various sites within the National Park; Fig. 2) which correlates with the earlier studies of Bhatnagar *et al.* (2009). They are always found them in mountain clefts, cliffs, and rocky outcrops. The study revealed that this region is home to ~200 markhor individuals, which indicated ~11% decrease in Markhor population in comparison to Bhatnagar *et al.* (2009) who reported 225 markhor in the region. Our survey regarding the human-Markhor conflict revealed a negative attitude towards the species. We also observed some detrimental activities for the markhor population. During field survey, several grazers were seen with their livestock like domestic goats and sheep that had a direct impact on the grazing of markhor. This scenario was also reported earlier (Riyaz *et al.*, 2009). Such habitat encroachment by local livestock grazers in key habitat resources not only disturb markhors in their distribution range but also disrupt their ecological niches and key resources. These anthropogenic activities impose a potent competition for habitat selection between the livestock and wild ungulates (Harris and Miller, 1995; Ali, 2008). Besides, the changes in land use policies, intensification of development projects, and poaching both by professional hunters (though predominantly in past) as well as local collective hunting (until recently) during winter often killing whole groups were observed to be the prominent threats to their existence. Other anthropogenic activities like collection of forest products viz., timber and non-timber products including medicinal plants, and mushrooms have imposed enough pressure on Markhor's food habitats. A prime example of habitat fragmentation was observed along the line of control (LOC) where politically disputes between India and Pakistan have led to multi-layered wired fencing, thereby enhanced their population isolation (Bhatnagar *et al.*, 2009; Khattak *et al.*, 2022; Ahmad *et al.*, 2022).

During winter the species was observed to feed upon coarse, fibrous shrubs and grasses like *Poa pratensis* (Kentucky bluegrass or blue grass), *Prunus tomentosa* (Mountain cherry or Chinese cherry), *Indigofera heterantha* (Himalayan indigo), *Lonicera spp.*

(Honey suckle) and *Euonymus hamiltonianus* (Himalayan spindle). During winter fresh grass is unavailable in Kazinag National Park, while in autumn season, Markhor shifts from fresh grass to fresh and leafy diets. This diet-related observation is the agreement with the study of Bashir *et al.* (2020) who suggested that the Markhor's feeding habit varies with the availability of food sources. These sorts of flexibility in their diet preferences depend upon the food availability that ensures their survival during harsh and diverse climatic conditions (Ali, 2008; Ahmad *et al.*, 2018).

Markhor mostly feeds on grass, tree leaves, and shrubs including oaks (*Quercus ilex*), pines (*Pinus gerardiana*), and junipers (*Juniperus macropoda*) as documented by (Nowak RM, 1999). They browse as well as graze and occasionally climb into Oak trees (*Quercus spp.*) to consume the foliage (Schaller, 1977). Markhor eats oak leaves when the ground is covered with snow, while in summer they feed primarily on forbs and grasses (Schaller, 1977; Aleem, 1976).

Due to low genomic concentration, it is not possible to confirm the extracted genomic DNA on 1 percent gel. The extracted DNA samples will be used in future for PCR amplification and sequencing. A successful extraction of genomic DNA from the non-invasive faecal samples will provide opportunities to address this elusive species genetically. In the future, the molecular data generated, will be used to study the phylogenetic affinities and population genetics of this robust wild goat.

### IV. CONCLUSION

The markhor is distributed in various regions of the valley with a maximum number dwelling in the Kazinag region. As markhor is an inhabitant of the border area, war, and insurgency are supposed to have caused tremendous damage to the habitat and livelihood of this world's largest wild goat as evidenced by the significant habitat loss from ~300 sq.km. in the 1940s to ~120 km. sq. in 2004-2005 discussed previously by some researchers (Ranjitsinh, 2005). Being close to the threat of becoming endangered we put efforts to unravel the habitat of this rugged wild goat and also collected the faecal samples for extraction of DNA which will be a keystone for the genetic study of markhor. A significant outcome of this study was the successful extraction of genomic DNA from the faecal samples, as it will serve as a credible source for the generation of valid and reliable molecular data. To the best of our knowledge, it is the first attempt from India to extract the DNA of Markhor through a non-invasive method.

**Acknowledgement:** We are thankful to the Chief Conservator of Forests & Chief Wildlife Warden, Jammu and Kashmir, and Wildlife Warden North Division Sopore for their permission to conduct this study vide letter No: WLP/Res/2017-18/ 674-77 and vide letter No: WLW(N)/Esstt/2023-24/ 1872-76 respectively.

**Funding:** This study was supported by the University Grants Commission (UGC) Junior Research Fellowship grant to Suhail Ahmad Lone vide award letter no:19/06/2016(i)EU-V.

## REFERENCES

- [1] Ahmad R, Sharma N, Mishra C, Singh NJ, Rawat GS and Bhatnagar YV. 2018. Security, size, or sociality: what makes markhor (*Capra falconeri*) sexually segregate? *Journal of Mammalogy*, 99(1):55–63.  
<https://dx.doi.org/10.1093/jmammal/gyx155>.
- [2] Ahmad, S.; Rehman, E.U.; Ali, H.; Din, N.; Haider, J.; Din, J.U.; Nawaz, M.A. 2022. Density Pattern of Flare-Horned Markhor (*Capra falconeri*) in Northern Pakistan. *Sustainability*, 14: 9567.  
<https://doi.org/10.3390/su14159567>
- [3] Aleem, A. 1976. Markhor in Chitral Gol. *Pakistan Journal of Forestry*, 26(2): 117-128.
- [4] Ali S. 2008. Conservation and status of markhor (*Capra falconeri*) in the Northern parts of North West Frontier Province, Pakistan.  
<https://scholarworks.umt.edu/10919>
- [5] Bashir M, Fazili MF, Ahmad F, Ahmad J. 2020. Dietary ecology of Markhor (*Capra falconeri cashmiriensis*) in winter range of Kazinag National Park, Kashmir, J&K, India. *Indian Journal of Science and Technology*, 13(24):2463-2474.  
<https://doi.org/10.17485/IJST/v13i24.432>
- [6] Benjelloun B, Pompanon F, Ben Bati M, et al. Mitochondrial DNA polymorphism in Moroccan goats. *Small Ruminant Res* 2011; 98(1–3):201–205.
- [7] Bhatnagar, Y., R. Ahmad, S. Kyarong, M. Ranjitsinh, C. Seth, I. Lone, P. Easa, R. Kaul, and R. Raghunath. 2009. Endangered markhor (*Capra falconeri*) in India: through war and insurgency. *Oryx*. 43 (03):407-411.
- [8] Bruford MW, Bradley DG, Luikart G. DNA markers reveal the complexity of livestock domestication. *Nat Rev Genet*. 2003 Nov;4(11):900-10.
- [9] Gissi, C., Iannelli, F., Pesole, G., (2008). Evolution of the mitochondrial genome of metazoan as exemplified by comparison of congeneric species. *Heredity* 101, 301-320.
- [10] Grubb, P. 2005. Artiodactyla. In: D.E. Wilson and D.M. Reeder (eds), *Mammal Species of the World. A Taxonomic and Geographic Reference* (3rd ed), pp. 637-722. *Johns Hopkins University Press*, Baltimore, USA.
- [11] Harris RB and Miller DJ. 1995. Overlap in summer habitats and diets of Tibetan Plateau ungulates. *Mammalia*, 59(2):197–212.
- [12] IUCN (2015). IUCN Categories and Criteria (version 3.1) IUCN, Gland.
- [13] Khattak, R.H.; Teng, L.; Ahmad, S.; Bari, F.; Rehman, E.U.; Shah, A.A.; Liu, Z. 2022. In Pursuit of New Spaces for Threatened Mammals: Assessing Habitat Suitability for Kashmir Markhor (*Capra falconeri cashmeriensis*) in the Hindukush Range. *Sustainability*, 14: 1544.livestock domestication. *Nat Rev Genet* 3: 900–910.
- [14] Luikart G, Gielly L, Excoffier L, Vigne JD, Bouvet J, et al. (2001) Multiple
- [15] Lydekker, R. 1898. Wild oxen, sheep, and goats of all lands. *Rowland Ward*, London.NU0PEugB1fi5WK9dXRM maternal origins and weak phylogeographic structure in domestic goats. *Proc Natl Acad Sci USA* 98: 5927–5932.
- [16] Naderi S, Rezaei H, Taberlet P, et al. Large-scale mitochondrial DNA analysis of the domestic goat reveals six haplogroups with high diversity. *PloS ONE* 2007; 2(10):e1012.
- [17] Nowak RM. 1999. Walker's Mammals of the World. Johns Hopkins University Press; Jul 29.
- [18] Ranjitsinh, M. K., Seth, C. M., Ahmad, R., Bhatnagar, V. Y. and Kyarong, S. S. 2005. Goats on the border: A rapid assessment of the Pir Panjal Markhor in Jammu and Kashmir: Distribution, status and threats. Wildlife Trust of India, New Delhi, India. [https://wti.org.in/wp-content/uploads/2017/03/pub\\_goats\\_border.pdf](https://wti.org.in/wp-content/uploads/2017/03/pub_goats_border.pdf)
- [19] Riyaz Ahmed Peerzada, Yash Veer Bhatnagar, Charudutt Mishra, Pranav Trivedi, R. Raghunath, and Rahul Kaul. 2009-2010. Interim Project Report. Markhor in Kajiinag National Park: Important habitats and interactions with livestock.
- [20] Schaller, G. B. 1977. Mountain monarchs—wild sheep and goats of Himalayas. University of Chicago Press, Chicago. 425pp.
- [21] Schaller, G. B., & Khan, S. A. 1975. Distribution and status of markhor (*Capra falconeri*). *Biological Conservation*, 7(3):185-198.  
[https://doi.org/10.1016/0006-3207\(75\)90014-2](https://doi.org/10.1016/0006-3207(75)90014-2)
- [22] Sharma, R., Kishore, A., Mukesh, M., Ahlawat, S., Maitra, A., Pandey, A.K., Tania, M.S., (2015). Genetic diversity and relationship of Indian cattle inferred from microsatellite and mitochondrial DNA markers. *BMC Genetics* 16, 73.
- [23] Sharma, S. D. 1990. Semantics and Syntax: Indian Loan Words in English: a Linguistic, Cultural, Literary & Historical Study. Prakash Book Depot. p. 83.

**Table 1. Details of observations from the latest visits to various locations of Kazinag National Park, Kashmir, India.**

| Sr. No. | Location      | GPS Coordinates                    | No. of Males | No. of Females | No. of Kids |
|---------|---------------|------------------------------------|--------------|----------------|-------------|
| 1       | Kootkassi     | Lat. 34°12006°<br>Long. 074.4300°  | 01           | 05             | NIL         |
| 2       | Kunjinar      | Lat. 34.12068°<br>Long. 047.04318° | NIL          | 02             | NIL         |
| 3       | Daritop       | Lat. 34.12137°<br>Long. 074.04516° | 01           | NIL            | NIL         |
| 4       | Kharitop      | Lat. 34.12006°<br>Long. 074.04300° | NIL          | 02             | NIL         |
| 5       | Kunjinar base | Lat. 34.12072°<br>Long. 074.04474° | 01           | 01             | NIL         |
| 6       | Kunjinar top  | Lat. 34.12106°<br>Long. 074.04449° | 01           | NIL            | NIL         |
| 7       | Kootkassi     | Lat. 34.12130°<br>Long. 074.04526° | NIL          | 03             | 02          |

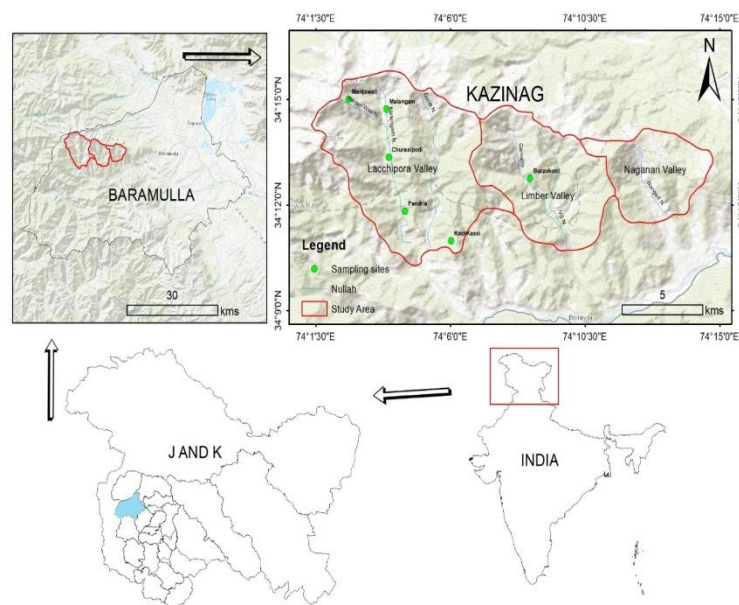


**Figure 1: Map of the Kazinag National Park showing the sampling sites within it.**



**Figure 2: Photographs showing Markhor (*Capra falconeri cashmiriensis*) in various locations within the Kazinag National Park Baramulla, Jammu-Kashmir.**

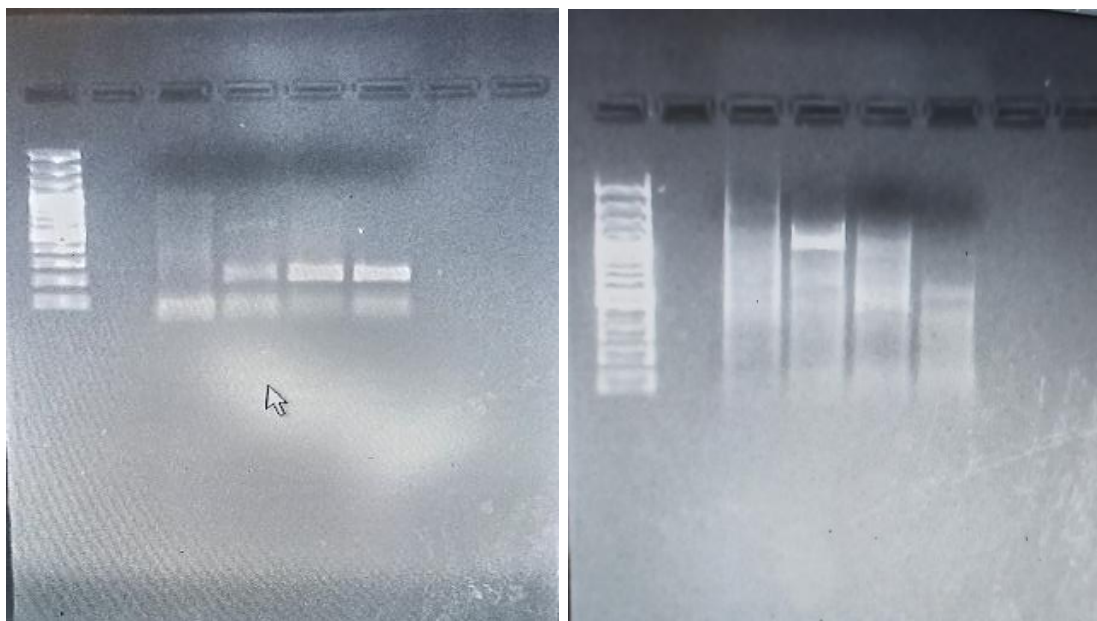


**Figure 3: DNA band images of different samples obtained by using Gel-doc**