

Habitat use, Foraging Ecology and Dietary Composition of the Himalayan Serow (*Capricornis sumatraensis thar*) in and around Dachigam National Park, Kashmir Himalaya

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Abstract

Mountain ungulates play a crucial role in maintaining ecosystem structure and the ecological functioning in Himalayan landscapes. Habitat selection and feeding ecology are fundamental components affecting the distribution, survival, and conservation of wild ungulates. The present study was conducted in and around Dachigam National Park and the Brein-Nishat Conservation Reserve, Jammu and Kashmir, India, during 2023–2024. Systematic transects were established across four major habitat types (mixed conifer, mixed woodland, riverine, and rocky slope) and surveyed. Habitat use was assessed through direct sightings and indirect evidence, while habitat characteristics were assessed by vegetation sampling and ground-cover analysis. The diet composition was assessed by micro-histological analysis of 74 fecal samples collected across four seasons. Floristic survey revealed 21 tree species, 12 shrub species and 27 herb species, indicating significant plant diversity in the study area. Shannon-Wiener diversity indices for trees, shrubs and herbs were 2.64, 2.48 and 2.77 respectively. The Himalayan Serow showed a strong preference for rocky slope habitats with the highest number of individuals recorded ($n = 14$), followed by mixed woodland, riverine and mixed conifer habitats. The ground vegetation cover varied seasonally, with the highest value in riverine habitats during summer (67.25%). Dietary analysis showed that seasonal variation in food preferences. The most consumed species *Cynodon dactylon* (46.86%) and *Rumex nepalensis* (33.33%). *Morus alba* (88.88%) and *Berberis lyceum* (77.77%) were the major food items in summer whereas *Rubus fruticosus* (44.82%) and *Rumex nepalensis* (37.93%) were preferred in autumn. Winter diet showed higher intake of *Aesculus indica* (42.85%) and *Populus alba* (33.33%). The findings demonstrate the ecological flexibility of the Himalayan Serow and highlight the need for conserving different vegetation communities and rugged habitats for supporting viable populations of this species in the Kashmir Himalaya. Given the ecological importance of mountain ungulates as indicators of ecosystem health, the findings provide valuable baseline information for developing effective management and conservation strategies for the species in the Kashmir Himalaya.

1. Introduction

Mountain ecosystems harbor a remarkable diversity of flora and fauna and provide essential ecological services, making them among the most significant biodiversity hotspots globally [1]. Large herbivores play a crucial role in these ecosystems by influencing vegetation dynamics, nutrient cycling, and predator prey interactions [2, 3]. As primary consumers, mountain ungulates are important indicators of ecosystems and the quality of habitats. Understanding their habitat needs and feeding habits is essential for effective conservation and management [3].

Himalayan serow (*Capricornis sumatraensis thar*) commonly known as serow, in Kashmir i.e., Wan-chawij or Ream belongs to the Kingdom Animalia, class Mammalia, family Bovidae, order Artiodactyla, and subfamily Caprinae [4, 5]. Currently, there are 279 species of bovids worldwide, which makes it the family with the highest species diversity among ungulates [6]. Serow is a medium-sized caprine distributed across the Himalayas (India, Nepal, Bhutan) and parts of Southeast Asia. It typically inhabits steep, rugged and densely forested mountain habitat between 1,500–4,000m elevation, preferring rocky terrain and inaccessible slopes [7, 8]. These mountain ungulates possess a generally goat-like structure, goat-like teeth, short tails, and relatively small cylindrical horns found in both genders [9]. Serows consume grasses, shoots, and leaves [10]. The differentiation in habitat choice for this species during winter and summer relies on factors such as

vegetation type, tree distribution, slope, altitude, rock distribution, tree size, slope location, canopy and water availability. However, opportunities for shelter and concealment, along with distance from water, were not observed to be significantly affected by the season [11]. The Serow is primarily active during various times, particularly at dawn [12]. Studies have shown that serows are positively correlated with rugged landscapes and places with less human disturbances, indicating the significance of securing habitats for their existence [13, 14, 15].

Despite its wide distribution, the Himalayan serow is perhaps one of the least-studied mountain ungulates in Asia. Listed as Vulnerable, it has been suffering from population declines because of habitat degradation, fragmentation, hunting pressure, and increasing human disturbance in its range [8]. The species is hunted for their meat, and their body parts like their gall bladder are used in traditional medicine. Serow are also targeted for trophies and illegal wildlife trade, contributing to population declines in several parts of their distribution range [16, 17, 8].

Studies have highlighted the need for further investigation into its ecology, distribution, and habitat associations limits the development of effective conservation strategies and management interventions. Habitat use and foraging ecology are crucial aspects of wildlife ecology, because they determine how animals utilize the resources at their disposal, both spatially and temporally. However, ecological information on habitat use, foraging behaviour and dietary composition of the Himalayan Serow in the Kashmir Himalaya is quite scanty. Dachigam National Park and its adjacent landscapes house an important population of the species and range from a mosaic of habitats, viz., mixed conifer forests, mixed woodlands, riverine forests and rocky slopes. Understanding how serows utilize different habitats and cope up with the changing food availability across seasons is crucial for developing science-based conservation strategies in the region. Therefore, the present study was undertaken to investigate the habitat use, foraging ecology, and dietary composition of the Himalayan Serow in and around Dachigam National Park, Kashmir Himalaya. The findings provide baseline ecological information that can contribute to the conservation and management of this threatened mountain ungulate in the northwestern Himalaya.

2. Material and methods

2.1 Study area

The study was carried out in and around Dachigam National Park (DNP) and the adjoining Brein-Nishat Conservation Reserve (BNCR) in the Zabarwan Range of the northwestern Himalaya, Jammu and Kashmir, India (Fig. 1). The study area falls between 34°05'–34°32' N and 74°50'–75°16' E with an altitude ranging between 1,700–4,250m. Dachigam National Park covers an area of 141km², while BNCR (34°04'30" N, 74°55'30" E) covers 13.51km² and ranges in elevation from 1,700 to 3,900m (Rodgers & Panwar, 1988). The landscape includes riverine forests, mixed woodlands, pine *Parrotiopsis* forests, mixed conifer forests dominated by *Pinus wallichiana* and *Abies pindrow*, grassy rocky slopes and alpine scrub-pasture habitats [18, 19]. The area hosts several key mammalian species such as the Himalayan Serow (*Capricornis sumatraensis* *thar*), Hangul (*Cervus hanglu hanglu*), Kashmir Musk Deer (*Moschus cupreus*), Asiatic Black Bear (*Ursus thibetanus*), Common Leopard (*Panthera pardus*), and Himalayan Gray Langur (*Semnopithecus ajax*). The

climate is temperate to sub-Mediterranean, with cold winters and mild summers. Snowfall forms the major source of precipitation at higher elevations and annual rainfall ranges between 32 and 546mm [20].

2.2 Sampling procedure

For the assessment of the Habitat use, Foraging Ecology & Dietary Composition of the Himalayan Serow in and around Dachigam National Park, 12 transects/trails have been established of about 1-2km. Inside the National Park, transects/trails were sampled evenly across four different habitats mixed woodland, riverine, mixed conifer and rocky slopes. Observation of serow was made whether they were seen or not in each transect/trail [21].

Amongst these, transects/trails 8 were laid in the National Park, two in each habitat and 4 around the park one in each habitat. Data were collected by observing both direct and indirect evidences in all the seasons i.e., spring, summer, autumn and winter. A multistage stratified random sampling has been used in this study viz., habitats such as mixed woodland, riverine, mixed conifer and rocky slopes. Moreover, a survey was also done around Dachigam National Park (Brein and Nishat) since they belong to the surroundings of the park. Regular surveys were conducted along the transect/trails on a rotational basis three times in a month in the morning and evening during autumn (September, October, and November) and winter (December, January, February, and March). In spring and summer, the surveys were conducted in the morning (06:00–14:00) and evening (15:00–19:00) to collect data on the daily activity of the Himalayan serow.

2.3. Data collection and analysis

Habitat use was assessed through direct sightings and indirect evidence (pellets/scats) collected along systematically established transects. At each sighting or sign location, habitat variables were recorded at that site vegetation types (trees, shrubs, herbs, litter, bare soil, rock, and snow), altitude, aspect and geographic coordinate with a Global Positioning System (GPS; [22, 23]. Vegetation sampling was conducted using 10 × 10 m, 5 × 5 m, and 1 × 1 m quadrats for trees, shrubs, and herbs, respectively. Data about ground cover were collected by applying line intercept method [24]. Diversity of plants was calculated by applying both Shannon-Wiener and Simpson's diversity indices to measure the homogeneity of species within community. Habitat occupancy was determined by applying pellet/scat count techniques [25, 26, 21].

2.3.1 Faecal sample collection

The faecal samples were collected systematically and opportunistically throughout regular field surveys conducted across the transect/trails in and surrounding Dachigam National Park. Faecal samples were collected seasonally across all transects/trails using 180 sampling plots. A total of seventy four (74) faecal samples were collected, 15 samples were collected during spring, 9 during summer, 29 in autumn and 21 in winter. Time, place, date, and geo-Coordinates for every fecal sample sites was noted down with help of global positioning system. To get a better understanding of the feeding behavior of Himalayan serow we did a direct observation with binoculars via scan sampling technique [27]. The dietary habits and feeding behaviors, including the composition of the diet and its seasonal changes, were evaluated through the method of micro histological analysis of faecal samples [28].

2.3.2 Faecal sample analysis

The faecal analysis was carried out according to [28]. Faecal samples were crushed first and subsequently passed on a sieve with 5 mm mesh size. Then they were boiled (5–10 mins) in a mixture of nitric acid and distilled water at a ratio 1:3. The material washed in distilled water until all traces of nitric acid were completely removed. Reference slides were prepared to identify dietary components that are unknown. Vegetative parts of plants from the same areas were collected and processed similarly to the faecal samples. The frequency of occurrences of dietary component was calculated using the formula given by [29]. In order to understand the diet composition of serows, faecal samples were analyzed to determine the diet composition. It provided us insights about the food habits and dietary preference of the serow within the study area.

2.4 Data analysis:

Primary data were collected through direct observation during transect/trail walks, indirect evidence of animal presence/absence which were evaluated for animal abundance and occupancy estimation using standard statistical techniques and tools in SPSS and R software package [30]. The data was organized with essential parameters, and tables, figures, graphs, charts and necessary mathematical calculations were created using Microsoft Excel.

3. Results

3.1 Habitat use of Himalayan Serow and Percentage distribution of sightings across seasons and altitude classes in and around Dachigam National Park.

The Himalayan Serow exhibited variation in habitat use across different habitats viz., mixed conifer, mixed woodland, riverine, and rocky slopes (Figure. 2). A total of 26 individuals were recorded rocky slope was the most frequently utilized habitat accounting for the maximum number of records ($n = 14$) i.e., 53.85%, followed by mixed woodland ($n = 5$, 19.23%) while riverine habitat had $n = 4$ (15.38%) and mixed conifer forest with least record count being $n = 3$ (11.54%). Seasonal distribution pattern of Himalayan serow sightings during the study period of study showed that the highest number of the sighting had been observed in autumn season (43.48%), then winter (34.78%) Spring (17.39%) and summer (4.35%). Most sightings of Himalayan serow were sighted at an altitude of 2700-2900m 56.52%, whereas 26.09% at 2500-2700m. Only 8.70% of serows were sighted at both altitudes i.e., 2300-2500 & 2900-3100m (figure 3). The overall analysis revealed that rocky slopes are most frequently used habitat by Himalayan Serow followed by mixed conifer forest having least numbers of observations. However the higher number of sightings in rocky slope habitat indicate more habitat usage for Himalayan Serow than mixed woodland, riverine and mixed conifer habitats.

3.2 Floristic composition.

The vegetation of the study area comprised a diverse range of tree, shrub and herb species with 60 plant species of 20 families were documented during the study. The species composition analysis revealed 21 tree species which represented 9 different families 12 shrubs species from 6 different families, while there were 27 herb species from 16 families. Within the tree layers, Salicaceae were the dominating family comprising five different trees species followed by Pinaceae and Rosaceae, each represented by three species In the shrub layer, Rosaceae were found as the dominative family (six species), followed by Fabaceae (two species).

The herbaceous vegetation consisted of 27 species, with Asteraceae, Poaceae, Malvaceae and Fabaceae family having been the most represented families. Some dominant plant species recorded in the study area include *Cedrus deodara* (cedar), *Pinus Wallichiana* (blue pine), *Abies Pindrow* (silver fir), *Populus alba* (white poplar), *Salix alba* (white willow), *Berberis Lyceum* (barberry), *Rubus Fruticosus* (blackberries), *Rosa Webbiana* (roses), *Artemisia Absinthium* (wormwood), *Cynodon Dactylon* (Bermuda grass), *Taraxacum Officinale* (dandelion) and *Trifolium Pratense* (red clover).

3.3 Plant Diversity (Shannon Weiner's and Simpson's Diversity Indices).

The Shannon-Weiner Diversity Index (H') and Simpson's Index of Dominance (D) were calculated for each vegetation layer within the study area i.e., trees, shrubs and herbs. The herb layer showed high species diversity than tree and shrub layer species diversity, with a Shannon Wiener index of 2.77 (herb), 2.64 (tree), 2.48 (shrub) respectively. Similarly, Simpson's Diversity Index was 0.917 for herbs, 0.929 for trees, and 0.938 for shrubs these results indicate variations in species diversity levels across all the three vegetation layers with herbe having the highest level of diversity (Figure 4).

3.4 Seasonal variation in ground cover composition across habitats.

The composition of ground covers varied among habitats and seasons within and around DNP a consistently higher proportion of vegetation cover were recorded in riverine habitat, increasing from 51.00% in winter to 67.25% in summer followed by decline till 57.75% in autumn season. Similarly, mixed woodland had also higher proportion of vegetation cover than other habitats, varying from 46.25 to 56.50% across seasons. Mixed conifer habitat showed moderate vegetation cover (35.75–47.25%). However, rocky slope has been found with lower vegetation coverage (13.75–21.75%) as well as highest percent of bare ground and rocks. Maximum snowfall was seen during winter period and maximum percentage was observed for mixed conifer habitat (12.50%). overall maximum vegetation coverage was detected during summer season while it decreased both during autumn and winter season among different habitat types (Table 1).

3.5 Food Habits and Dietary Composition of Himalayan Serow.

A total of 74 fecal samples were collected and analyzed (15 in spring, 09 in summer, 29 in autumn and 21 in winters) 19 plant species were identified through micro-histological analysis of these samples (figure 5). Dietary analysis showed different types of plant species consumed and seasonal variation in food composition of Himalayan serow (figure 6). In spring, *Cynodon dactylon* showed the highest frequency of occurrence (46.86%) frequency of occurrence for other plant species during spring season was less than that of *Cynodon dactylon*. Other frequent occurring plants included *Rumex nepalensis* (33.33%), *Aesculus indica* (26.66%) and *Rubus fruticosus* (26.66%). Species with highest frequencies of occurrence were *Morus alba* (88.88%) during summer followed by *Berberis lyceum* (77.77%) and *Prunus armeniaca* (66.66%). In autumn, *Rubus fruticosus* (44.82%) and *Rumex nepalensis* (37.93%) were the dominant dietary components. In winter, the most frequently recorded food species were *Aesculus indica* (42.85%) and *Populus alba* (33.33%), followed by *Cynodon dactylon* (19.04%). Dietary composition of the Himalayan serow showed variation across the seasons due to consumption of various plants depending on season (Table 2-5).

4. Discussion

The Himalayan Serow showed a preference for rocky slopes habitat over mixed woodland, riverine and mixed conifer forests habitats. The predominance of serows on rocky slopes is likely associated due to provision of steep escape terrain, shelter and food sources. These rugged habitats provide protection from predators and human disturbance and provide safe and efficient movement across rugged mountainous landscapes. Similar habitat preferences have been reported by several studies throughout the species distribution, where serows are primarily associated with steep forested slopes, cliffs and rocky escarpments ranging in elevation from 1500–4000m ([5, 31, 14]. The higher proportion of Himalayan Serow sightings during autumn and winter may be due to lower vegetation cover increasing visual detection probability compared to dense vegetation during summer months when these animals are harder to find [7, 32]. Most sightings occurred between 2700–2900m, indicating a preference for mid-elevation habitats with suitable forage and cover. The comparatively lower occurrence of serows in other habitats could reflect relatively less suitable conditions for them or a reduction in abundance of their preferred forage resources in those habitats [11, 32, 31]. The floristic survey revealed a total of 60 plant species were identified encompassing a significant variety of tree, shrub and herb flora within and surrounding DNP. Such diverse vegetation provides a wide range of forage resources that promote habitat heterogeneity for herbivorous mammal communities. The dominance of families including Salicaceae, Pinaceae, Rosaceae, Asteraceae and Poaceae reflects the characteristic vegetation of typical temperate Himalayan forest vegetation [18, 33].

The Shannon-Wiener and Simpson diversity indices indicated the presence of the highest species diversity in the herbaceous layer when comparing all the three vegetation strata. Greater herb diversity can perhaps be attributable to favorable micro-habitat condition, seasonal regeneration as well as heterogeneous environment conditions typical of temperate Himalayan ecosystem. Similar patterns has also been observed previously that higher diversity in herbs than trees and shrubs was found in Himalayan forests [33].

A dietary analysis revealed that there was a marked seasonal change in food habits of Himalayan Serow with an increase in consumption of grasses and herbaceous species (*Cynodon dactylon*) in spring season. Similarly, in Summer season the browsing species i.e. *Morus alba*, *Berberis lyceum* and *Prunus armeniaca* constituted majority of diet while in Autumn and Winter seasons diets were comprised mostly from shrubs and tree species viz. *Rubus fruticosus*, *Aesculus indica* and *Populus alba* reflecting seasonal changes in vegetation availability. Similar kind of dietary shifts were also observed by [32]. Regarding Himalayan Serow population found in different parts of Nepal where forage preference was directly influenced by the seasonal variations in plant's Phenology and availabilities. The ability of the Himalayan Serow to exploit diverse types of grasses, shrubs and tree species throughout the year indicates their generalist feeding behavior, possibly enhancing their adaptability to heterogeneous environment of north-western Himalayas.

Overall, the findings highlight the dependence of the Himalayan Serow on structurally complex habitats with a diversity of vegetation resources. Habitat heterogeneity, seasonal differences in ground cover and the presence of preferred forage species collectively influence habitat utilization patterns and dietary composition of this species. These results provide important ecological baseline dataset necessary for effective implementation of habitat management practices and development of long-term conservation plans for the Himalayan Serow in and around DNP.

5. Conclusion

The findings of this study provides comprehensive baseline data about the habitat utilization patterns, floristic composition of plants, vegetation heterogeneity, ground cover attributes and the feeding ecology of the Himalayan Serow (*Capricornis sumatraensis thar*) in and around Dachigam National Park. Results showed that the Himalayan serow showed a clear preference for rocky slope habitats, highlighting the importance of rugged terrain in meeting its ecological requirements. In our study area there was significant vegetation heterogeneity with herbs being the most diversified group in terms of their species variety providing a wide range of forage resources throughout the year. The seasonal variability in ground cover and plant availabilities has a significant impact on the dietary composition of the Himalayan Serow enabling this species to adjust its feeding behavior in response to changing environmental conditions. Reliance on a diversity of grass, shrub, and tree species also highlights the ecological importance of maintaining heterogeneity in the different types of habitats within the landscape. These findings provide us valuable insights into the ecology of this species that may prove useful in scientific basis for habitat management strategies, and long term monitoring efforts to conserve them. Protection of rocky habitats, conservation of native vegetation and minimizing anthropogenic disturbances will be essential for ensuring the long term viability of Himalayan Serow populations both in Dachigam National Park, and across temperate Himalayan regions.

Declarations

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Permissions

Permission to conduct the study was obtained from the Department of Wildlife Protection, Jammu and Kashmir, and the authorities of Dachigam National Park prior to the commencement of fieldwork.

Author contributions

Aamir Majeed Baba: Conceptualization, methodology, investigation, fieldwork, laboratory analysis, data curation, formal analysis, visualization, writing original draft.

Khursheed Ahmad, Amir Farooq Bhat, Intesar Suhail, and Stefano Focardi: Conceptualization, supervision, methodology, validation, writing review and editing.

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Data Availability

The datasets generated and/or analyzed during the current study are available from the corresponding author upon reasonable request.

Clinical trial number

Not applicable.

Ethics Approval and Consent to Participate

Ethical approval was not required for this study because it involved non-invasive field observations and fecal sample collection only. No animals were captured, handled, or subjected to experimental procedures.

References

1. Korner, C. (2005). Mountain systems. Ecosystems and human well-being: current state and trends, 681-716.
2. Hobbs, N. T. (1996). Modification of ecosystems by ungulates. *The Journal of Wildlife Management*, 695-713.
3. Gordon, I. J. (2004). **The management of wild large herbivores to meet economic, conservation and environmental objectives.** *Journal of Applied Ecology*, **41**(6), 1021–1031. <https://doi.org/10.1111/j.0021-8901.2004.00985.x>
4. Prater, S. H. (1993). *The Book of Indian Animals* (4th ed.). Bombay Natural History Society, Mumbai, India.
5. Schaller, G. B. (1977). Mountain monarchs. Wild sheep and goats of the Himalaya (pp. 425-pp).
6. Castelló, J. R. (2016). Bovids of the world: antelopes, gazelles, cattle, goats, sheep, and relatives. In *Bovids of the World*. Princeton University Press.
7. Aryal, A. (2009). Habitat ecology of Himalayan serow (*Capricornis sumatraensis* ssp. *thar*) in Annapurna Conservation Area of Nepal. *Tiger paper*, 34(4), 12-20.
8. Phan, T.D., Nijhawan, S., Li, S. & Xiao, L. 2020. *Capricornis sumatraensis*. The IUCN Red List of Threatened Species 2020: e.T162916735A162916910. <https://dx.doi.org/10.2305/IUCN.UK.2020-2.RLTS.T162916735A162916910.en>
9. Prater, S. H. (1980). *The Book of Indian Animals* (3rd ed.). Bombay Natural History Society, Bombay, India.
10. Nowak, R. M., & Paradiso, J. L. (1983). *Walker's Mammals of the World* (4th ed., Vols. 1–2). Johns Hopkins University Press, Baltimore, Maryland, USA.
11. Wu, P., and Zhang, E. 2004. Habitat selection and its seasonal change of serow (*capricornis sumatraensis*) in Cibagou Nature Reserve, Tibet. *Acta Theriologica Sinica* 24(1): 6-12.
12. Li, X., Bleisch, W. V., & Jiang, X. (2018). Unveiling a wildlife haven: occupancy and activity patterns of mammals at a Tibetan sacred mountain. *European Journal of Wildlife Research*, 64(5), 53.

<https://doi.org/10.1007/s10344-018-1213-y>

13. Bhattacharya, T., Bashir, T., Poudyal, K., Sathyakumar, S., & Saha, G. K. (2012). Distribution, occupancy and activity patterns of goral (*Nemorhaedus goral*) and serow (*Capricornis thar*) in Khangchendzonga Biosphere Reserve, Sikkim, India. *Mammal Study*, 37(3), 173–181. <https://doi.org/10.3106/041.037.0302>
14. Paudel, P. K., Hais, M., & Kindlmann, P. (2015). Habitat suitability models of mountain ungulates: identifying potential areas for conservation. *Zoological studies*, 54(1), 37. <https://doi.org/10.1186/s40555-015-0116-9>
15. Phan, T. D., Baxter, G. S., Phan, H. A. D., Mai, L. S., & Trinh, H. D. (2019). An integrated approach for predicting the occurrence probability of an elusive species: the Southwest China serow. *Wildlife Research*, 46(5), 386–397. <https://doi.org/10.1071/WR18116>
16. Lynam, A. J., Round, P. D., & Brockelman, W. Y. (2006). Status of birds and large mammals in Thailand's Dong Phrayayen-Khao Yai forest complex. Biodiversity Research and Training (BRT) Program and Wildlife Conservation Society, Bangkok, 245.
17. Shepherd, C. R., & Krishnasamy, K. (2014). Observations of illegal trade in Sumatran serows in Malaysia. *TRAFFIC Bulletin*, 26(2), 81–84.
18. Singh, G., & Kachroo, P. (1978). Plant Community Characteristics in Dachigam Sanctuary, Kashmir. Natraj Publishers, Publications Division, Dehradun, India. 434 pp.
19. Ahmad, K., Sathyakumar, S., & Qureshi, Q. (2009). Conservation status of the last surviving wild population of hangul or Kashmir deer *Cervus elaphus hanglu* in Kashmir, India. *Journal of the Bombay Natural History Society*, 106(3), 245.
20. Bhat, G. A. (1985). Biological Studies of Grassland of Dachigam National Park, Kashmir. Ph.D. Thesis, Centre of Research for Development (CORD), University of Kashmir, Srinagar, India. 521 pp.
21. Buckland, S. T., Anderson, D. R., Burnham, K. P., Laake, J. L., Borchers, D. L., & Thomas, L. (2001). *Introduction to Distance Sampling: Estimating Abundance of Biological Populations*. Oxford University Press, Oxford, UK. 432 pp.
22. Rikhari, H. C., Chandra, R., & Singh, S. P. (1989). Pattern of species distribution and community characters along a moisture gradient within an oak zone of Kumaun Himalaya. *Proceedings of the Indian National Science Academy, Part B: Biological Sciences*, 55(5–6), 431–438.
23. Wilson, D. E., Cole, F. R., Nichols, J. D., Rudran, R., & Foster, M. S. (1996). Measuring and monitoring biological diversity: standard methods for mammals. *Measuring and monitoring biological diversity: Standard methods for mammals*, 27.
24. Canfield, R. H. (1941). Application of the line interception method in sampling range vegetation. *Journal of Forestry*, 39(4), 388–394. <https://doi.org/10.1093/jof/39.4.388>
25. Neff, D. J. (1968). The pellet-group count technique for big game trend, census, and distribution: A review. *The Journal of Wildlife Management*, 32(3), 597–614. <https://doi.org/10.2307/3798941>
26. Cairns, A. L., & Telfer, E. S. (1980). Habitat use by 4 sympatric ungulates in boreal mixedwood forest. *The Journal of Wildlife Management*, 44(4), 849–857. <https://doi.org/10.2307/3808313>
27. Altmann, M. (1952). Social behavior of elk, *Cervus canadensis nelsoni*, in the Jackson Hole area of Wyoming. *Behaviour*, 4(2), 116–143. <https://doi.org/10.1163/156853951X00089>

28. Dacar, M. A., & Giannoni, S. M. (2001). A simple method for preparing reference slides of seed. *Journal of Range Management*, 54(2), 191–193. https://doi.org/10.2458/azu_jrm_v54i2_dacar
29. Corbett, L. K. (1989). Assessing the diet of dingoes from faeces: A comparison of three methods. *The Journal of Wildlife Management*, 53(2), 343–346. <https://doi.org/10.2307/3801135>
30. Jeelani, M. I., Nazir, N., Mir, S. A., Jeelani, F., Dar, N. A., Haq, S., Maqbool, S., & Wani, S. (2014). Application of simple random sampling in agriculture using R-software. *Indian Journal of Science and Technology*, 7(5), 706–709. <https://doi.org/10.17485/ijst/2014/v7i5.18>
31. Li, S., Zhang, X., Chen, P., Wang, J., Xiang, D., Dong, W., Zhang, X., He, B., Sun, R., Zhao, N., & Wang, D. (2014). The community structure and elevational patterns of forest ungulates at the southern slope of the Qinling Mountains, China. *Chinese Journal of Zoology*, 49(5), 633–643. <https://doi.org/10.13859/j.cjz.201405001>
32. Giri, S., Aryal, A., Koirala, R. K., Adhikari, B., & Raubenheimer, D. (2011). Feeding ecology and distribution of Himalayan serow (*Capricornis thar*) in Annapurna Conservation Area, Nepal. *World Journal of Zoology*, 6(1), 80-85.
33. Ahmad, K., & Farooq, M. (2018). Vegetation classification and habitat mapping of Dachigam National Park, Kashmir, India. In *Vegetation of Central Asia and Environs* (pp. 119–142). Springer Nature, Cham. https://doi.org/10.1007/978-3-319-99728-5_5

Tables

Table 1: Percentage of ground cover in and around Dachigam National Park in different habitats during different seasons.

Seasons	Habitat	Vegetation%	Bare Ground%	Litter%	Rock%	Snow%	Total%
WINTER	Riverine	51	11	13.5	20.25	4.25	100
	Mixed woodland	53.25	9.75	22.5	8	6.5	100
	Mixed coniferous	47.25	24.75	6	9.5	12.5	100
	Rocky slope	13.75	32.25	16.5	29.25	8.25	100
SPRING	Riverine	61.25	12.75	17.75	9.25	0.00	100
	Mixed woodland	56.25	15.25	18.25	10.25	0.00	100
	Mixed coniferous	35.75	32.75	24.25	7.25	0.00	100
	Rocky slope	19.25	31.5	18.75	30.5	0.00	100
SUMMER	Riverine	67.25	7.75	11.5	13.5	0.00	100
	Mixed woodland	56.5	9.75	26.25	7.5	0.00	100
	Mixed coniferous	44.25	34.75	16.5	5.5	0.00	100
	Rocky slope	21.75	32.25	18.5	27.5	0.00	100
AUTUMN	Riverine	57.75	9.75	11.25	21.25	0.00	100
	Mixed woodland	46.25	9.75	32.75	11.25	0.00	100
	Mixed coniferous	41.75	36.25	12.75	9.25	0.00	100
	Rocky slope	18.75	35.5	14.25	31.5	0.00	100

Table 2: Percentage occurrence of Plant species consumed by Himalayan Serow in and around Dachigam National Park during spring.

S No.	Plant species	No. of occurrence (N=15)	Frequency of occurrence percentage (FO %) (N=15)
1	<i>Aesculus indica</i>	4.00	26.66
2	<i>Berberis lyceum</i>	2.00	13.33
3	<i>Celtis australis</i>	0.00	0.00
4	<i>Cynodon dactylon</i>	7.00	46.86
5	<i>Fragaria vesca</i>	2.00	13.33
6	<i>Morus alba</i>	0.00	0.00
7	<i>Quercus robur</i>	0.00	0.00
8	<i>Prunus armeniaca</i>	0.00	0.00
9	<i>Prunus cornuta</i>	3.00	20.00
10	<i>Prunus tomentosa</i>	0.00	0.00
11	<i>Populus alba</i>	0.00	0.00
12	<i>Parrotiopsis jacquemontiana</i>	3.00	20.00
13	<i>Podophyllum hexandrum</i>	0.00	0.00
14	<i>Robinia pseudoacacia</i>	0.00	0.00
15	<i>Rosa webbiana</i>	2.00	13.33
16	<i>Rubus fruticosus</i>	4.00	26.66
17	<i>Rumex nepalensis</i>	5.00	33.33
18	<i>Salix alba</i>	0.00	0.00
19	<i>Trifolium repens</i>	4.00	26.66

Table 3: Percentage occurrence of Plant species consumed by Himalayan Serow in and around Dachigam National Park during summer.

S No.	Plant species	No. of occurrence (N=9)	Frequency of occurrence percentage (FO %) (N=9)
1	<i>Aesculus indica</i>	4.00	44.44
2	<i>Berberis lyceum</i>	7.00	77.77
3	<i>Celtis australis</i>	3.00	33.33
4	<i>Cynodon dactylon</i>	4.00	44.44
5	<i>Fragaria vesca</i>	2.00	22.22
6	<i>Morus alba</i>	8.00	88.88
7	<i>Quercus robur</i>	0.00	0.00
8	<i>Prunus armeniaca</i>	6.00	66.66
9	<i>Prunus cornuta</i>	0.00	0.00
10	<i>Prunus tomentosa</i>	2.00	22.22
11	<i>Populus alba</i>	0.00	0.00
12	<i>Parrotiopsis jacquemontiana</i>	3.00	33.33
13	<i>Podophyllum hexandrum</i>	4.00	44.44
14	<i>Robinia pseudoacacia</i>	6.00	66.66
15	<i>Rosa webbiana</i>	0.00	0.00
16	<i>Rubus fruticosus</i>	3.00	33.33
17	<i>Rumex nepalensis</i>	5.00	55.55
18	<i>Salix alba</i>	4.00	44.44
19	<i>Trifolium repens</i>	4.00	44.44

Table 4: Percentage occurrence of Plant species consumed by Himalayan Serow in and around Dachigam National Park during autumn.

S No.	Plant species	No. of occurrence (N=29)	Frequency of occurrence percentage (FO %) (N=29)
1	<i>Aesculus indica</i>	0.00	0.00
2	<i>Berberis lyceum</i>	4.00	13.79
3	<i>Celtis australis</i>	7.00	24.13
4	<i>Cynodon dactylon</i>	5.00	17.24
5	<i>Fragaria vesca</i>	0.00	0.00
6	<i>Morus alba</i>	0.00	0.00
7	<i>Quercus robur</i>	4.00	13.79
8	<i>Prunus armeniaca</i>	0.00	0.00
9	<i>Prunus cornuta</i>	4.00	13.79
10	<i>Prunus tomentosa</i>	6.00	20.68
11	<i>Populus alba</i>	5.00	17.24
12	<i>Parrotiopsis jacquemontiana</i>	8.00	27.58
13	<i>Podophyllum hexandrum</i>	0.00	0.00
14	<i>Robinia pseudoacacia</i>	6.00	20.68
15	<i>Rosa webbiana</i>	9.00	31.03
16	<i>Rubus fruticosus</i>	13.00	44.82
17	<i>Rumex nepalensis</i>	11.00	37.93
18	<i>Salix alba</i>	7.00	24.13
19	<i>Trifolium repens</i>	4.00	13.79

Table 5: Percentage occurrence of Plant species consumed by Himalayan Serow in and around Dachigam National Park during winter.

S No.	Plant species	No. of occurrence (N=21)	Frequency of occurrence percentage (FO %) (N=21)
1	<i>Aesculus indica</i>	9.00	42.85
2	<i>Berberis lyceum</i>	5.00	23.80
3	<i>Celtis australis</i>	6.00	28.57
4	<i>Cynodon dactylon</i>	4.00	19.04
5	<i>Fragaria vesca</i>	0.00	0.00
6	<i>Morus alba</i>	0.00	0.00
7	<i>Quercus robur</i>	5.00	23.06
8	<i>Prunus armeniaca</i>	0.00	0.00
9	<i>Prunus cornuta</i>	0.00	0.00
10	<i>Prunus tomentosa</i>	2.00	9.52
11	<i>Populus alba</i>	7.00	33.33
12	<i>Parrotiopsis jacquemontiana</i>	4.00	19.04
13	<i>Podophyllum hexandrum</i>	0.00	0.00
14	<i>Robinia pseudoacacia</i>	5.00	23.80
15	<i>Rosa webbiana</i>	0.00	0.00
16	<i>Rubus fruticosus</i>	3.00	14.28
17	<i>Rumex nepalensis</i>	2.00	9.52
18	<i>Salix alba</i>	3.00	14.28
19	<i>Trifolium repens</i>	0.00	0.00

Figures

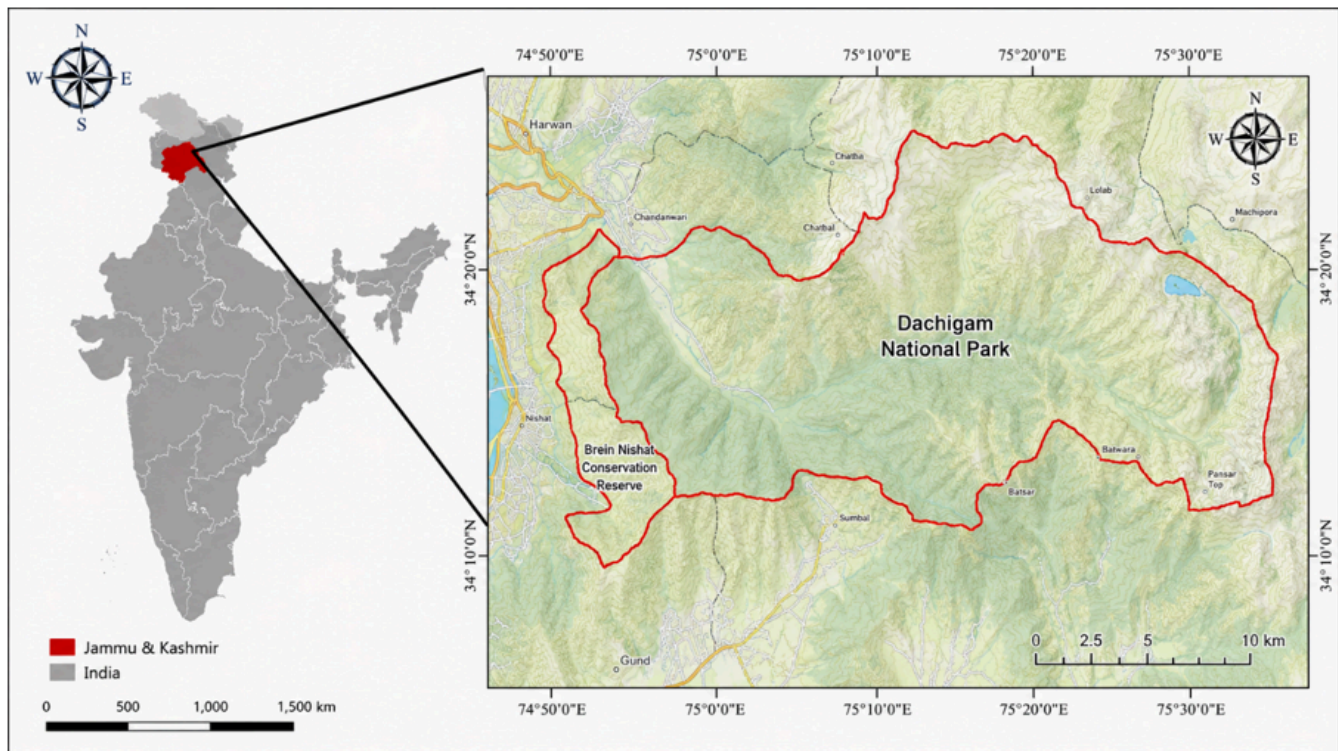


Figure 1

Map of the study area Dachigam National Park, and its surroundings viz., Brein and Nishat Conservation Reserve.

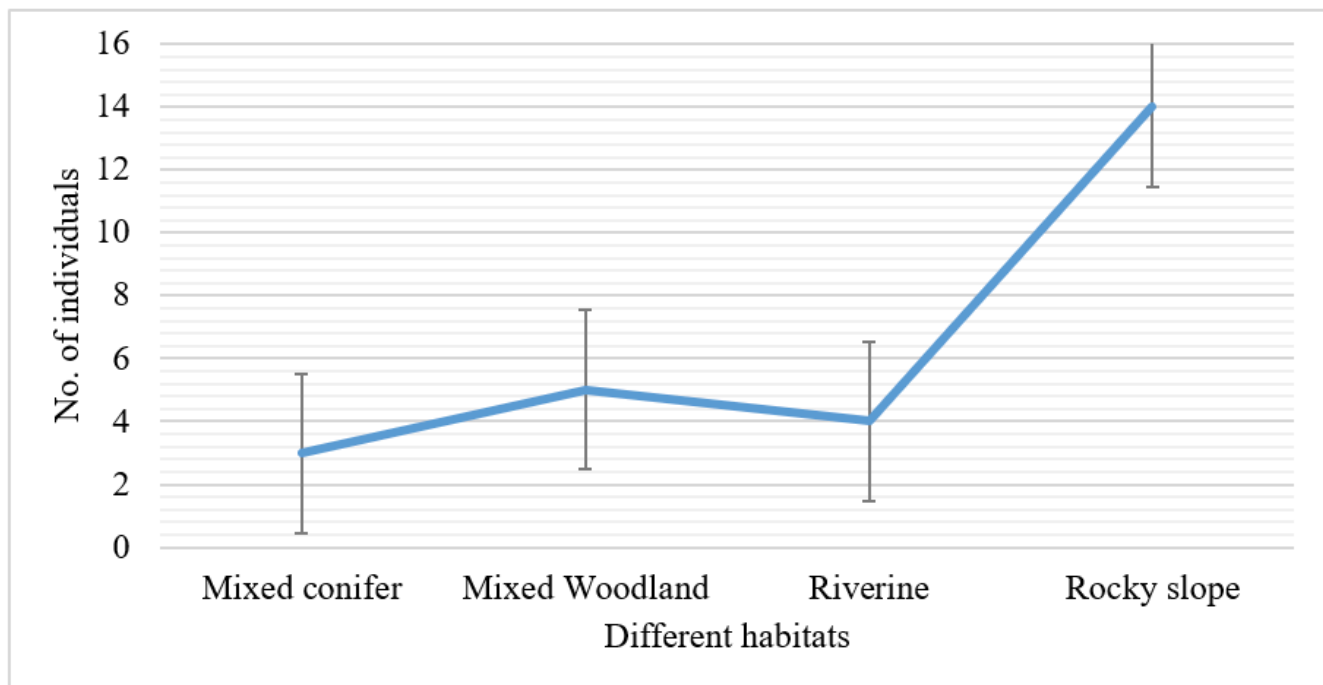


Figure 2

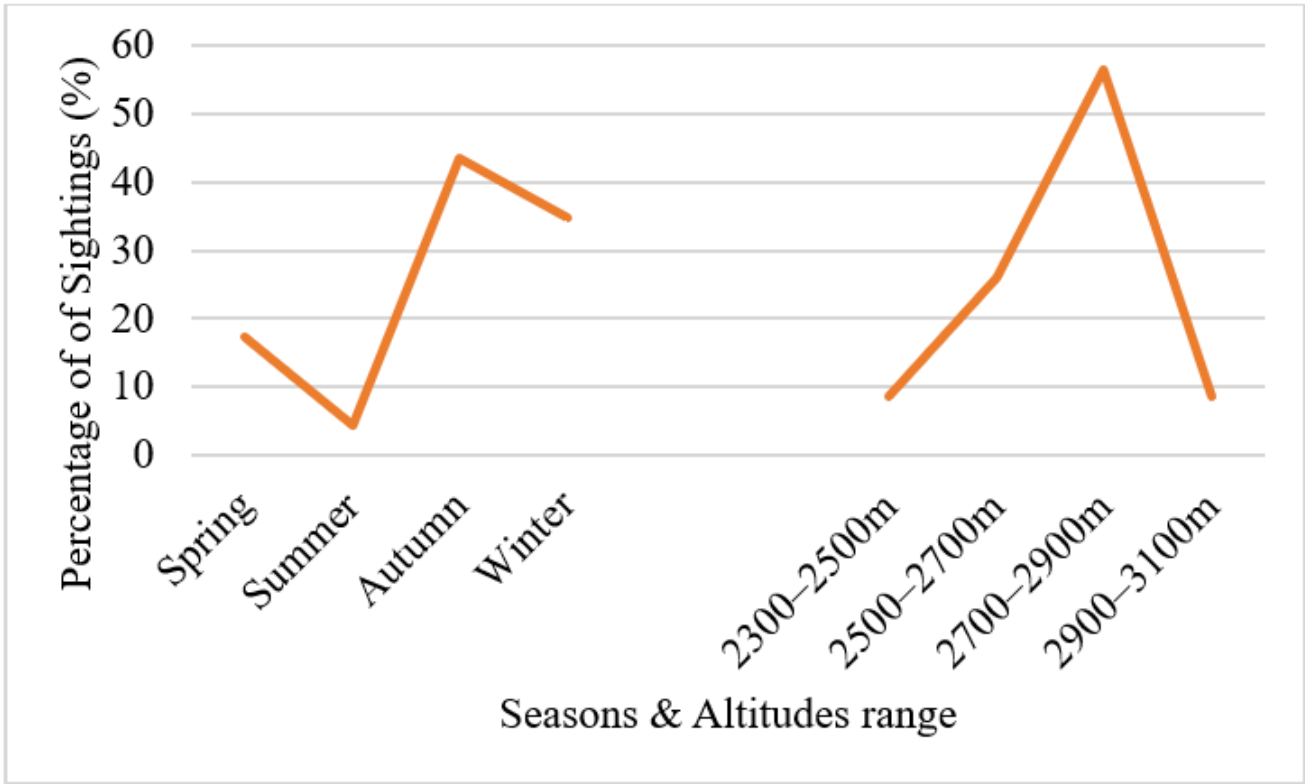


Figure 3
Percentage distribution of Himalayan Serow sightings during different season and different altitudinal classes.

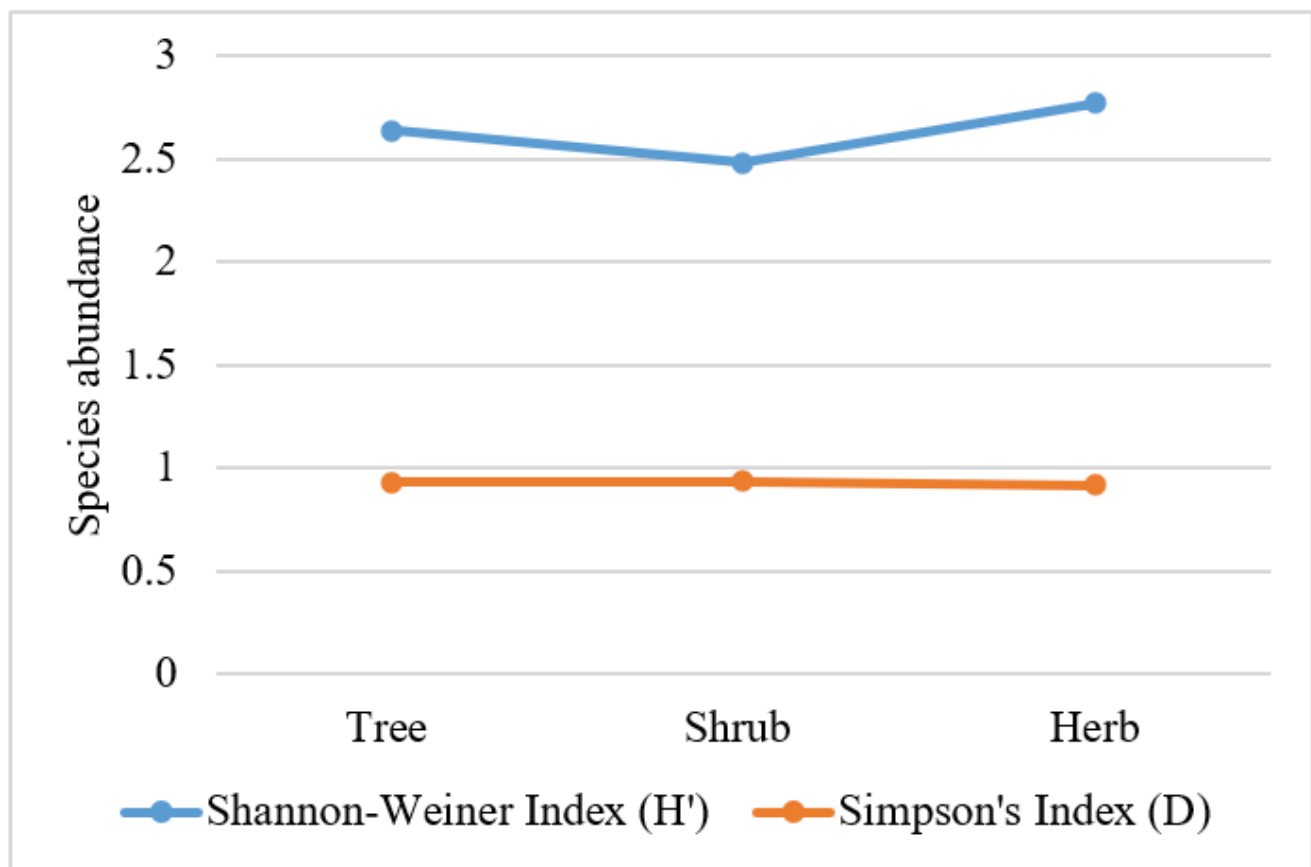


Figure 4

Diversity indices of plants in and around Dachigam National Park.

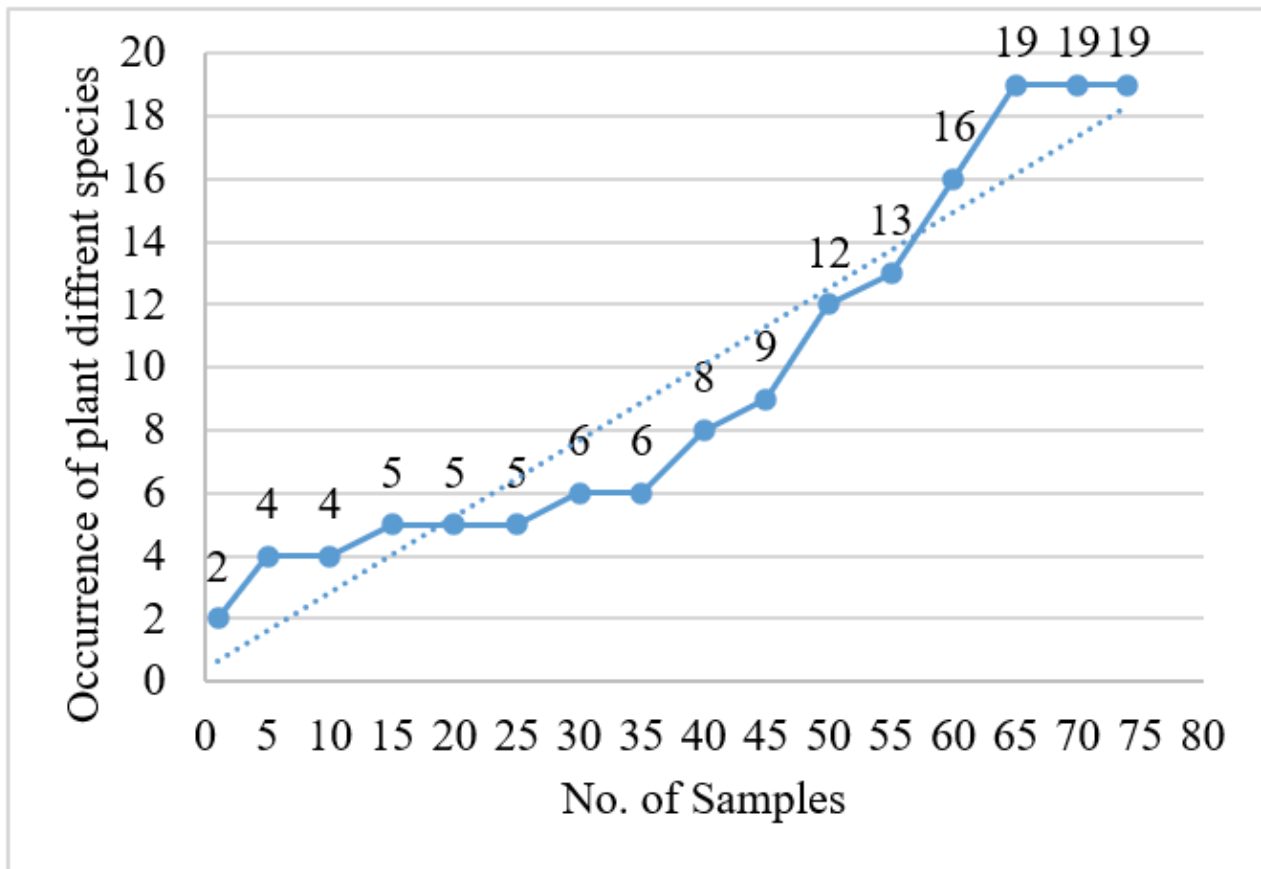


Figure 5

Occurrence of different plant species consumed by Himalayan Serow in and around Dachigam National Park in different samples.

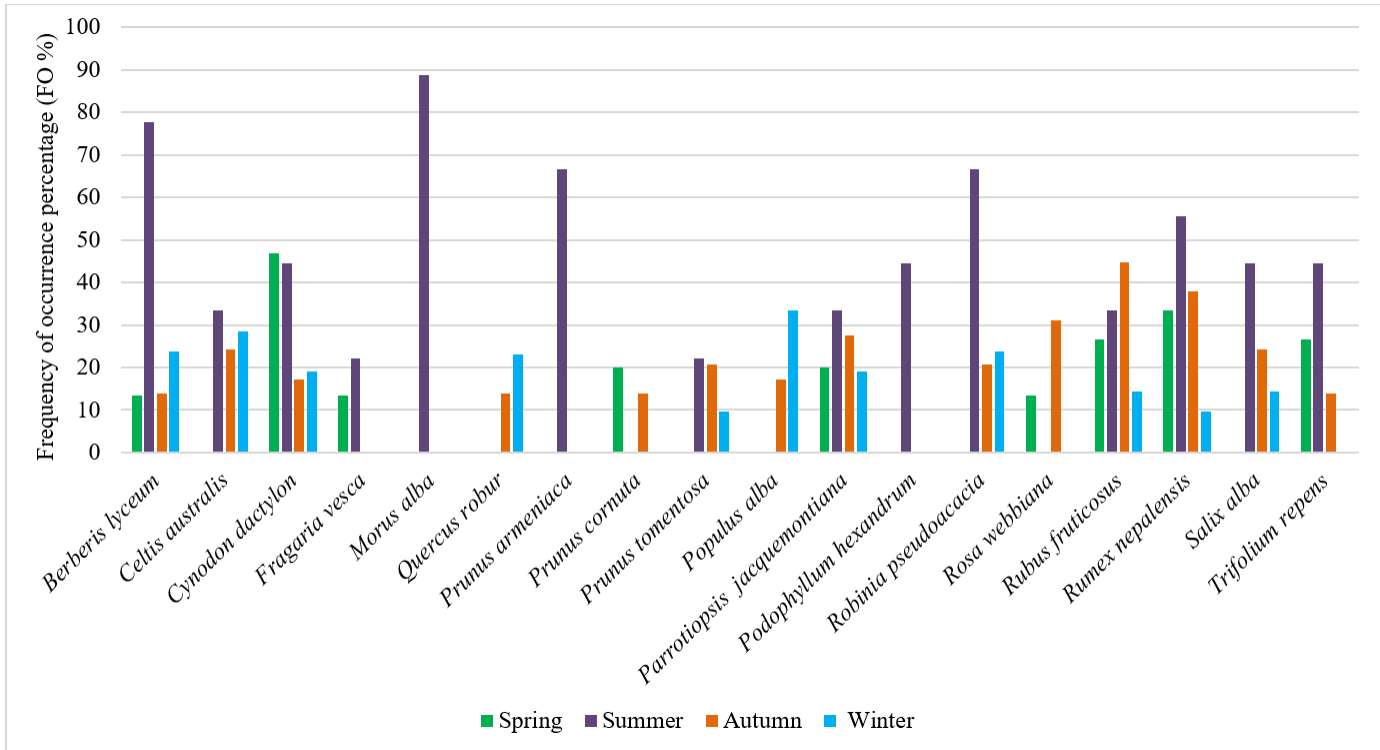


Figure 6

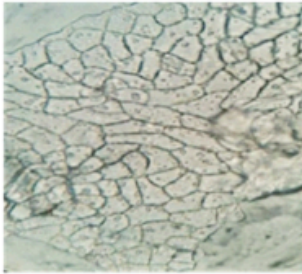
FO% of plant species consumed by Himalayan Serow in and around Dachigam National Park during different seasons.



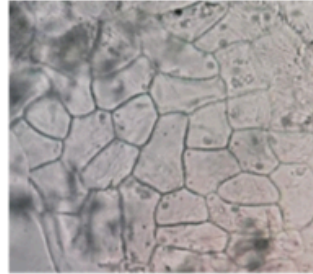
**Reference slide of
*Cynodon dactylon***



**Observed cell structure of
*Cynodon dactylon***



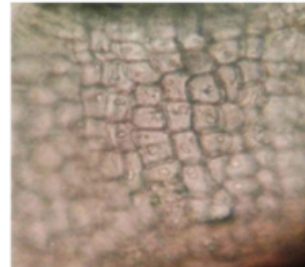
**Reference slide of
*Prunus tomentosa***



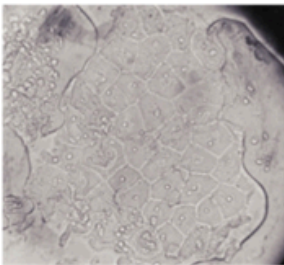
**Observed cell structure of
*Prunus tomentosa***



**Reference slide of
*Parrotiopsis jacquemontiana***



**Observed cell structure of
*Parrotiopsis jacquemontiana***



**Reference slide of
*Aesculus indica***



**Observed cell structure of
*Aesculus indica***

Figure 7

Observed cell structures under the microscope for comparison with reference epidermis slide & corresponding plant fragment identified from Himalayan serow fecal sample.