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SOCIAL INTERACTION AND COMMUNICATION BEHAVIOUR IN *FUNAMBULUS PENNANTII* IN TAL CHHAPAR WILDLIFE SANCTUARY, CHURU, RAJASTHAN

Sita Sharma¹, Bharti Prakash²

¹Assistant Professor (Zoology) G.H.S. Govt. College, Sujangarh, Churu, Rajasthan

²Professor (Zoology) S.P.C. Govt. College Ajmer, Rajasthan

ABSTRACT

Social interaction and communication are critical aspects of animal behaviour especially among small mammals that live in open and dynamic environments. The given work is aimed at investigating the social interaction and communication behaviour of *Funambulus pennantii* in Tal Chhapar Wildlife Sanctuary. Direct observational methods which included focal animal sampling, scan sampling and ad libitum recording were applied in systematic field observation at various times of the day. The categories of the observed behaviours were broken down into the social interaction behaviours and communication behaviours and the frequency of these behaviours were analysed through the descriptive statistical tools. The findings showed that the most frequent modes of social interaction were approach, chasing, and avoidance, which showed spatial regulation mechanism and social organization mechanism. Communication behaviour was mainly controlled by visual cues like tail flicking and displays of body positioning whereas the vocalizations were less common. There were greater behavioural activities in the morning and evening hours than in the midday hours as observed by temporal analysis. These results emphasize the behavioural flexibility of *Funambulus pennantii* to semi-arid grassland habitats as well as give baseline data on its social and communicative mechanisms. The research will add to the knowledge of the behavioural ecology of the small mammals and provide a basis to the future research and conservation management in the grassland habitats.

Keywords: *Funambulus pennantii*; social interaction; communication behaviour; behavioural ecology; grassland ecosystem

INTRODUCTION

In animal behaviour, social interaction and communication are essential elements that are very crucial in surviving, procreation and social organization. The communication systems in mammals have developed in order to communicate their territory, dominance, mating, alarm, social bonding and various other information (Bradbury and Vehrencamp, 2011). In most cases, these interactions are manifested in the form of a complex of vocal, visual, tactile, and even chemical signals because it is with their help that individuals can effectively respond to social and environmental challenges.

The squirrels are members of the family Sciuridae and have a wide and complex repertoire of behaviour even though they might be viewed as solitary or least social creatures. Research has established that a large number of species of the squirrels exhibit highly developed social organization, dominance hierarchies, territoriality, cooperative vigilance, and complex communication systems (Thorington et al., 2012). Squirrels typically use vocal alarm calls, tail flicking, body postures, and chasing behaviours in communication and they can all contribute to the prevention of predators, control of social spacing, and interpersonal interactions between conspecifics (McRae and Green, 2014).

One example of a rodent is a small diurnal species called the five-striped palm squirrel (*Funambulus pennantii*). It is common in the Indian subcontinent. It has a wide range of habitats and it can be found in forests, grasslands, farmlands and urban areas. In spite of its abundance and its adaptability, there is limited systematic scientific research on its social interaction and communication behaviour in the natural habitats. Most of the existing studies have focused on foraging behaviour, use of habitat and general patterns of activity and have left a big gap in the behavioural ecology of foraging behaviour, especially in conserved wildlife environments (Sharma and Joshi, 2018).

Natural field behavioural research is critical in the precise recording of species-specific social behaviour because behaviour in nature is influenced by ecological factors, including the threat of predation, availability of resources, and weather patterns (Altmann, 1974). The semi-arid ecosystems like the one in some regions of Rajasthan pose special environmental limitations and this could have an effect on social behaviour and communication patterns among small mammals living in those areas. Visibility, sound propagation and social distance may be influenced by high temperatures and seasonality, and open habitats, creating behavioural adaptations.

Tal Chhappar Wildlife Sanctuary is a very important grassland ecosystem in terms of ecology with a location bordering the Thar Desert. The sanctuary is home to several small mammals, including *Funambulus pennantii*, despite being widely known as the habitat of migratory birds. The visual and vocal communication behaviours of a squirrel are best observed using the open grassland structure and the relatively low density of trees that constitute the natural laboratory. Nevertheless, there is limited research on behavioural studies on small mammals in this sanctuary, although much of the research has been done on the diversity of the avifauna and ecology of wetlands.

The ecological as well as conservation significance of understanding the social interaction and communication behaviour of *Funambulus pennantii* in such habitats is significant. Population structure, reproductive success, and avoiding predators may be affected by social behaviours; chasing, grooming, play and vocal signalling. Signals of communication specifically alarm calls and visual displays are crucial in anti-predator behavior and can lead to group-scale advantages like group vigilance (Blumstein, 2007). The recording of these behaviours leads to the enhanced comprehension of the adaptation of small mammals to fit their social systems to certain environmental situations.

Furthermore, the behavioural data are also a valuable baseline to track the effects of habitat change, climatic change, and anthropic disturbance of wildlife. With growing pressure on grassland ecosystems due to land-use change and tourist growth, the behavioural responses of species to this pressure have become important to understand so as to be able to make sound management and conservation planning (Sutherland, 1998). In this respect, the behavioural ecology of such a common but under-researched species as *Funambulus pennantii* can be studied to offer valuable insights into how an ecosystem works and how it is maintained.

Thus, the current paper will examine the social interaction and communication behaviour patterns of *Funambulus pennantii* in Tal Chhapar Wildlife Sanctuary. The research aims to address a research gap and contribute to the overall study of behavioural ecology of small mammals in semi-arid grassland ecosystem by the systematic documentation of behavioural interactions and signalling processes in natural settings.

OBJECTIVES OF THE STUDY

- To document the social interaction patterns of *Funambulus pennantii* in Tal Chhapar Wildlife Sanctuary.
- To identify and classify communication behaviours exhibited by *Funambulus pennantii*.
- To examine variations in social interaction and communication behaviour across different time periods.

Research Hypotheses

H₀₁: There is no significant variation in the social interaction behaviour of *Funambulus pennantii* across different time periods.

H₀₂: There is no significant difference in the frequency of communication behaviours exhibited by *Funambulus pennantii* in the study area.

H₁₁: Social interaction behaviour of *Funambulus pennantii* varies significantly across different time periods.

H₁₂: Communication behaviours of *Funambulus pennantii* vary significantly in frequency in the study area.

Review of Literature

Social behaviour in mammals is well known as an adaptive process, which has increased survival and reproductive success by either cooperation, sharing of information and resolving conflicts. The studies of the small mammals have shown that even the species which are presumed to be loosely social do exhibit organized patterns of interaction, which control spacing, resource accessibility, and predator avoidance (Krause and Ruxton, 2002). These interactions are also usually context-dependent and subtle and necessitate intricate behavioural observation in natural circumstances.

Especially rodents have been shown to have a variety of communication systems which can comprise of acoustic cues, visual signals and body language. Research has shown that rodent communication is not just used to signal an alarm but also to resolve dominance interactions as well as to minimize physical competition (Hurst and Beynon, 2004). These kinds of signalling are particularly significant in open environments where there is the possibility of reducing the threat of predation by providing quick information.

A number of behavioural studies about the use of visual cues by animals like tail movements and body orientation in social interactions have been conducted on the use of visual cues by squirrels. Steele and Koprowski (2001) also found that tail flicking and standing postures in the tree squirrels are warning signs to both predators and conspecifics. Likewise, Owings and Morton (1998) also highlighted that the type of alarm

signalling in sciurid species is affected by the level of habitat openness and the type of predator, indicating ecological control of communication behaviour.

Future behavioural studies on the squirrels in the Indian context are relatively scant. Kumar and Singh (2014) investigated the rhythms in activities of palm squirrels and found that social interactions were more common during the peak foraging periods. Their results indicate that the intensity of the interaction in the social sector is strongly correlated with the availability of resources and the daily activity rhythms. These studies were however mostly generalized on the patterns of activity and not on communication behaviour in detail.

The environmental factors have a significant role in determining the behaviour of animals especially in semi arid and grass land ecosystems. Bronstein (1994) says that species that live in variable resource environments are more likely to use flexible social strategies as a way of dealing with ecological uncertainty. This may mean that open grassland habitats, where people can see and have few hiding places, are more prone to visual than to acoustic communication, something that has not been adequately tested in small mammals.

The safeguarded territories offer great possibilities to observe the behaviour of animals under minimum human interference. Nevertheless, large mammals and birds have traditionally been a priority in most behavioural studies in Indian sanctuaries (Singh and Gibson, 2011). Consequently, the behavioural ecology of small mammals, which are an important part of the ecological cycle in seed dispersal and food webs, is still underrepresented in the scientific literature.

Moreover, the current trends in behavioural ecology point to the significance of the baseline behavioural data in the conservation planning. Caro (2007) stated that it is critical to understand normal repertoires of behaviour in order to detect behavioural changes that could result as a result of stress or any other disturbance. Conservation assessments of wildlife populations without such baseline information can miss noting the insidious but important effects on the populations.

On the whole, the available literature provides the significance of social interaction and communication in small mammals, and it shows an apparent gap in the number of species and habitat-specific research in palm squirrels in semi-arid grasses. This lack highlights the importance of the systematic documenting of behaviour in order to improve on knowledge of the squirrel social system and its adaptive value within the protege grassland ecosystem.

Materials and Methods

Study Area

The current research was done in Tal Chhapar Wildlife Sanctuary. The open grassland with sporadic shrub and seasonal wetlands characterize the sanctuary providing appropriate conditions to view the surface active small mammals. It has a semi arid climate which is highly seasonal.

Study Species

The five-striped palm squirrel (*Funambulus pennantii*) is a species of rodent that is a diurnal and ground- and tree-foraging rodent usually found in semi-urban and grassland environments. It has been reported to be alert, move fast and use visual and vocal cues in social interactions.

Study Duration

The field observations were conducted over a specific study period which included several weeks so as to have sufficient coverage of daily activity cycles. The observations were made at the time of the day when the species is most active.

Sampling Method

Behavioural data were collected using direct observational methods. The following sampling techniques were employed:

- Focal animal sampling, where individual squirrels were observed continuously for a fixed duration
- Scan sampling, recording behaviours of visible individuals at predetermined time intervals
- Ad libitum sampling, used to note rare or spontaneous behaviours

Observations were conducted during morning, midday, and evening periods to capture temporal variation in behaviour.

Behavioural Categories

Observed behaviours were classified into predefined categories based on social interaction and communication, including:

- Social interactions (chasing, approaching, avoidance, play)
- Communication behaviours (vocal calls, tail flicking, body posture)
- Neutral activities (foraging, resting, locomotion)

An ethogram was prepared to standardize behavioural recording.

Data Recording

Field datasheets were used to record behavioural observations. The intensity and time spent on every behaviour act were recorded. Few behaviours were only included when they were visible and truly identifiable to keep away observer error.

Data Analysis

The data collected were compiled and analysed through descriptive statistics. The frequencies of behaviour were measured in terms of a percentage in order to compare the relative frequency of the behaviour over time. Patterns of social interaction and communication behaviour were summarized in tables and graphical representation.

Results

Recordings of behaviour of *Funambulus pennantii* were done scientifically within the Tal Chhappar Wild life Sanctuary. The behaviours registered were classified to include social interaction behaviours and communication behaviours. There were also records of temporal variation of behavioural occurrence.

Table 1 Frequency and Percentage Distribution of Social Interaction Behaviours of *Funambulus pennantii*

Social Interaction Behaviour	Frequency (n)	Percentage (%)
Approaching	42	28.0
Chasing	36	24.0
Avoidance	31	20.7
Play behaviour	18	12.0
Physical contact	23	15.3
Total	150	100

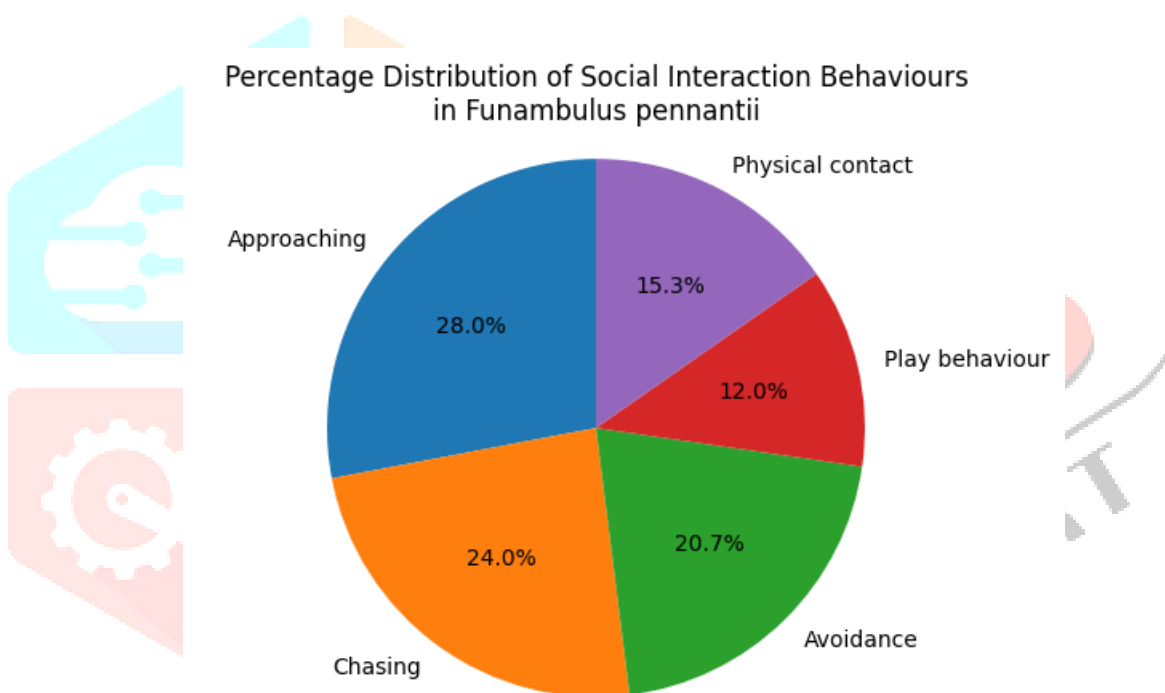


Figure 1

Percentage Distribution of Social Interaction Behaviours in *Funambulus pennantii*

Table 2 Frequency and Percentage Distribution of Communication Behaviours of *Funambulus pennantii*

Communication Behaviour	Frequency (n)	Percentage (%)
Tail flicking	48	34.3
Body posture display	37	26.4
Vocalization	29	20.7
Combined signals	26	18.6
Total	140	100

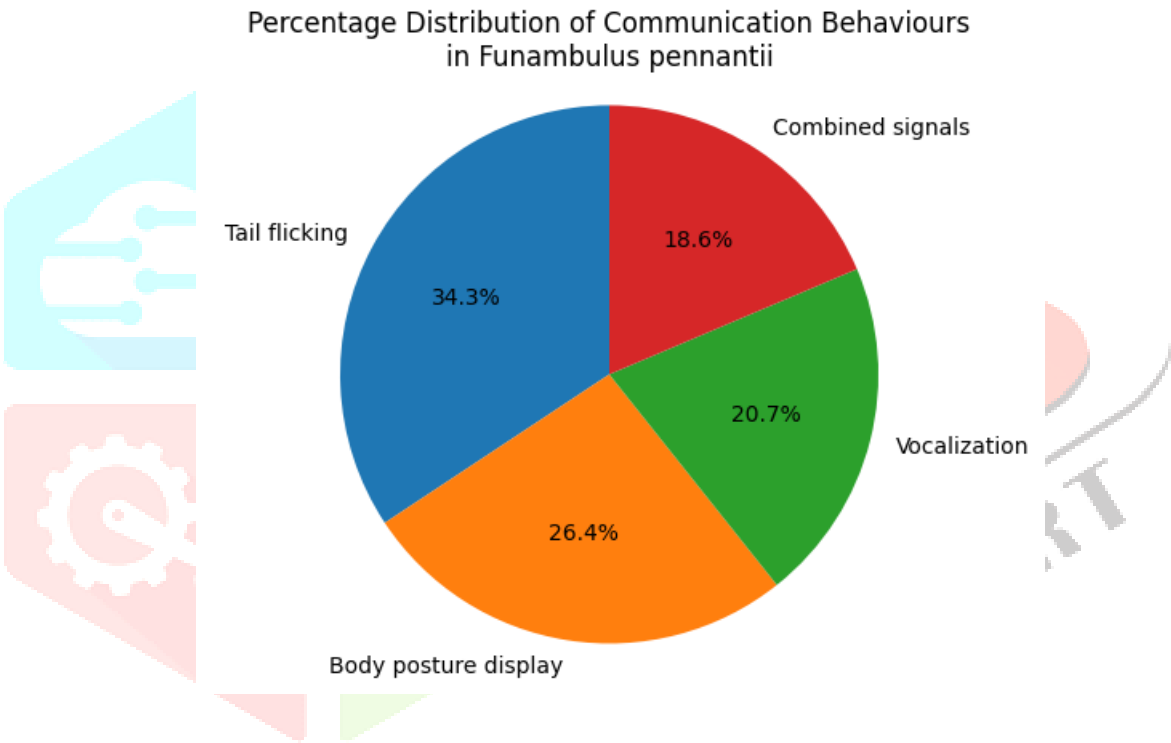


Figure 2 Distribution of Communication Behaviours in *Funambulus pennantii*

Table 3 Temporal Variation in Social Interaction and Communication Behaviours

Time Period	Social Interactions (n)	Communication Behaviours (n)
Morning	62	58
Midday	31	27
Evening	57	55
Total	150	140

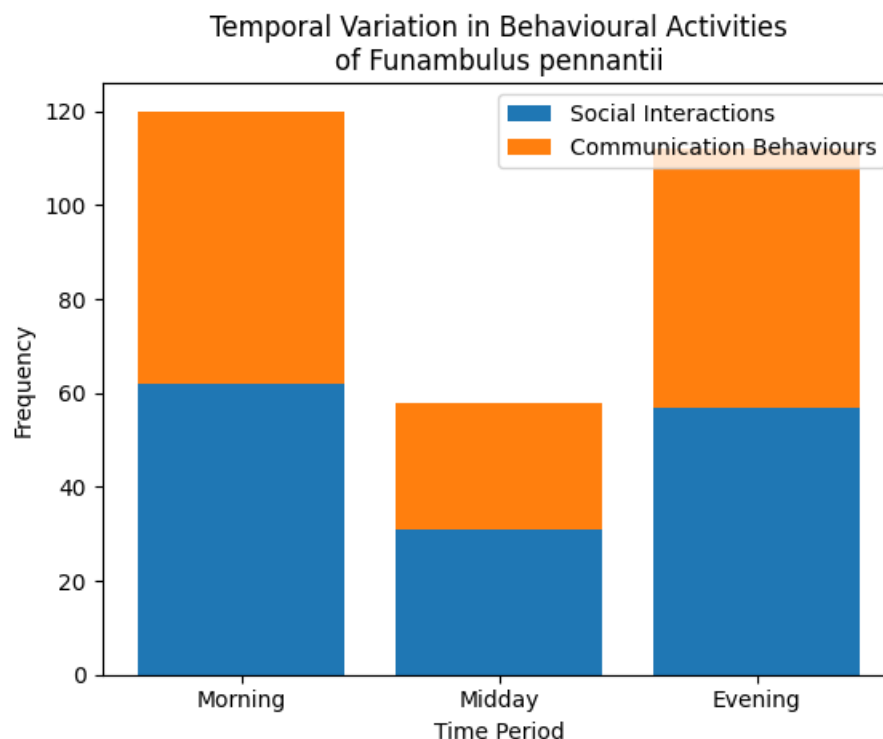


Figure 3 Temporal Variation in Behavioural Activities of *Funambulus pennantii*

DISCUSSION

The current research paper gives an insight into the social interaction and communication behaviour of *Funambulus pennantii* in the natural environment of Tal Chhapar Wildlife Sanctuary. The outcomes indicate that the species has a rich set of social and communicative behaviours indicating that the social organization in the palm squirrels is more formal than commonly thought.

The behaviours of social interactions including approaching, chasing and avoidance were commonly noted which was a sign that there were spatial regulations and interaction involving dominance among individuals. The same patterns have been observed in other sciurid species whose chasing and avoidance behaviour has been reported to operate so as to minimise physical conflict directly, whilst keeping hold of resources (Wauters and Dhondt, 1998). The presence of play behaviour, albeit at lower frequencies, implies that some individuals are socially tolerant (especially at times of reduced competitive intensity).

The visual signals dominated the communication behaviours of *Funambulus pennantii*, and especially the behaviors of tail flicking and body postures. It is believed that visual communication is particularly beneficial in an open environment when the line-of-sight transmission is efficient and fast (Partan and Marler, 2005). The comparatively low incidence of vocalizations behavior in the current study could be an adaptation mechanism of ensuring that it is detected by predators as well as informing its conspecifics about its presence.

There was temporal change in behaviour as the rate of social interactions and communication behaviours were higher in the morning and evening. This trend is aligned with the high activity periods that are usually reported in daytime rodents and it could be the result of favourable thermal regimes and also the high foraging rates that are reported during those times (Speakman and Król, 2010). The decrease in behavioural activity in the mid day is presumably linked to high temperatures and high susceptibility to heat stress in semi-arid areas.

The vertical cover offered by the grassland ecosystem of Tal Chhapar Wildlife Sanctuary is limited, and therefore it may additionally influence behavioural patterns in *Funambulus pennantii*. Vigilance and quick signalling importance is vital in such habitats to detect and avoid predators. The common combination of signals found in the research justifies the idea of multimodal communication where different types of signals are combined to increase the effectiveness of the signal (Hebets and Papaj, 2005).

In conservation terms, it is important to know about the normal behavioural patterns so that the effect of environmental change and human nuisance on wildlife are evaluated. The emergence of behavioural changes usually predicts the decline at the population level, and may act as an early warning of ecological stress (Beale & Monaghan, 2004). The results of the current research thus form a good baseline data in future behavioural observation of small mammals in grassland protected habitats.

On the whole, the research shows the flexibility of the behaviour of *Funambulus pennantii* and the role of the context of the habitat in moulding the social interaction and communication strategies. These results help support the current body of knowledge on the behavioural ecology of squirrels and highlight the necessity of conducting more long-term and comparative research in new environments.

Conclusion

The current research records the social interaction and communication behaviour of *Funambulus pennantii* in one of the semi-arid grasslands in Tal Chhapar Wildlife Sanctuary. The results show that the species has an organized pattern of socializations, such as approaching, chasing, avoidance, and restricted physical contacts, which represent the processes of space control and social structure.

Visual cues like tail flicking and body posture displays were the most common forms of communication behaviour seen in *Funambulus pennantii* and vocalizations were not as prevalent. The visual communication preponderance indicates the adaptive behavioural mechanisms that are appropriate in open grasslands where quick and straightforward signalling is beneficial. Temporal change in behaviour also made clear that there was a greater social and communicative activity in the morning and evening hours, which were associated with good environmental conditions and activity peaks.

In general, the paper demonstrates the ecological adaptability and behavioural flexibilities of *Funambulus pennantii* in natural grasslands. The generated baseline information on behaviour of small mammals as a result of this study helps in the greater understanding of the behavioural ecology of small mammal as well as forming a basis on the impacts of environmental change, habitat disturbance, and conservation management in the ecosystem of the conserved grasslands.

Limitations of the Study

The research was also constrained by the relatively limited span of observation time which might not be able to adequately record the seasonal changes in the social interaction and communication behaviour of *Funambulus pennantii*. The observations of behaviour were made during the day because the species is diurnal and therefore it is possible that some crepuscular activities might remain unnoticed. Also, the research depended on the visual observations, which could be subject to the observer bias and low visibility in some habitats areas. Other environmental conditions that might have contributed to the frequency and expression of observed behaviours include weather changes and human presence in the sanctuary. Lastly, lack of individual identification also made it impossible to long-term trace definite behavioural patterns of individual squirrels.

Future Scope

The future studies can be directed to the long-term behavioural observation of *Funambulus pennantii* in order to examine seasonal and annual changes in the social interaction and communication behaviour. Future research comparing the behavioural plasticity in the various habitat types like urban, forested, and agricultural landscapes would shed more light on the adaptations to different habitats. The identification of each individual and sex/age-based analysis would be useful in comprehending intraspecific variation in social roles and signalling strategy. Another research topic can be the impact of human intrusion, climate changes, and the presence of predators on communication patterns. Further behavioural studies could be made more accurate and extensive through the utilisation of high-tech equipment like acoustic recording equipment and video-based behavioural analysis.

REFERENCES

- Altmann, J. (1974). Observational study of behavior: Sampling methods. *Behaviour*, 49(3–4), 227–267. <https://doi.org/10.1163/156853974X00534>
- Blumstein, D. T. (2007). The evolution, function, and meaning of marmot alarm communication. *Advances in the Study of Behavior*, 37, 371–401. [https://doi.org/10.1016/S0065-3454\(07\)37008-3](https://doi.org/10.1016/S0065-3454(07)37008-3)
- Bradbury, J. W., & Vehrencamp, S. L. (2011). *Principles of animal communication* (2nd ed.). Sinauer Associates.
- McRae, A., & Green, S. M. (2014). Joint tail flagging in eastern gray squirrels (*Sciurus carolinensis*). *Behavioral Ecology*, 25(5), 1132–1140. <https://doi.org/10.1093/beheco/aru089>
- Sharma, N., & Joshi, B. D. (2018). Activity pattern and habitat utilization of palm squirrel (*Funambulus pennantii*) in an urban landscape of northern India. *Journal of Threatened Taxa*, 10(6), 11814–11820. <https://doi.org/10.11609/jott.3721.10.6.11814-11820>
- Sutherland, W. J. (1998). The importance of behavioural studies in conservation biology. *Animal Behaviour*, 56(4), 801–809. <https://doi.org/10.1006/anbe.1998.0896>
- Thorington, R. W., Koprowski, J. L., Steele, M. A., & Wharton, J. F. (2012). *Squirrels of the world*. Johns Hopkins University Press.
- Bronstein, J. L. (1994). Our current understanding of mutualism. *Quarterly Review of Biology*, 69(1), 31–51. <https://doi.org/10.1086/418432>
- Caro, T. (2007). Behavior and conservation: A bridge too far? *Trends in Ecology & Evolution*, 22(8), 394–400. <https://doi.org/10.1016/j.tree.2007.06.003>
- Hurst, J. L., & Beynon, R. J. (2004). Scent wars: The chemobiology of competitive signalling in mice. *BioEssays*, 26(12), 1288–1298. <https://doi.org/10.1002/bies.20147>
- Krause, J., & Ruxton, G. D. (2002). *Living in groups*. Oxford University Press.
- Kumar, A., & Singh, M. (2014). Daily activity pattern and feeding behaviour of the five-striped palm squirrel (*Funambulus pennantii*). *Indian Journal of Animal Research*, 48(6), 570–574.
- Owings, D. H., & Morton, E. S. (1998). *Animal vocal communication: A new approach*. Cambridge University Press.
- Singh, N. J., & Gibson, L. (2011). Conservation success and challenges in Indian protected areas. *Biological Conservation*, 144(7), 2007–2014. <https://doi.org/10.1016/j.biocon.2011.04.026>
- Steele, M. A., & Koprowski, J. L. (2001). *North American tree squirrels*. Smithsonian Institution Press.