

Altered habitats, altered behaviours: use of plastic in nest building by Indian palm squirrel

Nests are observed throughout the animal kingdom, and in general, they are essential for the protection and upbringing of young ones^{1,2}. Owing to the thermal determination of sexes in reptilian species, and communal livelihoods of social insects, both nest-building and nests have received considerable scientific attention. Social insects communally build large nests and spend their lives completely within them^{3,4}. Birds build their nests just before egg laying and abandon them immediately after the departure of the fledglings⁵. Chimpanzees build their nests for the purpose of sleeping^{6,7} and hence, construct them on a daily basis. Additionally, nests differ in shape, size and materials used to build them^{2,8}. Each nest has pertinent functional significance, viz. protection from predators, thermoregulation⁹, mate attraction, etc. The type of nest, the materials used and the architectural design provide important insights into the life of a species¹⁰. Therefore, nests and nest-building are of vital importance in understanding the adaptive behaviour of a species to the changing habitat.

Nest building behaviour is recognized as important in understanding the ecology and evolution of a species¹¹. Squirrels construct their nests in hollow trees, abandoned cavities and similar hollows; they also build spherical shaped nests or dome-shaped nests on tree branches. Usually, nesting materials include leaves,

twigs, shredded bark, mosses and other soft materials^{12,13}, however we observed the use of alternative nesting material such as plastic bags, plastic threads and cigar butts along with natural materials in an urban landscape.

We observed an Indian palm squirrel (*Funambulus palmarum*) female building its nest on a prosopis tree (*Prosopis juliflora*) in the University of Mysore campus, Karnataka, using plastic that was available abundantly in its habitat (Figure 1). It was observed that she collected a long plastic sheet from a small dump yard. She then carefully checked the plastic material and tore it into the appropriate size and shape. Thereafter, she rolled the entire plastic material into her mouth and carried it to the nesting site. There she spread the snipped pieces of plastic and built her nest (Figure 2). We found two more nests which were built using similar plastic material in habitats dominated by plastic detritus, encompassing up to 8–10 m (see Supplementary Figures 1 and 2). In another location, on a teak tree (*Tectona grandis*) that was 50–60 m away from the nearest plastic and other waste materials (see Supplementary Figure 3), only one of the four nests on the tree was built completely with natural materials. The different materials used in nest construction reflect differences in their local availability. Although Indian palm squirrels usually build nests using natural materials, these squirrels appear to be adapting themselves to changes in habitat.

The proportion of anthropogenic material used in nest building is directly related to the extent of urbanization¹⁴. With rapid changes in urban environments, most commensal species of animals have

to make modifications in their behaviour to survive. The use of plastic for nest building by palm squirrel, a behaviour not reported earlier, is a typical example of the struggle for existence by the commensal species in altered habitats.

1. Collias, N. E., *Am. Zool.*, 1964, **4**, 175–190.
2. Heenan, C. B., Goodman, B. A. and White, C. R., *Glob. Ecol. Biogeogr.*, 2015, **24**, 1203–1211.
3. Sudd, J. H. and Franks, N. R., *The Behavioural Ecology of Ants*, Springer Science & Business Media, 2013.
4. Tschinkel, W. R., *J. Bioecon.*, 2015, **17**, 271–291.
5. Collias, N. E. and Collias, E. C., *Nest Building and Bird Behavior*, Princeton University Press, 2014.
6. Goodall, J. M., *Ann. N. Y. Acad. Sci.*, 1962, **102**, 455–467.
7. Hakizimana, D., Hambuckers, A., Brothorne, F. and Huynen, M. C., *Afr. Primates.*, 2015, **10**, 1–12.
8. Nores, A. I. and Nores, M., *Wilson. Bull.*, 1994, **106**, 106–120.
9. Kinder, E. F., *J. Exp. Zool.*, 1927, **47**, 117–161.
10. Rohwer, V. G. and Law, J. S. Y., *Condor*, 2010, **112**, 596–604.
11. Collias, N. E. *Endeavour*, 1986, **10**, 9–16.
12. Borges, R. M., Resource heterogeneity and the foraging ecology of the Malabar Giant Squirrel *Ratufa indica*, Ph D thesis, University of Miami, Florida, 1989.
13. Datta, A. and Goyal, S. P., *Biotropica*, 1996, **28**, 394–399.
14. Wang, Y., Chen, S., Blair, R. B., Jiang, P. and Ding, P., *Acta Ornithol.*, 2009, **44**, 185–192.

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Figure 1. Immediate habitat where the nest of the first Indian palm squirrel was found.



Figure 2. Nest of the Indian palm squirrel (*Funambulus palmarum*) built using plastic material.