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Foraging and nesting behaviour of Baybacked Shrike (*Lanius vittatus*) in southern India

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Abstract

The nesting and nest-site characteristics of Baybacked Shrike (*Lanius vittatus)* were studied in Mudumalai Wildlife Sanctuary, southern India. Foraging records (n=67) were obtained regardless of age and sex. Pouncing was the predominant mode of insect capture. Foraging attempts were largely made on the ground. In all, 24 nests were studied. Nests were placed on eight plant species, mostly shrubs. In general, shrike preferred open places in which to nest, possibly because this facilitates better vigilance over the nests, as well as more effective foraging.

Key words: Birds, India, Baybacked Shrike, *Lanius vittatus,* Foraging, Reproductive ecology, Nest-site characteristics.

Introduction

The true shrikes of the genus *Lanius* are a rather uniform group of about 25 species of small to medium-sized passerines which combine insectivorous and carnivorous modes of feeding to varying degrees depending on species, region, and local conditions (Cade, 1995). In recent years, concern over this group has increased considerably among conservationists as populations are suspected to be declining worldwide as a result of human activities (Yosef & Lohrer, 1995). Moreover, the reputation of shrikes as 'butcher birds' among some segments of the community (pers. obs.) further hampers the task of conserving these birds. However, no attempt has until now been made to investigate the status and ecology of any of the nine species of true shrikes distributed in India: these birds are little known apart from the species descriptions given by Ali and Ripley (1987). The nesting and foraging of Baybacked Shrike (*Lanius vittatus*) in Mudumalai Wildlife Sanctuary (MWS), south India was investigated in this study. Baybacks are one of the more widely distributed shrike species in India, inhabiting open scrublands; it is a resident in Mudumalai Wildlife Sanctuary (Gokula & Vijayan 1997).

Study area

The Mudumalai Wildlife Sanctuary (321 km^2) is located at an average elevation of about 1000 m between 11°30′–11°39′N to 76°27′–76°43′ E in the Nilgiri District, Tamil Nadu, southern India. Daytime temperatures vary from 14°–17°C during December-January to 29°–33°C during March-May. Annual rainfall varies from 600 mm to 2000 mm and is received in two monsoons (Desai, 1991). The area receives high rainfall during the southwest monsoon (June–August), the contribution from the northeast monsoon (September–November) being lower. The sanctuary is drained mainly by the perennial Moyar River and partly by various ephemeral rivers and streams. Corresponding with the rainfall, the vegetation varies from thorn forest in the east to semi-evergreen forest in the west. In recent years, a sharp increase in the human population in and around the sanctuary has considerably altered these vegetation types as a majority of the people depends on the forest for resources such as fuel wood. Further details of the sanctuary are given in Desai (1991). Based on the distribution of Baybacked Shrike, the eastern part of the sanctuary was selected for this study. The study-site is dominated by plants such as *Acacia* spp. (including *A. chundra, A. leucopholea,* and *A. ferruginea*), *Anogeissus latifolia, Ziziphus* spp., *Sapindus emarginatus, Phyllanthus emblica, Erythroxylum monogynum, Cassia fistula* and *Capparis* spp.

Methods

Foraging and nesting records were collected at the study site during the dry periods (January to April) of 1995 to 1997.

Foraging pattern. Bearing in mind that the foraging pattern could determine nest-site selection, foraging was studied alongside nesting and nest-site selection. Only one foraging record (initial record) was taken from any individual encountered, following MacNally (1994). Records were collected the four hours following sunrise. For each bird observed, a record was maintained of the foraging method and height,

and substrate type used. Foraging heights were assigned to 11 height categories: 0 m (ground), and at every 1 metre interval up to 10 m based on the general physiognomy of the vegetation. I consider the 'substrate' to be the material from which food is taken by birds. Substrates were classified as (1) ground, including debris, litter and grass; (2) trunk/main branches/twigs: the axes of trees; (3) foliage: leaves including leaf-blades and petioles; and (4) air. Foraging methods of insectivorous birds were broadly categorized as follows. (1) glean: a stationary food item is picked from its substrate by a standing or hopping bird; (2) probe: as for glean, but only the bird's beak disturbs the substrate to locate concealed food; (3) pounce: a bird flies from a perch and grabs the food item as it lands on the substrate; and (4) sally or fly-catching: a bird flies into the air to catch flying prey.

As no significant changes in the weather between years during the study period was observed, and in view of the similarity of climatic seasonality between years, data collected for the entire study period were pooled for analysis. I followed Morrison (1984) in treating 30 as the minimum number of foraging records necessary in order to represent accurately the behaviour of a bird.

Nesting and nest-site selection. Intensive searches for nest structures were made on foot in the entire sample area (20 ha) by searching substrates suitable for nesting. An active nest was confirmed if adults were seen engaging in breeding activities (nest building or renovation, incubation, feeding young) in or adjacent to the nest.

The method of determining nest-site selection was similar to that already established in a number of nest-site selection studies (e.g. Bechard et al., 1990; Hullsieg & Becker, 1990). Variables were set at three levels: nest, nest-plant and nest-patch. The nest variables were collected to obtain information on the physical structure (namely nest height, length, width and depth), of the nest. In addition, 'nest concealment' was estimated by viewing the nest at nest-level or above or below from a distance of 2m, 5m, 7m and 10m in each of four cardinal directions (Martin & Roper, 1988). In total, concealment of nests was evaluated at 16 points. Abundance rating for the nest concealment was made based on number of points at which the nest was not seen (0–4 points =very low; 5–8 points =moderate; 9–12 points =high; and 13–16 points =very high). The nest-plant variables were to identify the key characteristics of the nest-plant species, which supports the nest of a particular bird species. It includes nest plant species, nest plant height, and nest plant girth at breast height (Gbh).

A 0.07 ha circular plot centred at the nest-plant was laid for every nest in order to study nest-site selection as suggested by Titus & Mosher (1981). Nest-patch variables were measured within the plot to identify the microhabitat required for nesting. Variables, namely canopy cover, ground cover and shrub cover were visually estimated and noted as percentages. Other variables, namely distance to road and disturbance to nest-plant were included to identify whether site selection was significantly affected by human activity. Lopping and cutting signs on the nest-tree were considered to constitute disturbance and were estimated in percentage disturbance. Distances were measured directly in the field when short, or from the topographical map (1:50,000). Height measurements were made using a clinometer. Vegetation cover (shrub and ground) was visually estimated as a percentage. Canopy cover immediately over the nest was measured using a hand mirror marked with a grid and the shaded area was estimated as a percentage of canopy cover (Martin & Roper, 1988). To test for nest-site selection, all parameters except nest measurements were compared with similar measurements recorded at randomly selected sites to identify the factors responsible for selecting a nest-site. Random sites were selected on the basis of a place having potential nest-sites and being sufficiently close to the used sites. The 20 ha plot laid for nest-searches was divided into (50´50 m) 80 grid squares. Grids were plotted and numbered on an enlarged topographic map of the study area. Twenty grid squares were selected randomly by using a lot system and were identified in the study site. Once the approximate grid square or site was located, the nearest tree or shrub was made the centre of the random plot.

Statistical analyses. Univariate analysis of variances (ANOVA), Mann-Whiteney *U*, and other routine statistics (mean and SD) were derived as appropriate (Sokal & Rohlf, 1981). Results are reported as significant if they are associated with a value of $P<0.05$. The SPSS software (Nouris, 1990) was used for the data analyses. Principal component analysis was performed on the nest-site characters to determine the most important factors in delimiting the habitat niche of the species. Discriminant function analysis was performed to identify the factors involved in separating the nest-sites from the random sites.

Results and discussion

Foraging pattern. A majority of foraging attempts was made on the ground (93.5%), pounce (88%) being the predominant method (Table 1). In total, insects were

Table 1. Use of foraging substrate (per cent), method and height by Baybacked Shrike. G= ground, GS= ground sally, GP= ground pounce, WG= wood-gleaning, GH= ground search.

Substrates (n=67)			Height (m) (n=67)				Method (n=67)			
Air	Ground	Wood	G	0-1	>1-2	>2-3	GS	GP	WG	GH
5	93.5	1.5	76.5	2	18	3.5	5	88	1.5	5.5

picked from substrates like air, ground and wood at a height of up to 3 m from the ground. During the behavioural study, no attempt by Baybacked Shrike to impale prey was observed. Martin & Karr (1990) opined that species were plastic only within certain limits determined by their evolutionary histories. As attack manoeuvres and substrate exploitation by a species may be constrained by its morphology, the use of these two aspects was more consistent. However, it showed some level of consistency even in the use of height. This could be because of the availability of particular (preferred) insects in that height class.

Breeding phenology. In Mudumalai Wildlife Sanctuary Baybacked Shrikes breed during summer (January to June) and build nests largely in late March to early May. They were secretive in their nesting behaviour, as a result of which opportunistic searches yielded more nests (n=18) than behavioural searches (n=6). Nests were built with fine grass, moss and rootlets almost in a bowl shape. The inner side was bound with feathers and cobwebs. Both sexes shared nesting activities. The clutch size varied from 3 to 5 eggs. The eggs were pinkish with dark brownish spots. The mean incubation period was 15±0.78 days (n=13 pairs). Desai & Malhotra (1986) reported that the clutch size varied from 3 to 4 and the incubation period 14 to 15 days with an average of 14.6 days (n=8 pairs).

Nest-plant selection. Baybacked Shrike used a variety of plant species for nest construction. In total, eight plant species were selected for placing the nests. They showed a high preference for *Erythroxylum monogynum* and *Toddalia asiatica,* which supported an equal proportion of nests (20%). These were followed by *Gymnosporia montana, Randia dumetorum, Eucalyptus* sp. and *Acacia chundra,* each of which supported 13% of nests. *Phillanthus emblica* and *Anogeissus latifolia* supported only a few (4%) nests. The use of a wide variety of nest-plants by these birds may be a strategy to counteract a predator's search tactics for particular types, as reported by Furrer (1975). Most of the nests were found on plants with cutting or lopping signs and also on disturbed parts (with evidence of having been cut or lopped).

Table 2. Nest site variables of the Baybacked Shrike and comparison with random-site variables. Variables showing significant difference between nest-site and random-site are in bold and details are given in text.

Variables	Mean	SD
Nest height (cm)	156.4	40.4
Shade over nest (%)	40.4	22.9
Nest depth (cm)	3.7	0.5
Total nest diameter(cm)	8.6	0.7
Interior diameter(cm)	6.2	0.6
Distance to next tree(m)	3.7	3.4
Disturbance on nest tree(%)	18.4	19.5
Nest concealment	6.7	5.1

Parameter	Nest site (n=24)	Random site (n=20)
Tree Height (m)	2.7 ± 1.2	7.0 ± 4.8
Tree Gbh (cm)	31.4 ± 13.2	51.1 ± 20.4
Tree Density	4.2 ± 0.7	4.2 ± 2.0
Ground Cover (%)	26.1 ± 24.4	83.5 ± 33.0
Shrub Cover (%)	26.0 ± 24.5	29.5 ± 28.6
Canopy Cover (%)	36.2 ± 17.4	78.5 ± 23.0
Distance to Road (m)	239.7 ±355.2	568.0 ± 636.1

Nest morphology. Baybacked Shrike constructed their nests largely on thick branches. The mean depth and diameter of the nests were 3.65 cm and 8.57 cm respectively (Table 2). Nests were placed at a mean height of 1.56 m, which varied from a minimum of 0.82m to a maximum of 2.21m above ground level. Most nests were built under shade rather than in locations exposed to direct sunlight. Shade over the nest varied from a minimum of 2% to a maximum of 85%. However, most nests were moderately concealed (86.72).

Nest-site selection. It is difficult to guess how close the factors described in relation to the bird nesting habitat are identical with the bird's own special requirements for nest site selection. Hence, an attempt to explain the ecological role of the preferred characteristics can be no more than a guide to the environmental preferences of the bird. Bearing this in mind, the results obtained were as follows.

Of the variables compared, canopy cover ($u=75.5$, $p<0.01$), ground cover ($u=37.5$, $p<0.01$), tree height ($F=18.9$, $p<0.01$), tree Gbh ($F=15.1$ $p<0.01$), and

Table 3. Factor loading of various vegetational characteristics with the first three principal components for the nest data of the Baybacked Shrike. Values representing high correlation with their respective principal components are shown in bold face.

Variables	PC I	PC II	PC III
Nest tree height	-0.93	0.03	-0.01
Nest tree Gbh	-0.61	-0.02	0.42
Nest height	-0.15	0.12	0.89
Ground cover	0.10	-0.01	0.08
Shrub cover	0.32	0.08	0.02
Canopy cover	0.65	-0.61	-0.12
Shade over nest	0.12	-0.88	0.01
Distance to trunk	0.13	-0.25	0.78
Distance to next tree	0.53	0.38	0.04
Distance to road	0.12	0.38	0.04
Disturbance on nest tree	0.05	0.41	-0.01
Nest visibility	0.12	0.72	-0.12
Eigen value	3.12	2.42	1.79
% variance	26.1	20.2	14.9
% accumulated variance	26.1	46.3	61.2

distance to road ($F=15.1$ $p<0.01$) differed significantly from the random plot (Table 3). The DFA (stepwise) resulted in identification of three variables (canopy 0.40, groundcover 0.36, and nest tree height 0.59) which discriminate the nest-site from the random-site.

The first three principal components were selected, and accounted for 61.2% of the total variance (Table 3). The first component was closely associated with nest-tree height, nest-tree Gbh, canopy cover and distance to nearest tree. The second component was associated with shade over the nest and nest visibility. The third component was closely associated with nest-height and distance to trunk. The factors highly correlated with these three components were those that directly relate to the nest-tree and indicating its importance in nest-site selection, viz., nest-tree height, nest-tree Gbh, and canopy cover.

In microhabitats with less canopy and ground cover, nests were mostly placed on small trees. Interestingly, nests were also found close to the road and on disturbed trees. Collias & Collias (1984) reported that nests placed closer to areas of human activity may discourage predators from searching in the vicinity of heavily used trails and in other areas frequented by people. Cade (1995) reported that shrike take most of their food from the ground or near it and tend to avoid areas with dense ground vegetation. The Baybacked Shrike is an aggressive defender capable of chasing away predators; moreover, it was observed frequently to pounce on ground insects from a perch. Thus, the selection of open sites permits vigilance over the nest and also enhances effective foraging.

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