

## Foraging and nesting niche segregation among three species of minivets in Mudumalai Wildlife Sanctuary, Tamil Nadu, India.

V. Gokula<sup>1</sup> and Lalitha Vijayan<sup>2</sup>

<sup>1</sup>Department of Zoology, National College, Tiruchirappalli - 620 001, Tamil Nadu, India.

<sup>2</sup>Salim Ali Centre for Ornithology and Natural History, Anaikatty P.O., Coimbatore - 641 108, Tamil Nadu, India.

### Abstract

The paper deals with foraging and nesting behaviours of Scarlet Minivet *Pericrocotus flammeus*, Small Minivet *P. cinnamomeus* and White-bellied Minivet *P. erythrogygius* in Mudumalai Wildlife Sanctuary, Tamilnadu, India. Our objective was to determine if foraging and nesting niche segregation exist among the three species of minivets. Regardless of species, minivets concentrated much of their foraging activities on a few available plant species and frequently sallied and gleaned for prey largely obtained from above the ground level. Foraging niche segregation between sexes of the same species was not pronounced as pair members typically foraged close together in the breeding season. On the other hand, foraging niche segregation was statistically well pronounced at the interspecies level, and is believed to be a strategy to avoid competition. In general, male and female conspecifics were more similar to each other in their behaviour than to either sex of the other species. In the study area, minivets were observed in breeding activities during April and May. Although the Scarlet Minivet may construct nests slightly higher than the other two minivets, our sample size was not enough to determine if nesting niche segregation exists among minivet species in the study site.

**Keywords:** competition, Mudumalai, Scarlet Minivet, Small Minivet, White-bellied Minivet

### INTRODUCTION

The Indian sub-continent harbours eight species of minivets *viz.* Rosy Minivet *Pericrocotus roseus*, Ashy Minivet *P. divaricatus*, Small Minivet *P. cinnamomeus*, White-bellied Minivet *P. erythrogygius*, Grey-chinned Minivet *P. solaris*, Long-tailed Minivet *P. ethologus*, Short-billed Minivet *P. brevirostris*, and Scarlet Minivet *P. flammeus* (Grimmett et al. 1998). However, except descriptions (Ali and Ripley 1987 and Grimmett et al. 1998) and little distributional status of minivets (Anon. 1994, Neelakandantan et al. 1993, Robertson and Jackson 1992, Uddin 1995, Giri and Choudhary 1996, Dhindsa et al. 1991), relatively little is known about the ecology of all these minivets.

Among the minivets, White-bellied Minivet, Small Minivet and Scarlet Minivet are broadly sympatric in secondary vegetation in Mudumalai Wildlife Sanctuary, Tamilnadu, India (Gokula and Vijayan 1997). The paper deals with foraging and nesting behaviours of these minivets. Our objective was to determine 1) if foraging niche segregation exists among species and 2) if nesting niche segregation exists among species.

### STUDY AREA

The Mudumalai Wildlife Sanctuary is located between 11°30' to 11°39' N and 76°27' and 76°43' E in the Nilgiris district, Tamil Nadu, India. It is situated at an average

elevation of 1000 m. The climate is moderate, and temperatures vary from 14°-17°C during December-January to 29°-33°C during March-May. The annual rainfall varies from 600 mm to 2000 mm, which is received in two periods. The first is of high rainfall (June-August) from the Southwest Monsoon and the second brings low rainfall (September-November) from the Northeast Monsoon. The sanctuary is drained mainly by a perennial river, the Moyar River, and by several streams. Corresponding to the rainfall, the vegetation varies from thorn forest in the east to semi-evergreen forest in the west. The present study was carried out in the tropical thorn forests adjacent to the dry deciduous forest near Masinagudi Village. It is dominated by tree species such as *Acacia chundra*, *A. leucopholea*, *A. ferruginea*, *Anogeissus latifolia*, *Ziziphus xylopyrus*, *Sapindus emarginatus*, *Phyllanthus emblica*, *Erythroxylum monogynum*, *Cassia fistula*, and *Capparis spp.*

### METHODS

Sexes of all three minivet species show some plumage differences and can easily be distinguished in the field. Immature males of Small Minivets were carefully avoided as they differed from adult female by having traces of black on throat and orange on breast. Foraging records were collected at the study site between 1995 and 1997 during the breeding season (January to July) of the majority of the birds; this is when demands for energy are greatest and birds spend most of their time in foraging. Most records were collected within the first four hours after sunrise. The variables recorded were: (1) sex of the minivets; (2) species of plant in which

\*Corresponding Author  
email: [gokulae@yahoo.com](mailto:gokulae@yahoo.com)

Table 1. Details of nests of Scarlet Minivet (n=5), Small Minivet (n=2) and White-bellied Minivet (n=2)

Bird species	Name of the nest plant	Nest tree Height(m)	Nest height from ground level (m)	Nest depth (cm)	Nest outer cup diameter (cm)	Nest interior cup diameter (cm)
Small Minivet	<i>Anogeissus latifolia</i>	4.0	3.8	3.0	4.0	3.5
Small Minivet	<i>Anogeissus latifolia</i>	4.5	3.7	3.1	4.0	3.6
		4.25 ± 0.35	3.75 ± 0.07	3.05 ± 0.07	4 ± 0	3.55 ± 0.07
Scarlet Minivet	<i>Anogeissus latifolia</i>	4.6	4.2	3.6	4.3	3.5
	<i>Anogeissus latifolia</i>	4.7	4.3	3.2	4.2	3.6
	<i>Anogeissus latifolia</i>	4.5	4.0	3.6	4.5	3.4
	<i>Anogeissus latifolia</i>	4.6	4.2	3.4	4.3	3.5
	<i>Anogeissus latifolia</i>	4.6	4.2	3.4	4.2	3.6
Mean and SD		4.6 ± 0.07	4.18 ± 0.10	3.44 ± 0.16	4.3 ± 0.12	3.52 ± 0.08
White-bellied Minivet	<i>Anogeissus latifolia</i>	4.0	4.0	3.1	4.0	3.5
	<i>Phyllanthusemblica</i>	4.1	3.2	3.0	4.0	3.5
Mean and SD		4.05 ± 0.07	3.6 ± 0.56	3.05 ± 0.07	4.0 ± 0	3.5 ± 0

minivet was foraging; (3) the height at which the minivet was foraging; (4) substrate on which the prey was found and (5) feeding technique. Foraging attempts were assigned to 12 height categories: 0 m (ground), and at every 1 meter interval up to 10, and >10 m based on the general physiognomy of the vegetation. Some dominant trees were selected and marked with heights and were used for reference. Foraging techniques were broadly categorized as 1) glean; 2) probe; 3) pounce; 4) sally or flycatching. Further details about the methods are given by Gokula and Vijayan (2000). Searches were made on foot for nest structures by examining the trees and shrubs. An active nest was corroborated if adults were seen performing breeding activities (nest-building or renovation, incubation, feeding the young etc.) in or adjacent to the nest. The plant species on which the nest was constructed was identified to species level. Nest details were collected as soon as the completion of fledging activities or nest desertion. A chi-squared test of independence was used to compare the categorical variables (foraging height and method) between and within minivet species, with lumping of small cells when required. To compare foraging behaviour, cluster analysis was performed following Holmes et al. (1979).

**RESULTS**

**Feeding**

The results discussed here were based on 636 feeding observations of Scarlet Minivet (male 386 and female 250), 877 of Small Minivet (male 465 and female 412) and 253 of White-bellied Minivet (male 143 and female 110) made during the study period.

**Inter-specific differences**

**Foraging height:** All minivets were active at a wide range of heights in the vegetation (Figure 1 & 2), but inter-specific comparisons revealed significant differences www.bvgt-journal.com

in the use of foraging heights among minivet species (Male:  $\chi^2 = 325.7$  df = 4 p< 0.001, Female:  $\chi^2 = 233.4$  df = 6 p< 0.001). All three minivet species concentrated

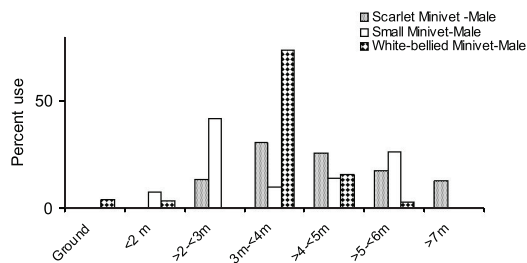


Figure 1. Foraging heights used by males of the three minivet species

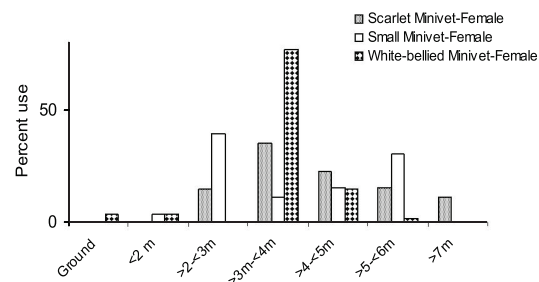
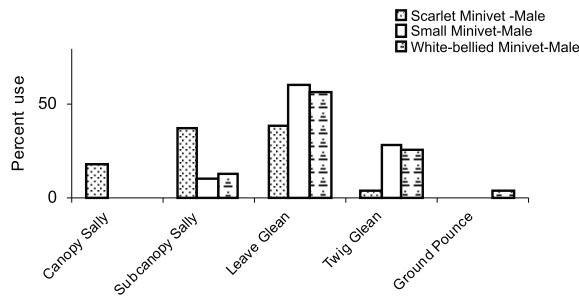


Figure 2. Foraging heights used by females of the three minivet species

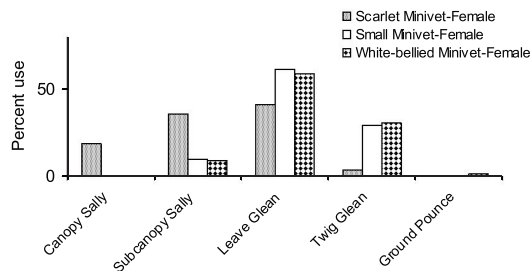
much of their foraging on foliage rich height classes. White-bellied Minivets alone foraged on the ground.

**Foraging technique:** Three foraging methods were identified for minivets: sally, gleaning, and pouncing

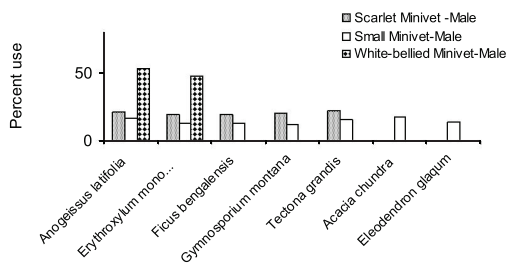


**Figure 3.** Foraging method used by males of the three minivet species

(Figure 3 & 4). Glean, a perched bird pecked at a sedentary prey item: Pounce, a bird flew a short distance to a new perch where it attacked a sedentary prey item seen from the first perch: Sally, flying prey taken on the wing. Inter-specific comparisons revealed significant differences in the use of foraging methods among



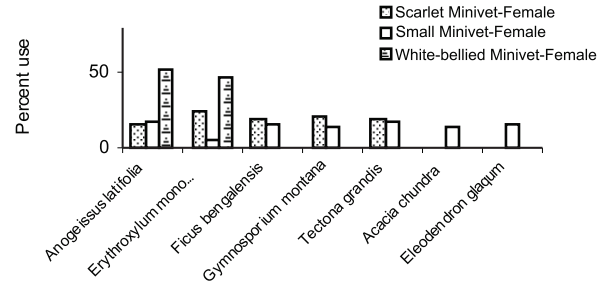
**Figure 4.** Foraging method used by females of the three minivet species



**Figure 5.** Plant species used by males of the three minivet species

minivets (Male:  $\chi^2 = 260.3$  df = 4 p < 0.001, Female:  $\chi^2 = 206.2$  df = 6 p < 0.001).

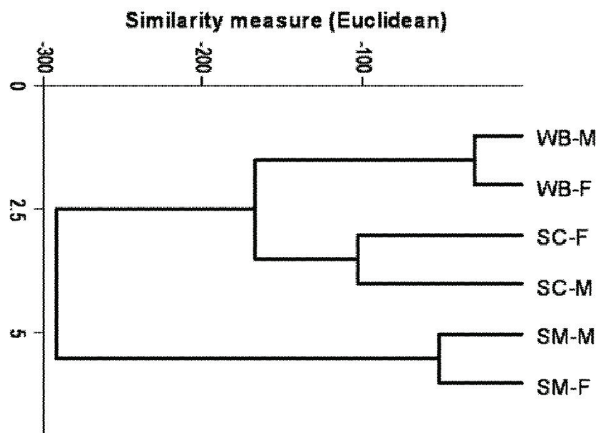
**Trees used for foraging:** In general, all three species of minivets concentrated their foraging activities in relatively few of the available tree and shrub species. Scarlet Minivets used five species of plants: *Tectona grandis*, *Ficus glomerata*, *Anogeissus latifolia*, *Erythroxyllum monogynum* and *Gymnosporium Montana*. White-bellied Minivet used only two plant species: *Anogeissus latifolia*



**Figure 6.** Plant species used by females of the three minivet species

and *Erythroxyllum monogynum*. The Small Minivet used seven tree species: *Tectona grandis*, *Ficus glomerata*, *Anogeissus latifolia*, *Erythroxyllum monogynum*, *Elaeodendron glaucum*, *Acacia chundra* and *Gymnosporia montana* (Figure 5 & 6).

**Inter-sexual differences:** No significant difference was prominent between sexes within species for all the three



**Figure 7.** Cluster diagram showing intersexual and interspecific relationships of three minivet species in the tropical thorn forest of Mudumalai Wildlife Sanctuary. WB-M = Whitebellied Minivet male; WB-F = White-bellied Minivet male; SC-M = Scarlet Minivet male; SC-F = Scarlet Minivet Female; SM-M = Small minivet male; SM-F = Small minivet female.

minivet species in the use of foraging height, foraging methods and plant species. The cluster diagram (Figure 7) showed that, males and females of the same species were more similar to each other in their behaviour than to either sex of the other species in the use of foraging niches.

**Breeding:** In total, nine nests (two nests of Small Minivet, five of Scarlet Minivet and two of White-bellied Minivet) were found during the study period. Nest

construction of Small Minivets and Scarlet Minivets was observed in April, and in late May for White-bellied Minivets. Nests of all the three minivets were cup shaped and covered with cobwebs. All the nests of Small and Scarlet Minivets were constructed only on *Anogeissus latifolia*. White-bellied Minivet constructed one nest on *Anogeissus latifolia*, and another on *Phyllanthus emblica*. Clutch size was three for all the minivet species. Among the nine, two nests with three eggs each were abandoned by the parents due to unknown reason and eggs of seven nests were predated. Among the minivets, Scarlet Minivet preferred to construct their nests slightly higher than the other two minivets (Table 1). However, the depth and diameter (outer and inner) of the nests of minivets showed not much difference (Table 1).

## DISCUSSION

The way species in a community share resources and interact has always interested ecologists. Interspecific interactions such as competition have implications for species survival and for the stability of the community. Two or more species, vying for a limited common resource, try to reduce the use of that resource by the other either through interference or exploitative competition (Miller 1968). Competition leads to niche segregation where some resources are shared and others are used exclusively by species (Pianka, 1978). It is expected that closely related species would contend for the same limited resources, and therefore, fewer pairs of congeneric species will occur within a community at a given point in time (Pianka, 1978). In order to reduce the cost in competition, species use either different parts of common resources or use resources at different time periods or through "preemption," where a resource is utilized earlier before it becomes available to the other. Niche segregation also achieved through vertical partitioning of the common habitat. In the present study, no significant intersexual difference was prominent within species for the three minivet species in the use of foraging height, foraging methods and plant species. All the three minivet species are arboreal, keep in pairs in the breeding season and in small parties when not breeding (Ali 1994). As foraging data was collected during the breeding season, all minivet species were seen foraging in pairs and nearly close to each other. Hence, the intersexual difference within the species was less pronounced. On the other hand, significant differences were prominent among males and among females of three minivet species. Moreover, although minivets were also seen in the mixed feeding flocks even in the breeding season, members of different minivet species were never seen together. Hence, foraging niche segregation among minivets species exists in the study site during the study period and it may be a strategy to avoid interspecific competition by varying the use of foraging height and foraging method.

Ali and Ripley (1987) and Grimmett et al (1998) reported June to October as breeding season for White-bellied Minivet but it breeds during April to May in Mudumalai Wildlife Sanctuary. In the Mudumalai Wildlife Sanctuary, the peak breeding season for most of the birds in the dry deciduous and thorn forests was during dry to early wet season I (Jan-May) as breeding during the dry season may be a strategy to avoid heavy rain and wind which often destroy the nests while the higher ambient temperature helps the speedy development and successful hatching of eggs (Gokula 1998). Hence, differences in breeding season between sites can be attributed to the differences in food and nest materials availability and climatic parameters.

Unlike foraging, nesting lacks sufficient data to prove if nesting niche segregation exists among minivet species. However, Scarlet Minivet seemed to construct nests slightly higher than the other two minivets. Constructing nests on the plants where foraging activities are predominant is a strategy to conserve energy and save the time during the breeding season. Hence, almost all the nests were on *Anogeissus latifolia*. Moreover, the colour of the nest is similar to the bark of the *Anogeissus latifolia*, and as such the selection of *Anogeissus latifolia* largely for constructing nests may be a strategy to conceal it from predators. Although majority of the nests were predated in the present study, above said factor can not be ruled out as sample sizes were poor.

## CONCLUSION

To avoid interspecies competition, minivet species expressed foraging niche segregation in the thorn forests of Mudumalai Wildlife Sanctuary. Males and females of the same species were more similar to each other in their behaviour than to either sex of the other species.

## ACKNOWLEDGEMENT

Thanks are due to V.S.Vijayan, SACON, Coimbatore and Tamil Nadu Forest Department for their support throughout the study.

## REFERENCE

- Ali, S., and Ripley, S.D 1987. *Compact Handbook of the Birds of India and Pakistan*, Oxford University Press, Bombay.
- Anon (1994) From the field: India. *Oriental Bird Club Bull.* 19:65-66
- Dhindsa, M.S., Sandhu, P.S., and Sandhu, J.S. 1991. Some additions to the checklist of birds of Punjab. *Pavo* 28:23-28.
- Giri, T.R and Choudhary, H. 1996. Additional sightings! *Bird Conservation Nepal Bull.* 5 (3):2-3.

- Grimmett, R., Inskipp.C and Inskipp.T 1998. *Birds of the Indian Subcontinent*. Oxford University Press, New Delhi
- Gokula, V. 1998. Bird communities of the thorn and dry deciduous forest of Mudumalai Wildlife Sanctuary, South India, Ph.D thesis, Bharathiyar University, Coimbatore, India
- Gokula, V. 2008. Human-bird competition for plant resources in and around Masinangudi Area, Mudumalai Wildlife Sanctuary, South India. *J. Sci. Trans. Environ. Technov.* 2(1): 37-48.
- Gokula, V. and Vijayan, L. 2000. Foraging patterns of birds during the breeding season in the thorn forest of Mudumalai wildlife sanctuary, Tamil Nadu, Southern India. *Trop. Ecol.* 41 (2): 195-208
- Gokula, V. and Vijayan, L.1997. Birds of Mudumalai Wildlife Sanctuary. *Forktail* 12: 107-117.
- Holmes, R.T., Bonney R.E.Jr. & Pacala, S.W. 1979. Guild structure of the Hubbard Brook bird community: a multivariate approach. *Ecology* 60:512-520.
- Miller R.S. 1968. Pattern and process in competition. *Adv. Ecol. Res.* 4:1-74.
- Neelakandantan, K.K., Sashikumar, C., and Venugopalan, R. 1993. A book of Kerala Birds. Part 1. World Wide Fund for Nature – India, Kerala State Committee, Trivandrum.
- Pianka, E.R. 1978. *Evolutionary ecology*. Harper & Row, New York:
- Robertson, A and Jackson, M.C.A. 1992 Birds of Periyar: An aid to bird watching in the Periyar Sanctuary. Tourism and Wildlife Society of India.
- Uddin S.R. 1995. Birds of Cuddapah District, Andhra Pradesh. *Mayura* 10:28-33.