

# Habitat preference by drongos (Dicruridae): a study conducted during non-breeding season in Kakoijana (Proposed) Wildlife Sanctuary, Assam, India

Naba K. Nath, Jyoti P. Das, Hilloljyoti Singha & Hemanta K. Sahu

Nath, N. K., Das, J. P., Singha, H., & Sahu, H. K., 2016. Habitat preference by drongos (Dicruridae): a study conducted during non-breeding season in Kakoijana (proposed) Wildlife Sanctuary, Assam, India. *Indian BIRDS* 10 (6): 64–68.

Naba K. Nath, State Resource Centre Dispur, H/N 31, Faguna Rabha Path, Jatia, Kahilipara Road, Dispur, Guwahati-781006, Assam, India.

E-mail: [nabanath@gmail.com](mailto:nabanath@gmail.com) [Corresponding author.]

Jyoti P. Das, Aranyak, 50, Samanwoy Path, Survey, Beltola, Guwahati 781028, Assam, India. E-mail: [jyoti@aaranyak.org](mailto:jyoti@aaranyak.org)

Hilloljyoti Singha, Centre for Biodiversity and Natural Resources Conservation, Department of Ecology & Environmental Science, Assam University, Silchar 788011, Assam, India. E-mail: [hilloljyoti.singha@gmail.com](mailto:hilloljyoti.singha@gmail.com)

Hemanta K. Sahu, Zoology Department, North Orissa University, Takatpur, Baripada 757003, Orissa, India. E-mail: [hks\\_nou@yahoo.com](mailto:hks_nou@yahoo.com)

Manuscript received on 28 January 2014.

## Abstract

In 2004–2005 we conducted a study on the habitat preferences of four species of drongos (Family Dicruridae): Black Drongo (BLD), Bronzed Drongo (BRD), Hair-crested (Spangled) Drongo (SD), and Greater Racket-tailed Drongo (GRTD), in Kakoijana (proposed) Wildlife Sanctuary (KWLS) in Assam, India. This was to understand the preferences of habitat usage amongst congeneric species. Data were collected through direct observation in five different forest habitats: evergreen, edge, logged, monoculture, and mixed-moist deciduous. In each habitat a natural trail was followed to observe the birds, once in a week and thrice a day using 8X40 binoculars. Data on microhabitat, activity first sighted, and association with other bird species were also collected. We found that in degraded habitat conditions, different congeneric species preferred particular habitats. In the same landscape, different species of drongos used different habitats, which was highly significant. GRTD preferred teak monoculture, BLD preferred edge, while both, SD and BRD, preferred mixed-moist deciduous habitat. Preference of microhabitat was also highly significant. Due to microhabitat conditions, a particular species of drongo preferred a particular habitat. GRTD and BRD used trees with 60–90% leaf cover, and chose leafy branches for perching, while BLD's and SD's preferences was the opposite; they perched in the upper canopy of tall trees, rather than on tree saplings, shrubs, or the ground. However, while foraging, they occasionally used middle, and lower canopy. In the pre-selected habitats, activities like perching, calling, foraging, flying, and preening were found to differ for different species of drongos. All the four species of drongos were associated with other bird species. Interestingly, BLD and BRD seem to have avoided each other as inferred from the negative associations that they showed, perhaps due to niche overlap.

## Introduction

Animals select resources that are best able to satisfy their nutritional requirements (Manly *et al.* 1993). Since resources are usually not distributed evenly in the environment, it is reasonable to assume that animals prefer some habitats to others (Osborn 2005). A preferred habitat is the one in which an animal is found proportionally more frequently, out of all those available to it (Petrides 1975). Variation in habitat may help explain why a species is present, or abundant, at one location, and absent, or scarce, at another (Javed & Kaul 2003). Birds are known to actively select their habitat on the basis of proximate factors such as features of the landscape, terrain, substrate, vegetative structure, or arrangement of the vegetation (Wiens 1969). Differential habitat selection is one of the principal relationships, which permits species to co-exist (Rosenzweig 1981).

The present study, on the habitat preferences of four species of drongos (Dicruridae), was conducted in the Kakoijana (Proposed) Wildlife Sanctuary (hereinafter, KWLS) in Assam, India. We wanted to understand how congeneric species prefer habitats for their different activities, and thereby separate themselves in different habitats. Of the seven species of drongos found in north-eastern India (Grimmett *et al.* 1999), including Assam (Choudhury 2000), four that are commonly sighted in KWLS (Das *et al.* 2007), were considered in this study: These are Black-*Dicrurus macrocercus* (hereinafter, BLD), Bronzed-*D. aeneus*

(hereinafter, BRD), Spangled-*D. hottentottus* (hereinafter, SD), and Greater Racket-tailed Drongo *D. paradiseus* (hereinafter, GRTD).

## Study area

KWLS (26.33°–20.35°N, 90.55°–90.57°E) is situated on the banks of Aie River 15 km east of Bongaigaon town, headquarters of the eponymous district (Fig. 1). Vegetation in KWLS comprises mixed moist deciduous forest (Singha & Borah 2001), which includes *Tectona grandis* plantations, natural *Shorea robusta* patches, scattered bamboo groves, and saplings of miscellaneous tree species. Two national highways—NH31C in the north, and NH31 on the south—border KWLS. It faces tremendous human pressure as more than 21 revenue villages, chiefly dependent on agriculture, surround it. The climate is 'subtropical with pronounced monsoon' with three distinct seasons: winter, summer, and monsoon (Borthakur 1986). The annual rainfall ranges from 2500 to 3500 mm, and the temperature ranges from 13°C in December–January to 32°C in May–June (National Information Center, Bongaigaon). The general topography of the region is undulating and hilly. The hills run in a western direction and have moderate slopes. Several streams intersect the physiography, but most of them have dried out, probably due to excessive extraction of timber; except the *Kalikapat* stream that flows through the forest and drains into paddy fields.

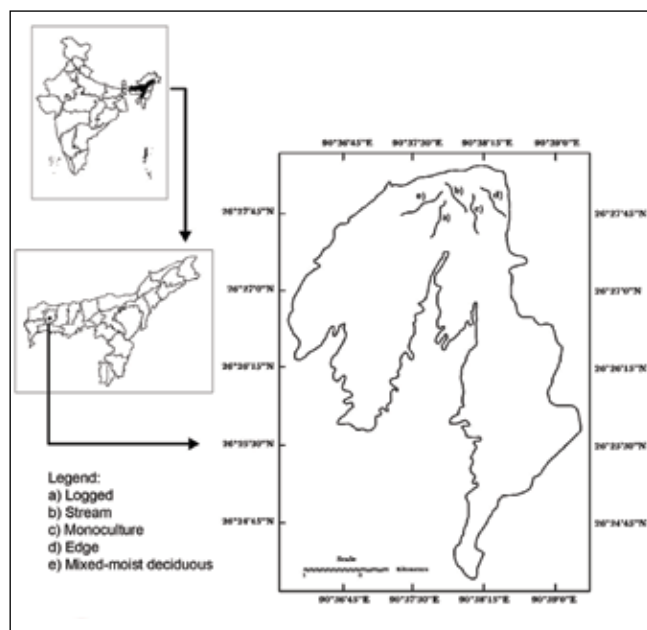


Fig. 1. Map of the study area in the Kakojiana (Proposed) Wildlife Sanctuary in Assam, India

## Methodology

Fieldwork commenced in mid-December 2004. Data collection began from January to March 2005. The habitat preferences of different species of drongos were investigated through direct observations in different habitats. Five different habitats were selected, namely, riparian evergreen, edge (between monoculture plantations and paddy field), logged (completely degraded forest), monoculture (teak plantation), and mixed moist deciduous forest (hereinafter, MMD). In each selected habitat a natural trail was followed to observe the drongos. Each trail was surveyed once in a week, and three times a day: in the morning, at noon, and in the evening. The drongos were studied within the same habitat patch, on each side of the trail with the help of a pair of 8x40 binoculars, and identified with the help of Grimmett *et al.* (1999). When the first drongo (the focal bird) was spotted, its activity was recorded, as first sighted. Five kinds of activities were categorised: perching, calling, foraging, flying, and preening. If the focal drongo was visible in the locality for more than five minutes, the next data collection continued after each five-minute interval. The first activity observed in the beginning of each bout was recorded. Simultaneously, the microhabitat around the focal bird, and its association with other bird species, including other drongos, were recorded. The microhabitat study included recording the use of substratum for perching (whether a tree or others: tree-sapling, shrub, or ground); part of canopy used (i.e., upper-, middle-, or lower- canopy, in the case of trees); status of perching branch (whether leafy, or leafless, in the case of trees); and leaf cover of the perching tree. For estimation of leaf cover, four different categories were considered: A = 1–30% cover, B = 30–60%, C = 60–90%, and D = no cover. However, all the observations were based on visual records. In case of SD, which is predominantly a nectar feeder, its association with flowering trees was also noted. To study the association of drongos amongst congeners, and with other bird species, we recorded the number of individuals of different birds within a three-meter radius of the focal drongo. Statistical analyses were followed as per Fowler & Cohen (1986), and the association

index was calculated following Southwood (1978):  $I_{ai} = 2 [(F/A + B) - 0.5]$ , where  $F$  = number of individuals of A and B in samples where both species are present, and  $A$  and  $B$  = total of individuals of A and B in all samples. The range of association is from  $-1$  (no association) to  $+1$  (full association).

## Results

### Habitat preference

Due to heavy biotic pressures, KWLS is being severely degraded. In this degraded habitat, different species of drongos preferred specific habitats. The habitat preference shown by them was highly significant. GRTD preferred teak monoculture habitat ( $\chi^2_3 = 9.5$ ,  $P < 0.05$ ) among the five habitats studied. BLD preferred edge habitat ( $\chi^2_3 = 34.88$ ,  $P < 0.01$ ), while both, SD ( $\chi^2_3 = 13.32$ ,  $P < 0.01$ ), and BRD ( $\chi^2_3 = 14.04$ ,  $P < 0.01$ ) preferred mixed-moist deciduous habitat. We did not find any drongos in logged habitat.

### Activities

Drongos performed different activities in different habitats (Fig. 2). GRTD vocalized, and flew oftener in evergreen habitat; foraged, and perched more in mixed-moist deciduous habitat; and seemed to preen only in monoculture habitat. BLD was found calling, perching, and flying more in monoculture habitat, while foraging and preening only in the edge habitat. SD foraged more in the edge habitat, while calling, perching, and flying only in the mixed-moist deciduous habitat. Foraging by BRD was recorded highest in mixed-moist deciduous forest, preening only in edge habitats, while calling, perching, and flying were seen more in evergreen habitat.

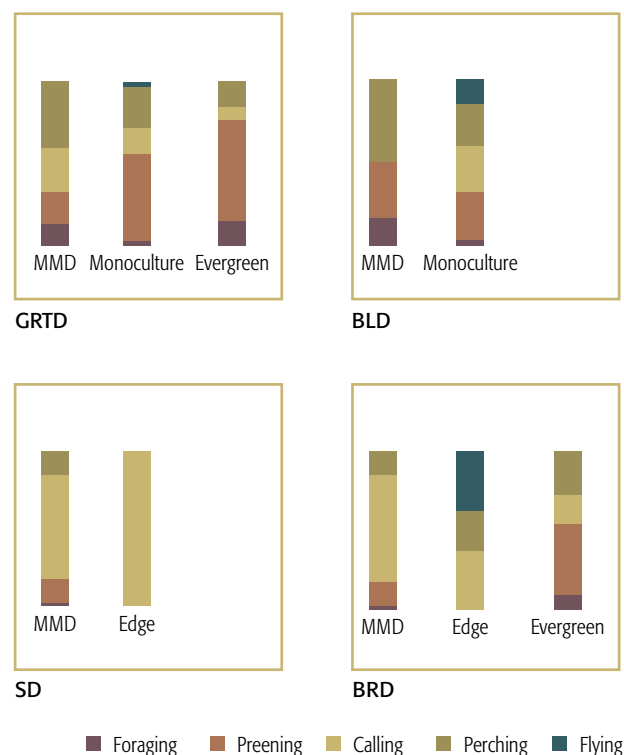


Fig. 2. Different activities of Greater Racket-Tailed Drongo (GRTD), Black Drongo (BLD), Spangled Drongo (SD) and Bronzed Drongo (BRD) observed in different habitats in Kakojiana (Proposed) Wildlife Sanctuary during December 2004–March 2005.

## Microhabitat preference

### Leaf cover of the perching tree

The difference in leaf cover of the perching tree, used by different species of drongos, was found to be highly significant among the four species ( $\chi^2_6 = 85.43$ ,  $P < 0.01$ ). GRTD and BRD used trees having 60–90% leaf cover, while BLD and SD used mostly the leafless trees.

### Use of perching branch (leafy or leafless)

There was a significant difference in use of perching branch among the drongos ( $\chi^2_3 = 40.31$ ,  $P < 0.01$ ). GRTD and BRD mostly used the leafy branches, whereas, BLD and SD used leafless branches.

### Use of canopy (upper, middle and lower)

All the four species, significantly, preferred the upper canopy for perching ( $\chi^2_6 = 49.1$ ,  $P < 0.01$ ). However, during foraging they were seen using the middle, and lower, canopy occasionally.

### Use of substratum for perching {trees or others (tree-sapling, shrub or ground)}

All the four species of drongos significantly used tall trees for perching, preferring them over tree saplings, shrubs, or the ground ( $\chi^2_3 = 31.01$ ,  $P < 0.01$ ).

### SD and its relationship with flowering plant species

We recorded four species of flowering trees—*Dalbergia sisoo*, *Delonix regia*, *Erythrina indica*, and *Bombax ceiba*—on which SD fed. Foraging on *B. ceiba* flowers was the highest ( $\chi^2_3 = 61.31$ ,  $P < 0.01$ ).

## Species association

**GRTD:** Six species of birds associated with GRTD (Table 1). The highest positive association was recorded with Jungle Babbler *Turdoides striatus*, while highest negative association with Grey-backed Shrike *Lanius tephronotus*.

**BLD:** 15 species of birds associated with BLD (Table 2). The highest positive association was recorded with Common Myna *Acridotheres tristis*, while highest negative association with Eurasian Collared Dove *Streptopelia decaocto*.

**SD:** Ten species of birds associated with SD (Table 3). The highest positive association was recorded with Red-vented Bulbul *Pycnonotus cafer*, while highest negative association with Common Tailorbird *Orthotomus sutorius*.

**BRD:** Six species of birds associated with BRD (Table 4). The highest positive association was recorded with Red-vented Bulbul, while highest negative association with Fulvous-breasted Woodpecker *Dendrocopos macei*.

**Table 1.** Association of Greater Racket-Tailed Drongo with other birds showing the values of Sorensen's association index during December 2004–March 2005 in Kakoijana (Proposed) Wildlife Sanctuary.

Association with other species	No. of association sighted	No. of total individuals sighted	Sorensen's association index ( $I_{ij}$ )
Jungle Babbler <i>Turdoides striata</i>	16	103	0.900
Rufous Treepie <i>Dendrocitta vagabunda</i>	11	14	0.462
Red-vented Bulbul <i>Pycnonotus cafer</i>	7	18	0.143
Blue Whistling Thrush <i>Myophonus caeruleus</i>	4	4	-0.429
Eurasian Collard Dove <i>Streptopelia decaocto</i>	3	4	-0.571
Grey-backed Shrike <i>Lanius tephronotus</i>	2	2	-0.700

**Table 2.** Association of Black Drongo with other birds showing the values of Sorensen's association index during December 2004–March 2005 in Kakoijana (Proposed) Wildlife Sanctuary.

Association with other species	No. of association sighted	No. of total individuals sighted	Sorensen's association index ( $I_{ij}$ )
Common Myna <i>Acridotheres tristis</i>	13	48	0.908
Spotted Dove <i>Streptopelia chinensis</i>	12	34	0.794
Asian Pied Starling <i>Gracupica contra</i>	12	66	0.784
Red-vented Bulbul <i>Pycnonotus cafer</i>	10	62	0.472
Jungle Myna <i>Acridotheres fuscus</i>	6	18	0.200
Indian Pond Heron <i>Ardeola grayii</i>	5	20	-0.019
White Wagtail <i>Motacilla alba</i>	3	15	-0.175
Blue-Rock Pigeon <i>Columba Livia</i>	3	4	-0.326
Cattle Egret <i>Bubulcus ibis</i>	3	18	-0.380
Rufous Treepie <i>Dendrocitta vagabunda</i>	4	5	-0.402
White-throated Kingfisher <i>Halcyon smyrnensis</i>	2	2	-0.620
Bronzed Drongo <i>Dicrurus aeneus</i>	1	2	-0.690
Fulvous-breasted Woodpecker	1	1	-0.735
<i>Dendrocopos macei</i>	1	3	-0.812
Intermediate Egret <i>Ardea intermedia</i>	1	3	-0.812
Eurasian Collared Dove <i>Streptopelia decaocto</i>	1	2	-0.857

**Table 3.** Association of Spangled Drongo with other birds showing the values of Sorensen's association index during December 2004–March 2005 in Kakoijana (Proposed) Wildlife Sanctuary.

Association with other species	No. of association sighted	No. of total individuals sighted	Sorensen's association index ( $I_{ij}$ )
Red-vented Bulbul <i>Pycnonotus cafer</i>	12	45	0.717
Grey-winged Blackbird <i>Turdus boulboul</i>	11	31	0.641
Jungle Myna <i>Acridotheres fuscus</i>	10	31	0.615
Asian Pied Starling <i>Sturnus contra</i>	9	33	0.400
Common Myna <i>Acridotheres tristis</i>	8	19	0.394
Chestnut-tailed Starling <i>Sturnia malabarica</i>	8	27	0.297
Blue-throated Barbet <i>Megalaima asiatica</i>	4	4	-0.529
Rufous Treepie <i>Dendrocitta vagabunda</i>	3	4	-0.607
Eurasian Collared Dove <i>Streptopelia decaocto</i>	3	3	-0.680
Common Tailorbird <i>Orthotomus sutorius</i>	2	2	-0.796

**Table 4.** Association of Bronzed Drongo with other birds showing the values of Sorensen's association index during December 2004–March 2005 in Kakoijana (Proposed) Wildlife Sanctuary.

Association with other species	No. of association sighted	No. of total individuals sighted	Sorensen's association index ( $I_{ij}$ )
Red-vented Bulbul <i>Pycnonotus cafer</i>	9	24	0.460
Spotted Dove <i>Streptopelia chinensis</i>	6	17	0.143
Oriental Magpie Robin <i>Copsychus saularis</i>	7	9	-0.042
Blue-throated Barbet <i>Psilopogon asiaticus</i>	7	7	-0.086
Black Drongo <i>Dicrurus macrocerus</i>	1	11	-0.48
Fulvous-breasted Woodpecker <i>Dendrocopos macei</i>	2	2	-0.658

Among the drongos, GRTD and SD showed no particular association with other congeners; however both BLD and BRD seem to have avoided each other as inferred from the negative associations that they showed (see Tables 2 & 4). The focal species BLD had negative association with BRD (-0.690), while the focal species BRD had negative association with BLD (-0.48).

## Discussion

Birds select habitats on the basis of "sign stimuli" that convey information about ultimate factors such as food, protection, and nest site availability (Lack 1933, 1949; Svardson 1949; Hilden 1965). Out of five habitats studied, all drongo species were found to avoid logged forest; however, GRTD and BRD were found to frequent three habitats, while BLD and SD frequented two. On the other hand, MMD and edge habitat were used by three species of drongos, while two used monoculture and



evergreen habitats. The preference of habitats could be explained by the availability of their basic requirements in the microhabitats we studied, which are described below.

The preference of monoculture habitat by Greater Racket-tailed Drongo was probably due to presence of tall trees with adequate cover. The selection of trees with good leaf cover and preference of leafy perching branches in the upper canopy also agrees with this. Whistler (1935) also mentioned GRTD inhabits the densest and dampest of the Indian forests. In our study, we noticed GRTD as a shy bird that avoided humans. Though in general, they used upper canopy, during foraging they were seen using the lower and middle canopy of the trees and occasionally came near to the ground. Although, the MMD habitat also seemed suitable for GRTD, human movement was more in this habitat due to presence of a village nearby, and probably for this reason GRTD avoided this habitat. On the other hand, though the evergreen habitat was dense, and provided cover, it lacked tall trees and so was not favored by GRTD.

Bird association in mixed foraging flocks offer improved feeding efficiency and increased protection from predators (Morse 1977). GRTD is often sighted with the mixed flocks of foraging forest birds (Santharam 2005; Nimnuan et al. 2004). Dhanasampaboon & Round (2004) reported the association of GRTD with mixed ground feeding flocks of White-crested Laughingthrush *Garrulax leucolophus*, Long-tailed Broadbill *Psarisomus dalhousiae*, and Silver-breasted Broadbill *Serilophus lunatus*. The tendency of GRTD to associate with Rufous Treepie *Dendrocitta vagabunda*, and other species to form 'mixed hunting parties' is also well known (Neelakantan 1972). We also observed the association of GRTD with Indian Treepie, Jungle Babbler, and other species. GRTD might benefit from such associations, either due to the ease of locating insects flushed by its flockmates, or due to the opportunities for kleptoparasitism (stealing food from flock-mates) (Gill 1995; Hino 1998; King & Rappole 2001; Styring & Ickes 2001). Rahmani (1981) reported the association of GRTD and Common Babbler *Turdoides caudatus* from Aligarh (UP). During associations with Jungle Babbler, we often observed that when the Jungle Babbler was about to capture an insect, the GRTD swooped down in a fly-catching sally, uttering a sharp whistle or screech, and snapped up the prey. There were 16 sightings of GRTD feeding with Jungle Babbler. This suggests a mutually beneficial association between them. The aerially hawking GRTD benefited by capturing insects flushed by babblers; on the other hand, Jungle Babblers may have tolerated GRTD because it provided an increased vigilance against predators (King & Rappole 2001). Even though there was positive association between GRTD and Indian Treepie, their relationship was not as reciprocal as observed between GRTD and Jungle Babbler. On two occasions, we recorded kleptoparasitism of Indian Treepie by GRTD. Other bird species (except Red-vented Bulbul) (Table 1) were found to be negatively associated with GRTD, which probably had no influence on its foraging.

It is quite possible that GRTD pair for life, and they seem to be attached to their territories throughout the year (Neelakantan 1972). During the study period, a GRTD pair was recorded on several occasions in the monoculture habitat defending the area from intruders (e.g., Large Cuckooshrike *Coracina macei* and BLD), which was perhaps their breeding territory.

BLD particularly affects light hill forest (oak, rhododendron, etc.), open wooded country, and is often found about cultivation and on the outskirts of habitations (Ali & Ripley 1987). The preference of edge habitat by BLD was probably due to the

presence of openness, since this habitat had open cultivated land on one side. BLD mostly preferred upper branches of the trees for perching, preferred bare trees, and was mostly found perched on the leafless branches of trees to get an open, exposed hunting perch, which they find in the edge habitat. Shahabuddin *et al.* (2004) observed that BLD was encouraged by forest degradation. However, the logged habitat also provided open space, but perhaps due to the lack of tall trees BLD did not prefer it.

Although, Ali & Ripley (1987) stated that BLD could be seen singly or in pairs, it was found to be a mixed foraging species. We have recorded BLD in association with 15 other species of birds to form mixed hunting parties (Table 2). However, out of these only five positively associated with BLD. We have also recorded monospecific BLD flocks (10–12 individuals together) on several occasions, mostly perched on the top canopies of the bamboo groves in the edge habitat during drizzling overcast afternoons. Saxena (2005) reported BLD foraging along with Small Bee-eater *Merops orientalis*, Common Myna, Brahminy Starling *Sturnia pagodarum*, House Sparrow *Passer domesticus*, and Red-vented Bulbul. Veena & Lokesh (1993) reported BLD foraging with both, pure, and mixed foraging flocks of Common Myna, and Jungle Myna *A. fuscus*. Mixed foraging of BLD with parakeets, Purple Sunbird *Nectarinia asiatica*, Common Myna, Red-vented Bulbul, and Red-whiskered Bulbul *P. jocosus* was also reported by Patel (2005). However during our study we recorded additional 11 new species, which constituted mixed flocks with BLD (Table 2). Moreover, due to its aggressiveness against crows and raptors, various birds take advantage of its close association. Gilliard (1958) recorded that orioles, and doves, frequently built nests on the same trees as the BLD, and enjoyed safety from crows and hawks. Shukkur & Joseph (1980) reported the nesting of Red-vented Bulbul in the territory of BLD. The bulbuls benefited from BLD's vigorous defense of its territory. As the edge habitat provided vast quantities of insect pests (in the paddy fields) BLD was found to forage exclusively in this habitat.

SD generally affects moist-deciduous, and evergreen forest biotope (Ali & Ripley 1987). Although, we found SD preferred the MMD habitat, its habitat selection was somehow related to the flowering trees present in this habitat, as SD is a predominantly nectar feeding bird (Ali & Ripley 1987). Pittie (1997) points to the need of studying the distribution of SD and its relationship with flowering plants. In MMD habitat we recorded 66.67% ( $n = 8$ , seven *B. ceiba* and one *D. sisoo*) flowering trees. The flowering season of *B. ceiba* is January–April, and that of *D. sisoo* is November–February (Hajra & Jain 1978). Hence we saw those trees in full bloom. On the other hand, in the edge habitat there were only 33.33% ( $n = 4$ , two *D. regia* and two *E. indica*) flowering trees. The flowering season of *D. regia* is March–July, and of *E. indica*, January–February (Hajra & Jain 1978). Probably due to the greater availability of nectar-bearing flowers in MMD habitat, SD frequented it more, in comparison to the edge habitat.

Though SD preferred no leaf cover, it might be coincidental with the leaf-shedding period of the flowering trees, where they were foraging on flowers.

Like other drongos, SD also joins the mixed foraging parties (passive aggregations of nectarivorous birds). We observed SD associated with ten other bird species (Table 3). However, of these, only six species were found to be positively associated with SD. A very strong competition existed between SD and associated birds. SD was always aggressive towards the associated species during foraging. The moment a SD found any other bird foraging

nearby, or within its foraging vicinity, it immediately chased the bird off and occupied the flower. After sipping nectar from that flower it again chased the nearest foraging bird, and so on. This interspecific competition (outside family) was very common during our study, which, however, was not observed among individuals within the species. Pure flocks of SD (five to six birds) were also noticed on several occasions.

BRD generally prefers broken foothills country, in moist-deciduous, and evergreen forest biotope. It keeps to wooded glades, the edge of forest paths, fire lines and clearings, mixed bamboo jungle, and tea, coffee, and rubber plantations (Ali & Ripley 1987). We found that BRD preferred MMD habitat, which provided sufficient cover, as well as tall trees. BRD always preferred the upper canopy of trees, preferring maximum leaf cover, and perched on the leafy branches. The microhabitat selection of BRD contrasted with what is reported by Ali & Ripley (1987). A possible explanation for this could be the strong interspecific competition observed between BLD and BRD in the study area. On one occasion, we noticed, a flock of 11 BLD chasing a pair of BRD, which, had perhaps accidentally ventured into the edge habitat. BLD and BRD were both negatively associated with each other. Under the same environmental conditions, a positive association may implicit some degree of beneficial interaction, for example, mutualism or complementary resource-partitioning, while a negative association may indicate the detrimental interaction between two species, such as inter-specific competition, or inter-specific interference (Maihiti & Zhang 2014). Moreover, BLD seemed to strongly occupy, and defend, the entire edge habitat. So, may be due its aggressive behavior, BLD had excluded BRD from the edge habitat.

Although BRD was recorded in association with other birds, it was always seen foraging singly, or in pairs, making aerial sallies to catch insects. This association probably had no influence on foraging of BRD. Instead, the association seemed to be merely a sharing of space, though the benefit to the associated members of being associated with BRD could not be denied.

Our study revealed that in degraded habitat conditions different congeneric species prefer specific habitats. We found that due to microhabitat conditions, a particular species of drongo prefers a particular habitat. Moreover, congeneric drongos live within the same preferred habitat because of niche separation.

## Acknowledgement

The study was conducted under a project generously sponsored by *Bombay Natural History Society* (Salim Ali Nature Conservation Fund). We thank Asad R. Rahmani, Director of BNHS for financial support. We greatly appreciate the cooperation of Assam State Forest Department, specially the staff of Hapachara Beat of KWLS. We offer our sincere gratitude to H. P. Panda, Mr. Mrigen Das, Sushil K. Dutta, Shrushtidhar Rout, Kaushik Deuti, Arnab Bose, Sadashib Nath Sen, and Raju Das for their help and assistance during the study.

## References

- Ali, S., & Ripley, S. D., 1987. *Compact handbook of the birds of India and Pakistan together with those of Bangladesh, Nepal, Bhutan and Sri Lanka*. 2nd ed. Delhi: Oxford University Press. Pp. i-xlii, 1 I., 1-737, 52 II.
- Borthakur, M., 1986. Weather and climate of North East India. *The North east Geographer* 18 (1&2): 20-27.
- Choudhury, A., 2000. *The birds of Assam*. 1st ed. Guwahati: Gibbon Books & World Wide Fund for Nature-India. Pp. 1-240.
- Das, J. P., Nath, N. K., Singha, H., & Sahu, H. K., 2007. Winter birds of Kakoijana (Proposed) Wildlife Sanctuary, Assam, India. *Indian Birds* 3 (1): 16-23.
- Dhanasampaboon, S., & Round, P. D., 2004. Foraging of Greater Racket-tailed Drongo (*Dicrurus paradiseus*) and Lesser Racket-tailed Drongo (*D. remifer*) in mixed species bird flocks at Khao Yai National Park. *Natural History Bulletin of the Siam Society* 52: 59-67.
- Fowler, J., & Cohen, L., 1986. *Statistics for Ornithologists*. British Trust for Ornithology, Guide No. 22: 74 pp.
- Gill, F. B., 1995. *Ornithology*. 2nd ed. W. H. Freeman, San Francisco, CA, USA. Pp. i-xvii, 1-766.
- Gilliard, E. T., 1958. *Living birds of the world*. Chanticleer Press Inc., New York. Pp. 303.
- Grimmett, R., Inskipp, C., & Inskipp, T., 1999. *Pocket guide to the birds of the Indian Subcontinent*. New Delhi: Oxford University Press. Pp. 1-384.
- Hajra, P. K., & Jain, S. K., 1978. *Botany of Kaziranga & Manas National Park*. Surya international Publications, Dehradun.
- Hilden, O., 1965. Habitat selection in birds. *Annales Zoologici Fennici* 2: 53-57.
- Hino, T., 1998. Mutualistic and commensal organization of avian mixed species foraging flocks in a forest of western Madagascar. *Journal of Avian Biology*. 29: 17-24.
- Javed, S., & Kaul, R., 2003. *Field methods for bird surveys*. 1st ed. New Delhi: Bombay Natural History Society; Department of Wildlife Sciences; Aligarh Muslim University; World Pheasant Association, South Asia Regional Office (SARO). Pp. i-ix, 1-61.
- King, D. I., & Rappole, J. H., 2001. Kleptoparasitism of laughingthrushes *Garrulax* by Greater Racket-tailed Drongos *Dicrurus paradiseus* in Myanmar. *Forktail* 17: 121-122.
- Lack, D., 1933. Habitat selection in birds. *Journal of Animal Ecology* 2: 239-262.
- Lack, D., 1949. The significance of ecological isolation. Pp.299-308. In Jepsen, G. L., Simpson, G., & Mayer, F., [ed.] *Genetics, paleontology and evolution*. Princeton Univ. Press, Princeton.
- Maihiti, M., & Zhang, W. J., 2014. A mini review on theories and measures of inter-specific associations. *Selforganizology*, 1(3-4): 206-210.
- Manly, B., McDonald, L., & Thomas, D., 1993. *Resource selection by animals, statistical design and analysis for field studies*. Chapman & Hall, London.
- Morse, D. H., 1977. Feeding behavior and predator avoidance in heterospecific groups. *Bio Science* 27: 332-339.
- Neelakantan, K. K., 1972. On the Southern Racket-tailed Drongo *Dicrurus paradiseus* (Linn.). *Journal of the Bombay Natural History Society* 69 (1): 1-9.
- Nimnuan, S., Round, P. D., & Gale, G. A., 2004. Structure and composition of mixed species insectivorous bird flocks in Khao Yai National Park. *Natural History Bulletin of the Siam Society* 52 (1): 71-79.
- Osborn, F. V., 2005. Habitat selection by bull elephants in central Zimbabwe. *Pachyderm* 39 (July-December): 63-66.
- Patel, S., 2005. Adaptations in nesting. *Newsletter for Birdwatchers* 45 (2): 27.
- Petrides, G. A., 1975. Principal foods versus preferred foods and their relation to stocking rate and range condition. *Conservation Biology* 7: 161-169.
- Pittie, A., 1997. Project: Haircrested Drongo. *Newsletter for Birdwatchers* 37 (3): 48.
- Rahmani, A. R., 1981. Large Racket-tailed Drongo and Common Babbler. *Journal of the Bombay Natural History Society* 78 (2): 380.
- Rosenzweig, M. L., 1981. A theory of habitat selection. *Ecology* 62 (2): 327-335.
- Santharam, V., 2005. Birds seen on a short trip to Peechi, Kerala, India. *Indian Birds* 1 (2): 32-33.
- Saxena, R., 2005. Birding in office. *Newsletter for Birdwatchers* 45 (2): 26.
- Shahabuddin, G., Verma, A., & Kumar, R., 2004. Birds, forests and conservation: Critical issues in Sariska Tiger Reserve, Rajasthan, India. *Newsletter for Ornithologists* 1 (6): 82-84.
- Shukkur, E. A. A., & Joseph, K. J., 1980. Breeding biology of the Black Drongo. *Journal of the Bombay Natural History Society* 75 (Suppl.): 1212-1226.
- Singha, H., & Borah, A., 2001. Pilot survey of late winter vegetation in Kakoijana (Proposed) Wildlife Sanctuary, Bongaigaon. Birjhora Mahavidyalaya. Pp. 22.
- Southwood, T. R. E., 1978. *Ecological methods* (with particular reference to the study of insect population). The English Language Book Society and Chapman and Hall. Pp. 336.
- Styring, A. R., & Ickes, K., 2001. Interaction between the Greater racket-tailed Drongos *Dicrurus paradiseus* and woodpeckers in a lowland Malaysian rainforest. *Forktail* 17: 119-120.
- Svardson, G., 1949. Competition and habitat selection in birds. *Oikos* 1: 157-174.
- Veena, T., & Lokesh, R., 1993. Association of drongos with myna flocks. Are drongos benefitted? *Journal of Biosciences (Bangalore)* 18 (1): 111-120.
- Whistler, H., 1935. *Popular handbook of Indian birds*. 2nd ed. London: Gurney and Jackson. Pp. i-xviii, 1-513.
- Wiens, J. A., 1969. An approach to the study of ecological relationships among grasslandbirds. *Ornithological Monographs* # 8. American Ornithologists' Union, Ithaca, New York. Pp. 93.