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Resource partitioning between two sympatric bee-eater species at Chittagong University campus

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ABSTRACT

Resource partitioning assists two or more sympatric species to coexist in the same habitat. The study was conducted on resource partitioning between two sympatric bee-eater species [chestnut-headed bee-eater (*Merops leschenaulti*) and green bee-eater (*Merops orientalis*)] to find out their habitat, food, feeding behavior and nesting. Data were collected through direct field observations where six days had been spent in every month in the field. Three types (agricultural land, tree and water body) of habitats were used by two bee-eater species during the study period; of which both species spent maximum (chestnut-headed bee-eater: 83.29%; green bee-eater: 81.32%) time in tree and minimum (chestnut-headed bee-eater: 3.16%; green bee-eater: 3.66%) in water body. Out of three types of perches (fence, tree and electric wire) chestnut-headed bee-eater spent the highest (42.42%) time in wires and the lowest (22.22%) on fences; whereas green bee-eater spent more (41.18%) time in trees and the less (25.49%) on fences. Out of twelve insects preyed upon by two bee-eater species hymenopterans were the maximum consumed food item of chestnut-headed bee-eater (25%) and green bee-eater (25%). The nest height of chestnut-headed bee-eater was 3.2 - 5.3 m (mean 4.27 ± 1.05 m, n = 3) and it was 7.0 – 9.0 m (mean 8.0 ± 1.41m, n = 2) for green bee-eater. The results suggest that, coexisting bee-eater species partition their resources to limit the effects of interspecific competition and it helps them to co-occur together.

***Key words*:** *Merops leschenaulti*; *Merops orientalis*; habitat; food; hymenopterans; nesting.

1. INTRODUCTION

Chestnut-headed bee-eater (*Merops leschenaulti*) is a common resident bird in Bangladesh and occur in the evergreen forests and mangroves of Chittagong, Dhaka, Khulna and Sylhet Divisions (Islam and Kamruzzaman, 2008); and well distributed in India, Nepal, Bhutan, Sri Lanka, China and Myanmar to Indonesia (Islam and Kamruzzaman, 2008; Ali, 1996). They occur mainly in well-wooded country in-between the moist-evergreen and the dry-deciduous types of habitats (Ali, 1996). They feed on large winged insects, such as dragonflies, bees, ants, termites and butterflies (Islam and Kamruzzaman, 2008).

Green bee-eater (*Merops orientalis*) occurs in village groves and open country in all divisions of Bangladesh (Islam and Kamruzzaman, 2008). Its global range extends through sub-Saharan Africa, Israel through Arabia to South and Southeast Asia, including Pakistan, India, Sri Lanka, Nepal, Bhutan, China, Myanmar and Thailand (Islam and Kamruzzaman, 2008). It occurs in open country with scattered trees; sandy areas on coasts; also semi-desert and grazing land (Grimmett *et al.*, 2011). It feeds on large winged insects, such as bees, ants and wasps; butterflies, moths, beetles dragonflies and termites (Islam and Kamruzzaman, 2008).

Resource partitioning relates to evolutionary change in species in response to selection pressures generated by inter-specific competition (Walter, 1991); and the concept of resource partitioning is derived from the theory of limiting similarity, for example the limit of similarity among the competing species to coexist together (MacArthur and Levins, 1967). It simply refers to the differences of resources used by two or more sympatric species (Walter, 1991). Resource partitioning among species reduces the effect of competition by decreasing the amount of overlap between the competing species and allows related sympatric species to coexist in the same area; whereas competition theory

predicts that related species should differ in habitat or food types, or foraging strategies, or should show divergence in major morphological features to avoid competitive elimination (MacArthur and Levins, 1967). The major three factors that help in partitioning the animals are habitat, food and time (Schoener, 1974). Several studies have done on resource partitioning specially on bird species, including songbirds (Moskat and Fuisz, 2002), raptors (Garcia and Arroyo, 2005) and waterfowl (Frederick and Bildstein, 1992). Vieira and Port (2007) described niche overlap and resource partitioning between two sympatric fox species in southern Brazil.

Two related species or populations are considered sympatric when they exist in the same geographic area and thus frequently encounter one another (Futuyma, 2009). Such speciation may be a product of reproductive isolation which prevents hybrid offspring from being viable or able to reproduce, thereby reducing gene flow that results in genetic divergence (Futuyma, 2009). A study has been conducted on diet of sympatrically breeding southern carmine bee-eater *Merops nubicoides* and white-fronted bee-eater *Merops bullockoides* (Kopij, 2018). Besides, Voeten and Prins (1999) studied resource partitioning between sympatric wild and domestic herbivores in the Tarangire region of Tanzania.

Resource partitioning between sympatric bee-eater species has not yet been studied in Bangladesh. The present study was aimed to determine how sympatric populations of chestnut-headed bee-eater and green bee-eater partition their resources, such as habitat and available dietary items; and to find out how significantly these resources are used by two bee-eater species coexisting in the same habitat at Chittagong University Campus.

2. MATERIALS AND METHODS

2.1 Study area

Chittagong University Campus (CUC) is located at the village Fatehpur under Hathazari Upazila of Chittagong District. It is situated about 22 km north of the Chittagong city and about 3 km southwest of the Hathazari Upazila headquarter (Ahsan and Khanom, 2005). The CUC lies approximately between latitude 22°24 N and longitude 91°50 E (Islam *et al*., 1979). The campus area comprises of 709.79 ha (1753.88 acres) of land, of which 72% of land consists of hills and hillocks; and remaining are either plains or valleys (Islam *et al*., 1979). The lands and valleys are under cultivation of rice and vegetables; whereas about 10% of the land of the CUC is occupied by the roads, building, inhabitants and gardens (Khatun, 1999). A number of patches of secondary forest and eye-catching roadside plantation are observed in the campus area (Ahsan and Khanom, 2005). About 215 species of resident and migratory birds are seen in CUC (Ahsan *et al.,* 2017).

The study area was divided into four distinct sites. Those were, Institute of Forestry and Environmental Science campus, Botanical Garden, Hill Bottom Colony and Kata Pahar (Fig.1). The monthly temperature, humidity and precipitation were recorded during the study period. The average temperature was the lowest (19°C) in January and the highest (28 °C) in May. The average humidity was the lowest 68% in February and the highest 88% in August; and the precipitation was 6 to 598 mm during the study period.

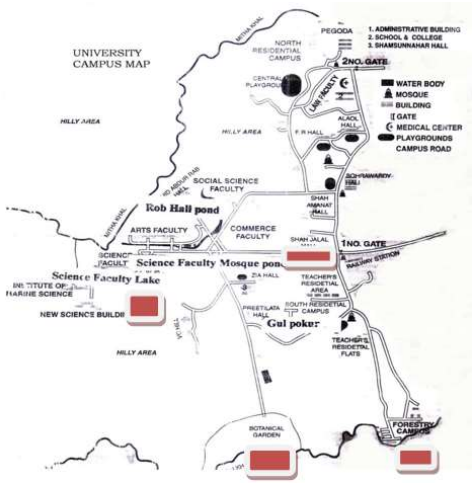

Figure 1. Map of Chittagong University Campus showing study sites.

2.2 Study Procedure

The study was carried out from January to December 2015. Field works were performed at four-time blocks based on two hours interval viz., 07:00-09:00 am, 09:00-11:00 am, 11:00-13:00 pm and 15:00-17:00 pm. The timing of the field work was selected on the basis of the activity and visibility of two studied species. Six days were spent per month in the field to observe birds. Data were gathered by direct field observation followed by scan sampling method of Altmann (1974) based on 05 minutes interval.

The habitats occupied by bee-eater species were divided into three types, such as agricultural lands, trees and water bodies. The perches used by both bee-eater species for resting, feeding and other activities were observed and height was measured by using measuring tape. Besides, trees (small, medium and large) occupied by the two bee-eater species were identified and height was recorded by using measuring tape.

The food items consumed by both bee-eater species were identified visually by using a pair of binoculars; whereas photographs and video clips were also used to identify them clearly. However, taxonomic descriptions were confirmed with the help of Border *et al*. (1981). Their feeding behavior was also observed and diving height was measured by using stick and measuring tape. Besides, Nest diameter and circumference were observed visually and recorded using a meter scale. The height of the nests were also measured from the ground level by using stick and measuring tape; and finally noted.

2.3 Data Analysis

Height of perches and trees used by two bee-eater species were analyzed with the help of a calculator. Diving height and nest size were also calculated. Microsoft Excel 2007 software was used for F-test.

3. RESULTS AND DISCUSSION

3.1 Analysis of habitat

Both of the bee-eater species occupied three types of habitats: (1) agricultural land, (2) tree, and (3) water body; of which trees were utilized maximum (83.29%) time and water bodies minimum (3.16%) time for chestnut-headed bee-eaters (*Merops leschenaulti*) (Fig.2). Green bee-eaters (*Merops orientalis*) also spent the highest time (81.32%) in trees and the lowest (3.66%) time in water bodies during the study period (Fig. 2). The habitats occupied by the two species did not vary significantly ($F = 1.2220109$, $df = 2$, $p = 0.4500428$). In general, both bee-eaters occupied different habitats highest (chestnut-headed bee-eater: 12.72%; green bee-eater: 14.62%) time in June and lowest (chestnut-headed bee-eater: 4.18%; green bee-eater: 3.85%) time in December (Fig. 3). Monthly time spent by two bee-eaters in different habitats did not vary significantly ($F = 0.7416328$, $df = 11$, $p = 0.3143094$).

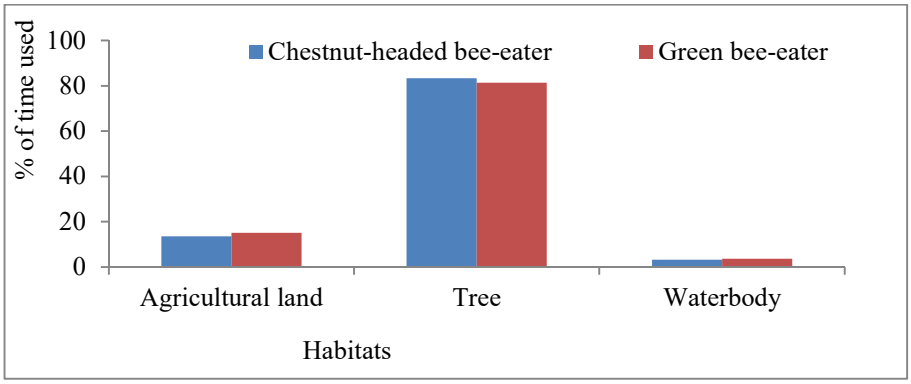

Figure 2. Habitats occupied by two bee-eater species during the study period.

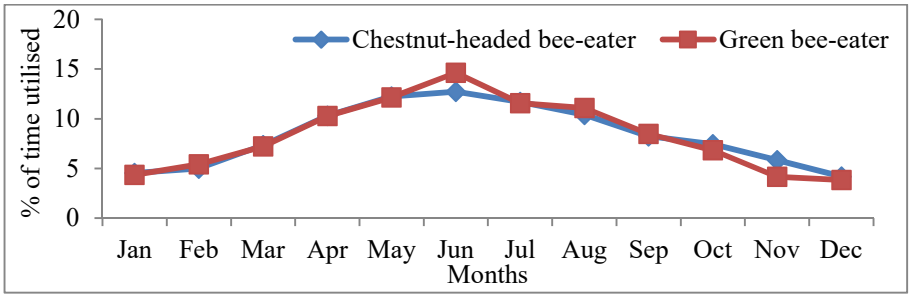

Figure 3. Habitats used by two bee-eater species in different months.

Grimett *et al.* (2011) reported that chestnut-headed bee-eater has vicinity of water in deciduous forest; whereas Islam and Kamruzzaman (2008) described it inhabits in the mixed deciduous and evergreen forests. Besides, Manakadan *et al.* (2011) reported it occurs in the mixed moist deciduous forest near streams. On the other hand, Green bee-eater inhabits the scattered trees, cultivated lands, coasts and grazing lands (Islam and Kamruzzaman, 2008). Ali (1996) also reported that it inhabits in the open country including the region of cultivation, forest clearings, fallow land, gardens, golf links and partial to the zone above sandy beach along the seacoast. Woodcock (1980) described that it occurs in open or lightly wooded countryside, deserts or cultivation lands.

3.2 Agricultural lands

The bee-eater species were reported in cultivated lands by many authors like Ali (1996) and Grimett *et al.* (2011). In the study sites, chestnut-headed bee-eater used the agricultural lands highest (2.60%) time in May and lowest (0.19%) time in January; whereas green bee-eater utilized the maximum (2.47%) time in June and the minimum (0.30%) time in December (Fig. 4). The time spent by two bee-eater species in agricultural lands did not vary significantly ($F = 1.3200910$, $df = 11$, $p = 0.3265437$).

3.3 Trees

Chestnut-headed bee-eater spent highest (9.84%) time in trees in June and lowest (3.99%) time in December, and green bee-eater used the trees maximum (11.36%) time also in June and minimum (3.56%) in December (Fig. 5). Monthly time spent in trees by two bee-eater species did not vary significantly ($F = 0.6042014$, $df = 11$, $p = 0.2082156$). Fry (2001) described bee-eaters are closely associated with rainforest, in tree-fall gaps, off trees overhanging ravines or on emergent crowns above the main canopy.

3.4 Water bodies

Water bodies like pond, lake and stream were occupied by both species. Water bodies were used maximum (0.65%) time in May and the minimum (0%) time in January and December by chestnut-headed bee-eater; while green bee-eater occupied water bodies most (0.79%) in June and least (0%) in January, November and December (Fig. 6). Water bodies used by both bee-eater species in different months did not vary significantly ($F = 0.7048105$, $df = 11$, $p = 0.2857985$).

3.5 Perches used by study species

The both bee-eater species used different perches (fence, tree and electric wire) during resting, diving and feeding (Table 1). Chestnut-headed bee-eater spent the highest (42.42%) time in wires and the lowest (22.22%) time on fences; whereas green bee-eater utilised the maximum (41.18%) time in trees and the minimum (25.49%) time on fences (Table 1). The different perches used by both bee-eater species did not differ significantly ($F = 1.7072378$, $df = 2$, $p = 0.3693802$). Islam and Kamruzzaman (2008) also reported chestnut-headed bee-eater perches on bare branches at the top of trees or on hanging wires. On the other hand, Ali and Ali and Ripley (1970) mentioned green bee-eater usually perches along telegraph wires, or on fence- posts and dead branches; frequently

on the bare ground, sometimes on the backs of grazing cattle.

3.6 Variation of perch height

The perch height of chestnut-headed bee-eater was 1.1 to 9.0 m (mean 4.44 ± 1.87 m, n = 66) and it was 1.0 to 7.0 m (mean 4.07 ± 1.62 m, n = 68) in case of green bee-eater (Fig 7). The average height of fences used by chestnut-headed bee-eater was 1.1 to 3.2 m (mean 2.3 ± 0.62 m, n=15) and it was 1.0 to 3.2 m (mean 2.08 ± 0.75 m, n=18) for green bee-eater (Table 1). The height of trees was 2.0 to 9.0 m (mean 4.35 ± 1.94 m, n = 23) for chestnut-headed bee-eater and 2.5 to 7.0 m (mean 4.6±1.4 m, n = 27) for green bee-eater (Table 1). Besides, the wires used by chestnut-headed bee-eater was 4.0 to 7.5 m (mean 5.65 ± 1.05 m, n = 28) in height; whereas it was 3.9 to 6.5 m (mean 5 ± 0.85 m, n = 23) in height in case of green bee-eater (Table 1).

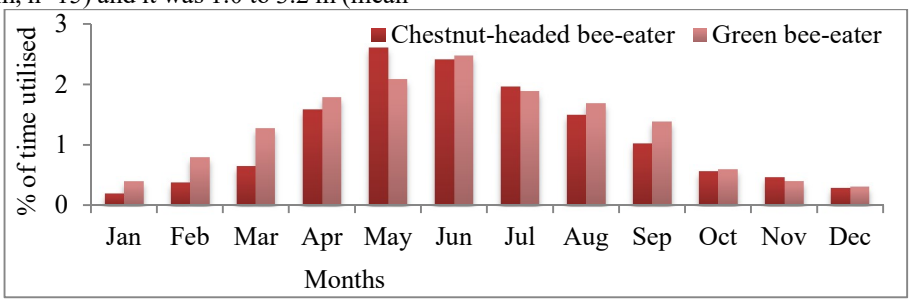

Figure 4. Agricultural lands occupied by two bee-eater species in different months.

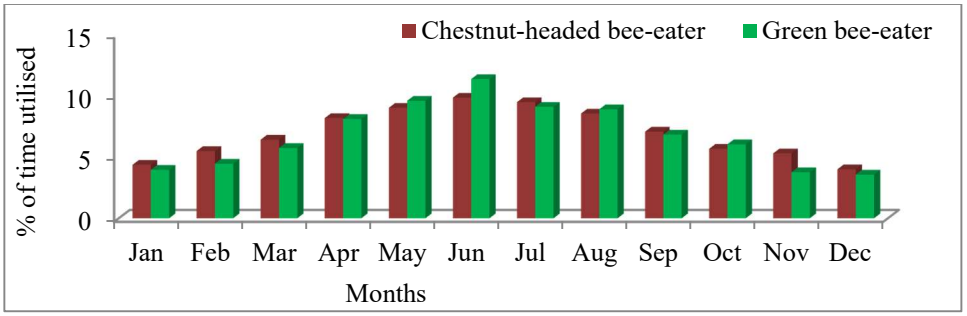

Figure 5. Trees used by two bee-eater species in different months.

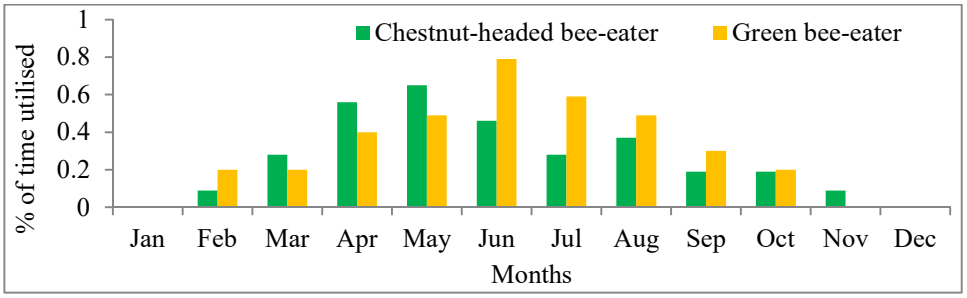

Figure 6. Water bodies utilised by two bee-eater species in different months.

3.7 Tree height partitioning

The both bee-eaters used 16 species of small, medium and large trees during resting, calling and feeding in different study sites during the study period (Table 2). In general, the large trees were 12 to 16 m (mean 13.9 ± 1.33 m, n = 15), while medium were 7 to 11.99 m (mean 8.88 ± 1.06 m, n = 16) and small were 1.2 to 6.99 m (mean 4.62 ± 1.67 m, n = 18) in height for both species (Fig. 8).

Large trees used by chestnut-headed bee-eater were 12 to 16 m (mean 14.03 ± 1.26 m, n = 10) in height, while it was 12 to 15.2 m (mean 13.64 ± 1.56 m, n = 5) in case of green bee-eater; medium trees were 8 to 10 m (mean 8.89 ± 0.84 m, n = 8) for chestnut-headed bee-eater and 7 to 11.2 m (mean 8.88 ± 1.3 m, n = 8) for green bee-eater; whereas small trees were 3.5 to 6.8 m (mean 5.4 ± 1.24 m, n = 5) for chestnut-headed bee-eater and 1.2 to 6.8 m (mean 4.32 ± 1.75 m, n = 13) for green bee-eater (Table 3).

Table 1. Variation of perch height used by two bee-eater species.

Perches	Chestnut-headed bee-eater		Green bee-eater	
	(%) of used (scan)	Average height variation (m)	(%) of used (scan)	Average height variation (m)
Wire	42.42	5.65 ± 1.05 (n = 28)	33.33	5 ± 0.85 (n = 23)
Tree	35.35	4.35 ± 1.94 (n = 23)	41.18	4.6 ± 1.4 (n = 27)
Fence	22.22	2.3 ± 0.62 (n = 15)	25.49	2.08± 0.75 (n =18)

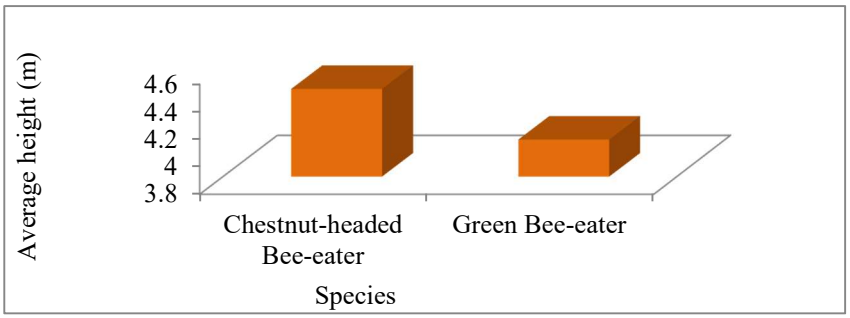

Figure 7. Overall perch height (m) partitioning between two bee-eater species.

Table 2. Plant species used by two bee-eater species.

Common Name	Scientific Name	Family
Aam	*Magnifera indica*	Anacardiaceae
Akashmoni	*Acacia moniliformis*	Fabaceae
Bot	*Ficus benghalensis*	Moraceae
Champa	*Magnolia champaca*	Magnoliaceae
Eucalyptus	*Eucalyptus oblique*	Myrtaceae
Fig tree	*Ficus* sp.	Moraceae
Garjan	*Dipterocarpus* sp.	Dipterocarpaceae
Guava	*Psidium guajava*	Myrtaceae
Jarul	*Lagerstroemia speciosa*	Lythraceae
Koroi	*Albizzia* spp.	Fabaceae
Lichi	*Litchi chinensis*	Sapindaceae
Mahogany	*Swietenia mahagoni*	Meliaceae
Palash	*Butea monosperma*	Fabaceae
Shegun	*Tectona grandis*	Lamiaceae
Shimul	*Salmalia* spp.	Malvaceae
Sonalu	*Cassia fistula*	Fabaceae

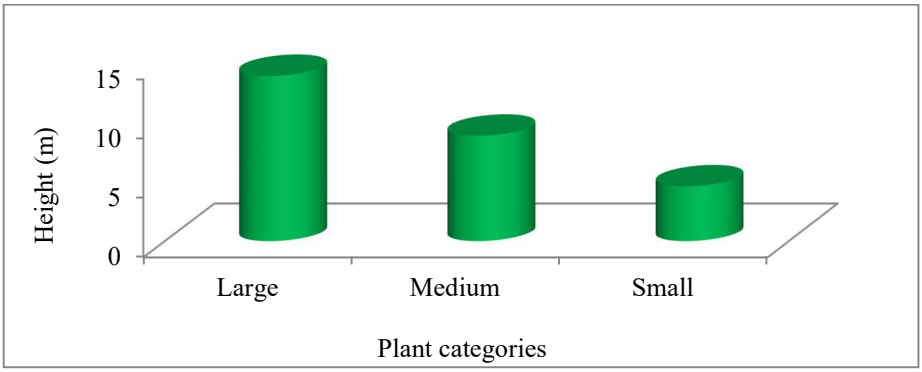

Figure 8. Overall tree height (m) partitioning between two bee-eaters.

Table 3. Tree height partitioning between two bee-eater species.

Types of trees	Chestnut-headed bee-eater		Green bee-eater	
	Height (m)	Height partitioning (m)	Height (m)	Height partitioning (m)
Smaller	3.5 - 6.8	5.4 ± 1.24 (n = 5)	1.2 - 6.8	4.32 ± 1.75 (n = 13)
Medium	8 – 10	8.89 ± 0.84 (n = 8)	7 - 11.2	8.88 ± 1.3 (n = 8)
Large	12 – 16	14.03 ± 1.26 (n = 10)	12 – 15.2	13.64 ± 1.56 (n = 5)

Table 4. Insects preyed by chestnut-headed bee-eater.

Common Name	Scientific Name	Family	Order
Bee	*Apis* sp.	Apidae	Hymenoptera
Wasp	*Vespa* sp.	Vespidae	
Ant	*Solenopsis* sp.	Formicidae	
Dragonfly	*Orthetrum* sp. *Urothemis* sp.	Libellulidae	Odonata
Butterfly	*Pieris* sp.	Pieridae	Lepidoptera
Grasshopper	*Atractomorpha* sp.	Pyrgomorphidae	Orthoptera
Termite	*Reticulitermes* sp.	Rhinotermitidae	Isoptera

3.8 Food items

A total of 12 insect species were identified for both bee-eater species (Table 4; Table 5); of which hymenopterans were the maximum consumed insects by both species (chestnut-headed bee-eater: 25%; green bee-eater: 25%), and lepidopterans, orthopterans and isopterans were the minimum (8.33% each) for chestnut-headed bee-eater, whereas orthopterans, isopterans, dipterans, coleopterans and hemipterans were the minimum (8.33% each) for green bee-eater (Fig. 9). Fry *et al.* (1992) also recorded that the foods of bee-eaters comprised of mainly Hymenoptera (20% to 96%) out of all insects and honeybees formed on average about one-third of the Hymenoptera.

Individually, chestnut-headed bee-eater preyed on 8 insects, of which hymenopterans were the maximum (n=3, 37.5%), and lepidopterans, orthopterans and isopterans were the minimum (n= 1, 12.5% each) (Fig. 10). Islam and Kamruzzaman (2008) described that the chestnut-headed bee-eater usually feeds on large winged insects including dragonflies, bees, ants, termites and butterflies. Ali and Ripley (1970) also mentioned that they feed on winged insects like bees, dragonflies, ants, termites etc.

Besides, green bee-eater preyed upon 12 insects, of which hymenopterans were the highest (n= 3, 25%) and orthopterans, isopterans, dipterans, coleopterans and hemipterans were the lowest (n=1, 8.33%) (Fig. 10). Similarly, Asokan *et al.,* (2009) found that the green bee-eater preyed on varieties of insects like Coleoptera, Hymenoptera, Hemiptera, Orthoptera, Odonata, Lepidoptera and Diptera. Ali and Ripley (1970) also described that they swallow mainly Hymenoptera like ants, bees and wasps; also moths, butterflies, small beetles, dragonflies, termites and other winged insects; whereas Islam and Kamruzzaman (2008) reported that green bee-eater feeds on large winged insects, such as dragonflies, bees, ants, wasps; and butterflies, moths, beetles, dragonflies and termites.

Table 5. Insects preyed by green bee-eater.

Common Name	Scientific Name	Family	Order
Bee	*Apis* sp.	Apidae	Hymenoptera
Wasp	*Vespa* sp.	Vespidae	
Ant	*Solenopsis* sp.	Formicidae	
Dragonfly	*Orthetrum* sp. *Urothemis* sp.	Libellulidae	Odonata
Butterfly	*Pieris* sp.	Pieridae	Lepidoptera
Moth	*Chilo* sp.	Crambidae	
Grasshopper	*Atractomorpha* sp.	Pyrgomorphidae	Orthoptera
Termite	*Reticulitermes* sp.	Rhinotermitidae	Isoptera
Fly	*Lucilia* sp.	Calliphoridae	Diptera
Beetle	*Myllocerus* sp.	Curculionidae	Coleoptera
Aphid	*Aphis* sp.	Aphididae	Hemiptera

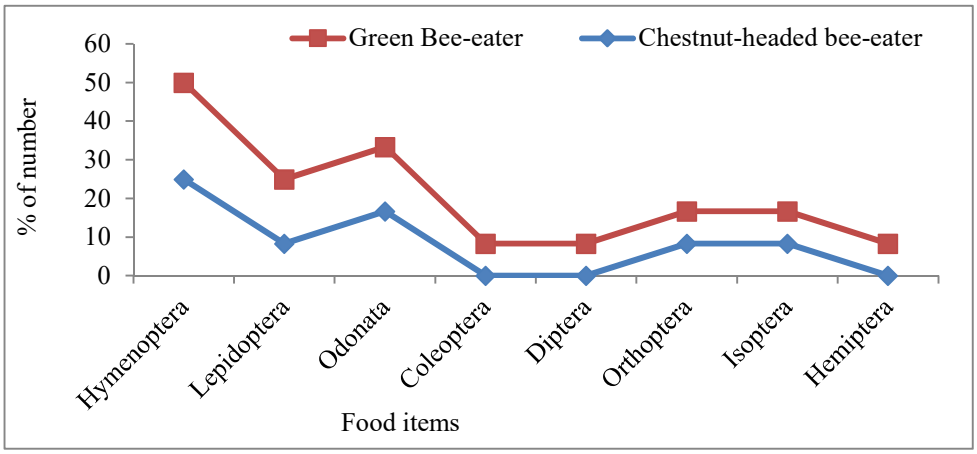

Figure 9. Insect groups preyed by two bee-eater species.

3.9 Feeding behaviour of two bee-eater species

Chestnut-headed bee-eater used their sharp and pointed bill to catch and kill the prey. They preyed on the insects from the perches (branches of trees, wires and fences). Islam and Kamruzzaman (2008) also reported that the chestnut-headed bee-eater forages by flying frequent aerial sorties from its perches to hawk its prey. The diving height of chestnut-headed bee-eater was 2.3 – 5.2 m (mean 4.3 ± 0.67 m, n = 10) above the water level (Fig. 11). After diving they usually returned to their perches with the prey.

Besides, green bee-eater usually hunted from the perches and sometimes from the ground. It takes rapid flight after an insect, seize its prey and return to the perch and before swallowing the prey. It removes stings and breaks the exoskeleton of the prey by repeatedly thrashing it on the perch. Ali and Ripley (1970) mentioned that green bee-eater launches aerial sallies after winged insects, flying with a few rapid flaps followed by graceful swallow-like glides on open motionless wings. It snaps up the quarry in mid-air with an agile upward swoop and circles back to the base where it is whacked against before being swallowed. The diving height of green bee-eater was typically 1 – 5.2 m (mean 4.05 ± 1.42 m, n = 10) high above the water level (Fig. 11).

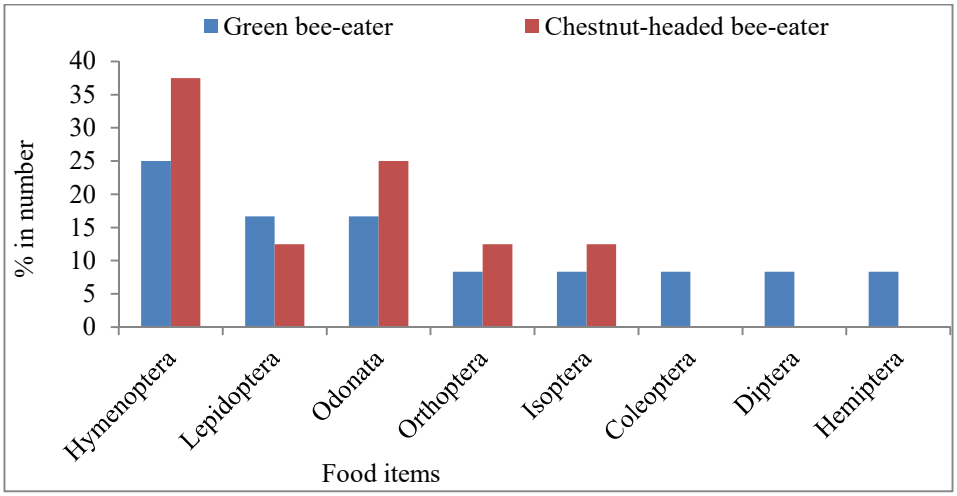

Figure 10. Insect groups consumed by two bee-eater species individually.

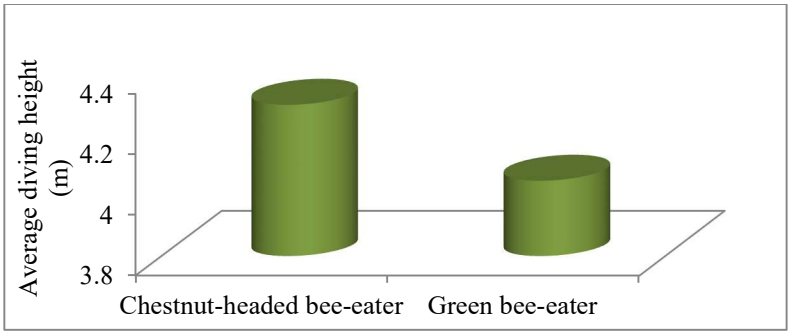

Figure 11. Average diving height (m) of two bee-eater species.

3.10 Nest size partitioning between two bee-eater species

A total of 3 nests of chestnut-headed bee-eater were found during the present study period. They built these nests by drilling the sandy level ground and made it like a horizontal tunnel and their nests were very close to the water body. Ehrlich *et al.* (1994) reported that most of the species of bee- eaters dig a horizontal tunnel into a vertical dirt cliff, with a chamber at the tunnel's end to house the eggs. Ali and Ripley (1970) also mentioned that their nest is drilled into the shelving sandy bank of a stream or in the sandy level ground at a gently downward-slopping angle. The nests were drilled in a mound that was several meters high from the ground. The height of the nests varied from 3.2 - 5.3 m (mean 4.27 ± 1.05 m, n = 3) above from the ground (Table 6). Nest tunnels were 8.5 – 9.2 cm (mean 8.9 ± 0.36 cm, n = 3) in diameter and circumference of the nests varied from 26.69

– 28.89 cm (mean 27.95 ± 1.13 cm, n = 3) (Table 6). Ali and Ripley (1970) recorded that the nests are scattered like rat-holes, a meter or two from one another.

Table 6. Physical characteristics of nest-holes of two bee-eater species.

Variables	Approximate length		Average ± SD	
	M. leschenaulti	*M. orientalis*	*M. leschenaulti*	*M. orientalis*
Nest height (m)	3.2 – 5.3	7 – 9	4.27 ± 1.05 n = 3	8.0 ± 1.41 n = 2
Nest hole diameter (cm)	8.5 – 9.2	8.6 – 8.9	8.9 ± 0.36 n = 3	8.75 ± 0.21 n = 2
Nest hole circumference (cm)	26.69 – 28.89	27.00 – 27.95	27.95 ± 1.13 n = 3	27.48 ± 0.67 n = 2

Only two nests of green bee-eater were found during the study period and these nests were burrowed in a mound near a stream. Ali (1996) described that the green bee-eater digs a horizontal and oblique tunnel in the side of earth cutting, borrow-pit or in uneven sandy ground. Besides, Ali and Asokan (2008) observed that the green bee-eater constructed their nests in a horizontal tunnel along the sandy river banks and sandy bunds with gently sloping bare ground. The height of the nests was varied from 7 – 9 m (mean 8.0 ± 1.41m, n = 2) and 8.6 – 8.9 cm (mean 8.75 ± 0.21 cm, n = 2) in diameter (Table 6). Ali and Ripley (1970) described that the nest- holes of green bee-eater was 3 – 4 cm in diameter and the circumference of the nests varied from 27.0 – 27.95 cm (mean 27.48 ± 0.67 cm, n = 2) (Table 6). On the other hand, Asokan *et al.* (2010) found that the green bee-eater excavated the nests at a mean height of 52.1 ± 2.69 cm from the bottom and 158.7 ± 4.11 cm from the top of the river banks which was 8.9 ± 1.03 cm in diameter having a mean circumference 26.9 ± 3.55 cm.

4. CONCLUSION

After considering all results, we can conclude that both of the bee-eater species spent most of their diurnal time in trees. Among the perches used by them, chestnut-headed bee-eater preferred electric wires while green bee-eater preferred trees. Hymenopterans were major food items consumed by both bee- eater species. Besides, the height of the nest of chestnut-headed bee-eater was 3.2 - 5.3 m and it was 7.0 – 9.0 m in case of green bee-eater. The investigation reveals that, partitioning of resources is the reason behind occurrence of two sympatric bee-eater eater species in same geographical region.

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