J. Asiat. Soc. Bangladesh, Sci. **51**(2): 177-192, December 2025
DOI: http://doi.org/10.3329/jasbs.v51i2.86981

TEMPORAL VARIATION AND HETEROGENEITY OF AVIFAUNA IN THE BANGLADESH NATIONAL MUSEUM PREMISES

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Abstract

The study on temporal variation and heterogeneity of avifauna was carried out in the Bangladesh national museum premises during May 2018 to April 2019 employing Strip Transect Sampling technique. A total of 46 species of birds belonging to 11 orders, 26 families and 40 genera were recorded. Of which, 21 species were passerines and 25 non-passerines, 40 were resident and 6 migratory. Family Ardeidae and Sturnidae constituted the highest number of species (n=4, 8.7%of total). Only a single species were recorded from each of the 13 families. The maximum numbers (33%) of species were locally rare. Insectivorous birds were the highest (n=18,39.13% of total) than the other type of birds (piscivorous, frugivorous, omnivorous, granivorous, scavengers, nectarivorous and carnivorous). The highest number of species were (36.22%) recorded during winter than the other two seasons and the species heterogeneity was negatively correlated with temperature ($y = -0.011x + 1.118$, $R^2 = 0.262$) and precipitation ($y = -0.000x + 0.835$, $R^2 = 0.048$) of the study area. The Euclidean distance between the recorded birds in monsoon and winter are much closer than summer. One third of the recorded birds (31.11% of total) used the tree holes, bank of the pond, tree canopies and roof top of the main building of the Bangladesh National Museum for breeding purposes. Altogether 63 tree species (n=556 individuals) of 34 families were recorded in the premises, all of which were used by birds for different purposes. Of the total species of trees, 60% of trees were used for roosting, 30% for feeding and 11% for nesting by birds.

Keywords: Bird diversity, Passerine, Non-passerine, Resident, Migratory, Birds and plant interaction

Introduction

Bird diversity is considered to be a great indicator of healthy environment and it's occupying a wide range of habitats (Islam *et al*., 2014). It can be sensitive to environmental change and are belong to near or at the top of the food chain (Khan and Ahsan, 2015). It can, therefore, be excellent barometers of the health of the environment and of the sustainability of human progress (Khan and Ahsan, 2015).They are potentials pollinators and bio-indicators (Amat and Green, 2010). Globally about 10,500 species of

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birds are recorded of which, 13% are threatened (IUCN Bangladesh, 2015). Bangladesh is harbours about 690 species of birds, of which 337 residents, 208 winter visitors, 12 summer visitors, 14 passage visitors and 119 vagrants (Khan, 2018). But due to excessive anthropogenic activities and lack of proper conservation measures 19 species of birds have extirpated from Bangladesh (IUCN Bangladesh, 2015). At present Dhaka is being an overpopulated city with a very limited range of habitats for wildlife (Kabir *et al.*, 2010).

Every county of a country should have a list of birds, because they are important biological components of all ecosystems (Ahsan and Khanom, 2005). This research was an attempted to find out the scientific data on temporal variation and avifaunal species diversity, local status and some other aspects of birds of Bangladesh National Museum (BNM) premises. Except this area, sporadically some studies have been done on birds of the different part of the capital city of Dhaka. Chowdhury *et al.* (2014) and Banu *et al.* (2016) studied on seasonal occurrence and checklist of avifauna in Dhaka University campus. The study on avifauna of the national botanical garden of Bangladesh, Dhaka was done by Islam *et al.* (2014). Status and diversity of birds in the Ramna park, Dhaka was noted by Rajia *et al.* (2015). Mohsanin and Khan recorded the status and seasonal occurrence of the birds in Jahangirnager University Campus, Bangladesh (Mohsanin, 2009). The study on diversity of avifauna in Sher-e-Bangla Agricultural University Campus was done by Shovon *et al.* (2014). Diversity and population of avifauna of two urban sites in Dhaka city was recorded by Sarker *et al*. (2009). Capital city of Dhaka is highly diversified with bird species. Bangladesh National Museum campus is surrounding by diversified plant species of Dhaka University Campus and Ramna Park. Hence, an attempt was taken to find out the temporal variation and bird species diversity of the Bangladesh National Museum area. This study should provide baseline information to take in-depth research plan in future.

The objectives of this study were to: (1) find out the diversity of bird species, (2) know the present status with abundance of passerine, non-passerine, resident and migratory bird species, (3) find out the temporal variation and (4) to examine the interaction of birds with tree species in this area.

Materials and Methods

Study site: The study was carried out at the Bangladesh National Museum (BNM) premises, Shahbag, Dhaka, Bangladesh from May 2018 to April 2019. Bangladesh National Museum is a national institute, focused on collection, preservation, research and

interpretative display of historical documents, archaeological artefacts, decorative arts, ethnological materials and specimens of natural heritage of Bangladesh. The museum is located at Shahbag in Dhaka city (Fig. 1) occupying 8.63 acres land, with a magnificent building. The geographical position of the study area is 23°44′15″ N latitude and 90°23′40.2″E longitude.

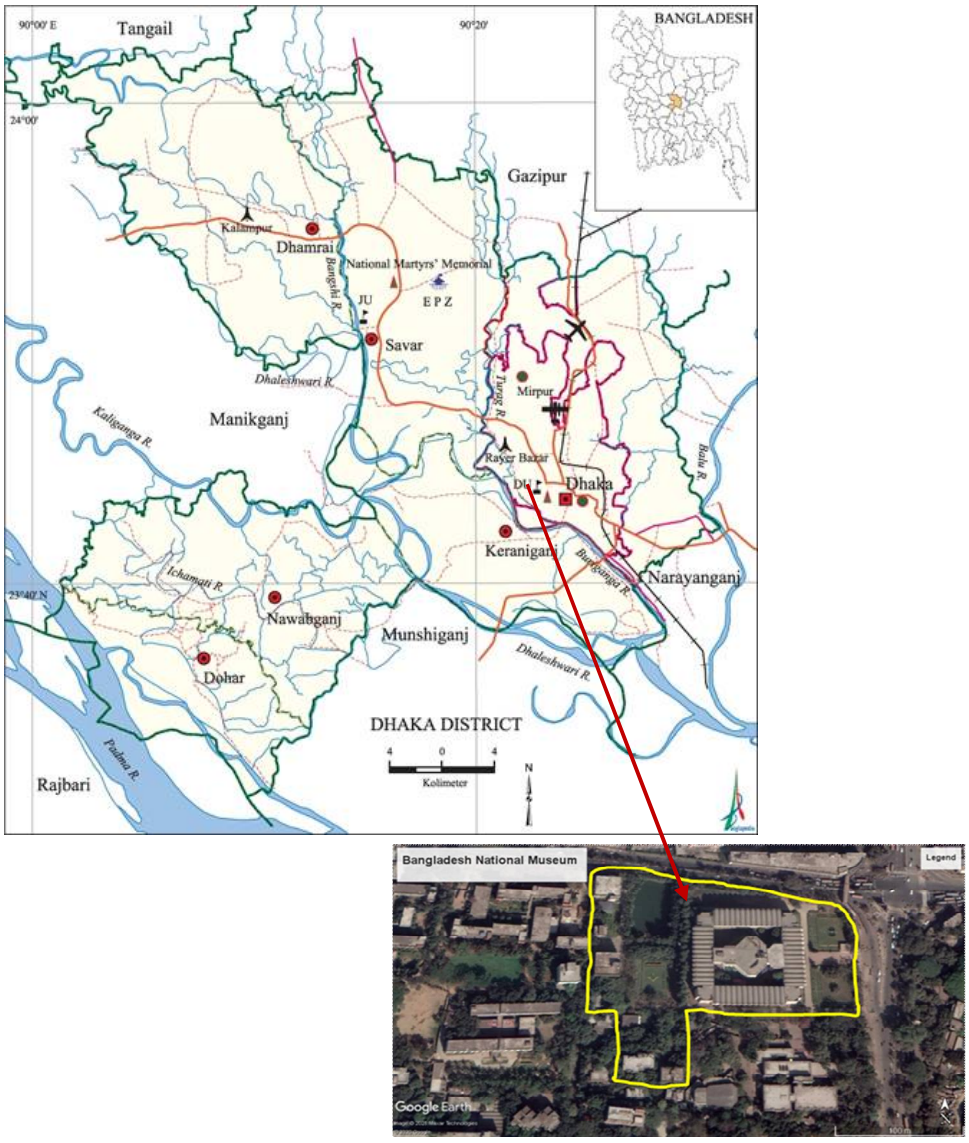

Fig. 1. Map of the study area (map source: Banglapedia 2009 and Google Earth).

PG hospital on the north and Dhaka University campus practically limit the southern and western boundaries of the study area. The Shahbag police station is on the eastern side of the national museum campus.

Dhaka experiences a hot, wet and humid tropical climate. The city has a distinct monsoonal season. The average high temperature for Dhaka ranges from 26°C in January to approximately 36.3°C in April. Similarly, the average low temperature oscillates from 15.3°C in January to 27.3°C in June (Fig. 2). Rainfall is significantly less frequent between October and April, with monthly averages not exceeding 10mm. Conversely, May to September is the wettest months, with an average of 100mm to 134mm of rain per month (Fig. 2). Cold weather is unusual in and around Dhaka.

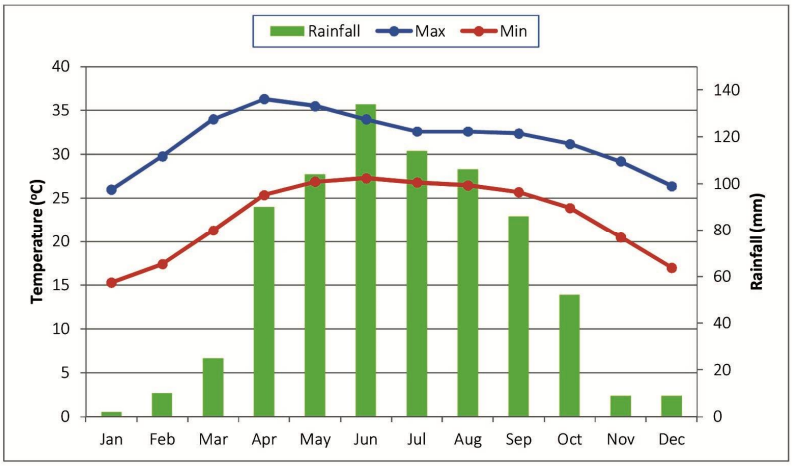

Fig. 2.Graphs show monthlyweather averages over the year in Dhaka city (Data source: www.weather-atlas.com).

Materials used: For clear observation of bird a pair of binoculars (Bushnell 10 x 40X) was used from a safe distance. Sometimes, telescope (Swarovski ATS 80 HD with 20 x 60X) was used on roof top of officer's building number 2 to observe the bird from a long distance. Nikon (D3200) camera with 70–300 mm lens used to take photographs of birds and tree species. Garmin (etrex 10) GPS machine used to measure the length of each transect and also to record latitude and longitude of start and end point of each transect. Weather station (Acurite 5 in 1) used to record the temperature, relative humidity and precipitation of the study area.

Data collection: The study area was inspected twice a week during day time. Sometimes night survey (from sunset to 2100 hr) was done to record nocturnal species from their sound call. A total of 96 days, 672 hours (7 hrs/day) were spent for this study. The observation was done during 0600 – 1000 hr and 1500 – 1800 hr. The time schedule was fluctuated depending on the seasonal day length variation. Most of the birds are diurnally active and data were collected through direct field observations. The survey was conducted through simple Strip Transect Sampling technique (Buckland *et al*., 2001). In total 6 transects were used to count the bird species. Each transect was repeated 3 to 4 times in a day. The total length of transects were 1,023.9 m (Table 1). Sometimes ad libitum data were also recorded to count the bird species.

All bird species were identified following Grimmette *et al*. (1999) and Halder (2010). The local status of the bird species was assessed based on the percentage of occurrence during observations (Emrose, 2024): Very Common (VC) – a species seen during 76 to 100% of the visits; Common (C) – a species seen during 51 to 75% of the visits; Fairly Common (FC) – a species seen during 26 to 50 % of the visits; and Rare (R) – a species seen single or in small number of occasions, i.e. up to 25% of the visits.

Table 1.Transects no, length and GPS coordinate.

Transect no.	Location	Length (m)	GPS	
			Start point	End point
1	Taltala gate to BNM substation	142	23°44′13″N 90°23′43″E	23°44′13″N 90°23′37″E
2	In between Officer's building number 2 and 3 to Agrani bank gate	226	23°44′11″N 90°23′37″E	23°44′17″N 90°23′36″E
3	North – west – south side of officer's building 2	76.4	23°44′12″N 90°23′37″E	23°44′11″N 90°23′37″E
4	East – north – west side of BNM main building	292	23°44′13″N 90°23′41″E	23°44′13″N 90°23′38″E
5	Taltala gate – shahbagh foot over – Agrani bank gate	246	23°44′13″N 90°23′43″E	23°44′17″N 90°23′36″E
6	South side of pond	41.5	23°44′15″N 90°23′37″E	23°44′15″N 90°23′36″E
	Total =	**1,023.9**		

Data analysis: All data were computerized and analysedby SPSS (version 19) software. Pearson two-tailed test performed to determine the correlation coefficient between number of bird species with monthly temperature and precipitation of the area. The temporal changes were analysed by comparing seasons. The hierarchical cluster analysis was done to find out the Euclidean distance between the numbers of bird species based on their diet and also to find out the temporal variation of bird diversity.

Results and Discussion

Heterogeneity of avifauna: During the study period, a total of 46 species of birds recorded belonging to 11 orders, 26 families and 40 genera (Table 2). Among the recorded species, 21species were passerine and 25 non-passerines (Fig. 3); 40 resident and 6 migratory (Fig. 4) (Plate 1). Whereas Shome *et al.* (2022), Banu *et al.* (2016) and Chowdhury *et al.* (2014) recorded 70, 54 and 78 species, respectively from the Dhaka University campus and 65 species were reported by Islam *et al.* (2014) from the National Botanical garden. Rajia *et al*. (2015) found 50 species from Ramna park. Shovon *et al.* (2014) and Sarker *et al.* (2009) recorded 60 and 27 species from Sher-e-Bangla Agricultural University campus and Uttara (sector 7 and 9), respectively.

Plate 1. Recorded migratory bird species in BNM premises: (a) Brown Shrike, (b) Taiga Flycatcher, (c) Blyth's Leaf Warbler, (d) Clamorous Reed Warbler. (Photo credit:Author)

Table 2. Recorded avifaunal species in the Bangladesh National Museum (BNM) premises during May 2018 to April 2019.

Scientific name	English common name	Resident/ Migratory	LS	CS (IUCN Bangladesh 2015)	GS
Order: Columbiformes					
Family: Columbidae					
Columba livia	Rock Dove	R	C	LC	LC
Spilopelia chinensis	Eastern Spotted Dove	R	FC	LC	LC
Order: Caprimulgiformes					
Family: Caprimulgidae					
Caprimulgus macrurus	Large-tailed Nightjar	R	Ra	LC	LC
Family: Apodidae					
Cypsiurus balasiensis	Asian Palm Swift	R	FC	LC	LC
Apus nipalensis	House Swift	R	Ra	LC	LC
Order: Cuculiformes					
Family: Cuculidae					
Eudynamys scolopaceus	Western Koel (Asian Koel)	R	C	LC	LC
Cacomantis merulinus	Plaintive Cuckoo	R	Ra	LC	LC
Order: Pelecaniformes					
Family: Ardeidae					
Butorides striata	Green-backed (Striated) Heron	R	Ra	LC	LC
Ardeola grayii	Indian Pond Heron	R	FC	LC	LC
Egretta garzetta	Little Egret	R	Ra	LC	LC
Ixobrychus cinnamomeus	Cinnamon bittern	R	Ra	LC	LC
Order: Suliformes					
Family: Phalacrocoracidae					
Microcarbo (Phalacrocorax) niger	Little Cormorant	R	Ra	LC	LC
Order: Strigiformes					
Family: Tytonidae					
Tyto alba	Common Barn Owl	R	FC	LC	LC
Family: Strigidae					
Athene brama	Spotted Owlet	R	FC	LC	LC
Order: Accipitriformes					
Family: Accipitridae					
Milvus migrans	Black Kite	R	C	LC	LC
Order: Coraciiformes					
Family: Meropidae					
Merops orientalis	Asian Green Bea-eater	R	FC	LC	LC
Family: Alcedinidae					
Alcedo atthis	Common Kingfisher	R	C	LC	LC
Family:Dalcelonidae					
Halcyon smyrnensis	White-breasted Kingfisher	R	VC	LC	LC
Pelargopsis capensis	Stork-billed Kingfisher	R	Ra	LC	LC
Order: Piciformes					
Family: Megalaimidae					
Psilopogon haemacephalus	Coppersmith Barbet	R	VC	LC	LC

Family: Picidae					
Dinopium benghalense	Black-rumped Flameback	R	C	LC	LC
Micropternus brachyurus	Rufous Woodpecker	R	Ra	LC	LC
Dendrocopos macei	Fulvous-breasted Woodpecker	R	FC	LC	LC
Order: Psittaciformes					
Family: Psittacidae					
Psittacula krameri	Rose-ringed Parakeet	R	VC	LC	LC
Psittacula alexandri	Red-breasted Parakeet	R	Ra	LC	NT
Order: Passeriformes					
Family: Lanidae					
Lanius cristatus	Brown Shrike	M	Ra	LC	LC
Family: Oriolidae					
Oriolus xanthornus	Black-hooded Oriole	R	C	LC	LC
Family: Dicruridae					
Dicrurus macrocercus	Black Drongo	R	C	LC	LC
Family: Corvidae					
Dendrocitta vagabunda	Rufous Tree-pie	R	FC	LC	LC
Corvus splendens	House Crow	R	VC	LC	LC
Corvus levaillantii	Jungle Crow	R	C	LC	LC
Family: Pycnonotidae					
Pycnonotus cafer	Red-vented Bulbul	R	VC	LC	LC
Family: Sylvidae					
Orthotomus sutorius	Common Tailorbird	R	VC	LC	LC
Acrocephalus dumetorum	Blyth's Leaf Warbler	M	Ra	LC	LC
Acrocephalus stentoreus	Clamorous Reed Warbler	M	Ra	LC	LC
Family: Sturnidae					
Sturnus contra	Asian Pied Starling	R	VC	LC	LC
Sturnus malabaricus	Chestnut-tailed Starling	R	VC	LC	LC
Acridotheres fuscus	Jungle Myna	R	C	LC	LC
Acridotheres tristis	Common Myna	R	VC	LC	LC
Family: Muscicapidae					
Ficedula albicilla	Taiga Flycatcher	M	Ra	LC	LC
Copsychus saularis	Oriental Magpie Robin	R	VC	LC	LC
Family: Nectarinidae					
Nectarinia zeylonica	Purple-rumped Sunbird	R	C	LC	LC
Nectarinia asiatica	Purple Sunbird	R	C	LC	LC
Family: Passeridae					
Passer domesticus	House Sparrow	R	C	LC	LC
Dendronanthus indicus	Forest Wagtail	M	Ra	LC	LC
Family: Motacilidae					
Motacilla alba	White Wagtail	M	FC	LC	LC

Note: LS - Local Status, CS - Country Status, GS - Global Status, R - Resident, M - Migratory, VC - Very Common, C - Common, FC - Fairly Common, Ra - Rare, LC - Least Concern, NT - Near Threatened

Number of bird species according to the order: The significant number of species (45.7%) and generae (40%) were recorded from the Order Passeriformes and the minimum number of species (2.2%) and generae (2.5%) recorded from Suliformes and Accipitriformes, respectively.

Passerine birds: Among the Order Passeriformes, family Sturnidae comprised the highest number of species (8.7% of the total and 19.1% of the passerines). Five generae consisted (*Corvus, Acrocephalus, Sturnus, Acridotheres* and *Nectarinia*) the maximum number of species (two, i.e. 4.5% of the total and 9.5% of the passerine species). Thirteen (8 Non-passerines and 5 Passerines) of the 26 recorded families contained single species.

Non-passerine birds: In case of non-passerine, Family Ardeidae consisted of the highest number of genera (four, i.e. 10% of the total and 16.7% of the non-passerines) and species (four, i.e. 8.7% of the total and 16% of the non-passerines) (Table 2). *Psittacula* consisted of the maximum number of species (two, i.e. 4.4% of the total and 8% of the non-passerines).

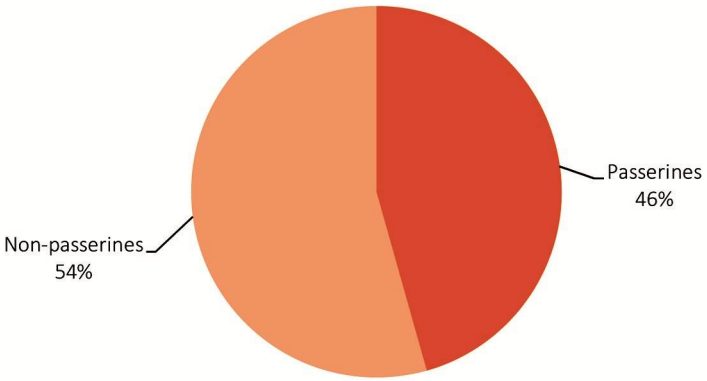

Fig. 3. Percentage of passerine and non-passerine species.

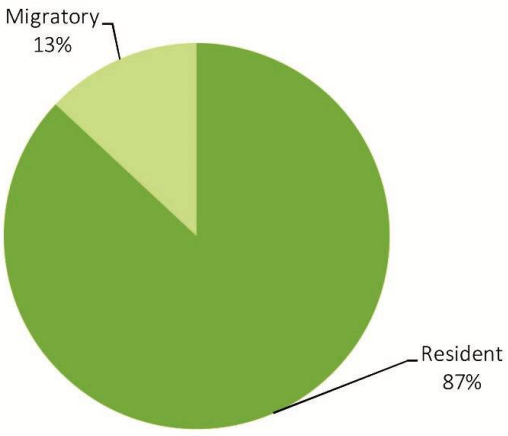

Fig. 4. Percentage of resident and migratory species.

Local status of the recorded bird species: During the study period the maximum number of species (15) were locally rare, 12 species were common, 10 very common and 9 species were fairly common (Fig. 5). Among the passerine species 7 were very common, 7 common, 5 rare and 2 fairly common and in non-passerine 10 rare, 7 fairly common, 5 common and 3 very common species recorded.

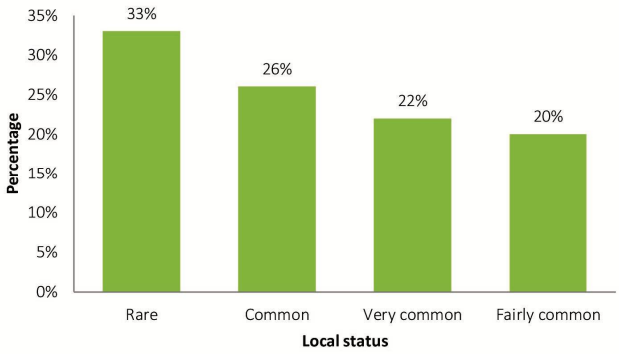

Fig. 5. Local status of the recorded species.

Bird species based on their food habit: Among the recorded species, the highest numbers of birds (18 species) were insectivorous than the other types of birds (piscivorous, frugivorous, omnivorous, granivorous, scavengers, nectarivorous and carnivorous) (Fig. 6).

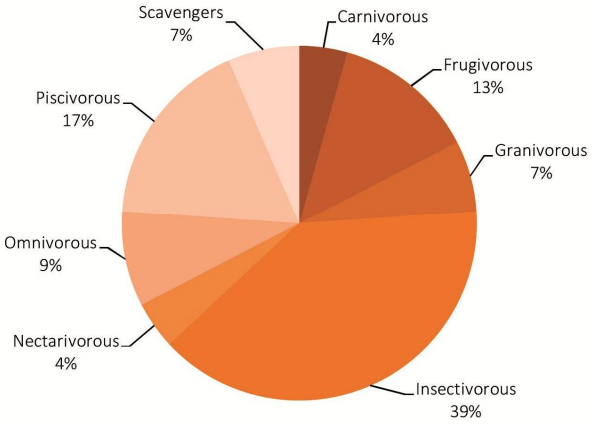

Fig. 6. Bird species based on their food habit.

Temporal variation: This study reported that the maximum numbers of bird species (36.22%) were recorded during winter due to abundance of migratory species than the other two seasons (monsoon, summer) (Fig. 7). Shome *et al.* (2022) also found the highest species diversity in winter.

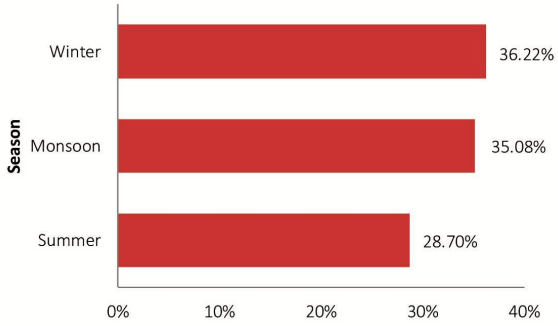

Fig. 7. Temporal variation of bird species in the BNM premises.

From hierarchical cluster analysis it is revealed that the Euclidean distance between the recorded birds in monsoon and winter are much closer than summer (Fig. 8). That means the recorded birds in winter and monsoon is more similar.

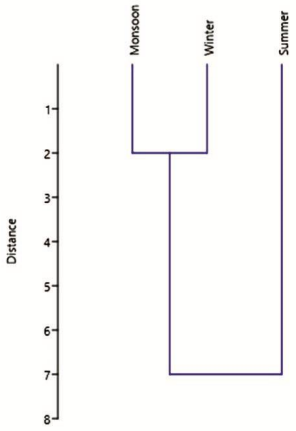

Fig. 8. Euclidean distance between the number of birds in different seasons.

Heterogeneity of birds in relation to temperature and precipitation: The bird species heterogeneity was negatively correlated with temperature ($y = -0.011x + 1.118$, $R^2 = 0.262$) and precipitation ($y = -0.000x + 0.835$, $R^2 = 0.048$) in this area (Fig. 9). That means, the highest number of species were recorded when the temperature was low and minimum precipitation recorded.

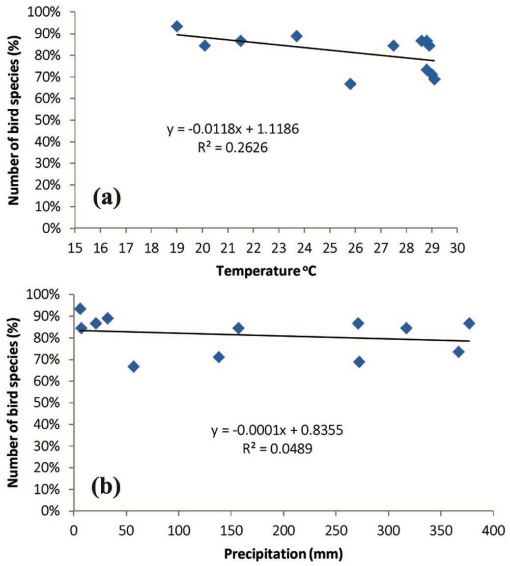

Fig. 9. Relationship of bird species diversity with temperature (a) and rainfall (b) of the study area.

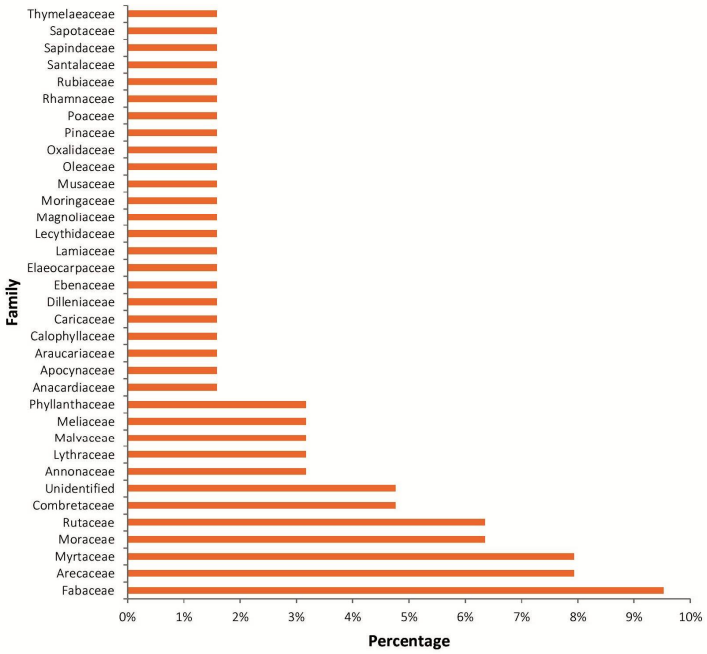

Fig. 10**.** Family wise tree species in the BNM premises.

Plate 2. Some breeding birds in the BNM premises (Photo credit: Author).

Breeding birds in the BNM premises: Among the total recorded species 31.11% birds (Plate 2) used the study area for breeding purposes. Tree holes, bank of the pond, tree canopies and roof top of the main building of the Bangladesh National Museum were the preferred breeding sites in this area (Plate 3).

Interaction of birds with tree species: A total of 63 tree species (556 individuals), under 34 families were recorded to be used by birds for different purposes. Family Fabaceae was dominant (9.52%) (Fig. 10). Most of the trees (59%) were used for roosting followed by feeding (30%) and nesting (11%).

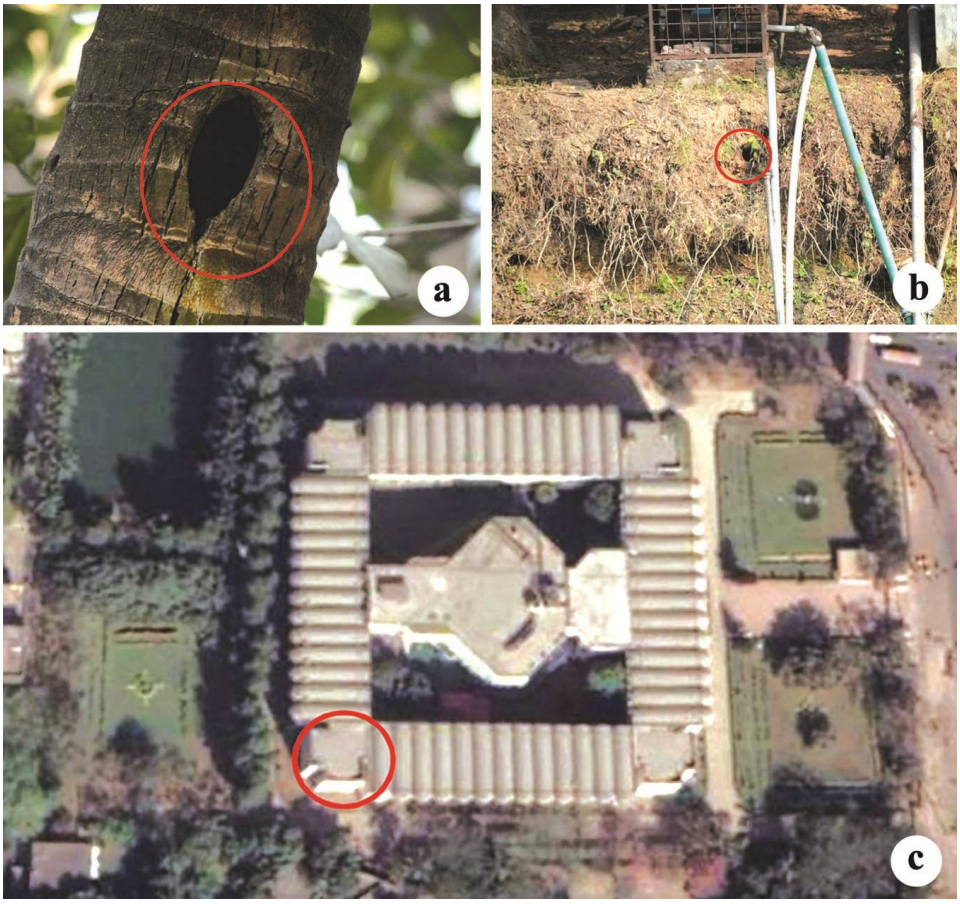

Plate 3. Some preferred bird breeding sites in the BNM premises; (a) tree hole, (b) bank of the pond and (c) roof top of the museum's building (Photo credit: Author).

Conservation values: This study revealed that the diversified habitats of BNM premises i.e.; aquatic habitat (pond), flowering, fruiting, roosting and nesting trees supports different types of bird. Different habitats shelter different species of birds, such as a large pond (0.50 acres) containing fishes and aquatic insects which supports 8 species of piscivorous birds. This habitat occupied by 30% fruit plants which provide food (fruits) for frugivorous birds (6 species).

Conclusions

Bangladesh national museum (BNM) premises are restricted and prohibited to access general people for avoiding excessive crowd, ensuring museum safety and healthy environment of avifaunal species. There is no record of anthropogenic activities in this area. Birds are enjoying this area through nesting, foraging, feeding and resting. Some of the species are living throughout the year in this area without any human disturbance. Even migratory birds are using this area as a stopover while they are flying over a thousand miles from their home country. Thus, BNM ensures a healthy and secure habitat which is rich with different foods and nesting opportunities, provides tremendous ecological benefits along with functional value to birds as well as other animals. BNM plays a great role in conservation of bird species in such an overcrowded unplanned capital city.

Acknowledgements

I gratefully acknowledge the Bangladesh national museum authority to give me the residential permission which encouraged me to do this study and for using the museum premises. Special thanks to Professor Dr. Mohammad Zashim Uddin, Department of Botany, University of Dhaka for helping me to identify the tree species and families.

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(Revised copy received on 12/12/2025)