A survey on Avian Biodiversity in habitats of Lucknow zone of North Indian Plain

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Abstract
Birds are the most attractive and fascinating groups of animals on the earth. Birds play an important and dynamic role in the balanced ecological parameters uniting of food chain in ecological unit of nature. The study was performed in selected habitats of Lucknow region during August 2021 to July 2022. The main objective of this study was to explore the avian diversity of this zone. Data were collected for twelve consecutive months by using the point count method. The observations have recorded 35 species of birds that includes 11 orders and 23 families. The order Passeriformes has 19 species of birds. The family Sturnidae and Phasianidae (3 species) was the most diverse among all the 23 families. Notably, Jungle babbler, house crow and common myna were the most common species in this region. Further, six groups were formed according to their feeding habits: approximately 47% were omnivorous, 17% insectivorous, 14% herbivorous, 8% carnivorous, 6% frugivorous and 8% others.
***Keywords*: Birds; Lucknow; Point Count Method; Passeriformes; Sturnidae; Omnivorous and Insectivorous; Jungle babbler**

1. INTRODUCTION

Avian diversity plays a major role in uniting of food chain in ecological unit of nature [1]. Birds are the most attractive and fascinating groups on the earth and their variety leads to an abundance of the life. The Diversity of birds is one of the most important environmental signal to give sign about the overall health of nature and estimation of natural surroundings [2]. Birds have always mesmerized mankind with their naturally enchanting feather, artistic behavior and coordinated songs [3, 4]. Bird plays an important role as an exterminator in garden, food web and other places. Around human habitation, they feed on variety of food scraps and even human excreta [5]. Birds are the fundamental part of biosphere and lead to maintain trophic level [6]. They are considered as an excellent bio-indicator that can easily detect for the small changes in environment and supporting in understanding the quality of habitats. Birds are widespread among all wildlife in urban areas such as cities and other places.

The avian diversity has interrupted and reduced due to urbanization, human disturbance, natural surroundings and destruction of plant. The birds perform diverse functional roles as seed dispenser, scavengers, ecosystem engineers, nutrient depositor, predator of insects and rodents [7, 8]. Native bird species in particular area are visible throughout year. Some urban birds become remarkably domesticated and relatively easy to observe. Birds show a variety of distribution patterns and often prefer to colonize in an area with abundant resources for their survival. Birds have exemption to move wherever they like to and they have no boundaries. Only thing that matters is the suitability of the climate. The study of bird diversity is essential for ecological balance [9]. Notably, the thick floral diversity of Lucknow region attracts abundant avian species. Rich flora of this region includes trees like *Mangifera indica* (Mango), *Azadarichta indica* (Neem), *Ficus religiosa* (Peepal), *Jijiphus spina crysti* (Ber), *Ficus benghalensis* (Banyan) and other herbs and shrubs. Its rich flora is the house of various bird species.

Birds are also known as aves and are characterized as 'Feathered Bipeds' and comes under the phylum chordata in the animal kingdom and are homoeothermic. It is characterized by the absence of tooth, strong skeleton, high metabolic rate and with four chambered heart. Aves are differentiated into orders according to their habitat, feeding behavior, and morphological patterns. The orders include, Passeriformes, Cuculiformes, Psittaciformes, Accipitriformes, Pelecaniformes, Bucerotiformes, Piciformes, Columbiformes, Coraciiformes, Strigiformes, Gruiformes, Galliformes, etc. Most passerine birds are small in size and mainly feed on insects, spiders, seeds fruits and nectar [10]. Birds are sociable animals and they interact by using a variety of signals. They can produce various types of sound to communicate with their flock members, mates, neighbors and family members. Bird's bodies are adapted for flight and have reptilian ancestry. They are quite easy to observe as they tend to be more active in the daylight. They also have highly developed eye sight and hearing capacity. Birds have shorter life cycles as compared to a number of other forms of life on earth. In India, 1340 species of bird's species have been reported and out of them, 310 (23%) species are wetland birds. The avian diversity is divided into forest, scrub and wetlands but some species of the birds require a mixed type of habitat [11].

2. MATERIALS AND METHODS

Study area, its geographical distribution and environmental conditions

The study was performed in selected habitats of Lucknow region, Uttar Pradesh, India, during August 2021 to July 2022. The habitats of Lucknow are located between 26° 55′ N Longitude and 80° 59′ E Latitude. The Lucknow region has a lush greenery of hundreds of trees and some of them provide shelter to birds and animals. It has also well maintained lawns and gardens. In summer, the climate of the study areas is extremely hot with the temperature of 40 ºC to 45 ºC and in winter the temperature is around 25 ºC and the minimum temperature is 2 to 3 ºC.

Observations and identification

The observations were made between 10: 00 to 12: 00 AM in the morning and 2: 00 to 4: 00 PM in the evening. Bird species were identified by using taxonomical manuals and key reference books [12, 13].

Procedure/methods for avian data collection

Data were collected for twelve consecutive months by using the point count method and were carried out by conducting avian surveys. Birds were also counted by using direct count method from walking within the selected habitats of Lucknow.

Photographic proofs

Photographs were taken with the help of Canon EOS 1000 D SLR camera. The birds were observed most active during the period of day.

3. RESULTS AND DISCUSSION

During the exploration of birds' diversity, 35 different species of birds were recorded in the habitats of Lucknow region (**Table 1**). These reported species belong to 11 orders and 23 families. Birds related orders such as Passeriformes, Columbiformes, Galliformes, Psittaciformes, Cuculiformes, Accipitriformes, Bucerotiformes, Coraciiformes, Strigiformes, Charadriiformes and Piciformes were observed (**Fig. 1**).

The majority of birds were observed from the order Passeriformes that comprises 19 different species of birds belong to the family Passeridae, Corvidae, Sturnidae, Pycnonotidae, Estrildidae, Muscicapidae, Dicruridae, Cisticolidae, Fringillidae, Sylviidae, Nectariniidae and Leiothrichidae, subsequently, it constitutes 54.2% of total avifauna (**Fig. 2**). The order Columbiformes constitutes 5.71% with 2 species belonging to the family Columbidae, Galliformes; 8.57% with 3 species of family Phasianidae, Psittaciformes; 5.71% with 2 species belonging to the family Psittacula, Cuculiformes; 5.71% with 2 species of the family Cuculidae and Bucerotiformes; 5.71% with 2 species belonging to the family Bucerotidae and Upupidae, each with one species. The orders Accipitriformes, Coraciiformes, Strigiformes, Charadriiformes and Piciformes were represented with single species each [14].

In this study, Jungle babbler (*Turdoides striata*) of Leiothrichidae, house crow (*Corvus splendens*) of Corvidae and common myna (*Acridotheres tritis*) of Sturnidae were the most common bird species of this region. According to IUCN status, all the 35 birds' species were the least concern species. The families Sturnidae and Phasianidae (3 bird species) were the most diverse among all the 23 families. The next diverse family was Pycnonotidae followed by Corvidae, Estrildidae, Muscicapidae, Psittacidae and Cuculidae (2 bird species each). There were 11 families that is represented by single bird species.

Table 1 The different species of birds, with their common and scientific name along with their IUCN status, witnessed during speculated time period in the habitats of Lucknow region.

S. No.	Common Name	Scientific Name	Family	IUCN Status
1.	House sparrow	*Passer domesticus*	Passeridae	Least Concern
2.	Rock Pigeon	*Columbia livia*	Columbidae	Least Concern
3.	Indian Peafowl	*Pavo cristatus*	Phasianidae	Least Concern
4.	House crow	*Corvus splendens*	Corvidae	Least Concern
5.	Jungle Babbler	*Turdoides striata*	Leiothrichidae	Least Concern
6.	Common myna	*Acridotheres tritis*	Sturnidae	Least Concern
7.	Black Francolin	*Francalinus francolinus*	Phasianidae	Least Concern
8.	Rose ringed parakeet	*Psittacula krameri*	Psittacidae	Least Concern
9.	Grey Francolin	*Francolinus pondicerianus*	Phasianidae	Least Concern
10.	Common Cuckoo	*Cuculus canorus*	Cuculidae	Least Concern
11.	Spotted Dove	*Streptopelia chinensis*	Columbidae	Least Concern
12.	Jungle Myna	*Acridotheres fuscus*	Sturnidae	Least Concern
13.	Red-whiskered Bulbul	*Pycnonotus jocosus*	Pycnonotidae	Least Concern
14.	Scaly Breasted Munia	*Lonchura punctulata*	Estrildidae	Least Concern
15.	Black Kite	*Milvus migrans*	Accipitridae	Least Concern
16.	Indian Robin	*Saxicoloidae fulicatus*	Muscicapidae	Least Concern
17.	Indian Silver Bill	*Euodice malabarica*	Estrildidae	Least Concern
18.	Red-Vented Bulbul	*Pycnonotuscafer*	Pycnonotidae	Least Concern
19.	Red Avadavat	*Amandava amandava*	Estrildidae	Least Concern
20.				
21.	Indian Roller	*Coracias benghalensis*	Coraciidae	Least Concern
22.	Common Hoopoe	*Upupa epops*	Upupidae	Least Concern
23.	Plum-Headed Parakeet	*Psittacula cyanocephala*	Psittacidae	Least Concern
24.	Jungle Owlet	*Glaucidium radiatum*	Strigidae	Least Concern
25.	Red-wattled Lapwing	*Vanellus indicus*	Charadriidae	Least Concern
26.	Black Drongo	*Dicrurus macrocercus*	Dicruridae	Least Concern

27.	Indian Jungle Crow	*Corvus macrorhynchos*	Corvidae	Least Concern
28.	Common Starling	*Sturnus vulgaris*	Sturnidae	Least Concern
29.	Ashy Prinia	*Prinia socialis*	Cisticolidae	Least Concern
30.	Asian Koel	*Eudynamys scolopaceus*	Cuculidae	Least Concern
31.	Common Rosefinch	*Carpodacus erythrinus*	Fringillidae	Least Concern
32.	Grey-headed Woodpecker	*Picus canus*	Picidae	Least Concern
33.	Common Chiffchaff	*Phylloscopus tritis*	Phylloscopidae	Least Concern
34.	Purple Sunbird	*Cinnyris asiaticus*	Nectariniidae	Least Concern
35.	Pied Bushchat	*Saxicola caprata*	Muscicapidae	Least Concern

House sparrow

Rock pigeon

Indian Peafowl

House crow

Jungle Babbler

Common myna

Black Francolin

Rose ringed parakeet

Grey Francolin

Common Cuckoo

Spotted Dove

Jungle Myna

Red-whiskered Bulbul

Scaly Breasted Munia

Black Kite

 Indian Robin	 Indian Silver Bill	 Red-Vented Bulbul
 Red Avadavat	 Indian Grey Hornbill	 Indian Roller
 Common Hoopoe	 Plum-Headed Parakeet	 Jungle Owlet
 Red-wattled Lapwing	 Black Drongo	 Indian Jungle Crow
 Common Starling	 Ashy Prinia	 Asian Koel
 Common Rosefinch	 Grey-headed Woodpecker	 Common Chiffchaff

Fig. 1 Photographic images showing the birds species recorded in the selected habitats of Lucknow zone.

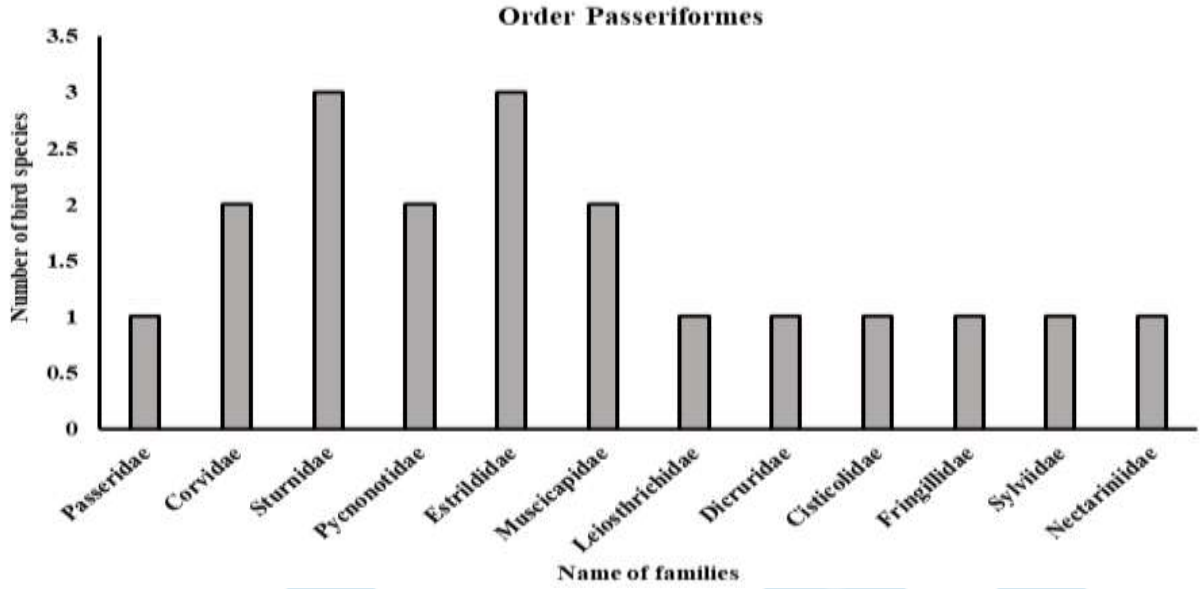

Fig. 2 Graphs showing the number of birds' species belonging to order Passeriformes and its related families reported in Lucknow region.

The feeding habits of birds were also observed that the maximum species were almost 47% omnivorous (feeding on both plants and animals), 17% insectivorous (feeding on insects), 14% herbivorous (Feeds on plants), 8% carnivorous (feeding on large animal or dead animal), 6% frugivorous (feeds on fruit) and 8% others (**Fig. 3**).

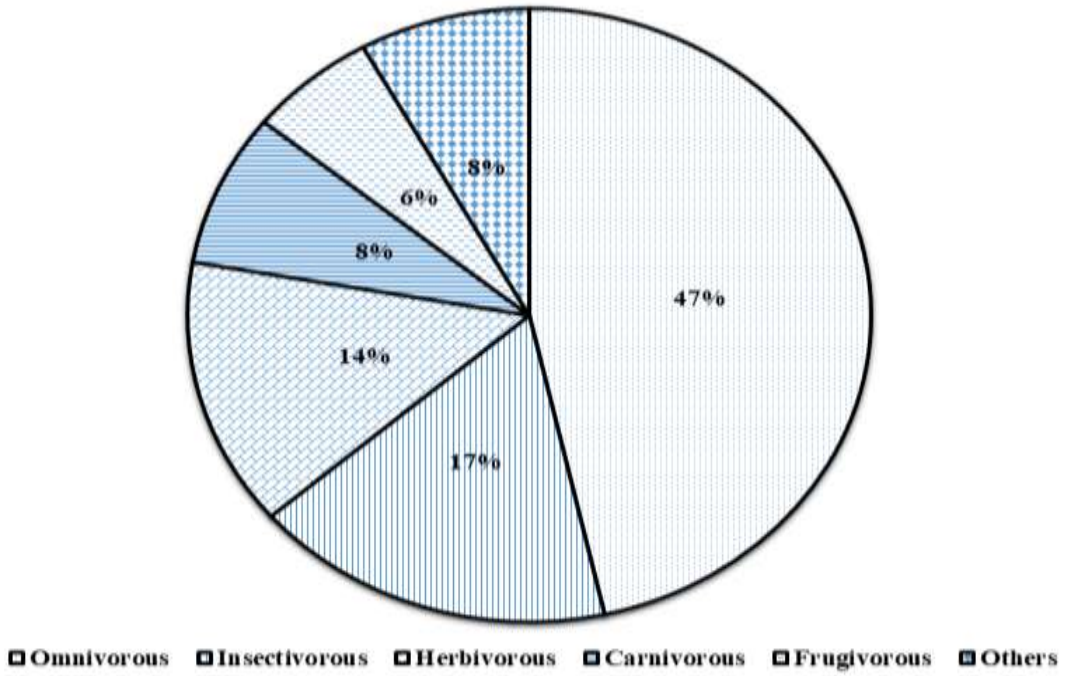

Fig. 3 Pie chart displaying the percentage of birds' species according to their food preferences stated in Lucknow habitats.

The findings showed that 23 species were residential (R), 9 species were winter migratory (WM), and 3 birds species were residential/local migratory or migrates partially. The maximum number of residential birds belong to the order Passeriformes. During study, the observed migratory birds were common cuckoo, black drongo, common hoopoe, Indian jungle crow, common starling, Asian koel, common rose finch and common chiffchaff. The recorded residential birds were house sparrow, rock pigeon, Indian peafowl, house crow, jungle babbler, rose-ringed parakeet, spotted dove, red-whiskered bulbul, scaly breasted munia, Indian robin, Indian silver bill, red-vented bulbul, red avadavat, Indian grey hornbill, Indian roller, plum-headed parakeet, jungle owlet, red-wattled lapwing, ashy prinia, grey headed wood pecker, purple sun bird and pied bush chat.

Similarly, the diversity of birds was observed that even in a limited urban ecosystem, it is able to support a diverse avifauna which illustrating the nature of birds, quite resilient [15]. The birds are less affected by contaminated environment in cities due to their better ability to acclimatize in artificial light, to communicate easily in noisy surroundings, to breed effectively in man-made buildings. This study engenders the strategies to educate the peoples for the urban biodiversity related to native and non-native birds' species including the abundant jungle babbler, house crow, common myna, house sparrows, pigeons and starlings [16]. In cities, complex communities can raise the initiatives which can effectively be used to aware the children and adults about the biodiversity [17]. The systematic planning, awareness programmes that enhance the knowledge of biodiversity and inspiration about

the ecosystems that livelihood for diversity. These awareness interventions can augment overall biodiversity in cities [18]. These efforts engender the supports for larger conservation of animal diversity beyond the metropolitan boundaries [19]. Several studies have described the biodiversity of birds at different places of Indian Subcontinent [14, 20, 21, 22].

4. CONCLUSION

This study provides the information about bird diversity of habitats of Lucknow zone, Uttar Pradesh, India. The purpose of this study is to explore the avian diversity during August 2021 to July 2022 (12 Months). The study areas show semi-arid condition with less annual rainfall (average 751 mm). The evaluation of the study area showed different habitats having rich avian diversity this is due to availability of varieties of food resources. The findings illustrated 35 birds' species that includes 11 orders and 23 families. The order Passeriformes has 19 species. The family Sturnidae and Phasianidae have 3 species each. Specially, Jungle babbler, house crow and common myna were very common species. Accordingly, the feeding habits of birds were almost 47% omnivorous, 17% insectivorous, 14% herbivorous, 8% carnivorous, 6% frugivorous and 8% others. This study established a fact that the species richness and evenness which are directly co-related with the stability of ecosystem. Also, the vegetation composition and vegetation structure are the key factors that influence the species diversity, distribution and abundance. Therefore, the need of the hour is to encourage the habitat and natural resources for long term monitoring of birds to get a complete idea of bird population dynamics. The study furnishes the information related to the status of the avifauna of this region.

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CONFLICT OF INTERESTS

The authors report that there is no conflict of interests.**ES**

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