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Avifaunal diversity and abundance in Jiwaji University campus, Gwalior (M.P.) India

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Abstract
Avifaunal diversity plays a very important role in determining the health of an ecosystem. The study was conducted over a period of 12 months from July 2018 to June 2019. The bird species were recorded using point counts and line transects method where ever possible for studying avian diversity. A total of 56 species belonging to 33 families and 12 orders were recorded during the study period. Least concern were recorded 100% A total of 8% species accounted for migratory and 4% species of near threatened were recorded. This study provides baseline data for monitoring the avifauna in the University campus and demonstrates the importance of University campus in bird conservation.

Keywords: avifauna, diversity, abundance, Jiwaji University

Introduction
Studies on bird diversity are important to understand global conservation needs for avian community. Birds, the most beautiful creatures of nature, are a group of vertebrates which have feathers, wings and hollow bones as aerial lifestyle adaptations. They are the most liked animals because of their fabulous colors, melodious calls and easily identifying characters. Further, our foremost need to have all manner of birds around us is due to their intrinsic values, aesthetic and ethical. They help in pollination of flowers and dispersal of seeds. They are also integral part of food chain and food web. Birds play a vital role in keeping balance of nature. Richness, abundance and community composition of birds are often used by ecologists to understand the diversity of species in natural occurrence (Singh *et al.*, 2018) [13]. Due rapid expansion of urban development, it is important to understand the relationship between natural flora and fauna and urban habitats. Urban biodiversity has received very little attention from conservation biologists as compared to natural and protected ecosystems. Many cities in India contain vast biodiversity of flora and fauna but due to rapid urbanization there has been an alarming reduction in biodiversity (Dapke *et al.*, 2015) [4]. The present study is focused on preparing the checklist of birds, also to find out their occurrence, status as well as to create awareness for their conservation. In addition, the study aims at providing the basic information of the avifauna for further studies related to campus biodiversity. This is the only large green spot in the city, where the birds can get cover. Hence the area should be wisely used without disturbing the activity of the birds and instead encouraging more number of species in the area.

Study Area
Jiwaji University was established in 1964 as an off shoot of Vikram University, Ujjain. It was named after the Alijah Bahadur Sir Jiwaji Rao Scindia the former ruler of the Gwalior state. About 340 Acres of land was allotted by Smt. Rajmata Vijayaraje Scindia to Jiwaji University for developing various departments in University.

The land allocated to university is known as Naulakkha Parade Ground of the state time. The foundation stone of the university was laid by Dr. Sarvepalli Radha Krishnan; the Former President of India. In Jiwaji University Campus total eight study site was established for study purpose to keep in mind the habitat features and presence of bird (Fig. 1).

Material and Methods
Instrument used
- **Global Positioning System:** Garmin GP5 60-(to find the location of study sites)
- **Camera:** Nikon D-60 (to take the picture of birds)
- **Binocular:** Nikon 10-60 zoom (to see the far birds)
- **Text book and Pen**
- **Field Guide book** (Ali, 2006 and Girmmit *et al.*, 1990)

Methodology
Bird watching technique identifying a bird can be a challenging process. Birds are active, energetic animals. Quick eye spotting is required in order to get possible detail in short span of time. The following techniques were used during bird watching- Birds were recognised by fixing eye on them. Continuous observations were made regarding their movement, songs, feeding habit and size. Simultaneously specific calls and songs were also identified. General size, shape, distinctive strips and patches of colour including crown strips, eye lines, nape colour, eye arcs or rings and birds bill size were noted. Wing bars, colour patches, and marking on bird body during stationary stage or flying stage were noted. Leg colour and length were also noted in each observation. Observations were confirmed with the help of Avibase bird count (2013). Standard literature on Indian Birds by Ali and Birds of regional museum of natural history were used for correct identification of birds. The bird species survey was conducted at early morning from 7:00 am to 8:30 am and 5:00 pm to 6:30 pm on every Saturday and Sunday.

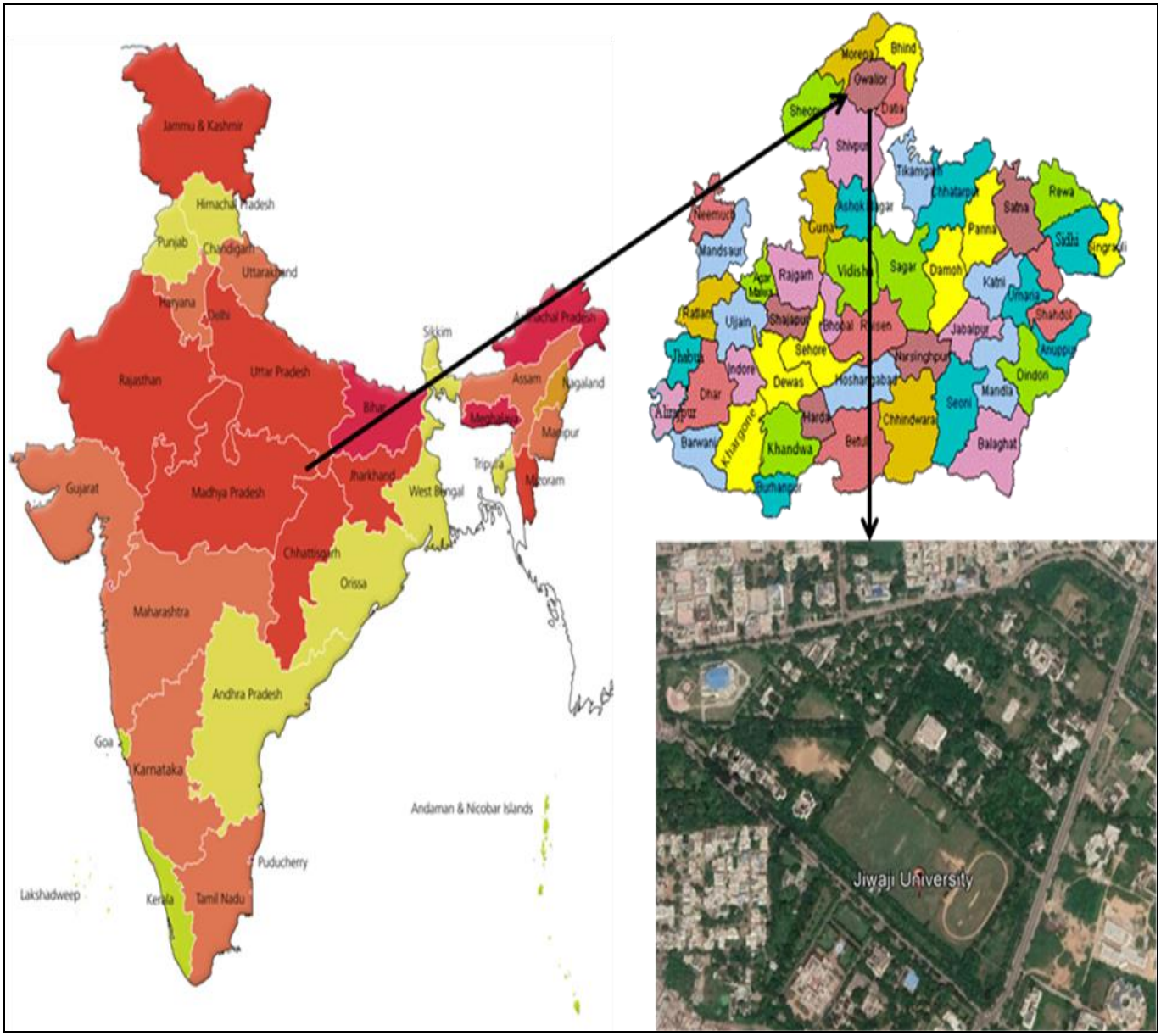

Fig 1: Study area of Jiwaji University, Campus

Result and Discussion

Birds are used for assessing ecosystem quality (Ridley *et al*., 1984). During the study period total 56 species of bird species were recorded from Jiwaji University, Campus belonging to 33 families, 12 orders with their scientific name, IUCN status (International Union for Conservation and Nature) and migratory status (Table 1). IUCN status revealed that out of all species (56=100%) was least concern. As per residential status 51 (91%) species residential, 5 (9%) species residential migrants were recorded in study area. Pragasan and Madesh (2018) [10] a total of 37 species of birds belonging to 23 families were recorded *in* Bharathiar University Campus, Tamil Nadu, India. Seasonal abundance of bird species recorded in monsoon season, winter season and summer season (Table 2). Maximum species 53 were recorded in winter season followed by 41 in monsoon season and 38 species in summer season respectively. Seasonally number of individuals species of birds recorded (Table 3). The highest number of individual of bird recorded 566 in winter season followed by 425 in summer season and 345 in monsoon season. Recorded data showed that out of total 56 species, 27 species were common, while 25 species were rarely common and 04 species were uncommon, seen during all the season of study period.

In this study Indian Robin, Laughing Dove, Rock Dove, Black Drongo, Red-vented Bulbul, Indian Peafowl, Grey Francolin, Purple Sunbird, Common Babbler, House Sparrow, Grey Francolin and National bird Peacock were the most common species. Nesting and their young ones were also observed in the University Campus. Columbidae was the dominant family with 05 speciies and followed by the family Sturnidae, Cuculidae with 4 species, Muscicapidae, Motacillidae, Corvidae with 3 species, Hirudinidae, Leiothrichidae, Phasianidae, Megalaimidae, Rallidae, Charadriidae, Ardeidae with 2 species while Oriolidae, Estrilidae, Passeride, Cisticolidae Compephagidae, Nectariniidae, Dicruridae, Pycnonotidae, Laniidae, Monarchidae,Alcedinidae, Coraciidae, Meropidae, Bucerotidae, Upupidae, Recurvirostridae, Apodidae, Strigidae, Strigidae, Psittaculidae, Psittaculidae, Accipitride with 1 family of each in Jiwaji University campus, Gwalior shown (Table 4). Family wise percentage of bird species distributions is showing in fig. 2.

Shannon diversity index was higher (0.176) observed in summer season followed by winter season (0.131) and summer season (0.126). Species evenness was higher (0.052) recorded in summer season while lowest value (0.033) of species richness recorded in winter season. Simpson Index ranged from 0.929 to 0.961 and species richness was higher in winter season while lowest in summer season (Table 5). Similar observation reported from Assam University campus located in Silchar, India (Chakdar *et al.*, 2016) [3] and moist deciduous forests of Mukkali (Jayson and Mathew, 2000) [8]. To have effective conservation measures in place, it is necessary to study the population size of birds. Population studies were, for long, used to monitor long time changes in natural and manmade ecosystems (Wiens, 2001) [15].

To maintain a viable population, conservation measures are needed.

There are several factors that influence changes in bird populations such as availability of food, location of nesting sites, availability of nesting materials, introduced diseases, introduced and invasive flora, predators, and competitors (Ramesh and Mc-Gowan, 2009) [11].

Table 1: Systematic list and status of Birds in Jiwaji University Campus

S. No.	Order	Family	Scientific name	Species name	IUCN Status	Mg. Status
1	Passeriformes	Sturnidae	*Sturnia pagodarum*	Brahminy Starling	LC	R
2			*Acridotheres ginginanus*	Bank Myna	LC	R
3			*Acridotheres tristis*	Common Myna	LC	R
4			*Gracupica contra*	Asian Pied Starling	LC	R
5		Hirudinidae	*Hirundo rustica*	Barn Swallow	LC	RM
6			*Cecropis daurica*	Red-rumped Swallow	LC	RM
7		Muscicapidae	*Saxicoloides fulicatus*	Indian Robin	LC	R
8			*Phoenicurs erythronotus*	Rufous-backed Redstart	LC	R
9			*Copsychus saularis*	Oriental Magpie-robin	LC	R
10		Leiothrichidae	*Turdoides striata*	Jungle Babbler	LC	R
11			*Argya caudata*	Common Babbler	LC	R
12		Motacillidae	*Motacilla cinerea*	Grey Wagtail	LC	RM
13			Motacilla maderaspatensis	White-browed Wagtail	LC	R
14			*Anthus trivialis*	Tree Pipit	LC	RM
15		Corvidae	*Dendrocitta vagabunda*	Rufous Treepie	LC	R
16			*Corvus macrorhynchos*	Large-billed Crow	LC	R
17			*Corvus splendens*	House Crow	LC	R
18		Oriolidae	*Oriolus oriolus*	Eurasian Golden Oriole	LC	R
19		Estrilidae	*Lonchura punctulata*	Scaly-breasted Munia	LC	R
20		Passeridae	*Passer domesticus*	House Sparrow	LC	R
21		Cisticolidae	*Orthotomus sutorius*	Common Tailorbird	LC	R
22		Compephagidae	*Coracina macei*	Indian Cuckooshrike	LC	R
23		Nectariniidae	*Cinnyris asiaticus*	Purple Sunbird	LC	R
24		Dicruridae	*Dicrurus macrocercus*	Black Drongo	LC	R
25		Pycnonotidae	*Pycnonotus cafer*	Red-vented Bulbul	LC	R
26		Laniidae	*Lanius vittatus*	Bay-backed Shrike	LC	R
27		Monarchidae	*Terpsiphone paradise*	Indian Paradise-flycatcher	LC	R
28	Columbiformes	Columbidae	*Treron phoenicopterus*	Yellow-footed Green-pigeon	LC	R
29			*Columba livia*	Rock Dove	LC	R
30			*Spilopelia senegalensis*	Laughing Dove	LC	R
31			*Streptopelia tranquebarica*	Red Turtle-dove	LC	R
32			*Spilopelia chinensis*	Eastern Spotted Dove	LC	R
33		Cuculidae	*Centropus sinensis*	Greater Coucal	LC	R
34			*Cuculus micropterus*	Indian Cuckoo	LC	R
35			*Hierococcyx varius*	Common Hawk-cuckoo	LC	R
36			*Eudynamys scolopaceus*	Western Koel	LC	R
37		Alcedinidae	*Halcyon smyrnensis*	White-breasted Kingfisher	LC	R
38		Coraciidae	*Coracias benghalensis*	Indian Roller	LC	R
39		Meropidae	*Meropus orientalis*	Asian Green Bee-eater	LC	R
40	Galliformes	Phasianidae	*Pavo cristatus*	Indian Peafowl	LC	R
41			*Francolinus pondicerianus*	Grey Francolin	LC	R
42	Bucerotiformes	Bucerotidae	*Ocyceros birostris*	Indian Grey Hornbill	LC	RM
43		Upupidae	*Upupa epops*	Common Hoopoe	LC	R
44	Piciformes	Megalaimidae	*Psilopogon zeylanicus*	Brown-headed Barbet	LC	R
45			*Psilopogon haemacephalus*	Coppersmith Barbet	LC	R
46	Gruiformes	Rallidae	*Amaurornis phoenicurus*	White-breasted Waterhen	LC	R
47			*Gallinula chloropus*	Common Moorhen	LC	R
48	Charadriiformes	Charadriidae	*Vanellus indicus*	Red-wattled Lapwing	LC	R
49			*Vanellus malabaricus*	Yellow-wattled lapwing	LC	R
50		Recurvirostridae	*Himantopus himantopus*	Black-winged Stilt	LC	R
51	Palecaniformes	Ardeidae	*Bubulcus ibis*	Cattle Egret	LC	R
52			Ardeola grayii	Indian Pond-heron	LC	R
53	Caprimulgiformes	Apodidae	*Apus affinis*	Little Swift	LC	R
54	Strigiformes	Strigidae	*Athene brama*	Spotted Owlet	LC	R
55	Psittaciformes	Psittaculidae	*Psittacula krameri*	Rose-ringed Parakeet	LC	R
56	Accipitriformes	Accipitridae	*Accipiter badius*	Shikra	LC	R

*Mg.: Migratory Status

Table 2: Seasonally abundant species of bird recorded in Jiwaji University, Campus

S. No.	Species name	Monsoon Season	Winter Season	Summer Season
1	Brahminy Starling	✓	✓	✓
2	Bank Myna	✓	✓	✓
3	Common Myna	✓	✓	✓
4	Asian Pied Starling	_	✓	✓
5	Barn Swallow	✓	_	✓
6	Red-rumped Swallow	✓	✓	_
7	Indian Robin	✓	✓	✓
8	Rufous-backed Redstart	_	✓	_
9	Oriental Magpie-robin	✓	✓	✓
10	Jungle Babbler	✓	✓	✓
11	Common Babbler	✓	✓	✓
12	Grey Wagtail	✓	✓	_
13	White-browed Wagtail	✓	✓	_
14	Tree Pipit	_	✓	✓
15	Rufous Treepie	✓	✓	✓
16	Large-billed Crow	_	✓	✓
17	House Crow	✓	✓	✓
18	Eurasian Golden Oriole	_	✓	✓
19	Scaly-breasted Munia	_	✓	_
20	House Sparrow	✓	✓	✓
21	Common Tailorbird	_	✓	_
22	Indian Cuckooshrike	✓	✓	_
23	Purple Sunbird	✓	✓	✓
24	Black Drongo	✓	✓	✓
25	Red-vented Bulbul	✓	✓	✓
26	Bay-backed Shrike	_	✓	✓
27	Indian Paradise-flycatcher	✓	_	_
28	Yellow-footed Green-pigeon	✓	✓	_
29	Rock Dove	✓	✓	✓
30	Laughing Dove	✓	✓	✓
31	Red Turtle-dove	_	✓	✓
32	Eastern Spotted Dove	_	_	✓
33	Greater Coucal	✓	✓	✓
34	Indian Cuckoo	✓	✓	_
35	Common Hawk-cuckoo	_	✓	✓
36	Western Koel	_	✓	_
37	White-breasted Kingfisher	✓	✓	_
38	Indian Roller	✓	✓	✓
39	Asian Green Bee-eater	✓	✓	✓
40	Indian Peafowl	✓	✓	✓
41	Grey Francolin	✓	✓	✓
42	Indian Grey Hornbill	✓	✓	✓
43	Common Hoopoe	_	✓	✓
44	Brown-headed Barbet	✓	✓	_
45	Coppersmith Barbet	✓	✓	✓
46	White-breasted Waterhen	✓	✓	_
47	Common Moorhen	✓	_	_
48	Red-wattled Lapwing	✓	✓	✓
49	Yellow-wattled lapwing	✓	✓	✓
50	Black-winged Stilt	✓	✓	_
51	Cattle Egret	✓	✓	_
52	Indian Pond-heron	✓	✓	_
53	Little Swift	✓	✓	✓
54	Spotted Owlet	_	✓	✓
55	Rose-ringed Parakeet	✓	✓	✓
56	Shikra	_	✓	✓
Total		41	53	38

Table 3: Seasonally recorded number of individual species in Jiwaji University, Campus

S. No.	Species name	Monsoon Season	Winter Season	Summer Season
1	Brahminy Starling	11	8	4
2	Bank Myna	9	15	29
3	Common Myna	17	37	24
4	Asian Pied Starling	0	12	16
5	Barn Swallow	2	0	1
6	Red-rumped Swallow	1	5	0
7	Indian Robin	8	18	13
8	Rufous-backed Redstart	0	3	2
9	Oriental Magpie-robin	8	14	10
10	Jungle Babbler	13	21	17
11	Common Babbler	23	37	46
12	Grey Wagtail	5	7	2
13	White-browed Wagtail	3	2	0
14	Tree Pipit	0	2	1
15	Rufous Treepie	1	3	2
16	Large-billed Crow	0	6	2
17	House Crow	12	9	7
18	Eurasian Golden Oriole	1	1	2
19	Scaly-breasted Munia	0	4	0
20	House Sparrow	9	17	14
21	Common Tailorbird	3	5	0
22	Indian Cuckooshrike	1	2	0
23	Purple Sunbird	8	14	5
24	Black Drongo	13	26	19
25	Red-vented Bulbul	23	31	26
26	Bay-backed Shrike	0	2	1
27	Indian Paradise-flycatcher	2	0	0
28	Yellow-footed Green-pigeon	18	42	0
29	Rock Dove	23	46	37
30	Laughing Dove	12	8	17
31	Red Turtle-dove	0	4	3
32	Eastern Spotted Dove	0	0	4
33	Greater Coucal	1	2	2
34	Indian Cuckoo	1	1	0
35	Common Hawk-cuckoo	0	1	1
36	Western Koel	0	1	0
37	White-breasted Kingfisher	3	1	2
38	Indian Roller	3	2	4
39	Asian Green Bee-eater	14	11	21
40	Indian Peafowl	13	9	6
41	Grey Francolin	9	22	14
42	Indian Grey Hornbill	2	1	4
43	Common Hoopoe	0	2	6
44	Brown-headed Barbet	1	1	0
45	Coppersmith Barbet	2	1	1
46	White-breasted Waterhen	2	3	0
47	Common Moorhen	5	0	0
48	Red-wattled Lapwing	11	15	8
49	Yellow-wattled lapwing	3	7	2
50	Black-winged Stilt	6	4	0
51	Cattle Egret	13	8	0
52	Indian Pond-heron	2	3	0
53	Little Swift	10	29	17
54	Spotted Owlet	2	4	3
55	Rose-ringed Parakeet	16	36	28
56	Shikra	0	1	2
Total		345	566	425

Table 4: Family wise distribution of bird species in Jiwaji University Campus

S. No.	Family	Recorded Species
1	Sturnidae	4
2	Hirudinidae	2
3	Muscicapidae	3
4	Leiothrichidae	2
5	Motacillidae	3

6	Corvidae	3
7	Oriolidae	1
8	Estrilidae	1
9	Passeridae	1
10	Cisticolidae	1
11	Compephagidae	1
12	Nectariniidae	1
13	Dicruridae	1
14	Pycnonotidae	1
15	Laniidae	1
16	Monarchidae	1
17	Columbidae	5
18	Cuculidae	4
19	Alcedinidae	1
20	Coraciidae	1
21	Meropidae	1
22	Phasianidae	2
23	Bucerotidae	1
24	Upupidae	1
25	Megalaimidae	2
26	Rallidae	2
27	Charadriidae	2
28	Recurvirostridae	1
29	Ardeidae	2
30	Apodidae	1
31	Strigidae	1
32	Psittaculidae	1
33	Accipitridae	1

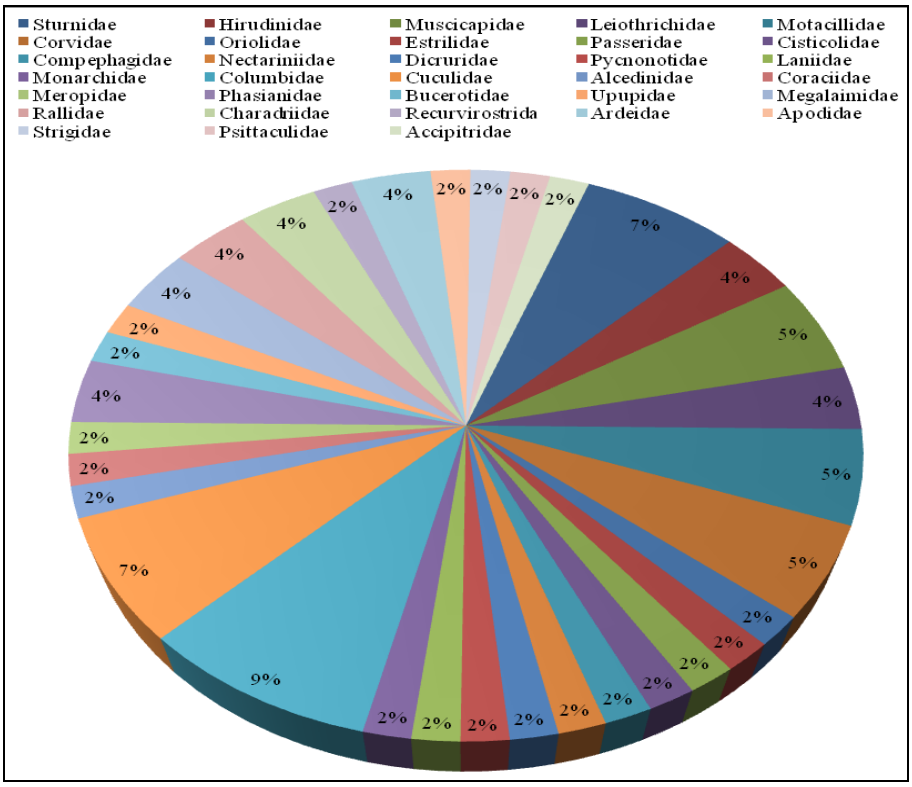

Fig. 2: Family wise % distribution of bird species

Table 5: Bird species Diversity index

Species Diversity	Monsoon Season	Winter Season	Sumer Season
Shannon_H	0.126	0.131	0.176
Evenness_e^H/S	0.034	0.033	0.052
Simpson_1-D	0.961	0.957	0.929
Species Richness	41.000	51.000	20.000

Conclusion

Rich diversity of birds is attributed to habitat structure and geographical location of the university. This area seems to provide a corridor for birds. It shows that there is a need to protect habitat structure present in university campus because it makes the food niches of bird species. In general urbanization reduced species diversity with only few species are more abundant whereas others are reduced, but in Jiwaji University Campus is not yet very homogenized and harbors rich species diversity of birds. This study brings to light the importance of open or green space of the University

Campus for maintaining ecological balance and conservation of avian diversity. This study is first of a kind attempt to prepare a checklist of birds at the university campus and recorded a representative sample size of the Jiwaji University avian diversity.

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