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Study of Bird Diversity of Three Villages of Amer Tehsil—District Jaipur, Rajasthan

Lina Sarkar

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ABSTRACT

Birds play the most important role to maintain the pace between the flora and fauna diversity of the ecosystem which ensures sustainable development of the ecosystem. Bird diversity in the pollution free zone is the matter of interest. This study is a details-description of avian faunal diversity of three villages Dhand, Khorameena and Kukas under Amber Tahasil in Jaipur, state Rajasthan. The study was conducted from December 2016 to December 2019. A total of 66 bird species belonging to 35 families and 15 orders are recorded during the study. 65 species of birds were recorded from Kukas area which established highest diversity value in comparison to Dhand and Khorameena village. From Khorameena village 53 bird specieswere recorded and from Dhand village 43. The diversity indices reflected highest Shannon diversity index value 3.8932 in Kukas during 2019 and its lowest value was observed in Dhand (3.3370) in the same year.The highest value of Simpson's Dominance Index, Pielou's evenness Index and Margalef's Richness index was found highest at Kukas region. Similarly, lowest value was found at Dhand village.The study revealed that, the area was close to Nahargarh Forest which might have increased the bird diversity of this semi arid region.These three villages had an added value for site selection because the common villagers as well as the Village Pradhans are concerned for avian diversity conservation.

Keywords Avian diversity, Conservation, Arid topography, Pollution free zone, Diversity indices.

INTRODUCTION

Avian diversity is dominant in the state of Rajasthan. 473 species of birds were recorded from Rajasthan (Vyas and Rahmani 2015) and specially from Udaipur city 86 species of birds were identified (Koli *et al.* 2019 and Agoramoorth and Mohnot 1986).Due to intense anthropogenic intervention, birds are gradually being uprooted from cities, and taking shelter in the nearby villages (Dookia and Paudey 2004, Chhangani

Lina Sarkar
Department of Zoology, Sree Chaitanya College,
Habra743268,West Bengal, India
Email: linabhowmik.scc@gmail.com

2002, Palei *et al.* 2012). This study aimed to identify the present status of bird diversity in those less popular areas which are adjacent to Jaipur and might be bird's suitable habitat alternatives.

Jaipur the capital city of Rajasthanis blessed with diverse topographylikedesert, lakes, water creeks, sand dunes, forests and hills. The climatic condition wassemi arid, during summer temperature rises to 52°C (2018 May) which was recorded during the study but in winter temperature went down to 9°C (studied in December 2016, 2017 and 2019), in 2018 January it was below 6°C.The monsoon is short but heavy rain, andhi, thunderstorm, prevails in the evening during this season. Rajasthan is such a place where all these asonal changes were rarely felt except extreme hot summer and shivering winter. Those sites were selected to study bird diversity which were adjacent to Jaipur city and were less affected with anthropogenic interventions.The study was conducted in three villages namely, Kukas village which is 35 kilometers away from Jaipur city, Dhand village is about 3 km from Kukas and Khorameena village which is 1 km away from Kukas under Amber Tahasil in Jaipur state Rajasthan. Those three villages had unique topography, likesmall hills covered with bushes and trees, small water creeks, bushy semi arid fields, sand dunes and grass lands, moreover, they are away from high anthropogenic intervention as in city. Kukas area had few factories but they had proper emission control system, Khorameena and Dhand area had only residential plots and vast arid vacant land. The study spots also included the Nagtalai Nalaand low marshy land near Sankatmochan Mandir at Alwarroad. At Man Sagar (Jal Mahal Lake) large number of migrant birds gathers during winter and accepted as a place of interest to the bird watcher which is adjacent to the study area. The study was conducted in three consecutive years from December 2016 to December 2019.

The trail of earlier researches indicated that India had a highly diversified avifaunal composition, (Ali and Ripley 1983, Ali and Ripley 1987, Ali and Daniel 2002, Grimmett *et al*. 1998). Anthropogenic activity has drastically changed the natural environment as well as thee cosystem; as a result natural habitat had also been lost. While working on avifauna of Hadagarh Wildlife Sanctuary Odisha, India (Palei *et al.* 2012) and (Chandra *et al*. 2018) indicated about the anthropogenic hazards and effects on avian diversity as well.

This research work not only aimed to identify avifauna diversity but also to identify breeding grounds of residential birds in those suitable alternative shelters. Moreover, Nahargarh reserve forest is adjacent to the study area and had naturally increased the numbers of bird population of these three villages. The common people who live in this area are highly motivated and conscious about avian diversity conservation, this was an added interest for selection of these areas. The vaillage Pradhans and his followers are always in touch with all the villagers to increase-awareness for bird conservation, they arranged food pots, planted shady bushes at their place of worships for bird shelters In almost every house rooftops, garden and in their place of worship waterpots and foodpots were placed, where during dawn and dusk birds gathered. Those spots were studied daily for identification of local birds.

MATERIALS AND METHODS

The present study is based on the observations made from December 2016 to December 2019. Three villages Dhand (357.5 hectares), Kukas (1733 hectares) and Khorameena (629 hectares), which covers a large area for direct sighting of birds and bird nests. The villages are under Amer Tahasil. 26°59'47.2956''N7 5°52'35.2992''E (Fig. 1).

Birds are observed from early morning 4.30 AM-upto 6 PM in the evening. Study was conducted for continuous 15 days in every alternate month since December 2016 to 2019 December. During winter, early morning study was difficult due to poor visibility through thick fog and mist therefore study time was scheduled from 6AM from morning to 6 PM in the evening. Point count method was one of the methods applied to record avian diversity during this study. According to Sutherland (2006), point count is the

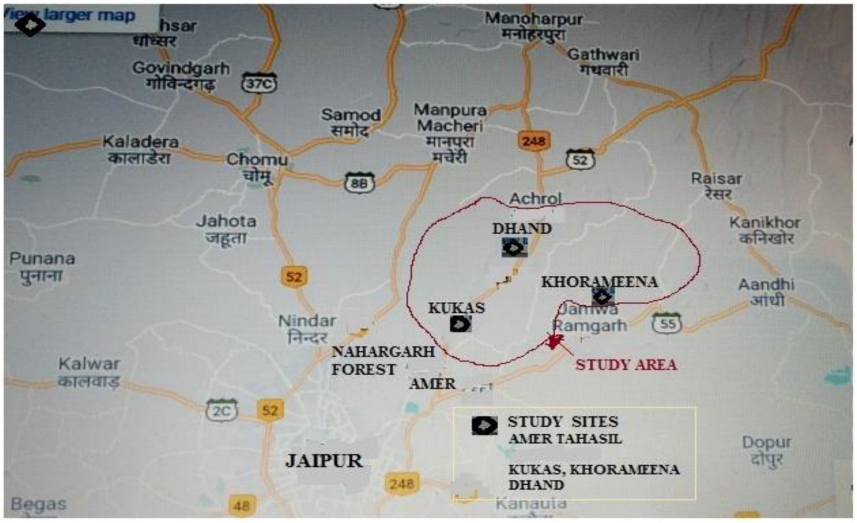


Fig. 1. Map showing the study sites of three villages, Dhand, Khorameena and Kukas under Amber Tahasil in Jaipur Rajasthan.

most efficient method of estimating avian density. While following point count methodology, remaining in a fixed point and at fixed timebirds were recorded by observing the bird. This study also includes those spots where local residents placed water and foodpots for birds. Not only the tree covered area was studied but all the personal gardens as well as temple gardens and university campus was studied keenly. The study reveals thatduring monsoon, the arid lands and the hilly area at Kukas and Dhand were covered with green grass and bushes and those clusters of green patches retained until next midsummer. Those clusters were studied by the Linetransact method.

Birds citation was done by using binoculars of 10 × 42 magnification and were photographed by Canon (model: 70D). Spot identification was done by using Field guide (Grimmett *et al*. 1999, Ali and Daniel 2002). After confirmation with the checklist by (Dookia and Paudey 2004, Koli *et al.*2019, Kumar *et al*. 2002, Vyas and Rahamani 2015).

Vegetation: The floral composition of Kukas, Khorameena, Dhand varied with the diverse plants and bushes. These regions show a mosaic of tropical dry deciduous trees , thorn trees, broad leaved trees and water vegetation in the low land area of area near Sankat Mochanmandir on Alwarjaipur road and Nagtalai Nala and Man Sarovar. Plant species identified studied in the study area include *Ficus religiosa* (Pipal), *Ficus benghalensis* (Banian), *Azadirachta indica* (Neem), *Saraca asoca* (Ashoka), *Salvadoraleoides* (Jal tree), *Vachellia nilotica* (Babool), *Zizyphus mauritiana* (Ber), *Calligonum polygonoides* (Phog tree), *Cordia myxa* (lasura), *Leptadenia pyrotechnica* (khimpoli), *Prosopis cineraria* (Ghaf), *Commiphora wighti* (guggul), *Cassia angustifoli*a (Sonamukhi'), *Aloe vera* (Ghreetkumari), *Jatropha curcas* (nettlespurge). *Citrullus colocynthes* (desert gourd), *Butea monosperma* (Butea), *Acacia catechu* (Cutch tree), *Boswelli aserrata* (oli-banum), *Anogeissus pendula* (Terminalia), *Tectona grandis* (Teak), *Zizyphus jujube* (kul) *Dalbergia sissoo* (Sisoo), *Tectona grandis* (segun), *Phoenix sylvestris* (Date Palm), *Racosperma* sp. (Acasia), Peepal or Fig (*Ficusreligiosa*), *Phyllanthus emblica* (Indian Gooseberry or Amla), *Capparis decidua* (Karira), *Salvadora oleoides* (Khabbar or Khabar or Toothbrush Tree), *Prosopis cineraria* (Khjri), *Ficus* sp.(Banyan), *Magniferaindica* (Mango tree), *Artocarpus heterophyllus* (Jack fruit), *Syzygium cumini* (Kala jamun), *Tamarindicus indica* (Imli), *Authocephalus cadamba* (Kadam), *Butea monosperma* (Dhak or Chila, flame of the forest).

Table 1. Checklist of birds in terms of their relative abundance (Number of birds -l) spotted during study (December 2016-December 2019) from Amer Tahasil (Kukas village, Dhand village and Khorameena village). A: Abundant (Spotted more than 25); C : Common (Spotted less than 15); R: (Spotted less than 10); M: Migratory ; RS: Resident; WM: Winter migrant; SM: Summer migrant.

Table 1	Status	Habitat
Order/Family/Species		
Order : Galliformes		
Family:Phasianidae		
1 .*Coturnix coturnix* (common quail)	A	RS
2. *Pavo cristatus* (Indian pea fowl)	A	RS
Order : Psittaciformes		
Family : Psittaculidae		
3. *Psittacula eupatria* (Alexandrine parakeet)	A	RS
4. *Psittacula krameri* (Rose ringed parakeet)	C	WM
5. *Psittacula Cyanocephala* (Plum-headed parakeet)	C	WM
Order: Pelecaniformes		
Family:Ardeidae		
6. *Bubulcus ibis* (Cattle egret)	A	RS
7.*Ardeola grayii* (Indian pond heron)	A	RS
8. *Ardeola alba* (Great egret)	C	RS
Family: Pelecanidae		
9. *Pelecanus crispus* (Dalmatian Pelican)	R	WM
Order: Gruliformes		
Family: Rallidae		
10. *Porphyrio poliocephalus* (Grey headed swamphen)	R	RS
Order : Anseriformes		
Family : Anatidae		
11. *Anas acuta* (Northern pintail)	R	WM
12.*Anas indicus* (Bar headed goose)	R	WM
13.*Anas crecca* (Common teal)	R	WM
14.*Gallinula chloropus* (Common moorhen)	C	RS
Order : Charadriiformes		
Family : Scolopacidae		
15. *Actitis hypoleucos* (Common sandpiper)	A	RS
16. *Tringa totanus* (Common red shank)	C	M
17. *Calidris pugnax* (Ruff)	R	M
Family:Recurvirostridae		
18. *Himantopus himantopus* (Black winged stilt)	R	WM
19. *Recurvirostra avosetta* (Pied avocet)		
Family:Glareolidae		
20. *Cursorius coromandelicus* (Indian courser)	A	RS
Order : Passeriformes		
Family:Motacillidae		
21. *Motacilla alba* (Wagtail)	A	RS
22. *Motacilla maderaspatensis* (White browed wagtail)	R	RS
Family: Paridae		
23. *Machlolophus nuchalis* (White napped tit)	R	WM
Family:Pittidae		
24. *Pitta brachyura* (Indian Pitta)		
Family: Nectariniidae		
25.*Cinnyris asiaticus* (Purple sunbird)	C	RS
Family:Stenostiridae		
26. *Culicicapa ceylonesis* (Grey headed canary flycatcher)	R	WM
Family : Corvidae		
27. *Dendrocitta vagabunda* (Rufous tree pie)	A	RS
28. *Corvus macrorhynchus* (Large billed crow.)	A	RS
29. *Corvus splendens* (House crow)	A	RS
Family:Muscicapidae		
30. *Muscicapa dauurica* (Asian brown flycatcher)	R	RS

Table 1. Continued.

Table 1	Statius	Habitat
31. *Copsychus saularis* (Oriental magpi robin)	A	RS
32. *Copsychus fulicatus* (Indian robin)	R	WM
Family : Oriolidae		
33. *Oriolus oriolus* (Euasian golden oriole)	C	RS
34. *Oriolus xanthornus* (Black hooded oriole)	C	RS
Family:Campephagidae		
35. *Pericrocotus cinnamomeus* (Small minivet)	C	RS
36. *Pericrocotus erythropygius* (White bellied minivet)	R	WM
Family:Dicruridae		
37. *Dicrurus macrocercus* (Black drongo)	A	RS
Family:Laniidae		
38. *Lanius schach* (Long tailed shrike)	A	RS
Family:Sturnidae		
39.*Acridotheres tristis* (Common myna)	A	RS
40.*Acridotheres ginginianus* (Bank myna)	A	RS
41.*Sturnus vulgaris* (Common sterling)		
42.*Gracupica contra* (Pied myna)	C	RS
Family:Pycnonotidae		
43.*Pycnonotus cafer* (Red vented bulbul)	A	RS
Family:Leiothrichidae		
44.*Argya malacolmi* (Large grey babbler)	A	RS
45.*Argya striata* (Jungle babbler)	A	RS
Family:Passeridae		
46.*Passer domesticus* (House sparrow)	A	RS
Family: Aegithinidae		
47. *Aegithina tiphia* (Common iora)	R	WM
Family:Turdidae		
48.*Turdus simillimus* (Indian black bird)	R	WM
49.*Turdus boulboul* (grey-winged blackbird)	R	WM
Order: Cuculiformes		
Family: Cuculidae		
50. *Centropus sinensi* (Greater coucal)	C	RS
51. *Cuculus canorus* (Common cuckoo)	A	RS
52. *Clametor coromandus* (Chestnut- winged cuckoo)	C	SM
53.*Clametor Jacobinus* (Jacobin cuckoo)	R	WM
Order: Ciconiiformes		
Family: Ciconiidae		
54**.** *Mycteria leucocephala* (Painted stork)	C	RS
Order: Coraciiformes		
Family: Meropidae		
55. *Merops orientalis* (Green bee eater)	C	RS
Family: Alcedinidae		
56. *Alcedo atthis* (Common kingfisher)	A	RS
Order: Strigiformes		
Family:Strigidae		
57. *Athene brama* (Spotted owlet)	A	RS
Order: Bucerotiformes		
Family:Upupidae		
58. *Upupa epops* (Hoopoe)	C	SM
Order: Columbiformes		
Family: Columbidae		
59.*Chalcophaps indica* (Common emeralddove/Green dove)	A	RS
60.*Treron phoenicoptera* (Yellow footed green pigeon)	A	RS
61.*Columba livia* (Common rock pigeon)		
Order: Suliformes		
Family: Phalacrocoracidae		

Table 1. Continued.

Table 1	Statius	Habitat
62. *Phalacrocorax fuscicollis* (Indian cormorant)	A	RS
Order: Piciformes		
Family:Picidae		
63. *Dinopium benghalense* (Black -rumped flameback/ woodpecker)	C	RS
64. *Chrysocolaptes festivus* (White naped woodpecker)	R	WM
Family:Megalaimidae		
65. *Psilipogon haemacephalus* (Coppersmith barbet)	A	RS
66. *Psilopogon zeylanicus* (Brown headed barbet)	R	WM

RESULTS

Total 66 species belonging to 35 family and 15 order was recorded from the studied area during the survey period of three years Table 1.

The present study revealed that the order Passeriformes is the most dominant order having a total number of 17 families, 29 specimens and 21 genera followed by order Pelecaniformes 2 families 3genera.4 species, order Coraciiformes 2 families and 2 genera and 2 species and order Piciformes 2 families 3 genera 4 species, order Galliformes 1 family 2 genera 2 species. Orders namely Ciconiiformes, Strigiformes, Bucerotiformes, Suliformes, Gruliformes are represented each with one family, one genera and one species. The order Cuculiformes represents one family and 3 genera and 4 species.

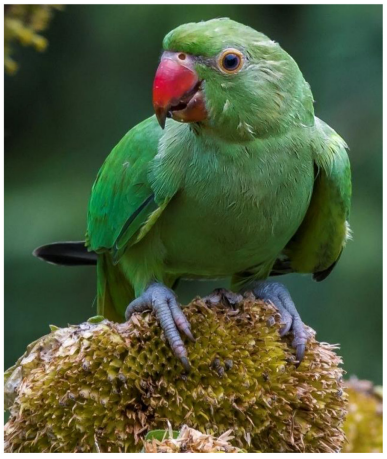
Family Anatidae belonging Order Anseriformes; family Sturnidae belonging order Passeriformes and family Cuculidae belonging to order Cuculiformes are represented by each with 4 species in the studied avifauna diversity, which had maximum species diversity in one family, which resembles the findings of (Kumar *et al*.2002 and Sharma 1982). Family Psittaculidae belonging to order Psittaciformes, family Ardeidae belonging to order Pelecaniformes, family Scolopacidae belonging to order Charadriiformes, family Corvidae and Muscicapidae belonging to order Passeriformes, Family Columbidae belonging to order Columbiformes, represented by each with 3 species in the studied bird diversity. The studied bird diversity depicts the representation of two species each from nine families namely, family Phasianidae belonging to order Galliformes, family Recurvirostridae belonging to order Charadriiformes, family Motacillidae , Oriolidae,Campephagidae, Leiothrichidaeand Turdidae belonging to order Passeriformes, family Picidae and Megalaimidae belonging to order Piciformes and family Pelecanidae belonging to order Pelecaniformes, family Rallidae belonging to order Gruliformes, family Glareolidae belonging to order Charadriiformes, family Paridae, Pittidae, Nectariniidae, Stenostiridae, Dicruridae, Laniidae, Pycnonotidae, Passeridae and Aegithinidae belonging to order Passeriformes, family Ciconiidae belonging to order Ciconiiformes, family Meropidae,

Table 2. Diversity indices of birds from the three study sites (December 2016-December 2019).

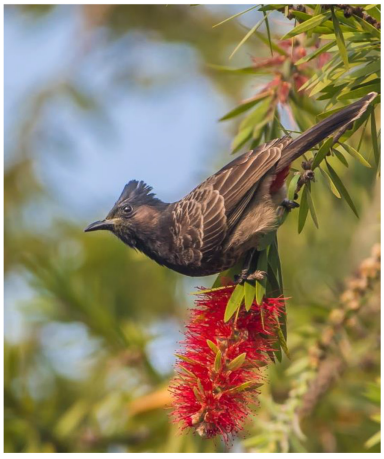
	Site 1			Site 2			Site 3		
	2016-2017	2017-2018	2018-2019	2016-2017	2017-2018	2018-2019	2016-2017	2017-2018	2018-2019
Shannon Wiener Diversity Index	3.817197	3.858878	3.892896	3.441673	3.563337	3.528844	3.146229	3.433139	3.337015
Simpson's Dominance Index	0.974669	0.975183	0.976361	0.959281	0.965027	0.964665	0.933404	0.961379	0.953549
Pielou's evenness Index	0.921331	0.931391	0.936044	0.909487	0.915597	0.921696	0.508419	0.559745	0.516324
Margalef's Richness Index	8.738469	8.836176	8.695722	6.591491	7.474747	6.692612	6.140656	6.358629	6.343774

Yellowfooted GreenPigeon (*Treron phoenicoptera*)

Whitebrowed wagtail(*Motacilla maderaspatensis)*



Rose-ringed Parakeet(*Psittacula krameri*)



Red-vented Bulbul(*Pycnonotus cafer*)

Alcedinidae, belonging to order Coraciiformes, family Strigidae belonging to order Strigiformes, family Phalacrocoracidae belonging to order Suliformes and family Upupidae belonging to order Bucerotiformes, all these families has single species representative in the avian diversity in the studied area. The highest bird diversity was recorded in the Kukas area, with 65 bird species, followed by Khorameena area (53) and Dhand area (43).

Table 2 shows the diversity indices for the three study sites, where it was found that the highest Shannon diversity index was in Kukas study site in the year 2019 (3.8932) whereas the lowest was in Dhand area in the year 2019 (3.3370) the highest Simpson's Dominance Index was in Kukas during 2019 (0.976361) this result is similar to the findings of (Singha *et al*. 2012) whereas lowest at Dhand site during 2017 (0.9334). Pielou's evennessindex was maximum in value at Kukas during 2019 (0.93604) and a minimum value in Dhand area during 2017 (0.5084). The Margalef's Richness index was highest in Kukas area during 2017 (8.7384) and lowest in Dhand area during 2017 (6.1406).

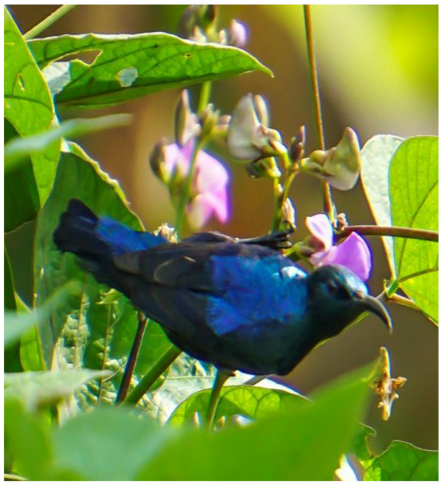
The avian diversity showed added species diversity as these three villages are adjacent to the Nahargarh Wildlife Sanctuary and the Man Sagar (Jal Mahal Lake) Jaipur.

The materialistic nature of economic development and consumerism of human society resulted

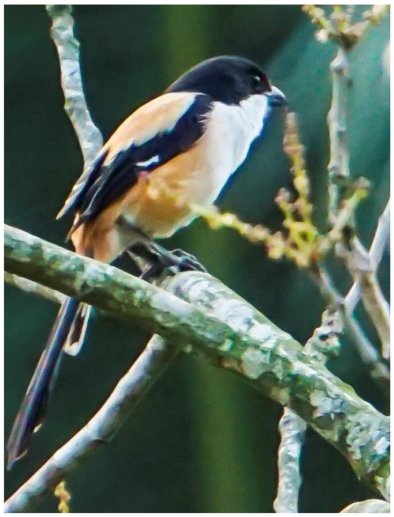
overexploitation of nature. Destruction of existing habitat of birds is one of the main causes for loss of avian diversity (Chaudhury and Gupta 2016, Sharma 1982, Sing 2008, Singha Roy *et al*. 1982, N aparat *et al*.(2019). Choudhury and Choudhury (2016) also reported the conflict between villagers and Wildlife at Valmiki Tiger Reserve, Bihar which was destroying the biodiversity as well. But this study reveals that special protection was taken by the villagers in some areas where bird nests were spotted. One of them was the water logged creek area at Kukas, the bushes around the creek was found as good breeding ground of *Pycnonotus cafer* (Red vented bulbul), *Argya striata* (Jungle babbler) and *Passer domesticus* (House sparrow) throughout the year. During post monsoon the creek retains rain water, where *Ardeola grayii* (Indian pond heron) was spotted in 2016 December and 2017 September. Nightjars and Owl species was located by listening. Interestingly, spotted owlet (*Athene brama*) also spotted during day survey at

Rufous Treepie(*Dendrocitta vagabunda*)

Spotted Owlet (*Athene brama*)



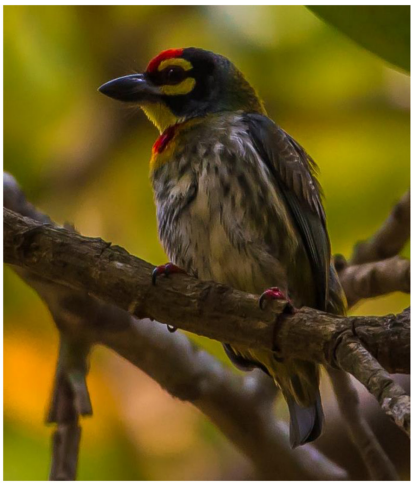
Purple sunbird (*Cinnyris asiaticus*)



Long Tailed Shrike(*Lanius schach*)

Indian pea fowl (*Pavo cristatus*)

Greyheaded Swamphen(*Porphyrio oliocephalus*)



Coppersmith Barbet(*Psilipogon haemacephalus*)

Common SandPiper(*Actitis hypoleucos*)

Maharaja Vinayak General Hospital, Shaibaba Temple Kukas and State bank Building at Kukas.

Some of the most common winter visitors are Dalmatian Pelican *(Pelecanus crispus),* red-necked grebe *(Podiceps griseigena),* black stork (*Ciconia nigra)*, Tragopan *(Tragopan satyra)* spotted at Nagtalai Nala. Among these species only *Pelecanus crispus* was observed only in winter. The lowland area near Sankat Mochanmandir on Alwar Jaipur road and Nagtalai Nala houses diverse avian species, the Cattle egret *(Bubulcus ibis),*Indian pond heron *(Ardeola grayii),* Great egret *(Ardeola alba),* Dalmatian Pelican *(Pelecanus crispus)* Grey headed swamphen *(Porphyrio poliocephalus)* Northern pintail *(Anasacuta)*, Bar headed goose (Anas indicus), Common teal (Anas crecca) which were recorded during every winter observation in these spots, important point is that, some waterfoul; *Anas acuta, Anas crecca* was observed during rainy season also at Nagtalai Nala (near Kukas). The grey headed. swamphen *(Porphyrio poliocephalus)*,Indian pond heron *(Ardeola-grayii)*, Great egret *(Ardeola alba)* was found in their nests at Dhand in the JDC campus garden, throughout study period. During evening study, throughout the year it was observed that, 4 peacock pairs gather in the evening at Dhand Shivji Mandir (road), 8 pairs were also spotted in the backyard garden of Shaibaba mandir, Khorameena; Hanumanji mandir Kukas. Moreover, *Pavo cristatus* nests are spotted at Amer fort forest, near Sreekhole Hanuman mandir, JDC campus, Dhandand also at the Hanuman mandir at

Common Kingfisher (*Alcedo atthis*)

Common Myna(*Acridotheres tristis*)

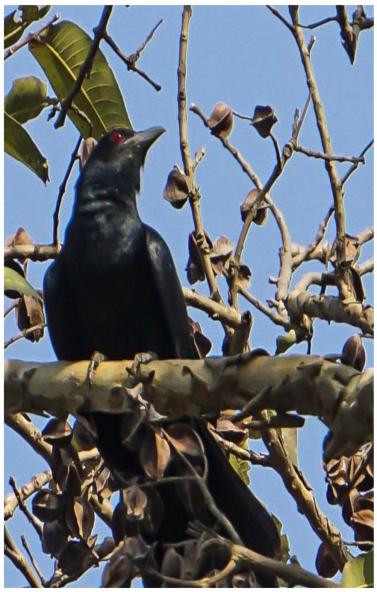
Black Drongo(*Dicrurus macrocercus*)

Kukas. *Aegithina tiphia* (Common iora), family Aegithinidae order Pas seriformes, this small bird was spotted in the court yard at Kukas Durga mandir.

DISCUSSION

The avian diversity presented in this paper is a cumulative data of each three years covering several sites for spotting. The Kukas area shows a highest diversity among three study sites. During month of October, 2017 the nest of *Pavo cristatus* and *Psittacula cyanocephala* were observed to be busy in nest building, in the garden tree at Sankat Mochan mandir. Nests of *Coturnix coturnix, Anas acuta* were found near Nagtalai Nala, under the dense bushes. *Pelecanuscrispus* was spotted in during winter in Nagtalai Nala area. *Pavocristatus* (Male female), *Dendrocitta vagabonda* (Male female), *Corvus macrorhynchus* (Male female), *Cuculus canorus* (Male female), *Oriolusoriolus* (Male female), *Oriolus xanthornus* (Male female), *Centropus sinensi* (Male female), are found in their nests in (Maharaja Vinayak Global University campus). At Dhand one Male and three Females of *Ocyceros birostris* were spotted during midsummer also. *Chalcophaps indica, Treron phoenicoptera, Cuculus canorus, Actitis hypoleucos* are observed in large flocks in almost all the study sites. *Phalacrocoraxfuscicollis* nests were spotted during mid summer on a large Banyantree at Khorameena. *Acridotherestristis, Acrido theres ginginianus, Gracupica contra,*

Common Cormorant (*Phalacrocorax fuscicollis*)



Common Koel(*Coturnix coturnix*)

Green Bee Eater(*Merops orientalis*)

Common sandpiper(*Actitis hypoleucos*)

Photograph of Some birds spotted during the study at Kukas, Khorameena and Dhand area.

Dicrurusmacrocercus, Motacilla maderaspatensis, Motacilla alba are spotted in the bushes and shady trees in all three study sites. The study reveals that the avian faunal diversity of region of Amer Tahasil Jaipur is moderately diverse. Interestingly, people of these three villages are more concerned about the conservation of indigenous and migratory birds, which has increased possibility of conservation to a greater perspective. Bird hunting is strictly prohibited in this area, water pots and food pots are there in almost all houses and places of worship which has increased the interest and also motivated common people of this area for avifauna protection. The approach towards protection of remaining patches of shrub and rock surrounded creek and lowland areas as well as the forest areas are earnestly needed. The conservation and protection approach for the avifauna by the local people is highly appreciable.

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