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RESEARCH ARTICLE

AVIAN DIVERSITY AND ITS ABUNDANCE IN THE KETHI VALLEY AREAS,THE NILGIRIS, WESTERN GHATS, TAMIL NADU.

G. Kalaiyarasi[1], D. Jayabalan[1], C. Rameshkumar[1] and C. Subramanian[2].

1. Post Graduate Department of Zoology & Wildlife Biology, Government Arts College, Udhagamandalam-643 002, TheNilgiris,Tamil Nadu, India.
2. Post Graduate and Research Department of Zoology, Government Arts College (Autonomous), Kumbakonam-612 002, India.

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Abstract

A total of 41 bird species were had in all the transects during the study period. Of these, the maximum number of sighting [n=2964 and Mean=19.76±14.71] were obtained for House sparrow (*Passer domestics*) and the lowest number of sightings [n=3; Mean=0.02±0.18] were had for the Greater coucal (*Centropssinensis*). A total of 150 samplings (visits) were observed throughout the study period. In which, a total of 10332 individuals for different kind of avian species were obtained. A total of 41species and it consisting of 12 orders and 28 families, were recorded. Out of 41 species, the highest Encounter Rate (ER) was for House Sparrow (*Passer domesticus*) (ER= 19.76 / Km walked) and the lowest ER was for Greater coucal (*Centropussinensis*) (ER= 0.02 / Km walked) obtained. The Shannon index of alpha diversity of avifaunal group in the Study Area was -1.8425.

Introduction:-

India is a hot spot for aves with over 1,240 bird species. Currently about 1,200 species of birds are threatened with extinction by human activities, though efforts are underway to protect them. Birds are social being and they communicate using audio and visual signal and also participate social behaviors including breeding, hunting, flocking, and mobbing of predators. The Indian subcontinent, a part of the vast Oriental biogeographical regions, is very rich in biodiversity. Out of the more than 9,000 birds of the world, the Indian subcontinent contains about 1,300 species, or over 13% of the world's birds [1]. The Western Ghats have one of the most complex and patchy, landscape in India. All these have streams and marshes forming a natural mosaic of patches which is the habitat specialist and endemics. The Western Ghats have divers avifauna there are 507 species from Western Ghats and adjacent narrow coastline [3]of these 369 birds species at residents with 16 being endemic [4].

The Nilgiri Hills in the Western Ghats is known for its high endemism. The species which have restricted range of distribution have more changes of getting endangered or extinct [5]and have hence require high priority for conservation. The number of resident species of the Western Ghats is however lower when compared with other parts of the tropics, particularly the Neotropics, a comparable richness of birds have been reported in the much smaller area in Panama and Amazonian ([6]; [7]).

Corresponding Author:-G. Kalaiyarasi.
Address:-Post Graduate Department of Zoology & Wildlife Biology, Government Arts College, Udhagamandalam-643 002, The Nilgiris,Tamil Nadu, India.

Several detailed study have been conducted on different aspect on birds in this Nilgiris region and many others are carried out surveys in different locations ([8], [9]. The abundance and distribution pattern of organism are shapely by various biotic, a biotic and historical factors, which very at different partial and temporal scales. The communities are assembling of population of species which occur together in space and time [10].

The changes in the status of birds may warn of habitat loss and modifications and can indicate the likely impact of these threats on other animals and plants [3]. The habitat structure, diversity and their relationship with the fauna provides information about the habitat utilization which ultimately leads to the management and monitoring species, habitats and the ecosystem.

The Western Ghats has to be made an ecologically sensitive zone. The important bird areas IBAs, namely Mukurthi National Park, Avalanche Reserved Forest, Taishola, Long wood shola, Coonoor, Bison Swamp and Governor shola have been identified recently from the Upper Nilgiris [11]. Ornithological exploration in the recent decades focused either in a single species or bird group ([12] worked on the ecology of black and orange flycatcher (*Ficedulanigroufa)*. Navaneethan [13] investigated the ecology and behavior of Nilgiri laughing thrush [14] studied the bird communities of the thorn and dry deciduous forest of Mudumalai wildlife sanctuary in the lower elevations of the Nilgiris.

Most of the studies conducted were the comparison of bird composition at upper Nilgiris and lower elevation. For instance a investigation recorded 265 species in the Mudumalai wildlife sanctuary in the lower elevation of the Nilgiri hills. This included breeding residents, winter visitors, local summer migrants and passage migrants. Nazia [15] reported on the diversity of birds in the selected sites in the Nilgiris. The abundance of birds species were observed in some of the locations in the Nilgiris [16,17 and 18].

Avian community studies are effective tools for monitoring forest ecosystems. Birds are widely recognized as good bioindicators of the quality of the ecosystems and the health of environment [19]. Avifaunas are important for the ecosystems as they play various roles as scavenger, pollinators and predators of insect pest. Several detailed studies have been conducted on different aspects on birds in this Nilgiri region [8]. There are few old records of the birds in the Nilgris by British and later compiled by Ali and Ripley [20]. Very few detailed studies were undertaken by Islam and Rahmani [11]. Gokula [14], Vijayan and Gokula [21] studied the bird communities in Mudumalai Wildlife Sanctuary.

The Nilgiris district from an integral part of the Western Ghats and covers an area 2,549 sq.km the typical evergreen temperate forests, endemic to the Nilgiris called sholas, grasslands endow this district with a unique and rich bio-diversity and unique geographical condition. The Nilgiris is the natural habitat of a variety of fauna like elephants, spotted deer, panthers, tigers, bison, wild buffaloes and variety of birds. The Mudumalai sanctuary and Mukurthi National Park are a part of the Nilgiris District. The district also has the distinction of having the highest tribal population in the state.

Some preliminary surveys were done by Karthick [22]; Selvaraj [23]; and Sudha [24] in some areas in the Nilgiris. Some parts of Nilgiris were surveyed for avifaunal population and diversity ([25]; [26]; [26 and 27]). Some of the baseline study on avian population and diversity were carried out by Sivakumar [28] and Dhanalakshmi [29] in Emerald and Glenmorgan areas in Nilgiris.

Due to the lack of baseline information on the abundance, population and diversity of birds in many parts in the Nilgiris, the present study was designed and carried out in and around the Kethi forest area and its adjoining areas in Nilgiris.

Materials and methods:-

The Kethi area Areas is a familiar place to Nilgiris and this area is located in between Coonoor and Ooty town. This area consisting of many villages and all these Spots are collectively called Kethi valley Areas. These areas are scanty in the scientific documentation on bird diversity and population. This area also attracts many tourists and naturalists because of having number avian fauna with patches of forest habitats.

The dominant tree and shrub species, herb species were recorded in the study area. The tree species are *Syzigiumjambolanum, Ficusbengalensis*and*Grevilearodusta* and the dominant species of shrub and herb species are

*Cestrum aurantiacum, Eupatorium sp, Lantana camera, Camellia sinensis, Cassia oceideentalis, Cytisusscoparicus, Achyrathusaspera, Rubuselliptcus*and*Solanummauritianum* in the study area.
The study on bird abundance, diversity and status was studied by the following methods and described below.

Methods for birds abundance and population:-
The Line transect method as described by Burnham *et al*[30] was adopted for estimating the abundance and population of avifauna in the study spots of Kethi and adjoining areas. The line transects that were laid in different direction in the study areas. In which, the data on species, and individuals for avian fauna were collected while sighting on the transects. The line transects were also laid in the different altitudinal gradient and available habitats. A total number of transect was fifteen. The samples (visit) were collected monthly once in all the transects. Each transect was measured and sampled for 1kms length. The intensive study was conducted in 15 locations from the month of November 2015 to August 2016 (10 months). The sampling hour was 6:30 am to 8:30 am for non-forested habitats and 3:30 pm to 6.30 pm for forested habitats regularly.

During the walk of a transect the data were collected based on the visual Encounter Rate on a bird the details such as species, number of individuals and distance from the observer when first sighted were noted.

Statistical analysis:-
To estimate the population of bird species in the study areas, the mean and Standard Deviation were applied and calculated. The alpha diversity (Shannon index) was applied for birds abundance.

Results and Discussion:-

A total of 41 bird species were had in all the transects during the study period. Of these, the maximum number of sighting (n=2986 and Mean=21.77±5.16) were obtained for House sparrow (*Passer domestics*). The lowest number of sightings (n=5; Mean=0.02±0.18) were had for the Greater coucal (*Centropssinensis*).

A total of 150 samplings observations were observed throughout the study period. In which, a total of 10332 individuals for different kind of avian species were obtained. A total of 41species it consisting of 12 orders and 28 families, were recorded. Out of 41 species, the highest Encounter Rate (ER) was for House Sparrow *Passer domesticus* (ER= 21.77 / Km walked) and the lowest ER was for Greater coucal*Centropussinensis* (ER= 0.02 / Km walked) obtained (Table 1 & Fig 1). The Shannon index of alpha diversity of avifaunal group in the Study Area was -1.8425 (negative correlation).

Ranking of species:-
The available bird species were ranked based on the encounter rate (ER=n/km walked). In the species rank, the House sparrow (*Passer domesticus*) occupied the top position (First Rank) in the study area. The last rank was placed for the Greater coucal (*Centropussinensis*) based on their sightings of encounter rate in the study area. The others were occupied between the second and fortieth ranks (Table 2 & Fig 2). Among the 41 species of birds, House sparrow was first at first rank (Rank 1) followed by Jungle myna (Rank 2), Red whiskered bulbul (Rank 3), Jungle crow (Rank 4), Common crow (Rank 5), Common drango (Rank 6), Spotted dove (Rank 7), Blue rock pigeon (Rank 8), Common coot (Rank 9), Oriental white eye (Rank 10) etc.

On the other hand, some of the important species were ranked as lower viz. Great Tit (12),Nilgiriverditer flycatcher (Rank 25), Grey Junglefowl (Rank 27), Nilgiri laughing thrush (Rank 37) and Nilgiri pipit (Rank 39) Table 2.

Table 1:- Abundance of different bird species during the study period in Kethi Valley Area

Species Code	Common Name	Scientific Name	Mean±SD
1	Grey Junglefowl	*Gallus sonneratii*	0.29±1.03
2	Grey duck	*Anaspoecilorhyncha*	0.05±0.21
3	Eurasian black bird	*Turdusmerula*	0.14±0.11
4	Streak-throated wood pecker	*Picusxanthopygacus*	0.32±0.56
5	Common hoopoe	*Upupaepops*	0.16±0.45
6	Small green bee-eater	*Meropsorientalis*	0.07 ± 0.39
7	House swift	*Apusaffinis*	0.24 ± 0.83
8	Greater coucal	*Centropssinensis*	0.02±0.18

9	Spotted dove	*Streptopeliachinensis*	3.4 ± 3.67
10	Blue rock pigeon	*Columba livia*	3.34 ± 4.58
11	Common coot	*Fulicaatra*	2.8 ± 5.73
12	White breasted water hen	*Amaurornisphoenicurus*	0.17 ± 0.79
13	Indian pond heron	*Ardeolagrayii*	0.86 ± 4.50
14	Mediate egret	*Mesophoyxintermedia*	0.92 ± 4.11
15	Brahminy kite	*Haliastur Indus*	0.66 ± 2.21
16	Common drango	*Dicrurusmacrocercus*	3.6 ± 0.90
17	Jungle crow	*Corvasmarorhynchis*	5.07 ± 3.30
18	Common crow	*Corvalsplendens*	4.99 ± 2.72
19	Long tailed shrike	*Laniusschach*	0.39 ± 0.77
20	Great tit	*Parus major*	1.15 ± 1.01
21	Red-rumped Swallow	*Hirundodaurica*	1.94±1.35
22	Red whiskered bulbul	*Pyconotusjocosus*	6.09 ± 3.33
23	Red vented bulbul	*Pyconptuscafer*	0.29 ± 0.30
24	Indian scimmiter babbler	*Pomatorhinushorsfieldii*	0.16±0.13
25	Oriental white eye	*Zosteropspalpehrosus*	2.29 ± 1.18
26	Ashy pirinia	*Priniasocialis*	0.39 ± 0.70
27	Nilgiri laughing thrush	*Garrulaxcachinnans*	0.08 ± 0.11
28	Pied bush chat	*Saxicolacapratos*	1.08 ± 1.21
29	Magpie robin	*Copsychussaularis*	0.09±0.11
30	Black and orange flycatcher	*Muscicapanigrorufa*	0.64 ± 31
31	Nilgiriverditer flycatcher	*Muscicapaalbicaudata*	0.3±0.16
32	White browed fantail flycatcher	*Rhipiduraaureola*	0.97 ± 11
33	Grey headed canary flycatcher	*Culicicapaceylonensis*	0.39 ± 0.41
34	Jungle myna	*Acridotheresjuscus*	11.22 ± 3.12
35	Purple sunbird	*Nectariniaasiatica*	0.18 ± 0.73
36	Spotted munia	*Lonchurapunctulata*	0.82 ± 1.02
37	House sparrow	Passer domesticus	21.77±5.16
38	Grey wagtail	*Motacillacinerea*	0.31 ± 0.06
39	White browed wagtail	*Motacillamaderespatensis*	0.19 ± 0.23
40	Nilgiri pipit	*Anthusnilghiriensis*	0.05 ± 0.12
41	Rose finch	*Carpodacuserythrinus*	0.09 ± 0.25

Table 2:- Rank of bird species observed in the study area (Encounter Rate= n / km walked)

Sl.No	Species Code	Common Name	ER	Rank
1	8	Greater Coucal	0.02	41
2	2	Grey duck	0.05	40
3	40	Nilgiri pipit	0.05	39
4	6	Small green bee-eater	0.07	38
5	27	Nilgiri laughing thrush	0.08	37
6	29	Magpie robin	0.09	36
7	41	Rose finch	0.09	35
8	3	Eurasian black bird	0.14	34
9	5	Common hoopoe	0.16	33
10	24	Indian scimmiter babbler	0.16	32
11	12	White breasted water hen	0.17	31
12	35	Purple sunbird	0.18	30
13	39	White browed wagtail	0.19	29
14	7	House swift	0.24	28
15	1	Grey Junglefowl	0.29	27
16	23	Red vented bulbul	0.29	26
17	31	Nilgiriverditer flycatcher	0.3	25
18	38	Grey wagtail	0.31	24

19	4	Streak-throated wood pecker	0.32	23
20	19	Long tailed shrike	0.39	22
21	26	Ashy pirinia	0.39	21
22	33	Grey headed canary flycatcher	0.39	20
23	30	Black and orange flycatcher	0.64	19
24	15	Brahminy kite	0.66	18
25	36	Spotted munia	0.82	17
26	13	Indian pond heron	0.86	16
27	14	Mediate egret	0.92	15
28	32	White browed fantail flycatcher	0.97	14
29	28	Pied bush chat	1.08	13
30	20	Great tit	1.15	12
31	21	Red-rumped Swallow	1.94	11
32	25	Oriental white eye	2.29	10
33	11	Common coot	2.8	9
34	10	Blue rock pigeon	3.34	8
35	9	Spotted dove	3.4	7
36	16	Common drango	3.6	6
37	18	Common crow	4.99	5
38	17	Jungle crow	5.07	4
39	22	Red whiskered bulbul	6.09	3
40	34	Jungle myna	11.22	2
41	37	House sparrow	21.77	1

Map showing the study area the in Nilgiri District

Fig 1:- Encounter Rate of bird abundance in the study area (Encounter Rate= n / km walked)

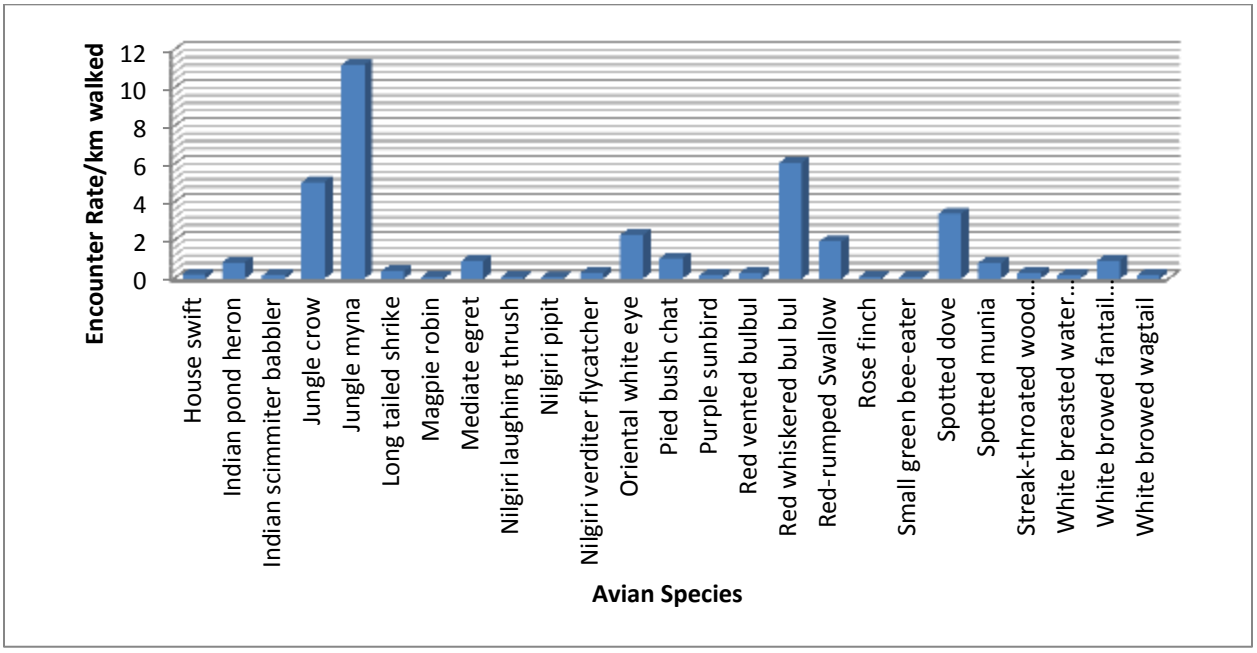
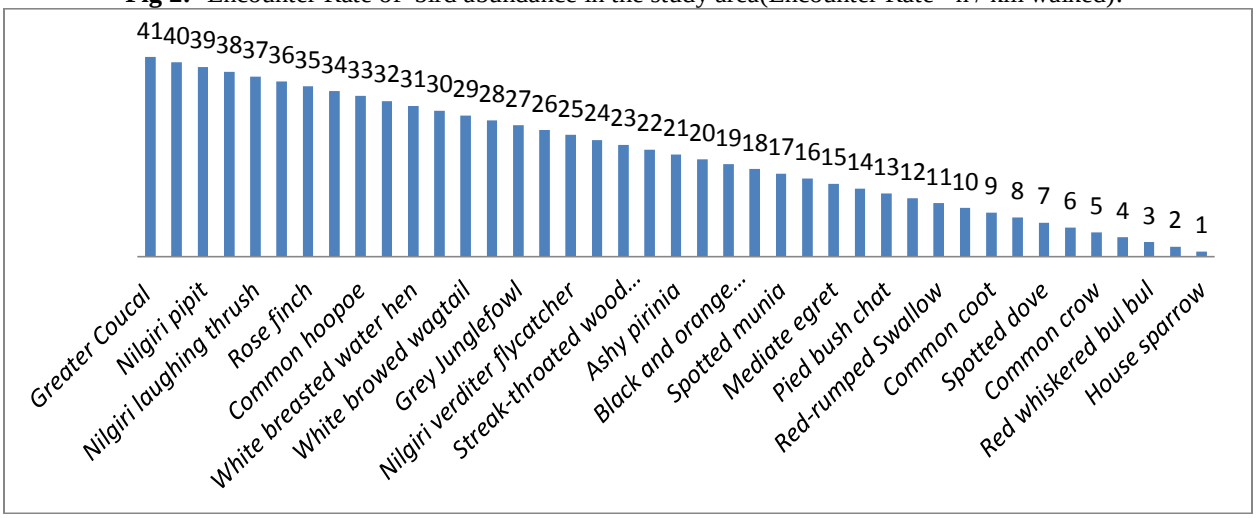


Fig 2:- Encounter Rate of bird abundance in the study area(Encounter Rate= n / km walked).



According to Gaston [31] the Biodiversity is the variety of life the different plants, animals and microorganism, their genes and the ecosystems of which they are a part. Biodiversity is often defined is often defined as the variety of all forms of life, from genes to species, through to the broad scale of ecosystems. Analysis of the avifaunal composition of the Western Ghats suggests that it has much representative in all families of tropical forest birds, than North-east India and the contiguous, Southeast Asian main land [7]. Thirumurthi and Balaji[32] surveyed the raptors in the Nilgiris. Vijayan and Gokula[21] conducted a preliminary status of the Nilgiri laughing thrush. Zarri*et al*[33]conducted the first intensive ecological investigation on the avifauna of the nilgiri and reported the patterns of bird community, guild structure and their habitat utilization.

Davidson [34] provided perhaps the earliest and the most comprehensive account of the birds of the Nilgiris, mainly based on his personal observations bird collections. Burnham [3] provided natural history observations on several Nilgiri birds. Betts [35] recorded the behavior and status of bulbuls of the Nilgiris and other birds.

Analysis of altitudinal changes in diversity, abundance and species composition of biota, can provide important information in such phenomena as aspects of the environment limiting the distribution of organisms factors influencing the structure of communities and aspect of biogeography. A theoretical frame work to understand altitudinal distribution of communities was described by [36] in responsible for considerable climatic differences, resulting in important variation in the distribution and composition of floral and faunal species. Recent studies in North and central America have established a close correlation between bird diversity and habitat MacArthur [37]. There is also evidence that different levels of habitat subdivision exist between more and less diverse avifauna. During 1990s the bird Nilgiri laughing thrush was very common around Coonoor and also Ooty. Then Nilgiri laughing thrush has been considered as a globally near threatened species [38].

The Kethi Area in the Nilgiris harbors about 41 species of birds. The Nilgiris have diverse avian fauna there are 50% species at birds known from Western Ghats and adjacent areas. Of these, 360 birds species are residents with 16 being endemic [4]. The Nilgiris hill in the western Ghats are known for its high endemism. The species which have restricted rang of distribution have more changes of getting endangered or extinct [39]. The number of resident species of the Western Ghats is however lower when compared with other parts of tropics.

However in addition to the diversity the endemic species namely Nilgiri Laughing Thrush and Nilgiri Flycatcher was predominantly observed in many spots of upper Nilgiris. However the result of the present study showed that these are decline trend in the population of endemic birds. Among the birds observed in this area most of them are resident species and lesser number of migration birds found here. The avian faunal diversity of wet land, Udupi district in kerala and some areas in Karnataka the migrating birds are lesser in number. The present study area containing habitats attracts more than 40 birds species and which are local and migratory including aquatic birds and others. Further, reported that it was evident that the purple moorhen and tree ducks have developed high tolerance to these highly fluctuating in the population. According to Renuka[16] reported 32 species were also obtained in the Botanical garden of Udhagamandalam and many birds are higher in number in the abundance except some migratory birds. Similar observations were also made in the boat house area in Ooty[17].

Karthick[22] studied in the selected sites in the Ketti area which was the house sparrow (*Passer domesticus*) was higher encounter rate and the Grey wagtail (*Motacillacinere*) was lower encounter rate. The similarly Selvaraj[23] observed in Love Dale villages, in Nilgiris. Sudha[24] recorded the maximum individual for House sparrow (*Passer domesticus*) and minimum for Bramini kite (*Haliastursindus*) in the Government Rose Garden, Udhagamandalam in Nilgiris. The present study is also supporting to previous observations. According to Karthick[22] there was strong relationship between the rainy and winter seasons for the population of bird species. The Shannon index of alpha diversity shows the good category in the study area. The present study reveals various ranks among all the available bird species in the study area. Many of them were differed in their ranks with a small variation in the encounter rate. However, the house sparrow only received the topper rank when compared to other species. This may be due to the suitable habitats and microhabitat features.

Conclusion:-

A total of 41 bird species were had in all the transects during the study period. Of these, the maximum number of sighting was obtained for House sparrow (*Passer domestics*). The lowest numbers of sightings were found for the Greater coucal (*Centropssinensis*). The Shannon index of alpha diversity of avifaunal group in the Study Area was -1.8425 (negative correlation).

The available bird species were ranked based on the encounter rate (ER=n/km walked). In the species rank, the House sparrow (*Passer domesticus*) occupied the first rank in the study area. The last rank was placed for the Greater coucal (*Centropussinensis*) based on their sightings of encounter rate in the Kethi valley. A few species were ranked as lower viz. Great Tit (Rank 12),Nilgiriverditer flycatcher (Rank 25), Grey Junglefowl (Rank 27), Nilgiri laughing thrush (Rank 37) and Nilgiri pipit (Rank 39). It is interestingly observed that the house sparrow received first rank. However, the house sparrow is very fewer number in their population status in many parts of the country and absent in some areas in India due to habitat destruction habitats or not availability suitable habitats. This study also showed the lower population for various bird species in the study area.

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