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Birds diversity and feeding guild in and around Abu road and Mount Abu Municipal area, Rajasthan, India

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Abstract- Birds are well-known bioindicator species and play a vital role in both natural and man-made ecosystems. Garbage dumps provide a variety of food resources for a large number of bird species, which belongs to different feeding guilds. During study, from July 2019 to December 2021, 68 avian species were found feed on household waste, garbage and dump sites in the Abu Road and Mount Abu areas. Out of 68 species, 65 species were categorized as least concerned, two species (*Threskiornis melanocephalus* and *Mycteria leucocephala*) near threatened and one species (*Ciconia episcopus episcopus*) was classified as vulnerable. During study, maximum relative diversity was found in two families: Columbidae and Muscicapidae (RDi= 8.82), followed by three families: Accipitridae, Ardeidae and Phasianidae (RDi= 7.35) and five families, Corvidae, Leiothrichidae, Sturnidae, Threskiornithidae and Turdidae (RDi= 4.41) and the remaining eight families: Ciconiidae, Cisticolidae, Coraciidae, Cuculidae, Dicruridae, Hirundinidae, Pyncnotidae, and Rallidae represent (RDi= 2.94) relative diversity. The remaining ten families (Charadriidae, Falconidae, Laniidae, Leiothrichidae, Motacillidae, Muscicapidae, Passeridae, Psittacidae, Rhipiduridae, Strigidae, and Upupidae) each had only one species and relative diversity (RDi = 1.47) was observed in the study area. During study, most birds belonged to the insectivore (22 species), followed by the omnivore (21), carnivore (17), granivores (7) and frugivores (*Psittacula krameri parvirosnis*) feeding guild. The highest average number of individuals belonged to the omnivore feeding guild, followed by garnivores, insectivore, carnivore and frugivore.

Key words: Birds, Garbage dump site, feeding guild, Mount Abu and Abu road

INTRODUCTION

Excessive growth of the human population is largely responsible for the expansion of urban areas. As a result, between 2000 and 2030, global urban areas will increase three fold, transforming large natural area into urban landscape.[1] Due to the rapid loss of wildlife and their habitats, urbanisation now seems like a challenging ecosystem for sustaining biotic communities and diversity.[2] Very limited flora and fauna are able to be sustained in urban ecosystems. Due to the rapid loss of natural habitats for birds, they adapt to anthropogenic modified habitats such as artificial feeding sites like dumpsites, sewage ponds and garbage sites.[3] These man-made sites have been found to provide unlimited food resources for birds and are one of the factors that attract birds to the sewage stabilisation pond and dumping sites area.[3] In urban areas, solid waste management is the main issue for responsive development in developing countries.

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It is essential to recognise that both the economy and population prosperity have an influence on solid-waste generation rates.[4]

Most developing countries are facing various problems, like rapid population growth and urbanization-related issues. The environment has been subjected to a great deal of stress as a result of increased urbanisation and growing economies. As the world becomes more industrialised, people are infesting the environment with new and complex chemicals, with no frequent bio-assessment of their toxicity.[4] As a result, waste management has emerged as one of the most pressing concerns for authorities in developing countries rapidly expanding cities.[5] Throughout history, humans have been able to dispose of biological waste such as bones, skins, fire, ash, stools, shells and other materials.[6] These wastes are effective because they are generally biodegradable and low in density, as well as because they use simple waste management technologies.[7]

As the human population and urbanisation continue to grow, effective solid waste management has become a main issue in urban areas.[8] Tons of municipal solid waste, mostly non-hazardous garbage, trash and garbage from homes, institutions and industrial facilities, end up in landfills. Construction of dumpsites not only reduces wildlife habitat, but also increases human-wildlife conflicts and interactions.[9-11] Despite the fact that improper waste management can have serious consequences for biodiversity and the environment, including disease-carrying organisms, poisonous gases and pollution, waste sites can serve as a resource for birds, which adapt to the area based on food availability.[12]

Toxins, pathogenic bacteria and poor food quality are now recognized as major contributors to health problems, individual morality and ultimately biodiversity decline at the local and regional levels.[13-16] Waste disposal sites are important for the attraction of various wildlife species. Many wildlife species, particularly opportunistic scavengers, use them as feeding grounds, including invertebrates and vertebrates, especially mammals and birds.[17,18] Food obtained from dump sites has a multitude of benefits, including that waste disposal sites have a number of advantages, including increased survival rates and body condition, improved reproductive performance, reduced feeding time costs and also reduced risk of predation, migration and extinction of species, especially threatened species.[19] Reduced food availability in waste disposal sites, on the other hand, may have an adverse effect on wildlife, such as shifting of diet and feeding habitat and dependency on anthropogenic derived food.[20]

Improper waste management has the potential to have serious environmental and biodiversity consequences. Pollutants and toxicant materials influence atmospheric conditions such as water, air and land. Other side waste disposal sites, on the other hand, provide several benefits and suitable feeding grounds for wildlife, particularly birds. Garbage dumps provide food for a variety of bird species from various feeding guilds.[21-26] Several studies have been made that garbage dumps have had a significant impact on the population, abundance and distribution of the cattle egret (*Bubulcus ibis*) and white stork (*Ciconia ciconia*) in the Iberian Peninsula region.[27,28] Garbage dumps are important not only during the migration season, but also during the breeding and wintering seasons. Several species of carnivores and scavenger birds like black kites, red kites, griffon vultures, crows, ravens and magpies utilize garbage dump areas as feeding stations and roosting grounds.[27-29]

Migratory birds also feed on garbage dump sites and several investigations also found positive results because garbage dump sites provide food material during the long path of migration and also enhance the survival rate during stressful and mortality prone periods. Due to sufficient food availability around dump sites, some bird species drastically reduce migration routes in some cases, like the white stork in Spain.[24,27] Garbage dump sites also provide new wintering ground habitat for resident and migratory avian species.[27,30] A more densely forested area can support a greater number of individuals or species of birds.[31] Additionally, the presence of water and trees near the dumping site may provide additional ecological services to birds. Although birds primarily use waste disposal sites for feeding, the surrounding habitats are also utilized for other ecological processes and requirements.[32]

Birds are a well-known group of organisms; they can survive in a wide variety of habitats, including natural and man-made ecosystems. They perform vital ecological and functional roles such as bio-indicators of ecosystems, pollination, nutrient recycling, seed dispersal and maintaining ecological balance in the food chain and food web.[33] According to Sethy *et al.,* (2015)[34] assessing bird

communities is an important part of biodiversity conservation and identifying the need for conservation actions towards ecosystems and natural resources. It is also essential to understand the diversity and composition of avian communities in order to assess the health status of local and regional landscapes for bird conservation.

In order to present study was conducted on avian diversity and feeding guilds at garbage dump sites, household and municipal waste in Mount Abu and Abu Road area of Sirohi district.

MATERIALS & METHODS

Data collection started from July, 2019 to December, 2021 in the Mount Abu and Abu Road area. Data were collected using point count and direct observation methods in the vicinity of hotels, houses and colonies where household and municipal waste were dumped in the vicinity of road sites where household and garbage were dumped by locals and tourists. At-least minimum 15 minutes observations were done at each site and observations were supported with the help of Nikon 8x40 binocular and Nikon P1000 camera. Birds were identified with help of standard filed guides by Grimmet *et al.,* (2011)[35] and Vyas, (2013).[36]

RESULT & DISSCUSION

Birds are well-known organisms that play a role in both natural and man-made ecosystems. They play an important role in ecological processes and functions such as serving as bio-indicators of ecosystem, assisting in the reduction of disposable waste and regulating insect and pest populations in agricultural landscapes.[33] Interspecific and intraspecific competitions were also observed between two similar food habitats for birds.[37] A large number of house crows and brahminy kites congregate during the daytime when waste is transported from the slaughterhouse to garbage dump sites. Due to similar food habitats, interspecific competitions are frequently observed between brahminy kites and house crows at dump sites.[38]

Similar observations we were also observed between house crow, jungle crow and black kites during the foraging, feeding and roosting time at garbage site in study area. We also observed interspecific completion for food in Asian pied starling, Common Myna and Brahmin starling. These birds were most abundant and more preferred feeding on garbage. During study, we observed 68 avian species on garbage and dump sites in the Abu Road and Mount Abu areas and they belonged to 28 families of birds. According to the Birdlife International (2021)[39], 65 species were least concerned, two species (*Threskiornis melanocephahus* and *Mycteria leucocephala*) belonged to two near-threatened categories and one species *Ciconia episcopus episcopus* belongs to vulnerable categories (Table -1).

The relative diversity of avian families was calculated with the help of the following formula.[40]

$$\text{RDi (Relative diversity)} = \frac{\text{Number of avian species in the family}}{\text{Total number of species}} \text{ X 100}$$

Relative diversity was highest in two families Columbidae and Muscicapidae (RDi = 8.82), followed by three families each of Accipitridae, Ardeidae, and Phasianidae (RDi = 7.35), five families Corvidae, Leiothrichidae, Sturnidae, Threskiornithidae and Turdidae (RDi = 4.41), and the remaining ten families (Charadriidae, Falconidae, Laniidae, Leiothrichidae, Motacillidae, Muscicapidae, Passeridae, Psittacidae, Rhipiduridae, Strigidae and Upupidae) each have only one species, and relative diversity was observed (RDi = 1.47) (Table 1).

Maximum birds species were belongs to Columbidae and Muscicapidae (6 species), followed by three families Accipitridae, Ardeidae, and Phasianidae were represent (5 species), five families Corvidae, Leiothrichidae, Sturnidae, Threskiornithidae and Turdidae (3 species), and the remaining ten families (Charadriidae, Falconidae, Laniidae, Leiothrichidae, Motacillidae, Muscicapidae, Passeridae, Psittacidae, Rhipiduridae, Strigidae and Upupidae) each have only one species (Table 1, Graph 1). Birds were also categorized on the basis of their feeding guilds and food choices.[41,42]

During present study birds were categorized into five feeding guilds namely Insectivore, Granivores, Frugivore, Carnivore and Omnivore according to their food preference. During the study, the most bird species belonged to the Insectivore (22) feeding guild, followed by the Omnivore (21), Carnivore (17), Granivores (7) and the Frugivore (*Psittacula krameri parvirosnis*) feeding guild. The average number of individuals was highest for individuals belonging to the Omnivore feeding guild, followed by Granivores, Insectivore and Carnivore, and lowest individual belonged to the Frugivore feeding guild (Table 2; Garph-2).

Dead animals dumped in landfills may have died as a result of infections that could have killed other birds, such as avian influenza, which is frequently observed in the Middle East.[43] Because infectious diseases, such as avian influenza and the West Nile virus will emerge more frequently in new areas as a result of climate change[44], wild birds may be able to transmit diseases along migratory routes.[45] Various wildlife species can now be found in and around urban areas, especially in developing countries due to lack of species and habitat management, outside their natural habitats such as agricultural and cultivated land and garbage dump sites.[46]

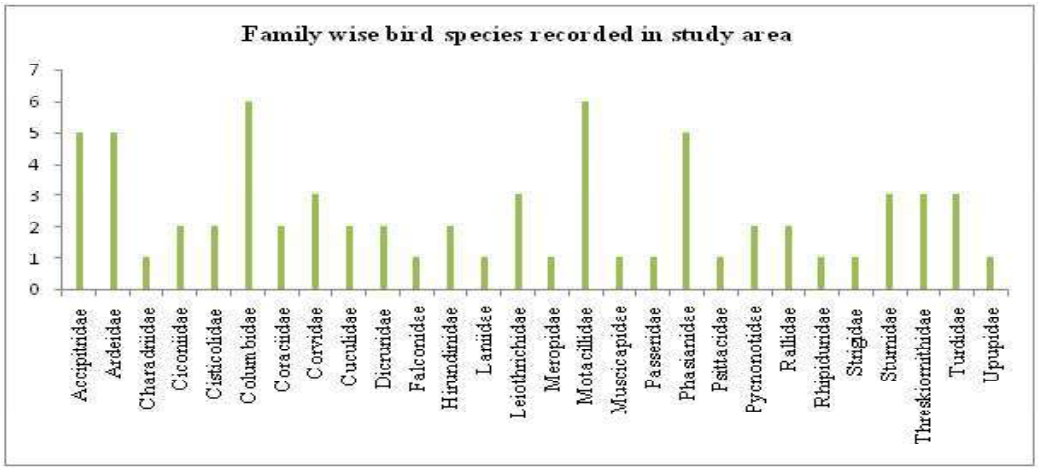
Table 1- Birds species recorded on garbage dump site in Abu road and Mount Abu

Sl. No.	Common name	Zoological name	Family	Feeding guild	IUCN status
1	Ashy prinia	*Prinia socialis stewarti*	Cisticolidae	Insectivore	LC
2	Asian koel	*Eudynamys scolopaceus scolopaceus*	Cuculidae	Omnivore	LC
3	Asian pied Starling	*Gracupica contracontra*	Sturnidae	Omnivore	LC
4	Bay bake shrike	*Lanius vittatus nargianus*	Laniidae	Insectivore	LC
5	Black drogue	*Dicrurus macrocercus minor*	Dicruridae	Insectivore	LC
6	Black kite	*Milvus migrans govinda*	Accipitridae	Carnivore	LC
7	Black Redstart	*Phoenicurus ochruros rufiventris*	Muscicapidae	Insectivore	LC
8	Black-headed white ibis	*Threskiornis melanocephalus*	Threskiornithidae	Carnivore	NT
9	Black-shouldered kite	*Elanus caeruleus*	Accipitridae	Carnivore	LC
10	Brahmin starling	*Sturnus pagodarum*	Sturnidae	Omnivore	LC
11	Brown Rock Chat	*Cercomela fusca*	Turdidae	Insectivore	LC
12	Cattle egret	*Bubulcus ibis*	Ardeidae	Insectivore	LC
13	Common Babbler	*Turdoides caudata*	Leiothrichidae	Omnivore	LC
14	Common hoopoe	*Upupa epops*	Upupidae	Insectivore	LC
15	Common Kestrel	*Falco tinnunculus*	Falconidae	Carnivore	LC
16	Common moorhen	*Gallinula chloropus*	Rallidae	Omnivore	LC
17	Common Myna	*Acridotheres tristis*	Sturnidae	Omnivore	LC
18	Common Swallow	*Hirundo rustica*	Hirundinidae	Insectivore	LC
19	Crested-serpent eagle	*Spilornis cheela*	Accipitridae	Carnivore	LC
20	Eurasian collared Dove	*Streptopelia decaocto decaocto*	Columbidae	Granivores	LC
21	European Roller	*Coracias garrulus*	Coraciidae	Carnivore	LC
22	Glossy ibis	*Plegadis falcinellus*	Threskiornithidae	Carnivore	LC
23	Greater cukaal	*Centropus sinensis sinensis*	Cuculidae	Carnivore	LC
24	Green bee- eater	*Merops orientalis*	Meropidae	Insectivore	LC
25	Grey Heron	*Ardea cinerea cinerea*	Ardeidae	Carnivore	LC
26	Grey jungle fowl	*Gallus sonneratii*	Phasianidae	Omnivore	LC
27	Grey Wagtail	*Motacilla cinerea*	Motacillidae	Insectivore	LC
28	House crow	*Corvus splendens splendens*	Corvidae	Omnivore	LC
29	House sparrow	*Passer domesticus indicus*	Passeridae	Omnivore	LC
30	Indian Black ibis	*Pseudibis papillosa*	Threskiornithidae	Omnivore	LC
31	Indian Grey Francolin	*Francolinus pondicerianus*	Phasianidae	Omnivore	LC

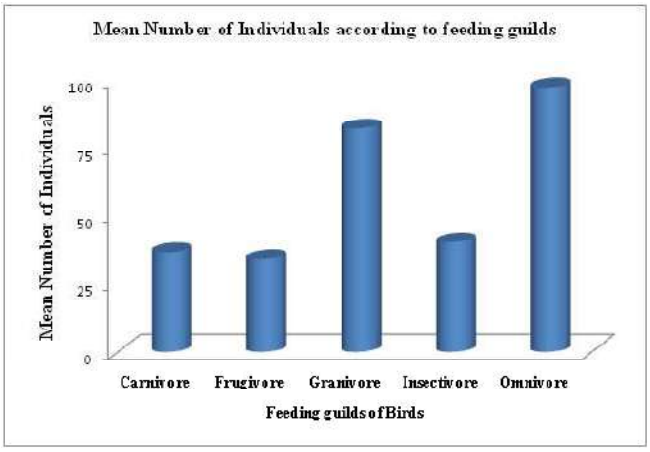
32	Indian Peafowl	*Pavo cristatus*	Phasianidae	Omnivore	LC
33	Indian pond heron	*Ardeola grayii*	Ardeidae	Carnivore	LC
34	Indian Robin	*Saxicoloides fulicatus cambaiensis*	Turdidae	Insectivore	LC
35	Indian roller	*Coracias benghalensis*	Coraciidae	Insectivore	LC
36	Intermediate egret	*Egretta intermedia*	Ardeidae	Carnivore	LC
37	Jungle Babbler	*Turdoides striata*	Leiothrichidae	Omnivore	LC
38	Jungle crow	*Corvus macrorhynchos*	Corvidae	Omnivore	LC
39	Large grey babbler	*Turdoides malcolmi*	Leiothrichidae	Omnivore	LC
40	Large Pied wagtail	*Motacilla maderaspatensis*	Motacillidae	Insectivore	LC
41	Laughing Dove	*Streptopelia senegalensis cambayensis*	Columbidae	Granivores	LC
42	Little egret	*Egretta garzetta garzetta*	Ardeidae	Carnivore	LC
43	Oriental magpie-robin	*Copsychus saularis saularis*	Turdidae	Insectivore	LC
44	Oriental turtle dove	*Streptopelia orientalis*	Columbidae	Granivores	LC
45	Paddy field Pipit	*Anthus rufulus waitei*	Motacillidae	Insectivore	LC
46	Painted Stork	*Mycteria leucocephala*	Ciconiidae	Carnivore	NT
47	Plain Prinia	*Prinia inornata inornata*	Cisticolidae	Insectivore	LC
48	Rain Quill	*Coturnix coromandelica*	Phasianidae	Granivores	LC
49	Red collared Dove	*Streptopelia tranquebarica*	Columbidae	Granivores	LC
50	Red Spur- fowl	*Galloperdix spadicea*	Phasianidae	Omnivore	LC
51	Red vented bulbul	*Pycnonotus cafer*	Pycnonotidae	Omnivore	LC
52	Red wattled lapwing	*Vanellus indicus indicus*	Charadriidae	Insectivore	LC
53	Rock pigeon	*Columba livia intermedia*	Columbidae	Granivores	LC
54	Rose-ring parakeet	*Psittacula krameri parvirosnis*	Psittacidae	Frugivore	LC
55	Rufous Tree pie	*Dendrocitta vagabunda*	Corvidae	Omnivore	LC
56	Shikra	*Accipiter badius*	Accipitridae	Carnivore	LC
57	Spotted dove	*Streptopelia chinensis chinensis*	Columbidae	Granivores	LC
58	Spotted Owlet	*Athenebrama indica*	Strigidae	Carnivore	LC
59	Tree pipit	*Anthus trivialisha ringtoni*	Motacillidae	Omnivore	LC
60	White breasted water hen	*Amaurornis phoenicurus*	Rallidae	Omnivore	LC
61	White browned fantail	*Rhipidura aureola compressirostris*	Rhipiduridae	Insectivore	LC
62	White eared bulbul	*Pycnonotus leucotis*	Pycnonotidae	Omnivore	LC
63	White wagtail	*Motacilla alba*	Motacillidae	Insectivore	LC
64	White-bellied Drogue	*Dicruru scaerulescen scaerulescens*	Dicruridae	Insectivore	LC
65	White-throated kingfisher	*Halcyon smyrnensis smyrnensis*	Alcedinidae	Carnivore	LC
66	Wire tailed swallow	*Hirundo smithii*	Hirundinidae	Insectivore	LC
67	Asian Wolly-necked Stork	*Ciconia episcopus episcopus*	Ciconiidae	Carnivore	V
68	Yellow Wagtail	*Motacilla flava*	Motacillidae	Insectivore	LC

Table 2- Feeding guilds and Mean number of birds individual observed during the study

Feeding guild	N	Mean Number of Individuals	Std. Deviation	Std. Error	Minimum	Maximum	p value
Carnivore	17	36.47	29.313	7.109	3	134	0.082
Frugivore	1	34	----	----	34	34	
Granivores	7	82.29	121.46	45.908	13	356	
Insectivore	22	40.14	24.445	5.212	17	121	
Omnivore	21	97.24	113.194	24.701	2	403	
Total	**68**	**61.1**	**79.396**	**9.628**	**2**	**403**	



Graph 1- Family wise bird's species recorded in study area



Graph 2- Mean Number of Individuals according feeding guilds of birds

Fig. 1- Jungle crow finds food material inside plastic waste

Fig. 2- Red wattled lapwing foraging at dump site

Fig. 3- Household dump site in Mount Abu

Fig. 4- Red Spur-fowl foraging and feeding on Garbage

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