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ASSESSMENT OF FLORISTIC AND AVIAN FAUNAL DIVERSITY OF BHINDAWAS WETLAND, JHAJJAR (HARYANA), INDIA

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Abstract

Bhindawas Wetland is spread over an area of 1074 acres in Jhajjar district of Haryana State, India. Bhindawas wetland in present time encountered with various environmental problems *viz*., point and non-point pollution created by surrounding agricultural fields and from drain No. 8, weed infestation, eutrophication and siltation etc. Water logging of peripheral agricultural field with higher salinity is threat to biodiversity loss. Keeping in view of biodiversity losses in the wetland, the present study was carried out to generate documentation information regarding floral and avian faunal diversity of Bhindawas wetland. Plants and birds were identified by comparing the specimen of plants with existing herbarium and picture of material prescribed in good reference books and with the help of expert. A total of 84 plants species have been reported. The maximum numbers of plant species were belonged to order Fabales followed by order Lamiales family. Total of 66 species of wetland birds belonging to 30 families have been recorded from the study area. Of all, families Anatidae dominated the list with 9 species.

Key words : Pollution, plant species, wetland birds, floristic diversity.

Introduction

Lakes, rivers, streams and creeks, waterfalls, marshes, peat lands and flooded meadows water bodies are inland wetlands. This also includes man-made wetlands *viz*., canals, aquaculture ponds, water storage areas and even wastewater treatment areas. The diversity in functions that wetlands perform makes them valuable ecosystems. They have a high ecological value, providing the water for human consumption and nutrients upon which countless species of plants and animals depend. High concentrations of birds, mammals, reptiles, amphibians, fish and invertebrate species are supported by wetlands. It has been estimated that freshwater wetlands hold more than 40% of the entire world's species and 12% of all animal species (Cohen *et al*., 1983). Wetland studies generally refer to the species richness of only one or a few groups of organism, such as vascular plants, birds, fish or micro-invertebrates (Schuyt and Brander, 2004). In India, lakes, rivers and other freshwaters support a large diversity of biota representing almost all taxonomic groups.

Wetlands are a major feature of the landscape in all parts of the world, covering nearly 6% of its area (*i.e.* 8.6 million km^2) (Maltby and Turner, 1983). Wetlands in India comprise of less than 5% of the total geographical area, they are identified as the richest and most fascinating biomes that support one-fifth of the country's total biodiversity (SACONH, 2004). The Indian landscape is dotted with 4290 large lakes and innumerable small water bodies (Sugunan, 1995 and Jain *et al*., 2011). Haryana is a small State situated between 27^{0}29' to 30^{0}56' N latitudes and 74^{0}27' to 77^{0}36' E longitudes, covering as area of about 44, 212 sq. km. The State mainly occupies the Indo-Gangetic Alluvial Plain. Total 1441 wetlands have been mapped in the State. In addition, 10529 small wetlands (smaller than 2.25 ha) have also been identified. Total wetland area estimated is 42478 ha that is around 0.86 per cent of the geographic area (Panigrahy *et al*., 2010). Excessive developments in state resulted in destructing of erstwhile balanced façade of environmental components. One visible effect is negatively influencing the age old rural wetlands (Gupta and Kaushik, 2012).

Wetlands are important in supporting species diversity. A significant number of plants species can be considered as bio-resources in wetlands. There are major and minor plant resources harvested from the wetlands of rural India (Misra *et al*., 2012). The total numbers of

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aquatic plant species exceed 1200 and they provide a valuable source of food, especially for waterfowl (Prasad *et al*., 2002). Wetlands provided the varieties of habitat to the birds due to their diversity and high productivity have led to increasing concern about the impact of their loss. Difference in habitat condition may also cause changes in relative abundance of bird species composition (Nazeem and Nirmala, 2015). Habitat concept has developed by ornithologists. They gathered information regarding the distribution and abundance of birds in aspects of environment (Pandotra and Sahi, 2014). Wetlands are important breeding areas for wildlife and provide a refuge for migratory birds. According to certain estimates, the approximate number of species of migratory birds recorded from India is between 1200 and 1300, which is about 24% of India's total bird species (Agarwal, 2011). Many migratory species of birds from western and European countries visited the Indian wetlands, like Bharatpur wild life sanctuary in Rajasthan, Rann of Kutch and coastal areas of Saurashtra in Gujarat and Sultanpur and Bhindawas wild life sanctuaries in Haryana (Bassia *et al*., 2014).

A number of floristic and avian faunal studies have been conducted from Haryana (Yadav and Kumar, 2003; Yadav *et al*., 2010; Gupta *et al*., 2012;Yadav *et al*., 2014 and Borah, 2014), but no documented information is available on the flora and avian fauna of the Bhindawas wetland.

The objective of this study is to document the baseline information of the existing flora and avian fauna of Bhindawas wetland. This study is the first attempt to make an inventory and analysis of the entire flora and avian fauna of Bhindawas wetland.

Materials and Methods

Study area and sampling location

Bhindawas bird sanctuary is a low-lying area in district Jhajjar (Haryana), India. It is located 15 Km away from Jhajjar district headquarters and 80 Km from Delhi located at 76^0 31' East and 28^0 32' West (Fig. 1). Mean minimum and maximum temperature are 7° C (January) and 40.5° C (May and June), whereas mean annual rainfall is 444 mm in the study area. Birds are the main attraction of the wetland complex. More than 30,000 varieties of migratory birds belonging to over 250 species and resident birds visit the wetland throughout the year. The sanctuary is spread over an area of 1074 acres. The peripheral embankment was man-made and basically constructed to store the escaped water of the Jawaharlal Nehru Canal through an escape channel at the time of power failure in the Pump House made on the canal.

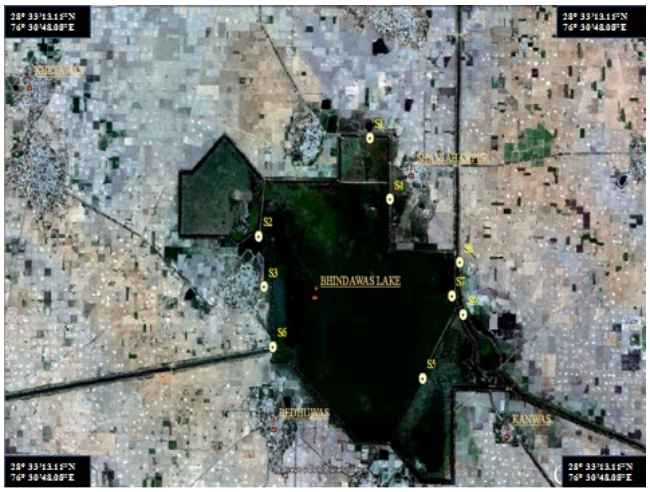

Fig. 1 : Study area.

Excess water of the wetland is siphoned off in the drain no. 8 through outlet channel. Drain no. 8 is a recipient of storm water as well as sewage of cities of Haryana, because some of the towns have a combined system of disposal for sewage and storm water. Survey work on floristic and avian faunal diversity was conducted in Feb. 2012.

Flora study

Data on taxon distribution of plants within forest area of Bhindawas wetland were collected mainly from two sources: field observations and collection of plants specimens to identified by taxonomy experts. Plant collections were made of all species occurring in the wetland forest area. In addition, flowering and fruiting material was also collected for proper identification. Specimens were typical and healthy, with at least some fully expanded leaves where as possible. Pictures of plants from all around the wetlands were clicked with Canon camera. Excess soil was shaken off and washed. Large herb and tree, the specimens were included basal leaves as well as enough stem to show the range of stem leaves and flowering and fruiting material. Collected plants were put immediately into paper sheet and pressed with field press in folding of News paper. Then plant specimens were transferred to the laboratory. Plants were identified by comparing with herbarium specimen of plants and picture with material in good reference books and with the help of experts from Botany Deptt. of the university.

Avian diversity of Bhindawas Bird Sanctuary

Visit to the Bindawas Bird Sanctuary were made in the month of Febuary 2011 for survey work. Canon Camera has proved very effective and efficient. Pictures of birds from all around the wetlands were clicked with maximum zoom. The identification of birds was done with

Table 1 : Flora identified in the forest area of wetland.

S. no.	Botanical name	Common name	Family	Order	Habit
1.	*Acorus calamus* Linn.	Sweet Flag	Acoraceae	Acorales	Herb
2.	*Aloe barbadensis* Miller	Gvarpatha	Xanthorrhoeaceae	Asparagales	Herb
3.	*Parthenium hysterophorus* L	Gajar ghas	Asteraceae	Asterales	Grass
4.	*Carthamus tinctorius* L.	Safflower	Asteraceae	Asterales	Herb
5.	*Eclipta alba* L.	Bhangara Kannada	Asteraceae	Asterales	Herb
6.	*Eclipta prostrata* L.	Bhangaara	Asteraceae	Asterales	Herb
7.	*Artemisia vulgaris* L.	Indian Wormwood	Asteraceae	Asterales	Herb
8.	*Iberis amara* L.	Roket Candytuff	Brassicaceae	Brassicales	Herb
9.	*Achyranthes aspera*	Chirchita	Amaranthaceae	Caryophyllales	Herb
10.	*Legenaria vulgaris* Ser.	Kaddu	Cucurbitaceae	Cucurbitales	Climber
11.	*Mimosa pudica* L.	Chhui-Mui	Fabaceae	Fabales	Herb
12.	*Cassia occidentalis* Linn	Chakunda	Fabaceae	Fabales	Shrub
13.	*Indigofera tinctoria* L.	Nili	Fabaceae	Fabales	Shrub
14.	*Albizia lebbeck* Linn.	Siris	Fabaceae	Fabales	Tree
15.	*Albizia odoratissima* (L.f.)	Kali siris	Fabaceae	Fabales	Tree
16.	*Bauthinia variegata* L.	Kachnar	Fabaceae	Fabales	Tree
17.	*Butea monosperma* (Lamk.) Taub.	Palash, Dhak	Fabaceae	Fabales	Tree
18.	*Cassia fistula* Linn.	Amaltas	Fabaceae	Fabales	Tree
19.	*Dalbergia sisso* Roxb.	Sheesham	Fabaceae	Fabales	Tree
20.	*Prosopis cineraria* L.	Khejri	Fabaceae	Fabales	Tree
21.	*Prosopis juliflora* (Sw.) DC.	Vilayati babul	Fabaceae	Fabales	Tree
22.	*Acacia nilótica* L.	Babul	Fabaceae	Fabales	Tree
23.	*Acacia arabica* (Lam.)	Kikar	Fabaceae	Fabales	Tree
24.	*Ficus rumphii* L.	Gagjaira, Pakar	Moraceae	Fagales	Tree
25.	*Carissa congesta* L.	Karonda	Apocynaceae	Gentianales	Herb
26.	*Catharanthes roseus* 'alba'L.	Sadabahar	Apocynaceae	Gentianales	Herb
27.	*Calotropis procera* Ait	Aak, Akada	Asclepiadaceae	Gentianales	Shrub
28.	*Nerium oleander* L.	Kaner	Apocynaceae	Gentianales	Shrub
29.	*Ervatamia divaricata* L.	Chandani Tagar	Apocynaceae	Gentianales	Shrub
30.	Alstonia scholaris L.	Saptprni	Apocynaceae	Gentianales	Tree
31.	*Arnthocephalus indicus* (Roxb.)	Kadam	Rubiaceae	Gentianales	Tree
32.	*Bacopa monnieri* Linn.	Brahmi	Plantaginaceae	Lamiales	Herb
33.	*Duranta repens* L.	Nilkanta	Verbenaceae	Lamiales	Herb
34.	*Martynia annua* L.	Baghnakh	Martyniaceae	Lamiales	Herb
35.	*Mentha piperita* L.	Paparaminta	Lamiaceae	Lamiales	Herb
36.	*Mentha spicata* L.	Putiha	Lamiaceae	Lamiales	Herb
37.	*Plantago ovata* Forssk.	Isabgol husk	Plantaginaceae	Lamiales	Herb
38.	*Cordia dichotoma* G.Forst.	Indian cherry	Boraginaceae	Lamiales	Herb
39.	*Nycltanthes arbor-tristis* L.	Harsringar	Oleaceae	Lamiales	Shrab
40.	*Barleria prionitis* Linn.	Vajradanti	Acanthaceae	Lamiales	Shrub
41.	*Coleus barbatus* willd	Mayamul, Garmar	Lamiaceae	Lamiales	Shrub
42.	*Cordia myxa* L.	Lasora	Boraginaceae	Lamiales	Shrub
43.	*Jasminum sambac* Aiton	Moghrâ	Oleaceae	Lamiales	Shrub
44.	*Oroxylum indicum* Vent.	Bhut-vriksha	Bignoniaceae	Lamiales	Shrub
45.	*Michelia champaca* L.	Champa	Magnoliaceae	Magnoliales	Shrub
46.	*Euphorbria hirta* Linn.	Chanderi, Dudhi	Euphorbiaceae	Malpighiales	Herb
47.	*Croton bonplandianum* L.	Ban tulsi	Euphorbiaceae	Malpighiales	Herb

Table 1 continued....

Table 1 continued....

48.	*Jatropha curcas* L.	Danti	Euphorbiaceae	Malpighiales	Shrub
49.	*Jatropha gossypifolia* L.	Ratan jyot	Euphorbiaceae	Malpighiales	Shrub
50.	*Ricinus communis* L.	Eranda	Euphorbiaceae	Malpighiales	Shrub
51.	*Mesua ferrea* L.	Gajapushpam	Calophyllaceae	Malpighiales	Tree
52.	*Abutilon indicum* (Link) Sweet	Kanghi	Malvaceae	Malvales	Herb
53.	*Hibiscus rosa sinensis* L.	Japapushpa	Malvaceae	Malvales	Shrub
54.	*Pterospermum acerifolium* L. Willd.	Kanak champa	Malvaceae	Malvales	Shrub
55.	*Callistemon citrinus* (Curtis) Skeels	Bottlebrush	Myrtaceae	Myrtales	Shrub
56.	*Eucalyptus camaldulensis* Dehnh	Saphada	Myrtaceae	Myrtales	Tree
57.	*Psidium guajava* L.	Guajava	Myrtaceae	Myrtales	Tree
58.	*Nymphea lotus* L.	White Lotus	Nymphaeoceae	Nymphaeales	Herb
59.	*Numphaea stellata* Burm. f.	Star lotus	Nymphaeoceae	Nymphaeales	Herb
60.	*Piper longum* L.	Ushana, Pippali	Piperaceae	Piperales	Herb
61.	*Saccharum munja* Roxb.	Munj	Poaceae	Poales	Grass
62.	*Cyperus* sp. L	Nagarmotha	Cyperaceae	Poales	Grass
63.	*Bambusa lako* Widjaja	Bas	Poaceae	Poales	Grass
64.	*Cymbopogon citratus* Stapf.	Lemon Grass	Poaceae	Poales	Shrub
65.	*Cymbopogon martini* (Roxb.) Wats.	Rosha grass	Poaceae	Poales	Shrub
66.	*Argemone mexicana* L.	Kathelli	Papaveraceae	Ranunculales	Herb
67.	*Zizyphus mauritiana* (Lam.)	Ber	Rhamnaceae	Rosales	Shrub
68.	*Cannabis sativa* Linn	Bhang	Cannabaceae	Rosales	Shrub
69.	*Ficus bangalensis* L.	Bargad	Moraceae	Rosales	Tree
70.	*Ficus glomerata* L.	Gular	Moraceae	Rosales	Tree
71.	*Ficus palmata* L.	Anjir	Moraceae	Rosales	Tree
72.	*Ficus religiosa* L.	Peepal	Moraceae	Rosales	Tree
73.	*Cordia wallichii* G.Don	Lasora, chhota	Boraginaceae	Lamiales	Shrub
74.	*Azadirachta indica* Juss	Neem	Meliaceae	Sapindales	Tree
75.	*Boswellia serrata* Roxb. Ex Colebr.	Salar	Burseraceae	Sapindales	Tree
76.	*Mangifera indica* L.	Mango	Anacardiaceae	Sapindales	Tree
77.	*Melia azedarach* L.	Bakain	Maliaceae	Sapindales	Tree
78.	*Cuscuta reflexa* L.	Amar bel	Convolvulaceae	Solanales	Climber
79.	*Convolvulus microphyllus* Sieb.	Shankhapushpi	Convolvaleae	Solanales	Herb
80.	*Cestrum nocturnum* L.	Raat ki Rani	Solanaceae	Solanales	Shrub
81.	*Datura alba* L.	Dhatura	Solanaceae	Solanales	Shrub
82.	*Datura metel* L.	Dhatura	Solanaceae	Solanales	Shrub
83.	*Ipomoea carnea* Jace.	Behaya	Convolvulaceae	Solanales	Shrub
84.	*Morus indica* L.	White Mulberry	Moraceae	Rosales	Tree

Table 2 : Type of flora identified from Bhindawas wetland.

Total plants collected	Tree	Shrubs	Herbs	Grasses	Climber
84	25	27	26	4	2

the help of reference books and literatures (Ali and Ripley, 1987; Grimmet *et al*., 1998). Further, the entire information on bird's diversity was rearranged in families.

Results and Discussion

Plant diversity in study area

The present study reveals a good information regarding flora of Bhidawas wetland. A total of 84 plants have been reported (table 1). Out of these 30% were tree, 32% were shrubs 31% herbs, 5% were grasses and 2% were climbers (table 2). The maximum number of plant species were belonged to order Fabales followed by order Lamiales with 13 species of 9 family. A total of 19 orders of plants with 40 families were reported in the present study area.

Present study also revealed that a total of 84 species with 22 orders and 41 families were recorded from the study area. The type of vegetation depends on edaphic, climatic and biotic factors, among which the effect of

Table 3 : Avian faunal inventory of Bhindawas wetland.

S. no.	Common name	Scientific name	Local name	Family	Status
1.	Avocet	*Recurvirosta avosetta*	Kusya Chaha	Recurvirostridae	M
2.	Common Babbler	*Turdoides caudatus*	Dumri	Timaliidae	R
3.	Jungle Babbler	*Turdoides striatus*	Jungle Babbler	Timaliidae	R
4.	Large Grey Babbler	*Turdoides malcolmi*	Gouge	Timaliidae	R
5.	Yellow Eyed Babbler	*Chrysomma sinense*	Bubal Chesham	Sylviidae	R
6.	Baya	*Ploceus philippinus*	Baya	Ploceidae	R
7.	Bluethroat	*Luscinia svecica*	Neelkant	Muscicapidae	M
8.	Honey Buzzard	*Pernis ptilorhynchus*	Tisa	Accipitridae	R
9.	Common Coot	*Fulica atra*	Tekari	Rallidae	R
10.	Cormorant	*Phalacrocorax carbo*	Pankauwa	Phalacrocoracidae	R
11.	Cotton Teal	*Nettapus coromandelianus*	Choti Murgabi	Anatidae	M
12.	Indian Courser	*Cursorius coromandelicus*	Nukni	Glareolidae	R
13.	Sarus Crane	*Grus antigone*	Sars	Gruidae	R
14.	Indian Cuckoo	*Cuculus micropterus*	Koel	Cuculidae	M
15.	Darter	*Anhinga melanogaster*	Snakebirds	Anhingidae	R
16.	Spotbill Duck	*Anas poecilorhyncha*	Gai-pai	Anatinae	R
17.	Cattle Egret	*Bubulcus ibis*	Sukhirya Bugla	Ardeidae	R
18.	Great Egret	*Ardea alba*	Bugla	Ardeidae	R
19.	Little Egret	*Egretta garzetta*	Chota Bugla	Ardeidae	R
20.	Flycatcher	*Muscicapa dauuric*	Buraseer	Ptilogonatidae	M
21.	Gadwall	*Anas strepera*	Bakhur	Ardeidae	M
22.	Heron Grey	*Ardea herodias*	Kabud	Ardeidae	R
23.	Heron Night	*Nycticorax nycticorax*	Kchak	Ardeidae	R
24.	Heron Pond	*Ardeola grayii*	Anada Bugla	Ardeidae	R
25.	Black Ibis	*Geronticus eremita*	Kala Baj	Threskiornithidae	R
26.	Pheasant-tailed Jacana	*Hydrophasianus chirurgu*	Bihuya	Jacanidae	R
27.	White Breast Kingfisher	*Ceryle rulis*	Kilkila	Alcedinidae	R
28.	Brahminy Kite	*Haliastur indus*	Chil	Alcedinidae	R
29.	Red Wattled Lapwing	*Vanellus indicus*	Titihri	Charadriidae	R
30.	White Tailed Lapwing	*Vanellus leucurus*	Titihri	Charadriidae	R
31.	Mallard	*Anas platyrhynchos*	Neelseer	Anatidae	M
32.	Purple Moorhen	*Porphyrio porphyrio*	Keim	Rallidae	R
33.	Red Munia	*Amandava amandava*	Lal Munia	Estrildidae	R
34.	Myna	*Acridotheres*	Desi Miana	Sturnidae	R
35.	Brahminy Myna	*Sturnia pagodarum*	Brahminy Miana	Sturnidae	R
36.	Pied Myna	Gracupica contra	Ablk Miana	Sturnidae	R
37.	Spotted Owlet	*Athene brama*	Dhabedar Ullu	Strigidae	R
38.	Common Pochard	Aythya ferina	Majita	Anatidae	M
39.	Rose Ringed Parakeet	*Psittacula krameri*	Laibar Tool	Psittacidae	R
40.	Common Peafowl	*Pavo cristatus*	Mor	Phasianidae	R
41.	Rosy Pelican	Pelecanus onocrocotalus	Hawasil	Pelecanidae	M
42.	Black Pheasant	*Phasianus colchicus*	Kala Titar	Phasianidae	R
43.	Blue Rock Pigeon	*Columba livia*	Neela Kabutar	Colubidae	R
44.	Pintail	*Anas acuta*	Sekhpar Digoch	Anatidae	M
45.	Kentish Plover	*Charadrius alexandrinus*	Batna	Charadriidae	M
46.	Indian Roller	*Coracias benghalensis*	Nelkant	Coraciidae	R
47.	Spoonbill	*Platalea ajaja*	Chammaj Baj	Threskiornithidae	R

Table 3 continued....

Table 3 continued....

48.	Black-winged Stilt	*Himantopus himantopus*	Gajpoen	Recurvirostridae	R
49.	Little Stint	*Erolia minuta*	Chota Panlua	Scolopacidae	M
50.	Black Necked Stork	*Ephippiorhynchus asiaticus*	Loharjang	Cicoriidae	M
51.	Openbill Stork	*Anastomus oscitans*	Gugla	Cicoriidae	M
52.	Painted Stork	*Mycteria leucocephala*	Joghal	Cicoriidae	R
53.	White Stork	*Ciconia ciconia*	Laglag	Cicoriidae	R
54.	White-Necked Stork	*Ciconia episcopus*	Mnik Jor	Cicoriidae	R
55.	Indian River Tern Tern	*Sterna aurantia*	Tihri	Sternidae	R
56.	Whiskered Tern	*Chlidonias hybridus*	Kurkri	Sternidae	R
57.	Large Pied Wagtail	*Motacilla maderaspatensis*	Mamula	Motacillidae	R
58.	White Wagtail	*Motacilla alba*	Pilkiya	Motacillidae	M
59.	White-breasted Waterhen	*Amaurornis phoenicurus*	Safad Chati Jalmurgi	Rallidae	R
60.	Black-throated Weaver	*Ploceus benghalensis*	Sarvo Baya	Ploceidae	R
61.	Streaked Weaver	*Ploceus manyar*	Thridar Sarvo Baya	Ploceidae	R
62.	Wigeon	*Anas penelope*	Piyasan	Anatidae	M
63.	Lesser Spotted Woodpecker	*Dendrocopos minor*	Catfodva	Picidae	R
64.	Common Teal	Anas crecca	Chhoti Murgabi	Anatidae	M
65.	Tufted Pachard	*Aythya ferina*	Rahwara	Anatidae	M
66.	Purple Heron	*Ardea purpurea*	—	Anatidae	R

M = migrant, **R** = Resident.

the climatic factor is most significant. The main climatic factors which control vegetative activities are temperature, sunlight and precipitation.

Manhas *et al*. (2010) investigated the floristic diversity of protected ecosystems of Kandi region of Punjab, India. They reported the total 206 species belonging to 159 genera and 59 families were identified from these sites. The contribution of dicotyledons, monocotyledons and pteridophytes was 77.7%, 20.4% and 1.9%, respectively. *Ipomoea* was the most dominant genera. Mata *et al*. (2011) studied the vegetation structure, composition and diversity of five forested coastal wetlands in Veracruz on the Gulf of Mexico. They recorded 109 woody and herbaceous species. The most frequent species were the trees *Pachira aquatica*, *Annona glabra*, *Diospyros digyna* and *Ficus insipida* subsp. *insipida*, the lianas *Dalbergia brownei* and *Hippocratea celastroides* and the hemi-epiphyte *Syngonium podophyllum*. Sun *et al*. (2009) studied the changes of species diversity in plant communities along latitude gradients is important to discover the correlation between biodiversity and environmental factors in Great Xing an Mountain valleys of Northeast China. They recorded about 150 plant species from 12 permafrost wetland plant communities. Most of the plants belong to the Compositae or Gramineae. Yadav *et al*. (2010) identified 50 plant species with their conservation status in Mahendergarh district, Haryana. They reported that among the 50 plants species 36% were tree, 30% shrubs, 26% herbs and 8% climbers.

Avian fauna

Total of 66 species of wetland birds belonging to 30 families have been recorded from the study area. Details such as common, scientific names, local name and status the wetland birds are presented in table 3. Of all, family Anatidae dominated the list with 9 species. It represented 13.6% of the total number of water bird species present in Bhindawas wetland (table 4). Out of total 66 species, 48 were resident and 18 (27.3%) were migrant species. Shallow area near the periphery and scattered vegetation cover might have extended comfortable shelter and suitable foraging grounds for the wetland birds. This habitat by supporting different food sources like fish, crustaceans, invertebrates, water plants and planktons further add to the diversity of wetland birds. Water birds require a cluster of platforms within the water bodies in order to sit there for basking during the winters. There are no platforms available within the Bhindawas wetland observed during present study. Hence, the suitable measures should be taken, to ensure that artificial platforms are made available within the Bhindawas wetland. Birds have played a unique role in the growth, protection and restoration of natural environment and their importance and significance in the maintenance of clean and healthy environment is of high order.

Table 4 : Status of bird families recorded in wetlands Bhindawas.

S. no.	Family	No. of species	Per cent occurrence
1.	Accipitridae	3	4.5
2.	Anatidae	9	13.6
3.	Anhingidae	1	1.5
4.	Ardeidae	7	10.6
5.	Charadriidae	3	4.5
6.	Cicoriidae	5	7.6
7.	Colubidae	3	4.5
8.	Estrildidae	1	1.5
9.	Glareolidae	1	1.5
10.	Gruidae	1	1.5
11.	Jacanidae	1	1.5
12.	Motacillidae	2	3.0
14.	Muscicapidae	1	1.5
15.	Pelecanidae	1	1.5
16.	Phalacrocoracidae	1	1.5
17.	Phasianidae	2	3.0
18.	Picidae	1	1.5
19.	Ploceidae	3	4.5
20.	Psittacidae	1	1.5
21.	Ptilogonatidae	1	1.5
22.	Rallidae	3	4.5
23.	Recurvirostridae	2	3.0
24.	Scolopacidae	1	1.5
25.	Sternidae	2	3.0
26.	Strigidae	1	1.5
27.	Sturnidae	3	4.5
28.	Sylviidae	1	1.5
29.	Threskiornithidae	2	3.0
30.	Timaliidae	3	4.5

The present study revealed that a total of 66 species of wetland birds belonging to 30 families have been recorded from the study area. Out of total 66 species, 48 were resident and 18 (27.3%) were migrant species. Where Gupta *et al*. (2012) studied the Khaparwas bird sanctuary, which is adjacent (2 km distance) to the Bhindawas bird sanctuary in Jhajjar district from 1997 to 2002. They recorded a total of 164 species of birds belonging to 16 Orders and 44 families. Out of 164 species of birds, 104 species were residents, 45 species were winter migratory, 9 species of birds local migratory, 5 species were summer migratory and one species of bird was Straggler. The comparison of results of both studied indicated that significant reduction in the birds diversity with time.

It is concluded that a total number 84 plant's and 66 bird's species have been reported from Bhindawas wetland. Importance of this wetland increase due to the Bharatpur national park in Rajasthan encounter with shortage of water during winter season, this sanctuary provide alternate wintering site to the migratory water fowls. But during the study it was observed that the bird's population decline with the time, it could be due to development activity in surrounding area and vehicular moment on the periphery. In addition, migratory birds were also distributed among the nearby water bodies of village's ponds. Govt. of India, Ministry of Environment and Forest also proposed to declare the area up to five kilometers from the boundary of the protected area of Bhindawas wildlife sanctuary as an eco-sensitive zone. The baseline information in the form of floristic and avian faunal inventory may be highly useful for future ecological work such as rehabilitation and conservation of the flora and fauna of the area.

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