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Phytosociological study of plant communities in Son Ghariyal Wetland and it's environs of Sidhi district (M.P.) India

Umesh Kumar Mishra and Rajshree Pandey

Abstract
The aim of this study was to perform a phytosociological survey of the plant community present in the Son Ghariyal wetland of Sidhi district Madhya Pradesh. The survey was carried out from January 2023 to December 2023. The evaluate parameter were given by the calculation of frequency, density, abundance, related frequency, related density, related abundance and importance value index (IVI) for each species. In this survey total 102 species were identified, which placed into 82 genera of 38 families. Maximum importance value index (IVI) was showed in *Tephrosia purpurea* (L.) Pers. with 8.64 and highest importance value index (IVI) was noted in Asteraceae family with 42.78%. Also recorded plant species was recorded by their scientific name, local name, family, habit and habitat.

Keywords: Phytosociology, diversity, son Ghariyal wetland, Sidhi district

Introduction
Wetland is the most productive ecosystems in the world. Several works have been done on the aquatic macrophytes and phytosociology in different freshwater bodies of India (Dabgar, 2006; Kar, D. and Barbhaiya, 2007; Pandit *et al.* 2010; Prajapati and Salim, 2019a; Patel and Dubey, 2020 and Patel, 2002) [1-6]. Wetlands are important for biodiversity conservation as some of the most endangered species survive on them, especially migratory birds. Wetlands are also vital for the maintenance of ground water at an optimum level.
The objectives of the present study are to understand the floristic diversity and phytosociology analysis of macrophytes in the Son Ghariyal wetland.

Materials and Methods
The Son Ghariyal sanctuary area lies longitude 81°20' and 82°50' E and latitude 24°15' and 25°40' N. This river is a major tributary of the river Ganges which originates from Sonmuda in Amarakantk, Anuppur district (Madhya Pradesh) The river flows through M.P. and U.P. and joints the Ganges in Bihar.
The course of the rivers of the Sidhi district is towards north and hence the slope of the district in general is towards north side. Sidhi district is largely hilly with an undulated land in which the height of the land above the sea level varies from 243.68-609.00 metres.
The phytosociological survey of the plant community along the Son Ghariyal wetland and its environs was carried out between the months of January 2023 to December 2023. Vegetation analysis along wetland was carried out by using 1m × 1m quadrate size and a total number of 30 quadrates were drawn in wetland stands. The quadrates were laid down randomly for plant species. The plant species observed during the study were identified with the help of local and regional flora (Cooke, 1908) [7] as well as following the Angiosperm Phylogeny Group- IV (APG-IV) system. The size and the number of quadrates were determined following Mishra (1968) [8] and Kershaw (1973) [9].
In addition to these calculations, the values of frequency, density abundance, relative frequency, relative density and relative abundance were also quantified, with which it was possible to estimate the importance value index (IVI) for each species. For the calculations of such parameters, the equations below were used (Cunha *et al*., 2014) [10].

$$\text{Frequency (F)} = \frac{\text{Total No. of Plots with the species}}{\text{No. of total of plots used}} \times 100$$

$$\text{Density (D)} = \frac{\text{Total No. of individuals per species}}{\text{Total sample area}}$$

$$\text{Abundance (Ab)} = \frac{\text{Total No. of individuals per species}}{\text{No. of total plots containing species}}$$

$$\text{Relative Frequency (RF)} = \frac{\text{Frequency of individuals the species}}{\text{Overall frequency}} \times 100$$

$$\text{Relative Density (RD)} = \frac{\text{Density of individuals the species}}{\text{Total density}} \times 100$$

$$\text{Relative Abundance (RAb)} = \frac{\text{Abundance of individuals the species}}{\text{Overall abundance}} \times 100$$

Importance Value Index (IVI) = RF + RD + RAb

Results and Discussions

A total of 102 species were recorded which represented 82 genera belonging to 38 families, which represent 76 Dicotyledonea species and 26 species of Monocotyledonea from the study area. Among, 102 species, 4 were tree species with 2 genera belonging to 2 families, 4 were twiner species with 2 genera belonging to 1 family, 1 climber species belonging to 1 genus and 1 family while 4 were shrub species with 3 genera belonging to 3 families and 89 herb species represented 74 families and 33 genera. The dominant family was Asteraceae with 12 species. Also 96 terrestrial species recorded belonging to 77 genera and 32 families while 6 aquatic species belonging to 6 genera and 5 families (Table 1).

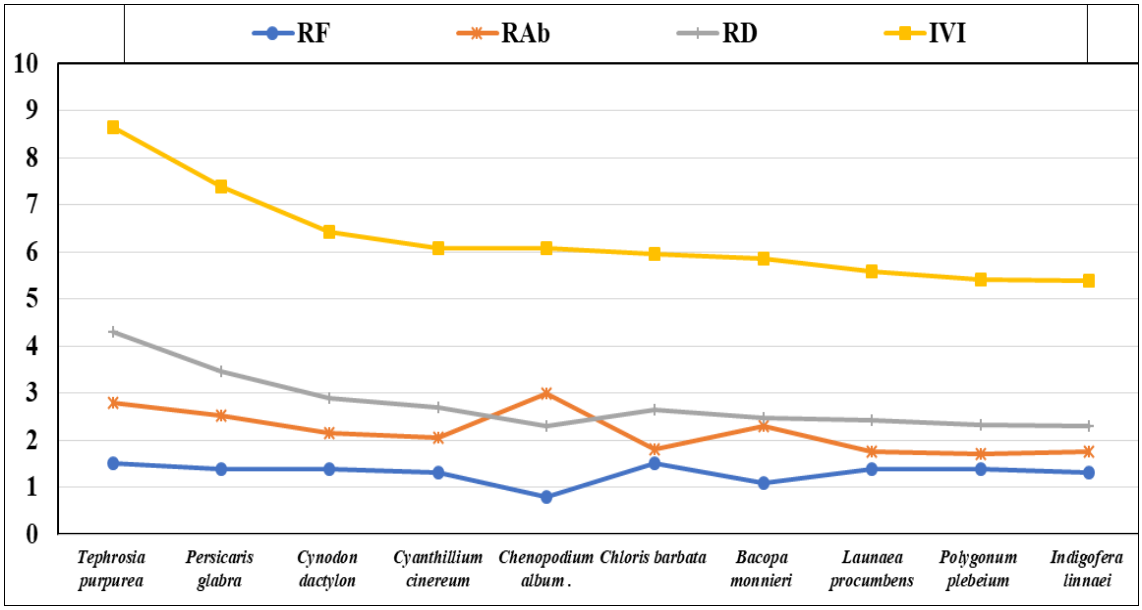

Fig 1: Graph analysis of top ten comperative dominant species within study area.

The highest density was recorded for *Tephrosia purpurea* (L.) Pers. with (5.20) density while the lowest density was observed for *Triumfetta rhomboidea* Jacq with 0.03 density. The highest frequency (86.70%) was observed for *Dinebra retroflexa* (Vahl.) Panz and the lowest frequency (3.35%) was recorded for *Luffa acutangula Var. amara* (Roxb.) C.B. Clarke. Urban. The dominant species was found *Tephrosia purpurea* (L.) Pers. with IVI (8.64%) while the least dominant species was found *Acacia senegal* (L.) Willd. with IVI (0.36%) (Figure 1 & Table 1).

Table 1: Phytosociological status of collected species of Son Ghariyal wetland

S. No.	Scientific Name	Family	Habit	Habitat	F (%)	Ab	D	RF	RAb	RD	IVI
1.	*Tephrosia purpurea* (L.) Pers	Papilionaceae	H	Terr	83.45	6.08	5.20	1.52	2.81	4.31	8.64
2.	*Persicaris glabra* (Willd.) M. Geomz.	Polygalaceae	H	Terr	76.70	5.45	4.18	1.39	2.52	3.46	7.38
3.	*Cynodon dactylon* (L.) Pers.	Poaceae	H	Terr	76.64	4.65	3.50	1.39	2.15	2.90	6.44
4.	*Cyanthillium cinereum* (L.) H. Rob.	Asteraceae	H	Terr	73.30	4.44	3.26	1.33	2.06	2.70	6.09
5.	*Chenopodium album* L.	Amaranthaceae	H	Terr	43.30	6.45	2.78	0.79	2.99	2.30	6.08
6.	*Chloris barbata* Sw.	Poaceae	H	Terr	83.32	3.90	3.20	1.51	1.81	2.65	5.97
7.	*Bacopa monnieri* (L.) Wettst.	Plantaginaceae	S	Terr	60.02	4.96	2.98	1.09	2.30	2.47	5.86
8.	*Launaea procumbens* (Roxb.) Ramayya. & Rajgopal.	Asteraceae	H	Terr	76.68	3.82	2.94	1.39	1.77	2.44	5.60
9.	*Polygonum plebeium* R. Br.	Polygalaceae	H	Terr	76.64	3.70	2.80	1.39	1.71	2.32	5.42
10.	*Indigofera linnaei* Ali.	Papilionaceae	H	Terr	73.40	3.80	2.78	1.33	1.76	2.30	5.40
11.	*Melilotus indicus* (L.) All.	Papilionaceae	H	Terr	83.44	3.22	2.66	1.52	1.49	2.20	5.21
12.	*Anagallis arvensis* L.	Primulaceae	H	Terr	63.32	4.02	2.50	1.15	1.86	2.07	5.08
13.	*Grangea maderaspatana* (L.) Poir.	Asteraceae	H	Terr	76.62	3.16	2.45	1.39	1.46	2.03	4.88
14.	*Tridax procumbence* (L.) L.	Asteraceae	H	Terr	83.30	2.65	2.22	1.51	1.23	1.84	4.58
15.	*Dentella repens* J.R. Forst. & G. Forst.	Rubiaceae	H	Terr	46.70	4.40	2.02	0.85	2.04	1.67	4.56
16.	*Acanthospermum hispidum* DC.	Asteraceae	H	Terr	63.42	3.40	2.16	1.15	1.57	1.79	4.52
17.	*Periploca aphylla* Decne.	Apocynaceae	H	Terr	83.30	2.42	2.06	1.51	1.12	1.71	4.34
18.	*Phyla nodiflora* (L.) Greene.	Verbenaceae	H	Terr	83.80	3.72	1.16	1.52	1.72	0.96	4.21
19.	*Cyperus rotundus* L.	Cyperaceae	H	Terr	78.00	2.44	1.96	1.42	1.13	1.62	4.17
20.	*Heliotropium supinum* L.	Boraginaceae	H	Terr	63.32	2.94	1.86	1.15	1.36	1.54	4.05
21.	*Leucas aspera* (Willd.) Link.	Lamiaceae	H	Aqu	40.04	4.10	1.66	0.73	1.90	1.38	4.00

22.	*Cyperus haspan* L.	Cyperaceae	H	Terr	40.02	4.10	1.62	0.73	1.90	1.34	3.97
23.	*Boerhavia diffusa* L.	Nyctaginaceae	H	Terr	73.31	2.42	1.78	1.33	1.12	1.47	3.93
24.	*Cyperus difformis* L.	Cyperaceae	H	Terr	30.12	4.66	1.46	0.55	2.16	1.21	3.91
25.	*Euphorbia hirta* L.	Euphorbiaceae	H	Terr	40.02	3.78	1.54	0.73	1.75	1.28	3.75
26.	*Amaranthus viridis* L.	Amaranthaceae	H	Terr	43.30	3.60	1.50	0.79	1.67	1.24	3.70
27.	*Euphorbia prostrata* Aiton.	Euphorbiaceae	H	Terr	76.62	2.08	1.60	1.39	0.96	1.33	3.68
28.	*Trichodesma indicum* R. Br.	Boraginaceae	H	Terr	83.82	1.85	1.54	1.52	0.86	1.28	3.65
29.	*Ludwigia perrenis* L.	Onagraceae	H	Terr	80.04	1.94	1.55	1.45	0.90	1.28	3.64
30.	*Commelina benghalensis* L.	Commelinaceae	H	Terr	78.00	1.98	1.56	1.42	0.92	1.29	3.63
31.	*Fimbristylis quinquangularis* (Vahl) Kunth.	Cyperaceae	H	Terr	76.62	1.98	1.52	1.39	0.92	1.26	3.57
32.	*Parthenium hysterophorus* L.	Asteraceae	H	Terr	73.34	2.02	1.54	1.33	0.94	1.28	3.54
33.	*Dinebra retroflexa* (Vahl.) Panz.	Poaceae	H	Terr	86.70	1.64	1.42	1.57	0.76	1.18	3.51
34.	*Alternanthera sessilis* (L.) R. Br. ex DC.	Amaranthaceae	H	Terr	82.04	1.72	1.40	1.49	0.80	1.16	3.45
35.	*Cyperus odoratus* L.	Cyperaceae	H	Terr	78.00	1.79	1.44	1.42	0.83	1.19	3.44
36.	*Spaeranthus indicus* L.	Asteraceae	H	Terr	38.02	3.40	1.38	0.69	1.57	1.14	3.41
37.	*Achyranthus aspera* L.var. aspera	Amaranthaceae	H	Aqu	73.36	1.92	1.42	1.33	0.89	1.18	3.40
38.	*Trianthema portulacastum* L.	Aizoaceae	H	Terr	76.62	1.80	1.40	1.39	0.83	1.16	3.38
39.	*Fimbristylis dichotoma* (L.) Vahl.	Cyperaceae	H	Terr	40.06	3.28	1.26	0.73	1.52	1.04	3.29
40.	*Dactyloctenium aegyptium* (L.) Willd.	Poaceae	H	Terr	83.30	1.52	1.28	1.51	0.70	1.06	3.28
41.	*Crotalaria burhia* Benth.-Ham.	Papilionaceae	H	Terr	83.30	1.50	1.28	1.51	0.69	1.06	3.27
42.	*Acalypha indica* L.	Euphorbiaceae	H	Terr	73.31	1.75	1.30	1.33	0.81	1.08	3.22
43.	*Crotalaria medicaginea* Lam.	Papilionaceae	H	Terr	75.68	1.65	1.30	1.37	0.76	1.08	3.22
44.	*Dactyloctenium scindicum* Boiss.	Cyperaceae	H	Terr	36.65	3.25	1.22	0.67	1.50	1.01	3.18
45.	*Pentanema indicum* (L.) Ling.	Asteraceae	H	Terr	38.04	3.06	1.24	0.69	1.42	1.03	3.13
46.	*Argemone mexicana* L.	Papaveraceae	H	Terr	82.66	1.38	1.18	1.50	0.64	0.98	3.12
47.	*Digera muricata* (L.) Mart	Amaranthaceae	H	Terr	73.31	1.65	1.22	1.33	0.76	1.01	3.11
48.	*Eleusine indica* (L.) Gaerth.	Poaceae	H	Terr	58.08	2.02	1.22	1.05	0.94	1.01	3.00
49.	*Commelina diffusa* Burm. f.	Commelinaceae	H	Terr	73.36	1.54	1.12	1.33	0.71	0.93	2.97
50.	*Solanum virginianum* L.	Solanaceae	H	Terr	66.65	1.68	1.14	1.21	0.78	0.94	2.93
51.	*Fimbristylis bisumbellata* (Forssk.) Bubani.	Cyperaceae	H	Terr	66.70	1.68	1.12	1.21	0.78	0.93	2.92
52.	*Evolvulus alsinoides* (L.) L.	Convolvulaceae	Twin	Terr	76.64	1.36	1.05	1.39	0.63	0.87	2.89
53.	*Justicia diffusa* Willd.	Acanthaceae	H	Terr	53.30	2.12	1.10	0.97	0.98	0.91	2.86
54.	*Echinochloa colona* (L.) Link	Poaceae	H	Terr	73.30	1.44	1.02	1.33	0.67	0.85	2.84
55.	*Apluda mutica* L.	Poaceae	H	Terr	39.50	2.50	1.05	0.72	1.16	0.87	2.74
56.	*Tribulus terrestris* L.	Zygophyllaceae	H	Terr	82.88	0.85	0.72	1.51	0.39	0.60	2.50
57.	*Rumex dentatus* L.	Polygalaceae	H	Terr	56.62	1.58	0.88	1.03	0.73	0.73	2.49
58.	*Hemigraphis latebrosa* (Heyne ex Roth) Nees var. *heyneana* Bremek.	Acanthaceae	H	Terr	60.00	1.42	0.88	1.09	0.66	0.73	2.48
59.	*Polygala arvensis* Willd.	Polygalaceae	H	Terr	71.06	0.96	0.70	1.29	0.44	0.58	2.31
60.	*Sida cordata* (Burm.f.) Borss. Waalk	Malvaceae	H	Terr	60.57	1.24	0.72	1.10	0.57	0.60	2.27
61.	*Senna auriculata* (L.) Roxb.	Caesalpinaceae	S	Terr	36.62	2.08	0.76	0.67	0.96	0.63	2.26
62.	*Digitaria ciliaris* (Retz.) Koeler	Poaceae	H	Terr	76.62	0.76	0.58	1.39	0.35	0.48	2.22
63.	*Bergia ammanniodes* Roxb. & Roth.	Elatinaceae	H	Terr	66.64	0.96	0.65	1.21	0.44	0.54	2.19
64.	*Datura metel* L.	Solanaceae	H	Terr	63.35	1.02	0.66	1.15	0.47	0.55	2.17
65.	*Chenopodium murale* L.	Amaranthaceae	H	Terr	62.86	1.00	0.64	1.14	0.46	0.53	2.13
66.	*Erigeron bonariensis* L	Asteraceae	H	Terr	63.40	0.96	0.64	1.15	0.44	0.53	2.13
67.	*Tetrapogon tenellus* (Roxb.) Chiov.	Poaceae	H	Terr	43.30	1.60	0.72	0.79	0.74	0.60	2.13
68.	*Typha angustifolia* L.	Thyphaceae	H	Terr	26.68	2.36	0.62	0.48	1.09	0.51	2.09
69.	*Xanthium stumarium* L.	Asteraceae	H	Terr	73.29	0.69	0.52	1.33	0.32	0.43	2.08
70.	*Datura stramonium* L.	Solanaceae	H	Terr	36.70	1.80	0.68	0.67	0.83	0.56	2.06
71.	*Echinops echinatus* Roxb.	Asteraceae	H	Terr	26.69	2.22	0.58	0.48	1.03	0.48	1.99
72.	*Melanocenchris jacquemontii* Jaub. & Spach.	Poaceae	H	Terr	62.65	0.84	0.48	1.14	0.39	0.40	1.93
73.	*Hydrilla verticillata* (L.f.) Royle.	Hydrocharitaceae	H	Aqu	16.74	2.45	0.46	0.30	1.13	0.38	1.82
74.	*Cleome viscosa* L.	Cleomaceae	H	Terr	49.01	1.12	0.41	0.89	0.52	0.34	1.75
75.	*Ipomoea batatas* (L.) Lam.	Convolvulaceae	S	Terr	60.02	0.70	0.38	1.09	0.32	0.31	1.73
76.	*Calotropis procera* (Aiton) Dryand.	Apocynaceae	H	Terr	26.70	1.80	0.48	0.48	0.83	0.40	1.72
77.	*Vallisnaria spirallis* L.	Hydrocharitaceae	H	Aqu	16.72	2.22	0.38	0.30	1.03	0.31	1.65
78.	*Enicostema axillare* (Poir. ex Lam.) A. Raynal.	Gentianaceae	H	Terr	43.32	1.02	0.45	0.79	0.47	0.37	1.63
79.	*Pilea microphylla* (L.) Lielm.	Utricaceae	H	Aqu	53.30	0.74	0.38	0.97	0.34	0.31	1.63
80.	*Senna occidentalis* (L.) Link.	Caesalpinaceae	S	Terr	50.10	0.74	0.36	0.91	0.34	0.30	1.55
81.	*Ammannia octandra* L. f.	Lythraceae	H	Terr	26.70	1.48	0.38	0.48	0.69	0.31	1.48
82.	*Cleome gynandra* L.	Cleomaceae	H	Terr	26.54	1.44	0.36	0.48	0.67	0.30	1.45
83.	*Dicliptera verticillata* (Forssk.) C. Chr.	Acanthaceae	H	Terr	46.64	0.65	0.34	0.85	0.30	0.28	1.43
84.	*Ipomoea pes-tigridis* L.	Convolvulaceae	Twin	Terr	53.36	0.45	0.24	0.97	0.21	0.20	1.38
85.	*Convolvulus microphyllus* Sieb ex Spreng.	Convolvulaceae	H	Terr	53.36	0.40	0.22	0.97	0.19	0.18	1.34
86.	*Physalis angulata* L.	Solanaceae	H	Terr	50.06	0.46	0.24	0.91	0.21	0.20	1.32
87.	*Chrozophora tinctoria* (L.) A Juss.	Euphorbiaceae	H	Terr	13.36	1.78	0.24	0.24	0.82	0.20	1.27
88.	*Polygala erioptera* DC.	Polygalaceae	H	Terr	48.02	0.44	0.24	0.87	0.20	0.20	1.27
89.	*Acacia farnesiana* (L.) Willd.	Mimosaceae	T	Terr	6.65	2.02	0.14	0.12	0.94	0.12	1.17
90.	*Blumea lacera* (Burm. f.) DC.	Asteraceae	H	Terr	20.08	1.18	0.26	0.36	0.55	0.22	1.13
91.	*Stuckenia pectinata* (L.) Borner.	Potamogetonaceae	H	Aqu	6.70	1.88	0.14	0.12	0.87	0.12	1.11
92.	*Aeschynomene indica* L.	Papilionaceae	H	Terr	26.68	0.89	0.24	0.48	0.41	0.20	1.10
93.	*Ipomoea fistulosa* Mart. ex Choisy.	Convolvulaceae	Twin	Terr	40.00	0.44	0.18	0.73	0.20	0.15	1.08
94.	*Acacia jacquemontii* Benth.	Mimosaceae	T	Terr	3.36	2.02	0.06	0.06	0.94	0.05	1.05

95.	*Luffa acutangula Var. amara* (Roxb.) C.B. Clarke.	Cucarbetaceae	Clim.	Terr	3.35	2.03	0.06	0.06	0.94	0.05	1.05
96.	*Merremia aegyptia* (L.) Urban.	Convolvulaceae	H	Terr	3.36	1.98	0.08	0.06	0.92	0.07	1.04
97.	*Cyperus cyperoides* (L.) Kuntze.	Cyperaceae	H	Terr	40.04	0.26	0.12	0.73	0.12	0.10	0.95
98.	*Azadirachta indica* A. Juss.	Meliaceae	T	Terr	10.00	1.00	0.11	0.18	0.46	0.09	0.74
99.	*Tamarix aegyptiaca* Bertol.	Tamaricaceae	H	Terr	6.68	1.00	0.09	0.12	0.46	0.07	0.66
100.	*Ipomoea turbinata* Lag. ex Choisy.	Convolvulaceae	Twin	Terr	6.62	0.48	0.04	0.12	0.22	0.03	0.38
101.	*Triumfetta rhomboidea* Jacq.	Malvaceae	H	Terr	6.65	0.51	0.03	0.12	0.24	0.02	0.38
102.	*Acacia senegal* (L.) Willd.	Mimosaceae	T	Terr	10.08	0.32	0.04	0.18	0.15	0.03	0.36

Conclusion

The phytosociological survey revealed that Asteraceae family had the highest numbers of individuals it was followed by Poaceae (10 Species), Cyperaceae (09 Species), Convolvulaceae (07 Species) and Papilionaceae (06 Species) in Son Ghariyal wetland and its environs. Maximum species was recorded in habit of herb with 89 species it was followed by 4 tree species, 4 twiner species, 4 shrub species and 1 climber species. Regarding IVI, all species seems to be well distributed showing good adaptability to the local biological conditions.

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