

## Angiospermic diversity of baghar beel wetland, Katihar, North Bihar, India

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### Abstract

Wetlands are among the most productive ecosystems in the world. Wetlands support both aquatic and terrestrial species. Angiosperms play an important role in the wetland ecosystem. The present study deal with the Floristic studies of angiosperms growing in and around of Baghar beel wetland, Katihar, North Bihar, India. It is a 'cut-off meanders' (Inland wetlands – Natural) type of wetland, a part of Trans–Gangetic plains of land located in Verihahi village, Manihari block of Katihar in North Bihar. It is flanked by the river Mahananda to the North–East and Ganga to the South. During floods, this wetland is confluenced with the Mahananda and Ganga rivers. The investigation was carried out during 2017–2021. Plant specimens were collected and processed for preservation and identification following standard taxonomic methods. A total of 162 angiosperms species belonging to 120 genera and 44 families are recorded from this wetland. Dicotyledons and monocotyledons comprise 99 species, 74 genera, 34 families and 63 species, 43 genera, 10 families respectively. Dicotyledons and monocotyledons represent 61% and 39% of the total angiosperm species respectively. Poaceae (25 species) is the most dominant family with high species representation, followed by Cyperaceae (15 species), Fabaceae (11 species) and Amaranthaceae (10 species). As for as habit is concerned, it was found that herbs, shrubs, trees and climbers occupies 86%, 6%, 1% and 7% of the total angiospermic species respectively. It is also observed that the extremely invasive species such as *Mikania micrantha* Kunth, *Xanthium strumarium* L., *Lantana camara* L., *Lippia alba* (Mill.) N.E.Br. ex Britton & P. Wilson, *Pontederia crassipes* Mart. and *Pontederia hastata* L. pose significant risks to this wetland.

**Keywords:** Baghar beel wetland, Angiosperm diversity, Katihar, North Bihar.

### Introduction

Wetlands are among the most productive ecosystems in the world (Ghermandi *et al.*, 2008) <sup>[15]</sup>, comparable to rain forests and coral reefs (Chinnadurai *et al.*, 2006) <sup>[8]</sup>. Wetland ecosystems consist a varied collection of aquatic and terrestrial species (Jeppesen *et al.*, 1997) <sup>[17]</sup>. Wetlands may support both aquatic and terrestrial species (Chowdhury & Das, 2013) <sup>[9]</sup>. Plants growing in wetlands are called 'Hydrophytes' (Reed, 1988; Sipple, 1988; Tinner, 1991) <sup>[28, 29]</sup>. Aquatic plants are important components of wetland ecosystem, that are generally herbaceous or very occasionally shrubby in nature, they grow very fast and interfere to the human activities in many ways (Raja *et al.*, 2015) <sup>[27]</sup>.

Duthie (1903-1929) <sup>[14]</sup>, Agharkar (1923) <sup>[2]</sup>, Almedia (1941 & 1942) <sup>[4, 5]</sup>, Deb (1976) <sup>[13]</sup>, Subramanyam (1962) <sup>[30]</sup>, Cook (1990) <sup>[10]</sup>, Cook (1996) <sup>[11]</sup> etc. have studied on the aquatic and wetland vascular plants of India. Major works on different plant diversity in wetlands of Bihar were carried out by Paul (1973) <sup>[25]</sup>, Majumdar *et al.* (1988) <sup>[24]</sup>, Kumar & Choudhary (2010) <sup>[20]</sup>, Bhattacharya *et al.* (2011) <sup>[6]</sup>, Adhishwar & Choudhary (2013) <sup>[1]</sup>, Kumari & Kumar (2013) <sup>[23]</sup>, Alam (2014) <sup>[3]</sup>, Jha *et al.* (2014) <sup>[19]</sup>, Das & Maurya (2015) <sup>[12]</sup>, Jha (2015) <sup>[18]</sup>, Kumar *et al.* (2016) <sup>[21]</sup>, Kumar *et al.* (2020) <sup>[22]</sup>. The present study is an attempt to assess the state of existing angiospermic diversity found in

and around of Baghar beel wetland of Katihar district in North Bihar.

**Study site:** Baghar beel wetland (25.359097N, 87.661167E) is a 'cut-off meanders' (Inland wetlands – Natural) type of wetland, a part of trans-Gangetic plains of land located in Verihahi village, Manihari block of Katihar in Bihar. It is flanked by the river Mahananda to the North-East and Ganga river to the South. During floods, this wetland is confluenced with the Mahananda and Ganga rivers.

### Materials and Methods

Field surveys were undertaken periodically during November, 2017 to August, 2021. The collected plant samples were identified using national and regional floras and were compared with authentic specimens deposited at CAL. The Angiosperm Phylogeny Group IV (Chase *et al.*, 2016) <sup>[7]</sup> system of classification is followed in the present documentation. The nomenclature of plants has been updated using Plants of the World Online (2021) <sup>[26]</sup> and International Plant Name Index (2021) <sup>[16]</sup>.

### Results and Discussion

A total of 162 angiosperms species belonging to 117 genera and 44 families are recorded (Table: 1) from this wetland.

**Table 1:** List of Angiosperms recorded from Baghar Beel wetland, Katihar district

Sl no.	Plant names	Family	Flowering & Fruiting Time	Habit
1.	<i>Euryale ferox</i> Salisb.	Nymphaeaceae	May–December	Herb
2.	<i>Nymphaea nouchali</i> Burm.f.		August–December	Herb
3.	<i>Nymphaea pubescens</i> Willd.		September–December	Herb
4.	<i>Nymphaea rubra</i> Roxb. ex Andrews		July–January	Herb

5.	<i>Colocasia esculenta</i> (L.) Schott	Araceae	August–December	Herb
6.	<i>Lemna minor</i> L.		April–October	Herb
7.	<i>Pistia stratiotes</i> L.		May–December	Herb
8.	<i>Spirodela polyrrhiza</i> (L.) Schleid.		February–April	Herb
9.	<i>Caldesia parnassifolia</i> (L.) Parl.	Alismataceae	May–October	Herb
10.	<i>Sagittaria sagittifolia</i> L.		October–April	Herb
11.	<i>Hydrilla verticillata</i> (L.f.) Royle	Hydrocharitaceae	April–December	Herb
12.	<i>Hydrocharis dubia</i> (Blume) Backer		December–February	Herb
13.	<i>Ottelia alismoides</i> (L.) Pers.		November–April	Herb
14.	<i>Vallisneria spiralis</i> L.		January–May	Herb
15.	<i>Aponogeton undulatus</i> Roxb.	Aponogetonaceae	August–February	Herb
16.	<i>Potamogeton crispus</i> L.	Potamogetonaceae	November–April	Herb
17.	<i>Potamogeton nodosus</i> Poir.		July–September	Herb
18.	<i>Commelina benghalensis</i> L.	Commelinaceae	June–November	Herb
19.	<i>Commelina diffusa</i> Burm.f.		August–November	Herb
20.	<i>Cyanotis axillaris</i> (L.) D. Don ex Sweet		August–October	Herb
21.	<i>Murdannia spirata</i> (L.) G. Brückn.		September–January	Herb
22.	<i>Murdannia nudiflora</i> (L.) Brenan		August–November	Herb
23.	<i>Pontederia crassipes</i> Mart.	Pontederiaceae	May–September	Herb
24.	<i>Pontederia hastata</i> L.		July–October	Herb
25.	<i>Pontederia vaginalis</i> Burm.f.		July–November	Herb
26.	<i>Typha angustifolia</i> L.	Typhaceae	May–June	Herb
27.	<i>Typha elephantina</i> Roxb.		July–September	Herb
28.	<i>Bulbostylis barbata</i> (Rottb.) C.B. Clarke	Cyperaceae	July–December	Herb
29.	<i>Cyperus alopecuroides</i> Rottb.		July–March	Herb
30.	<i>Cyperus articulatus</i> L.		Throughout the year	Herb
31.	<i>Cyperus compressus</i> L.		July–December	Herb
32.	<i>Cyperus difformis</i> L.		August–December	Herb
33.	<i>Cyperus distans</i> L.f.		August–October	Herb
34.	<i>Cyperus iria</i> L.		August–January	Herb
35.	<i>Cyperus rotundus</i> L.		July–December	Herb
36.	<i>Eleocharis dulcis</i> (Burm.f.) Trin. ex Hensch.		October–March	Herb
37.	<i>Eleocharis retroflexa</i> (Poir.) Urb.		September–December	Herb
38.	<i>Fimbristylis aestivalis</i> Vahl		September–November	Herb
39.	<i>Fimbristylis cymosa</i> R.Br.		July–October	Herb
40.	<i>Fimbristylis littoralis</i> Gaud.		August–October	Herb
41.	<i>Fuirena ciliaris</i> (L.) Roxb.		October–January	Herb
42.	<i>Schoenoplectiella articulata</i> (L.) Lye		July–December	Herb
43.	<i>Apluda mutica</i> L.	Poaceae	October–January	Herb
44.	<i>Coix lacryma-jobi</i> L.		September–February	Herb
45.	<i>Chrysopogon aciculatus</i> (Retz.) Trin.		Throughout the year	Herb
46.	<i>Chrysopogon zizanioides</i> (L.) Roberty		September–February	Herb
47.	<i>Cynodon dactylon</i> (L.) Pers.		Throughout the year	Herb
48.	<i>Dactyloctenium aegyptium</i> (L.) Willd.		June–October	Herb
49.	<i>Desmostachya bipinnata</i> (L.) Stapf		August–September	Herb
50.	<i>Dichanthium annulatum</i> (Forssk.) Stapf		August–November	Herb
51.	<i>Digitaria ciliaris</i> (Retz.) Koeler		August–November	Herb
52.	<i>Digitaria sanguinalis</i> (L.) Scop.		September–November	Herb
53.	<i>Echinochloa colona</i> (L.) Link		Throughout the year	Herb
54.	<i>Echinochloa stagnina</i> (Retz.) P. Beauv.		June–March	Herb
55.	<i>Eleusine indica</i> (L.) Gaertn.		June–November	Herb
56.	<i>Hygroryza aristata</i> (Retz.) Nees ex Wight & Arn.		August–October	Herb
57.	<i>Hymenachne amplexicaulis</i> (Rudge) Nees		September–November	Herb
58.	<i>Imperata cylindrica</i> (L.) Raeusch.		August–October	Herb
59.	<i>Leersia hexandra</i> Sw.		June–March	Herb
60.	<i>Leptochloa chinensis</i> (L.) Nees		July–December	Herb
61.	<i>Oryza rufipogon</i> Griff.		October–March	Herb
62.	<i>Oryza sativa</i> L.		September–October	Herb
63.	<i>Panicum repens</i> L.		Throughout the year	Herb
64.	<i>Paspalum distichum</i> L.		August–January	Herb
65.	<i>Paspalum scrobiculatum</i> L.		August–November	Herb
66.	<i>Phragmites karka</i> (Retz.) Trin. ex Steud.		June–March	Herb
67.	<i>Saccharum spontaneum</i> L.		September–December	Herb
68.	<i>Ceratophyllum demersum</i> L.	Ceratophyllaceae	June–September	Herb
69.	<i>Ranunculus sceleratus</i> L.	Ranunculaceae	December–March	Herb
70.	<i>Nelumbo nucifera</i> Gaertn.	Nelumbonaceae	March–December	Herb
71.	<i>Aeschynomene aspera</i> L.	Fabaceae	September–December	Shrub
72.	<i>Caesalpinia bonduc</i> (L.) Roxb.		August–April	Shrub

73.	<i>Cicer arietinum</i> L.		July–October	Herb
74.	<i>Crotalaria pallida</i> Aiton		September–March	Herb
75.	<i>lathyrus sativus</i> L.		June–September	Herb
76.	<i>Mimosa pudica</i> L.		August–March	Herb
77.	<i>Neptunia oleracea</i> Lour.		September–April	Herb
78.	<i>Senna occidentalis</i> (L.) Link		August–January	Herb
79.	<i>Senna sophera</i> (L.) Roxb.		August–December	Herb
80.	<i>Senna tora</i> (L.) Roxb.		August–December	Herb
81.	<i>Sesbania sesban</i> (L.) Merr.		August–March	Shrub
82.	<i>Cannabis sativa</i> L.	Cannabaceae	March–November	Herb
83.	<i>Ficus hispida</i> L.f.	Moraceae	January–March	Tree
84.	<i>Ficus heterophylla</i> L.f.		January–May	Herb
85.	<i>Citrullus lanatus</i> (Thunb.) Matsum. & Nakai	Cucurbitaceae	March–July	Climber
86.	<i>Coccinia grandis</i> (L.) Voigt		December–June	Climber
87.	<i>Cucumis melo</i> L.		March–September	Climber
88.	<i>Luffa aegyptiaca</i> Mill.		July–September	Climber
89.	<i>Luffa echinata</i> Roxb.		September–January	Climber
90.	<i>Trichosanthes cucumerina</i> L.		August–January	Climber
91.	<i>Biophytum sensitivum</i> (L.) DC.	Oxalidaceae	October–January	Herb
92.	<i>Oxalis corniculata</i> L.		October–January	Herb
93.	<i>Passiflora foetida</i> L.	Passifloriaceae	March–May	Climber
94.	<i>Acalypha indica</i> L.	Euphorbiaceae	August–February	Herb
95.	<i>Euphorbia hirta</i> L.		August–October	Herb
96.	<i>Euphorbia hypericifolia</i> L.		July–November	Herb
97.	<i>Jatropha gossypifolia</i> L.		April–September	Shrub
98.	<i>Mallotus nudiflorus</i> (L.) Kulju & Welzen		February–August	Tree
99.	<i>Phyllanthus niruri</i> L.		July–March	Herb
100.	<i>Ricinus communis</i> L.		September–June	Shrub
101.	<i>Ammannia baccifera</i> L.	Lythraceae	November–April	Herb
102.	<i>Ludwigia adscendens</i> (L.) H. Hara	Onagraceae	June–September	Herb
103.	<i>Ludwigia hyssopifolia</i> (G. Don) Exell		October–January	Herb
104.	<i>Ludwigia perennis</i> L.		October–December	Herb
105.	<i>Cardiospermum halicacabum</i> L.	Sapindaceae	March–November	Climber
106.	<i>Glycosmis pentaphylla</i> (Retz.) DC.	Rutaceae	September–February	Shrub
107.	<i>Abutilon indicum</i> (L.) Sweet	Malvaceae	August–April	Herb
108.	<i>Malachra capitata</i> (L.) L.		April–December	Herb
109.	<i>Sida cordata</i> (Burm.f.) Borss. Waalk.		June–November	Herb
110.	<i>Sida cordifolia</i> L.		Throughout the year	Herb
111.	<i>Sida rhombifolia</i> L.		July–December	Herb
112.	<i>Persicaria barbata</i> (L.) H. Hara	Polygonaceae	May–December	Herb
113.	<i>Persicaria glabra</i> (Willd.) M.Gómez		September–February	Herb
114.	<i>Persicaria hydropiper</i> (L.) Delarbre		September–January	Herb
115.	<i>Persicaria orientalis</i> (L.) Spach		August–October	Herb
116.	<i>Polygonum plebeium</i> R.Br.		November–June	Herb
117.	<i>Achyranthes aspera</i> L.	Amaranthaceae	August–February	Herb
118.	<i>Aerva sanguinolenta</i> (L.) Blume		April–October	Herb
119.	<i>Alternanthera paronychioides</i> A.St.-Hil.		Throughout the year	Herb
120.	<i>Alternanthera philoxeroides</i> (Mart.) Griseb.		August–October	Herb
121.	<i>Alternanthera sessilis</i> (L.) R.Br. ex DC.		July–March	Herb
122.	<i>Amaranthus spinosus</i> L.		Almost throughout the year.	Herb
123.	<i>Amaranthus viridis</i> L.		August–May	Herb
124.	<i>Celosia argentea</i> L.		August–December	Herb
125.	<i>Digera muricata</i> (L.) Mart.		August–December	Herb
126.	<i>Gomphrena celosioides</i> Mart.		July–December	Herb
127.	<i>Trianthema portulacastrum</i> L.	Aizoaceae	July–December	Herb
128.	<i>Boerhavia diffusa</i> L.	Nyctaginaceae	June–December	Herb
129.	<i>Glinus lotoides</i> L.	Molluginaceae	February–April	Herb
130.	<i>Glinus oppositifolius</i> (L.) Aug.DC.		Throughout the year	Herb
131.	<i>Portulaca oleracea</i> L.	Portulacaceae	September–December	Herb
132.	<i>Dentella repens</i> (L.) J.R. Forst. & G. Forst.	Rubiaceae	January–July	Herb
133.	<i>Oldenlandia corymbosa</i> L.		September–April	Herb
134.	<i>Calotropis gigantea</i> (L.) W.T. Aiton	Apocynaceae	March–September	Shrub
135.	<i>Pergularia daemia</i> (Forssk.) Chiov.		October–January	Climber
136.	<i>Heliotropium indicum</i> L.	Boraginaceae	March–September	Herb
137.	<i>Evolvulus nummularius</i> (L.) L.	Convolvulaceae	July–February	Herb
138.	<i>Ipomoea aquatica</i> Forssk.		November–April	Herb
139.	<i>Ipomoea carnea</i> Jacq.		Throughout the year	Shrub
140.	<i>Merremia emarginata</i> (Burm. f.) Hallier f.		October–March	Herb

141.	<i>Merremia hederacea</i> (Burm. f.) Hallier f.		September–December	Climber
142.	<i>Operculina turpethum</i> (L.) Silva Manso		October–March	Climber
143.	<i>Solanum sisymbriifolium</i> Lam.	Solanaceae	November–January	Herb
144.	<i>Solanum torvum</i> Sw.		Throughout the year	Shrub
145.	<i>Solanum virginianum</i> L.		August–June	Herb
146.	<i>Nicotiana plumbaginifolia</i> Viv.		September–May	Herb
147.	<i>Bacopa monnieri</i> (L.) Wettst.	Plantaginaceae	July–March	Herb
148.	<i>Limnophila heterophylla</i> (Roxb.) Benth.		October–December	Herb
149.	<i>Limnophila sessiliflora</i> (Vahl) Blume		September–November	Herb
150.	<i>Mecardonia procumbens</i> (Mill.) Small		October–December	Herb
151.	<i>Veronica anagallis-aquatica</i> L.		April–August	Herb
152.	<i>Hygrophila auriculata</i> (Schumach.) Heine	Acanthaceae	October–March	Herb
153.	<i>Utricularia aurea</i> Lour.	Lentibulariaceae	October–February	Herb
154.	<i>Utricularia stellaris</i> L.f.		November–February	Herb
155.	<i>Phyla nodiflora</i> (L.) Greene	Verbenaceae	Throughout the year	Herb
156.	<i>Nymphoides hydrophylla</i> (Lour.) Kuntze	Menyanthaceae	April–November	Herb
157.	<i>Nymphoides indica</i> (L.) Kuntze		August–November	Herb
158.	<i>Caesulia axillaris</i> Roxb.	Asteraceae	August–February	Herb
159.	<i>Grangea maderaspatana</i> (L.) Poir.		November–April	Herb
160.	<i>Mikania micrantha</i> Kunth		December–March	Climber
161.	<i>Centella asiatica</i> (L.) Urb.	Apiaceae	February–November	Herb
162.	<i>Foeniculum vulgare</i> Mill.		December–March	Herb

Dicotyledons and monocotyledons comprises 99 species, 74 genera, 34 families and 63 species, 43 genera, 10 families respectively. Dicotyledons and monocotyledons represents 61% and 39% of the total angiospermic species respectively. The ratio of dicotyledones and monocotyledons species is nearly 1.53:1. The genus to species ratio (1: 1.35), which is less in the study area conforms that the flora of small area is relatively richer in genera than species. Poaceae (25 species)

is the most dominant family with high species representation, followed by Cyperaceae (15 species), Fabaceae (11 species) and Amaranthaceae (10 species). 15 families are represented by one species. As for as habit is concerned, it was found that herbs, shrubs, trees and climbers occupy 86%, 6%, 1% and 7% of the total angiospermic species respectively.

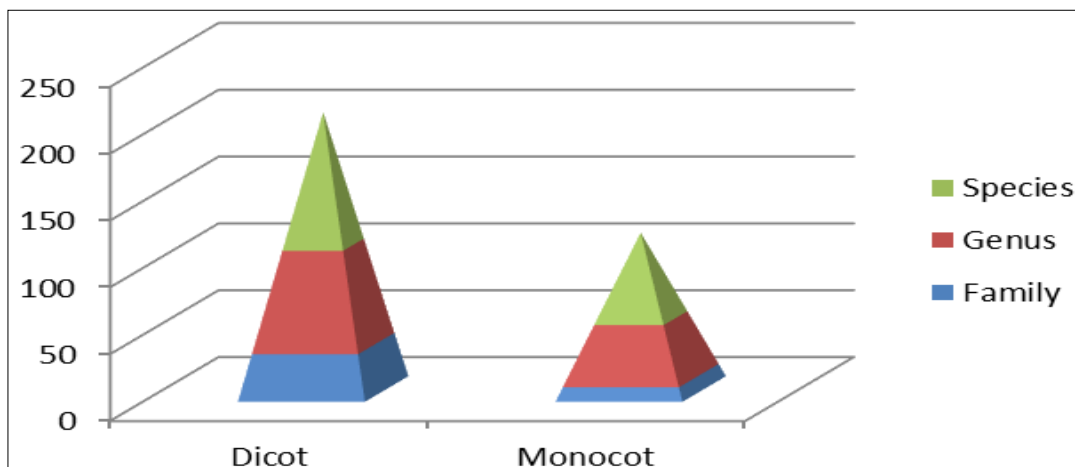


Fig. 3: Dicot and Monocot species with respect to family, genera and species

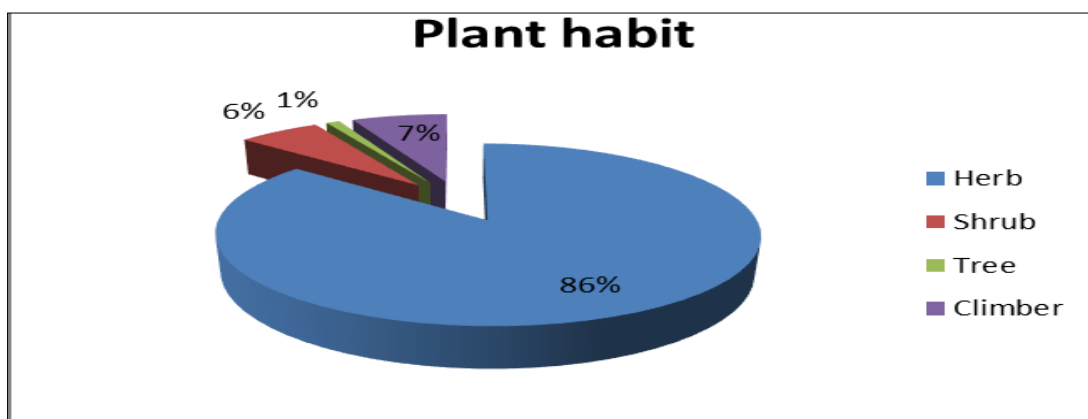
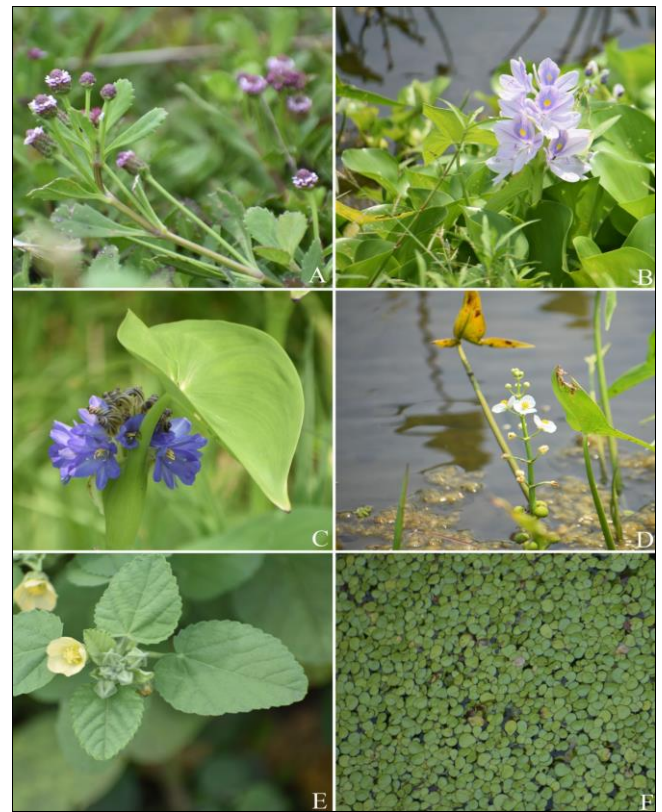


Fig. 4: Habit of the plant species



**Plate 1:** A. *Alternanthera philoxeroides* (Mart.) Griseb. B. *Alternanthera sessilis* (L.) R.Br. ex DC. C. *Calotropis gigantea* (L.) W.T.Aiton D. *Cyperus rotundus* L. E. *Dactyloctenium aegyptium* (L.) Willd. F. *Foeniculum vulgare* Mill.



**Plate 3:** A. *Phylla nodiflora* (L.) Greene B. *Pontederia crassipes* Mart. C. *Pontederia hastata* L. D. *Sagittaria sagittifolia* L. E. *Sida cordifolia* L. F. *Spirodela polyrrhiza* (L.) Schleid.



**Plate 2:** A. *Hygrophila auriculata* (Schumach.) Heine B. *Leersia hexandra* Sw. C. *Lemna minor* L. D. *Nelumbo nucifera* Gaertn. E. *Nymphaea rubra* Roxb. ex Andrews F. *Persicaria glabra* (Willd.) M.Gómez

**Conclusion**

The present study highlights occurrence of 162 angiosperms species diversity in and around of Baghar beel wetland, Katihar district, North Bihar. The documentation of the flora is of immense help to researchers/students in general and foresters in particular in correct identification of plants available in this wetland. Further, this will play a vital role in the management of the wetland, implementation of various conservation strategies. This wetland is a major living spot for the large number of local and migratory birds. It is also noted that *Eichhornia crassipes* (Mart.) Solms and *Pistia stratiotes* L. are major threats to this wetland. Moreover, threats to the phytodiversity such as cattle grazing, fuel wood collection, invasive species, encroachment of land, soil transferring for the nearby brick field are identified.

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