

## THE FLORISTIC COMPOSITION OF SALON WETLAND, UTTAR PRADESH

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### A B S T R A C T

Wetlands are an important ecosystems in itself and also form an important life support systems for the flora and fauna. An extensive field survey and plant collection in Samaspur Bird Sanctuary (Salon Wetlands) situated in Rae Bareilly district of Uttar Pradesh reveals that 192 species belonging to 147 genera and 59 families have been gathered from the area. Out of them 13 families 44 genera and 65 species are of monocots; 44 families, 101 genera and 125 species are of dicots and 2 families, 2 genera and 2 species are of pteridophytes. The systematic enumeration of plant species along with ecological notes, flowering and fruiting periods, and economic uses have been provided in each species. Besides, the floristic composition, the economic importance and conservation strategies have also been discussed.

### INTRODUCTION

Wetlands are the transitional areas between aquatic and terrestrial ecosystems where the water table is usually at or near the surface or the land is covered by shallow water (Cowardin *et. al.*, 1979). They include marshes, flood plains, bogs, peatlands, shallow ponds, littoral zone of large water bodies, tidal marshes etc. As per the definition of wetland given at Ramsar Convention (Scott, 1989) "Wetlands are the areas of marsh, fen, peatland or water, whether natural or artificial, permanent or temporary, with water i.e. static or flowing, fresh, brackish or salt, including areas of marine water, the depth of which at low tide does not exceed six meters".

The wetlands must serve one or more of the following attributes (qualities):

- i) Wetland supports, at least periodically hydrophytes.
- ii) The substrate is classified predominately as an undrained hydric soil, and
- iii) The substrate is saturated with water or covered by shallow water at sometime during every year.

Wetlands are shallow water bodies in which water keeps up for most part of the year and recedes below the surface level during the dry season. The biotic community undergo changes from aquatic / marshy to mesophytic types. These are complex hydrological

and biogeochemical systems and have been recognised as distinctly separate ecosystems between the terrestrial and aquatic ones.

It is a well known fact that lakes and ponds play an important role in maintaining ecological balance through their biotic and abiotic components. Lakes also provide recreation in the form of boating, fishing, swimming and bird watching etc. In addition the water of lakes is also used for drinking, bathing and irrigation etc. Rae Bareli, though a traditional agricultural district of U.P. has been undergoing massive industrialisation and urbanisation during the last two decades, threatening specially the aquatic life in the lakes, tanks, ponds etc. With a view to study the impact of industrialisation and urbanisation, ecological studies of the largest lake of Salon Wetland have been undertaken on priority basis.

Hydrophytes, as compared with terrestrial plants are much less affected by climate and seasonal changes of the environment on account of physical properties of water. For this reason, the aquatic habitat preserves the primitive as well the highest evolved plants of the world. The botany and ecology of the hydrophytes of India have been explored by Biswas and Calder (1937), Misra (1946), Mirashi (1954, 57), Patnaik and Patnaik (1956), Chavan & Sabnis (1961), Vyas (1964), Gupta (1966), Singh and Pandey (1998), Subramanyam (1962), Islam (1989), Sinha *et al.*, (1989, 1990) and Singh (1994).

The Salon wetland renamed as Samaspur Bird Sanctuary is situated near Salon, a southern belt of Rae Bareli district of Uttar Pradesh. It covers an area of *ca* 8 sq. km and is a perennial lake. The lake is somewhat 'S' shaped with its depth varying from 10 cm to 5 m. It comprises 6 small lakes connected with each other namely Samaspur lake, Mamania lake, Mamaina Gram Samaj lake, Gorwa Hasanpur lake, Hakganj lake and Rohania lake. The seventh the Bissaiya lake, situated very close to the above six lakes, though not connected with the main water body, also forms the part of the sanctuary.

#### GEOLOGY AND SOIL

The sanctuary area near Salon belongs to a part of Indo-Gangetic alluvium, comprising a thick sequence of unconsolidated sand, silt and clays. No rock exposures are found in the area. The area has gentle slope northwards and drains into Sai river, a tributary of Ganges. The lakes, south of river Sai generally represent the remnants of the old river channel of river Sai, that existed in the geologic times.

The presence of Marl and Kankar deposits in the area around the sanctuary is conspicuous. As a general rule the marl deposits occur in areas of depression that form a part of the lake while Kankar deposits occur on the adjacent high ground.

Around the Samaspur lake marl deposits have been located in Tikaria tal and Maowai lake. The marl generally contains *ca* 44% CaO and occurs in beds 60-90 cm thick. Several tenticular bodies of Kankar have been located adjacent to the lake near Autahia and Mohammadabad Khwajapur over an area of 200 ha.

#### Soil

Soil is typical usar land of Gangetic plains with its pH varying from 8.5. to 10.5

## Temperature

The climate is like a plain region of U.P. In summer, the maximum temperature rises up to 48°C and in the winter the temperature goes down even upto 4°C. In the months of December and January, frost is of frequent occurrence.

## Rainfall

The average rainfall is 849.90 mm per year. The maximum rainfall is reported in the month of August while minimum in the month of April.

## Water Supply and Water Table

The lake is perennial in nature. The main water sources are of the various tail ends of canals which are released into these lakes due to its situation in depression, it receives water from adjoining areas. The water level varies from 10 cm to 5 m. During summers, water level shrinks by about a meter, while in rainy season, it rises upto about 5 m.

## Terrestrial Vegetation around the Lake

A large number of trees or shrubs have been planted or growing in wild, around the lakes which are important for birds providing shelter, roosting, nesting and breeding, etc. These are *Adhatoda zelanica*, *Carissa opaca*, *Cordia dichotoma*, *Calotropis procera*, *Jatropha curcas*, *Acacia nilotica* ssp. *indica*, *Ziziphus nummularia*, *Butea monosperma*, *Prosopis juliflora*, *Salvadora persica*, *Madhuca longifolia* ssp. *latifolia*, *Ipomoea carnea* sp. *fistulosa*, *Breynia retusa*, *Phoenix sylvestris*, *Azadirachta indica* and *Ficus religiosa*.

## Aquatic Vegetation of the Lake

The visual observation of the lake reveals that the hydrophytic plants of the lake can be classified into following life-forms on the basis of their contacts with soil, water and air. These are classified as follows :

### (i) Free Floating Hydrophytes :

The stagnant water exhibits rich growth of free floating hydrophytes like *Eichhornia crassipes*, *Lemna perpusilla*, *Pistia stratiotes*, *Azolla pinnata* and *Spirodela polyrrhiza*. They frequently occur in pure formation. Though *Nymphoides hydrophylla* and *N. indica* are basically attached species with floating leaves, yet, their detached branches occur as free floating.

### (ii) Attached with Free Floating :

*Ipomoea aquatica*, *Marsilea minuta*, *Nymphaea nouchali*, *N. pubescens* and *Nelumbo nucifera* are dominant species, often showing pure formation in the lakes. Other species of occasional occurrence, growing mixed with these are *Nymphoides hydrophylla*, *N. indica*, *Hydrorhiza aristata* and *Neptunia oleracea*.

(iii) Submerged and Rooted:

*Vallisneria spiralis*, *Ottelia alismoides*, *Utricularia stellaris*, *Potamogeton crispus*, *P. nodosus*, *P. pectinatus*, *Najas graminea*, *N. marina* and *Hydrilla verticillata* are the most common species making large patches on the substratum and under surface of the lakes.

(iv) Suspended Hydrophytes:

*Ceratophyllum demersum* and *Utricularia* spp. are the most common plants of this nature.

(v) Rooted Amphibious :

The shallow habitats of the lakes are dominated by the herbs, sedges and grasses, e.g. *Bacopa monnieri*, *Limnophila indica*, *Veronica anagallis-aquatica*, *Hygrophila auriculata*, *Atlernanthera sessilis*, *Polygonum barbatum*, *P. glabrum*, *P. limbatum*, *Rumex dentatus*, *Limnophyton obtusifolium*, *Sagittaria guayanensis* ssp. *lappula*, *Echinochloa colona* and *Cyperus difformis*, etc.

(vi) Plants of Marsh Land :

Receding the lake, an large areas as marsh land or wetland. At such places most common marshy and wetland plant species are *Typha australis*, *Ipomoea carnea*, *Marsilea minuta*, *Scirpus articulatus*, *Eleocharis dulcis*, *Scirpus littoralis*, *S. lateriflorus*, *Fimbristylis dichotoma*, *F. miliacea*, *Phyla nodiflora*, *Polygonum barbatum* and species of *Cyperus*, *Panicum*, etc. Beside that, several herbaceous species are also found in this area.

Among the aquatic species the maximum frequency and density was of suspended submerged life forms, while free floating and attached submerged show lowest frequency and density. They mostly form pure stands of their own in patches.

### Biodiversity of the Lake

The analysis of the flora and fauna of the lake reveals that 192 species, belonging to 147 genera and 59 families are of wetland flora. As concerned the fauna, many invertebrates and vertebrates are reported from the lake and nearby areas viz.,

#### Invertebrates :

Protozoans	5 species
Porifera	3 species
Annelida	3 species
Arthropoda	7 species
Mollusca	9 species
Nematoda	1 species

**Vertebrates :**

Amphibia	2 species
Pisces	13 species
Reptilia	3 species
Mammalia	8 species
Aves	112 species (42 migratory birds, 70 resident birds)

The several migratory and resident birds are seen in and around the lake area. Few of them are :

**Migratory Birds :** Greylag geese, Pintail, Pochards, Gadwall, Brahmini duck, Common and Gargany Teals, Shoveller, Wigeon, Mallard, Spot bill duck, Tawny eagle, Greater spotted eagle, Marsh harrier, Coot, Little ringed plover, Ken tish plover, Red shank, Marsh sand piper, Green shank, Green sand piper, Stints, Tuffed rumped shellow, Brown shrike, Starling, Rosy pasor, Lesser white throat.

**Resident Birds :** Saras Crane, Stroks including painted, open billed, Lesser, Adjutant, white necked, black necked, Ibis, Bronze winged and pleasant tailed Jacana, Purple Moorhen, Grebe, Waterhen, Cormorant, Darter, Egrets, Herons, Avocet, Snipe, Sand piper, Red shank, king fishers, Lapwing, Nightjar, Spoon bill, Tern, Vulture, kit, Hawak eagle, Merlin, Shikra, Fishing eagle, Crow, Owl, Pea fowl, Gray part ridge, Quail, Lark, Dove, Pigeon, Sparrow, Sunbird, Baya, Drongs, Babbler, Robin, Muria & Hoopoe.

**MATERIAL AND METHODS**

For the study of aquatic and wetland plant wealth in and around the lakes, the survey tours were conducted for three different seasons and collected voucher specimens have been preserved at BSA. Field notes were taken as to their habit, time of flowering and fruiting, colour of flowers, ecology, occurrence and economic importance, etc. Identification of these were made using herbarium and relevant literature. A brief account of species of the Wetland flora of the lake has been enumerated in the present paper. A total number of 192 species recorded from the lake.

The plants are enumerated as per Bentham and Hooker' (1862-1883) system of classification.

**EMUMERATION**

The 192 species enumerated in the survey belongs to 147 genera and 59 families. The families other than angiosperms include Marsileaceae and Azollaceae. Of the 57 families of angiosperms, 13 are of Monocotyledons and 44 are of Dicotyledons. The monocot families contributed 65 species distributed among 44 genera, while the dicot families have 125 species belonging to 101 genera. (Table - 1). Of the total list of 192 species, 28 species are of purely aquatic, 35 species grow in marshy/muddy habitat and 129 species grow in dry regions (Table 2).

Table 1 : The number of Families, Genera and Species included in different groups

Groups	Families	Genera	Species
Pteridophytes	2	2	2
Angiosperms :			
Dicots	44	101	125
Monocots	13	44	65
Total	59	147	192

Table 2 : Distribution of different plant communities (Aquatic, Marshy/Muddy and Plants in Dry Region) growing in or around the lakes.

Groups	Plant communities		
	Aquatic Region	Marshy Plants	Dry, / Muddy
Pteridophytes	2		
Angiosperms :			
Dictos	10	17	98
Monocots	16	18	31
Total	28	35	129

## DICOTYLEDONS

## Nymphaeaceae

**Nymphaea nouchali** Burm. f.

Rhizomatous herbs, leaves floating on water surface. Common in lakes.

*Fl. & Fr.* : Sept.-Jan. Samaspur, BKS 50718**N. pubescens** Willd.

Rhizomatous herbs, leaves pubescent. Common in lakes.

*Fl. & Fr.* : Sept.-Jan. Samaspur, BKS 52398, 52399

## Nelumbonaceae

**Nelumbo nucifera** Gaertn.

Rhizomatous herbs, leaves raised above the water surface, flowers pink-red in colour. Common in Samaspur lake.

*Fl. & Fr.* : May-Oct. Samaspur, BKS 51499, 52310

## Brassicaceae

**Coronopus didymus** (L.) Sm.

Prostrate annual herbs O, flowers white in dense leaf opposed racemes. Rare, growing in marshy places.

*Fl. & Fr.* : Sept.-Jan. Samaspur, BKS 51450

**Rorippa indica** (L.) Hiern

An annual erect herbs, flowers yellowish white. Common in marshy places.

*Fl. & Fr.* : Oct.-Jan. Samaspur, BKS 50719

## Fumariaceae

**Fumaria indica** (Haussk.) Pugsley

Diffuse, slender glaucous herbs, leaves pinnatisect, flowers purplish pink. Rare in wet places.

*Fl. & Fr.* : Nov.-Mar. Samaspur, BKS 50720

## Portulacaceae

**Portulaca oleracea** L.

Prostrate succulent herbs. Common in wet places.

*Fl. & Fr.* : Throughout the year. Samaspur, BKS 50722

## Papaveraceae

**Argemone mexicana** L.

Glaucous prickly herbs with yellow saps, flowers yellow. Common in marshy dry places.

*Fl. & Fr.* Dec.-Mar. Samaspur, BKS 50721

## Malvaceae

**Abutilon indicum** (L.) Sweet

Stout undershrubs, flowers orange yellow, mericarps with short awns. Common along the lakes.

*Fl. & Fr.* : Oct.- Feb. Salon, BKS 50781

**Hibiscus cannabinus** L.

Branched prickly herbs ca 1.5 m. high, flowers yellow with purple centre. Rare in moist places.

*Fl. & Fr.* : Oct.-Jan. Samaspur, BKS 52382

**Sida cordata** (Burm. f.) Borss.

Woody herbs with yellow flowers, mericarp tetrahedral with rounded angles. Rare in moist dry places.

*Fl. & Fr.* : Nov. - Feb. Salon, BKS 51455

**S. rhombifolia** L.

Erect branched stellately hairy herbs, flowers yellow, mericarps smooth, 5-10 with

stellately hairy awns. Common in moist places.

*Fl. & Fr.* : Nov.-Feb. Salon, BKS 52396

Sterculiaceae

**Melochia corchorifolia** L.

Erect annual branched herbs, flowers yellowish white in dense terminal and axillary clusters, capsules 5 loculed. Common in marshy places.

*Fl. & Fr.* : Sept.-Dec. Salon, BKS 52361, 52375, 52420

Tiliaceae

**Corchorus aestuans** L.

Erect woody herbs *ca* 60 cm high, flowers pale yellow, capsules 3-winged. Rare in moist places.

*Fl. & Fr.* : Oct.-Jan. Salon, BKS 52331, 52366

**C. olitorius** L.

An erect subglabrous woody herbs *ca* 50 cm high, capsules oblong *ca* 6 cm long, 10 ribbed. Rare in moist places.

*Fl. & Fr.* : Oct.-Jan. Salon, BKS 52367

**C. tridens** L.

Small woody herbs, flowers yellow, capsules slender, terate. Rare in moist places.

*Fl. & Fr.* : Sept.-Jan. Salon, BKS 52366

**Triumfetta rotundifolia** Lamk.

Woody herbs, leaves obovate to orbicular, sparsely hairy, flowers yellow, capsules ovoid, spines hooked. Common in marshy places.

*Fl. & Fr.* : Sept.-Jan. Salon, BKS 52432

Zygophyllaceae

**Tribulus terrestris** L.

Prostrate herb, leaves paripinnately compound, flowers yellow, fruits 5 angled with 5 woody cocci and 2 short spines. Common in moist sandy places.

*Fl. & Fr.* : Oct.-Jan. Samaspur, BKS 50722

Polygalaceae

**Polygala arvensis** Willd.

Polymorphic pilose herbs, flowers yellow in axillary clusters. Common in moist places.

*Fl. & Fr.* : Oct.-Jan. Salon, BKS 50728

Oxalidaceae

**Oxalis corniculata** L.

Trailing herbs rooting at nodes, flowers yellow 1-few, together, capsules oblong. Common in moist places.

*Fl. & Fr.* : Oct.-Jan. Samaspur, BKS 50741.



## Rhamnaceae

**Ziziphus nummularia** (Burm. f.) Wt. & Arn.

Thorny bushy under shrubs with grey hairy branches, flowers pale yellow, drupes globose. Rare along the lakes.

*Fl. & Fr.* Aug.-Jan. Samaspur, *BKS* 51472

## Meliaceae

**Azadirachta indica** Juss.

Large trees with yellowish green flowers. Rare planted or grow as wild along the lakes.

*Fl. & Fr.* : Mar.-May. Samaspur lake, *BKS l.c.*

## Fabaceae

**Aeschynomene indica** L.

Stout herbs, stem pithy, flowers yellow, pods slightly curved, 6-10 jointed. Rare in marshy and water logged places.

*Fl. & Fr.* : Aug.-Mar. Salon, *BKS* 52426

**Alysicarpus vaginalis** (L.) DC.

Prostrate branched herbs, racemes 8-10 flowers, pods 5-8 jointed. Common in moist places.

*Fl. & Fr.* : Aug.- Nov. Salon, *BKS* 52358

**Butea monosperma** (Lamk.) Taub.

Medium sized tree, leaves 3- foliolate, flowers bright pink. Commonly planted along the lakes.

*Fl. & Fr.* : Mar, Apr. Samaspur, *BKS* 50782

**Indigofera tinctoria** L.

Woody hairy herbs *ca* 70 cm high, flowers pink, pods straight or slightly curved, 10-20 seeded. Rare near ponds and ditches.

*Fl. & Fr.* : Oct. - Jan. Salon, *BKS* 52416

**Lathyrus aphaca** L.

Trailing annual herbs, stipules hastate, flowers light yellow. Common in moist places.

*Fl. & Fr.* : Oct.- Jan. Salon, *BKS* 51465, 50 605 a

**Medicago polymorpha** L.

Prostrate annual herbs with yellow flowers, pods -4 seeded, coiled 2-3 times, armed with hooked projection. Rare in moist places.

*Fl. & Fr.* : Oct. - Jan. Salon, *BKS* 50715

**Melilotus alba** Desr.

Branched glabrous herbs with white flowers, racemes *ca* 10 cm long. Rare in sandy soil.

*Fl. & Fr.*: Sept.-Jan. Salon, *BKS* 50605b

**Melilotus indica** (L.) All.

Herbs with yellow flowers, racemes 2-5 cm long. Rare in moist places.

*Fl. & Fr.* : Sept.- Jan. Salon, BKS 50606

Caesalpiniaceae

**Cassia occidentalis** L.

Erect woody herbs, flowers yellow, pods torulose, 20-30 seeded. Common in moist places.

*Fl. & Fr.* : Nov.-March. Salon, BKS 52385

**Cassia tora** L.

Woody branched foetid herbs, flower yellow, pods subterrate, 20-30 seeded. Rare in moist places.

*Fl. & Fr.* : Oct.-Jan. Salon, BKS 51459

Mimosaceae

**Acacia nilotica** (L.) Willd. ex Delile ssp. **indica** (Benth.) Brenan

Medium sized trees with straight spines, flowers yellow in heads, pods moniliform. Commonly planted along the lakes.

*Fl. & Fr.* : Oct.-Dec., Salon, BKS 51466

**Neptunia oleracea** Lour.

Floating herbs with spongy floater, leaves peripinnate, flowers yellow in small heads, pods shortly beaked. Common in lakes.

*Fl. & Fr.* : Sept.-Jan. Salon, BKS 50722, 50755, 514777

**Prosopis juliflora** (Sw.) DC.

Small trees, branches cylindrical with axillary spines, flowers cream coloured, yellow in drooping spikes, pods curved. Commonly planted along the lakes.

*Fl. & Fr.* : Throughout the year. Salon, BKS 52373

Rosaceae

**Potentilla supina** L.

Prostrate annual herbs, flowers solitary axillary, achenes numerous. Rare in sandy moist places.

*Fl. & Fr.* : Jan.-Feb. Salon, BKS 50740

Lythraceae

**Ammannia baccifera** L.

Erect glabrous herbs, flowers axillary, solitary, or in 3-many flowered cymes. Common in moist places.

*Fl. & Fr.* : Sept.-Jan. Salon, BKS 50605, 51503, 22330, 52411

Onagraceae

**Ludwigia adscendens** (L.) Hara

Floating herbs with yellow flowers. Common in lakes.

*Fl. & Fr.* : Nov.-Mar.. Salon, BKS 50705, 50763, 52350.

**Ludwigia octovalvis** (Jacq.) Raven

Erect herbs with yellow flowers, capsules long *ca* 15 cm long, pale brown. Common in moist places.

*Fl. & Fr.* : Nov.- Jan. Salon, *BKS* 51495, 52392

## Molluginaceae

**Glinus lotoides** L.

Prostrate hairy herbs, flowers in axillary clusters, capsules 5 loculed. Rare in sandy moist places.

*Fl. & Fr.* : Oct.-Jan. Salon, *BKS* 50748, 51446

## Aizoaceae

**Trianthema portulacastrum** L.

Prostrate succulent herbs, flower solitary, axillary, capsules 6-8 seeded. Rare in moist places.

*Fl. & Fr.* : Oct.-Jan. Salon, *BKS* 52334

## Apiaceae

**Centella asiatica** (L.) Urban

Prostrate trailing herbs with orbicular leaves, flowers white. Common in marshy places

*Fl. & Fr.* : Throughout the year. Salon, *BKS* 51452

## Rubiaceae

**Dentella repens** (L.) J. R. & G. Forst.

Prostrate dichotomously branched herbs, flowers white. Common in marshy places.

*Fl. & Fr.* : Oct.-Mar. Salon, *BKS* 50793

**Oldenlandia corymbosa** L.

Diffusely branched herbs with sessile leaves, flowers white. Common in moist places.

*Fl. & Fr.* : Sept.-Jan. Samaspur, *BKS* 52363

## Asteraceae

**Ageratum conyzoides** L.

Erect hairy herbs with opposite leaves, heads in terminal cymose clusters, corolla purple. Common in moist places.

*Fl. & Fr.* : Sept.-Jan. Samaspur, *BKS* 50735

**Blumea bifoliata** (L.) DC.

Densely hairy branched herbs, heads long peduncled, flowers white. Rare in moist places.

*Fl. & Fr.* : Sept. - Dec. Salon, *BKS* 50713, 52337

**B. oxyodonta** DC.

Branched multicauline annual herbs, leaves villous with long white silky hairs. Rare in moist places

*Fl. & Fr.* : Sept.-Jan. Samaspur, *BKS* 50765, 50788.

**Caesulia axillaris** Roxb.

Annual herbs *ca* 40 cm. high, heads 2-3, united into a compound head. Common in marshy places.

*Fl. & Fr.* : Sept.-Jan. Samaspur, BKS 52364

**Centipeda minima** (L.) A. Br. & Aschers.

Prostrate hairy herbs, heads solitary. Rare in wet places.

*Fl. & Fr.* : Sept.-Jan. Samaspur, BKS 50612 and 51443

**Cotula hemisphaerica** Wall. ex Benth. & Hook. f.

Prostrate or decumbent herbs. Common in moist places.

*Fl. & Fr.* : Sept.-Jan. Salon, BKS 50609, 50742

**Eclipta alba** (L.) Hassk.

Diffuse pubescent herbs, heads solitary, white. Common in marshy places.

*Fl. & Fr.* : Throughout the year. Samaspur, BKS 52329, 50603, 50770

**Enhydra fluctuans** Lour.

Floating herbs with white flowers. Common in marshy places.

*Fl. & Fr.* : Nov.-Mar. Salon, BKS 50756, 50766

**Gnaphalium luteo-album** L. ssp. *affine* (D. Don) Koster.

Woolly multicauline herbs, capitula short, pedunculate yellow. Common in marshy places.

*Fl. & Fr.* : Nov.-Jan. Salon, BKS. 51442, 50738

**G. polycaulon** Pers.

Decumbent woolly herbs, heads clusters. Rare in moist places.

*Fl. & Fr.* : Oct.-Jan. Salon, BKS. 50603

**Grangea maderaspatana** Poir.

Diffuse herbs with prostrate branches, capitula globose and solitary. Rare in marshy places.

*Fl. & Fr.* : Oct.-Jan. Salon, BKS. 50742, 50769

**Lagascea mollis** Cav.

Annual herbs, branches scabrid, heads in leafy balls, solitary, white. Rare in moist places.

*Fl. & Fr.* : Dec.-Mar. Salon, BKS 50610

**Laggera alata** (D. Don) Schultz Bip. ex Oliver

Perennial pubescent herbs, heads arranged in paniced corymbs. Rare in moist places.

*Fl. & Fr.* : Oct.-Jan. Samaspur, BKS 52301

**Launaea procumbens** (Roxb.) Ramayya & Rajgopal

Prostrate scrambling herbs, leaves pinnately lobed, heads solitary, yellow. Rare in sandy soils.

*Fl. & Fr.* : Nov.-Jan., Salon, BKS 50604, 50714, 51504

**Sonchus asper** (L.) Hill.

Erect sparingly branched herbs, basal leaves in rosette, cauline one semi-amplexicaule, head solitary, corolla yellow. Rare in moist places.

*Fl. & Fr.* : Oct.-Mar. Salon, BKS 50734

**Tridax procumbens** L.

Procumbent hispid herbs, leaves long petioled, lobed, heads solitary, long peduncled, corolla yellow. Rare in sandy soil.

*Fl. & Fr.* : Oct.-Mar. Salon, BKS 52415

**Vernonia cinerea** (L.) Less.

Polymorphic tomentose herbs ca 60 cm high, heads in loose open, often spreading cymes, involucre purple. Common in moist places.

*Fl. & Fr.* : Oct.-Mar. Salon, BKS 52315

**Xanthium strumarium** L.

Woody aromatic ca 1.5 m high, leaves palmately 3-5 lobed, achenes 2. Common along the lakes.

*Fl. & Fr.* : Nov.-Mar. Salon. BKS 50486

## Primulaceae

**Anagallis arvensis** L.

Annual herbs ca 30 cm high with opposite leaves, flowers blue in colour, capsules globose. Common in marshy places.

*Fl. & Fr.* : Nov.-Mar. Samaspur, BKS 50771, 51447

## Salvadoraceae

**Salvadora persica** L.

Small trees with opposite succulent fleshy leaves, flowers yellowish-green. Common along the lakes.

*Fl. & Fr.* : Jan.-Nov. Samaspur, BKS 50784, 52309

## Sapotaceae

**Madhuca longifolia** (Koen.) Mac ssp. **latifolia** (Roxb.) Chev.

Large trees, leaves clustered near branch ends. Common along the lakes.

*Fl. & Fr.* : Mar.-Nov. Samaspur, BKS, 52397b

## Apocynaceae

**Carissa opaca** Stapf ex Haines

Shrubs with spines, leaves opposite, flowers white and scented. Rare along the lakes.

*Fl. & Fr.* : Jan.-Apr. Samaspur, BKS 50754

## Asclepiadaceae

**Calotropis procera** (Aiton) R. Br.

Woody shrubs with fleshy leaves, flowers purplish red, pale silvery outside. Rare along the lakes.

*Fl. & Fr.* : Throughout the year. Samaspur, BKS 50771b

**Oxystelma esculentum** (L.f.) Smith

Lianas with opposite leaves, flowers pinkish white. Common along the lakes. *Fl. & Fr.* : Nov. - March. Samaspur, BKS 50791, 52308

**Menyanthaceae**

**Nymphoides hydrophylla** (Lour.) O. Ktze.

Floating herbs rarely rotted in muds, leaves broadly ovate-orbicular, flowers white, petals entire. Common in ponds.

*Fl. & Fr.* : Aug. Apr. Samaspur, BKS 50710b, 50723, 50768, 52397 a

**N. indica** (L.) O. Ktze.

Floating herbs, flowers white, petals woolly-fimbriate, seeds smooth. Common in ponds.

*Fl. & Fr.* : Aug.-April. Samaspur, BKS 50710a, 50716b

**Cordiaceae**

**Cordia dichotoma** Forster f.

Large trees with white flowers, drupe ovoid. Rare planted along the lakes.

*Fl. & Fr.* : Mar.-July. Samaspur, BKS 50611

**Convolvulaceae**

**Convolvulus prostratus** Forssk.

Prostrate hairy herbs, flowers solitary or in pairs, corolla pale-rose, capsule globose. Common in moist places.

*Fl. & Fr.* : May-Dec. Samaspur, BKS 50778

**Evolvulus alsinoides** L.

Prostrate herbs, leaves elliptic to linear-oblong, silky pilose, flowers blue or white. Common in moist places.

*Fl. & Fr.* : Aug.-Mar. Samaspur, BKS 52425

**E. nummularius** L.

Prostrate herbs, leaves broadly ovate to orbicular, glabrous, flowers white. Common in moist places.

*Fl. & Fr.* : Oct.-Mar. Samaspur, BKS 50774, 52328

**Ipomoea aquatica** Forssk.

Procumbent or floating herbs, rooting at the nodes, leaves hastate, flowers purple or white. Common in ponds.

*Fl. & Fr.* : Sept.-Mar. Samaspur, BKS 52302

**Ipomoea carnea** Jacq. ssp. **fistulosa** (Mart. ex Choisy) Austin

Woody shrubs ca 2 m high, leaves ovate-cordate, flowers in cymose paniculate clusters, pink to purple in colour. Common along the lakes.

*Fl. & Fr.* : Throughout the year. Samaspur. BKS 50796, 51409, 51415

**Merrema emarginata** (Burm. f.) Hall. f.

Creeping herbs with yellow flowers. Rare in sandy soil.

*Fl. & Fr.* : Sept.-Jan. Samaspur, BKS 50790

**Solanaceae**

**Nicotiana plumbaginifolia** Viv.

Annual herbs, basal leaves in rosette, obovate, cauline ones elliptic, flowers in cymose

leafy paincles, greenish white. Common in moist places.

*Fl. & Fr.* : Nov.-Mar. Samaspur, BKS 52314

***Datura innoxia* Mill.**

Robust shrubs with white flowers, capsules globose with short prickles. Rare in moist places.

*Fl. & Fr.* : Nov.-Apr. Samaspur, BKS 52387

***Physalis minima* L.**

Annual herbs with purple-yellow flowers, fruits enclosed with papery calyx cover. Common in moist places.

*Fl. & Fr.* : Sept.-Dec. Samaspur, BKS 52384

***Solanum nigrum* L.**

Annual herbs with white flowers, berry purplish black. Common in moist places.

*Fl. & Fr.* : Oct.-Mar. Samaspur, BKS 50736

Scrophulariaceae

***Bacopa monnieri* (L.) Wettst.**

Erect herbs with white or lilac flowers. Common in marshy places.

*Fl. & Fr.* : Oct.-Mar. Samaspur, BKS 51495

***Limnophila indica* (L.) Druce**

Submerged herbs with purple white flowers. Common in lakes and moist places.

*Fl. & Fr.* : Sept.-Jan. Samaspur, BKS 50764

***Lindernia antipoda* (L.) Pennell**

Annual herbs. Common in muddy places along lakes and paddy fields.

*Fl. & Fr.* : July-Jan. Samaspur, BKS 52326, 50608

***L. ciliata* (Colsm.) Alston**

Annual herbs with white flowers. Common in moist places.

*Fl. & Fr.* : July-Dec., Samaspur, BKS 52355, 52418

***L. crustacea* (L.) F.U. Muell.**

Small annual herbs. Common in moist places.

*Fl. & Fr.* : July-Dec. Samaspur, BKS 50747

***Scoparia dulcis* L.**

Woody herbs with white flowers, capsules subglobose. Rare in moist places.

*Fl. & Fr.* : Sept.-Mar. Samaspur, BKS 52389

***Verbascum chinensis* (L.) Sant.**

Annual herbs with yellow flowers. Common in moist places.

*Fl. & Fr.* : Nov. Mar. Samaspur, BKS 50724

***Veronica anagallis-aquatica* L.**

Annual herbs with white flowers. Common in water logged places.

*Fl. & Fr.* : Nov.-Mar. Samaspur, BKS 50607

Lentibulariaceae

***Utricularia stellaris* L. f.**

Floating herbs with yellow flowers, capsules subglobose. Common in lakes and ponds.

*Fl. & Fr.* : Oct.-Mar. Samaspur, BKS 50757, 52359

**Acanthaceae**

**Adhatoda zeylanica** Medik.

Shrubs with opposite leaves, flowers white with purple streak. Rare in moist places along the lakes.

*Fl. & Fr.* : Nov.-Mar. Salon, *BKS* 51433

**Dipteracanthus prostratus** (Poir.) Nees

Prostrate herbs with pale purple flowers. Rare in moist places.

*Fl. & Fr.* : Nov.-Mar. Salon, *BKS* 50743, 52431

**Hygrophila auriculata** (K. Schum.) Heine

Erect spiny herbs with pale purple flowers. Rare in marshy and water logged places.

*Fl. & Fr.* : Sept.-Mar. Salon, *BKS* 50775a, 52365

**Hygrophila polysperma** T. Anders.

Prostrate herbs with white flowers. Common in marshy places.

*Fl. & Fr.* : Oct.-Mar. Salon, *BKS* 50772, 50726, 51484

**Justicia simplex** D. Don

Erect or prostrate herbs, spikes *ca* 10 cm long, flowers pale purple or lilac. Rare in moist places.

*Fl. & Fr.* : Oct.-Jan. Salon, *BKS* 51440

**Peristrophe bicalyculata** (Retz.) Nees

Erect or suberect herbs with pale pink or white flowers. Rare along the lakes.

*Fl. & Fr.* : Oct.-Jan. Samaspur, *BKS* 50609, 51509

**Rungia repens** (L.) Nees

Decumbent herbs, spikes terminal, flowers violet. Rare in moist places.

*Fl. & Fr.* : Sept.-Jan. Salon, *BKS* 50787

**R. pectinata** (L.) Nees

Annual herbs, spikes axillary and terminal, flowers violet. Rare in moist places.

*Fl. & Fr.* : Nov.-Jan., Salon, *BKS* 50767

**Verbenaceae**

**Phyla nodiflora** (L.) Greene

Perennial creeping herbs, spikes subglobose, flowers purple. Common in moist places.

*Fl. & Fr.* : Throughout the year, Samaspur, *BKS* 50709, 52327

**Lamiaceae**

**Anisomeles indica** (L.) O. Ktze.

Robust pubescent herbs with bluish purple flowers. Rare along the lakes.

*Fl. & Fr.* : Nov.-Mar. Salon, *BKS* 52413

**Ocimum basilicum** L.

Strongly aromatic herbs with pale purple flowers. Rare in wet places.

*Fl. & Fr.* : Nov. Mar. Salon, *BKS* 52394

**Orthosiphon pallidus** Royle *ex* Benth.

Annual woody herbs with purple white flowers. Rare in moist places.

*Fl. & Fr.* : Nov. Mar. Salon, *BKS* 51453



**Salvia plebeia** R. Br.

Erect branched herbs with purple violet flowers. Rare in marshy places.

*Fl. & Fr.* : Nov. Mar. Samaspur, BKS 50706, 50606

## Amaranthaceae

**Achyranthes aspera** L.

Annual herbs *ca* 1 m high with long spikes. Common in moist places.

*Fl. & Fr.* : Sept.-Apr. Samaspur, BKS 52386

**Alternanthera pungens** Kunth

Prostrate branched herbs, bracts, bracteoles and tepals all tipped with sharp spines. Common in moist places.

*Fl. & Fr.* : Sept.-Mar. Samaspur, BKS 52312 b

**Alternanthera sessilis** (L.) DC.

Prostrate branched herbs, flower heads globose. Common in wet places.

*Fl. & Fr.* : Oct.-Mar. Samaspur, BKS 52360, 52312 c

**Amaranthus viridis** L.

Erect herbs, flowers clustered in axillary spikes or panicles. Common in moist places.

*Fl. & Fr.* : Oct.-Mar. Samaspur, BKS 50792

**Amaranthus tricolor** L.

Branched herbs, flowers clustered dense axillary or terminal spikes. Rare in moist places.

*Fl. & Fr.* : Nov.-Mar. Salon, BKS 52436

**Digera muricata** (L.) Mart.

Erect annual herbs, flowers white tinged with pink arranged in simple or long paniced spikes. Rare in moist places.

*Fl. & Fr.* : Oct.-Mar. Salon, BKS 52409

## Polygonaceae

**Polygonum barbatum** L.

Suberect herbs, ochreae ciliate, pseudospikes 4-10 cm long. Common in wet places.

*Fl. & Fr.* : Oct.-Jan. Samaspur, BKS 50721, 51494

**P. glabrum** Willd.

Erect branched herbs, ochreae glabrous, pseudospikes 4-10 cm. long. Rare in wet places.

*Fl. & Fr.* : Sept.-Jan. Samaspur, BKS 51493

**P. limbatum** Meissn.

Woody herbs *ca* 1.5 m high, ochreae with limb, spikes *ca* 20 cm long. Common in lakes.

*Fl. & Fr.* : Sept.-Jan. Samaspur, BKS 52332, 52403, 50719

**P. plebeium** R. Br.

Prostrate spreading herbs. Common in wet places.

*Fl. & Fr.* : Nov.-Mar. Samaspur, BKS 51449, 50737

**Rumex dentatus** L. ssp. **klotzschianus** (Meissn.) Reching f.

Erect glabrous herbs with small flowers. Common in moist places.

*Fl. & Fr.* : Oct.-Mar. Salon. *BKS* 50729

Euphorbiaceae

**Breynia retusa** (Dennst.) Alston.

Large shrubs, berry globose-ovoid, dull red or purple. Rare along the lakes.

*Fl. & Fr.* : June Oct., Samaspur, *BKS* 52307

**Chrozophora prostrata** Dalzell

Multicauline, prostrate herbs, capsules subglobose. Rare in moist places.

*Fl. & Fr.* : Oct.-Jan. Samaspur, *BKS* 50749

**Croton bonplandianum** Bail.

Woody herbs, inflorescence terminal, flowers white, capsule 3-gonous. Common in sandy soil.

*Fl. & Fr.* : Nov.-Mar. Samaspur, *BKS* 52393

**Euphorbia hirta** L.

Prostrate herbs. Common in moist places.

*Fl. & Fr.* : Sept.-Apr. Salon, *BKS* 52353, 52424 a

**E. heyneana** Spreng.

Small dichotomously branched, glaucous herbs. Rare in moist places.

*Fl. & Fr.* : Oct.-Jan. Samaspur, *BKS* 52304

**E. heterophylla** L.

Erect annual herbs. Common in moist places.

*Fl. & Fr.* : Oct.-Jan. Salon, *BKS* 52424 b

**Jatropha curcas** L.

Shrubs, branches smooth, capsules 3-lobed. Common along the lakes.

*Fl. & Fr.* : Sept.-Apr. Samaspur, *BKS* l.c.

**Phyllanthus fraternus** Webster

Erect glabrous branched herbs, leaves distichous, flowers fascicled, capsules globose. Common in moist places.

*Fl. & Fr.* : Sept.-Mar. Salon, *BKS* 5235

**P. urinaria** L.

Annual prostrate herbs. Common in moist places.

*Fl. & Fr.* : Oct.-Mar. Samaspur, *BKS* 51469, 52429

Moraceae

**Ficus religiosa** L.

Large trees, leaves cordate below, receptacle globose purple at age. Rare along the lakes.

*Fl. & Fr.* : Throughout the year, Samaspur, *BKS* 50783

## Ceratophyllaceae

**Ceratophyllum demersum** L.

Submerged herbs, leaves in whorls. Common in lakes.

*Fl. & Fr.* : Oct.-Apr. Samaspur, *BKS* 50780

## MONOCOTYLEDONS

## Hydrocharitaceae

**Hydrilla verticillata** (L. f.) Royle

Submerged herbs, leaves long or linear, flowers unisexual. Common in lakes.

*Fl. & Fr.* : Nov.-Apr. Samaspur, *BKS* 50758, 50779, 51508, 52421

**Ottelia alismoides** (L.) Pers.

Submerged herbs, leaves ovate-reniform, flowers large, showy white with yellow blotches. Common in lakes.

*Fl. & Fr.* : Sept.-Mar. Samaspur, *BKS* 51500

**Vallisneria spiralis** L.

Submerged herbs. Leaves *ca* 35 cm long, faintly toothed, male flowers numerous. Common in lakes.

*Fl. & Fr.* : Oct.-Mar. Samaspur, *BKS* 50717, 52311, 50607

## Pontederiaceae

**Eichhornia crassipes** (Mart.) Solms

Floating herbs with fleshy leaves, flowers lilac in colour. Common in lakes.

*Fl. & Fr.* : Throughout the year. Samaspur, *BKS* 52336, 50711, 51498

## Liliaceae

**Asphodelus tenuifolius** Cav.

Annual bulbous herbs, scapes several, capsules globose. Common in paddy fields and moist places.

*Fl. & Fr.* : Nov.-Jan. Samaspur, *BKS* 51507

## Commelinaceae

**Commelina benghalensis** L.

Annual herbs with purple violet flowers. Common in moist places.

*Fl. & Fr.* : Oct.-Jan. Samaspur, *BKS* 52402, 52390

**Murdannia nudiflora** (L.) Brenan

Diffuse herbs, flowers in terminal cymose. Common in moist places.

*Fl. & Fr.* : Oct.-Mar. Samaspur, *BKS* 52390

## Typhaceae

**Typha australis** Schum. & Thonn.

Perennial rhizomatous herbs *ca* 3 m, high, leaves thick and spongy, spikes long. Common along the lakes.

*Fl. & Fr.* : Oct.-May. Samaspur, *BKS* 52357

Alismataceae

**Limnophyton obtusifolium** (L.) Miq.

Herbs rooted in muds, flowers white-violet. Rare in shallow ditches or paddy fields.

*Fl. & Fr.* : Oct.-Jan., Salon, BKS 52374

**Sagittaria guayanensis** H.B.K. ssp. **lappula** (D.Don) Bogin

Herbs rooted in muds, leaves floating, flowers in 2-6 whorls, yellowish white in colour. Rare in paddy fields.

*Fl. & Fr.* : Sept.-Oct. Salon, BKS 52419

Araceae

**Pistia stratiotes** L.

Free floating herbs, leaves many in rosette, obovate-oblong, roots leathery. Common in ponds and lakes.

*Fl. & Fr.* : Aug.-Nov. Samaspur, BKS 50777, 52401

**Colocasia esculenta** (L.) Schott

Perennial herbs with short tuberous root stock. Common in paddy fields.

*Fl. & Fr.* : Nov.-Feb., Salon, BKS 50734 b

**Sauromatum pedatum** Schott

Perennial herbs with foetid tuberous root stocks. Rare in marshy shady places.

*Fl. & Fr.* : Nov.-Feb. Samaspur, BKS 50798

Areaceae

**Phoenix sylvestris** Roxb.

Robust trees, leaves 3-5 m long, leaflets spines tipped. Common grow along the lakes.

*Fl. & Fr.* : Jan.-Apr. Samaspur lake, BKS 50781 b

Lemnaceae

**Lemna perpusilla** Torr.

Free floating herbs, fronds with 1-roots. Common in stagnant or slow running water.

*Fl. & Fr.* : June-Aug. Samaspur, BKS 51416

**Spirodela polyrhiza** (L.) Schleid.

Free floating herbs, fronds with several roots. Common in lakes.

*Fl. & Fr.* : June-Aug. Samaspur, BKS 51419, 52378, 50745

Najadaceae

**Najas graminea** Del.

Submerged herbs. Common in lakes.

*Fl. & Fr.* : Aug.-Oct. Samaspur, BKS 52441, 50721 b

**N. marina** L.

Submerged herbs, leaves with spines. Rare in lakes.

*Fl. & Fr.* : Aug.-Nov. Samaspur, BKS 52335

## Potamogetonaceae

**Potamogeton crispus L.**

Submerged herbs. Common in lakes.

*Fl. & Fr.* : Jan.-Apr. Samaspur, BKS 50800, 50795, 50704

**P. nodous Poir.**

Herbs with floating leaves, spikes cylindric. Common in lakes.

*Fl. & Fr.* : Nov.-Mar. Samaspur, BKS 50761, 50704, 50727, 52377

**P. pectinatus L.**

Submerged slender herbs. Common in ponds and lakes.

*Fl. & Fr.* : Nov.-Apr. Samaspur, BKS 50799

## Cyperaceae

**Cyperus alopecuroides Rottb.**

Stout perennial herbs. Common in water logged places and lakes.

*Fl. & Fr.* : Sept.-Jan. Samaspur, BKS 50702, 50602, 51502

**C. alulatus Kern**

Annual small herbs, spikelets greenish yellow. Common in moist places.

*Fl. & Fr.* : Sept.-Jan. Samaspur, BKS 52339

**C. brevifolius (Rottb.) Hassk**

Small sedge with slender rhizomes, spikes globose. Common in moist places.

*Fl. & Fr.* : Aug.-Jan. Samaspur, BKS 52430

**C. difformis L.**

Fibrous rooted sedge ca 25 cm high, spikelets clustered. Common in moist places.

*Fl. & Fr.* : Sept.-Jan. Samaspur, BKS 52369, 52340a

**C. exaltatus Retz.**

A robust sedge ca 1.5 m high, inflorescence compound umbels. Rare in lakes.

*Fl. & Fr.* : Sept.-Dec. Samaspur, BKS 52320, 52388

**C. iria L.**

Annual tufted glabrous sedge, inflorescence simple or compound. Common in moist places.

*Fl. & Fr.* : Aug.-Nov. Samaspur, BKS 52316, 52341, 52427

**C. pumilus L.**

Annual sedge ca 2 cm high, inflorescence simple or compound, spikelets oblong linear. Rare in moist places.

*Fl. & Fr.* : Aug. Sept, Samaspur, BKS 52428

**C. platystylis R. Br.**

Perennial herbs. Rare along the ponds in shallow water.

*Fl. & Fr.* : Sept. - Oct. Samaspur, BKS 51502

**C. rotundus L.**

Polymorphic sedge with tufted rhizome, spikelets spicately arranged. Common in moist places.

*Fl. & Fr.* : Aug.-Nov. Samaspur, BKS 52323, 51437

**Cyperus. squarrosus L.**

Small sedge. Common in moist places.

*Fl. & Fr.* : Aug.-Nov. Samaspur, BKS 52356

**Eleocharis dulcis Trin.**

Perennial sedge *ca* 40 cm high. Common in moist places.

*Fl. & Fr.* : Aug.-Nov. Samaspur, BKS 50728

**Fimbristylis dichotoma (Rottb.) Clarke**

Annual herbs, inflorescence simple or compound. Common in moist places.

*Fl. & Fr.* : July-Nov. Samaspur, BKS 52352

**F. miliacea (L.) Vahl**

Annual sedge. Common along ponds & streams.

*Fl. & Fr.* : Sept.-Oct. Samaspur, BKS 52368, 52343

**F. schoenoides (Retz.) Vahl**

Perennial herbs. Rare in moist places.

*Fl. & Fr.* : Sept.-Nov. Samaspur, BKS 52321

**Scirpus articulatus L.**

Annual or perennial herbs, stems spongy, transversely septate, inflorescence capitate. Common in muddy places.

*Fl. & Fr.* : Sept.-Apr. Samaspur, BKS 50759, 51405, 50759

**Scirpus lateriflorus Gmelin**

Annual herbs *ca* 40 cm high, inflorescence capitate. Common in muddy places.

*Fl. & Fr.* : Aug.-Nov. Samaspur, BKS 50762

**S. littoralis Schrad.**

Perennial tall sedge *ca* 1.5 m high, inflorescence pseudolateral. Common in lakes and shallow water.

*Fl. & Fr.* : Sept.-Jan., Samaspur, BKS 50789, 52408 and 50720

**S. roylei (Nees) Parker**

Annual sedge, culms slender with a single head of 1-9 golden yellow spikelets, on their upper halves. Rare in moist places.

*Fl. & Fr.* : Oct.-Jan. Samaspur, BKS 52342 b

Poaceae

**Chrysopogon aciculatus (Retz.) Trin.**

Tufted annual grass *ca* 50 cm high. Common in moist places.

*Fl. & Fr.* : Sept.-Jan. Samaspur, BKS 52322

**Chloris dolichostachya Lag.**

Tufted decumbent ascending grass *ca* 1 m high. Rare along lakes.

*Fl. & Fr.* : Oct.-Jan. Samaspur, BKS 52414

**C. virgata Swartz**

Tufted grass, spikes 5-15 in number. Common in marshy places.

*Fl. & Fr.* : Sept.-Jan. Samaspur, BKS 52348 a, 52406

**Cynodon dactylon** (L.) Pers.

Perennial grass with terminal digitate spikes. Common in moist places.

*Fl. & Fr.* : July-Mar. Samaspur, BKS 52348 b

**Dactyloctenium aegyptium** (L.) Willd.

Small grass with terminal digitate spikes. Common in moist places.

*Fl. & Fr.* Sept. March. Samaspur, BKS 52305

**Desmostachya bipinnata** (L.) Stapf

Perennial herbs, panicles 9-13 cm long, spikelets sessile, 2-seriate. Common in moist places.

*Fl. & Fr.* : July-Nov. Samaspur, BKS 50707

**Echinochloa colona** (L.) Link.

Annual grass, inflorescence a panicle of branched spikes. Common in moist places.

*Fl. & Fr.* : Sept.-Jan. Samaspur, BKS 52347, 52354

**E. crusgalli** (L.) P. Beauv.

Branch stout grass *ca* 80 cm high, racemes solitary or 2 nate. Rare in water logged places.

*Fl. & Fr.* : Sept. - Nov. Samaspur, BKS 52437

**E. stagnina** (Retz.) P. Beauv.

Annual grass *ca* 1 m high, culms rooting at nodes, panicles *ca* 20 cm long. Rare in moist places.

*Fl. & Fr.* : Sept.-Jan. Samaspur, BKS 52318, 52380, 52437

**Eleusine indica** (L.) Gaertn.

Annual herbs, spikes 2-7 or more. Common in moist places.

*Fl. & Fr.* Aug.-Dec. Samaspur, BKS 52345

**Eragrostis japonica** (Thunb.) Trin.

Tufted annual grass. Common in moist places.

*Fl. & Fr.* : Oct.-Mar. Samaspur, BKS 51498

**E. tenella** (L.) P. Beauv.

Annual herbs, panicles *ca* 13 cm long. Common in moist places.

*Fl. & Fr.* Aug.-Nov. Samaspur, BKS 52319

**Hygroryza aristata** (Retz.) Nees ex. Wt. & Arn.

Floating aquatic grass with spongy sheaths, panicles globose, *ca* 7 cm long. Common in lakes.

*Fl. & Fr.* : Aug.-Jan. Samaspur, BKS 52383

**Ischaemum rugosum** Salisb.

Annual grass, racemes in pairs, *ca* 15 cm high. Common in moist places.

*Fl. & Fr.* Aug.-Nov. Samaspur, BKS 52417

**Oplismenus burmannii** (Retz.) P. Beauv.

Slender annual grass *ca* 60 cm high, panicles *ca* 8 cm long. Common in moist places.

*Fl. & Fr.* : Sept.-Dec. Samaspur, BKS 51462, 52395

**Oryza rufipogon** Griff.

Wild rice in shallow water margin, panicles *ca* 20 cm. long. Common in paddy fields.

*Fl. & Fr.* : Aug.-Dec. Samaspur, BKS 52317, 52405

**Panicum paludosum** Roxb.

Large floating aquatic grass. Common in lakes.

*Fl. & Fr.* : Sept.-Feb. Samaspur, BKS 52325

**Paspalum scrobiculatum** L.

Tufted grass *ca* 70 cm high, rooting at lower nodes, spikes 2-6. Common in moist places.

*Fl. & Fr.* : Sept.-Dec. Samaspur, BKS 52349

**Paspalidium flavidum** (Retz.) A. Camus

Decumbent grass *ca* 1 m high, panicles of 5-10 spikes. Rare in moist places.

*Fl. & Fr.* : Oct.-Jan. Samaspur, BKS 52324, 52415

**Polypogon monspeliensis** (L.) Desf.

Small annual grass, inflorescence cylindric or spiciform. Common in moist paddy fields.

*Fl. & Fr.* Nov.-Jan. Samaspur, BKS 50725

**Phalaris minor** Retz.

Small annual grass, panicles cylindric. Common in moist places.

*Fl. & Fr.* Sept.-Mar. Samaspur, BKS 50614

**Pseudoraphis spinescens** (R. Br.) Vickery

Slender perennial grass. Common in muddy places.

*Fl. & Fr.* : Sept.-Jan. Samaspur, BKS 52381, 50708

**Saccharum spontaneum** L.

Robust grass, panicles *ca* 40 cm high. Common in moist places.

*Fl. & Fr.* : Sept.-Jan. Samaspur, BKS 50797

**Setaria intermedia** Roem. & Schult.

Small annual grass, panicles *ca* 12 cm long bristles retrorsely barbed. Common in moist places.

*Fl. & Fr.* : Sept.-Jan. Samaspur, BKS 52303, 52433.

**Sporobolus diander** (Retz.) P. Beauv.

Small grass common in moist places.

*Fl. & Fr.* : Sept.-Jan. Samaspur, BKS 41240, 50712

**Vetiveria zizanioides** (L.) Nash

Erect stout herbs, panicles *ca* 30 cm long. Frequent along the ditches.

*Fl. & Fr.* Aug.-Jan. Samaspur, BKS 52306, 51403

PTERIDOPHYTES

Azollaceae

**Azolla pinnata** R. Br.

Small aquatic plants, rhizome very slender. Common in ponds.

*Fl. & Fr.* : Throughout the year. Samaspur, BKS 52362, 50703



## Marsileaceae

**Marsilea minuta L.**

Aquatic or amphibious herbs, fronds simple with 2-4 leaflets, sporocarps heterosporous. Common in ponds.

*Fl. & Fr.* : July-Nov. Samaspur, BKS 50776, 52313, 50730

## IMPORTANCE OF WETLANDS

Wetlands are important due to an important life support system for the flora and fauna. Wetlands are of great economic and aesthetic values and have played key role in the evolution of human settlements, culture, agricultural operations and industrial growth. The plants of aquatic habitats are used by man and animals by various ways viz., as source of vegetables, medicine, green manure, as food for fishes and birds and some miscellaneous and commercial uses. The details are given below :

## 1 Hydrophytes as source of food :

Name of species	Parts used
<i>Ipomoea aquatica</i>	Stem and leaves used as vegetables.
<i>Sagittaria guayanensis</i>	Leaves used as vegetables.
<i>Alternanthera sessilis</i>	Leaves used as vegetables.
<i>Amaranthus viridis</i>	Whole plant used as vegetables.
<i>A. tricolor</i>	Whole plant used as vegetables.
<i>Centella asiatica</i>	Plant used as vegetables.
<i>Enhydra fluctuans</i>	Whole plant used as vegetables.
<i>Commelina benghalensis</i>	Whole plant used as vegetables.
<i>Ottelia alismoides</i>	Leaves & fruits are used as vegetables.
<i>Marsilea minuta</i>	Tender parts are eaten as pot herb.
<i>Nelumbo nucifera</i>	Tender root stocks, rhizome & young leaves are used as vegetables. Flowers & seeds are eaten as raw or cooked.
<i>Nymphaea nouchali</i>	Tender & ripe carpels are eaten as raw and roots & stems are eaten cooked, seeds are eaten as raw.
<i>N. pubescens</i>	Tender & ripe carpels are eaten as raw and roots & stems are eaten cooked, seeds are eaten as raw.
<i>Oxalis corniculata</i>	Whole plant used as vegetables.
<i>Hygroryza aristata</i>	Grains eaten by poor people during scarcity.
<i>Oryza rufipogon</i>	Grain eaten by poor.
<i>Typha australis</i>	Rhizome & young shoots eaten as vegetables.
<i>Neptunia oleracea</i>	Plant used a pot herb and pods for vegetables.
<i>Colocasia esculenta</i>	Tuberous roots & leaves are eaten as vegetables.

# 1) Hydrophytes as source of medicines :

Name of species	Part Diseases
<i>Ottelia alismoides</i>	Whole plant : Used for curing female diseases and for bone fracture.
<i>Vallisneria spiralis</i>	Leaf : As invigora- ting tonic.
<i>Nymphaea stellata</i>	Seed : As invigora- ting tonic.
<i>Nelumbo nucifera</i>	Seed : As invigora- ting tonic.
<i>Nymphaea nouchali</i>	Tuber : Piles, dyspe- psia and dysentery.
<i>Ipomoea aquatica</i>	Leaf : Biliousness & Jaundice.
<i>Limnophila indica</i>	Leaf : Biliousness & Jaundice.
<i>Hygrophila auriculata</i>	Leaf : Biliousness & Jaundice.
<i>Ceratophyllum demersum</i>	Whole plant : Biliousness & Jaundice.
<i>Pistia stratiotes</i>	Leaf : Chronic skin diseases, asthma & cough.
<i>Centella asiatica</i>	Whole plant : For improving health and mental problems.
<i>Enhydra fluctuans</i>	Whole plant : As laxative and used in cutaneous and nervous disorder.
<i>Neptunia oleracea</i>	Stem and root : Used for cursing ear ache and for syphilis.
<i>Nymphoides hydrophylla</i>	Whole plant : As tonic of development of foetus during pregnancy period.
<i>Polygonum glabrum</i>	Whole plant : Used as febrifuge and the infusion of leaves is used for curing pain.
<i>Hygroryza aristata</i>	Seeds : Used of cooling agent, astringent & in biliousness.

# 1) Hydrophytes as food for animals :

<i>Hygrophila polysperma</i>	Whole plant as fodder.
<i>Justicia simplex</i>	Whole plant as fodder.
<i>Rungia repens</i>	Whole plant as fodder.
<i>Limnophyton obtusifolium</i>	Whole plant as fodder.
<i>Alternanthera pungens</i>	Whole plant as fodder.
<i>Digera muricata</i>	Whole plant as fodder.
<i>Amaranthus tricolor</i>	Whole plant as fodder.
<i>Caesulia axillaris</i>	Whole plant as fodder.
<i>Ageratum conyzoides</i>	Whole plant as fodder.
<i>Coronopus didymus</i>	Whole plant as fodder.
<i>Cyperus</i> spp.	Whole plant as fodder.
<i>Eleocharis</i> spp.	Whole plant as fodder.
<i>Fimbristylis</i> spp.	Whole plant as fodder.
<i>Scirpus</i> spp.	Whole plant as fodder.
<i>Medicago polymorpha</i>	Whole plant as fodder.
<i>Melilotus alba</i>	Whole plant as fodder.
<i>M. indica</i>	Whole plant as fodder.
<i>Cynodon dactylon</i>	Whole plant as fodder.

<i>Chrysopogon aciculatus</i>	Whole plant as fodder.
<i>Chloris dolichostachya</i>	Whole plant as fodder.
<i>C. virgata</i>	Whole plant as fodder.
<i>Dactyloctenium aegyptium</i>	Whole plant as fodder.
<i>Desmostachya bipinnata</i>	Whole plant as fodder.
<i>Echinochloa</i> spp	Whole plant as fodder.
<i>Oplismenus burmannii</i>	Whole plant as fodder.
<i>Paspalidium flavidum</i>	Whole plant as fodder.
<i>Rumex dentatus</i>	Whole plant as fodder.
<i>Eichhornia crassipes</i>	Whole plant as fodder.

### 1) Hydrophytes as source of food for fishes and ducks :

Several hydrophytes are used by the fish and duck as food. Some of them are : *Hydrilla verticillata*, *Lemna perpusilla*, *Ottelia alismoides*, *Pistia stratiotes*, *Vallisneria spiralis*, *Spirodela polyrhiza*, *Azolla pinnata*.

### 2 Hydrophytes in miscellaneous commercial uses :

Several hydrophytes are as a source of useful products viz., The strong fibrous culms or leaves of *Typha*, *Aeschynomene* and *Saccharum* species are used for weaving of mats, screens and chair bottoms.

Species of *Azolla*, *Lemna*, *Utricularia*, along with *Eichhornia*, *Pistia* and *Hydrilla* are commonly collected in large quantities and are used as manure or fodder for cattle.

### 3 Plant bird relationship in Salon Wetland :

Migrator as well as indigenous birds depend for their foods and shelter in the above wetlands. A list of plant species are given below as they use their parts for food or shelter purposes.

Birds	Plant Species & Parts Used
Crane	<i>Nymphaea pubescens</i> Rhizome eaten.
Crane	<i>N. nouchali</i> Rhizome eaten.
Coots	<i>Ipomoea aquatica</i> Whole plant eaten.
Ducks	<i>Ceratophyllum demersum</i> Achenes eaten.
Coots & Pochards	<i>Hydrilla verticillata</i> Whole plant.
Purple Morhan	<i>Typha australis</i> Rhizome eaten, also nesting.
Ducks	<i>Spirodela polyrhiza</i> Whole plant eaten.
Ducks	<i>Lemna perpusilla</i> Whole plant eaten.
Cotton teals	<i>Potamogeton nodosus</i> Whole plant eaten.
	<i>P. crispus</i> , <i>P. pectinatus</i> Whole plant eaten.
Coots, Pochards	<i>Najas marina</i> , <i>N. graminea</i> Whole plant eaten.
Purple Morhan	<i>Cyperus alopecuroides</i> For nesting.
Purple Morhan	<i>Eleocharis dulcis</i> Rhizome eaten.
Crane & Ducks	<i>Hygroryza aristata</i> Achenes & Leaves eaten.

Ducks	<i>Azolla pinnata</i> Seeds eaten.
Purple Morhan	<i>Ipomoea carnea</i> ssp. <i>fistulosa</i> For nesting.
Ducks	<i>Marsilea minuta</i> Seeds eaten.

#### CONSERVATION MEASURES

The present status of wetland ecosystem in and around the Salon may be improved by the following measures :

- 1 Afforestation in catchment areas for checking the soil erosion and sedimentation of the lakes.
- 2 Weed control by manual eradication adversely affect biodiversity, hence some other techniques, preferably biological are needed. Further, the proper economic utilization of weeds is also necessary for the economic development of the area.
- 3 Mapping of the Wetlands and their demarcation for checking encroachment will improve the present status of wetlands.
- 4 Awareness among the people regarding the economic and aesthetic values and functions of the wetland ecosystems will also considerably improve the present status of the wetlands.
- 5 Biological treatment of the wetlands suffering from eutrophication can be more economic way for the control of nutrient enrichment. The species like *Potamogeton pectinatus*, *Myriophyllum spicatum* and *Elodea canadensis* which have capacity of absorbing 60% nitrogen and quite a high percentage of phosphorus may be introduced. On the bank of wetlands the species like *Typha australis* may be grown which have the capacity of trapping about 50% phosphorus and 25% nitrogen (Solbe & Del. 1986).

#### Recommendation for the Future Management of the Lakes

For better management of the wetland and to provide adequate facilities for roosting, nesting and breeding to the avian fauna, the following measures are proposed.

- i) Creation of islands and dykes.
- ii) Plantation of fruit bearing and shade trees.
- iii) Control of pesticides, insecticides and weeds of the lake.

The sanctuary provides immense opportunity for bird watching and has great potential to develop as a place of tourist attraction. In this context following infrastructure need to be developed in the sanctuary area.

- 1 Construction of rest house.
- 2 Construction of reception cum information centre.
- 3 Construction of auditorium.
- 4 Construction of interpretation centre.
- 5 Providing facilities for transport.
- 6 Construction of Hides.
- 7 Providing binoculars and boats etc.

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