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Macrophytes of the lowland wetlands in Morang district, Nepal

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Abstract

In total, 149 species of macrophytes (angiosperms 138, pteridophytes 7, bryophytes 2, algae 2) were recorded among which 117 species were emergent, 12 floating-leafed, 14 submerged and 6 free-floating on the basis of life form. In general, 68% species had flowering-fruiting during the rainy season, 17% in winter and 15% in the summer season. Many of the plant species were observed to play important role in meeting day to day requirements of the rural people.

Key words: Ethnobotany, life form, macrophytes, reproductive phase, wetlands.

Introduction

Known as 'Simsar' in Nepal, wetlands are those areas which lie between the land and deepwater and remain waterlogged or submerged under water, seasonally or throughout the year. Generally, the land is so muddy that one cannot easily walk over it, and water is so deep that one can neither swim nor get drowned. River floodplains, shallow margins of lakes and reservoirs, depressions/ditches, man-made ponds, islands in rivers, marshes, swamps and deepwater paddy fields are typical examples of freshwater wetlands found in Nepal (Jha, 2008). Wetland macrophytes are grouped into five categories: obligate wetland plants (OBL) that occur almost always in wetlands under natural conditions; facultative wetland plants (FACW) that occur usually in wetlands, but also occur in nonwetlands; facultative plants (FAC) with a similar likelihood of occurring in both wetlands and nonwetlands; facultative upland plants (FACU) that occur sometimes in wetlands, but occur more often in nonwetlands; and obligate upland plants (UPL) that occur rarely in wetlands, but occur almost always in nonwetlands under natural condition (Mitsch & Gosselink, 2000). This paper enumerates macrophytes of OBL, FACW and FAC categories that occur in the lowland wetlands (a part of the Indo-Gangetic floodplain) of Morang district along with their life form, season for flowering-fruiting/spore formation, locality, habitat and human use (s) value.

Materials and Methods

All types of wetlands occurring at five locations (Biratnagar, Indrapur, Baghjhoda, Betana and Madhumalla) in the lowland region (26°20′ to 26°45′ N and 87°15′ to 87° 30′ E, altitudes 72 to 300 m msl) of Morang district were surveyed for macrophytes during January, 2009 to December, 2010. Climate of the lowland region of Morang district is tropical and monsoonic with three seasons in a year, *viz*., rainy (mid-June to October), winter (November to February), and summer (March to mid- June). The maximum and minimum annual temperature is 30.6°C and 14.2°C, respectively. July

is the hottest month while January is the coldest month. The average annual rainfall is about 1312 mm, of which 85% is received during the rainy season.

Plant materials and field data were gathered by making regular visits at monthly intervals to the selected locations. Generally, four to five specimens of each species were collected after recording field data such as life from, habitat, and phenology. The collected specimens were properly dried and treated with 0.1% solution of mercuric chloride for 1 to 2 min before mounting them on the herbarium sheet (Jha and Jha, 2000). The herbarium specimens were identified with the help of standard literature (Banerji, 1972; Hooker, 1872-1897; Iwatsuki, 1988; Cook, 1996; Siwakoti & Varma, 1999), and all the identifications were confirmed further by cross-checking with the authentic specimens at the National Herbarium and Plant Laboratories, Godavari (KATH). Scientific names of the specimens provided by Hara *et al.* (1978, 1979, 1982), Iwatsuki (1988), Koba *et al.* (1994), Cook (1996) and Press *et al.* (2000) were adopted for nomenclature.

Information on use(s) of the macrophytes were collected either through direct consultation with local practitioners or through consulting standard literature (CSIR, 1992; Manandhar, 1998).

Results and Discussion

In total 149 species of macrophytes were recorded in the present study among which angiosperms were represented by 45 families (dicots 28, monocots 17), 103 genera (dicots 48, monocots 55), and 138 species (dicots 60, monocots 78); pteridophytes by 6 families, 6 genera and 7 species; bryophytes by 2 families, 2 genera and 2 species, and algae by only one family, 2 genera and 2 species (Table 1). The ten dominant families of angiosperms occurred in the order: Poaceae (26 species) > Cyperaceae (21) > Asteraceae (8) > Scrophulariaceae (5) > Acanthaceae (4), Araceae (4), Commelinaceae (4), Hydrocharitaceae (4), Polygonaceae (4), and Potamogetonaceae (4). The dicot genera with two or more species were *Alternanthera, Ammannia, Hygrophila, Ipomoea, Limnopila, Lindernia, Ludwigia, Nymphoides, Persicaria,* and *Rorippa.* The genera represented by two or more species among the monocots were *Cyperus, Echinochloa, Eragrostis, Fimbristylis, Kyllinga, Leptochloa, Monochoria, Panicum, Paspalum, Potamogeton, Sacciolepis, Sagittaria,* and *Schoenoplectus.* Only one genus *(Equisetum)* was represented by two species among the pteridophytes.

The invasive alien species (IAS) occurring in the wetlands were *Alternanthera philoxeroides, Eichhornia crassipes, Ipomoea carnea* and *Mikania micrantha.*

Phenological information can be used to study animal-plant interactions which affect pollination, seed dispersal, and fruit/seed predation. These interactions are important for plant reproduction and reciprocally for food for the animals involved (Jha, 2005). Observations made on the recorded macrophytes revealed that 68% species attained reproductive phase in rainy, 17% in winter, and 15% in the summer season.

Analysis of life form indicated that 117 species of the recorded macrophytes were emergents, 12 floating-leafed, 14 submerged, and 6 free-floating. Both the free-floating and floating-leafed species provide a nesting habitat for birds such as the pheasant-tailed Jacana, bronze-winged Jacana, and purple Moorhen (Sankhala, 1990). The submerged macrophytes provide food for fish and a habitat for large numbers of

Table 1. Wetland macrophytes and their uses (Life forms: E = emergent; FL= floating -leafed; FF= free-floating; S=submerged). LF= Life form, SFFSF= Season for flowering-fruiting/spore formation

Family	Plant species	LF	SFFSF	Locality	Habitat	Parts used	Uses
A. Dicotyledons							
1. Acathaceae	*Hygrophila auriculata* (Schumach.) Heine	E	Oct.-Apr.	Biratnagar-4	Edge of ditches	-	-
	H. difformis (L.f.) Blume	E	Aug.-Dec.	Betana	Edge of ditches, marshes	-	-
	H. polysperma (Roxb.) T. Anderson	E	Oct.-May.	Betana	Edge of ditches, marshes	-	-
	Phlogacanthus pubinervius T. Anderson	E	Feb.-Mar.	Betana	Marshes	-	Pot-herb
2. Amaranthaceae	*Alternanthera paronychioides* St. Hil.	E	Aug.-Dec.	Biratnagar-4	Moist soil	Shoot	Green manure/compost
	A. philoxeroides (Mart.) Griseb	E	Mar.-Jun.	Biratnagar-10	Muddy ponds, canals & ditches	Whole plants	Pot-herb, medicinal , IAS
	A. sessilis (L.) DC	E	All seasons	Indrapur	Edge of ditches, moist soil	Whole plant	Young shoot-nutritious plant-galactagogue, febrifuge, abortifacient. Cures indigestion.
	Gomphrena celosioides Mart.	E	All seasons	Biratnagar-18	Moist soil	-	Feed for livestock.
3. Apiaceae	*Centella asiatica* (L.) Urban	E	All seasons	Biratnagar-18	Moist soil	Whole plant	Used as an diuretic, decoction useful in leprosy & nervous disorder.
	Hydrocotyle sibthorpioides Lam.	E	Dec.-Jan.	Madhumalla	Moist soil	-	-
	Oenanthe javanica (Blume) DC.	E	May.-Jul.	Biratnagar-18	Marshes	Shoot	Pot-herb.
4. Asclepiadaceae	*Oxystelma esculentum* (L.f.) Sm.	E	Aug.-Nov.	Biratnagar-10	Moist soil	Root	Medicinal
5. Asteraceae	*Caesulia axillaris* Roxb.	E	Sep.-Feb.	Biratnagar-6	Wet paddy field	Shoot	Fodder, Medicinal
	Cotula hemisphaerica (Roxb.) Wall. ex C.B.Clarke	E	Jan.-Apr.	Biratnagar-18	Wet paddy fields	Shoot	Medicinal.
	Eclipta prostrata (L.) L	E	All seasons	Biratnagar-15	Edge of water course, moist soil	Shoot	Medicinal, religious
	Gnaphalium affine D. Don.	E	Feb.-Oct.	Biratnagar-18	Moist soil	-	-
	Grangea maderaspatana (L.) Poir.	E	All seasons	Biratnagar-15	Moist soil	Whole plant	Green manure/compost, Medicinal
	Mikania micrantha Kunth	E	Nov.-Feb.	Biratnagar-18	Moist soil, ditches & ponds	-	IAS.
	Sphaeranthus indicus L.	E	Feb.-Apr.	Biratnagar-18	Wet paddy fields	Shoot	Insect repellent
	Spilanthes iabadicensis A.H. Moore	E	All seasons	Biratnagar-4	Marshes, edge of water bodies	-	-
6. Boraginaceae	*Heliotropium indicum* L.	E	Oct.- Dec.	Biratnagar-15	Dry ditches	-	-
7. Brassicaceae	*Rorippa benghalensis* (DC.) H. Hara	E	Apr.-Jun.	Biratnagar-15	Moist soil	Shoot	Medicinal
	R. nasturtium-aquaticum (L.) Hayek	E	Apr.-Jun.	Biratnagar-18	Marshes	Shoot	Pot-herb, Medicinal
8. Cabombaceae	*Cabomba aquatica* Aublet	S	Jun.-Oct.	Betana	Silty ponds	Whole plant	Fodder
9. Ceratophyllaceae	*Ceratophyllum demersum* L.	S	All seasons	Biratnagar -18	Silty ponds, canals	Leaves	In scorpion sting, antipyretic, cooling effect, hyper accumulator of heavy metals
10. Convulvulaceae	*Impomea aquatica* Forrsk.	FL	Nov.- Jan.	Biratnagar-4	Ponds, ditches	Leaf	Pot-herb, Juice emetic, & purgative

	I. carnea Jacq. sub sp. *fistulosa* (Mart. ex Choisy) D.F. Austin	E	Apr.- Jan.	Biratnagar-4	Ponds, edge of water course	Whole plant	Leaf Juice has insecticidal properties, IAS
11. Fabaceae	*Aeschynomene asper* L.	E	Aug.-Nov.	Biratnagar-16	Wet paddy field	Shoot	Fodder/ Handicrafts
	Alysicarpus rugosus (Willd.) DC.	E	Sep.-Dec.	Biratnagar-18	Moist soil	Shoot	Fodder
	Smithia ciliata L.	E	May.-Sep.	Madhumalla	Edge of water courses, moist soil	Shoot	Fodder
12. Gentianaceae	*Nymphoides hydrophyllum* (Lour.) O. Kuntze	FL	Jul.-Sep.	Biratnagar-15	Muddy ditches, canals	Whole plant	Used in jaundice & ulcer
	N . indica (L.) O.Kuntze	FL	Oct.-Feb.	Biratnagar-18	Muddy ponds	Shoot	Used as a substitute for chiretta/febrifuge
13. Hydrophyllaceae	*Hydrolea zeylanica* (L.) Vahl	E	Nov.-Feb.	Biratnagar-15	Wet paddy fields	Flowers	Medicinal
14. Lamiaceae	*Leonurus japonicus* Houtt.	E	Dec.-Feb.	Biratnagar-18	Moist soil	–	–
15. Lentibulariaceae	*Urticularia aurea* Lour.	S	Aug.-Jan.	Betana	Muddy ponds, ditches	Bladder	Food (Fish)
16. Lythraceae	*Ammannia auriculata* Willd.	E	Nov.-Mar.	Madhumalla	Edge of water courses	Shoot	Fodder
	A. baccifera L.	E	Nov.-Mar.	Biratnagar 15	Paddy fields	-	-
	Rotala rotundifolia (Buch.-Ham. ex Roxb.) Koehne	E	Dec.-Feb.	Betana	Marshes	-	-
17. Melastomataceae	*Osbekia stellata* Buch-Ham.ex D.Don	E	Jul.-Oct.	Betana	Fringes of ox-bow ponds	Fruits	Food
18. Nymphaeaceae	*Euryale ferox* Salisb.	FL	May. Aug.	Biratnagar-18	Ponds, ditches	Seeds	Food
	Nelumbo nucifera Gaertn.	FL	Jul.-Sep.	Betana	Muddy water bodies	Leaves, seeds & flower	Leaves-food plates, seeds edible. Flower- worship
	Nymphaea pubescens Willd.	FL	Jul.-Sep.		Muddy water bodies	Seeds	Food
19. Onagraceae	*Ludwigia adscendens* (L.) H. Hara	FL	Mar.- Apr.	Biratnagar-16	Ponds, ditches	Shoots	Medicinal
	L. octavalvis (Jacq.) Raven	E	Aug.-Jan.	Betana	Marshes	-	-
20. Polygonaceae	*Persicaria barbata* (L.) H. Hara	E	Jul.-Nov.	Birtnagar-10	Edge of water course	Inflorescence	Medicinal
	P. hydropiper (L.) Spach.	E	.Jul.-Oct.	Biratnagar-10	Moist soil, ditches	Shoot	Decoction as an oral contraceptive, used in uterine disorders, fish poison.
	Polygonum glabrum Willd.	E	Sep.-Nov.	Biratnagar-18	Muddy edges of perennial water	Shoot	Medicinal.
	Rumex dentatus L.	E	Jan.-Apr.	Biratnagar-18	Ditches	Whole plant	Green manure/Compost.
21. Ranunculaceae	*Ranunculus sceleratus* L.	E	Jan.-May.	Biratnagar-16	Muddy ditches	Shoot	Plant juice in inrheumatism & asthma
22. Scrophulariaceae	*Limnophila indica* (L.) Druce.	FL	Aug.-Nov.	Betana	Edges of muddy ponds	Shoot	Medicinal
	L. rugosa (Roth.) Merr.	E	Aug.-Nov.	Betana,	Silty marshes in shade	-	-
	Lindernia anagallis (Burm.f) Pennell	E	Oct.-Dec.	Baghjoda	Marshes	-	-
	*L. antipod*a (L.) Alston	E	All Seasons	Biratnagar-8	Moist sandy soil	Shoot	Medicinal
	Veronica anagallis-aquatica L.	E	May.-Aug.	Biratnagar-10	Marshes	-	-
23. Solanaceae	*Physalis divaricata* D. Don	E	All Seasons	Biratnagar-6	Moist soil	-	-
24. Sphenocleaceae	*Sphenoclea zeylanica* Gaertn.	E	Jul.-Nov.	Madhumalla	Wet paddy fields	Shoot	Pot-herb
25. Tamaricaceae	*Tamarix dioica* Roxb. ex Roth	E	Aug.-Nov.		Sand riverbank soils	Shoot	Fodder

26. Trapaceae	*Trapa qudrispinosa* Roxb.	FL	Mar.-Jul.	Biratnagar-18	Cultivated, ponds, ditches	Fruits	Fruit edible
27. Urticaceae	*Pouzolzia zeylanica* (L.) J. Bennett & Br.	E	Sep.-Nov.	Biratnagar-18	Marshes	Leaf	Medicinal
28. Verbinaceae	*Lippia nodiflora* (L.) Rich.	E	All Seasons	Biratnagar-18	Shady moist places	Whole plant	Medicinal
B. Monocotyledons							
29. Alismataceae	*Sagittaria guyanensis* Kunth	FL	Sep.-Nov	Biratnagar-4	Ditches, paddy fields	Rhizome	Pot-herb
	S. trifolia L.	E	Jun.-Sep.	Betana	Marshes	Young leaves	Pot--herb
30. Amaryllidaceae	*Crinum asiaticum* Roxb.	E	Jul.-Aug.	Biratnagar-4	Edge of ditches	-	-
31. Aponogetonaceae	*Aponogeton appendiculatus* H. Bruggen	FL	Sep.-Feb.	Betana	Sandy bottom of running water	Tubers	Food
32. Araceae	*Acorus calamus* L.	E	Mar.-Jun.	Biratnagar-1	Marshes	Rhizome	Medicinal/Insect repellents
	Colocasia esculenta (L.) Schott	E	Aug,.-Sep.	Biratnagar-10	Muddy ditches, canals	Whole plant	Vegetable /Fodder
	Lasia spinosa (L.) Thwaites	E	Sep.-Nov.	Betana	Oxbow pond/silty-marshes	Shoot	Vegetable
	Pistia stratiotes L.	FF	Aug.-Feb.	Biratnagar-15	Ponds, ditches	Whole plant	Plant as manure, juice in earache, ashes in ringworm. Leaves eczema, leprosy, ulcer
33. Butomaceae	*Butomopsis latifolia* (D.Don) Kunth	E	Sep.-Nov.	Madhumalla	Wet paddy fields	-	-
34. Cannaceae	*Canna indica* L.	E	All Seasons	Biratnagar-15	Muddy ditches	-	-
35. Commelinaceae	*Amischophacelus axillaris* (L.) Rao & Kammathy	E	Aug.-Nov.	Biratnagar-18	Moist places	-	-
	Commelina benghalensis L.	E	Jul.-Jan.	Biratnagar-18	Edges of water, marshes & ditches	Shoot	Useful in leprosy
	Floscopa sc&ense Lour.	E	Sep.-Dec.	Betana	Edges of water courses	Shoot	Fodder
	Murdania nudiflora L.Brenan	E	Aug.-Oct.	Biratnagar-18	Paddy fields	Shoot	Fodder
36. Cyperaceae	*Carex nubigena* D.Don	E	Aug.-Nov.	Betana	Marshes	Shoot	Fodder
	Cyperus amabilis Vahl	E	Aug.-Oct.	Madhumalla	Wet paddy field	-	-
	C. compressus L.	E	Sep-Oct.	Biratnagar-10	Marshes	Shoot	Fodder
	C. corymbosus Rottb.	E	Sep.-Nov.	Madhumalla	Marshes	Shoot	H&icrafts
	C. difformis L.	E	Aug.- Nov.	Biratnagar-18	Marshes, ditches	-	-
	C. esculentus L.	E	Aug.- Nov	Biratnagar-18	Marshes, paddy fields	Shoot	H&icrafts
	C. iria L.	E	Sep.-Nov.	Biratnagar-4	Paddy fields	Whole plant	Medicinal
	C. natus Vahl	E	Aug.-Oct.	Betana	Muddy edge of ponds	Shoot	Fodder
	C. pilosus Vahl	E	Sep.- Nov	Biratnagar-7	Swamps	-	-
	C. platystylis R. Br.	E	Sep.- Nov	Betana	Sandy moist soil	-	-
	Eleocharis atropurpurea (Retz.) Presl	E	Nov.-Dec.	Biratnagar-8	Rice field	Shoot	Fodder
	Fimbristylis dichotoma (L.) Vahl	E	Jun.-Nov.	Biratnagar-18	Edge of ponds	Shoot	Fodder
	F. littoralis Gaud.	E	Jun.-Nov.	Biratnagar-18	Moist paddy fields	Shoot	Fodder
	F. schoenoides (Retz.) Vahl	E	Set.-Nov	Biratnagar-18	Wet paddy fields	Shoot	Fodder
	Kyllinga brevifoia Rottb.	E	Jul.-Nov.	Biratnagar-10	Moist soil	Shoot	Fodder

	K. nemoralis (J.R.& G. Frost.) D&y ex Hutch. & Dalziel	E	Jul.-Nov.	Biratnagar-18	Moist soil	Shoot	Fodder
	Pycreus flavidus (Retz.) Koyama	E	Sep.-Nov.	Betana	Edges of silty ponds	-	-
	Schenoplectus juncoides (Roxb.) Palla	E	Apr.-Nov.	Madhumalla	Marshes	Roots	Medicinal
	S. mucronatus (L.) Palla.	E	Jun.-Nov	Biratnagar-10	Marshes, Edges of ponds	-	-
	S. quandrangulus D. Don	E	Oct.- Dec.	Biratnagar-18	Marshes	-	-
	Scleria paravula Steudel	E	Sep.-Nov	Betana	Marshes	Shoot	Fodder
37. Eriocaulaceae	*Eriocaulon trilobum* Ham. ex. Kornicke	E	Sep.-Oct.	Biratnagar-16	Wet paddy fields	-	-
38. Hydrocharitaceae	*Blyxa japonica* (Miq.) Maxim	S	Nov.-Feb.	Betana	Silty pond	Whole plant	Fodder
	Hydrilla verticillata (L.f.) Rolye	S	Nov.-Feb.	Betana	Muddy river beds, ponds	Whole plant	Food for fishes & source of oxygen
	Hydrocharis dubi (Blume) Backer	S	Oct.-Dec.	Betana	Silty ponds	Shoot	-
	Ottelia alismoides (L.) Pers	S	Sep.-Mar.	Biratnagar-18	Muddy ditches, canals	-	-
	Vallisnaria natans (Lour.) H.Hara	S	Oct.-Mar	Betana	Muddy ditches, canals		Medicinal
39. Lemnaceae	*Lemna perpusilla* Torrey	FF	Sep.- Dec.	Biratnagar-16	Ditches, ponds, canals	Whole plant	Medicinal
	Spirodela polyrhiza (L.) Schleiden	FF	Sep.- Dec.	Biratnagar-16	Ditches, ponds, canals	Whole plant	compost/Manure
40. Najadaceae	*Najas graminea* Raff.-Del	S	Sep.- Dec	Betana	Silty ponds	Leaves & stem	Food (fish)
41. Pandanaceae	*Pandanus nepalensis* St. John	E	Sep.- Nov.	Biratnagar-18	Fringes of oxbow ponds)	-	-
42. Poaceae	*Arundinella nepalensis* Trin.	E	Aug.-Dec.	Biratnagar-18	Muddy ditches, canals	Shoot	Fodder
	Bracharia mutica (Forssk.) Stapf	E	Sep.-Dec.	Biratnagar-15	Paddy fields	Shoot	Fodder
	Coix lachryma-Jobi L.	E	Oct.-Feb.	Biratnagar-15	Edges of ditches	Shoot	Fodder/Medicinal
	Cynodon dactylon (L.) Pers	E	Sep. -Apr.	Biratnagar-4	Moist soil	Whole Plant	Fodder/Religious
	Echinocloa colona (L.) Link	E	Jul. -Oct.	Biratnagar-16	Ditches, paddy fields	Shoot	Fodder
	E. stagnina (Retz.) P. Beauvois	E	Nov.-Mar.	Betana	Ditches, moist soil	Shoot	Fodder
	Eragrostis tenella (L.) P. Beauvois	E	Aug.-Dec.	Biratnagar-18	Shady moist field	Shoot	Fodder
	E. unioloides (Retz.) Nees ex Steudel	E	Jul. -Oct.	Biratnagar-18	Moist fields	Shoot	Fodder
	Hymenachne pseudointerrupta C. Mull.	E	Sep.- Jan.	Biratnagar-18	Silty ditches, ponds	Shoot	Fodder
	Isachne albens Trin.	E	Sep.- Nov.	Biratnagar-18	Marshes	-	-
	Ischaemum rugosum Salisb.	E	Sep.- Dec.	Biratnagar-18	Paddy fields	Shoot	Fodder
	Leersia hexandra Swartz	E	All seasons	Biratnagar-18	Ditches, marshes	Shoot	Fodder
	Leptochloa chinensis (L.) Nees	E	May.-Nov.	Betana	Ditches	Shoot	Fodder
	L. panicea (Retz.) Ohwi	E	Jul. -Dec.	Betana	Ditches	-	-
	Panicum paludosum Roxb.	E	Aug. Nov.	Biratnagar-18	Ditches, ponds	Shoot	Fodder
	P. psilopodium Trin.	E	Jul.- Sep.	Biratnagar-18	Edges of water courses	Shoot	Fodder
	Paspalidium punctatum (Burm.) A. Camus	E	Jul.- Dec.	Biratnagar-18	Ditches	Shoot	Fodder

	Paspalum distichum L.	E	Aug.- Feb.	Biratnagar-18	Ditches	Shoot	Fodder
	P. scrobiculatum L.	E	Jul.- Feb.	Biratnagar-18	Marshes	Shoot	Fodder
	Phragmites karka (Retz.) Trin. ex Steudel	E	Jul.-Dec.	Betana	Fringes of ponds, river beds	Shoot	Fodder, handicrafts, thatch, cordage
	Pseudoraphis brunoniana Griffith	E	Apr.- Jun.	Biratnagar-10	River bank, moist soil	-	-
	Saccharum spontaneum L.	E	Otc.- Jan.	Biratnagar-16	Edges of water courses, river beds	Leaves	Fodder, Handicrafts, thatch.
	Sacciolepis indica (L.) Chase	E	Aug.- Oct.	Biratnagar-18	Ditches	Leaves	Fodder
	S. interrupta (Willd.) Stapf	E	All Seasons	Biratnagar-18	Ditches, water course	Shoot	Fodder
	Setaria pumila (Poir.) R. & S.	E	Aug.- Jan.	Biratnagar-18	Moist soil	Shoot	Fodder
	Vetiveria zizanioides (L.) Nash	E	Jul.-Dec.	Biratnagar-18	Marshes	Inflorescence/ Rhizome	Handicrafts , Medicinal
43. Pontederiaceae	*Eichhornia crassipes* (Mart.) Solms	FF	Apr.-Nov.	Biratnagar-18	Ditches, ponds	-	IAS
	Monochoria hastata (L.) Solms	E	Jul.-Nov.	Biratnagar-4	Muddy ditches	Leaf	Medicinal
	M. vaginalis (Burm.f.) C. Presl	E	Jul.-Nov	Biratnagar-4	Ditches, wet paddy fields	Root, leaf	Root as toothache, asthma, stomach & liver complaints. Leaf- coughs.
44.Potamogetonaceae	*Potamogeton crispus* L.	S	Dec.-Apr.	Biratnagar-15	Clayey hard bottom ditches, canals	Leaves/flowers	Food for water-fowls, ducks
	P. nodosus Poir.	S	Jul.- Dec.	Betana	Silty ponds	Leaves	Fodder
	P. pectinatus. L.	S	Jul.-Dec.	Betana	Silty ponds	-	-
45.Typhaceae	*Typha angustifolia* L.	E	Oct.-Dec.	Biratnagar-16	Marshes	Whole plant	Handicrafts/ fodder
C. Pteridophytes							
46. Athyriaceae	*Diplazium esculentum* (Retz.) Sw.	E	Dec.-Feb.	Betana	Edges of water courses, dams	Young shoots	Pot herbs
47. Azollaceae	*Azolla imbricata* (Roxb.) Nakai	FF	Jan.-Feb.	Biratnagar-16	Ponds, ditches	Whole plant	Green manure/Compost
48. Equisetaceae	*Equisetum debile* Roxb. ex Vaucher	E	Nov.-Jan.	Betana	River beds, fringes of ponds	Shoot	Medicinal
	E. diffusum D. Don	E	Sep.-Nov.	Betana	River beds, fringes of ponds	-	-
49. Marsileaceae	*Marsilea crenata* Persl	FL	Jan.-Feb.	Biratnagar-15	Edges of water courses, ditches	Shoot	Pot-herb
50. Parkeriaceae	*Ceratopteris thalictroides* (L.) Brongn	E	Nov.-Jan.	Biratnagar-16	Muddy edges of ponds, ditches	Whole plant	Green Manure/Compost.
51.Thelypteridaceae	*Thelypteris dentata* (Forsk.) St. John	E	Jul.-Oct.	Betana	Edges of water courses	-	-
D. Bryophytes							
52. Marchantiaceae	*Marchantia palmata* Nees	E	Jan.-Feb.	Biratnagar-10	East facing river beds	-	Soil binder
53. Ricciaceae	*Riccia fluitans* L.	FF	Jan.-Feb.	Biratnagar-10	Shaded pond surface	-	-
E. Algae							
54. Characeae	*Chara schweinitzii* A. Braum	S	Jan.-Feb.	Biratnagar-18	Clayey hard bottomed ditches, ponds	Whole plant	Larvicide (mosquito)
	Nitella mucronata (Thuill) Kuentz	S	Nov.-Dec.	Betana	Silty bottomed pond	-	-

invertebrates. The leaves and shoots of emergent macrophytes provide food for grasshoppers and habitats for several bird species.

The rural people were observed to use most of the macrophytes listed in Table 1 as food, fodder, medicine, green manure/compost, insect repellent, etc. Macrophytes recorded as wild food plants were *Alternanthera philoxeroides* (pot-herb), *Diplazium esculentum* (pot-herb), *Euryale ferox* (seeds), *Ipomoea aquatica* (pot-herb), *Nelumbo nucifera* (seeds), *Rorippa nasturtium-aquaticum* (pot-herb), *Trapa quadrispinosa* (fruits) etc. Notable species used as fodder were *Alysicarpus rugosus, Arundinella nepalensis, Blyxa japonica, Brachiaria mutica, Cabomba aquatica, Carex nubigena, Coix lachryma-jobi, Colocasia esculenta, Cynodon dactylon, Echinochloa colona, Panicum psilopodium, Paspalum distichum, P. scrobiculatum, Sacciolepis indica* and *Vetiverria zizanioides.* Macrophytes used for treating various diseases and ailments were *Acorus calamus, Centella asiatica, Ceratophyllum demersum, Commelina benghalensis, Eclipta prostrata, Equisetum debile, Hydrolea zeylanica, Lippia nodiflora, Ludwigia adscendens, Monochoria hastata, Ottelia alisomoides, Oxystelma esculentum, Persicaria barbata, Ranunculus sceleratus, Rorippa benghalensis, Vetiveria zizanioides,* etc. Macrophytes used in traditional crafts were *Aeschynomene asper, Cyperus corymbosus, C. esculentus, Typha angustifolia* and *Vetiveria zizanioides;* whereas plants used as green manure/compost were *Azolla imbricata, Eichhornia crassipes, Pistia stratiotes, Rumex dentatus* and *Spirodela polyrhiza.*

Since time immemorial the rural people (particularly fisher-folk and other ethnic communities) have depended on wetlands for fishing, deepwater paddy cultivation, wild food/vegetables, medicinal herbs, reeds and mud for house construction, and specific plant species for traditional crafts. Hence, establishment of small scale cottage industries for the utilization of the macrophytes for various purposes will certainly provide adequate employment opportunities for the wetlanders.

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