

Studies on the diversity and ethnic uses of wetland vascular plants in Terai and Duars of West Bengal, India

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I declare that the thesis entitled “Studies on the diversity and ethnic uses of wetland vascular plants in Terai and Duars of West Bengal, India” has been prepared by me under the guidance of Dr. Abhaya Prasad Das, Professor of Botany, University of North Bengal. No part of this thesis has formed the basis for the award of any degree or fellowship previously.

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Abstract

Wetlands are the transitional zones where aquatic and terrestrial habitats meet. Terai and Duars are generally situated on the western and Eastern bank of River Teesta of West Bengal. The Terai means dampness or marshiness and the Duars means the door or the gate way of Bhutan. These regions are under Himalayan Hotspot. Numerous wetlands are present in this region due to its geographical variations. The wetlands of these areas are generally *Riverine*, *Lacustrine* and *Palustrine*. The study area covers a total of 6227 sq km, out of which 484.27 sq km area is occupied by wetlands. Regular recurrence flood, almost every year gradually increases the wetlands in Terai & Duars. This area is the house of so many fresh water wetlands. Among the 23 larger wetlands of west Bengal 06 are present in the study areas. Several parameters have been studied during the last five years. 40 wetlands of Terai & Duars have studied for Taxonomical explorations. But, to examine the other parameters several small and larger wetlands, lakes, ponds, roadside ditches, river beds, ephemeral water bodies and streams have been studied and huge bulk of data was accumulated. 53 largest wetlands like *Gajoldoba Beel*, *Mahananda Barrage*, *Shova Bari Beel*, *Kuchi Daineer Beel*, *Khatambari Beel*, and several forest wetlands like *Gossaihat Beel*, *Garati Beel* and *Chukchuki Beel* have been chosen for detailed study. Beside these, several ancient dighi ponds, rivers and roadside ephemeral ditches have also been chosen.

Floristic exploration in different wetlands has been conducted mainly in three important seasons in last few years and during the survey total 455 species are recorded from Terai & Duars. The collected plants are generally hydrophytes, fenland loving and few pseudo wetland plants that grown during summer within the boundary of wetlands areas. Among these 241 species are dicot, 192 species are monocot and 22 species are pteridophytes. The total collected specimen is almost 37.58 % of the Indian total wetland flora.

Two novelties [*Nymphaea abhayana* A. chowdhury & M. Chowdhury of Nymphaeaceae and *Lindernia palustris* A. Chowdhury, M. Chowdhury & A.PDas of Linderniaceae] recoded during the present work. In addition, the new records of as much as eight species of plants is also significant for the vegetation. Of these one [*Adenostemma suffruticosum* Gardner of Asteraceae] is new record for the entire northern hemisphere; three [*Potamogeton gramineus* Linnaeus of Potamogetonaceae, *Murdania keisak* (Hasskarl) Handel-Mazzetti of Commelinaceae and *Polygonum hastatogagittatum* Makino of Polygonaceae] are for the flora of the country; and, Four [*Ludwigia peruviana* (Linnaeus) H. Hara of Onagraceae), *Hygrophila erecta* (N.L. Burman) Hochreutiner of Acanthaceae, *Soliva anthemifolia* (A. Jussieu) R. Brown of Asteraceae and *Carex phacota* Sprengel of Cyperaceae] are forming the new records for the state of West Bengal.

244 species of aquatic and semi-aquatic species have been selected for the phonological study in their *in situ* condition. The information about the life cycle of the collected plant species have been studied in details. The flowering and fruiting calendar of the plant species of wetland have been prepared.

The pollination patterns of these plants are very interesting that involves almost all types of pollination for fertilization.

The wetlands are also natural habitat for several economically important plants. This segment studied in two ways firstly the Ethnobotany i.e., wetland plants those are used by different local and tribal peoples of the Terai & Duars. They use those plants in various purposes like as medicine, food, fodder, manure, building materials and some other purpose. Around 83 species are found to as medicinal importance, 31 leafy vegetables, 7 building materials, 12 plants used in broom, utensil etc making. Except these several species used as fodder, fuel and ornamental purpose. Secondly, the wetlands plants of these areas are with various economical importances. 149 species of these wetlands are found to as useful. As much as 87 species have been recorded on sale in different village and urban markets.

The wetlands of Terai & Duars are under various threats, which are mostly anthropological and few are natural. Among the anthropological causes excessive irrigation and agricultural activities are most dangerous. The urban sewage, garbage, vehicle washable materials reduces the depth of wetlands and badly affects the water quality and the wild ecosystem leading to the drastic reduction in biological diversity.

After the study of different parameters of the wetlands areas of Terai & Duars it is found that these wetlands are very rich in their biodiversity. Regarding conservation of those wetlands few measures or management strategies have suggested in the dissertation. Too much of exploitation in the form of crop-cultivation, pisciculture, and ecotourism are need to be reduced drastically. Considering several aspects and understandings strategies for the management of the wetland ecosystems of Terai and Duars have been framed for the proper conservation of their natural biological diversity.

Preface

Since the wetlands are the highly biodiversity *ecotonal* zone caring wide range of ecological importance as global ecosystem concern. These water land interface are distributed in all altitudinal ranges of tropical, temperate and arctic regions of the earth. Terai-Duars of sub-himalayan foot hills of North Bengal are blessed with several ephemeral & perennial drainage systems originating from the glacial of Himalayas and through anastomating with each other during their long zigzag run ways forming several permanent and temporary wetlands or marshes. These wetlands are harboring various kinds of floras and faunas and the interrelationship of such biodiversity and inorganic entities forming a stable and healthy ecosystem in this region.

Several wetlands of this region are also associated with different conservatories and providing continuous water supply to the existing vegetation and wildlife's. The green and dense forest and associated water-bodies makes a wonderful environment and wilderness of this part of country. These wetlands are providing shelter and food to many migratory birds and other wildlife of these areas.

Present study reveals the importance of the aquatic flora of different wetlands of these regions to understand the vegetation types and their present status along with their phenology and distribution patterns. Wetlands of study area are also associated with several settlement areas with ethnic and poor inhabitants who are directly or indirectly getting facilities from those water bodies. Socio-economic study reflects the utilization of wetland botanicals in their daily life uses as food, medicines, fodders, household etc. Good number information regarding the ethnic uses of different aquatic plants and their formulation among the tribal communities were documented. Peoples are also uses non-forested, temporary wetland areas as paddy cultivation and perennial as jut retting and water uses as irrigation purposes.

These wetlands areas are housing of several *RET*, endemic and wild relatives of rice species along with many other economically important plants. The present study records a good number of vascular plants and excluded the other algae, fungi, bryophytes and micro organism.

The wetlands of the study areas are also suffering with several threats for their existence as forested land and its biodiversity. The probable physical treats were assessed and documented during this study and some common conservation strategies were also formulated for the conservation for keep them healthy and wealthy.

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Chapter 1

INTRODUCTION

INTRODUCTION

Wetlands are the unique creation of nature on this blue planet and are to be treated as living bowls of soup because without water or moisture life is not possible. Wetland means the areas with adequate dampness, where terrestrial territory meets with aquatic territory. All kinds of small and big water bodies are generally considered as wetlands and even oceanic areas with less than 6 meter deep water are also included. Wetland soil is generally very rich in micro- and macro-nutrients, which are accountable for the survival of their rich and diverse floral, faunal and microbial inhabitants. According to Tiner (1999), it is a generic term used to define universe of wet habitats including marshes, swamps, bogs, fens and similar areas. Wetlands are also considered as *ecotonal* habitat as it lies on transition zone of tension between two or more communities with rich biota (Mitsch & Gosselink, 1986 & 1993; Clark, 1954; Odum, 1959). But, traditionally wetlands have been contemplated as useless wastelands and used mainly for muck-filled for urban sewage, dumping ground for house hold garbage, and extending concrete structures after artificial increase of elevation. In folktales, the swamps are expressed as dirty, murky places full of hidden dangers. Wetlands are the most beautiful water bodies and full of unique biodiversity including plants, animals and microbes (Chowdhury, 2009). Condering from the biodiversity point, wetlands are the 2nd richest ecosystem after the tropical rain forests of the world. After the Ramsar Convention of IUCN in Iran in 1971, wetlands are now considered as hot-cakes and attention-grabbing topic to the scientists or biologists who are working in world's environment and ecological research. The Indian wetlands are quite diverse ecosystem located in various climatic zone and support around 20 % of country's total biodiversity (Deepa *et al*, 1999); (Chowdhury, 2009). Gopal (1995) prepared a list of over 1200 plant species and a partial list of animals those are found in Indian wetland systems.

Terai and Duars of Sub-Himalayan West Bengal are falling under 'Himalaya' Biodiversity Hotspot (Conservational International, 2005). The study area is harbouring a large number of floral species (Choudhuri, 1969); (Das, 1995, 2004; (Das & Chanda, 1987); (Rai, 2001) in its wide range of habitat providing ample opportunity for ecological diversity (Champion & Seth, 1968; (Kadir, 2001); (Ghosh, 2007); (Sarkar, 2011). High degree of endemism is the characteristic of its vegetation (Bhujel & Das, 2002). But, continuous physical threats in very drastic manner, forced the indigenous floras to their extinction is imminent for the region (Das, 1995, 2004; Bhujel & Das, 2002;). Sub-Himalayan wetlands are extending from Darjeeling to East bank of the River Ganga. The Terai and Duars region of West Bengal, Koch Behar district and low floodplains, lakes, streams, beels, seasonal waterlogged areas etc. (IWMED 1997) biodiversity rich areas. Highly favourable tropical to temperate climatic conditions, coupled with heavy rainfall, made these areas to support a large number of seasonal wetlands, covering wide areas, which are inhabited by diverse wet-loving aquatic or semi-aquatic plants. Innumerable anthropological activities like rapid expansion of civilization, construction of road, rail, increase of automobiles, implementation of mega-projects, population explosion, tourism related exploitation, rapid extension of crop field etc. are very rapidly converting these areas into fragmented wetlands and finally leading to the extinction of numerous wetlands. Random collection of wide array of useful plants, excessive agricultural activities, urbanization, pollution, filling for settlement areas and excessive tourism are causing the destruction of fertile and virgin wetlands. The rate and amount of exploitation of wetland areas are much above the sustainability limit (Sarkar, 2014). Floristic survey of plant community provides information for analysing the diversity dynamics and structures of the vegetation. Wetland plants quickly respond to changes in water quality and have been used as bio-indicator for pollution (Tripathi & Shukla, 1991).

A wetland is an area of ground that is inundated with water either enduringly or seasonally. This means that a wetland is neither truly aquatic nor terrestrial; it is possible that wetlands can be both at the same time depending on seasonal variability. They have been described as the *kidneys* of the landscape as they filter the sediments and nutrients from the surface water. Wetlands are often referred to as biologically fragile important ecosystem as they support all life forms through extensive food webs and biodiversity (Mitsch & Gosselink, 1993). These help to regulate water levels within watersheds, improve water quality, reduce flood and storm damages, provide habitat for important fish and wildlife, support hunting, fishing, other recreational and life-sustaining activities and perform some useful functions in the maintenance of ecological balance. Rapid urbanization, burgeoning human population and their various activities have contributed to the decline of quality and quantity of wetlands. So, it is imperative to focus on the preservation of these endangered habitats to achieve back the ecological sustainability on earth.

Hence, the present study has been taken up with a view to study the floristic diversity, recognition of RET plants and recording of ethnobotanical knowledge of the ethnic inhabitant in study areas. Phenology and pollination of wetland plants are also important and interesting aspects of study. The recognition of disturbance factors for different wetlands of the area, if recognized, may act as basics in framing required conservation strategies and developing sustainable utilization strategies.

1.1. DEFINITIONS OF WETLAND

The 'Wetland' has been defined differently by various authors and agencies for different purposes depending on the specific objective and needs. It is a fact that not only in our country but all over the world, there exists a lot of controversy and confusion regarding the definition of a wetland. Several such definitions of wetlands are at hand, among those one of the popular earlier definition and widely accepted scientific Ramsar definitions are given below:

A. One of the early definitions of wetland but still habitually used by Ecologist, and Researcher was given by S.P. Shaw & C.G. Fredine (1956) who suggested:

“The term Wetlands refer to lowlands covered with shallow and sometimes temporary or intermittent waters. They are referred to by such names as marshes, swamps, bogs, wet meadows, potholes, sloughs, and river-overflow lands. Shallow lakes and ponds, usually with emergent vegetation as a conspicuous feature, are included in the definition, but the permanent waters of the streams, reservoirs and deep lakes are not included. Neither are water areas that are so temporary as to have little or no effect on the development of moist soil vegetation”.

B. Ramsar definition

The Ramsar Convention takes a broad approach in determining the wetlands which come under its regulations. Under the text of the Convention (Article 1.1), wetlands are defined as:

“areas of marsh, fen, peatland, or water; whether natural or artificial, permanent or temporary, with water that is static or flowing, fresh, brackish, or salt, including areas of marine water the depth of which at low tide does not exceed 6 meter”.

1.2. RAMSAR CONVENTION & ITS IMPORTANCE

The Ramsar Convention is an International convention on Wetlands of International Importance. It is an intergovernmental treaty, adopted in Ramsar, a city of Iran, on 2nd February, 1971, that provides the skeleton for national action and international co-operation for the conservation and sustainable utilization of wetlands and their resources. Now, 2nd February of every year is celebrating as *World Wetland Day*.

The importance of the Ramsar Convention is, as adopted by the Parties in 1999 and refined in 2002, is *“the conservation and sensible use of all wetlands through local, regional and national*

activities and international assistance, as a contribution towards achieving sustainable development throughout the world”.

1.3. CLASSIFICATION OF WETLANDS

The Ramsar Convention developed a new and more widespread wetland classification system (adopted in 1990 and modified in 1996). This is given below:

Marine/Coastal

- A. Permanent shallow marine waters less than six metres deep at low tide; includes sea bays and straits.
- B. Marine subtidal aquatic beds; includes kelp beds, sea-grass beds, tropical marine meadows.
- C. Coral reefs.
- D. Rocky marine shores; includes rocky offshore islands, sea cliffs.
- E. Sand, shingle or pebble shores; includes sand bars, spits and sandy islets; includes dune systems.
- F. Estuarine waters; permanent water of estuaries and estuarine systems of deltas.
- G. Intertidal mud, sand or salt flats.
- H. Intertidal marshes; includes salt marshes, salt meadows, saltings, raised salt marshes; includes tidal brackish and freshwater marshes.
- I. Intertidal forested wetlands; includes mangrove swamps, nipah swamps and tidal freshwater swamp forests
- J. Coastal brackish/saline lagoons; brackish to saline lagoons with at least one relatively narrow connection to the sea.
- K. Coastal freshwater lagoons; includes freshwater delta lagoons.

Inland Wetlands

- L. Permanent inland deltas.
- M. Permanent rivers/streams/creeks; includes waterfalls.
- N. Seasonal/intermittent/irregular rivers/streams/creeks.
- O. Permanent freshwater lakes (over 8 ha); includes large oxbow lakes.
- P. Seasonal/intermittent freshwater lakes (over 8 ha); includes floodplain lakes.
- Q. Permanent saline/brackish/alkaline lakes.
- R. Seasonal/intermittent saline/brackish/alkaline lakes and flats.*
- Sp. Permanent saline/brackish/alkaline marshes/pools.
- Ss. Seasonal/intermittent saline/brackish/alkaline marshes/ pools.*
- Tp. Permanent freshwater marshes/pools; ponds (below 8 ha), marshes and swamps on inorganic soils; with emergent vegetation water-logged for at least most of the growing season.
- Ts. Seasonal/intermittent freshwater marshes/pools on inorganic soil; includes sloughs, potholes, seasonally flooded meadows, sedge marshes.*
- U. Non-forested peatlands; includes shrub or open bogs, swamps, fens.
- Va. Alpine wetlands; includes alpine meadows, temporary waters from snowmelt.
- Vt. Tundra wetlands; includes tundra pools, temporary waters from snowmelt.
- W. Shrub-dominated wetlands; Shrub swamps, shrub-dominated freshwater marsh, shrub carr, alder thicket; on inorganic soils.*
- Xf. Freshwater, tree-dominated wetlands; includes freshwater swamp forest, seasonally flooded forest, wooded swamps; on inorganic soils.*

Xp. Forested peatlands; peat swamp forest.*

Y. Freshwater springs; oases.

Zg. Geothermal wetlands.

Zk. Subterranean karst and cave hydrological systems.

**As appropriate, includes: floodplain wetlands such as seasonally inundated grassland (including natural wet meadows), shrublands, woodlands or forest.*

“Man-made” wetlands

1. Aquaculture (e.g. fish/shrimp) ponds.
2. Ponds; includes farm ponds, stock ponds, small tanks; (generally below 8 ha).
3. Irrigated land; includes irrigation channels and rice fields.
4. Seasonally flooded agricultural land.
5. Salt exploitation sites; salt pans, salines, etc.
6. Water storage areas; reservoirs/barrages/dams/impoundments; (generally over 8 ha).
7. Excavations; gravel/brick/clay pits; borrow pits, mining pools.
8. Wastewater treatment areas; sewage farms, settling ponds, oxidation basins, etc.
9. Canals and drainage channels, ditches.

1.4. WETLAND DISTRIBUTION

Wetlands are distributed throughout the world from tropics to temperate and from plains to glacial mountains (Chowdhury, 2009). Two-third areas of this blue planet are covered by water (UNEP, 1994). Wetlands occur in every country, from the tropics to the tundra. The World Conservation Monitoring Centre has suggested and estimated of about 5.7 million square kilometres i.e., roughly 6 % of the earth's land surface [WCMC, *Global Biodiversity*, 1992] is wetland. Out of this 6 % of total wetlands, only 2.53 % area covers with fresh water wetlands and the rest vast areas are seawater. Of the global fresh water 69.6 % is locked away in the continental ice, 30.1 % is in underground aquifers and 0.26 % is composed of rivers and lakes. However, 0.0075 % fresh water areas are covered by particular lakes (UNEP, 1994). Out of total global wetlands, 30 % are bogs, 26 % fens, 20 % swamps, about 15 % flood plains, etc. (IUCN, 1999).

1.4.1. Continental distribution of Ramsar sites:

It has been recorded by Ramsar convention that highest percent i.e., around 53 % of global Ramsar sites are located in different countries of Europe followed by Asia (13 %) and Africa (13 %) whereas, lowest percentage is recorded from ice covered Oceania (5 %). [Figs. 1.1 & 1.2].

1.4.2. Wetlands in India

In India, a variety of wetlands covering inland and coastal areas even small ponds and ephemeral water bodies are located in different altitudinal ranges. It is recorded that around 18.4% of total geographical

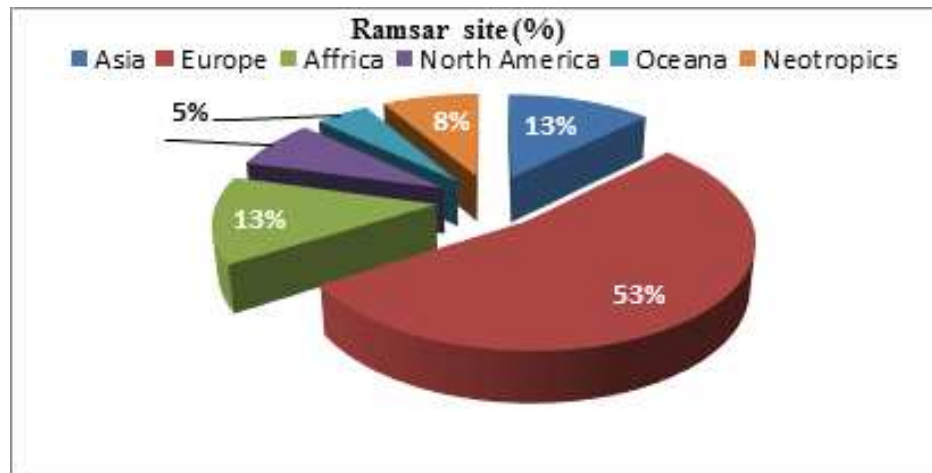


Fig. 1.1. Global distribution of declared Ramsar sites [Source: www. Ramsar.org]



Fig. 1.2. State wise distribution of Ramsar sites in India [Source: www. Ramsar.org]

area of the country occupied by wetland areas except rivers and 70 % of these wetlands are as paddy field (Deepa *et al.*, 1999).

In India, assessing their wetland wealth in different times, primary inventory by the Department of Science and Technology, Govt. of India recorded a total of 1,193 wetlands, covering an area of about 3,904,543 ha, of which 572 were natural (Scott & Poole, 1989); (Anonymous, 1993a & 1993b). The latest inventory records a total 67,429 number of wetlands in the Indian territory, which covers about 4.1 million hectares of total land, out of which 2,175 wetlands are natural and 65,254 are manmade i.e. artificial and are occupying the 1.5 and 2.6 million hectares of area, respectively (MoEF, 1990). Highest percentage of declared Ramsar Sites are established in the state of Kerala (31 %) followed by Orissa (27 %) and in West Bengal (2 %) only one Ramsar site is present covering 12,500 ha and lowest in Tripura covering only 240 ha. (Anonymous, 1993c).

1.4.3. Type-wise wetland distribution in India:

The major wetland types in inland category are rivers/streams, reservoirs/barrages, tanks/ponds and lakes/ponds. In coastal wetland category, major types are inter-tidal mudflats, mangroves, aquaculture ponds and lagoons. Type-wise area estimates are shown in Table 1.1.

Table 1.1. Type-wise wetland areas in India

Wetland category	No of wetlands	Total wetland area (ha)
Inland wetlands (Natural)		
Lakes/Ponds	11740	729532
Ox-bow lakes/Cut- off meanders	4673	104124
High altitude wetlands	2,707	124253
Riverine wetlands	2834	91682
Waterlogged areas	11957	315091
Rivers/Streams	11747	5258385
Inland artificial wetlands		
Reservoirs/Barrages	14894	2481987
Tanks/Ponds	122370	1310443
Waterlogged areas	5488	135704
Salt pan	60	13698
Total inland	188470	10564899
Costal-natural wetlands		
Lagoons	178	246044
Creeks	586	206698
Sand/Beach	1353	63033
Intertidal mud flats	2931	2413642
Salt marshes	744	161144
Mangroves	3806	471407
Coral Reefs	606	142003

Coastal artificial wetlands		
Salt pans	609	148913
Aquaculture ponds	2220	287232
Sub-total	201503	14705015
Wetlands (<2.25ha)	555557	555557
TOTAL	757060	15260572
Area	Post monsoon	Pre monsoon
Area under aquatic vegetation	1322837	2065096
Area under turbidity levels		
Low	3206003	1888493
Moderate	4168401	2967523
High	1226394	945204

1.4.4. Wetlands of West Bengal:

The wetlands comprise 11,07,907 ha of area accounting for about 12.5 % of total geographical area of the state of West Bengal (Chowdhury, 2009). The total number of wetlands mapped in the state is 1,47,826 including 1,38,707 wetlands are smaller than 2.25 ha (Chowdhury, 2009). The number of inland wetlands are recorded as 8670 including both natural (3675) and man-made (4995), distributed in an area of 7,47,383 ha. The total number of coastal wetlands are 449 comprising of 421 natural and 28 man-made distributed in an area of 2,21,817 ha. The major wetland types are rivers/streams (5,59,192 ha) followed by mangroves (2,09,330 ha), lakes/ponds (58,654 ha), waterlogged areas (56,603 ha) and reservoirs (22,672 ha). In addition, 1,38,707 smaller wetlands (<2.25 ha) were also identified (Battacharyya *et al.*, 2000). (Fig. 1.3).

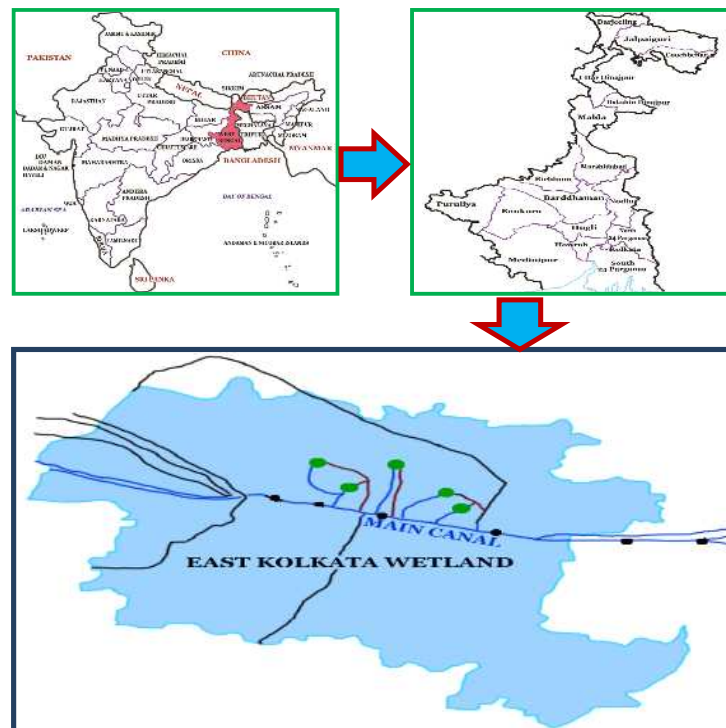


Fig. 1.3. Ramsar site of West Bengal [www.ramsar.org]

1.4.5. Wetlands of Terai and Duars:

The physiography of the study area is most suitable for the formation of ox-bow lakes as sediments brought down from the hills are deposited in this undulating plain located at around 150 m a.m.s.l. forming the land that is too much porous and loose with almost no sticking capacity. Due to abrupt changes of gradient in river systems in the region, repeated shifting occurred in the past lead to the formation of numerous riverine wetlands or dead rivers or ox-bow lakes. These riverine wetlands are the small or long dead or cut-off parts from the main river system and are water-fed or remain quite moist during summer, the most dry season in the area. These riverines are mostly linked to the major perennial river systems like the *Tista, Mahananda, Balason, Mechi, Torsa, Jaldhaka* and *Sankosh* those have originated mostly from the Himalayas. The important wetlands in the study area are *Ghoshpukuri Wetland, Teesta Char, Jalpaiguri Rajar Dighi, Saadbeki Beel* and *Ghoksadanga Beel* etc. along with three major reservoirs namely *Mahananda, Teesta* and *Aambari* barrages. Three major wetland types are generally recognized from the study area and are:

- **Lacustrine** – small or big lakes or ponds
- **Riverine** - wetlands along rivers and streams
- **Palustrine** - meaning “marshy” - marshes, swamps and bogs

Numerical distributions of wetlands in the study area are summarized in Table 1.2.

Table 1.2. Type wise wetland numerical data of study area

Nature of wetland		Classes of wetland	Number	Area (Sq Km)	
INLAND	Natural	Rivers/Streams	65	463.2	
		Reverine wetlands	25	1.3	
		Lakes	30	3.15	
		Ox bow Lakes	33	3.61	
		Marshes/ Swamps	18	1.71	
		Waterlogged seasonal	21	3.64	
		High altitude wetlands	05	1.05	
	Manmade	Reservoirs	13	1.27	
		Barrages	04	2.53	
		Tanks	03	1.19	
		Ponds	45	1.62	
			TOTAL	262	484.27

1.5. IMPACT OF WETLANDS

– Goods and services of wetland ecosystems

Wetlands are the most dynamic ecosystems in the world. It plays an imperative role to provide healthy environment and services to millions of people directly or indirectly. They sustain important processes like the movement of water into streams and rivers; moulder of organic matters; release of nitrogen, sulphur, and carbon into the atmosphere; elimination of nutrients, sediment and organic matter from water moving into the wetland; and the growth and development of all organisms dependent on them.

It has significant role in socio-economic development too! Due to its diverse habitat it produces so many multidimensional products such as fish, housing materials, medicinal plants, fodder plants, leafy vegetables, humus rich sediment, fertile land for low-land agriculture, water supply for domestic,

agricultural and industrial purposes and hydro-power generation, transport, recreation, sustainable tourism opportunities, research-education, genetic reservoir for various wild relatives of cultivated species, support to different life forms, habitat to aquatic flora and fauna, as well as numerous species of local and migratory terrestrial and avi-fauna, flood mitigation, sinks and climate stabilizers etc.

In addition, wetlands have special attributes as part of the cultural heritage of humanity: they are related to religious and cosmological beliefs, constitute a source of aesthetic inspiration, cultural aptitudes, provide wildlife sanctuaries, and form the basis of important Ethnic traditions.

It has some indirect reimbursement such as improved water quality (including drinking water) removing or retaining its nutrients, processing organic wastes, reducing sediment before it reaches open and deep water areas.

1.5.1. Functions of wetlands:

Wetlands are referred to as the most productive ecosystems on earth. They directly or indirectly support millions of people and provide goods and services to them. Table 1.3 recorded various goods and services provided by wetlands are as suggested by Gopal *et al.* (2010)

Table 1. 3. Wetland ecosystem services [*Source: Gopal et al., 2010*]

Ecological services	Example
Provisioning	
Food	Production of fish, wild game, fruits, and grains
Fresh water	Storage and retention of water for domestic, industrial, and agricultural uses
Fibre and fuel	Production of logs, fuel wood, peat, fodder
Biochemical	Extraction of medicines and other materials from biota
Genetic materials	Genes for resistance to plant pathogens, ornamental species, and so on
Regulating	
Climate regulation	Source of and sink for greenhouse gases; influence local and regional temperature, precipitation, and other climatic processes
Water regulation	Groundwater recharge/discharge
Water purification and waste treatment	Retention, recovery, and removal of excess nutrients and other pollutants.
Erosion regulation	Retention of soils and sediments
Natural hazard regulation	Flood control, storm protection

Ecological services	Example
Pollination	Habitat for pollinators
Cultural	
Spiritual and inspirational	Source of inspiration; many religions attach spiritual and religious values to aspects of wetland ecosystems
Recreational	Opportunities for recreational activities
Aesthetic	Many people find beauty or aesthetic value in aspects of wetland ecosystems
Educational	Opportunities for formal and informal education and training
Supporting	
Soil formation	Sediment retention and accumulation of organic matter
Nutrient cycling	Storage, recycling, processing, and acquisition of nutrients

1.6. IMPORTANCE OF MACROPHYTES ON WETLAND HABITAT

Wetland provides shelter to the various types of plant groups like algae, fungi, bryophytes, pteridophytes and most importantly angiosperms. Plants growing in the wetlands are called aquatic and/or wetland plants; those can also be termed as hydrophytes (Raunkaier, 1934).

The vegetation of wetland makes it so beautiful and rich in biodiversity as well as healthy and fresh ecosystem. As in other ecosystems, the floral elements act as primary producers or energy assimilators; they synthesise food by photosynthesis in wetland ecosystem. The output of photosynthesis actually increases the nutrient status of wetland soil and water. Based on these outputs, food chains, food webs and energy flow sequences of such ecosystem are regulated (Chowdhury, 2009).

Some phytoplankton's and submerged aquatic macrophytes are the good food for fishes and other aquatic animals. Fishes eat seeds, leaves, and rootstock of different aquatic plants. Fishes choose roots of floating plants for breeding or releasing eggs. Seeds, leaves, rootstock are also taken as food by different migratory wetland birds.

The seasonal rainfall and regular flooding increase the soil erosion causing filling of wetlands, thereby losing the depth of water. The shoreline erosion is controlled by the adventitious and densely anastomosing root system of grasses and sedges.

Few species of wild submerged and marshland plants are also used as ornamentals for household aquariums along with different colourful fishes.

1.7. Threat to Wetlands

When, in future years, man will realise, what are the importance of wetland for their survival and sustenance, by then more than 60% of wetlands will disappear. Most of the people always think that 'wetlands are just wastelands' and always misuse these in various ways and such over-exploitation causing a great

change in wetland structure and function negatively. Many research works to find out several causes behind the wetland loss and the causes are categorised into two major groups:

1.7.1. Anthropogenic threats:

The rapid increases of population are creating a heavy load on wetlands because it has been seen that most of the wetland areas are filling-off in favour of the extension of human settlements (Chowdhury, 2009). Due to over establishment of the industry and related pollution are dramatically increases that create pressure on wetlands and its ecosystem. That particular negligence is the main cause of such drastic loss. Wetlands of every country of the world always are used in bad manners from the very beginning. It is always used as sink for sewage discharge from urban and rural areas, chemicals from factory, various poisonous metals from different atomic power station etc. This process is steel being continued in various countries of the world.

1.7.2. Natural threats:

On the other hand, wetlands are also degraded by natural activities like siltation, eutrophication, reduction of depth due to the accumulation of excessive amount decayed macrophytes etc. The excessive nutrient from agricultural runoff and existing flora for decades the water is polluted. These situation induced growth of huge algal bloom creating eutrophication, which destroy the healthy wetland ecosystem.

All these factors are responsible for converting the wetlands into non-wetland or terrestrial areas rapidly.

1.8. SUSTAINABLE UTILIZATION

Wetlands of Terai and Duars are generally marsh or floodplains with littoral fresh water systems. The wetlands play important role in the life of people who reside surrounding such areas. Local people use the wetlands in their daily life for livelihood and many other means like, agriculture, irrigation, fisheries, ground water recharge and flood control, rural economy, jute retting, green manure etc.

1.9. FRAMING CONSERVATION STRATEGIES

Data recorded through the present survey and understanding the status of wetlands can help to framing the conservation strategies, which can be as follows: increasing the depth of wetlands, periodical weed removal, public awareness, creation of bird sanctuary, control over fishing, control of excessive agricultural activity, control of monoculture, control bird poaching, stop releasing urban and industrial influx or sewages, research and monitoring etc.

Chapter **2**
STUDY AREA

STUDY AREA

Sub-Himalayan West Bengal, consisting of Terai and Duars are spreading through the districts of Jalpaiguri, Alipurduar and plains of Darjeeling are taken as study area for the present dissertation. A belt of moist forests passes along the study areas, at the foot of the majestic Himalayas.

The undulating *Terai* and *Duars* landforms and temporary or permanent virgin elaborate wetland systems are forming a mosaic of tall grasslands, savannas, evergreen and deciduous forests. The slope of the study area is gentle from north to south and located at 25° 57' to 26° 36' N latitude and 89° 54' to 88° 47' E longitude (Terai) & 26° .16' to 27° .0' N latitude and 88° .4' to 89° .53' E longitude (Duars) with altitudinal range varying from 80 to 100 m above mean sea level. The entire region is made up of sand, gravel and pebbles laid down by major and minor river and/or stream (*Khola* or *Jhora*) systems like *Teesta*, *Torsa*, *Jarda*, *Raidak*, *Jaldhaka*, *Sankosh* and several other small rivulets coming from the Darjeeling and Sikkim Himalayas and also from the neighboring countries Nepal and Bhutan. The river Teesta has divided this entire area into two parts and the western part is referred as *Terai* whereas the eastern part is named as *Duars* or *Dooars*. Based on forest types and nature of soil formation the *Duars* region can be further subdivided into the small parts, like Siliguri area as *Western Duars*, the middle or Jalpaiguri part as *Central Duars* and the easternmost end part of Alipurduar is referred as *Eastern Duars*.

The word '*Terai*' meaning dampness and the word '*Duar*' has been derived from the word 'doors', Duars or Dooars acts as a gateway to mountain kingdom of Bhutan and the North-Eastern states of India. The *Terai-Duars* area (Fig. 2.1) is a land with dense tropical evergreen forests interspersed with numerous marshy areas. It represents a transitional belt between lower hills of the Himalayas and plains and the rolling flat plain of North Bengal.

2.1. TERAI

The western bank of river Teesta is generally known as *Terai* with very rich and diversified evergreen forested system. It is a belt of marshy grassland, savannas and forests at the foot of the Himalayan range stretching southwards to about 38 km. Above the *Terai* belt, a forested belt of rock, gravel, and eroded soil covered Himalayan areas are referred as *Bhabhar*. The *Terai* zone is composed of alternate layers of clay and sand, with a high water table that created many springs and wetlands.

2.2. DUARS

Duars, a land of unending beauty, lies in the sub-Himalayan foothills in Jalpaiguri and Alipurduar districts in the Northern part of the state of West Bengal. The area is starting from the eastern bank of river *Teesta* in the Jalpaiguri district and stretching up to the western bank of the river *Sankosh* in Alipurduar district and is spreading over a span of 130 km of which 40 km area is running along the Himalayan foothills.

Duars with a vast texture of dense forests teeming with wildlife, unending tea gardens, babbling rivers, interspersed with small ethnic settlements, constitute a fascinating tourist destination in this part of

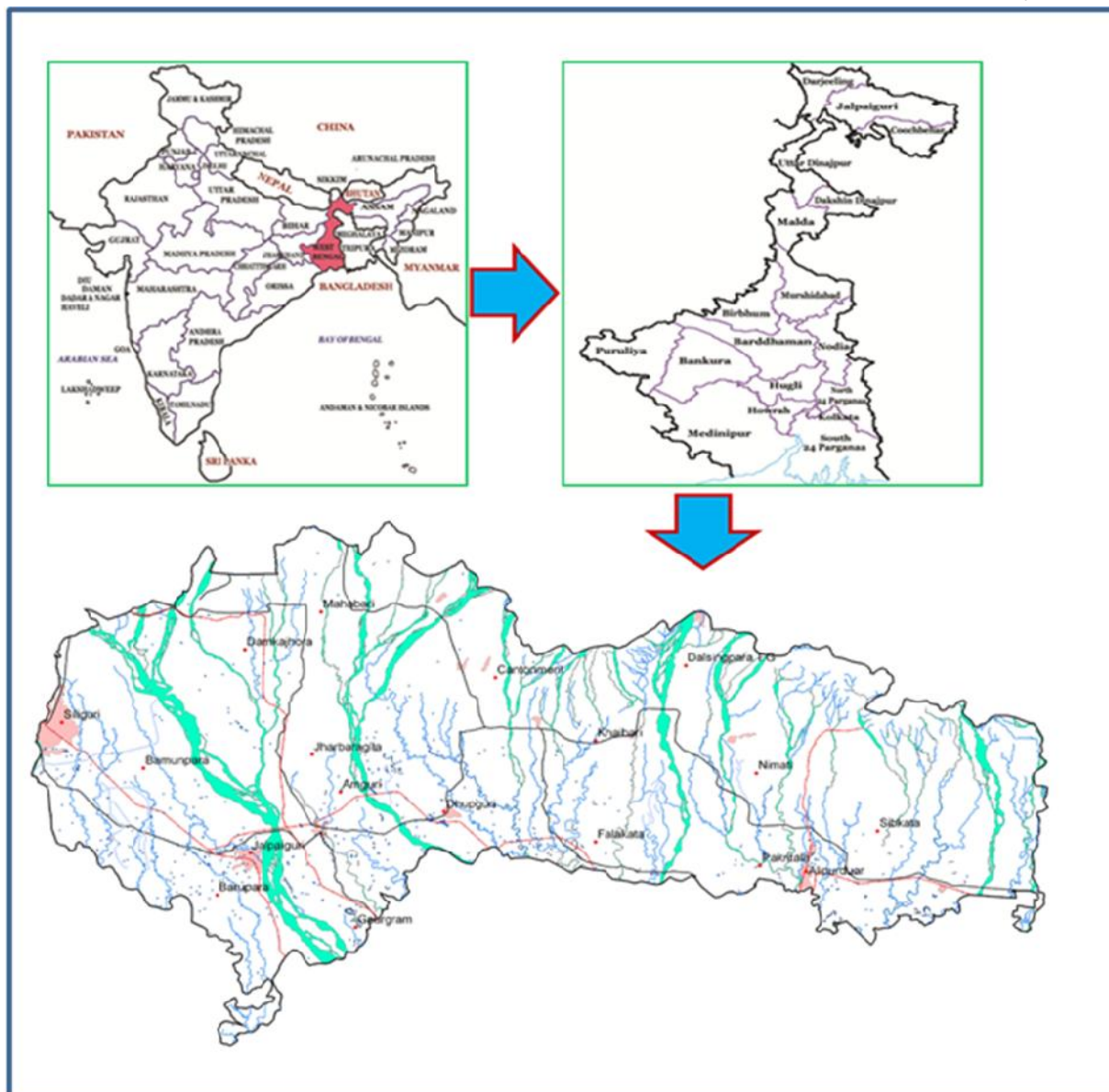


Fig. 2.1. Map showing the areas of Terai and Duars [Source: www.jalpaiguri.gov.in]

the country. *Duars* offers some magical landscape with fascinating view of river valleys and hills and this beautiful landscape is still unknown to the large section of tourists.

The Duars area is specially noted for its Protected Areas in IUCN guideline and includes Gorumara National Park, Buxa Tiger Reserve, Buxa National Park, Jaldapara National Park, Chapramari wildlife Sanctuary etc. These in-situ conservatories are harbouring a rich and fascinating diversity of flora, fauna and microbes including several endemic rare and threatened species. The vast texture of massive trees sheltering varieties of orchids, other epiphytes and climbers and the forests resounded with songs of birds and call of wild animals make it a veritable paradise for nature lovers and eco-tourism.

2.3. LOCATION

Terai [25° 57' to 26° 36' N latitude and 89° 54' to 88° 47' E longitude] and Duars [26°.16' to 27°.0' N latitude and 88°.4' to 89°.53' E longitude]

2.4. TOPOGRAPHY

Terai and *Duars* region is extended upto the river *Sankosh* in the East and is spreading over an area of 6227 sq km. The major geographic facial appearance of this area are the numerous rivers and streams which are intersecting with each other in every direction, and large tracts of Sal forests, tall grasses and reeds, growing along the banks of rivers and their rivulets throughout the entire region interrupted with patches of crop fields, tea gardens and large patches of reserved or plantation forests.

2.5. DRAINAGE SYSTEM

The foothills of *Terai* and *Duars* are intersecting by a good number of perennial rivers/ streams coming down from the Himalayan glaciers. The major such rivers are *Mahananda*, *Balason*, *Mechi*, *Karotoa*, *Sahu*, *Panga* etc along with several small streams are continuously proving the life support to greenery of *Terai* regions. *Duars* regions are also blessed with several big and small rives like *Teesta*, *Torsa*, *Karala*, *Jaldhaka* and *Diana* and their rivulets makes the area paradise of biodiversity. All these rivers originated from Himalayan hills, flow from North-east to South-West and are rain fed, except *Teesta* which has its origin from the Jemu glaciers in North Sikkim. Though they are tame, shallow and nearly dry during summer, but generally overflow during monsoon sometime causing heavy floods. The numerous low laying areas holds good volume of rain water and saves terrestrial areas from inundation.

2.6. SOIL

Soil of the study area is basically porous in nature, deep, light textured, highly acidic, with moderate organic matter, low Phosphate, Potassium, and micronutrient contents (Monda *et al.*, 2002); (Status Report, 1993). Soil consists of soft sands of different sizes and is interspersed with humus along with variable sized gravels and boulders. The soils are brought down by rivers coming down from hills and their tributaries those are bringing materials from a height of about 3048 m of Himalayan ranges and are deposited layer by layer in the form of soil all over the study area. The greater part of the region is covered with alluvial soils, ranging from pure sand to clay, but mainly sandy loam in nature. In the upland of the north of the *Duars*, the soil is ferruginous clay and is particularly well-suited to the growth of the tea plants (Sarkar, 2011). The *Western Duars* has numerous old and/or dead river beds which have been left over by the streams. Near the hills soils are composed of more stones and boulders while lower down they contain gravel and in the plain they contain more sand with humus.

2.7. CLIMATE

The weather conditions of the study area are more or less remains pleasant throughout the year. Three predominant seasons namely pre-monsoon, monsoon and post-monsoon are quite prominently recognizable in these areas. The pre-monsoon starts from the 1st week of February and extended up to the middle of May, whereas, monsoon starts from the last week of May and extended up to end of September. The post-monsoon season begins from the 3rd week of November and extended up to last week of January. Climatic data for the study area is collected from Central Tobacco Research Institute at Dinahata and Hydromet division, India Meteorological Department, Kolkata.

2.7.1. Temperature

The study area is basically located in sub-tropical region and facing the heavier rainfall during summer and monsoon seasons and the temperature is rarely excessive. November, to February is recorded as the driest months of the year. The temperature of this region fluctuates from 37.5° C during summer to about 6° C in winter. In December, January and February it is colder, and from the end of March it begins to get warmer, and from May to September is rather hot when the monsoon prevails in the region (Fig. 2.2).

2.7.2. Precipitation

Precipitation occurs all over the study area mainly in the form of rain. However, formation of dense fog, sometimes almost with zero visibility, also adds some amount of moisture and becomes much useful for the vegetation for sustenance during the dry spell of the climate. The dense fogs also substantially reduce the loss of soil moisture by reducing the evaporation of soil-water and also the rate of transpiration by plants.

Rainfall mainly occurs due to south–western monsoon and usually begins from the month of April and continues till the 2nd week of October. In consequence of the heavy and wide-spread rainfall, the region never presents a dry appearance, and always remains green and the growth of vegetation is also with the growth of the ever-green elements. In April the average rainfall is around 177.14 mm and the rains are usually very heavy between June and September, when the humidity becomes very high. The average maximum rainfall *i.e.*, 933.28 mm is recorded in the month of July (Fig. 2.3).

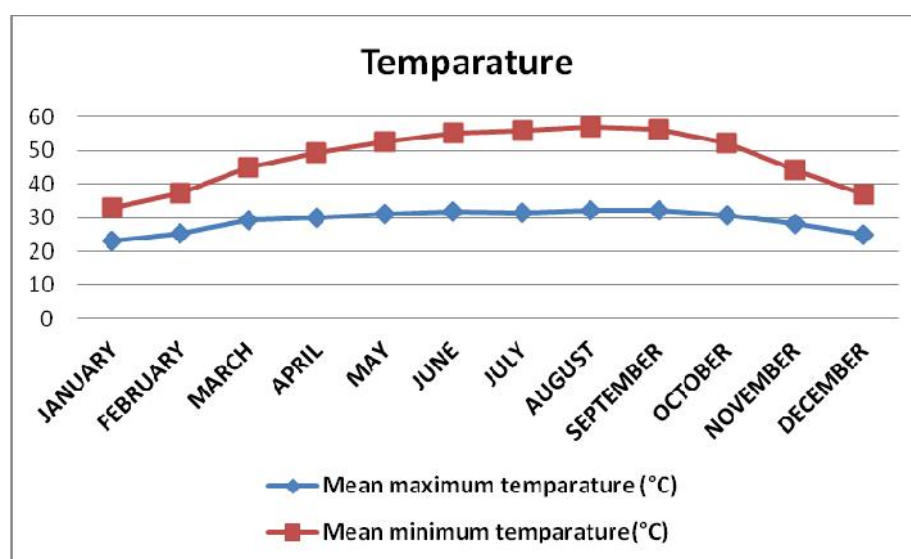


Fig. 2.2. Graphical representation of annual temperature in Study area [Source: Meteorological Department, Jalpaiguri, India]

2.7.3. Relative Humidity

The atmospheric humidity refers to the average water content of the air. Relative Humidity of the study area is remaining in maximum almost throughout the year. The high relative humidity generally starts from summer *i.e.* March and it gradually rises up till September. During early summer at morning the relative humidity lies between 70–80% and at evening between 50–60%. The Relative Humidity annual data for the last 10 years shows that March and April maintain comparatively low Relative Humidity than remaining period of the year. The reading for Relative Humidity was recorded after every 3 hours interval. The month wise maximum and minimum relative humidity is given in (Fig. 2.4).

2.8. Origin of Wetlands

The study area is covered with several small and large, annual and perennial, littoral and sub-littoral wetland systems with diversified biota. It is found that a good number of wetlands are situated at international border or in no-mens-land areas of Indo-Bhutan and Indo-Bangladesh line of controls. Most of the wetlands of these areas are fed by the water which comes down from the Great Himalayan regions.

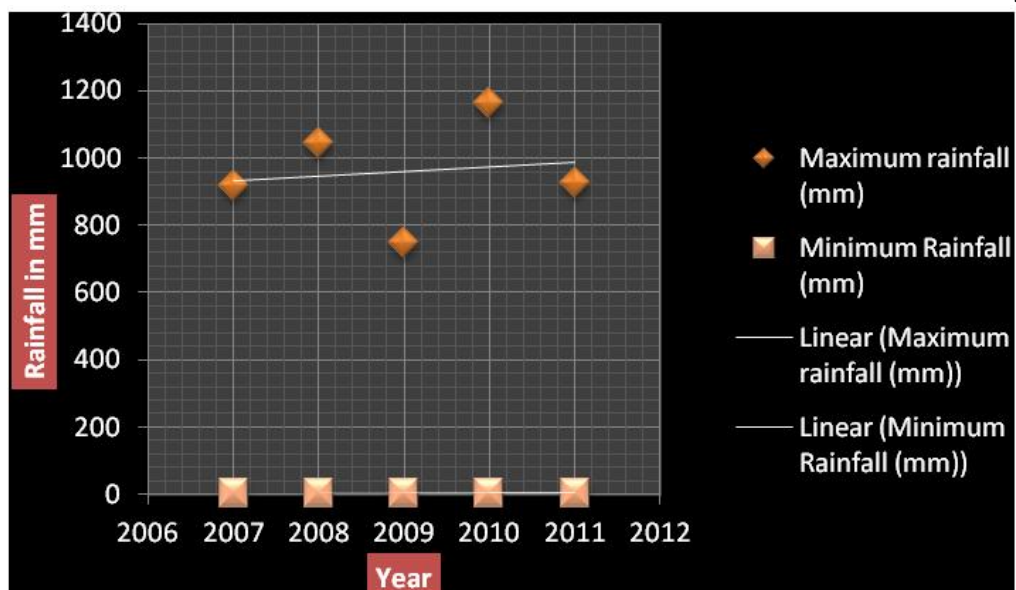


Fig. 2.3. Graphical representation of annual rainfall in Study area during 2007 – 2011 [Source: Meteorological department, Jalpaiguri, India]

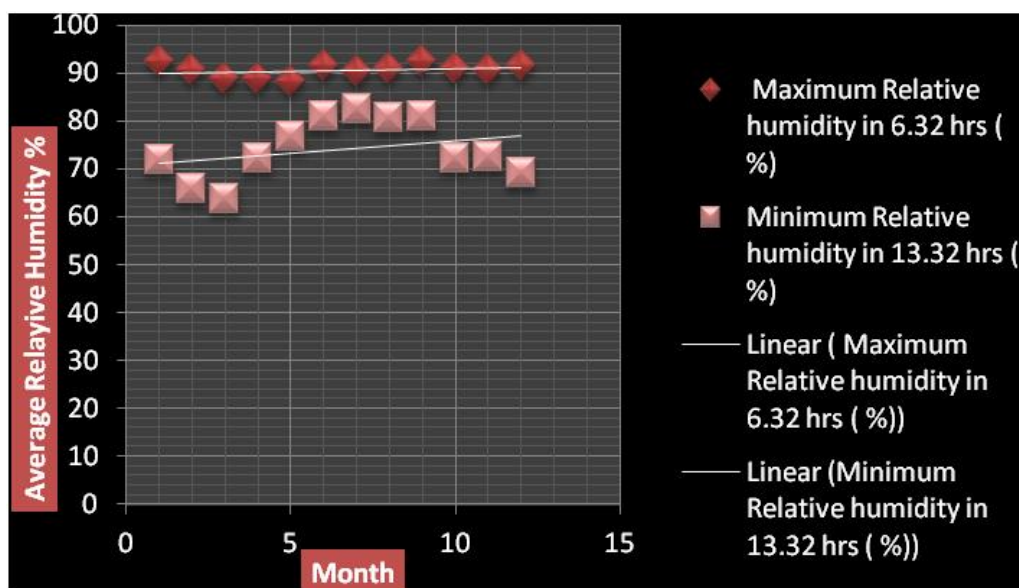


Fig. 2.4. The graphical presentation of annual relative humidity in Study area [Source: Meteorological department, Jalpaiguri, India]

Of the whole wetland systems in the study area, 65 % wetlands are perennial and the rest 35 % are seasonal or ephemeral.

However, three types of wetlands, namely *Riverine*, *Palustrine* and *Lakustrine* are mainly located in this region. Few beels are regularly feeding during the period of monsoon by different fast or slow flowing *riverine* wetland systems. The study area is rich with other wetlands like *lakustrine* i.e. large or small lakes, ponds etc. and *palustrine* including ephemerals seasonally waterlogged areas, beels etc.

2.8.1. Riverine Wetlands

The study area is mainly flood floated. Numerous rivers are flowing through different peats of the study area. Several ox-bow lakes were formed in these regions during the random shifting of rivers. These cut off wetlands are always fed by rivers and flood water during monsoon. Depth and water current of some small narrow fast flowing rivers (*Karala, Jarda, Panga* etc.) gradually decreases every year during summer and these are locally referred as 'Mara-nadi' (dead-rivers). Some large rivers such as Balason, Mahananda, Teesta, Jaldhaka etc. creates devastating situations during monsoon when the water level increases beyond the danger level.

2.8.2. Lakustrine Wetlands

Human beings created numerous wetlands for aquaculture, pisciculture, agriculture, tourism and for various domestic uses. *Lakustrine* wetlands are lakes and ponds and some of these are very old and approximately 200 to 2000 years old. Lakes are locally called as *Dighi*. These are generally perennial and are now mostly used for aquaculture. Numerous ponds are present in the study area, those locally known as *Pukur*.

2.8.3. Palustrine Wetlands

The one of the major wetland system of the study areas is *Palustrine* that includes both perennial and seasonal wetlands. These are mainly low laying fresh water marshes, narrow slow flowing water bodies locally called *Nala* or *Khaal* and fresh water swamps and floodplain areas. Many small and big ditches and ephemeral water bodies are also quite common along the road sides in study area. In seasonal wetlands water depth is 2 – 4 m whereas it is 1 to 6 m in perennial wetlands.

2.9. Wetlands under study

In the study area numerous large, medium and small wetlands are present. Among these, some wetlands are situated inside different Protected Areas like National Parks, Wildlife sanctuaries and Reserve forests. The 15 larger wetlands and many smaller wetlands including roadside ditches and paddy field have been studied for the present dissertation. The larger wetlands are composed of a group of small fragmented water bodies. So, today's larger wetlands should be treated as wetland complexes. Some of these wetlands are: *Mahananda Reservoir, Aambari Reservoir, Domahoni Beel, Gajoldoba Beel, Kathambari Beel, Nijiarap Beel, Gosshaihat Beel* (in Moraghat Reserve Forest), *Jaulapara Beel, Kuchi-Daineer Beel, Garati Beel* (in Gorumara National Park) *Ramsai Beel* (in Gorumara National Park), *Chukchuki Beel* (in Gorumara National Park), *Sursuti Beel* (in Lataguri Reserve Forest), *Rajbari Dighi* (Jalpaiguri), irrigation canals, Municipality drains and numerous social ponds, road side ditches, paddy fields etc (Table 2.1).

Table 2.1. Some major study areas along with types, GPS location and Administrative locations

Wetlands	Types	GPS location of study site	Administrative Location
Mechi River	Large, Natural, seasonally flooded	26°32 09.90 N 88°04 33.97 E	Ind -Nepal transboundary region Darjeeling, Panitanki (Terai)
Hulia River	Natural, narrow, slow flowing	26°41 31.24 N 88°17 16.28 E	Bengdubi forest, Darjeeling (Terai)
Ponta-bari River	Natural, narrow, slow flowing	26°41 09.23 N 88°15 28.41 E	Naxal-bari, Darjeeling (Terai)
Buri-Balason River	Large, Natural, seasonally flooded	26°41 56.07 N 88°19 52.33 E	Bagdogra, Darjeeling (Terai)
Bounivita River	Natural, narrow, slow flowing	26°41 19.86 N 88°15 34.41 E	Bounivita, Darjeeling (Terai)

Wetlands	Types	GPS location of study site	Administrative Location
Lachka River	Natural, narrow, slow flowing	26°43 02.23 N 88°20 27.10 E	Outside of N.B.U. campus, Darjeeling (Terai)
Magurmari River	Natural, narrow, slow flowing	26°42 26.97 N 88°21 34.85 E	N.B.U. campus, Darjeeling (Terai)
Chamta River	Natural, narrow, slow flowing	26°43 22.95 N 88°23 31.61 E	Lexicon, Darjeeling (Terai)
Mahananda River	Large, natural, seasonally flooded	26°41 20.51 N 88°24 31.13 E	Siliguri, Darjeeling (Terai)
Sahu River	Large, Natural and seasonally flooded	26°37 21.43 N 88°27 27.36 E	Radha Bari, Jalpaiguri (Terai)
Karatoa River	Large, Natural, seasonally flooded	26°38 43.74 N 88°30 01.36 E	Aam Bari, Jalpaiguri (Terai)
Panga River	Large, Natural, seasonally flooded	26°35 37.60 N 88°29 50.86 E	Talma, Jalpaiguri, (Terai)
Karala River	Natural, narrow, slow flowing	26°32 18.57 N 88°42 39.94 E	Jalpaiguri town, Jalpaiguri, (Terai)
Gadadhar tributaries	Natural, narrow, slow flowing	26°30 28.05 N 88°43 27.27 E	Kather bridge, Jalpaiguri, (Terai)
Rukruka Tributaries	Natural, narrow, slow flowing	26°32 47.51 N 88°42 35.30 E	Gosala more, Jalpaiguri (Terai)
Dhardhara tributaries	Natural, narrow, slow flowing	26°34 10.30 N 88°47 36.46 E	Sadar Hospitals Babupara, Jalpaiguri, (Duars)
Nathuar char	Natural, but degraded	26°34 05.38 N 88°39 06.87 E	Bodaganj, Jalpaiguri (Terai)
Teesta River	Large, Natural, seasonally flooded	26°30 41.14 N 88°44 02.67 E	Daspara, Jalpaiguri (Terai)
Jarda River	Natural, narrow, slow flowing	26°35 55.85 N 88°49 30.59 E	Maynaguri Jalpaiguri (Duars)
Raidak River	Large, natural, seasonally flooded	26°26 34.66 N 89°41 59.91 E	Jalpaiguri (Terai)
Shankosh River	Large, natural, seasonally flooded	26°22 55.71 N 89°48 02.23 E	Jalpaiguri (Duars)
Mansai River	Large, natural, seasonally flooded	26°11 51.46 N 89°18 00.66 E	Jalpaiguri (Duars)
Torsa River	Large, natural, seasonally flooded	26°36 59.35 N 89°23 01.63 E	Jalpaiguri (Duars)
Jaldhaka River	Large, natural, seasonally flooded	26°34 19.51 N 88°56 33.25 E	Jalpaiguri (Duars)
Kaljani River	Large, natural, seasonally flooded	26°36 39.14 N 89°29 07.46 E	Jalpaiguri (Duars)
Murti River	Large, natural, seasonally flooded	26°49 04.36 N 88°49 40.21 E	Jalpaiguri (Duars)
Aam-bari Barrage	Artificially created	26°38 25.49 N 88°30 04.78 E	Aambari, Jalpaiguri (Terai)
Gajol Doba	Naturally created near Teesta Barrage	26°44 57.46 N 88°34 22.34 E	Gajol Doba, Jalpaiguri (Duars)
Mahananda Barrage	Artificially created	26°39 20.46 N 88°24 34.65 E	Ranidanga, Rajganj Jalpaiguri, (Terai)
Reservoir I	Artificially created	26°41 34.93 N 88°24 29.64 E	Jalpaiguri, (Terai)
Reservoir II	Artificially created	26°41 28.11 N 88°24 32.30 E	Jalpaiguri, (Terai)

Wetlands	Types	GPS location of study site	Administrative Location
Reservoir III	Artificially created	26°41 10.65 N 88°24 45.25 E	Jalpaiguri, (Terai)
Reservoir 4	Artificially created	26°50 02.00 N 89°17 56.14 E	Totopara, Madarihat, Jalpaiguri, (Duars)
Nijiarap Beel	Natural	26°20 16.03 N 88°20 05.14 E	Baxiganj, Haldibari (Terai)
Domohani Beel	Natural	26°35 32.61 N 88°46 03.17 E	Domohani, Maynaguri, (Duars)
Rajbari dighi	Artificial lake	26°32 12.87 N 88°43 16.20 E	Jalpaiguri (Terai)
Jalpesh pond	Artificial	26°31 29.68 N 88°51 58.03 E	Jalpesh, Jalpaiguri (Duars)
Goshaihat Beel	Natural	26°41 41.01 N 88°59 23.12 E	Gayerkata, Jalpaiguri (Duars)
Kuci dainer Beel	Natural	26°41 36.09 N 88°59 21.14 E	Gayerkata, Jalpaiguri (Duars)
Garati Beel	Natural	26°43 16.01 N 88°40 26.82 E	Gorumara, Lataguri, (Duars)
Chukchukia Beel	Natural	26°43 26.11 N 88°41 25.68 E	Gorumara (Duars)
Ramsai Beel	Natural	26°43 38.71 N 88°51 19.32 E	Lataguri, Jalpaiguri (Duars)
Katham Bari Beel	Natural	24°48 55.22 N 88°35 41.50 E	Kathambari, Jalpaiguri (Duars)
Sursuti Beel	Semi-natural,	26°47 03.81 N 88°46 36.82 E	Lataguri (Duars)
Sova Bari old brick field	Artificial, big, now used as reservoir	26°33 15.07 N 88°39 29.04 E	Sova Bari, Jalpaiguri (Duars)
Jaulapara Beel	Artificial, large, used for fishery	25°57 57.53 N 88°59 58.58 E	Madarihat, Jalpaiguri (Duars)
Social Pond 4	Big, used for fishery	26°31 14.65 N 88°42 38.96 E	4 no. Ghumti, Jalpaiguri (Duars)
Roadside ditches	Water source for agricultural activities	26°39 04.30 N 88°30 27.82 E	Aambari, Jalpaiguri (Duars)
Social Pond 7	Big, used for fishery	26°32 18.03 N 88°43 06.73 E	Rajbari, Jalpaiguri (Terai)
Social Pond 8	Big, used for fishery	26°38 43.74 N 89°43 30.97 E	Near Jalpaiguri rail station (Terai)
Roadside ditches, near Teesta bridge	Water source for agricultural activities and fishery	26°34 17.26 N 88°45 43.59 E	Vivekananda Pally, Jalpaiguri (Terai)
Social Pond 10	Big, used for fishery	26°31 03.96 N 88°41 47.59 E	Haldibari More, Jalpaiguri (Duars)
Social Pond 11	Big, used for fishery	26°30 18.73 N 88°42 40.36 E	Mohitnagar, Jalpaiguri (Duars)

2.10. Survey areas for Ethnobotany

The following villages and localities/settlements: *Bengdubi Tea garden, Munda Basti (Assam-more, Jalpaiguri), Banabasti (Lataguri), Nagrakata, Paschim Satali, Satali Eastate, Lachu Bhita, Purba Madati, Jhavaguri Chhat, Baragharia, Dakshin Barajhar, Uttar Paitkapara, Uttar Dhalkor, Samuktala, Baniapara, Latabari, Sibkata, Khoardanga, Panbari, Sankosh Tea Garden, Raidak*

Tea Garden, Raja Bhatkhawa, Dalgaon, Totopara, Ghoramara, Salkumar and Mahakalguri etc. were selected and surveyed for the ethnobotanical studies and the purpose of the study was to record the traditional knowledge of the *Rabha, Toto, Munda, Mech, Santal, Oraon* and *Malpahari* people, who commonly use wetland vascular plants in different purposes.

2.11. Vegetation

Terai and *Duars*, the two contiguous sub-Himalayan regions of West Bengal and the adjacent part of Assam are very rich in its floristic diversity. The dense growth of diverse type of floristic elements here is primarily due to the local physiography, climatic conditions as also courses of the turbulent tributaries of the study area and its soil texture. The forest and vegetation of this area is similar to the mixed plain forest of Darjeeling and has various kinds of vegetation formation including very tall Savannah type of grasslands. Two famous Wildlife Sanctuaries [Mahananda Wildlife Sanctuary and Chapramari Wildlife Sanctuary] and three National Parks [Gorumara National Park, Jaldapara National Park and Buxa National Park (including Buxa Tiger Reserve)] are situated in this region. After declaration of Buxa Duar as a tiger reserve in Jalpaiguri, the flora of North Bengal gained special attention to maintain the forest habitat for proper conservation. Mukherjee (1965) worked on the vegetation of Jalpaiguri and prepared a sketch of forest types of Jalpaiguri and described its main floristic composition.

2.12. Faunal diversity

The Faunal diversity of this area is not properly known. But, the study area provides ample opportunity for food and shelter to wild faunal elements. Bird diversity of this area is somehow interesting, especially for the wetlands birds. During post-monsoon period almost all the wetlands suddenly becomes the happy home for different birds and these areas provides them food, shelter and favourable breeding environment. A large number of migratory birds (migrating from the different parts of the World) are visited these areas mainly during post-monsoon and stayed up to summer period. These birds include Ducks, Kingfisher, Stork, Heron etc. Except waterfowl various species of fish are found in such wetlands that also attract the waterfowls. Few identified common avifauna includes *Aythya fuligula* (Tufted Duck), *Anas acuta* (Northern pintail), *Anas clypeata* (Northern shoveler), *Anas strepera* (Gadwall), *Anas anser*, *Ardeola grayii*, *Ardea cinerea* (Indian Pond heron), *Phalacrocorax niger*, *Phalacrocorax carbo*, *Leptoptilos javanicus*, *Leptoptilos dubius*, *Anastomus osciyanus* (Asian openbill), *Helcyon capensis* (Stork billed kingfisher), *Alcedo atthis*, *Alcedo meninting*, *Ergetta garzetta* etc. are common in different wetlands.

The fish fauna of different river and wetlands are also very interesting and some those are *Catla catla*, *Labeo rohita*, *Chana punctata*, *Clarias batrachus*, *Heteropneustes fossilis*, *Oreochromis mossambicus*, *Trichogaster fasciatus*, *Puntius sarana*, *Channa striatus*, *Burbus tinto* (titputi), *Puntius ticto*, *Anabas testudineus*, *Collisa fasclata* (Khalisa) etc.

Apart from the fishes and birds, several species of mollusks, reptiles, insects are available in those wetlands. Among the reptiles some important lizards are *Calotes jerdoni*, *Chamaeleon zeylenica*, *Mabuya carinata*, *Varanus benghalensis* (Go Sap), *V. salvator* etc. and important snakes are *Xenochrophis piscator* (Jaldhora), *Athaetulla nasuta* (lawdoga), *Naja naja* (Gokhro), *Ophiophagus hannah* etc. are very common in this region.



PLATE 2.1. Figs. 1 – 6. Study sites: 1. Mahananda Barrage I; 2. Sova-Bari Beel; 3. Katham-Bari Beel; 4. Raj Bari Dighi; 5. Doumohani Beel; 6. Balapara Beel



PLATE 2.2. Figs. 7 – 12. Study sites: 7. Sahu river bed; **8.** NH-31 Road-side ditches; **9.** Baikunthapur forest wetland; **10.** Fishery pond at Daspara; **11.** Karala River bed; **12.** Gadadhar canal- I

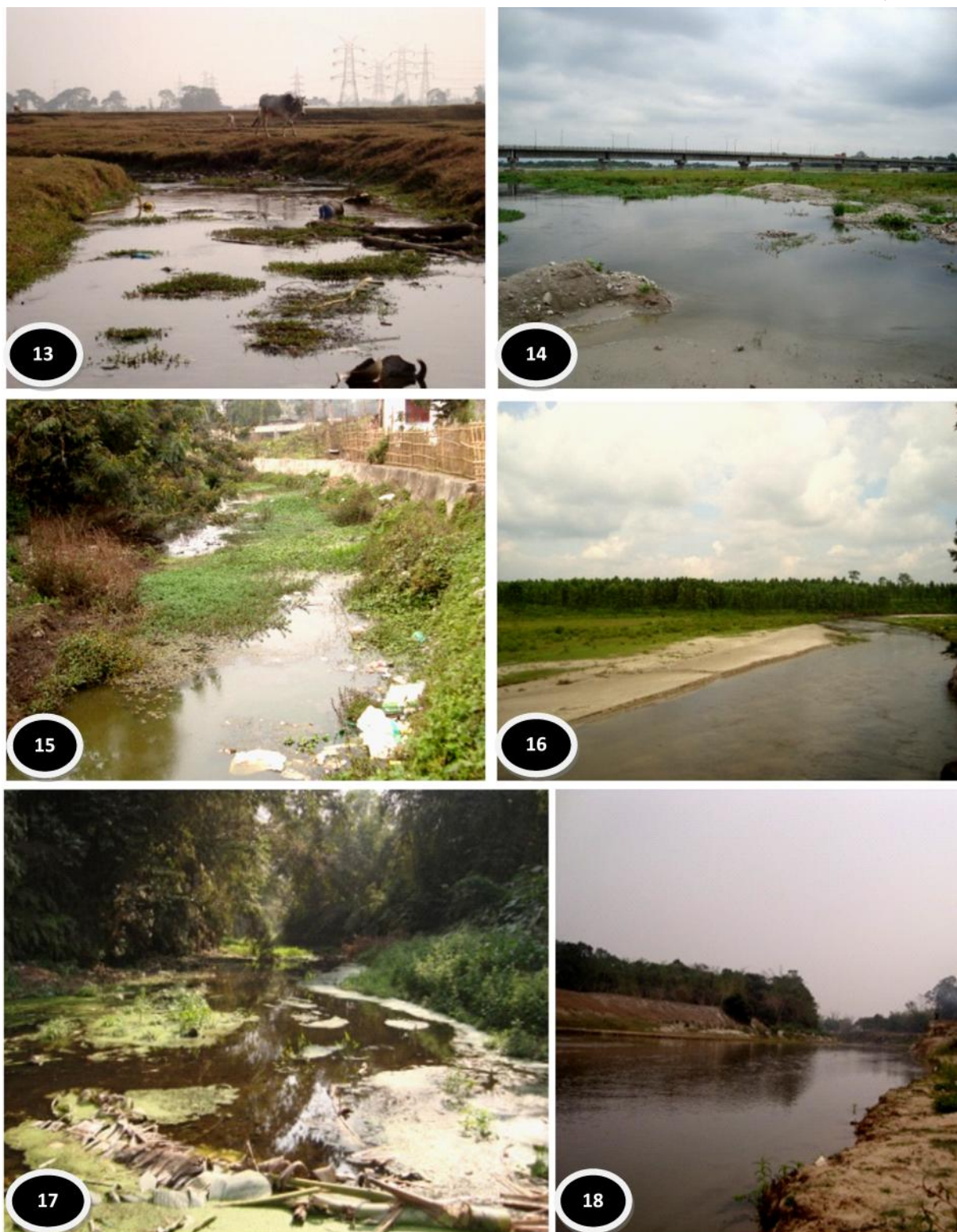


PLATE 2.3. Figs. 13 – 18. Study sites: 13. Lachka River; 14. Balason River; 15. Gadadhar canal-II; 16. Karotoa River; 17. Rukruka River; 18. Panga River



PLATE 2.4. Figs. 19 – 24. Study sites: 19. Dhardhara canal; 20. Pond of Totopara, 21-22. Social pond, 23. Gossaihaat Beel, 24. Kathambari Beel



PLATE 2.5. Figs. 25 – 30. Study sites: 25. Irrigation canal [Jalpaiguri]; **26.** Gajoldoba [Jalpiguri]; **27.** Forest wetland [Suruti forest, Lataguri]; **28.** Teesta Barrage; **29.** Garati Beel; **30.** Chukchuki Beel

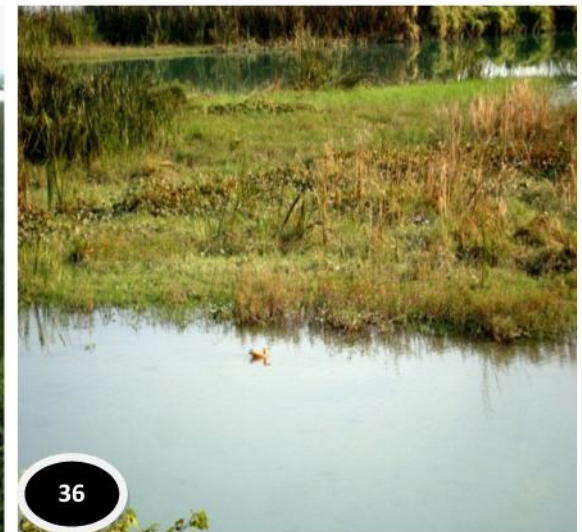


PLATE: 2.6. Figs. 31 – 36. Study sites: 31. Fatapukur Pond; 32. Aambari Barrage; 33. Rajbari Dighi; 34. Kuchi-dainer Beel; 35. Mahananda Barrage; 36. Nathuar Beel

Chapter 3

MATERIALS AND METHODS

MATERIALS AND METHODS

The present dissertation is covering a number of aspects using wide array of methodology that has been discussed below:

3.1. Floristics

The floristic survey of the study area includes all the vascular plants which grow over wetland areas in different seasons of the year. To understand the proper and actual floristic diversity of this part of the country, following methodologies are applied using techniques basically devised by (Jain & Rao, 1977) with modifications wherever it was essential.

3.1.1: *Sampling Specimens*

Plant specimens were collected mostly at random from different wetlands of the district, round the year, covering all the three predominant seasons during 2010 to 2014. In dry season, after receding of water, some plants starts growing in bare wetlands also were collected. Specimens were collected in their reproductive stages, i.e. with flowers and/or fruits, as much as possible. For this purpose in numerous cases repeated visit to the same spot was essential sometimes even within a week.

3.1.2: *Record of Field Data*

During collection, the specimens were tagged and necessary field data like colour on different plant parts including flowers, presence or absence of exudate, aroma/scent, habitat structure, association, population structure, etc. were recorded in the *Field Note-Book*. The ethno botanical uses of plant materials were investigated through direct interview of the local people and observation on use and were also recorded in the *Field Note-Book*.

3.1.3: *Processing and Drying of Specimens*

At the field camp or at the laboratory, the collected specimens are cleaned and trimmed suitably, displayed properly on blotters (blotting papers and old news-prints) and then dried in wooden Plant Press. Before pressing, most of the specimens were treated with 6 % formaldehyde (HCHO) solution to avoid fragmentation of specimens and to eliminate chances of decomposition through microbial infestation. Soft aquatic plants are kept in a separate light-weight Plant Press, where the pressure was increased very slowly and much frequent change of blotters during the first few days of the drying operation. For other plants blotters were changed with regular frequency in a heavy wooden Plant-Press until drying. During moist season for proper drying a Hot Air Oven was used with temperature adjusted at 40 – 45° C. Generally specimens were completely dried out within one or two week time.

3.1.4: *Poisoning of Specimens*

After drying all the specimens were poisoned with 4% ethanolic solution of Mercuric Chloride (HgCl₂) and dried again in blotting papers.

3.1.5: *Mounting and Labeling*

After poisoning, specimens were mounted on standard Herbarium Sheets. Later on a label was attached, in most cases, near the right hand bottom corner of the sheet, which bears the Field No, date and place of collection, scientific name, family, local name, field-characters and the name of the collector and determinator. Mounted and labelled specimens were stored temporarily in a steel cabinet for further use during the present dissertation.

3.1.6: *Identification*

After the mounting, specimens were taken under study and identified with the help of different Taxonomic literature by various authors (Prain, 1903; Cook, 1996) and were matched with the pre-identified specimens in NBU-Herbarium, and doubtful specimens were taken to CAL for further matching and or confirmation. In numerous cases, experts in different taxa were also consulted for finalization.

3.1.7: *Storing the Herbarium Sheets*

After the present dissertation is over, the first set of voucher specimens and *Field Note-Books* will be deposited in the NBU-Herbarium and the duplicates will be deposited at CAL Herbarium.

3.2. Growth Forms

Growth forms of different aquatic and semi-aquatic plants are determined by observing how a plant species overcome the adverse environmental conditions. Growth forms were recorded as suggested by (Raunkiaer, 1934); (Chowdhury, 2009) and (Chowdhury & Das, 2013)

3.3. Classification for wetland plants

This area harbors large number of wetland macrophytes and those can be classified (Boutin & Keddy, 1993) into the following habit groups:

- **Free floating hydrophytes:** This type of plants float over the water surface freely. eg. *Pistea stratiotes* Linnaeus, *Eichhornia crassipes* (Martius) Solms., *Azolla pinnata* R. Brown, *Lemna perpusilla* Torrey, *Spirodela polyrrhiza* (Linnaeus) Schleid etc.
- **Rooted with floating leaved hydrophytes:** Plants of this group mainly rooted with bottom soil but leaves with long petioles are floating on water surface. e.g. *Nymphaea nouchali* Burman f., *Nymphaea pubescens* Willdenow, *Nelumbo nucifera* Gaertner, *Nymphodes hydrophylla* (Loureiro) Kuntze etc.
- **Submerged hydrophytes:** Plants of this group mainly lies in submerged condition in the water and rooted at the bottom soil of water bodies. e.g. *Vallisneria spiralis* Linnaeus var. *denseserrulata* Mikino, *Nechamandra alternifolia* (Roxburgh ex Wight) Thwaites, *Hydrilla verticillata* (Linnaeus f.) Royel, *Najas graminea* Delile, *Potamogeton crispus*, *Aponogeton natans* (Linnaeus) Engl. & Krause, *Aponogeton crispum* Thunberg etc.
- **Suspended hydrophytes:** These groups of plants are without root and remain in freely suspended condition inside the water. e.g. *Ceratophyllum demersum* Linnaeus, *Utricularia aurea* Loureiro, *Utricularia gibbosa* Linnaeus ssp. *exoleta* (R. Brown) P. Taylor etc.
- **Emerged hydrophytes:** These groups of plants are rooted and emerged the shoot apex and inflorescence from the water. Eg. *Aponogeton natans* (Linnaeus) Engl. & K. Krause, *Monochoria hastata* (Linnaeus) Solms, *Hydrolea zeylanica* (Linnaeus) Vahl, *Butomopsis latifolia* (D. Don) Kunth etc.

- **Amphibian hydrophytes:** The plants of this group generally grown on marshland and they are able to survive in water and in dry soil for some period. e.g. *Sagittaria guayanensis* Humboldt, Bonpland & Kunth, *Sagittaria sagittifolia* Linnaeus, *Ammannia baccifera* Linnaeus, *Ammannia multiflora* Roxburgh, *Bergia ammannioides* Roxburgh, *Monochoria hastata* (Linnaeus) Solms, *Monochoria vaginalis* (Burman f.) C. Presl ex Kunth etc.
- **Wet marginal hydrophytes:** The plants of this group generally grown on the wet marginal regions of the wetland. e.g. *Ludwigia peruviana* (Linnaeus) H. Hara, *Ranunculus sceleratus* Linnaeus etc.
- **Simulated hydrophytes:** The plants of this group generally grown on dry wetland and it considered to be a simulated hydrophyte. e.g. *Chenopodium album* Linnaeus, *Xanthium strumarium* Linnaeus, *Amaranthus spinosus* Linnaeus, etc.

To study the Life-Form, the classification as suggested by (Raunkiaer, 1934) is followed in general. Following types of Life-Forms have been recognized:

- i. **Phanerophytes:** Perennating buds are not well protected. They are located in shoots much above the ground surface upto 30 cm height.
- ii. **Chamaephytes:** Herbaceous perennials or suffrutescent plants bearing perennating buds just above the ground level to 25 cm high or close to the ground.
- iii. **Hemicryptophytes:** Perennating buds half hidden at the ground level.
- iv. **Cryptophytes:** Perennating organs below the ground surface. This part has been studied in much details as most of the aquatic and semi aquatic plants belongs either of the three sub categories like geophytes, helophytes and hydrophytes.
- v. **Therophytes:** Annuals which perennate the unfavorable season through seeds or spores and complete their life cycle within a short period.

3.4. Phenology and Mode of Pollination

Study of phenology and pollination technique of various wetland macro-floras were recorded through repeated observation on the different stages of the growth and development in their *in-situ* condition during the period of August 2010 to June 2014. During this study different phenophases of naturally growing plants have been recorded, which includes germination / sprouting, leaf development, tiller formation, stem elongation, inflorescence emergence, flowering, fruit development, ripening of fruits and seeds and senescence have been noted for all aquatic and semi-aquatic wetland plants following different authors (Caprio, 1966); (Wang, 1967); (Leith, 1970); (Croat, 1975); (Bhoj & Ramkrishnan, 1981); (Sivaraj & Krishnamurthy, 1989); (Das & Chanda, 1987); (Sundriyal, 1990); (Chowdhury, 2009). Pollination types and agents were also observed and recorded on *in-situ* condition. For the observation of phenology and pollination, *Mahananda Barrage*, *Gajoldoba*, and the artificial ponds and tanks and other marshy areas located within the campus North Bengal University campus were mainly visited and taken under study.

3.5. Ethnobotanical Investigation

The complete methodology for the ethnic uses of wetland vascular plants is primarily based on the interaction with the *Ethnic* and/or *traditional people*, those who were working in different wetlands at that time and nearby tribal villages were also surveyed to enrich the list, pursuing them to share their traditional knowledge and analyzing the documented data scientifically.

For the ethnobotanical study of wetland plants the conventional methods of survey and record of data as adopted by (Jain, 1981, 1987, 1991), (Rai *et al.*, 1998); (Rai & Bhujel, 1999), (Rai, 2002), (Sarkar, 2011) and (Chowdhury, 2015) were followed. A questionnaire prepared based on the model by (Jain, 1991), and (Sarkar, 2011) for the present study. The extensive fieldwork undertaken was spreading over for three years from 2010 to 2014 and was carried out in different villages of Terai and Duars in West Bengal. Enquiries were made on their daily life, food habit, fodder collection, occupation, health practices, medicines, trade, beliefs, rituals, ceremonies, traditions and customs using a pre-designed questionnaire.

3.5.1. Establishing Contact and Developing Confidence with Ethnic People

The random demand of information from the people of Ethnic communities generally shows their unwillingness to share their traditional knowledge. The *Ethnic* people in general, are all apparently seemed to be very friendly but maintained a deep secrecy about their traditional knowledge, especially concerning to herbal medicines. So, preliminary development of contact and confidence with Ethnic people is very much essential. For this, basically some contact persons were traced and basic persuasion proceeded through them.

3.5.2. Observing the Daily Life

Direct observation on the daily life in *Ethnic* society including food and traditional liquor preparations, process of making of instruments for different activities etc. helped to record the related plants and to understand the use much easily. The daily or weekly markets (*haats*) were also visited frequently to study the marketability of wild and cultivated plants, vegetables and other plants or plant-parts collected and/or produced in this area. Various plant materials were observed and in some cases introduced into the *NBU Garden of Medicinal Plants* for *ex-situ* conservation. During daily life observation several plants were recorded as edible plants, food plants, medicinal plants, fodder plants, plant related folklores and myths, etc.

3.5.3. Plants and their Economics

The village dwellers are directly depending on many wildy grown economically important plant species. Such economically imperative wetland species of the study areas are also recorded during survey.

To execute this part of the work several literature on various uses of different wetland plants by various ethnic groups, as well as by local poor people were followed and discussed. Apart from that, data procured from literature were matched and authenticated with the same species from the present investigation through door to door interactions with local poor and ethnic people and tried to understand the commercial values of those plant materials especially in the local markets. This part of the work was designed and executed by following workers like (Kirtikar & Basu 1935); (Chopra *et al.* 1956, 1969); (Asolkar *et al.*, 1992); (Hajra & Chakraborty, 1981); (Das & Chanda, 1990); (Jain, 1991), (Bhujel *et al.* 1984 a,b,c); (Shah & Das, 2002); (Chowdhury, 2009); and (Sarkar 2011).

3.6: Wetland Destruction

Being civilized we are very rapidly destroying our life land *i.e.* wetland throughout the world due to several reasons. The visible physical threats were observed and documented from different wetlands of study areas. The reasons of wetland degradation are categorized in to two broad segments: **Anthropogenic stresses**-Through the visual observation of human activities leading to the loss of wetland were recorded and photographed. Duration of such activities was tried to measure through direct interaction with field workers during survey.; and

Natural stresses: Through the observation natural stresses of wetland also have been categorized and recorded.

Chapter **4**

THE FLORA

THE FLORA

4.1. Introduction

Thousands of species of plants have been adapted to life in water or marshy areas. A significant proportion of the world's total flora is generally growing in such habitat. The wetlands are providing the idyllic habitat for almost all kind of plants. The wetland macrophytic vegetation of the study area is quite interesting, which supports all kinds of fresh water aquatic plants. Most of the plants are herbs along with few shrubs and climbers. Few tree species also have been recorded from these regions. However, in tropical regions, different species of *Eucalyptus*, *Acacia*, *Lagerstroemia*, etc. are also planted in these low laying areas by different agencies.

The floristic exploration of aquatic and wetland plants of different part of the world conducted by various workers including (Muenscher, 1944); (Miller & Egnler, 1950); (Fassot, 1957), (Arbar, 1963); (Lapinot, 1963); (Mason, 1969); (Godfrey & Wooten, 1979); (Minc & Albert, 1998). The endemic species number is high, which is around 13% of the total aquatic angiosperms, next to the tropical South America (Gopal, 1990). The lakes, rivers and other freshwaters bodies of Indian subcontinent support a large diversity of biota representing almost all taxonomic groups. The total numbers of aquatic plant species that exceed 1200 for aquatic and wetland systems in India (Gopal, 1990). Biswas & Calder (1937, 1955) made major survey work in India and prepared a list of aquatic angiosperms of India and Myanmar. Cook (1996) latter on revised the aquatic flora of India and reported over 485 species of aquatic and semi-aquatic angiosperms. K. Subramanyam (1961) and D.B. Deb (1962) studied and estimated the aquatic and semi-aquatic plants in different wetland regions of the Indian sub-continent. J.F. Duthie (1903 – 1929) and U.N. Jha (1965) studied the wetland vegetation of upper and middle Gangetic plains, where as K. Naskar (1990) studied lower Gangetic plains and enlisted a total of 327 species covering 60 families of flowing plants. In India, district or river or specific wetland wise or area wise work were performed by several workers including (J.D. Hooker, 1872-1897); (B. Gopal, 1973); (S.K. Mukherjee, 1965); (D. V. Narayana, 1934); (G.S. Puri & S. D. Mahajan, 1958); (J.K. Maheswari, 1960); (V. Kaul & D.P. Zutsi, 1965); (N.C. Majumdar, 1965); (B.S. Trivedi & P.C. Sharma, 1965); (K.S. Unni, 1967); (M.K. Ghosh, 1967); (V. Bhaskar & B.A. Razi, 1973); (S.R. Paul, 1973); (C.R. Babu, 1977); (Guha, 1984); (Chowdhury, 2009); (Chowdhury & Das, 2013); (Chowdhury *et al.*, 2012, 2014 & 2015).

Wetlands of WestBengal are occupying 9% of total wetlands area of the Indian sub-continent and are the habitat of 380 macrophytes including many species adapted to mangrove vegetation. This number covers 47% of total aquatic and semi-aquatic flora of India (Ghosh, 2003). Prain (1903) provided detailed idea about the flora of the study area. Recently, M. Chowdhury (2009) studied the aquatic vegetation in the different wetlands of Malda district of West Bengal. His investigation shows the presence of rich vegetation in different corner of this district.

Recent survey in the wetlands of Terai and Duars regions of West Bengal led to the record of a rich flora that is enumerated here in this chapter.

4.2. Classification

Presently recorded floristic elements of wetlands are enumerated here following the APG III system of classification (Chase & Reveal, 2009). In the present discourse, non-vascular plants were not described. So, only the recorded vascular plants were arranged following this classification.

4.2.1. PTERIDOPHYTES

For the systematic arrangement of the recorded Pteridophytic families from the wetlands of Terai & Duars of West Bengal, Classification of Pichi-Sermollis (1973) has been followed.

1. Fern–Allies

I. Lycopodiaceae

II. Selaginellaceae

2. Ferns

I. Schizaeaceae

II. Pteridaceae

III. Adiantaceae

IV. Davalliaceae

V. Marsileaceae

VI. Salviniaceae

VII. Blechnaceae

VIII. Dryopteridaceae

IX. Gleicheniaceae

X. Thelypteridaceae

XI. Woodsiaceae

4.2.2. ANGIOSPERMS

For the systematic arrangement of the recorded Angiospermic families from the wetlands of Terai & Duars of West Bengal, Classification of APG III system of classification (Chase & Reveal, 2009) has been followed.

4.2.2.1. Angiosperms

- Nymphaeales

- Nymphaeaceae

Magnoliids

- Piperales

- Piperaceae

Monocots

- Acorales
 - Acoraceae
- Alismatales
 - Alismataceae
 - Aponogetonaceae
 - Araceae
 - Hydrocharitaceae
 - Potamogetonaceae
- Pandanales
 - Pandanaceae
 - Asparagales
 - Amaryllidaceae
 - Orchidaceae

Commelinids

- Arecales
 - Arecaceae
- Commelinales
 - Commelinaceae
 - Pontederiaceae
- Poales
 - Cyperaceae
 - Eriocaulaceae
 - Poaceae
 - Typhaceae
 - Xyridaceae
- Zingiberales
 - Cannaceae
 - Costaceae
 - Marantaceae
 - Musaceae
 - Zingiberaceae

Probable sister of eudicots

- Ceratophyllales
 - Ceratophyllaceae

Eudicots

- Ranunculales
 - Papaveraceae
 - Ranunculaceae
- Proteales
 - Nelumbonaceae

Core eudicots

- Saxifragales
 - Haloragaceae
- Caryophyllales
 - Amaranthaceae
 - Caryophyllaceae
 - Droseraceae
 - Molluginaceae
 - Polygonaceae
 - Portulacaceae
 - Tamaricaceae

Fabids (Eurosids I)

- Oxalidales
 - Oxalidaceae
 - Malpighiales
 - Elatinaceae
 - Euphorbiaceae
 - Hypericaceae
 - Phyllanthaceae
- Fabales
 - Fabaceae
 - Polygalaceae
- Rosales
 - Moraceae
 - Rosaceae
 - Urticaceae

Malvids (Eurosids II)

- Myrtales
 - Lythraceae
 - Onagraceae
- Brassicales
 - Brassicaceae
 - Cleomaceae
- Malvales
 - Malvaceae

Asterids

- Ericales
- Primulaceae

Lamiids (Euasterids I)

- Boraginaceae
- Gentianales
 - Gentianaceae
 - Rubiaceae
- Lamiales
 - Acanthaceae
 - Lamiaceae
 - Linderniaceae
 - Lentibulariaceae
 - Phrymaceae
 - Plantaginaceae
 - Verbenaceae
- Solanales
 - Convolvulaceae
 - Hydroleaceae
 - Solanaceae
 - Sphenocleaceae

Campanulids (Euasterids II)

- Asterales
 - Asteraceae
 - Campanulaceae
 - Menyanthaceae
- Apiales
 - Apiaceae
 - Araliaceae

4.3. ENUMERATION OF WETLAND FLORA

Different families of Pteridophytes have been arranged according to the system of Pichi-Sermollis (1973) and for the Angiosperms as in APG III (2009) system of classifications. However, for lower (minor category) ranks, like genera under families and species under genera have been enumerated alphabetically for easy handling of the work. For the identification of genera and other minor categories of taxa (i.e. Sub-genus, Section, Species, Sub-species, Variety and Forma) artificial dichotomous identification keys have been provided.

4.3.1. DIVISION I. **PTERIDOPHYTA**

For the systematic arrangement of the recorded Pteridophytic families from the wetlands of Terai & Duars of West Bengal, Classification of Pichi-Sermollis (1973) has been followed.

LYCOPODIACEAE Palisot de Beauvois *ex* Mirbel in Lamarck *et* Mirbel, Hist. Nat. Veg. 4: 293. 1802. [Club-moss family]

LYCOPODIELLA Jour. Holub, Preslia 36: 22. 1964

Lycopodiella cernua (Linnaeus) Pichi-Sermollis, In Webbia 23(1): 166. 1968; Ollgaard in Kramer & Green, Fam. Gen. Vasc. Pl. 1: 38. 1990; Singh *et* Panigrahi, Fern & Fern – Allies Arun. Prad. I. 48. 2005. *Lycopodium cernuum* Linnaeus, Sp. Pl.2: 1103. 1753; Deb & Dutta in Jour. Bombay. Nat. Hist. Soc. 68(3): 581. 1972.

Aerial shoots erect, terete, glabrous, dichotomously branched with well-differentiated lateral branchlets; leaves of aerial shoots spirally arranged, sparse, subulate to linear, straight or slightly involute, papery, midrib indistinct, base rounded, decurrent, sessile, entire, acuminate. Lateral branches ascending, dichotomously branched with well-differentiated lateral branchlets much branched, pubescent or glabrous; leaves of lateral branches and branchlets spirally arranged, dense, slightly curved upward, subulate to linear, papery, longitudinally furrowed, glabrous, midrib indistinct, base decurrent, sessile, margin entire, apex acuminate. Strobilus solitary, terminal on small branches, often pendulous when mature, pale yellow, shortly terete, sessile; sporophyll ovate-rhombic, imbricate, Sporangia enclosed.

Fertile fronds: July – September

Exiccatus: Gossaihat Beel, **Anurag & AP Das 0282**, dated 14.07.2011; Doumahoni Beel, **Anurag & AP Das 0507**, dated 12.06.2013.

Status: Less common.

Local Distribution: Only found in few wetlands of the study area.

General Distribution: India, Tropics and Subtropics of Asia and South America, Pacific Island.

SELAGINELLACEAE Willkom, Prodr. Fl. Hisp. 1(1): 14. 1861. [Spike-moss family]

SELAGINELLA P. Beauvois, Megasin Encycl. 9: 478. 1804

Selaginella monospora Spring, Mém. Acad. Roy. Sci. Belgique 24: 135, 1850; Monogr. Lyc. II: 135, 1850; Alston, Bull. Fan. Mem. Inst. Biol. Bot. 5: 288, 1954; Alston, Proc. Nat. Inst. Sc. Ind. 11: 228, 1945; Alston, Fl. Gen. de Indo-Chine 7(2): 587 – 588, 1951; Ghosh *et al.*, Pter. Fl. East. Ind. 1: 127, 2004. *Selaginella gorvalensis* Spring, Monogr. Lyc. II: 256, 1850; Bak, Handb. Fern Allies 107, 1887; *Selaginella microclada* Bak, Jour. Bot. 22: 246, 1884; Bak, Fern Allies 76, 1887.

Main stem prostrate, rooting on all sides and at intervals, unequally tetragonal, polished shining, main stem alternately branched 5 – 9 times, branching unequal, flexuous, oblique-patent; leaves obscurely green, dimorphus, lateral leaves Oblong to ovate-lanceolate, subacute, denticulate to serrulate at base, median leaves acuminate or gracefully mucronate to short aristate, oval, small. Spike short, quadrangular,

sporophylls dimorphic, large sporophylls less than half as long as lateral leaves, oblong-lanceolate, obtuse, denticulate, small sporophylls dentate, ovate, cuminiate.

Fertile fronds: October – January

Exiccatus: Gajoldoba, **Anurag & AP Das 0126**, dated 12.09.2010; Mahananda Barrage, **Anurag & AP Das 0630**, dated 13.11.2013.

Status: Rare.

Local Distribution: In few wetlands of the study area.

General Distribution: India, Myanmar, Bhutan, Indo-China, Nepal.

SCHIZAEACEAE Kaulfuss *sensu* Kramer in Kramer *et* Green, Fam. Gen. Vasc. Pl. 1: 258. 1990

LYGODIUM Swartz, Schrad. Jour. Bot. 1800 (2): 7. 1801

Key to the species:

- 1a. Rhizome usually long creeping; leaflets entire, obtuse, surfaces smooth; sporophores upto 3
..... *L. microphyllum*
- 1b. Rhizome short creeping or suberect; leaflets serrate and sometimes crenately lobed, dorsally
puberulous; sporophores 4 – 9 *L. flexuosum*

Lygodium flexuosum (Linnaeus) Swartz in Schrad. In Jour. Bot. 1800 (2): 7.106. 1810; R.H. Beddome, Handb. Ferns Brit. Ind. 457. f. 283. 1883; Panigrahi *et* Dixit, Proc. Aut. Sch. Bot. 217, 1967; Hara, Fl. East. Himal. 1: 455, 1966; Baishya *et* Rao, Fern & Fern Allies Meghalaya 37. 1982; Chauhan *et al.*, in Hajra, Fl. Namdapha 79. 1996; Sing *et* Panigrahi, Proc. Ind. Acad. Sci. 93B (2): 124, 1984; Ghosh *et al.*, Pter. Fl. East. Ind. 1: 221, 2004. *Ophioglossum flexuosum* Linnaeus Sp. Pl. 2: 1063. 1753. *Ophioglossum scandens* Linnaeus Sp. Pl. 2: 1063. 1753. *Lygodium scandens* (Linnaeus) Swartz in Schrad Jour. Bot. 1800 (2): 106, 1801.

Rhizome short creeping. Fronds very long, juvenile fronds once or twice dichotomously branched, each branch deeply palmately lobed, almost equal at the base, the whole leaflets cordate, serrate and sometimes crenately lobed, dorsally puberulous, ovate to deltoid, tripinnate to quadripinnatifid, dormant apex bearing hairs, brown, septate, secondary rachis branches narrowly winged, hairy, ovate oblong to deltoid, base cordate, basal ones largest and stalked, becoming sessile upwards. Midvein hairy, simple to septate, veins hairy. Sorophores 4 – 9 mm long. Sporophores 4 – 9; spores pale.

Fertile fronds: March – December

Exiccatus: Gajoldoba, **Anurag & AP Das 0132**, dated 12.09.2010; Doumahoni Beel, **Anurag & AP Das 0498**, dated 12.06.2013.

Status: Common.

Local Distribution: In some wetlands of study area.

General Distribution: India, Sri Lanka, China, Thailand, Malaysia, Philippines, Vietnam, Africa, Australia.

Lygodium microphyllum (Cave) R. Brown, Prodr. Fl. Nov. Holl. 1: 162, 1810; Bedd. Handb. 455, t. 282, 1883; Holttum, Fl. Males. Ser. 2. 47. f. 5e – f, 1959; Panigrahi *et* Dixit, Proc. Aut. Sch. 224, f. 4, 1967; Ghosh *et al.*, Pter. Fl. East. Ind. 1: 225, 2004. *Ugena microphylla* Cave, Icon. Descr. Pl. 6(2): 76, t. 595, f. 2, 1801. *Lygodium scandens sensu* Sw. in Schrad. Jour. Bot. 1800 (2): 106, 1801,

pp. excl. typo, *non* (Linnaeus) Swartz in Sims. Ferns South Afr., ed. 2: 302, 1915; R.H. Beddome, Ferns of S. Ind. t. 61, 1863. *Ophioglossum filiforme* Roxburgh ex Griffith in Calc. Jour. Nat. Hist. 4: 476, t. 26, f. 3, 1844.

Rhizome long creeping. Fronds tri-pinnate, rachis surface glabrous, ovate-oblong, pinnate, primary rachis branches 3 – 5 mm long, dormant apex brown, septate hairs, secondary rachis branches glabrous, apex of stalk swollen and articulate with the lamina, pinnule lamina ovate-oblong, base cordate to auricled, entire, obtuse, surface smooth, veins many times forked, prominent, ending into the margin. Sorophores up to 3 mm long. Sporophores upto 3.

Fertile fronds: March – December

Exiccatus: Gossaihat Beel, **Anurag & AP Das 0453**, dated 17.08.2012; Doumahoni Beel, **Anurag & AP Das 0504**, dated 12.06.2013.

Status: Common.

Local Distribution: In some wetlands of study area.

General Distribution: India, China, Sri Lanka, Africa, Malaysia, Australia.

PTERIDACEAE Ching, *Webbia* 35(2): 239. 1982. [Maidenhair fern family]

Key to the genera:

- 1a. Fertile fronds much dissected into terete terminal segments; indusium absent, paraphyses absent; whole plant succulent ***Ceratopteris***
 1b. Fertile fronds normal leafy; indusium present, paraphyses present ***Pteris***

CERATOPTERIS Brongniart, Bull. Sci. Soc. Philom. Paris. Ser. 3, 8: 186. 1821

Ceratopteris thalictroides (Linnaeus) Brongniart, Bull. Soc. Philom. Paris ser. 3, 8: 186. 1821; R.H. Beddome, Handb. 123, 1883; Hope in Jour. Bombay Nat. Hist. Soc. 13: 458, 1901; Ghosh *et al.*, Pter. Fl. East. Ind. 1: 190, 2004; Singh *et Panigrahi*, Fern & Fern – Allies Arun. Prad. II: 430. 2005. *Acrostichum thalictroides* Linnaeus, Sp. Pl. 2: 1070. 1753. *Pteris thalictroides* (Linnaeus) Swartz in Schrad. Jour. Bot. 4: 651, 1801. *Acrostichum siliquosum* Linnaeus, Sp. Pl. 2: 1070. 1753. *Ceratopteris siliquosa* (Linnaeus) Copeland in Philip. Jour. Sci. 56: 107. 1935. **[PLATE 4.18. Figs. 103]**

Marshy, annual, erect fern. Stem with scales and roots. Leaves dimorphic, sterile frond slightly dissected; fertile fronds highly dissected. Lamina base cordate. Sporangia arranged on lower side of fertile frond.

Fertile fronds: September – December

Exiccatus: Mahananda Barrage, **Anurag & AP Das 0628**, dated 13.11.2013; Kathambari Beel, **Anurag & AP Das 0757**, dated 03.09.2014.

Status: Abundant.

Local Distribution: Water bodies throughout Terai & Duars.

General Distribution: India, throughout the tropics and sub-tropics.

PTERIS Linnaeus, Sp. Pl. 1073. 1753

Key to the species:

- 1a. Sori continuous in all pinnae of mature plants ***P. vittata***
 1b. Sori continuous round the sinus but not reaching apices of lobes ***P. biaurita***

Pteris biaurita Linnaeus, Sp. Pl. ed. 1, 2: 1076, 1753; Hope in Jour. Bombay Nat. Hist. Soc. 13: 455, 1901; Hooker Sp. Fil. 2: 203, 1858; Clarke, Trans. Linn. Soc. ser. 2. Bot. I: 469, 1880, p.p.; Hara, Fl. East. Himal. 1: 465, 1966 (Reprint 2008); Ghosh *et al.*, Pter. Fl. East. Ind. 1: 338, 2004. *Campteria biaurita* (Linnaeus) Hooker, Gen. Fil. 65-A, 1841; R.H. Beddome, Handb. 116, 1883. *Pteris biaurita* Linnaeus var. *mazor* Clarke, Trans. Linn. Soc. ser. 2. Bot. I: 469, 1880. *Campteria biaurita* Hooker *et* Bauer, Gen. Fil. t. 65 A, 1841; *Pteris peetinata* D. Don, Prod. Fl. Nepal. 15, 1825; *non* Cav. 1802; Morton, Contr. U. S. Nat. Herb. 38(6): 267, 1973.

Rhizome short, erect, clothed with at apex and base of stipe with brown scales. Stipe glabrous, grooved on adaxial surface, rachis and midrib of pinnae deeply grooved, rachis groove minutely hairy. Lamina slightly dimorphous, deeply bipinnatifid, pinnae opposite or subopposite, 5–9 pairs, lowest pinnae longest and bipartite on basioscopic side, other pinnae unbranched, sessile, oblique, slightly falcate, acuminate, base cuneate, thin. Sori continuous round the sinus but not reaching the apices of the lobes.

Fertile fronds: July – January

Exiccatus: Doumahoni Beel, **Anurag & AP Das 0509**, dated 12.06.2013.

Status: Common.

Local Distribution: In most of the wetlands of the study area.

General Distribution: India, Bhutan, China, West Indies, Malesia, South Africa, Brazil.

Pteris vittata Linnaeus, Sp. Pl. 2: 1074, 1753; Heiron, Hedwigia 54: 290, 1914; Copeland Fern Fl. Philip. 1: 128, 1958; Bir *et* Verma, Res. Bull. Panj. Univ. 14: 191, 1963; Mehra *et* Bir, Res. Bull. Panj. Univ. 15: 112, 1964; Shieh, Bot. Mag. Tokyo 79: 287, 1966; Hara, Fl. East. Himal. 1: 467, 1966 (Reprint 2008); Ghosh *et al.*, Pter. Fl. East. Ind. 1: 319, 2004. *Pteris longifolia auct.* Quoad pl. Asiat.: Bedd. Ferns S. Ind. t. 33, 1863.

Rhizome short, erect to sub-erect, densely clothed, narrow, thin, entire margined scales, pale brownish when old. Fronds simply pinnate with terminal pinnae. Stipes up to 40 cm long, green, scaly almost throughout, pale brownish. Lamina 30–80 cm long, pinnae numerous. All pinnae sessile and oblique, linear, base broadly cuneate – cordate, somewhat dilated, acuminate, edges where sori not formed acutely and shortly toothed throughout. Veins fine, distinct on both surfaces. Sori continuous from near the base to near the apex of mostly all pinnae in mature plants except the reduced basal ones.

Fertile fronds: July – December

Exiccatus: Mahananda Barrage, **Anurag & AP Das 0632**, dated 13.11.2013; Gajoldoba, **Anurag & AP Das 0754**, dated 03.09.2013.

Status: Common.

Local Distribution: In most of the wetlands of the study area.

General Distribution: India, Tropical and Sub Tropical World.

ADIANTACEAE Newman, Hist. Brit. Ferns 5. 1840; *nom. cons.*

Key to the genera:

- 1a. Rhizome erect, fronds simply pinnate; stipes glossy-black; lamina green below ***Adiantum***
- 1b. Rhizome short, decumbent. fronds tufted, widest at base; silvery below ***Cheilanthes***

ADIANTUM Linnaeus, Sp. Pl. 1094, 1753

Adiantum caudatum Linnaeus, Mant. Pl. 308, 1771; R.H. Beddome, Handb. 83, 1883; Hope, Jour. Bomb. Nat. Hist. Soc. 13: 237, 1900; Hara, Fl. East. Himal. 1: 459, 1966.

Rhizome short erect, clothed with deep brown lanceolate scales, scale margin hyaline and entire. Fronds simply pinnate, linear oblong, up to 20 cm. Stipe scaly at base, deep brown to black, glossy, terete. Lamina up to 15 cm long, ending in a small leaflet, pinnae largest towards base, subsessile, dimidiate, upper margin 3 – 4 lobed, sinus narrow, lower margin straight, apex round, base cuneate, both surface glabrous. Venation free dichotomously branched. Sorus transversely oblong.

Fertile fronds: August – November

Exiccatus: Gossaihat Beel, *Anurag & AP Das 0454*, dated 17.08.2012; Mahananda Barrage, *Anurag & AP Das 0633*, dated 13.11.2013.

Status: Common.

Local Distribution: In most of the wetlands of the study area.

General Distribution: India, Nepal, Bhutan, China, Japan, Taiwan, Myanmar, Philipines, Malaya Island.

CHEILANTHES Swartz, Syn. Fil. 5, 126. 1806; *nom. cons.*

Cheilanthes albo-marginata C.B. Clarke in Trans. Linnaeus. Soc. London. Ser. II. Bot. 1: 456. f. 52. 1880; R.H. Beddome, Handb. Ferns Brit. India: Jamir & Rao, Ferns Nagaland: 139. 1988. *Aleuritopteris albomarginata* (C.B. Clarke) Ching in Hong Kong Nat. 10: 199. 1941. Panigr, in Bull. Bot. Surv. India 2: 312. 1960.

Rhizome short, decumbent; roots thick. Fronds tufted, widest at base, deltoid or ovate lanceolate up to 25 cm. Stipes polished, blackish brown up to 10 – 12 cm. Lamina up to 18 cm long; pinnae up to 4 cm, basal pair largest, sessile, oblique, acute, margin irregular; veins thin. Sori consisting of several sporangia.

Fertile fronds: July – October

Exiccatus: Gajoldoba, *Anurag & AP Das 0139*, dated 12.09.2010; Doumahoni Beel, *Anurag & AP Das 0538*, dated 12.06.2013.

Status: Common.

Local Distribution: In most of the wetlands of the study area.

General Distribution: India, Nepal, Bhutan, China.

DAVALLIACEAE Mettenius *ex* Frank in Leunis, Syn. Pflanzenkd. ed. 2, 3: 1474. 1877**NEPHROLEPIS** Schott, Gen. Fil. [Schott] t. 3. 1834

Nephrolepis auriculata (Linnaeus) Trimen in Jour. Linn. Soc. London Bot. 24: 152. 1887; R.H. Beddome, Handb. Ferns Brit. India, 282, t. 144. 1883; Clarke in Trans, Linn. Soc. London, II, Bot., 1: 540. 1880; Mehra *et* Bir, Pter. Fl. Darjeeling Sikkim Him. 121. 2008; Singh *et* Panigrahi, Fern & Fern – Allies Arun. Prad. I. 405. 2005. *Polypodium auriculatum* Linnaeus, Sp. Pl. 2: 1088. 1753. *Aspidium auriculatum* (Linnaeus) Swartz in Schrad. Jour. Bot. 1800 (2): 31. 1801.

Rhizome short, erect, paleaceous at apex; roots thick, bearing fleshy tubers; paleae up to 6 x 1 mm, peltate, lanceolate, long acuminate, light brown. Fronds 35 – 50 x 4.5 – 5.0 cm, tufted, linear-elliptic, acuminate, pinnate; stipes 4 – 6 cm long, pale brownish, paleaceous; pinnae largest in the middle of the

fronds, 20 – 25 x 7 – 8 mm, sessile, alternate, drying pale green. Sori median, terminal, indusium reniform.

Fertile fronds: August – November

Exiccatus: Gajoldoba, **Anurag & AP Das 0145**, dated 12.09.2010.

Status: Rare.

Local Distribution: In most of the wetlands of the study area.

General Distribution: India: West Bengal, Assam, Arunachal Pradesh; Tropical Asia.

MARSILEACEAE Mirbel in Lamarck *et* Mirbel, Hist. Vog. 5: 126. 1802

[Water clover family]

MARSILEA Linnaeus, Sp. Pl. 2: 1099. 1753

Marsilea minuta Linnaeus, Mant. 308. 1771; Sledge, Bot. Jour. Linn. Soc. 84: 22. 1982; Fourn., Bull. Soc. Bot. Fr. 27: 329, 1880; Bak, Handb. Fern Allies 140, 1887; Hara, Fl. East. Himal. 1: 500, 1966 (Reprint 2008); Prain, Beng. Plants 2: 957, 1903; Ghosh *et al.*, Pter. Fl. East. Ind. 1: 187, 2004; Chowdhury & Das, Pl. 9(1): 20. 2015. *Marsilea aegyptiaca* Wallich, List no. 7096, 1828. Non Willdenow. *Marsilea dentate* Roxburgh, Mss. in herb. Mus. Brit.; A. Br. Mber. Akad. Berl. 729, 1871. *Marsilea poonensis* Kolhat, Kew Bull. 2: 293. 1957. [PLATE 4.18. Figs. 104]

Vernacular name: *SusniShak*

Aquatic with creeping rhizome; roots borne usually on nodes, stipes scattered, usually green.

Leaves emerging, leaflets four, sessile arranged cross-wise at the tip. Sporocarps borne at the nodes in alternate clusters.

Fertile: January – April

Exiccatus: Doumahoni Beel, **Anurag & AP Das 0214**, dated 02.02.2011; Gajoldoba, **Anurag & AP Das 0375**, dated 08.03.2012.

Status: Abundant.

Local Distribution: Water bodies throughout Terai & Duars.

General Distribution: India, Africa, Trinidad and Brazil.

SALVINIACEAE Dumortier, Anal. Fam. Pl. 67. 1829

Key to the genera:

- 1a. Sporocarps in pair; leaves minute, imbricate; roots present, simple *Azolla*
- 1b. Sporocarps in cluster; leaves dimorphic, floating ones entire; submerged leaves much dissected, root-like *Salvinia*

AZOLLA Lamarck, Encycl. Meth. 1. 343. 1783

Azolla pinnata ssp. *africana* (Desvaux) R.M.K. Saunders & K. Fowler, Bot. Jour. Linn. Soc. 109: 351, f. 30A 351.1992. *Azolla africana* Desvaux, Mém. Soc. Linn. Paris 6(2): 178. 1827. *Azolla guineensis* Schumacher, Beskr. Guin. Pl. 462. 1827. *Azolla pinnata* var. *africana* (Desvaux) Baker, Handb. Fern – Allies 138. 1887. *Azolla pinnata* R. Brown in Prodr. Fl. Nov. Holland. 167.

1810; Prain, Beng. Pl. 2: 1266. 1903; Holttum, Fl. Malaya 2: 621. 1968. Ghosh *et al.*, Pterid. Fl. East. Ind. 1: 184. 2004; Chowdhury & Das, Pl. 9(1): 20. 2015. **[PLATE 4.18. Figs. 102]**

Small, triangular, free floating ferns; roots hanging downward. Fronds two lobed, close together. Sori indusiate on submerged lobes of leaf; microsporangium many with microspores; megasporangia few with one megaspore.

Fertile fronds: May – August

Exiccatus: Mahananda Barrage, **Anurag & AP Das 0076**, dated 12.05.2010; ; Doumahoni Beel, **Anurag & AP Das 0510**, dated 12.06.2013.

Status: Abundant.

Local Distribution: Water bodies throughout Terai & Duars.

General Distribution: India (Entire low lands), Africa, Asia, Australia, Malaysia and Taiwan.

SALVINIA Seguir, Fl. Veron. 3: 52, 1754

Key to the species:

- 1a. Floating leaves multiaxillary; leaves large, spongy and crowded *S. adnata*
- 1b. Floating leaves uniaxillary; leaves smaller, neither crowded nor spongy 2
- 2a. Floating leaves solitary, cup shaped *S. cucullata*
- 2b. Floating leaves, flat not cup shaped *S. natans*

Salvinia adnata Desvaux, Mém. Soc. Linn. Paris 6: 177, 1827; Chowdhury & Das, Pl. 9(1): 20. 2015. *Salvinia molesta* D.S. Mitchell, Brit. Fern Gaz. 10 (5): 251 – 252, 1972; Ghosh *et al.*, Pter. Fl. East. Ind. 1: 179, 2004. *Salvinia auriculata sensu* Ind. Auth. *non* Aublet 1775.

[PLATE 4.18. Figs. 101]

Floating, aquatic ferns. Frond compressed, oval, folded, covered with arching, spongy. Sporocarps globose, densely hairy, short stalked. Macrosporocarps 2 – 3, with 20 – 25 macrosporangia. Microsporocarps pubescent, sessile or sub-sessile, containing mostly empty microsporangia.

Fertile fronds: September – March

Exiccatus: Gajoldoba, **Anurag & AP Das 0375**, dated 08.03.2012; Mahananda Barrage, **Anurag & AP Das 0634**, dated 13.11.2013.

Status: Less common.

Local Distribution: Found in few wetlands of the study area.

General Distribution: India, Sri Lanka, Indonesia, Western Australia, South and Central Africa, Brazil.

Salvinia cucullata Roxburgh *ex* Bory in C.P. Belanger, Voy. Indes Or. 2(1): 6. 1833; Roxburgh *ex* Griffith, Calc. Jour. Nat. Hist. 4: 470. 1844; Griffith, Calc. Jour. Nat. Hist. 5: 255, t. 20, f. 21, 1845; J.G. Baker, Handb. Fern Allies 186, 1887; Prain, Beng. Pl. 2: 956. 1903; Chowdhury & Das, Pl. 9(1): 20. 2015. **[PLATE 4.18. Figs. 100]**

Free floating, rhizome hairy. Uppermost fronds in row, entire, edged infolded, papillae not regular. Sporocarps in cluster, globose, on submerged leaves. Around 55 sporocarps in 2 rows, first 2 – 3 with macrosporocarp and rest with microsporocarp.

Fertile fronds: September – March

Exiccatus: Mahananda Barrage, **Anurag & AP Das 0309**, dated 26.11.2011; Kathambari Beel, **Anurag & AP Das 0761**, dated 03.09.2014.

Status: Abundant.

Local Distribution: Water bodies throughout Terai & Duars.

General Distribution: India, Malay, Bangladesh, Myanmar.

Salvinia natans (Linnaeus) Allioni, Fl. Pedemont. 2: 289. 1785; J. G. Baker, Handb. Fern Allies, 135. 1887; Prain, Beng. Pl. 2: 96. 1903; Ghosh *et al.*, Pter. Fl. East. Ind. 1: 181, 2004; Chowdhury & Das, Pl. 9(1): 20. 2015. *Mersilea natans* Linnaeus, Sp. Pl. ed. 2: 1099. 1762. *Salvinia verticillata* Roxburgh ex Griffith, Calc. Jour. Nat. Hist. 4: 469. 1844; Griffith, Calc. Jour. Nat. Hist. 4: 24, t. 18 – 20. 1845.

[PLATE 4.18. Figs. 99]

Free floating ferns, rhizome hairy. Uppermost frond flat, ovate to oblong, upper surface with hooked papillae, stalk hairy. Sporocarps arise from nodes, globose, hairy, contains 25 microsporangia in each.

Fertile fronds: November– March

Exiccatus: Gajoldoba, **Anurag & AP Das 0383**, dated 08.03.2012; Mahananda Barrage, **Anurag & AP Das 0638**, dated 13.11.2013.

Status: Abundant.

Local Distribution: Water bodies throughout Terai & Duars.

General Distribution: India, Europe, Asia, Africa and North America.

BLECHNACEAE Newman, Hist. Brit. Ferns, ed. 28. 1844. [Chain fern family]

BLECHNUM Linnaeus, Sp. Pl. 2: 1077. 1753

Blechnum orientale Linnaeus, Sp. Pl. ed. 1, 2: 1077. 1753; R.H. Beddome, Handb. Ferns Brit. Ind. 132. t.66. 1883; Singh *et Panigrahi*, Fern & Fern – Allies Arun. Prad. I. 206 – 207. 2005. *Asplenium orientale* (Linnaeus) Bernhardt, in Schrad. Jour. 1801 (1): 17. 1802.

Rhizome erect, apex densely paleaceous. Fronds tufted, pinnate, caudate acuminate. Stipes up to 40 cm long, paleaceous at base, thick, auricles several pair, small; lamina 120 cm long, pinnae alternate, spreading, entire. Sori costal, elongated, indusium long, narrow, brown.

Fertile fronds: September – January

Exiccatus: Gajoldoba, **Anurag & AP Das 0163**, dated 12.09.2010; Doumahoni Beel, **Anurag & AP Das 0524**, dated 12.06.2013.

Status: Common.

Local Distribution: In most of the wetlands of the study area.

General Distribution: India, Sri Lanka, Nepal, Bhutan, Bangladesh, China, Myanmar, Thailand, Indonesia, Malaysia, Australia.

DRYOPTERIDACEAE Herter, Revista Sudamer. Bot.9: 15. 1949; *nom.cons.* [Wood fern family]

Key to the genera:

- 1a. Pinnules simple at base, subsessile, oblique, deltoid, serrations acute *Dryopteris*
 1b. Pinnules with a lateral lobe, sessile, oblong, serrations finely acuminate *Polystichum*

DRYOPTERIS Adans, Familles des Plantes 2. 1763**Key to the species:**

- 1a. Rhizome creeping, densely scaly, pale brown; leaves bipinnate; sori 3 or 4 pairs ... *D. filix-mas*
 1b. Rhizome erect, sparsely scaly, dark brown; leaves tripinnate; sori 2 or 3 pairs *D. sikkimensis*

Dryopteris filix-mas (Linnaeus) Schott, Gen. Fil. Ad. Pl. 9. 1834; Singh *et* Panigrahi, Fern & Fern – Allies Arun. Prad. I. 285, 2005. *Polypodium filix-mas* Linnaeus, Sp. Pl. 1090. 1753.

Creeping rhizome with dense scaly apex, scales pale brown, ovate-lanceolate. Lamina oblong-lanceolate, widest at middle, bipinnate, gradually narrowed toward base, acuminate, base truncate, shortly stalked. Sori 3 or 4 pairs on each pinnule.

Fertile fronds: July – December.

Exiccatus: Gajoldoba, **Anurag & AP Das 0160**, dated 12.09.2010; Doumahoni Beel, **Anurag & AP Das 0517**, dated 12.06.2013.

Status: Common.

Local distribution: In most of the wetlands of the study area.

General distribution: India, China, Pakistan, NE Afghanistan, Kazakhstan, Russia (W Siberia); SW Asia (N Iran), Europe, North America.

Dryopteris sikkimensis (Beddome) O. Kuntze., Rev. Gen. Pl., 2, 813, 1891. *Polystichum sikkimensis* R.H. Beddome, Ferns Brit. India, t. 127, 1866. *Polystichum sikkimense* R.H. Beddome, Ferns Brit. India 1: 127. 1866.

Erect rhizome short and sparsely scaly; scales dark brown, ovate – lanceolate. Lamina herbaceous, glabrous, ovate, tripinnate – pinnatifid, acuminate, shortly stalked, base symmetrical, rounded-truncate, veins slightly visible. Sori 2 or 3 pairs, 1 sorus on each segment

Fertile fronds: August – December

Exiccatus: Gossaihat Beel, **Anurag & AP Das 0279**, dated 14.07.2011; Doumahoni Beel, **Anurag & AP Das 0528**, dated 12.06.2013.

Status: Abundant.

Local distribution: Water bodies throughout Terai & Duars.

General distribution: India, Bhutan, Bangladesh, China and Pakistan.

POLYSTICHUM A.W. Roth, Tent. Fl. Germ. 3: 31, 69. 1799, nom. Cons.

Polystichum lentum (D. Don) Moore, Ind. Fil. 86: 95. 1858; Hara, Fl. East. Himal. 1: 480. 1966; Singh *et* Panigrahi, Fern & Fern – Allies Arun. Prad. I. 299 – 301. 2005. *Aspidium lentum* D. Don, Prod. Fl. Nepal. 4. 1825. *Polystichum auriculatum* var. *subbipinnatum* (Hooker) R.H. Beddome, Ferns Brit. India, pl. 136. 1866. *Polystichum auriculatum* var. *lentum* (D. Don) R.H. Beddome, Handb. Ferns Brit. Ind. 204. 1883.

Rhizome erect, short, paleaceous, curve, teeth dark brown. Stipes densely scaly, ascending. Lamina 20 – 35 cm, pinnae 20 – 40 pairs, basal pair strongly reflexed and slightly reduced or equal, sessile, sub-opposite. Sori dorsal on basal acroscopic vein, entire, peltate, deciduous.

Fertile fronds: August – December

Exiccatus: Gossaihat Beel, **Anurag & AP Das 0280**, dated 14.07.2011.

Status: Rare.

Local distribution: Found in few wetlands of the study area.

General distribution: India, Nepal, Bhutan.

GLEICHENIACEAE (R. Brown) Presl, ReI. Haenk 1(1): 70. 1825

DICRANOPTERIS Bernahardi, Schrad. Neu. Jour. Bot. 1(2): 38. 1905

Dicranopteris linearis (Burman f.) Underwood in Bull. Torrey Bot. Cl., 34: 250. 1907; Holttum, *Reinwardtia* 4: 275, 1957; Holttum, Fl. Males. Ser. 2.1: 33, 1959; Mehra & Bir, Pterid. Fl. Darjeeling & Sikkim Him. 122. 2008; Singh *et* Panigrahi, Fern & Fern – Allies Arun. Prad. I. 313 – 314. 2005; Ghosh *et al.*, Pter. Fl. East. Ind. 1: 211, 2004. *Polypodium lineare* Burman f., Fl. Indica: 235. T. 67. F. 2. 1768.

Rhizome wide creeping. Fronds large, forming thickets; stipes stout, brown, lanceolate, deeply lobed; ultimate-pinnae ca 30 x 7 cm, lanceolate, gradually acuminate, base unequal. Ultimate-lobes oblong, 4 – 5 mm wide, entire and incurved. Sori round, dorsal, exindusiate, sub-basal.

Fertile fronds: July – September

Exiccatus: Gossaihat Beel, **Anurag & AP Das 0286**, dated 14.07.2011; Gajoldoba, **Anurag & AP Das 0382**, dated 08.03.2012.

Status: Rare.

Local Distribution: In few wetlands such as Mahananda Barrage, Gossaihat Beel etc.

General Distribution: India: West Bengal, Assam, Sikkim, Arunachal Pradesh, Manipur, Meghalaya, Mizoram, Nagaland, Tripura, South India; Tropical and sub Tropical Asia, Malaysia, Australia.

THELYPTERIDACEAE Ching ex Pichi-Sermolli in Webbia 24: 709. 1970. [Marsh fern family]

THELYPTERIS Schmidel, Icon. Pl., Ed. Keller 3, 45. 1763

Thelypteris rectangularis (Zollinger) B.K. Nayer & S. Kaur in Comp. R.H. Beddome, Handb. Ferns Brit. India 72. 1974; Kaur & Chandra in New Botanist 12: 106. 1985; Singh *et* Panigrahi, fern & fern – allies Arun. Prad. II. 762. 2005. *Polypodium rectangulare* Zoll. Syst. Verz. 37, 48. 1854.

Rhizome short, sub-erect. Fronds clustered. Lamina narrowly oblong-lanceolate slightly tapering and with pinnate-pinnatifid pinnae. Lateral veins simple or occasionally forked. Sori suborbicular, borne at middle or near tips of lateral veins, 2 – 4 pairs per segment.

Fertile fronds: October – January

Exiccatus: Mahananda Barrage, **Anurag & AP Das 0643**, dated 13.11.2013; Kathambari Beel, **Anurag & AP Das 0765**, dated 03.09.2014.

Status: Common.

Local Distribution: Found in few wetlands of the study area.

General Distribution: India, Bhutan, Nepal, Malaya, Indonesia, Myanmar.

WOODSIACEAE Herter, Revista Sudamer. Bot. 9: 14. 1949

DIPLAZIUM Swartz, Jour. Bot. (Schrader) 2: 461. 1801

Diplazium esculentum (Retzius) Swartz in Schrader, Jour. Bot. 1801 (1): 312. 1803; R.H. Beddome, Handb. Ferns Brit. Ind. 192. 1883; Singh *et* Panigrahi, Fern & Fern – Allies Arun. Prad. I: 161. 2005; Nair *et al.*, Jour. Econ. Tax. Bot. 16(3): 506. 1992. *Hemionitis esculenta* Retz., Obs. Bot. 4: 38. 1791.

Vernacular Name: *Dheki-shak*

Marshy or sometimes terrestrial herbs; rhizome erect, stipes tufted and sparsely scaly at base, glabrous above, purplish band on stipes and rachis; lamina deltoid, acuminate, truncate, bipinnate; pinnae narrowly deltoid; sori linear, all along the veins.

Fertile fronds: July – February

Exiccatus: Gajoldoba, **Anurag & AP Das 0144**, dated 12.09.2010; Doumahoni Beel, **Anurag & AP Das 0220**, dated 02.02.2011.

Status: Abundant.

Local Distribution: Water bodies throughout Terai & Duars.

General Distribution: India, Bangladesh, China, and Malaysia.

4.3.2. ANGIOSPERMS

For the systematic arrangement of the recorded Angiospermic families from the wetlands of Terai & Duars of West Bengal, Classification of APG III system of classification (Chase & Reveal, 2009) has been followed.

Angiosperms

Basal angiosperms

Order: Nymphaeales

NYMPHAEACEAE Salisbury, Ann. Bot. 2: 70. 1805

Key to the Genera:

- 1a. Leaves round, prickly present; flower epigynous, seed black broad *Euryale*
 1b. Leaves cordate, prickle absent; flower hypogynous, seed minute, red *Nymphaea*

EURYALE Salisbury, Ann. Bot. 2(1): 78. 1805

Euryale ferox Salisbury in Koeing & Sims, ed., Ann. Bot. 2: 74. 1805; Hooker *f*, Fl. Brit. Ind. 1: 115. 1872; Prain, Beng. Pl. 1: 140. 1903; Misra in Sharma *et al.*, Fl. Ind. 1: 427. 1993; Cook, Aqua. Wetl. Pl. Ind. 275. 1996. **[PLATE 4.17. Figs. 96]**

Vernacular Name: *Makhna*

Perennial, much spiny, rooted with floating leaved aquatic herbs. Rootstock short but thick. Leaves floating with long petiole, entire, orbicular. Flowers blue or violet, epigynous; sepals 4, spiny; petals numerous; ovary 8-ovuled, stigma discoid, depressed, concave; ovules few. Berry much spiny, embryo small remains embedded in endosperm.

Flowers & Fruits: April – June

Exiccatus: Doumohani Beel, *Anurag & AP Das 0496*, dated 12.06.2013.

Status: Rare.

Local Distribution: Found only in Doumohani Beel and its adjoining areas.

General Distribution: India, Bangladesh, Nepal, Bhutan and China.

NYMPHAEA Linnaeus, Sp. Pl. 1: 510. 1753

Key to the Species:

- 1a. Lamina entire Anther with appendages 2
 1b. Lamina margin toothed; anther without appendages..... 3
 2a. Flowers not submerged, appendages yellow, stigma rays 8 – 30 *N. nouchali*
 2b. Flowers slightly submerged, appendages blue, stigma rays 7..... *N. abhayana*
 2a. Flowers white *N. pubescens*

2b. Flowers red *N. rubra*

Nymphaea abhayana A. Chowdhury & M. Chowdhury, *sp. nov.* [Plate No. 4.1]

Annual submerged. Lamina round-ovate; base peltate, notch notched to petiole, margin entire; lamina; shape & size: Round-Ovate & 13 x 16 (18) cm. base deeply cordate and basal lobes parallel to contiguous. Texture: Thin, delicate, abaxially glabrous, shiny scarcely peltate. Colour: Bluish-purple. Flowers floating, 5 – 6 cm in diam. Sepals 4; 3.7 – 4 cm, x 0.8 – 1.2 cm, prominently veined. Petals 7; transition to stamens regular, Bluish-purple, broadly lanceolate, oblong, or obovate, 2.9 (3.5) x 0.5 (0.7) cm. Stamens; filament of inner & outer stamens slightly wider than anther, 13 (5+4+4), 0.5 cm large, outer stamen, 0.8 cm inner stamen. Appendage; anthers connective apically appendaged, elongated, deep blue, 0.01 – 0.6 cm. Carpels completely united, walls between locules of ovary single. Stigma rays 7.

Flowers & Fruits: October – December

Exiccatus: **Type:** **INDIA:** Gorumara National Park, Jalpaiguri, West Bengal, *Chowdhury et al.*, 01631, dated 16.11.2014 (Holotypus: CAL); *Chowdhury et al.* 01633 (Paratypus: NBU).

Status: Rare

Local Distribution: In only one forest wetland of the study area.

General Distribution: India [sub-Himalayan Duars of West Bengal]

Nymphaea nouchali Burman *f.*, Fl. Ind. 120. 1968; Van Royen in Nova Guinea 8: 110. f. 1962; Cook, Aqua. Wetl. Pl. Ind. 274. 1996. *Nymphaea stellata* Willdenow Sp. Pl. 2: 1153. 1799; Prain, Beng. Pl. 1: 213. 1903.

[PLATE 4.3. Figs. 2]

Vernacular Name: *Neel Padda*

Annual, rooted and floating leaved herbs. Rhizomes attached to bottom clay. Lamina ovate to subsagittate, deeply cordate with sharply minute tooth, bright green and glabrous above, pubescent beneath. Flowers blue; anthers without appendage; stigmatic rays with clubbed appendages. Seeds ellipsoid or subglobose, longitudinally striate, green.

Flowers & Fruits: September – December

Exiccatus: Mahananda Barrage, **Anurag & AP Das 0645**, dated 13.11.2013; Gajoldoba, **Anurag & AP Das 0733**, dated 03.09.2014.

Status: Less common.

Local Distribution: Throughout the study area.

General Distribution: India, Africa and S.E. Asia.

Nymphaea pubescens Willdenow, Sp. Pl. 2: 1154. 1799; Cook, Aqua. Wetl. Pl. Ind. 275. 1996. *Nymphaea lotus* var. *pubescens* (Willdenow) Hooker *f.* & Thomson, Fl. Ind. 1: 241. 1855, & in Hooker *f.*, Fl. Brit. Ind. 1: 114. 1872.

[PLATE 4.3. Figs. 3]

Vernacular Name: *Sapla, Saaluk*

Large aquatic herbs. Lamina quite entire, sometime sinuate-toothed. Flowers 5-15 cm, rose, white or variously coloured; floating on by long radical spaces; sepals obtuse, white-ribbed dorsally; petals acute or tapering at both the ends; stigma rays terminating in short horns.

Flowers & Fruits: September – January

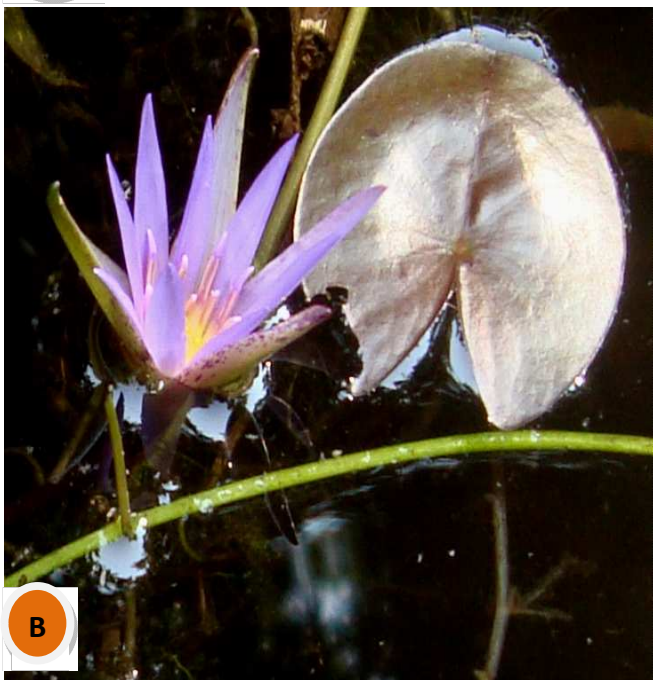


PLATE – 4.1: *Nymphaea abhayana* A. Chowdhury & M. Chowdhury, *sp. nov.* A. Habitat; B. Flower and leaf in the habitat; C. Petals; D. Stamens

Exiccatus: Mahananda Barrage, **Anurag & AP Das 0334**, dated 26.11.2011; Gajoldoba, **Anurag & AP Das 0734**, dated 03.09.2014.

Status: Common.

Local Distribution: Throughout the study area

General Distribution: India, Bangladesh, Malaysia, Africa, Java, Philippines, Hungary.

Nymphaea rubra Roxburgh *ex* Andrews, Bot. Rep. 8(104): t. 503. 1808; Prain, Beng. Pl. 1: 213. 1903; Mitra & Subramanyam in Bull. Bot. Surv. Ind. 24: 83. 1983; Cook, Aqua. Wetl. Pl. Ind. 275. 1996.

PLATE 4.3. Figs. 1]

Vernacular Name: *Lal sapla, Lal Saaluk*

Large aquatic herbs. Lamina quite entire, sometime sinuate- dentate, reddish, at first dark red both surfaces, turning greenish above with age. Flowers hermaphrodite, musually crimson red. Petals 16-25; stamens 55-80; Filaments of nearly inner two third stamens with a dark puplish band near base.

Flowers & Fruits: October – February

Exiccatus: Doumahoni, **Anurag & AP Das 0219**, dated 02.02.2011.

Status: Common.

Local Distribution: Throughout the study area.

General Distribution: India (throughout the plains), Sri Lanka, Myanmar, Taiwan, Thailand, Loas, Cambodia, Vietnam, Malaysia, Indonesia, Philippines.

Magnoliids

Order: Piperales

PIPERACEAE Giseke, Prael. Ord. Nat. Pl. 123. 1792

Key to the Genera:

- 1a. Climbing; flowers unisexual; anthers ellipsoid, ovary ovoid *Piper*
- 1b. Not climbing; flowers bisexual; anthers sub-globose, ovary ellipsoidal *Peperomia*

PIPER Linnaeus, Gen. Pl. ed. 1. 333. 1737

Piper longum Linnaeus, Sp. Pl. 1: 29. 1753; Fl. Brit. Ind 5: 83; Prain, Beng. Pl. 2: 893. 1903; Fl. Bhut. 1(2): 348. 1984.

Dioecious climbers; pubescent when young. Stems flexuous. Lamina sessile, densely glandular, base cordate, slightly incurved; sometimes basal lobes overlapping in upper leaves, slightly unequal. Spikes leaf-opposed, recurved. Spikes peduncled; bracts suborbicular, sometimes slightly cuneate, stalk short; stamens 2; filaments very short; anthers ellipsoid; ovary ovoid, partly connate to rachis; stigmas 3, ovoid, acute. Drupes globose, apex umbonate.

Flowers & Fruits: July – October

Exiccatus: Gajoldoba, **Anurag & AP Das 0119**, dated 12.09.2010; Kathambari Beel, **Anurag & AP Das 0730**, dated 03.09.2014.

Status: Less common.

Local Distribution: In few wetlands of the study area.

General Distribution: India, Sri Lanka, Nepal, China, Malaysia and Vietnam.

PEPEROMIA Ruiz. & Pavon, Fl. Peruv. Prodr. 8. 1794

Peperomia pellucida (Linnaeus) Kunth, Nov. Gen. Sp. 1: 64. 1816; Prain, Beng. Plants 2: 894. 1903; Grierson & Long, Fl. Bhut. 1(2): 345. 1984. *Piper pellucidum* Linnaeus, Sp. Pl. 1: 30. 1753.

Annual succulent glabrous herbs. Stems glabrous branched, erect or ascending. Petiole 1 – 2.5 cm; lamina glabrous, broadly ovate, acute, cordate at base. Spikes terminal, bracts suborbicular. Anthers sub-globose. Ovary ellipsoidal with short penicillate stigma.

Flowers & Fruits: March – November

Exiccatus: Mahananda Barrage, *Anurag & AP Das 0646*, dated 13.11.2013.

Status: Abundant.

Local Distribution: Throughout the study area.

General Distribution: Native to tropical North and South America. Widely naturalized.

4.3.3. Monocots – Monocotyledon

Order: Acorales

ACORACEAE Martinov, Bota. Prot., 1820. [Sweet flag family]

ACORUS Linnaeus, Sp. Pl. 1: 324. 1753

Acorus calamus Linnaeus, Sp. Pl. 324. 1753; Hooker f., Fl. Brit. Ind. 6: 555. 1893; Noltie, Fl. Bhut. 3(1): 158. 1994; Cook, Aqua. Wetl. Pl. Ind. 51, 1996. *Acorus angustatus* Rafinesque, Autik. Bot. 196. 1840. **[PLATE 4.17. Figs. 95]**

Vernacular Name: *Boch* (Bengali), *Bojo* (Nepali)

Erect with creeping rhizomes, perennial, marshland herbs. Leaves unifacial, ensiform, erect with a prominent midrib, with acute apex. Spadix appears laterally on foliage leaf. Flowers bisexual, tri-merous; perianth segments 6. Stamens 6 with linear filament. Ovary hexagonal-cylindrical with 2 – 3 locules.

Flower & Fruits: May – August

Exiccatus: Mahananda Barrage, *Anurag & AP Das 0065*, dated 12.05.2010; Magurmari River (NBU), *Anurag & AP Das 01612*, dated 12.07.2013.

Status: Less Common.

Local Distribution: In Magurmari River, Mhananda Barrage and Ggajoldoba.

General Distribution: India, Asia, Europe, North America.

Note: Sometimes grown as a medicinal plant.

Order: Alismatales

ALISMATACEAE Ventenat, Tabl. Regne Veg., 2: 157. 1799

Key to the Genera:

- 1a. Stamens 8 or 9, or numerous, filaments flattened; stigmas sessile, carpels 6 – 9 or numerous crowded in head; terminal umbels; involucre bracts present..... 2

- 1b. Stamens 3 to numerous; style present; carpels few to numerous; racemes, panicleulate or umbels; involucre bracts absent 3
- 2a. Lamina lanceolate to oblanceolate; petals white; stamens 8 or 9, carpels 6 – 9, pedicels slender *Butomopsis*
- 2b. Lamina ovate to suborbiculate; petals yellowish; stamen numerous; carpels numerous; pedicels thick *Limnocharis*
- 3a. Inflorescences unbranched, flowers unisexual or polygamous *Sagittaria*
- 3b. Inflorescences much branched, flowers bisexual *Caldesia*

SAGITTARIA Linnaeus, Sp. Pl. 2: 993. 1753

Key to the Species:

- 1a. Plants with floating leaves, lamina cordate, stolons absent *S. guayanensis*
- 1b. Plants with emergent leaves, lamina hastate or sagittate stoloniferous 2
- 2a. Lamina sagittate, sepals not recurved, achenes lanceolate *S. sagittifolia*
- 2b. Lamina hastate, sepals recurved, achenes oblanceolate *S. latifolia*

Sagittaria guayanensis Humboldt, Bonpland & Kunth, Nov. Gen. Sp. 1: 250. 1815; Hooker f., Fl. Brit. Ind. 6: 561. 1893; Prain, Beng. Pl. 2: 1120. 1903; Rao & Verma in Bull. Bot. Surv. Ind. 18 (1–4): 39. 1976; Guha Bakshi, Fl. Mur. Dist. 343. 1984; Cook, Aqua. Wetl. Pl. Ind. 39, 1996. *Sagittaria guanyanensis* Humboldt, Bonpland & Kunth ssp. *lappula* (D. Don) Bogin in Mem. N. Y. Bot. Gard. 9: 192. t. 5. 1955. *Echinodorus guayanensis* (Kunth) Grisebach, Fl. Brit. W. I. 505. 1862.

[PLATE 4.5. Figs. 15]

Fleshy, aquatic or marshy rosette herbs. Petioles up to 40 cm long. Lamina floating, heart shaped, obtuse or rounded, base cordate. Scapes erect, 16–35 cm, 2 – 5 whorls of 2 – 3 flowers. Bracts 3 in each whorl; upper flowers male and lower ones bisexual; sepals broadly triangular; petals white, ovate. Stamens 8 – 12. Carpels numerous; achenes numerous, elliptic.

Flowers & Fruits: September – February

Exiccatus: Gajoldoba, *Anurag & AP Das 0136*, dated 12.09.2010; Mahananda Barrage, *Anurag & AP Das 0571*, dated 13.11.2013.

Status: Abundant.

Local Distribution: Water bodies throughout Terai & Duars.

General Distribution: Throughout India; China, Malaysia, Australia.

Sagittaria sagittifolia Linnaeus, Sp. Pl. 993. 1753; Hooker f., Fl. Brit. Ind. 6: 561. 1893; Rao & Verma in Bull. Bot. Surv. Ind. 18 (1–4): 39. 1976; Deb, Fl. Tripura 2: 347. 1983; Prain, Beng. Pl. 2: 1120. 1903; Majumdar, Bull. Bot. Soc. Bengal 19: 15. 1965; Noltie, Fl. Bhut. 3(1): 164. 1994; Cook, Aqua. Wetl. Pl. Ind. 39, 1996. *Sagittaria sagittaria* Thunberg, Fl. Jap. 242. 1784. *Alisma sagittaria* Stokes, Bot. Mat. Med. 2: 335. 1812. *Sagittaria aquatica* Lamarck, Fl. Franç. 2: 197. 1779.

[PLATE 4.5. Figs. 13]

Aquatic or marshy land erect, fleshy stoloniferous herbs. Petiole erect 22 – 45 cm long, lamina sagittate, acute. Scape 10 – 40 cm long. Flowers unisexual, 1 – 3 flowered in each whorl. Sepals ovate-triangular; petals whitish purple. Stamens numerous. Achenes lanceolate & in globose heads.

Flowers & Fruits: March – September

Exiccatus: Mahananda Barrage, **Anurag & AP Das 0066**, dated 12.05.2010; Gossaihat Beel, **Anurag & AP Das 0410**, dated 17.08.2012.

Status: Abundant.

Local Distribution: Water bodies throughout Terai & Duars.

General Distribution: Plains of India, N. Asia, N. America, Europe.

Sagittaria latifolia Willdenow, Sp. Pl. 4(1): 409. 1805. *Sagittaria latifolia* (Willdenow) Nieuwl., Amer. Midl. Natur. 3: 21. 1913. *Sagittaria esculenta* Howell, Fl. N. W. Amer. 1: 679. 1903.

[PLATE 4.5. Figs. 14]

Aquatic or marshy land perennial herbs, corms present. Petiole erect triangular, lamina hastate, Inflorescences racemes, rarely panicles, of 3 – 7 whorls, bracts connate. Flowers white; sepals recurved, pistillate, pedicellate, sterile stamens absent. Achenes oblanceolate in globose heads.

Flowers & Fruits: March – July

Exiccatus: Gajoldoba, **Anurag & AP Das 0343**, dated 08.03.2012.

Status: Rare

Local Distribution: In Gajoldoba of Duars.

General distribution: Mexico; Central America, South America.

Note: Present collection forms a new record for the main land of India. This species has been recommended as an excluded species from the Himalayas by C.D.K. Cook in 1996.

CALDESIA Parlature, Fl. Ital. 3: 598. 1860

Caldesia parnassifolia (Bassi ex Linnaeus) Parlature, Fl. Ital. 3: 599. 1860; Sharma *et al.*, Fl. Karnataka 299. 1984; Verma *et al.*, Fl. Raipur, Durg, and Rajnandgaon 398. 1985; Karthikeyan *et al.*, Fl. Ind. Enum. (Monoc.) 2. 1989; Guha & Mondal, Wetl. Phyt. 86, 2005 *Alisma parnassifolium* Bassi ex Linnaeus, Syst. Nat., ed. 12, 3: 230. 1768. *Alisma reniforme* D. Don, Prod. Fl. Nepal 22. 1825; Hooker *f.*, Fl. Brit. India, 6: 560. 1893; Prain, Beng. Pl. 2: 1119. 1903. [PLATE 4.5. Figs. 18]

Aquatic, perennial, rhizomatous creeping herbs. Petiole 5 – 80 cm, lamina ovate-elliptic or sub-orbicular, obtuse, base deeply cordate. inflorescences paniculate, much branched 20 – 30 cm. Flowers 3-verticillate; pedicels 2.5 – 5 cm. Sepals persistent, ovate. Petals ovate, larger than sepals. Stamens 6. Carpels 5 – 10. Achenes elliptic.

Flowers & Fruits: April – November

Exiccatus: Gossaihat Beel, **Anurag & AP Das 0175**, dated 14.07.2011.

Status: Rare.

Local Distribution: Only found in Gossaihat Beel of Duars.

General distribution: India, Japan, Korea, Nepal, Pakistan, Russia, Thailand, Vietnam; Africa, Australia, Europe.

BUTOMOPSIS Kunth, Enum. Pl. 3: 164. 1841

Butomopsis latifolia (D. Don) Kunth, Enum. Pl. 3: 165. 1841; Noltie, Fl. Bhut. 3(1): 163. 1994; Cook, Aqua. Wetl. Pl. Ind. 247, 1996; Guha & Mondal, Wetl. Phyt. 103, 2005. *Butomus latifolius* D. Don, Prodr. Fl. Nepal. 22. 1825. *Butomus lanceolatus* Roxburgh, Fl. Ind. 2: 315. 1832. *Butomopsis lanceolata* (Roxburgh) Kunth, Enum. Pl. 3: 165. 1841; Hooker f., Fl. Brit. India, 6: 562. 1893; Prain, Beng. Pl. 2: 1120. 1903. *Tenagocharis latifolia* (D. Don) Buchenau in Abh. Naturw. Ver. Bremen, 2: 6. 1868. [PLATE 4.5. Figs. 17]

Marshy land erect herbs, Petiole up to 19 cm; lamina lanceolate-oblong, 4–13 cm long, acute or obtuse, base cuneate. Scapes up to 30 cm long, Sepals 3, broadly elliptic to obovate. Petals 3, thin, white. Stamens 9. Carpels 6–9. Achenes 8–12. Seeds broadly elliptic-oblong.

Flowers & Fruits: March – October

Exiccatus: Mahananda Barrage, **Anurag & AP Das 0053**, dated 12.05.2010; Gossaihat Beel, **Anurag & AP Das 0460**, dated 17.08.2012.

Status: Less common.

Local Distribution: Found in Mahananda Barrage, Gossaihat Beel, Gajoldoba etc.

General Distribution: India, Nepal Tropical Africa, Tropical SE Asia, N Australia.

LIMNOCHARIS Bonpland in Humboldt & Bonpland, Pl. Aequin. 1: 116. 1807.

Limnocharis flava (Linnaeus) Buchenau, Abh. Naturwiss. Vereins Bremen. 2: 2. 1869; Cook, Aqua. Wetl. Pl. Ind. 248, 1996. *Alisma flavum* Linnaeus, Sp. Pl. 1: 343. 1753.

Leaves radical; Petiole trigonous, stout; lamina ovate-suborbiculate, veins 9–13, parallel, obtuse or retuse, base obtuse or cuneate. Scapes upper trigonous, umbels 2–14-flowered; bracts green, orbicular, Pedicels 2–6 cm. Petals pale yellow but black at base, broadly ovate to rhomboidal, apex rounded. Stamens numerous, shorter than petals. Carpels numerous, yellowish green; fruits clustered, suborbicular; seeds brown.

Flowers & Fruits: March – May

Exiccatus: Mahananda Barrage, **Anurag & AP Das 0079**, dated 12.05.2010; Gajoldoba, **Anurag & AP Das 0376**, dated 08.03.2012.

Status: Rare.

Local Distribution: In Mahananda Barrage & Gajoldoba Beel of Terai & Duars.

General Distribution: India, China, Central America, North America, South America, naturalized throughout S and SE Asia.

APONOGETONACEAE Planchon, Bot. Mag. 82: 4894. 1856, *nom. cons.*

APONOGETON Linnaeus f., Suppl. Pl. 32, 214. 1782

Key to the species:

- 1a. Spathe persisting during anthesis; perianth segments falling off after flowering... *A. undulatus*
- 1b. Spathe falling off before anthesis; perianth segments persisting after flowering..... 2
- 2a. Leaves submerged, long appendages; spathe 4–6 cm long *A. appendiculatus*

- 2b. Leaves submerged and floating, without appendages 3
- 3a. Perianth segments yellow; fruits less than 4 mm long; anthers yellow *A. lakhonensis*
- 3b. Perianth segments white, pink, violet or purple; fruit over 4 mm long; anthers violet 4
- 4a. Follicles 1 – 2 seeded, smooth with a short terminal beak *A. crispus*
- 4b. Follicles 4 – 8 seeded, smooth with a very long beak *A. natans*

Aponogeton undulatus Roxburgh, Fl. Ind. ed. Carey, 2: 211. 1832; Prain, Beng. Pl. 2: 1122. 1903; Guha Bakshi, Fl. Mur. Dist. 345. 1984; Henry *et al.*, Fl. Tamilnadu. 3: 61. 1989; Karthikeyan *et al.*, Fl. Ind. Enum. (Monoc.) 5. 1989; Cook, Aqua. Wetl. Pl. Ind. 49, 1996; Guha & Mondal, Wetl. Phyt. 124, 2005. *Spathium undulatum* (Roxburgh) Edgewarth, Cale. Jour. 3: 504. 1843. *Ouvirandra undulata* (Roxburgh) Edgewarth in Hooker Lond. Jour. Bot., 3: 404. 1844.

Aquatic monoecious herb. Leaves sub-merged, rarely floating, subulate, undulate, cuneate, base cuneate. Spathe persisting; flowers small; perianth segments yellow, falling off after flowering, tepals 2; stamens 6; carpels 3. Fruits 2 – 3 mm with short terminal beak.

Flowers & Fruits: August – December

Exiccatus: Gajoldoba, **Anurag & AP Das 0147**, dated 12.09.2010; Mahananda Barrage, **Anurag & AP Das 0599**, dated 13.11.2013.

Status: Common.

Local Distribution: Almost throughout the study area.

General Distribution: India, Bangladesh, Malaysia, Myanmar.

Aponogeton appendiculatus H. Bruggen in Blumea, 16: 265. 1968; Bennet, Fl. Howrah. 25. 1979; Bhargawan in Henry *et al.*, Fl. Tamilnadu. 3: 61. 1989; Karthikeyan *et al.*, Fl. Ind. Enum. (Monoc.) 4. 1989; Cook, Aqua. Wetl. Pl. Ind. 47, 1996; Guha & Mondal, Wetl. Phyt. 114, 2005.

Aquatic herbs. Roots fibrous. Leaves submerged; lamina lanceolate, much undulate, narrowly acuminate, cuneate at base, distinct midrib with 4 parallel veins. Spikes up to 15 cm long. Spathes 4 – 6 cm. Flowers small; tepals 2, white; stamen 6. Carpels 3; fruits terminally beaked. Embryo very unusual, with a whorl of linear tortuous appendages of 3 – 5 mm long

Flowers & Fruits: July – November

Exiccatus: Gossaihat Beel, **Anurag & AP Das 0255**, dated 14.07.2011.

Status: Rare.

Local Distribution: Stagnant water bodies of Terai.

General Distribution: Asia-Tropical, Indian Subcontinent.

Aponogeton lakhonensis A. Camus, Notul. Syst. 1: 273. 1910; Fl. Gen. Indo Chine, 6: 1226. 1942; van Bruggen, Blumea, 18.2: 479. 1970; Karthikeyan *et al.*, Fl. Ind. Enum. (Monoc.) 4. 1989; Cook, Aqua. Wetl. Pl. Ind. 48, 1996.

Rhizome elongated, up to 2 cm. Petiole 8 – 13 cm in submerged leaves and 30 – 55 cm in floating leaves; lamina narrowly ovate to linear, entire, apex rounded, base rounded, herbaceous, with 7 – 9 primary veins at base. Inflorescence 4 – 5.5 cm long, pedunculate. Flowers bisexual; perianth segments 2, slightly obovate; stamens 6. Carpels slightly united near base; fruits ovoid.

Flowers & Fruits: July – October

Exiccatus: Doumahoni Beel, **Anurag & AP Das 0549**, dated 22.08.2013.

Status: Rare.

Local Distribution: Stagnant water bodies of Duars.

General Distribution: India, China, Thailand, Indonesia, Vietnam.

Aponogeton crispus Thunberg, Nov.Gen.4: 73. 1784; Hooker *f.*, Fl. Brit. Ind. 6: 564. 1893 PP.; Prain, Beng. Pl. 2: 845. 1903; Datta & Majumdar, Bull. Bot. Soc. Beng. 20 (2): 22. 1966; Cook, Aqua. Wetl. Pl. Ind. 48. 1996.

Perennial, submerged, stoloniferous aquatic herbs. Leaves submerged, translucent. Flowers white, bisexual on long scapes; perianth segments longer than mature carpel. Follicles 1 – 2 seeded.

Flowers & Fruits: September – February

Exiccatus: Doumahoni Beel, **Anurag & AP Das 0209**, dated 02.02.2011; Mahananda Barrage, **Anurag & AP Das 0337**, dated 26.11.2011.

Status: Common.

Local Distribution: Throughout the study area.

General Distribution: India; Native to Sri Lanka.

Aponogeton natans (Linnaeus) Engler & Krause, Engler Pfreich. 24: 11. 1906; Majumdar, Bull. Bot. Soc. Beng. 19 (1): 15. 1955. *Saururus natans* Linnaeus, Mantissa. 2: 227. 1767; Cook, Aqua. Wetl. Pl. Ind. 48. 1996; Guha & Mondal, Wetl. Phytd. 124, 2005. *Aponogeton monostachyus* Linnaeus *f.*, Suppl. 214. 1781 (ut. *monostachon*); Hooker *f.*, Fl. Brit. Ind. 6: 564. 1893; Prain, Beng. Pl. 2: 845. 1903.

[PLATE 4.5. Figs. 19]

Aquatic, perennial, stoloniferous herbs; scapigerous. floating leaves oblong to linear lanceolate, cuneate, base cordate or cuneate. Submerged leaves lanceolate. Spikes densely flowered, petals 2; stamens 6; carpels 3. Fruits with long terminal beak.

Flowers & Fruits: July – January

Exiccatus: Gossaihat Beel, **Anurag & AP Das 0436**, dated 17.08.2012; Mahananda Barrage, **Anurag & AP Das 0581**, dated 13.11.2013.

Status: Abundant.

Local Distribution: Stagnant water bodies of Terai & Duars.

General Distribution: India, Sri Lanka, Tropical Asia, Africa.

ARACEAE A.L. de Jussieu, Gen. Pl. 23. 1789

Key to the Genera:

- 1a. Plants armed *Lasia*
- 1b. Plants unarmed 2
- 2a. Plants free floating 5
- 2b. Plants rooted to soil, semi-aquatic 3

- 3a. Flowers and leaves appears simultaneously; leaf 3 – 5 lobed or partite ***Typhonium***
 3b. Flower and leaves not appearing simultaneously; entire 4
 4a. Plants large; lamina triangular with prominent basal lobes, long petiolate; ovules many ... ***Colocasia***
 4b. Plants small; lamina linear-lanceolate, sessile; ovule few ***Cryptocoryne***
 5a. Leaves normal, arial, with prominent venation; spadix with normal spathe ***Pistia***
 5b. Plants highly reduced; flat and lower part touching water 6
 6a. Frond rootless; minute ***Wolffia***
 6b. Frond rotted; comparatively larger 7
 7a. Fronds with one root; both sides green ***Lemna***
 7b. Fronds with many root; lower side purple ***Spirodella***

COLOCASIA Schott in Schott & Endlicher, Melet. Bot. 18. 1832. *nom. cons.*

Colocasia esculenta (Linnaeus) Schott in Schott & Endlicher, Melet. Bot. 18. 1832; Cook, Aqua. Wetl. Pl. Ind. 51, 1996; Hara *et al*, Enum. Fl. Pl. Nap. 1: 91. 1978. Panda & Das, Fl. Sambalp. 386. 2004. *Arum erculentum* Linnaeus, Sp. Pl. 965. 1753. *Colocasia antiquorum* Schott in Schott & Endlicher, Melet. Bot. 18. 1832; Hooker *f.*, Fl. Brit. Ind. 6: 523. 1893.

Vernacular Name: *Kachu*

Erect, marshland herbs; rhizomes variable, leaves, dark-green above and glabrous, light orange red or yellow, convolute, peduncle long. Spadix long. Female portion at the base, fertile ovaries intermixed with sterile ones; neuter above the female; male portion above the neuter synandrium lobed.

Flowers & Fruits: July – October

Exiccatus: Gossaihat Beel, **Anurag & AP Das 0248**, dated 14.07.2011; Doumahoni Beel, **Anurag & AP Das 0485**, dated 12.06.2013.

Status: Common.

Local Distribution: In all wetlands of Terai & Duars.

General Distribution: Tropical Asia and South America.

CRYPTOCORYNE Fischer *ex* Wydler, Linnaea 5: 428. 1830

Key to the Species:

- 1a. Lamina linear-oblong; Spathe fimbriate ***C. ciliata***
 1b. Lamina narrowly linear; Spathe glabrous ***C. retrospiralis***

Cryptocoryne ciliata (Roxburgh) Fischer *ex* Wydler, Linnaea 5: 428. 1830; Hooker *f.*, Fl. Brit. Ind. 6: 492. 1893; Prain, Beng. Pl. 2: 1106. 1903; Blatter, Jour. Bomb. Nat. Hist. Soc. 17: 27. 1911; Cook, Aqua. Wetl. Pl. Ind. 54, 1996. *Ambrosinia ciliata* Roxburgh, Corm. Pl. 7.90, t. 294. 1819. *Ambrosina ciliaris* Sprengel, Syst. Veg. 3: 771. 1826. *Cryptocoryne elata* Griffith, Not. Pl. Asiat. 3: 134. 1851.

Unarmed erect aquatic herbs with stolons. Lamina linear-oblong or linear-lanceolate. Spathe 22 – 43 mm long, axillary, cuspidate with purple fimbriate margins. Male flowers irregularly arranged. Ovary 5 – 7. Fruit syncarpous, 5–7 loculed with 6 – 8 seeds in each locules.

Flowers & Fruits: June – November

Exiccatus: Gajoldoba, **Anurag & AP Das 0089**, dated 12.09.2010; Gossaihat Beel, **Anurag & AP Das 0587**, dated 13.11.2013.

Status: Common.

Local Distribution: In few wetlands of Terai & Duars.

General Distribution: India and Malayan Islands.

Cryptocoryne retrospiralis Fischer ex Wydler, *Linnaea* 5: 428. 1830; Kunth, *Enum.* 3: 12. 1841; Hooker f., *Fl. Brit. Ind.* 6: 493. 1893; Prain, *Beng. Pl.* 2: 1106. 1903. Noltie, *Fl. Bhut.* 3(1): 155. 1994; Cook, *Aqua. Wetl. Pl. Ind.* 57, 1996.

Aquatic, submerged rhizomatous herbs with stolons. Leaves numerous, erect or spreading, radical, narrowly linear, lanceolate, acute. Spathes 10 – 25 cm long, shorter than the leaves. Ovaries 5 – 6, ovules 3 or more; stigma orbicular.

Flowers & Fruits: June – November

Exiccatus: Gajoldoba, **Anurag & AP Das 0148**, dated 12.09.2010.

Status: Rare occurrence.

Local Distribution: It is found in only one wetland from the study area.

General Distribution: India, S.E. Asia.

LASIA Loureiro, *Fl. Coch.* 1: 64, 81. 1790

Lasia spinosa (Linnaeus) Thwaites, *Enum.* 336. 1864; Noltie, *Fl. Bhut.* 3(1): 129. 1994; Cook, *Aqua. Wetl. Pl. Ind.* 64, 1996. *Dracontium spinosum* Linnaeus, *Sp. Pl.* 967. 1753. *Lasia heterophylla* (Roxburgh) Schott, *Melet. Bot.* 1: 21. 1832; Hooker f., *Fl. Brit. Ind.* 6: 550. 1893; Prain, *Beng. Pl.* 2: 1116. 1903. *Pothos heterophyllus* Roxburgh, *Fl. Ind.* 1: 457. 1820. *Pothos lasia* Roxburgh, *Fl. Ind.* 1: 458. 1820.

[PLATE 4.16. Figs. 91]

Vernacular Name: *Kata Kachu.* and *Kantasuli*

Perennial, rhizomatous, stout, prickly, aquatic herbs. Leaves coriaceous, hastate or sagittate, spiny, pinnatifid; lobes narrow or broadly acuminate. Spathe greenish purple, axis spongy. Perianth pink, lobes hooked over the stamens. Ovary ovoid. Fruits rugose -spiny.

Flowers & Fruits: September – February

Exiccatus: Mahananda Barrage, **Anurag & AP Das 0332**, dated 26.11.2011; Mahananda Barrage, **Anurag & AP Das 0589**, dated 13.11.2013.

Status: Less common.

Local Distribution: Some wetlands of Terai and Duars.

General Distribution: India (Tropical Himalaya), China, Malaysia, Myanmar, Sri Lanka.

TYPHONIUM Schott, *Wiener Z. Kunst* 1829: 732. 1829

Key to the species:

1a. Lamina cordate-ovate, ovary yellowish green *T. flagelliforme*

1b. Lamina linear lanceolate-hastate, ovary pale green.....*T. trilobatum*

Typhonium trilobatum (Linnaeus) Schott in Wien. Zeitschr. 3: 72. 1829; Hooker f., Fl. Brit. Ind. 6: 509. 1893; Noltie, Fl. Bhut. 3(1):139. 1994; Hajra *et al.*, Fl. Sikkim 1: 195. 1996. *Arum trilobatum* Linnaeus, Sp. Pl. 965. 1753. *Typhonium triste* Griffith, Not. Pl. Asiat. 3: 145. 1851. *Arum orixense* Roxburgh, Fl. Ind., 3: 503 – 505. 1832.

Vernacular Name: *Kharkone*

Rhizome short, tuberous. Petiole green, up to 38 cm; lamina cordate-ovate in outline, usually deeply 3-lobed; central lobe ovate, 10–15 x 5–10 cm, acuminate to mucronate; lateral lobes 8–11 cm. Inflorescence appearing after the leaves; peduncle elongating in fruit. Spathe green, up to 32 cm, base convolute, ovoid to ellipsoid; limb spreading, outside green, inside dark purple, ovate-lanceolate, acuminate. Ovary yellowish green; stigma sessile. Stamens pink. Fruiting part with spathe remaining; white when mature.

Flowers & Fruits: April – October

Exiccatus: Mahananda Barrage, **Anurag & AP Das 0044**, dated 12.05.2010; Gossaihat Beel, **Anurag & AP Das 0250**, dated 14.07.2011.

Status: Common.

Local Distribution: In most of the wetlands of the study area.

General Distribution: India, Myanmar, Sri Lanka, Nepal, Thailand, Malaysia.

Typhonium flagelliforme (Loddiges) Blume, Rumphia. 1: 134. 1837. *Arum flagelliforme* Loddiges, Bot. Cab.4: t. 396. 1819.

Underground tuberous rhizome short, Petiole green up to 13–30 cm; lamina linear, lanceolate, elliptic, or hastate. Inflorescence appearing alongside leaves; peduncle thin. Spathe convolute at base, green, ovoid or globose, constricted at apex. Ovary pale green, elongate. Berries pale greenish, 2- or 3-seeded.

Flowers & Fruits: March – July

Exiccatus: Gajol doba, **Anurag & AP Das 0385**, dated 08.03.2012; Domohoni Beel, **Anurag & AP Das 0492**, dated 12.06.2013

Status: Not common.

Local Distribution: Few wetlands of Terai & Duars.

General Distribution: NE and S India, Sri Lanka, China Bangladesh, Bhutan, Cambodia, Indonesia, Laos, Malaysia, Myanmar, Philippines, Singapore, N Thailand; N Australia.

PISTIA Linnaeus, Sp. Pl. 2: 963. 1753.

Pista stratiotes Linnaeus, Sp. Pl. 963. 1763; Hooker f., Fl. Brit. Ind. 6: 497. 1893; Prain, Beng. Pl. 2: 831. 1903; Cook, Aqua. Wetl. Pl. Ind. 65, 1996; Panda & Das, Fl. Sambalpur 387. 2004.

Vernacular name: *Topapana*.

Small, free floating fleshy stoloniferous herbs. Lamina sessile, obovate-cuneate. Spathe small shortly peduncled, open above. Spadix adnate to the back of the tube of the spathe, free above. Fruits membranous, few seeded. Seeds oblong or obovoid albuminous.

Flowers & Fruits: April – October

Exiccatus: Gossaihat Beel, **Anurag & AP Das 0275**, dated 14.07.2011; Gossaihat Beel, **Anurag & AP Das 0423**, dated 17.08.2012.

Status: Common.

Local Distribution: In most of the wetlands of the study area.

General Distribution: Throughout India; Sri Lanka.

LEMNA Linnaeus, Sp. Pl. 2: 970. 1753

Key to the species:

- 1a. Frond 1.5 – 2 mm long, ovate-oblong, seeds ribbed *L. perpusilla*
 1b. Frond 1 – 8 mm long, flattened, seeds not ribbed *L. minor*

Lemna perpusilla Torrey, Fl. N.Y. 2: 245. 1843; Cook, Aqua. Wetl. Pl. Ind. 65, 1996. *Lemna paucicostata* Hegelm., Lemnac 139. t. 8. 141. 1868; Hooker f., Fl. Brit. Ind. 6: 556. 1893.

Small, free floating herbs. Frond, 1.5 – 2 mm. long, ovate or ovate-oblong, asymmetric, nearly flat. Roots solitary with winged root-sheath and acute root cap is called root pocket. Female flowers with solitary orthotropous ovule. Seed ovoid, prominently ribbed.

Flowers & Fruits: August – October

Exiccatus: Gajol Doba, *Anurag & AP Das 0096*, dated 12.09.2010; Gossaihat Beel, *Anurag & AP Das 0463*, dated 17.08.2012.

Status: Common.

Local Distribution: Trough out the study area.

General Distribution: Throughout the India; Cosmopolitan in tropics and subtropics.

Lemna minor Linnaeus, Sp. Pl. 2: 970. 1753; Cook, Aqua. Wetl. Pl. Ind. 228, 1996.

Fronds free floating, flattened, 1 – 8 mm long, without green stalk at base, margin entire, base rounded; veins 3(-5), nearly reaching apex, sheath not winged, apex mostly rounded. Ovary with 1 ovule; utricular scale with narrow opening at apex. Fruit winged laterally toward apex. Seeds not ribbed.

Flowers & Fruits: May – October

Exiccatus: Gossaihat Beel, *Anurag & AP Das 0244*, dated 14.07.2011; Domohoni Beel, *Anurag & AP Das 0480*, dated 12.06.2013.

Status: Very common.

Local Distribution: In most of the wetlands of Terai & Duars.

General Distribution: N India, Nepal, China, Afghanistan, Kazakhstan, N Pakistan, W Russia, Turkmenistan; Africa, SW Asia, Europe, North America; introduced in Australia, Japan, Pacific islands.

SPIRODELA Schleiden, Linnaea 13: 391. 1839

Key to the species:

- 1a. Fronds with 7 – 13 veins and 5 – 10 roots, 1 or 2 perforating scale, spathe open at apex, seeds smooth *S. polyrrhiza*
 1b. Fronds 3 – 7 veins and 2 – 7 roots, all perforating scale, spathe open at laterally, seeds with distinct ribs *S. punctata*

Spirodela polyrrhiza (Linnaeus) Schleid. in Linnaea 13: 392. 1829. *Lemna polyrrhiza* Linnaeus, Sp. Pl. 970: 1753; Hooker f., Fl. Brit. Ind. 6: 557. 1893; Prain, Beng. Pl. 2: 1117. 1903. *Lemna orbiculata*

[PLATE 4.17. Figs. 92]

Roxburgh, Fl. Ind. 3: 565. 1832. *Lemna maxima* Blatter and Hallb. in Jour. India Bot. 2: 49. 1921. *Spirodela maxima* (E. Blatter And Hellb.) MaC. In Jour. Bombay Nat. Hist. Soc. 43: 158. 1942.

Free floating tufted herbs with round or ovate fronds, dark green above, purplish beneath orbicular to obovate, 7–13 nerved; each frond with 5–10 minute roots, 1 or 2 perforating scale. Spathe open only at the top. Seeds smooth or faintly reticulate.

Flowers & Fruits: January – April

Exiccatus: Domohoni Beel, **Anurag & AP Das 0190**, dated 02.02.2011; Gajol Doba, **Anurag & AP Das 0363**, dated 08.03.2012.

Status: Common.

Local Distribution: In most of the wetlands of study area.

General Distribution: India; tropical and temperate part of the world.

Spirodela punctata (G. Meyer) C. H. Thompson, Rep. (Annual) Missouri Bot. Gard. 9: 28. 1898. *Lemna punctata* G. Meyer, Prim. Fl. Esseq., 262. 1818; Cook, Aqua. Wetl. Pl. Ind. 230, 1996.

[PLATE 4.17. Figs. 93]

Free floating tufted herbs with obovate, flat or gibbous fronds, apex mostly pointed, upper surface without red spot, 3 – 7 nerved, 2 – 7 roots, all scales are perforating, spathe open at laterally. Ovaries 1 – 2 ovulate. Fruits laterally winged to apex. Seeds with distinct ribs.

Flowers & Fruits: June – October

Exiccatus: Gossaihat Beel, **Anurag & AP Das 0443**, dated 17.08.2012.

Status: Not common.

Local Distribution: In only one wetland (Gossaihat Beel).

General Distribution: South America, Asia, Africa, Atlantic Islands, Pacific Islands, Australia.

WOLFFIA Horkel *ex* Scheiden, Linnaea 13: 389. 1839

Key to the species:

- 1a. Fronds shiny on the upper surface, bright green *W. arrhiza*
 1b. Fronds not shiny on the upper surface, pale green *W. globosa*

Wolffia arrhiza (Linnaeus) Horkel *ex* Wimmer, Fl. Schiiles. ed. 3: 140. 1857; Hooker *f.*, Fl. Brit. Ind. 6: 557. 1893. Prain, Beng. Pl. 2: 1117. 1903. *Lemna arrhiza* Linnaeus, Mantiss. 2: 294. 1771. *Wolffia michelii* Schleiden, Beitr. Bot. 233. 1844.

Minute 1 – 5 mm, free floating annual herbs. Fronds sub-globose, minute, ellipsoid, upper surface shiny convex, rootless. Bright green at the surface. Inflorescence 2 flowered, with one male and one female spathe; anther 1 -celled; ovary 1 ovular.

Flowers & Fruits: July – October

Exiccatus: Gossaihat Beel, **Anurag & AP Das 0278**, dated 17.08.2012; Gossaihat Beel, **Anurag & AP Das 0441**, dated 17.08.2012.

Status: Common.

Local Distribution: In most of the wetlands of Terai & Duars.

General Distribution: India, warmer part of both Hemispheres.

Wolffia globosa (Roxburgh) Hartog & Plas, *Blumea*. 18: 367. 1970; Cook, *Aqua. Wetl. Pl. Ind.* 231, 1996. *Lemna globosa* Roxburgh, *Fl. Ind.*, ed. 1832, 3: 565. 1832; Prain, *Beng. Pl.* 2: 1117. 1903.

Fronds free floating on or just below water surface, pale green on upper surface, ovoid, 0.4-0.8 mm, 1.3-2 × as long as wide, 1-1.5 × as deep as wide, rounded or slightly pointed at apex; papillae absent. Turions sometimes present, whitish green, globose.

Flowers & Fruits: May – September

Exiccatus: Gossaihat Beel, **Anurag & AP Das 0270**, dated 14.07.2011; Gossaihat Beel, **Anurag & AP Das 0455**, dated 17.08.2012.

Status: Common.

Local Distribution: In most of the wetlands of Terai & Duars.

General Distribution: India, Nepal, Sri Lanka, Bangladesh, China, Pakistan, Japan, Cambodia, Indonesia, Malaysia, Myanmar, Philippines, Singapore, Thailand, Vietnam.

HYDROCHARITACEAE A. Jussieu, *Gen. Pl.* 67. 1789; *nom. cons.*

- 1a. Perianth 3 in single whorls; female flowers solitary with spiral stalk ***Vallisneria***
- 1b. Perianth 3+3 in two whorls 2
- 2a. Leaves whorled sometime opposite 3
- 2b. Leaves not in whorled 4
- 3a. Female spathe bifid ***Hydrilla***
- 3b. Male spathe bifid..... ***Nechamandra***
- 4a. Stem present, spathy ***Najas***
- 4b. Stem absent, without spathe 5
- 5a. Leaves sessile, linear ***Blyxa***
- 5b. Leaves petiolate, ovate-oblong ***Ottelia***

BLYXA Noronha *ex* Thouars, *Gen. Nov. Madagasc.* 4. 1806

Key to the species:

- 1a. Stems unbranched, leaves radical, spathe pedunculate ***B. octandra***
- 1b. Stems branched, leaves cauline, spathe sessile ***B. japonica***

Blyxa octandra (Roxburgh) Planchon *ex* Thwaites, *Enum.* 332. 1864; Haines, *Bot. Bihar & Orissa pt. V:* 854. 1924. *Vallisneria octandra* Roxburgh, *Pl. Corom.* 2: 34. t. 165. 1802. *Blyxa roxburghii* L.C. Richard, *Mem. Inst. Paris* 12(2): 23 – 1812; Hooker *f.*, *Fl. Brit. Ind.* 5: 660. 1888; Prain, *Beng. Pl.* 2: 748. 1903.

Annual, tufted, submerged, delicate, aquatic herbs. Stems unbranched. Leaves radical, linear, acuminate, base broad, entire, membranous. Spathe linear, cylindrical with white flowers; peduncle slender, terete. Fruits linear. Seeds many, small oblong-elliptic.

Flowers & Fruits: November – February

Exiccatus: Doumahoni Beel, **Anurag & AP Das 0226**, dated 02.02.2011; Mahananda Barrage, **Anurag & AP Das 0336**, dated 26.11.2011.

Status: Abundant.

Local Distribution: In all the wetlands of Terai & Duars.

General Distribution: Tropical parts of Asia and Australia.

Blyxa japonica (Miquel) Maximowicz *ex* Ascherson & Gürke in Engler & Prantl, Pflanzenfam. 2(1): 253. 1889. *Hydrilla japonica* Miquel, Ann. Mus. Bot. Lugduno-Batavi 2: 271. 1866; Cook, Aqua. Wetl. Pl. Ind. 51. 1996. **[PLATE 4.17. Figs.97]**

Stems branched, elongated. Leaves cauline, lanceolate, acuminate, veins 3. Spathe green, sessile. Flowers bisexual. Sepals green, mid-vein purple, linear-lanceolate; petals 6 – 11 × 0.5 – 1.5 mm; stamens 3; filaments 1 – 4 mm; anthers 2 – 2.5 mm; styles 3 – 4.5 mm. Seeds 30 – 70, narrowly elliptic.

Flowers & Fruits: April – October

Exiccatus: Mahananda Barrage, **Anurag & AP Das 0002**, dated 12.05.2010; Doumahoni Beel, **Anurag & AP Das 0530**, dated 12.06.2013.

Status: Very common.

Local Distribution: In all the wetlands of Terai & Duars.

General Distribution: India, Nepal, Bangladesh, China, Japan, Korea, Malaysia, Myanmar, New Guinea, Thailand, Vietnam; Europe.

HYDRILLA L.C. Richard, Mem. Just. Par. 2: 61. 1811

Hydrilla verticillata (Linnaeus *f.*) Royel, Ill. Bot. Himal. t. 376. 1839; Hooker *f.*, Fl. Brit. Ind. 5: 659. 1888; Prain, Beng. Pl. 2: 995. 1903. *Serpicula verticillata* Linnaeus *f.*, suppl. 416. 1781. Roxburgh, Cor. Pl. 2: 33. t. 164. 1798 & Fl. Ind. 3: 578. 1832. *Hydrilla polysperma* Blatter in Jour. Proc. Asiat. Soc. Beng. (N.S.) 26: 356. 1931.

Vernacular name: *Koisal*

Submerged, leafy, dioecious herbs. Stems slender, branched. Leaves whorled, rarely opposite, oblong to linear, rarely lanceolate, acute, serrate or sub-entire. Flowers unisexual, perianth 3+3; male spathe solitary, axillary, globose; female spathe bifid, axillary, cylindrical, 1 – 2 flowered. Fruits subulate, smooth to muriculate. Seeds oblong.

Flowers & Fruits: November – January

Exiccatus: Mahananda Barrage, **Anurag & AP Das 0333**, dated 26.11.2011; Sova-Bari Beel, **Anurag & AP Das 0716**, dated 03.12.2014.

Status: Abundant.

Local Distribution: In all the wetlands of Terai & Duars.

General Distribution: India, S. & E. Europe, Africa, S & E Asia, Australia.

NAJAS Linnaeus, Sp. Pl. 2. 1753

Key to the species:

- 1a. Male and female flower alike without spathe; anthers 4 locular *N. graminea*
- 1b. Male and female flower not alike; spathes present 2
- 2a. Male flowers without short neck, anther 4 thecous *N. indica*

2b. Male flowers with a short neck, 1 thecos..... *N. minor*

Najas graminea Delile, Descr. Egypt. Hist. Nat. 2: 282, t. 50, f. 3. 1813; Hooker *f.*, Fl. Brit. Ind. 6: 569. 1893; Prain, Beng. Pl. 2: 1125. 1903. *Najas seminuda* Griffith *ex* Voigt, Hort. Suburb. Calc. 694. 1845.

Short, slender grass-like, aquatic herbs. Rooting at nodes. Leaves narrowly linear with numerous minute oblique spinules on each side. Pistillate flowers with single sessile carpel. Seeds narrowly oblong – ellipsoid.

Flower & Fruits: October – July

Exiccatus: Katham-Bari Beel, **Anurag & AP Das 0653**, dated 03.09.2014; Mahananda Barrage, **Anurag & AP Das 0568**, dated 13.11.2013.

Status: Abundant.

Local Distribution: In all the wetlands of Terai & Duars.

General Distribution: India, N. Africa to Japan, New Caledonia, Australia.

Najas indica (Willdenow) Chamisso in Linnaea 4: 501. 1829. *Cauline indica* Willdenow In Mem. Ac. R. Sc. Berl. 89, f. 3. 1801. *N. falciculata* R. Brown in Jour. Bot. 2: 278, f. 4. 1864. *Najas minor sensu* Hooker *f.*, Fl. Brit. Ind. 6: 569. 1893; Prain, Beng. Pl. 2: 1125. 1903.

Submerged much branched, herbs. Leaves slightly recurved. Staminate flowers solitary, enclosed in a spathe, anther 4-celled; pistillate flowers with fertile stamens, without spathe. Seeds ellipsoid.

Flower & Fruits: November – February

Exiccatus: Doumahoni Beel, **Anurag & AP Das 0171**, dated 02.02.2011; Mahananda Barrage, **Anurag & AP Das 0641**, dated 13.11.2013.

Status: Abundant.

Local Distribution: In all the wetlands of Terai & Duars.

General Distribution: India, China, Japan, Taiwan.

Najas minor Allioni, Auct. Syn. Meth. Stirp. Horti Regii Taur. 3. 1773; Hooker *f.*, l. c. 569; de Wilde l. c. 164; Hara *et al.*, Enum. Fl. Pl. Nep. 1: 95. 1978. [**PLATE 4.17. Figs. 98**]

Stems 4 – 28 cm tall. Leaves recurved, serrulate, acuminate, sheath 2.5 mm. Flowers yellowish green. Male flowers elliptic, spathe with a short neck; anthers 1-thecos. Female flowers 2.5 mm; stigmas 2-lobed. Fruits linear – ellipsoid slightly curved at apex. Seeds narrowly ellipsoidal.

Flower & Fruits: May – November

Exiccatus: Gajoldoba Beel, **Anurag & AP Das 0162**, dated 12.09.2010.

Status: Rare.

Local Distribution: Found only in Gajoldoba Beel

General Distribution: India, Nepal, Sri Lanka, China, Pakistan, Afghanistan, Indonesia Japan, Kazakhstan, Korea, Philippines, Tajikistan, Thailand, Uzbekistan, Vietnam; Africa, SW Asia, Europe.

NECHAMANDRA Planchon, Ann. Sci. Nat., Bot. sér. 3, 11: 78. 1849

Nechamandra alternifolia (Roxburgh *ex* Wight) Thwaites, enum. Pl. Zeyl. 332; 1864; Subramanyam & Balakrishnan, Bull. Bot. Surv. Ind. 3: 23. 1961; Datta & Majumdar, Bull. Bot. Soc. Beng 20 (20): 23. 1966. *Vallisneria alternifolia* Roxburgh (Hort. Beng. 71. 1814) & Fl. Ind. 3: 750. 1832. *Lagarosiphon roxburghii* (Planchon) Bentham & Hooker *f.*, Gen. Pl. 3: 451. 1883 (*nom. illeg.*), Hooker *f.*, Fl. Brit. Ind. 5: 652. 1888; Prain Beng. Pl. 2: 995. 1903.

Submerged, fresh water annual herbs. Leaves opposite below and crowded towards the tips, linear or linear lanceolate, serrulate, acuminate to acute, sessile, amplexicaule, usually 3-nerved. Male spathe sessile, axillary, ovoid, 2-fid. Female spathe sessile, narrowly oblong. Flowers many, densely arranged.

Flowers & Fruits: December – June

Exiccatus: Mahananda Barrage, **Anurag & AP Das 0078**, dated 12.05.2010; Sova-Bari Beel, **Anurag & AP Das 0714**, dated 03.12.2014.

Status: Abundant.

Local Distribution: In all the wetlands of Terai & Duars.

General Distribution: India, Sri Lanka, Tropical Asia.

OTTELIA Persoon, Syn. Pl. 1: 400. 1805

Ottelia alismoides (Linnaeus) Persoon, Sys. pl. 1: 400. 1805; Hooker f., Fl. Brit. Ind. 5: 662. 1888; Prain, Beng. Pl. 2: 997. 1903. *Stratiotes alismoides* Linnaeus, Sp. Pl. 535. 1753.

[PLATE 4.11. Figs 52]

Vernacular name: *Pani-Kola*

Submerged herbs. Leaves crowded, submerged, long-petioles variable in shape; ovate-lanceolate, oblong or cordate. Spathe solitary, axillary, 1-flowered. Flowers bisexual, sessile, yellowish white. Fruits oblong, ellipsoid, crowded with the sepals. Seeds many, oblong.

Flowers & Fruits: October – February

Exiccatus: Doumahoni Beel, **Anurag & AP Das 0178**, dated 02.02.2011; Mahananda Barrage, **Anurag & AP Das 0647**, dated 13.11.2013.

Status: Abundant.

Local Distribution: In all the wetlands of Terai & Duars.

General Distribution: India, N & E Africa, Tropical Asia, Australia.

VALLISNERIA Linnaeus, Sp. Pl. 2. 1753

Vallisneria spiralis Linnaeus, Sp. Pl. 2: 1015. 1753; Prain, Beng. Pl. 2: 996. 1903. *V. spiraloidea* Roxburgh, Fl. Ind. 3: 75. 1832; Naskar, Aqu. And semiaquat. Pl. of low. Gangetic plain, 231. 1990.

Submerged, stoloniferous, tufted herbs. Leaves linear, acute or obtuse, translucent green. Male spathe 5 - 10 mm long. Female spathe on long coiled peduncle which at maturity uncoiled and help pollination by floating pollens from the water surface. Fruits linear. Seeds numerous, oblong.

Flowers & Fruits: January – May

Exiccatus: Gajoldoba, **Anurag & AP Das 0380**, dated 08.03.2012.

Status: Abundant.

Local Distribution: In all the wetlands of Terai & Duars.

General Distribution: India, Sri Lanka, Nepal, China, Japan, Malaysia, Australia.

POTAMOGETONACEAE Dumortier, Anal. Fam. Pl. 59. 61. 1829

Key to the Genera:

- 1a. Submerged or floating, turions present; inflorescence arise above water surface *Potamogeton*
 1b. Fully submerged, turions absent; inflorescence do not arise above water surface..... *Stuckenia*

POTAMOGETON Linnaeus, Sp. Pl. 126. 1753

Key to the species:

- 1a. Leaves monomorphic, all submerged 2
 1b. Leaves dimorphic, both submerged and floating leaves present3
 2a. Lamina linear-oblong, serrate; fruit beak equal to or longer than body of carpel..... *P. crispus*
 2b. Lamina narrowly linear, entire, white; fruit beak shorter than body of carpel..... *P. distinctus*
 3a. Floating lamina less than 24 x 12 mm; submerged leaves sessile, filiform *P. octandrus*
 3b. Floating lamina more than 29 x 16 mm; Submerged lamina petiolate or sessile... 4
 4a. Submerged lamina phyllodial..... *P. natans*
 4b. Submerged leaves with expanded lamina 5
 5a. Submerged lamina petiolate *P. nodosus*
 5b. Submerged lamina sessile 6
 6a. Lamina 7 – 46 mm long, entire, obtuse, 7 – 19 veined; stem usually unbranched, with distinct reddish tinge when dry *P. alpinus*
 6b. Lamina 10 – 14 mm long, minutely denticulate, mucronate, 4 – 7 veined; stem usually branched, without reddish tinge when dry *P. gramineus*

Potamogeton crispus Linnaeus, Sp. Pl. 126. 1753; Hooker *f.*, Fl. Brit. Ind. 6: 566. 1893; Prain, Beng. Pl. 2: 1123. 1903; Majumdar, Bull. Bot. Soc. Beng. 19 (1): 15. 1965. Rao & Verma in Bull. Bot. Surv. Ind. 18(1 – 4): 42. 1976; Deb, Fl. Tripu. 2: 348. 1983; Cook, Aqua. Wetl. Pl. Ind. 332, 1996; Bora & Kumar, Flor. Div. Ass. 375. 2003. *Potamogeton tuberosus* Roxburgh, Fl. Ind. 1: 472. 1820.

[PLATE 4.6. Figs. 20]

Submerged, slender, rhizomatous, perennial herbs. Stems filiform, branched, 0.5 – 1 m. Leaves sessile, linear-oblong, 4 – 11 cm × 5 – 8 mm, translucent, obtuse, margins serrate and undulate. Stipules free, 2 – 4 mm long, early deciduous. Spikes 4 – 6 cm long, laxly few flowered. Fruitlets 2 – 3 mm, ovoid, curved beaked, 1-keeled; keel wavy and curved.

Flowers & Fruits: August – December

Exiccatus: Gajoldoba, *Anurag & AP Das 0134*, dated 12.09.2010; Sova-Bari Beel, *Anurag & AP Das 0155*, dated 03.12.2014.

Status: Abundant.

Local Distribution: Found nearly in all wetlands of the study area.

General Distribution: Tropical to sub-tropical Asia, Africa, Europe, Australia.

Potamogeton nodosus Poiret, Encycl. Meth. Bot. Suppl. 4: 535. 1810; Majumdar, Bull. Bot. Soc. Beng. 20(2): 78. 1966; Cook, Aqua. Wetl. Pl. Ind. 333, 1996. *Potamogeton indicus* Roxburgh, Fl. Ind. 1: 1123. 1820 (Roth *ex* Roem & Schult. 1818); Hooker *f.*, Fl. Brit. Ind. 6: 565. 1893; Prain, Beng. Pl. 2: 845. 1903.

Aquatic herbs, stems terete, branched, length depend upon the depth of the water. Leaves petiolate,

oblong or elliptic-lanceolate, only upper leaves floating, acuminate, coriaceous, glossy, many nerved. Spikes 3 – 4 cm long, dense flowered, green. Flowers bisexual. Druplets, long beaked, oblique.

Flowers & Fruits: August – February

Exiccatus: Gossaihat Beel, **Anurag & AP Das 0412**, dated 17.08.2012; Katham-Bari Beel, **Anurag & AP Das 0675**, dated 03.09.2014.

Status: Less common.

Local Distribution: Found in few wetlands of the study area.

General Distribution: India, Sri Lanka, Malaysia, Temperate and Tropical region of world.

Potamogeton natans Linnaeus, Sp. Pl. 126. 1753; Karthikeyan *et al.*, Fl. Ind. Enum. (Monocot): 284. 1889; Hooker *f.*, Fl. Brit. Ind. 6: 565. 1893; Guha & Mondal, Wetl. Phyt. 141. 2005.

Reddish spotted, rhizomatous aquatic perennial herb. Stem simple or branched, erect, terete. Submerged leaves linear, acute, base truncate. Lamina and petiole not distinguishing. Floating leaves ovate elliptic, rounded, base cordate. Spikes dense flowered. Flowers tiny; tepals 4, stamens 4. Fruits ovate.

Flowers & Fruits: May – August

Exiccatus: Mahananda Barrage, **Anurag & AP Das 0051**, dated 12.05.2010; Gossaihat Beel, **Anurag & AP Das 0452**, dated 17.08.2012.

Status: Less common.

Local Distribution: Found in almost all the wetlands of study area.

General Distribution: India, China, Afghanistan, Japan, Kazakhstan, Korea, Myanmar, Pakistan, Russia, Uzbekistan, Africa, SW Asia Europe, North America.

Potamogeton alpinus Balbis, Misc. Bot. 13. 1804; Kak in J. Bomb. Nat. Hist. Soc. 80: 316. 1984; Karthikeyan *et al.*, Fl. Ind. Enum. (Monocot): 284. 1889; Guha & Mondal, Wetl. Phyt. 130. 2005. *Potamogeton fluitans* Smith, Fl. Brit. 1391. 1800 – 1804.

Perennial rhizomatous slender fresh water herb. Stems terete, simple below, rarely branched above. Submerged leaves linear-lanceolate, acute or obtuse, base cuneate, sessile, entire, 3 – 4 nerved. Floating leaves either absent or poorly developed, oblong lanceolate-elliptic lanceolate, acute, base tapering, stipulate but not adnate to leaf base. Spikes cylindrical, densely flowered; tepals 4, stamens 4, carpels 4. Fruits obovoid.

Flowers & Fruits: August – November

Exiccatus: Gajoldoa, **Anurag & AP Das 0111**, dated 12.09.2010.

Status: Rare.

Local Distribution: Only found in few wetlands of the study area.

General Distribution: India, China, Pakistan, Afghanistan, Japan, Kazakhstan, Korea, Myanmar, Russia, Uzbekistan; Europe, North America.

Potamogeton octandrus Poiret in Lamarck, Encycl., Suppl. 4: 534. 1816; Deb, Fl. Tripura 349. 1883; Karthikeyan *et al.*, Fl. Ind. Enum. (Monocot): 284. 1889; Subramanyam, Aquat. Angio. 95. 1962; Cook, Aqua. Wetl. Pl. Ind. 333, 1996; Guha & Mondal, Wetl. Phyt. 145. 2005.

Rhizomatous, annual or perennial, fresh water aquatic herb. Stems sparsely branched, terete. Dimorphic leaves; stipules axillary. Submerged leaves alternate, sessile, linear to filiform, 3-veined. Floating leaves petiolate, alternate, 5 – 7 veined, acute or obtuse, base rounded. Spikes densely flowered. Fruit obovoid.

Flowers & Fruits: September – March

Exiccatus: Mahananda Barrage, **Anurag & AP Das 0341**, dated 26.11.2011; Gajoldoba, **Anurag & AP Das 0387**, dated 08.03.2012.

Status: Common.

Local Distribution: Found in almost all the wetlands of study area.

General Distribution: India, Nepal, Bangladesh, China, Indonesia (Java), Japan, Korea, Malaysia, Myanmar, New Guinea, Russia, Thailand, Vietnam; Africa, Australia.

Potamogeton distinctus A. Bennett, Jour. Bot. 42: 72. 1904; Cook, Aqua. Wetl. Pl. Ind. 332. 1996. *Potamogeton distinctus* var. *tonkinensis* (E.G. Camus) V.C. Vu ex Aver, Konsp. Sosud. Rast. Fl. V'etnama 2: 155. 1996.

Rhizomatous, fresh water perennial herb. Stems slender, terete, simple or sparsely branched. Leaves dimorphic; stipules axillary, convolute. Submerged leaves petiolate; lamina lanceolate, 9 – 17 veined. Floating leaves petiolate; lamina lanceolate – ovate lanceolate or broadly elliptic, 11 – 19-veined, base obtuse, apex acute or obtuse. Spikes cylindric, densely flowered. Fruit broadly obovoid.

Flowers & Fruits: September – March

Exiccatus: Gajoldoba, **Anurag & AP Das 0131**, dated 12.09.2010.

Status: Less common.

Local Distribution: Found in only one wetland (Gajoldoba)

General Distribution: India, Bhutan, Nepal, China, Indonesia, Japan, Korea, Malaysia, Philippines, Russia, Thailand, Vietnam, Pacific islands.

Potamogeton gramineus Linnaeus, Sp. Pl. 127. 753; Dandy in Rech. f., l.c. 4; SRC, l.c. t. 21; Chowdhury *et al.*, IJCR. 7(2) 12362-1234. 2015. *Potamogeton heterophyllus* Schreb., Spic. Fl. Lips. 21. 1771. **[PLATE 4.6. Figs. 21]**

Perennial soft aquatic herbs, anchored to bottom. Rhizome slender, densely branched, with apical dormant buds. Stem terete, densely or sparsely branched, 1–1.5 mm in diam. Leaves dimorphic, floating lamina opaque, elliptic or ovate-elliptic to elliptic-lanceolate, leathery, 20 – 35 mm x 8 – 10 mm., entire, mucronate, 7 veined, base cuneate or rounded; petiole 12 – 10 mm; submerged leaves sessile, translucent, linear-oblong to oblanceolate, 12 – 16 mm x 1 mm., entire or minutely denticulate, mucronate, base cuneate; petiole 8 – 10 mm. long; stipules axillary, 5.5–34 mm long, herbaceous, amplexicauled; Spikes cylindric, 13 – 36 mm long, densely flowered, with many whorls of opposite flowers; peduncles 13 – 17 mm; stamens 4, united, anthers sessile; carpels 4. Drupe with a short beak at tip.

Flowers & Fruits: March – May

Exiccatus: River karala, **Anurag & AP Das 0406**, dated 18.03.2012.

Status: Rare.

Local Distribution: Only in one site in River Karala.

General Distribution: India, Pakistan, China, Japan, Kazakhstan, Korea, Mongolia, Russia, Turkmenistan, Uzbekistan; SW Asia (Iran), Europe, North America.

Note: This species has been recorded as a new record for India.

STUCKENIA Börner, Abh. Naturwiss. Vereins Bremen. 21: 258. 1912

Stuckenia pectinata (Linnaeus) Börner, Fl. Deut. Volk. 713. 1912. *Potamogeton pectinatus* Linnaeus, Sp. Pl. 1: 127. 1753; Cook, Aqua. Wetl. Pl. Ind. 333, 1996.

Rhizomatous, submerged perennial herb. Stems sparsely branched, filiform to slender. Stipules partially fused at leaf base. Leaves sessile, filiform – linear, 3 – 5 veined. apex acuminate – acute. Spikes cylindrical, Fruits obovoid.

Flowers & Fruits: May – September

Exiccatus: Mahananda Barrage, **Anurag & AP Das 074**, dated 12.06.2013; Doumahoni Beel, **Anurag & AP Das 0511**, dated 12.05.2009.

Status: Abundant.

Local Distribution: Found in all wetlands of the study area.

General Distribution: India, Nepal, Bangladesh, Sri Lanka, China, Pakistan, Afghanistan, Myanmar, Philippines, Russia, Africa, SW Asia, Australia, Europe, North and South America, Pacific islands.

Order: Pandanales

PANDANACEAE, R. Brown in Prodr. 340. 1810

PANDANUS Parkinson in Jour. Voy. S. Seas 46. 1773

Key to the Species:

- 1a. Stamens 10 *P. unguifer*
 1b. Stamens 3-12 *P. furcatus*

Pandanus unguifer Hooker f., Bot. Mag. 104: t. 6.347. 1878; St. John., Bot. Mag. Tokyo 85: 241 – 262. 1972; Karthikyan *et al.*, Fl. Ind. Enum.: Monocot., 177 – 178, 1989. *Pandanus minor* Buchanon-Hamilton *ex* Solms, Linnaea 42: 18. 1878; Prain, Beng. Pl. 2: 1101. 1903.

Rigid shrub; lower stem prostrate, decumbent; forming close thickets, upto 1.3 m high. Leaves linear lanceolate, margins and mid vein with numerous sharp spines. Plants dioecious; inflorescence terminal, spathes 6.5 – 22 cm. Stamens 10. Male spike unbranched. Infructescence spherical. Seeds single per fruitlet.

Flowers & Fruits: August – February.

Exiccatus: Doumahoni Beel, **Anurag & AP Das 0170**, dated 02.02.2011; Gossaihat Beel, **Anurag & AP Das 0445**, dated 17.08.2012.

Status: Less common.

Local Distribution: Found in few forest Jhoras of Terai & Duars.

General Distribution: India, S, and South East Asia.

Pandanus furcatus Roxburgh, Hort. Bengal. 71 1814; Prain, Beng. Pl. 2: 1101. 1903. *Pandanus nepalensis* H. St. John, Bot. Mag. (Tokyo) 85: 254 1972.

Small trees. Stems simple or branched at apex. Leaves clustered; lamina linear, leathery, abaxially spinose along midrib, margin densely serrate spines. Male inflorescences consisting of several spikes; spikes golden yellow, flowers numerous; stamens 3–12 per bundle; anthers linear. Female inflorescence pendulous, capitate; female flowers with 1 carpel; stigma bifurcate. Fruits solitary or in racemes, reddish brown.

Flowers & Fruits: August – December

Exiccatus: Gajoldoba, **Anurag & AP Das 0123**, dated 12.09.2010; Mahananda Barrage, **Anurag & AP Das 0609**, dated 13.11.2013.

Status: Less common.

Local Distribution: Found in few forest Jhoras of Terai & Duars.

General Distribution: India, China, Vietnam.

Order: Asparagales

AMARYLLIDACEAE J. St. Hilaire, Expos. Fam. Nat. 1: 134. 1805., *nom. Cons.*

CRINUM Linnaeus, Sp. Pl. 1: 291. 1753

Crinum asiaticum Linnaeus, Sp. Pl. 292. 1753; Prain, Beng. Pl. 2: 1061. 1903. *Amaryllis carnosa* Hooker f., Fl. Brit. India 6: 280. 1892. *Crinum bancanum* Kurz, Tijdschr. Ned.-Indië 27: 231. 1864.

Vernacular name: *Bara Kanur*

Marshland perennial bulbous herb. Leaves dark green, linear-lanceolate, acute-acuminate, margins undulate. Umbels, white, scape with 3–10 white flowers; bracts linear with 2 involucre, perianth white, anthers versatile. Capsules subglobose.

Flowers & Fruits: June – September

Exiccatus: Gossaihat Beel, **Anurag & AP Das 0238**, dated 14.07.2011; Doumahoni Beel, **Anurag & AP Das 0465**, dated 12.06.2013.

Status: Rare.

Local Distribution: Throughout the study area.

General Distribution: India, Sri Lanka, Java, Malaysia, Western Polynesia.

ORCHIDACEAE A. Jussieu, Gen. Pl. 64. 1789

Key to the Genera:

- 1a. Dorsal sepal forming a hood with petals, narrowly ovate-oblong, concave... .. ***Zeuxine***
- 1b. Dorsal sepal forming a hood with petals, narrowly oblong, cymbiform... .. ***Spiranthes***

ZEUXINE Lindley, Orchid. Scelet. 9. 1826

Zeuxine strateumatica (Linnaeus) Schlechter, Bot. Jahrb. Syst. 45: 396. 1911; Liu & Su, Fl. Taiwan 5: 1136. 1978. *Z. sulcata* (Roxburgh) Lindl. ex Wight, Cat. Ind. Pl. 123. 1836; Prain, Beng. Pl. 2: 1029. 1903. *Orchis sulcata* Linnaeus, Sp. Pl. 943. 1753.

Marshy or terrestrial, succulent herbs. Lamina membranous, linear-lanceolate, sessile. Spikes terminal, unbranched. Sepals sub-equal, apical lobe of lip sub-orbicular, erose; lip not longer than sepals; anther membranous, pollinia clavate, sessile; stigmas 2, rostellum of varied form. Capsule elliptic.

Flowers & Fruits: March – August

Exiccatus: Gajoldoba, **Anurag & AP Das 0374**, dated 08.03.2012.

Status: Less common.

Local Distribution: In the margin of few wetlands of the study area.

General Distribution: India, Taiwan, Tropical and sub tropical Asia, America.

SPIRANTHES Rich., De Orchid. Eur. 28. 1817

Spiranthes sinensis (Persoon) Ames, Orchidaceae 2: 53 1908. *Spiranthes australis* (R. Brown) Lindl. Bot. Reg. 10: t. 823 1824; Prain, Beng. Pl. 2: 1028. 1903. *Neottia sinensis* Persoon, Syn. Pl. 2: 511. 1807.

Plants 12 – 28 cm tall. Leaves erect and spreading, broadly linear, acute or acuminate, with an indistinct petiole-like base. Inflorescence glabrous; rachis with many spirally arranged flowers; floral bracts ovate-lanceolate. Flowers purplish red. Dorsal sepal forming a hood with petals, cymbiform, lateral sepals lanceolate, slightly oblique. Petals rhombic-oblong, oblique, rostellum narrowly triangular-lanceolate; stigma discoid.

Flowers & Fruits: March – August

Exiccatus: Sevok, **Anurag & AP Das 0558**, dated 15.08.2013.

Status: Less common.

Local Distribution: In the margin of Jhoras.

General Distribution: India, Nepal, Bhutan, China, Afghanistan, Japan, Korea, Malaysia, Mongolia, Myanmar.

Commelinids

Order: Arecales

ARECACEAE Berchtold & J. Presl, Prir. Rostlin 266. 1820 ; *nom. alt.*

Key to the Genera:

- 1a. Tree with long, hard spines **Phoenix**
- 1b. Shrub with numerous long small spines..... **Calamus**

CALAMUS Linnaeus, Sp. Pl. 1: 325. 1753

Calamus erectus Roxburgh, Ann. Roy. Bot. Gard. (Calcutta) II (1): 125. 1908; Noltie, Fl. Bhut. 3(1): 419. 1994. *Calamus erectus* Roxburgh Fl. Ind. ed. 3: 774. 1832; Hooker f. Fl. Brit. Ind. 4: 447. 1892; Prain, Beng. Pl. 2: 1099. 1903. *C. erectus* var. *Collinus* (W. Griffith) Beccari in Hooker f., Fl. Brit. Ind. 6: 439. 1892.

Vernacular Name: *Bet* (Bengali)

Densely tufted, erect, bushy shrubs. Stem with many flat spines. Leaflets almost equidistant, sheath 5 – 7cm diameter; inflorescence in erect, amongst petiole with no flagellum; fruit 3-36 cm long, covered with reddish brown scales, deeply channeled.

Flowers & Fruits: April – October

Exiccatus: Gossaihat Beel, **Anurag & AP Das 0230**, dated 14.07.2011; Gossaihat Beel, **Anurag & AP Das 0449**, dated 17.08.2012.

Status: Common.

Local Distribution: Edges of the forest wetlands (Garati, Chukchuki etc.)

General Distribution: India (Plains), Bangladesh, China, Laos, Myanmar, Thailand.

PHOENIX Linnaeus, Sp. Pl. 2: 1188. 1753.

Phoenix sylvestris (Linnaeus) Roxburgh, Fl. Ind. 3: 787. 1832; Hooker. *f.*, *l.c.* 425. 1892; Das & Panda, Fl. Sambalpur 383. 2004. *Elate sylvestris* Linnaeus, Sp. Pl. 1189. 1753.

Vernacular Name: *Khejur* (Bengali)

Tall trees, unbranched with crown of leaves at top. Leaves pinnate; leaflets rigid; petiole spiny near the base. Flowers dioecious in spadix; male and female flowers white. Drupes oblong-ellipsoid, orange-yellow, 1-seeded.

Flowers & Fruits: April – October

Exiccatus: Gossaihat Beel, *Anurag & AP Das 0442*, dated 12.08.2012.

Status: Not common.

Local Distribution: Bank of few wetlands of Duars.

General Distribution: India (Plains), Bangladesh and Myanmar.

Note: This species is not a wetland plant but sometimes it grows on the margin of few wetland of Terai & Duars.

Order: Commelinales

COMMELINACEAE Mirbel, Hist. Nat. Pl. 8: 177. 1804

Key to the Genera:

- 1a. Fertile stamens 6; staminodes 0 *Cyanotis*
- 1b. Fertile stamens 3; staminodes 1-3 or 0 2
- 2a. Inflorescence capitate, emerges penetrating base of leaf sheath *Amischotolype*
- 2b. Inflorescence not capitate 3
- 3a. Inflorescence a dense terminal, panicle, densely hairy; flowers small; common sheathing bract absent *Floscopa*
- 3b. Inflorescence not a dense terminal, not densely hairy, flowers medium; common sheathing bract generally present 4
- 4a. Inflorescence enclosed in spathe; sepals connate at base *Commelina*
- 4b. Inflorescence free from spathe; sepals free at base.....*Murdannia*

COMMELINA Linnaeus, Sp. Pl. 1: 40. 1753

Key to the species:

- 1a. Lamina elliptic-ovate; generally symmetric; capsules 5 seeded *C. benghalensis*
- 1b. Lamina ovate-lanceolate or linear-lanceolate; sometimes asymmetric; capsules 2–3 seeded ... 2
- 2a. Leaves scabridly pubescent; ovary 2 celled *C. suffruticosa*
- 2b. Leaves not scabridly pubescent; ovary 3 celled 3
- 3a. Seeds reticulate; spathes 2–3 cm 4
- 3a. Seeds appendaged, smooth; spathes 2–4 cm *C. longifolia*

- 4a. Cincinni dichotomously branched from base; flowers long exserted *C. diffusa*
 4b. Cincinni one and unbranched; pedicels not exserted at flowering *C. paludosa*

Commelina benghalensis Linnaeus, Sp. Pl. 1: 41. 1753; Hooker *f.*, Fl. Brit. Ind. 6: 370. 1892; Prain, Beng. Pl. 2: 1082. 1903; Guha Bakshi, Fl. Mur. Dist. 326.1984. Noltie, Fl. Bhut. 3(1): 238. 1994; Hajra *et al.*, Fl. Sikkim 1: 168. 1996; Cook, Aqua. Wetl. Pl. Ind. 86, 1996.

Vernacular Name: *Kanshira*.

Creeping, glabrous or pubescent herb, rooting at basal nodes. Lamina ovate or elliptic – ovate or oblong, entire-ciliate, sub-acute to rounded apex, sheath pubescent or villous. Spathe 1 – 3 together at branch-tips, pubescent, turbinate, Capsules pyriform. Seeds 5, oblong, closely pitted.

Flowers & Fruits: January – September

Exiccatus: Mahananda Barrage, **Anurag & AP Das 0032**, dated 12.05.2010; Doumahoni Beel, **Anurag & AP Das 0176**, dated 02.02.2011.

Status: Abundant.

Local Distribution: In all the wetlands of Terai & Duars.

General Distribution: India, Bangladesh, Myanmar, Java, Hong Kong.

Commelina diffusa Burman *f.*, Fl. Indica 18. t.7. f. 2. 1768; Datta & Majumdar, Bull. Bot. Soc. Bengal 20(2): 39. 1966; Noltie, Fl. Bhut. 3(1): 237. 1994; Cook, Aqua. Wetl. Pl. Ind. 86, 1996; Hajra *et al.*, Fl. Sikkim 1: 168. 1996; *Commelina nudiflora auct. non* Linnaeus, Sp. Pl. 1: 41. 1753; Hooker *f.*, Fl. Brit. Ind. 6: 369. 1892; Prain, Beng. Pl. 2: 1082. 1903.

Creeping herbs, rooting at the lower nodes. Leaves sessile. Lamina glabrous or sparsely puberulous, slightly unequal-sided, lanceolate, acute, leaf sheath glabrous, margin ciliate. Spathe glabrous or sparsely pubescent, ovate or ovate-lanceolate. Cymes usually 1 – 3 flowered; pedicels much exserted at flowering. Flowers blue, capsule broadly oblong, acuminate or apiculate. Seeds 5, oblong, cylindric, reticulate, brown.

Flowers & Fruits: January – September

Exiccatus: Gossaihat Beel, **Anurag & AP Das 0277**, dated 14.07.2011; Doumahoni Beel, **Anurag & AP Das 0451**, dated 17.08.2012.

Status: Abundant.

Local Distribution: In all the wetlands of Terai & Duars.

General Distribution: Pantropic.

Commelina longifolia Lamark, 111. Gen. 1: 129. 1791; Cook, Aqua. Wetl. Pl. Ind. 85, 1996; Khan & Alam, Fl. Banglad. 4: 22. 1977. *Commelina salicifolia* Roxburgh, Fl. Ind. 1: 172. 1832; Hooker *f.*, Fl. Brit. Ind. 6: 370. 1892; Prain, Beng. Pl. 2: 1082. 1903. *Commelina pedunculosa* Sprengel & Link, Jahrb. Gewächsk. 1(3): 74. 1820.

Stem slender, diffuse or spreading with long internodes; rooting from the basal nodes. Leaves glabrous, linear or linear-lanceolate, acute; sheath ciliate. Spathe axillary, ovate to ovate-lanceolate usually acuminate. Flowers blue, capsule upto 6 mm long, broadly oblong, 3-celled, seeds 2 – 4 mm long, ovoid, smooth appendiculate.

Flowers & Fruits: July – January

Exiccatus: Mahananda Barrage, **Anurag & AP Das 0331**, dated 26.11.2011; Gossaihat Beel, **Anurag & AP Das 0447**, dated 17.08.2012.

Status: Common

Local Distribution: In all the wetlands of Terai & Duars.

General Distribution: India, Java, Hong Kong.

Commelina suffruticosa Blume, Enum. Pl. Jav. 1: 3. 1827–28; Hooker *f.*, Fl. Brit. Ind. 6: 374. 1892; Noltie, Fl. Bhut. 3(1): 236. 1994; Hajra *et al.*, Fl. Sikkim 1: 169. 1996; Prain, Beng. Pl. 2: 1083. 1903. ***Commelina rugulosa*** C.B. Clarke, Jour. Linn. Soc., Bot. 11: 446. 1871. ***Commelina simsonii*** C.B. Clarke, Jour. Linn. Soc., Bot. 11: 446. 1871. ***Spathodithyros suffruticosus*** (Blume) Hasskarl, *Commelin.* Ind. 11. 1870.

Stout branched and scrambling herb with creeping rhizome and fleshy roots; nodes thickened. Leaves large, sessile, lanceolate, finely acuminate with equal base. Scaberulous above, margins scabrid. Capsules 2 celled; seeds straw coloured.

Flowers & Fruits: January – March

Exiccatus: Doumahoni Beel, **Anurag & AP Das 0211**, dated 02.02.2011; Gajoldoba, **Anurag & AP Das 0344**, dated 08.03.2012.

Status: Less common.

Local Distribution: In all the wetlands of Terai & Duars.

General Distribution: India, Bangladesh, Nepal, Malaysia.

Commelina paludosa Blume, Enum. Pl. Jav. 1: 2. 1827; Hooker *f.*, Fl. Brit. India 6: 372. 1894; Hara *et al.*, Enum. Fl. Pl. Nepal 1: 82. 1978; Cook, Aqua. Wetl. Pl. Ind. 85.1996; Hajra & Verma, Fl. Sikkim 1: 169. 1996. ***Commelina obliqua*** Buchanan-Hamilton *ex* D. Don, Prodr. Fl. Nepal. 45. 1825; Hooker *f.*, Fl. Brit. India 6: 372. 1894; Prain, Beng. Pl. 2: 1083. 1903.

Perennial herbs. Stems often semi-erect, simple or sometimes branched distally, up to 1 m, glabrous. Leaves sessile; leaf sheath densely brown hispid at mouth and in a line on 1 side, sometimes either glabrous with only a few hairs at mouth or hirsute throughout; lamina lanceolate to ovate-lanceolate, 9–18 × 3–6 cm, glabrous on both surfaces or adaxially granular hairy and abaxially hirsute. Involucral bracts often 5–8, forming terminal heads, sessile, funnel form, 2 × 2 cm, glabrous, proximal margins connate, apex acute. Cincinnus 1; peduncle 1 cm; flowers 1 to several, nearly included in involucral bracts; pedicels 7 mm, twisted. Sepals 3–6 mm, membranous. Petals blue, 5–8 mm. Capsules ovoid globose, trigonous, 4 mm, 3 valved.

Flowers & Fruits: August – April

Exiccatus: Gossaihat Beel, **Anurag & AP Das 0456**, dated 17.08.2012; Mahananda Barrage, **Anurag & AP Das 0588**, dated 13.11.2013.

Status: Common.

Local distribution: In all the wetlands of Terai & Duars.

General Distribution: India, Nepal, Bhutan, Myanmar, China, Thailand, Malaysia, Laos, Vietnam, Cambodia, Indonesia.

MURDANNIA Royle, Ill. Bot. Himal. Mts. 11: 403. 1840

Key to the species:

- 1a. Lamina linear; inflorescence scorpioid cymose..... *M. nudiflora*
 1b. Lamina ovate or lanceolate; inflorescence terminal or axillary, one or many flowered 2
 2a. Lamina ovate-lanceolate; inflorescence terminal panicle, many flowered *M. spirata*
 2b. Lamina lanceolate; inflorescence terminal and axillary, usually 1-flowered, internodes with a line of white hairs *M. keisak*

Murdannia nudiflora (Linnaeus) Brenan, Kew. Bull. 7: 189. 1952; Noltie, Fl. Bhut. 3(1): 229. 1994; Hajra *et al.*, Fl. Sikkim 1: 171. 1996; Cook, Aqua. Wetl. Pl. Ind. 90, 1996. *Commelina nudiflora* Linnaeus, Sp. Pl. 1: 41. 1753. *Aneilema nudiflorum* (Linnaeus) R. Brown, Prodr. 271. 1810; Hooker *f.*, Fl. Brit. Ind. 6: 378. 1892; Prain, Beng. Pl. 2: 1084. 1903. *Commelina minuta* Blume, *Catalogus* 34. 1823.

Annual, branched decumbent herbs; rooting from the lower nodes. Leaves glabrous, linear or linear-lanceolate. Inflorescence scorpioid cyme. Ovary 2-celled with two ovules. Capsules 2 seeded, brown, rugose.

Flowers & Fruits: October – March

Exiccatus: Mahananda Barrage, **Anurag & AP Das 0339**, dated 26.11.2011; Mahananda Barrage, **Anurag & AP Das 0586**, dated 13.11.2013.

Status: Very common

Local Distribution: Found in all over the study areas.

General Distribution: Pantropical.

Murdannia spirata (Linnaeus) G. Brueckner, Nat. Pflanzenfam. 2, 15a: 173. 1930 (ut “*spiratum*”); Noltie, Fl. Bhut. 3(1): 229. 1994; Cook, Aqua. Wetl. Pl. Ind. 91, 1996. *Commelina spirata* Linnaeus, Mant. Alt. 176. 1771. *Aneilema spiratum* (Linnaeus) R. Brown, Prodr. 271. 1810; Hooker *f.*, Fl. Brit. Ind. 6: 377. 1892; Prain, Beng. Pl. 2: 1084. 1903.

Rhizomatous, perennial branched, procumbent herb. Leaves sessile, lamina ovate – lanceolate, slightly wavy (repund), obtuse – acute, base almost rounded, glabrous; sheaths densely hirsute. Flowers in terminal panicle, bluish-violet; bracts minute, persistent; pedicels 4 – 8 cm. Sepals 3, ovate-elliptic; petals 3, obovate – orbicular; fertile stamens 3. Capsules oblong, trigonous, mucronate, 3-celled; seeds 4 in each cell.

Flowers & Fruits: July – February

Exiccatus: Gossaihat Beel, **Anurag & AP Das 0231**, dated 14.07.2011; Mahananda Barrage, **Anurag & AP Das 0561**, dated 13.11.2013.

Status: Less common.

Local Distribution: In all the wetlands. *General Distribution*: India, Indo-Malaysia.

General Distribution: Pantropical.

Murdannia keisak (Hasskarl) Handel-Mazzetti, Symb. Sin. 7: 1243. 1936. *Aneilema keisak* Hasskarl, Commelin. Ind. 32. 1870. **[PLATE 4.15. Figs. 84]**

Perennial herbs with fibrous roots. Rhizomes elongate, horizontal. Stems proximally creeping, ascending distally, branched, to 45 cm; internodes ca. 9 cm, with a line of white hairs. Leaves sessile; sheaths with a line of hairs; lamina spreading or slightly folded, linear-lanceolate or linear-elliptic, acuminate. Inflorescence terminal and axillary, usually 1-flowered; peduncle 1-5 cm with linear bract at middle; sepals narrowly oblong, 6 – 12 mm; petals obovate, pink, blue-purple, or pale blue; fertile stamens 3, staminodes 3, Capsule narrowly ovoid; seeds 4 per valve and slightly flattened.

Flowers & Fruits: August – December

Exiccatus: Gossaihat Beel, **Anurag & AP Das 0438**, dated 17.08.2012; Mahananda Barrage, **Anurag & AP Das 0559**, dated 13.11.2013.

Status: Rare.

Local Distribution: Found in only one wetland of Terai.

General Distribution: India, China, S Japan, Korea

Note: The present collection of this species from Nathuar Char, Bodaganj of Jalpaiguri district forms a new record for the species from India.

AMISCHOTOLYPE Hasskarl, Flora 46: 391. 1863

Amischotolype hookeri (Hasskarl) Hara, Fl. East. Himal. 1: 399. 1966; Noltie, Fl. Bhut. 3(1): 223. 1994; Hajra *et al.*, Fl. Sikkim 1: 167. 1996; *Forrestia hookeri* Hasskarl, Flora 47: 629. 1864; Prain, Beng. Pl. 2: 1086. 1903.

Perennial shrubs. Basal stem prostrate, distally producing erect, 70 – 200 cm high branches. Leaf sheaths overlapping in distal part of stem, densely brownish yellow hirsute; lamina elliptic, 25 – 30 × 5 – 10 cm, apex caudate-acuminate, base cuneate, adaxially sparsely hispid or glabrous, abaxially yellow hirsute along veins. Heads up to 10 flowered; sepals ovate-oblong, 5 × 4 mm, sub-glabrous; petals pale purple to reddish. Capsule ovoid, trigonous, 10 × 5 mm, much longer than persistent sepals, conical-tapered at apex; seeds 4 × 2 mm, rugose.

Flowers & Fruits: June – July

Exiccatus: Gossaihat Beel, **Anurag & AP Das 0276**, dated 14.07.2011; Doumahoni Beel, **Anurag & AP Das 0466**, dated 12.06.2013.

Status: Less common

Local Distribution: Found in almost all wetlands of the study area.

General Distribution: Bangladesh, Bhutan, India, Laos, Myanmar, Nepal, Vietnam.

CYANOTIS D. Don, Prodr. Fl. Nepal. 45. 1825, *nom. cons.*

Key to the species:

- 1a. Cincinni reduced, in axillary fascicles *C. axillaris*
- 1b. Cincinni solitary, rarely terminal and also with flowers in axillary heads 2
- 2a. Spathe-bracts many, compact; capsule obovoid, root not fibrous..... *C. vaga*
- 2b. Spathe-bracts a pair or few; capsule columnar, root fibrous *C. cristata*

Cyanotis axillaris (Linnaeus) D. Don *ex* Sweet, Hort. Brit. 430. 1826; Prain, Beng. Pl. 2: 1085. 1903; Noltie, Fl. Bhut. 3(1): 222. 1994; Hajra *et al.*, Fl. Sikkim 1: 167. 1996; Cook, Aqua. Wetl. Pl. Ind. 87, 1996. *Commelina axillaris* Linnaeus, Sp. Pl. 1: 42. 1753; *Cyanotis axillaris* (Linnaeus) Schultes *f.*, Syst. Veg. 7(2): 1154. 1830. *Tonningia axillaris* (Linnaeus) Kuntze, Revis. Gen. Pl. 2: 722. 1891. *Cyanotis disrumpens* Hasskarl, Commelin. Ind. 105. 1870.

[PLATE 4.16. Figs. 87]

Annual herbs; roots fibrous. Stems creeping, branched, 25 – 40 cm. Leaves all cauline; lamina linear, 20 – 60 × 5 – 7 mm, abaxially glabrous. Cincinni reduced, in axillary fascicles of 3 – 6 flowers; sepals free, linear spatulate, abaxially hirsute; petals blue; filaments blue, lanate. Capsule oblong, trigonous.

Flowers & Fruits: June – July

Exiccatus: Gossaihat Beel, **Anurag & AP Das 0249**, dated 14.07.2011; Doumahoni Beel, **Anurag & AP Das 0472**, dated 12.06.2013.

Status: Very common

Local Distribution: Found in almost all wetlands of the study area.

General distribution: Cambodia, India, Indonesia, Laos, Malaysia, Myanmar, Philippines, Sri Lanka, Thailand, Vietnam; Oceania.

Cyanotis vaga (Loureiro) J.A. & J.H. Schultes in R. & S., Syst. Veg. 7: 1153. 1830; Hara *et al*, Enum. Fl. Pl. Nepal 1: 82. 1978; Noltie, Fl. Bhut.3(1): 220. 1994; Hajra & Verma, Fl. Sikkim 1: 169. 1996. *Tradescantia vaga* Loureiro, Fl. Cochinch. 193. 1790. *Cyanotis barbara* D. Don, Prodr. Fl. Nepal 46. 1825; Hooker *f.*, Fl. Brit. India 6: 385. 1894.

Perennial herbs, bulbiferous. Bulbs globose. Stem usually branching from base, 10–50 cm. Leaves all cauline; lamina linear to lanceolate, 4–12 cm × 0.3–1.5 cm, abaxially glabrous or sparsely pubescent. Cincinni solitary, rarely terminal and also with flowers in axillary heads; peduncle absent or very short; bracts 7 mm; sepals connate at base, oblong-lanceolate, 5 mm, abaxially white hirsute; petals blue-purple, 8 mm; filaments blue, lanate. Capsules obovoid, trigonous, 2.5 mm; seeds gray-brown, striate and finely reticulate.

Flowers & Fruits: July – October

Exiccatus: Gossaihat Beel, **Anurag & AP Das 0272**, dated 14.07.2011; Doumahoni Beel, **Anurag & AP Das 0478**, dated 12.06.2013.

Status: Common.

Local Distribution: Found in almost all wetlands of the study area.

General Distribution: Bhutan, India, Laos, Myanmar, Nepal, Sikkim, Thailand, Vietnam.

Cyanotis cristata (Linnaeus) D. Don, Prodr. Fl. Nepal. 46. 1825; Prain, Beng. Pl. 2: 1085. 1903; Noltie, Fl. Bhut. 3(1): 222. 1994; Hajra *et al.*, Fl. Sikkim 1: 169. 1996; Cook, Aqua. Wetl. Pl. Ind. 87, 1996. *Commelina cristata* Linnaeus, Sp. Pl. 1: 42. 1753; *Tonningia cristata* (Linnaeus) Kuntze, Revis. Gen. Pl. 2: 722. 1891. *Tradescantia cristata* (Linnaeus) Linnaeus, Syst. Nat. 12(2): 233. 1767. *Cyanotis imbricata* (Roxburgh) Kunth, Enum. Pl. 4: 103. 1843. *Tradescantia imbricata* Roxburgh, Fl. Ind. 2: 120. 1824.

Annual herbs; roots fibrous. Stems creeping, often branched, 10–30 cm. Leaves all cauline; lamina oblong, lanceolate to narrowly elliptic, 2–8 × 1–2 cm, abaxially glabrous or sparsely arachnoid. Cincinni often solitary, terminal or also axillary; peduncle 3–9 cm; bracts 1 cm; sepals connate at base, linear-lanceolate to oblanceolate, 5 mm, abaxially hirsute along midvein and at margin; petals blue or purple, 4–5 mm; filaments blue, lanate. Capsule columnar, trigonous, 2.5 mm; seeds gray-brown, pitted.

Flowers & Fruits: July – October

Exiccatus: Gossaihat Beel, **Anurag & AP Das 0243**, dated 12.05.2009; Doumahoni Beel, **Anurag & AP Das 0595**, dated 12.06.2013.

Status: Very common.

Local Distribution: Found in almost all wetlands of the study area.

General Distribution: Bhutan, Cambodia, India, Indonesia, Laos, Malaysia, Myanmar, Philippines, Sikkim, Sri Lanka, Thailand, Vietnam.

FLOSCOPA Loureiro, Fl. Cochinch. 1: 189, 192. 1790

Floscopa scandens Loureiro, Fl. Cochinch. 193. 1790; Fl. Brit. Ind. 6: 390. 1892; Prain, Beng. Pl. 2: 1086. 1903; Fl. E. Himal. 1: 401. 1966; Hara *et al.*, Enum. Fl. Pl. Nepal 1: 82. 1978; Das & Chanda, Trans. Bose Res. Inst. 51(4): 114. 1987; Karthikeyan *et al.*, Fl. Ind. Enum. Mono. 27. 1989; Noltie, Fl. Bhut. 3(1): 225. 1994; Fl. Sikkim 1: 170. 1996; Bora & Kumar, Fl. Divers. Assam 362. 2003. *Tradescantia paniculata* Roxburgh, Pl. Coromandel. 2: 6, t. 109. 1799 & Fl. Ind. 1.119. 1820.

[PLATE 4.15. Figs. 83]

Perennial herbs. Stems 50–70 cm, simple, prostrate proximally. Plants glandular pubescent throughout with multi-cellular hairs or hairy only on leaf sheaths and inflorescences, sometimes sheaths hairy only on 1 side. Leaves usually sessile or with short, winged petiole; lamina elliptic to lanceolate, 5–10 × 1–3 cm, adaxially with scaly processes. Inflorescences several, terminal and axillary, densely glandular with long hairs; peduncle nearly absent; pedicels very short; sepals shallowly boat shaped; petals blue–purple; fertile stamens 6; filaments glabrous. Capsules ovoid, compressed, 2 × 2 mm; seeds gray-blue, semi-ellipsoid, 2 mm, shallowly radiate striate.

Flowers & Fruits: July – November

Exiccatus: Gajoldoba, **Anurag & AP Das 0088**, dated 12.09.2010; Mahananda Barrage, **Anurag & AP Das 0594**, dated 13.11.2013.

Status: Very common.

Local Distribution: In all the wetland of Terai & Duars

General Distribution: India, Bhutan, Laos, Myanmar, Thailand, Vietnam; Oceania.

PONTEDERIACEAE Kunth, Nov. Gen. Sp. 1(3): 265.1816**Key to the Genera:**

- 1a. Perianth zygomorphic; one tepal with a large eye-mark ***Eichhornia***
 1b. Perianth actinomorphic; tepal with no eye-mark ***Monochoria***

EICHHORNIA Kunth, Gen. Nov. 3. 1842

Eichhornia crassipes (Martius) Solms in A.P. de Candolle, Mon. Phan. 4: 527. 1832; Subramanym, Aqua. Angiosp. 70. 1962; Deb, Fl. Tripu. 2: 390. 1983; Bora & Kumar in Flor. Div. Ass. 358. 2003. *Pontederia crassipes* Martius, Nov. Gen. Pl. 9. t. 4. 1823. **[PLATE 4.10. Figs. 50]**

Vernacular name: *Kachuri pana*

Floating herbs. Leaves radical, rhomboid or ovate; petioles spongy, swollen into bladders. Flowers pinkish violate, in many flowered spikes. Perianth zygomorphic; odd tepal with a large eye-mark. Stamens 6, unequal; filaments hairy.

Flowers & Fruits: July – January

Exiccatus: Gossaihat Beel, **Anurag & AP Das 0245**, dated 14.07.2011; Mahananda Barrage, **Anurag & AP Das 0327**, dated 26.11.2011.

Status: Abundant.

Local Distribution: Found in all wetlands of the study area.

General Distribution: India; Native to Brazil, now Pantropic.

MONOCHORIA C. Presl, Reliq. Haenk. 1: 127. 1827**Key to the species:**

- 1a. Lamina triangular with sagittate or hastate base..... *M. hastata*
 1b. Lamina broadly ovate to oblong, base obtuse..... *M. vaginalis*

Monochoria hastata (Linnaeus) Solms in A.P. de Candolle, Mon. Phan.4: 523. 1883; Chauhan *et al.* in Hajra, Fl. Namd. 332. 1996; Bora & Kumar, Flor. Div. Ass. 358. 2003. *Pontederia hastata* Linnaeus, Sp. Pl. 288. 1753. *Monochoria hastaefolia* Presl, Rel. Haenk. 1: 128. 1827; Hooker *f.*, Fl. Brit. Ind. 6: 362. 1882; Prain, Beng. Pl. 2: 1079. 1903. **[PLATE 4.3. Figs. 6]**

Vernacular name: *Daam-ghaash*

Aquatic herbs; erect or oblique. Lamina sagittate, hastate or cordate, acute, or obtuse; petioles sheathing. Flowers bluish, long pedicelled, in many flowered racemes; perianth actinomorphic; 1 stamen large, 5 smaller; ovary ellipsoid; stigma shortly 3-lobed. Capsule ellipsoid, seeds oblong.

Flowers & Fruits: July – December

Exiccatus: Doumahoni Beel, **Anurag & AP Das 0550**, dated 27.08.2013; Gossaihat Beel, **Anurag & AP Das 0227**, dated 14.07.2011

Status: Abundant.

Local Distribution: Found almost in all wetlands of the study area.

General Distribution: Throughout India; China, Malaysia, Sri Lanka, S.E. Asia.

Monochoria vaginalis (Burman *f.*) C. Presl *ex* Kunth, Enum. 4: 134. 1834; Hooker *f.*, Fl. Brit. Ind. 6: 363. 1892; Prain, Beng. Pl. 2: 1079. 1903. *Pontederia vaginalis* Burman *f.*, Fl. Ind. 80. 1768. *Monochoria vaginalis* var. *plantaginea* (Roxburgh) Solms in A. DC., Monog. Phan. 4: 524. 1883; Hooker *f.*, Fl. Brit. Ind. 6: 363. 1892. **[PLATE 4.3. Figs. 5]**

Vernacular name: *Daam-ghaash*

Annual, aquatic herbs. Leaves in basal rosette or shortly decumbent stem, blades lanceolate to ovate, acuminate, usually shallowly to deeply cordate, petiole usually exceeding scape. Racemes sub-umbellate, erect at first, strongly deflected in fruit. Flowers pedicellate; tepals 6, blue; ovary 3-locular; ovules many. Capsule oblong.

Flowers & Fruits: September – May

Exiccatus: Gajoldoba, **Anurag & AP Das 0153**, dated 12.09.2010; Doumahoni Beel, **Anurag & AP Das 0204**, dated 02.02.2011.

Status: Abundant.

Local Distribution: Found in all wetlands of the study area.

General Distribution: India, Bangladesh, Sri Lanka, Malay Island, China, Japan, Tropical Africa.

Order: Poales

CYPERACEAE A. L. de Jussieu, Gen. Pl. 26. 1789. *nom. cons.*

Key to the Genera:

- 1a. Leaves blade absent, only basal tubular sheathe present 2
 1b. Leaves blade present 3

- 2a. Spikelets capitate, glumes ovate, concave, acute, ovoid to cylindrical-oblong ... *Schoenoplectiella*
 2b. Spikelets elliptical or ovoid, Glumes boat-shaped *Eleocharis*
 3a. Flowers bisexual.....4
 3b. Flowers unisexual..... *Carex*
 4a. Inflorescence a single globose terminal heads *Kyllinga*
 4b. Inflorescence branched or more than 2 heads 5
 5a. Perianth of hypogynous bristles or scales present..... 6
 5b. Perianth of hypogynous bristles or scales absent 7
 6a. Leaves throughout stems, hairy, glumes hairy *Fuirena*
 6b. Leaves basal, glabrous, glumes glabrous 8
 7a. Flowering glumes all distichous 9
 7b. Flowering glumes spirally arranged rarely distichous 10
 8a. Glumes broadly elliptic concave *Actinoscirpus*
 8b. Glumes ovate to ovate lanceolate *Rhynchospora*
 9a. Leaf sheathe long white hairy at apex *Bulbostylis*
 9b. Leaf sheathe glabrous *Fimbristylis*
 10a. Stigma 2, nut biconvex *Pycreus*
 10b. Stigma 3, nut trigonous.....*Cyperus*

BULBOSTYLIS Kunth, Enum. Pl. 2: 205. 1837

Bulbostylis densa (Wallich) Handle-Mazzetti ex Karsten & Schenck, Vegetationsbilder 20.7: 16. 1930; Noltie, Fl. Bhut. 3(1): 298. 1994; Hajra *et al.*, Fl. Sikkim 1: 198. 1996; *Scirpus densus* Wallich, Roxburgh, Fl. Ind. 1: 231. 1820. *Bulbostylis capillaris* var. *trifida* (Nees) C.B. Clarke in Hooker *f.*, Fl. Brit. Ind. 6: 652. 1893; Prain, Beng. Pl. 2: 1156. 1903.

Slender, marshy, annual sedges. Stems glabrous, triangular. Leaves filiform, shorter than stem, glabrous. Umbels with cluster of 1 – 7 spikelets; bracts shorter, 2 – 3. Spikelets few, solitary. Glumes ovate-cymbiform, compressed, glabrous, brown. Stamens 2. Achene obovoid, trigonous, surface light yellow, granular and slightly transversely wrinkled.

Flowers & Fruits: September – March

Exiccatus: Mahananda Barrage, *Anurag & AP Das 0312*, dated 26.11.2011; Gajoldoba, *Anurag & AP Das 0342*, dated 08.03.2012.

Status: Common.

Local Distribution: Throughout the study area.

General Distribution: India, Bangladesh, Nepal, China, Japan, Africa.

CYPERUS Linnaeus, Sp. Pl. 1: 44. 1753

Key to the Species:

- 1a. Glumes mucronate 2
 1b. Glumes not mucronate 3
 2a. Spikelets squarrose; nut oblong – ovoid *C. squarrosus*
 2b. Spikelets not squarrose; nut broadly ovoid *C. compressus*

- 3a. Inflorescence of 3 – 10 whitish spikelets in single head *C. niveus*
- 3b. Inflorescence of many Spikelets in two-more heads 4
- 4a. Spikelets arranged in dense spherical heads 5
- 4b. Spikelets arranged in umbel or linear heads.....6
- 5a. Bracts 2 – 3 *C. difformis*
- 5b. Bracts 4 – 8 *C. compactus*
- 6a. Spikes densely cyllindric 7
- 6b. Spikes otherwise, not cyllindric 8
- 7a. Spikelets linear, very narrow up to 0.8 mm wide *C. cyperoides*
- 7b. Spikelets over 1 mm wide *C. digitatus*
- 8a. Spikelets oblong oval, under 10 mm long, glumes under 1.5 mm long 9
- 8b. Spikelets linear to oblong elliptic over 10 mm long, glumes over 1.8 mm long 11
- 9a. Spikelets arranged irregularly *C. iria*
- 9b. Spikelets arranged regularly/uniformly 10
- 10a. Spikelets over 1.3 mm wide *C. halpan*
- 10b. Spikelets under 1mm wide *C. tenuispica*
- 11a. Plants stoloniferous 12
- 12a. Umbels compound, rachilla not winged *C. pilosus*
- 12b. Umbels simple, rachilla winged *C. rotundus*
- 11b. Plants rhizomatous..... 13
- 13a. Stem triquetrous, leaves shorter or equalling than culms, stigma 3 *C distans*
- 13b. Stem trigonus, leaves as long as culms, stigmas 2 14
- 14a. Nuts bi-convex, ellipsoid, finely reticulate *C. michelianus*
- 14b. Nuts not bi-convex, broadly ovoid, not reticulate *C. corymbosus*

Cyperus digitatus Roxburgh, Fl. Ind. 1: 205. 1820; Hooker *f.*, Fl. Brit. Ind. 6: 618. 1893; Prain, Beng. Pl. 2: 862. 1903. Rao & Verma, Cyper. NE. Ind. 20. 1982; Noltie, Fl. Bhut. 3(1): 318. 1994.

Rhizomatous, tall, annual, marshland sedges. Leaves equaling or shorter than stem, lamina 5 – 10 mm wide, coriaceous. Spikelets sub-terete, yellowish brown; wings of rhachilla deciduous. Glumes linear, apicular. Stigmas 3. Nuts ellipsoid, trigonous.

Flowers & Fruits: August – December

Exiccatus: Gajoldoba, **Anurag & AP Das 0094**, dated 12.09.2010; Mahananda Barrage, **Anurag & AP Das 0579**, dated 13.11.2013.

Status: Common.

Local Distribution: Throughout the study area.

General distribution: India; Tropical countries.

Cyperus distans Linnaeus *f*, Suppl. P1. 103. 1781; Hooker *f*, Fl. Brit. Ind 6: 607. 1893; Noltie, Fl. Bhut. 3(1): 314. 1994; Hajra *et al.*, Fl. Sikkim 1: 214. 1996; Prain, Beng. Pl. 2: 1143. 1903.

Perennial sedges, usually rhizomatous. Stems solitary or tufted, trigonous, up to 1 m high. Leaves shorter or as long as stem. Umbel compound, large; primary rays 6 – 10, up to 25 cm long; secondary rays fewer; bracts 3 – 6 usually overtopping the umbel, leaf-like. Spikelets spicate, narrowly linear, erect or spreading 10 – 20 flowered; rachilla slender, scarcely winged. Glumes long, elliptic – oblong, redish-brown, margins membranous, obtuse, slightly imbricate. Stamens 3. Achene oblong, trigonous, brown.

Flowers & Fruits: August – December

Exiccatus: Gajoldoba, **Anurag & AP Das 0121**, dated 12.09.2010; Mahananda Barrage, **Anurag & AP Das 0575**, dated 13.11.2013.

Status: Common.

Local Distribution: Throughout the study area.

General distribution: Tropical and sub-tropical regions of the old world.

Cyperus rotundus Linnaeus, Sp. Pl. 45. 1753; Hooker *f*, Fl. Brit. Ind. 6: 598. 1893; Noltie, Fl. Bhut. 3(1): 316. 1994; Prain, Beng. Pl. 2: 1145. 1903; Hajra *et al.*, Fl. Sikkim 1: 217. 1996; Guha Bakshi, Fl. Mur. Dist. 358. 1984; Bora & Kumar, Fl. Div. Ass. 382. 2003.

Vernacular Name: *Mutha ghas* (Bengali)

Perennial sedges; rhizome slender, elongate, bearing hard, ovoid, black, fragrant tubers. Stems trigonous. Leaves shorter than or longer than stem, acuminate. Umbels simple or compound; rays 2 – 9, bearing short spikes of spreading spikelets; bracts usually 3, shorter or longer than inflorescence; spikelets linear-lanceolate, many-flowered redish-brown; rachilla winged. Glumes ovate to elliptic, imbricate, obtuse or obtuse or apiculate. Achene broadly obovoid, trigonous, dark-brown.

Flowers & Fruits: July – December

Exiccatus: Mahananda Barrage, **Anurag & AP Das 0299**, dated 26.11.2011; Doumahoni Beel, **Anurag & AP Das 0467**, dated 12.06.2013.

Status: Common.

Local Distribution: Throughout the study area.

General distribution: Throughout India; warm countries.

Cyperus difformis Linnaeus, Sp. Pl. 46. 1753; Rao & Verma, Cyper. NE. Ind. 12. 1982; Guha Bakshi, Fl. Mur. Dist. 353. 1984. Hooker *f*, Fl. Brit. Ind. 6: 605. 1893; Prain, Beng. Pl. 2: 859. 1903; Noltie, Fl. Bhut. 3(1): 310. 1994; Hajra *et al.*, Fl. Sikkim 1: 214. 1996.

Vernacular name: *Jawna*

Annual, tufted sedges; roots filiform. Leaves much shorter than stem, acuminate. Umbels compound or contracted into a head; rays 3 – 8; bracts 2 – 3, leaf-like. Spikelets many, brown, 10-many flowered; rachilla slender, winged. Glumes closely imbricate, obovate, concave, apex rounded. Achene nearly as long as the glume, elliptical or obovoid, yellow or pale brown; style much shorter than achene.

Flowers & Fruits: Throughout the year

Exiccatus: Mahananda Barrage, **Anurag & AP Das 0019**, dated 12.05.2010; Gossaihat Beel, **Anurag & AP Das 0290**, dated 14.07.2011.

Status: Common.

Local Distribution: Throughout the study area.

General distribution: India, Bangladesh, Sri Lanka.

Cyperus pilosus Vahl, Enum. Pl. 2: 534.1805; Hooker *f.*, Fl. Brit. Ind. 6: 609.1893; Prain, Beng. Pl. 2:1143.1903; Rao & Verma, Cyper. NE. Ind. 17.1982; Noltie, Fl. Bhut. 3(1):315.1994; Hajra *et al.*, Fl. Sikkim 1:216.1996. *Cyperus obliquus* Nees *ex* Wight, Contrib. Bot. Ind. 86.1834. *Cyperus pilosus* var. *obliquus* (Nees) C.B. Clarke in Jour. Linn. Soc. 21:151.1884 & Fl. Brit. Ind. 6: 610.1893; Noltie, Fl. Bhut. 3(1): 316.1994. *Cyperus obliquus* Nees *ex* Wt., Contrib. Bot. Ind. 86.1834. *C. pilosus* var. *polyantha* C.B. Clarke in Jour. Linn. Soc. 21:148.1884 & Fl. Brit. Ind. 6:610.1893.

Perennial sedge; rhizome slender, stoloniferous. Stems triquetrous. Leaves shorter than or as long as the stem, up to 10 mm wide. Umbels compound; primary rays 2 – 10 up to 20 cm long; rachis of spike pilose; bracts overtopping the umbel. Spikelets linear-lanceolate, 10 – 20 flowered; rachilla not winged. Glumes broadly ovate, obtuse and apiculate with sharp keel pale or reddish-brown. Stamens 3. Achene obovate-elliptic, trigonous, black, granular.

Flowers & Fruits: August – March

Exiccatus: Gajoldoba, **Anurag & AP Das 0140**, dated 12.09.2010; Mahananda Barrage, **Anurag & AP Das 0326**, dated 26.11.2011.

Status: Common.

Local Distribution: Throughout the study area.

General Distribution: India, Tropical Africa, Asia, Australia.

Cyperus compressus Linnaeus, Sp. Pl. 46. 1753; Hooker *f.*, Fl. Brit. Ind. 6: 605. 1893; Noltie, Fl. Bhut. 3(1): 310. 1994; Hajra *et al.*, Fl. Sikkim 1: 214. 1996; Prain, Beng. Pl. 2: 1143. 1903. *Cyperus pectiniformis* Roemer & Schultes, Mantissa 2: 128. 1824; Guha Bakshi, Fl. Mur. Dist. 352. 1984.

Glabrous annual sedges; roots fibrous; stems tufted, erect or rarely prostrate, 3- gonous. Leaves shorter, sometimes longer than the stem, acuminate. Bracts 3 – 7, leafy. Spikelets digitately clustered, much compressed; glumes ovate-lanceolate, closely imbricate; Keel produced into a laterally compressed. Nuts obovate, dark- brown or brown or brownish – black.

Flowers & Fruits: July – December

Exiccatus: Gossaihat Beel, **Anurag & AP Das 0236**, dated 14.07.2011; Mahananda Barrage, **Anurag & AP Das 0565**, dated 13.11.2013.

Status: Common.

Local Distribution: Throughout the study area.

General Distribution: Throughout India; Sri Lanka, Tropical Africa, Asia, America.

Cyperus cyperoides (Linnaeus) O. Kuntze, Revis. Gen. Pl. 3(2): 333. 1898; Noltie, Fl. Bhut. 3(1): 307. 1994. *Scirpus cyperoides* Linnaeus, Mantissa Pl. 181. 1771; Hajra *et al.*, Fl. Sikkim 1: 230. 1996; *Mariscus sieberianus* Nees *ex* Steudel, Synops. Pl. Glum.2: 61. 1855; Prain, Beng. Pl. 2: 1147. 1903.

Slender sedges, up to 50.0 cm tall. Leaves equaling or exceeding stem. Spikelets closely and spirally arranged in cylindrical pedunculate spikes in a simple terminal umbel with 3 – 5 foliaceous bracts. Spikelets erect, linear-subulate, in fruit spreading at right angles to the rachis, semi-fusiform. Nuts brown, curved-oblong, 3-quetrous.

Flowers & Fruits: April – August

Exiccatus: Mahananda Barrage, **Anurag & AP Das 0012**, dated 12.05.2010; Gossaihat Beel, **Anurag & AP Das 0433**, dated 17.08.2012.

Status: Common.

Local Distribution: Throughout the study area.

General Distribution: Tropical and sub-tropical regions of the old world.

Cyperus halpan Linnaeus, Sp. Pl. 45. 1753 (ut “*haspan*”); Hooker *f.*, Fl. Brit. Ind. 6: 600. 1892; Noltie, Fl. Bhut. 3(1): 313. 1994; Hajra *et al.*, Fl. Sikkim 1: 215. 1996; Prain, Beng. Pl. 2: 1142. 1903.

Perennial, tufted, rhizomatous annual erect sedges. Stems solitary, compressed-trigonous. Lamina broad, spreading. Spikelets linear-lanceolate. Primary rays 3 – 8, longest 1 – 6 cm, secondary to 1 cm, involucre bracts 2 – 3, leafy, lowest exceeding and the other shorter or equaling inflorescence. Spikelets sessile, digitately arranged, narrowly lanceolate-ovoid with 5 – 25 florets. Glumes ovate-oblong. Stamen-1; style bifid. Nuts shortly apiculate.

Flowers & Fruits: May – November

Exiccatus: Mahananda Barrage, **Anurag & AP Das 0042**, dated 12.05.2010; Gossaihat Beel, **Anurag & AP Das 0459**, dated 17.08.2012.

Status: Common.

Local Distribution: Throughout the study area.

General Distribution: India, Tropical, sub-tropical and temperate regions of the old world.

Cyperus iria Linnaeus, Sp. Pl. 45. 1753; Hooker *f.*, Fl. Brit. Ind. 6: 606. 1893; Noltie, Fl. Bhut. 3(1): 312. 1994; Hajra *et al.*, Fl. Sikkim 1: 215. 1996; Prain, Beng. Pl. 2: 1143. 1903; Guha Bakshi, Fl. Mur. Dist. 356. 1984.

Erect, annual sedges. Roots fibrous; stem erect, trigonous. Umbel decomposed of many primary rays bearing fascicled umbellous of many interrupted spikes of 5 – 20 spikelets, compressed, 6-flowered, greenish brown. Glumes loosely or scarcely imbricate, 3 – 5 nerved. Obovate, apex sub-rounded, mucronate. Nuts brown, ovate triquetrous, apex mucronate.

Flowers & Fruits: August – March

Exiccatus: Doumahoni Beel, **Anurag & AP Das 0023**, dated 02.02.2011; Gossaihat Beel, **Anurag & AP Das 0458**, dated 17.08.2012.

Status: Common.

Local Distribution: Throughout the study area.

General Distribution: India; Southern Hemisphere.

Cyperus niveus Retzius Obs. fasc 5: 12. 1789; Hooker *f.*, Fl. Brit. Ind. 6: 601. 1893; Prain, Beng. Pl. 2: 860. 1903; Rao & Verma, Cyper. NE. Ind. 14. 1982; Noltie, Fl. Bhut. 3(1): 309. 1994; Hajra *et al.*, Fl. Sikkim 1: 216. 1996.

Perennial, tufted, glabrous, erect sedges. Rhizomes creeping, woody, short. Leaves shorter than the stem, narrowly linear. Spikelets 3 – 10 in one head, oblong-elliptic, compressed, whitish. Glumes ovate-lanceolate, compressed. Stamens 3. Nut obovoid, trigonous, dark brown.

Flowers & Fruits: May – September.

Exiccatus: Mahananda Barrage, **Anurag & AP Das 0030**, dated 12.05.2010; Gossaihat Beel, **Anurag & AP Das 0232**, dated 14.07.2011.

Status: Common.

Local Distribution: Throughout the study area.

General Distribution: India (throughout), South Asia, Afghanistan, China.

Cyperus squarrosus Linnaeus, Cent. Pl. 2: 6. 1756. *Cyperus aristatus* Rottboell, Descr. & Icon. Pl. 23, t. 6, f. 1. 1773; Hooker f., Fl. Brit. Ind. 6: 606. 1893; Prain, Beng. Pl. 2: 860. 1903.

Annual, tufted, annual sedges. Stem triquetrous. Inflorescence usually reduced to a single hemispherical head; spikelets oblong-linear, strongly compressed; glumes elliptic-ovate, reddish brown; stamen 1. Nuts oblong-obovate to almost linear, stipitate, grayish brown.

Flowering & Fruiting: June – February.

Exiccatus: Mahananda Barrage, **Anurag & AP Das 0077**, dated 12.05.2010; Doumahoni Beel, **Anurag & AP Das 0193**, dated 02.02.2011.

Status: Common.

Local Distribution: Throughout the study area

General Distribution: India (major part), Sri Lanka, Tropical Africa.

Cyperus tenuispica Steudel, Syn. Pl. Cyperac. 11. 1855; Kükenthal, in Engler, Pflanzenr. IV. 20:101.1936; Kern, in Van Steenis, Flora Malesiana 7, 3: Fig. 58. 1974; Haines & Lye, Sedges and Rushes East Afr. 313 – 314. 1983; Noltie, Fl. Bhut. 3(1): 314. 1994

Annual, small tufts sedges. Stem 3 – 5-angular, smooth. Leaves shorter than stem; sheaths green or red, soft, lower blade-less, mouth oblique or, when leaf blade present, rather straight; ligule 0; Inflorescence a compound anthelodium; cluster of spikes at the tip of all of the secondary branches, with 2 – 10 sessile spikes; compressed, with 10 – 30 glumes. Stamens 1 or 2, connective tip smooth. Nuts almost spherical to obovoid, obtusely trigonous, white or yellowish, papillose or tuberculate.

Flowers & Fruits: September – January

Exiccatus: Gajoldoba, **Anurag & AP Das 0157**, dated 12.09.2010; Doumahoni Beel, **Anurag & AP Das 0215**, dated 02.02.2011.

Status: Rare.

Local Distribution: Throughout the study area.

General Distribution: India; Tropical Africa, E. Africa, Sri Lanka.

Cyperus corymbosus Rottboell, Descr. Pl. Rar. 19. 1772; Hooker f., Fl. Brit. Ind. 6: 612. 1893; Rao & Verma, Cyper. NE. Ind. 18. 1982; Prain, Beng. Pl. 2: 1144. 1903; Noltie, Fl. Bhut. 3(1): 315. 1994. *C. diphyllus* Retzius, Observ. bot. 5: 11. 1789; *C. koenigii* Vahl, Enum. Pl. 2: 302. 1805. *C. bengalensis* Sprengel, Neue Entdeck. Pflanzenk. 3: 101. 1822.

Tufted, erect, perennial, sedges. Rhizome horizontal. Stem woody, trigonous. Leaves reduced; sheath green or brown. Inflorescence conical, compound, flat, rachis rectangular, Spike reflexed; fusiform, terete; cymbiform; Glumes loosely imbricating, mucronate. Anther 1 mm long.

Flowers & Fruits: July – October

Exiccatus: Gossaihat Beel, **Anurag & AP Das 0268**, dated 14.07.2011; Doumahoni Beel, **Anurag & AP Das 0506**, dated 12.06.2013.

Status: Abundant.

Local Distribution: Throughout the study area.

General Distribution: India, Pakistan, Sri Lanka, Myanmar, Africa, America.

Cyperus michelianus (Linnaeus) Delile, *Descr. Egypte, Hist. Nat. 3: 50 1813*. *Scirpus michelianum* Linnaeus, Sp. Pl. 1: 52. 1753; Hooker f., Fl. Brit. Ind. 6: 662. 1893; Prain, Beng. Pl. 2: 873. 1903; Datta & Majumdar, Bull. Bot. Soc. Beng. 20(2); 35. 1966. *Cyperus diffuses* Roxb. Fl. Ind. 1: 189. 1832.

Small, annual, tufted sedge; root fibrous. Stem triquetrous, leafy towards and base. Leaves as long as the stem, linear, acute. Spikelets numerous, in dense compound terminal heads. Glumes elliptic. Nut fusiform.

Flowers & Fruits: July – January

Exiccatus: Gajoldoba, **Anurag & AP Das 0158**, dated 12.09.2010; Doumahoni Beel, **Anurag & AP Das 0225**, dated 02.02.2011.

Status: Common.

Local Distribution: Throughout the study area.

General distribution: India (throughout), South Asia, South Europe to Japan.

Cyperus compactus Retzius, Obs. Bot. 5: 10. 1789; Noltie, Fl. Bhut. 3(1): 308. 1994; *C. dilutus* Vahl, Enum. Pl. 2: 357. 1805. *Cyperus spinulosus* Roxburgh, Fl. Ind. 1: 207. 1820. *Mariscus compactus* (Retzius) Boldingh., Zakf. Landb. Java. 77. 1916; Hajra *et al.*, Fl. Sikkim 1: 228. 1996. *M. microcephalus* J. Presl & C. Presl, Rel. Haenk. 1: 182. 1828; Hooker f., Fl. Brit. Ind. 6: 624. 1893; Prain, Beng. Pl. 2: 1147. 1903.

Tufted, rhizomatous, perennial, erect sedges, stem spongy. Leaves linear, acuminate; lamina 5 – 6 mm wide, coriaceous, margin serrate, sheath reddish. Inflorescence 2 × compound, involucre bracts 4 – 8; spikelets narrowly linear, reddish brown. Glumes imbricate. Nuts trigonous.

Flowers & Fruits: August – December

Exiccatus: Gajoldoba, **Anurag & AP Das 0142**, dated 12.09.2010; Mahananda Barrage, **Anurag & AP Das 0596**, dated 13.11.2013.

Status: Common.

Local Distribution: Throughout the study area.

General distribution: India (throughout), China, Malaysia, Sri Lanka.

ELEOCHARIS R. Brown, Prodr. 224. 1810

Key to the Species:

- 1a. Erect, more than 1m high; spikes over 30 mm long *E. tetraquetra*
- 1b. Erect, less than 1m high; spikes less than 20 mm long 2
- 2a. Styles 2-fid, nuts compressed 3
- 2b. Styles 3-fid, nuts trigonous or obovoid 5

- 3a. Rhizome short or absent4
 3b. Rhizome creeping; perianth bristles brown rusty *E. palustris*
 4a. Perianth bristles glistening, white *E. atropurpurea*
 4b. Perianth bristles brown or rusty *E. geniculata*
 5a. Nuts smooth; spikes 7 – 10 x 3.5 – 4 mm *E. congesta*
 5b. Nut coarse; spikes 4 x 3 mm *E. retroflexa*

Eleocharis congesta D. Don, Prodr, Fl. Nepal 41. 1825; Hooker f., Fl. Brit. Ind. 6: 630. 1893; Noltie, Fl. Bhutan 3(1): 286. 1994; Prain, Beng. Pl. 2: 1149. 1903. *Eleocharis afflata* Steudel, Syn. Pl. glum. 2: 76. 1855.

Annual or perennial, marshy sedges; stems up to 35.0 cm long, triangular, ridged. Sheath apex truncate, apiculate. Spikelets oblong, terete, sub-acute, purplish; glumes loosely imbricate, oblong; stigmas 3. Nuts 0.15 cm long, yellowish green. Bristles 7, white or brown.

Flowers & Fruits: July – December

Exiccatus: Gossaihat Beel, **Anurag & AP Das 0228**, dated 14.07.2011; Mahananda Barrage, **Anurag & AP Das 0566**, dated 13.11.2011.

Status: Common.

Local Distribution: Throughout the study area.

General distribution: India, Sri Lanka, Malaysia.

Eleocharis retroflexa (Poiret) Urban subsp. ***chaetaria*** (Roemer & Schultes) Koyama, Bull. Nat. Sci. Mus. Tokyo 17: 68. 1974; Noltie, Fl. Bhut. 3(1): 287. 1994. *Eleocharis chaeraria* Roemer & Schultes, Syst. 2: 154. 1871; Prain, Beng. Pl. 2: 1149. 1903.

A tufted annual, marshy sedges. Stems filiform, recurved. Leaves reduced to sheaths. Spikelets elliptical or ovoid, purple; glumes 6 – 8, boat-shaped, obtuse or subacute, sides membranous, purple-tinged, pale-brown; style-base pyramidal, 3 lobed; style 3-fid. Achenes obovate, trigonous, trabeculate.

Flowers & Fruits: July – November

Exiccatus: Gajoldoba, **Anurag & AP Das 0081**, dated 12.09.2010; Gossaihat Beel, **Anurag & AP Das 0408**, dated 12.08.2012.

Status: Common.

Local Distribution: Throughout the study area.

General distribution: Tropical to temperate regions of the world.

Eleocharis tetraquetra Nees in Wight, Contr. Bot. Ind. 112. 1834; Noltie, Fl. Bhut. 3(1): 186. 1994; Naskar, Aqu. Semiaquat. Pl. Low. Ganget. Plain, 245. 1990. **[PLATE 4.16. Figs. 85]**

Annual, erect, stoloniferous. Stems rather firm, tetraquetrous. Leaf sheaths 2, reddish brown. Spikelets erect, ovoid – lanceolate, acute; glumes 1-nerved. Perianth bristles 5, subequal, rather coarse; stamens 2; style long; stigmas 3. Nuts narrowly or broadly obovoid, biconvex, smooth, pale brown.

Flowers & Fruits: October – November

Exiccatus: Mahananda Barrage, **Anurag & AP Das 0310**, dated 26.11.2011; Mahananda Barrage, **Anurag & AP Das 0604**, dated 13.11.2013.

Status: Common.

Local Distribution: Throughout the study area.

General distribution: India to Malaysia.

Eleocharis palustris R. Brown, Prodr. 224. 1810; Hooker *f.*, Fl. Brit. Ind. 6: 628. 1893; Noltie, Fl. Bhutan 3(1): 285. 1994; Prain, Beng. Pl. 2: 1149. 1903. *Helocharis palustris* Lindley, syst. 2: 154. 1817 & Syn. Brit. Fl. 280. 1829.

Erect, tufted sedge with creeping rhizome. Stem terete. Leaves absent, sheath truncate. Spikelets ellipsoid or cylindrical. Glumes imbricate, ovate-lanceolate. Nuts broadly obovoid, biconvex.

Flowers & Fruits: November – March

Exiccatus: Doumahoni Beel, **Anurag & AP Das 0169**, dated 02.02.2011; Mahananda Barrage, **Anurag & AP Das 0607**, dated 13.11.2013.

Status: Abundant.

Local Distribution: Throughout the study area.

General Distribution: India (throughout); cosmopolitan except Australia.

Eleocharis atropurpurea (Retzius) Kunth, Enum. 2: 151. 1837; Hooker *f.*, Fl. Brit. Ind. 6: 627. 1893; Noltie, Fl. Bhutan 3(1): 287. 1994; Prain, Beng. Pl. 2: 1149. 1903. *Scirpus atropurpurea* Retzius, Obs. 5: 14. 1788. *Eleocharis atropurpurea* Nees in Wight, Contrib. Bot. Ind. 113. 1834.

Marshy, unbranched sedge. Stem terete, short. Spikelets in terminal heads; glumes imbricate. Nuts black, obtuse, biconvex, tipped with the pale disciform style base; styles 2 fid.

Flowers & Fruits: October – December

Exiccatus: Mahananda Barrage, **Anurag & AP Das 0340**, dated 26.11.2011.

Status: Abundant.

Local Distribution: Throughout the study area.

General Distribution: India; cosmopolitan.

Eleocharis geniculata (Linnaeus) Roemer & Schultes, Syst. Veg. 2: 150. 1817; Svenson, Rhodora 41: 50. 1939. *Scirpus geniculata* Linnaeus, Sp. Pl. 1: 48. 1753. *Eleocharis capitata* R. Brown, Prodr. 225. 1810; Hooker *f.*, Fl. Brit. Ind. 6: 627. 1893; Prain, Beng. Pl. 2: 1149. 1903.

Small, marsh sedges. Roots fibrous; stem terete. Leaf-sheath short, base oblique with acute tip. Spikelets terminal, brown, globose – oblong; glumes imbricate. Nuts brownish, slightly compressed.

Flowers & Fruits: September – December

Exiccatus: Gajoldoba, **Anurag & AP Das 0161**, dated 12.09.2010; Mahanand Barrage, **Anurag & AP Das 0561**, dated 13.11.2013.

Status: Common.

Local Distribution: Throughout the study area.

General Distribution: India and warmer countries of world.

FIMBRISTYLIS Vahl, Enum. Pl. 2: 285. 1805**Key to the Species:**

- 1a. Style 2-fid, nut bi convex 2
 1b. Style 3-fid, nut trigonous 8
 2a. Stem with only one spikelet *F. tetragona*
 2b. Stem with more Spikelets 3
 3a. Spikelets all solitary 4
 3b. Spikelets several, Spikelets linear 5
 4a. Style base long, hairy, glumes short, squarrose *F. squarrosa*
 4b. Style base short, glabrous 6
 5a. Nut conspicuously longitudinally striate 7
 5b. Nut smooth, straw coloured *F. aestivalis*
 6a. Spikelets angular; achene pale brown *F. dichotoma*
 6b. Spikelets terete; achene brown 8
 7a. All spikelets sessile, cluster *F. argentea*
 7b. Most spikelets stalked, not in cluster *F. dipsacea*
 8a. Spikelets Solitary; Spikelets globose *F. quinquangularis*
 8b. Spikelets compound, several 9
 9a. Leaves fertile stem reduced to sheathl spikelets sub globose *F. littoralis*
 9b. Leaves of fertile stem well developed; spikelets lanceolate *F. tenera*

Fimbristylis tetragona R. Brown, Prodr. 226. 1810; Hooker *f.*, Fl. Brit. Ind. 6: 631. 1893; Prain, Beng. Pl., 2: 1150. 1903.

Tufted perennial, marshy, erect sedges. Stems slender, quadrangular. Leaves reduced to sheaths. Inflorescence of one terminal spikelet. Spikelet ovoid or conical. Glumes obovate – oblong, obtuse. Stamens usually 2, rarely 3; style flattened, villous, 2-fid. Achene linear – oblong, pale, tapering towards base, with a slender stalk.

Flowers & Fruits: October – December

Exiccatus: Mahananda Barrage, *Anurag & AP Das 0330*, dated 26.11.2011; Mahananda Barrage, *Anurag & AP Das 0576*, dated 12.11.2013.

Status: Common.

Local Distribution: Throughout the study area.

General distribution: India, Bangladesh, Nepal, Sri Lanka, E. Asia to tropical Australia.

Fimbristylis aestivalis (Retzius) Vahl, Enum. Pl. 2: 288. 1806; Hooker *f.*, Fl. Brit. Ind. 6: 637. 1893; Prain, Beng. Pl., 2: 1151. 1903 Mooney, Suppl. Bot. Bihar & Orissa 149. 1950. *Scirpus aestivalis* Retzius, Obs. Bot. 4: 12. 1786.

Annual, erect, marshy sedges. Stems angular. Leaves setaceous, broad, eligulate; sheath usually villous to hairy, rarely glabrous. Spikelets solitary, oblong – lanceolate, acute; keel 3- nerved, glabrous; stamen 1; stigmas 2. Nuts elliptic or obovate, biconvex, smooth.

Flowers & Fruits: August – February

Exiccatus: Gajoldoba, **Anurag & AP Das 0083**, dated 12.09.2010; Mahananda Barrage, **Anurag & AP Das 0292**, dated 26.11.2011.

Status: Common.

Local Distribution: Throughout the study area.

General distribution: India, china, Japan, Malaysia, N. Australia.

Fimbristylis dichotoma (Linnaeus) Vahl, Enum. Pl. 2: 287. 1806; Noltie, Fl. Bhut. 3(1): 294. 1994; Hajra *et al.*, Fl. Sikkim 1: 220. 1996; Bora & Kumar, Fl. Div. Assam, 385. 2003. *Scirpus dichotomus* Linnaeus, Sp. Pl. 50. 1753. *Fimbristylis diphylla* (Retzius) Vahl, Enum. Pl. 2: 289. 1806; Hooker *f.*, Fl. Brit. Ind. 6: 636. 1893; Prain, Beng. Pl. 2: 1153. 1903.

Annual or perennial, marshy, erect sedges, shortly rhizomatous. Leaves flat, broad. Anthela simple or sub-compound. Spikelets ovate – acute, terete; glumes broadly ovate; stamens 3. Nuts obovate – elliptical, whitish.

Flowers & Fruits: May – November

Exiccatus: Mahananda Barrage, **Anurag & AP Das 0013**, dated 12.05.2010; Doumahoni Beel, **Anurag & AP Das 0468**, dated 12.06.2013.

Status: Common.

Local Distribution: Throughout the study area.

General Distribution: Tropical to temperate zones across the world.

Fimbristylis dipsacea (Rottboøll) Clarke in Fl. Brit. Ind. 6: 635. 1893. *Scirpus dipsaceus* Rottboøll, Descr. & l. c. Pl. 56. t. 12. f. 1. 1773; Prain, Beng. Pl. 2: 1155. 1903. *Echinolytrum dipsaceum* (Rottboøll) Desvux in Jour. Bot. 1: 21. t. 1: 1808. **[PLATE 4.16. Figs. 90]**

Tufted annual sedges. Stem slender. Leaves shorter or as long as stem, filiform. Spikelets in terminal, simple or compound dense umbels, subglobose, echinate, greenish. Bracts several, filiform. Glumes lanceolate, aristate, pale. Stamen 1. Achenes linear – oblong, faintly striolate.

Flowers & Fruits: August – November

Exiccatus: Gossaihat Beel, **Anurag & AP Das 0417**, dated 17.08.2012; Mahananda Barrage, **Anurag & AP Das 0576**, dated 13.11.2013.

Status: Common.

Local Distribution: Throughout the study area.

General Distribution: India, Myanmar, China, Japan, Korea, Malaysia, Australia, S. America.

Fimbristylis squarrosa Vahl, Enum. Pl. 2: 289. 1806; Hooker *f.*, Fl. Brit. Ind. 6: 635. 1883; Prain, Beng. Pl. 2: 1153. 1903.

Plants annual, cespitose, delicate, bases soft; rhizomes absent. Leaves polystichous, spreading to ascending; sheaths entire or ciliate distally, backs hirtellous; ligule absent; lamina linear – filiform. Inflorescences simple or compound, mostly open, ascending – branched, mostly longer than broad.

Spikelets greenish brown or brownish. Stamen 1; styles 2-fid, slender, base flat, long-fimbriate, hairs recurved over achene.

Flowers & Fruits: February – July

Exiccatus: Mahananda Barrage, **Anurag & AP Das 0018**, dated 12.05.2010; Doumahoni Beel, **Anurag & AP Das 0166**, dated 02.02.2011.

Status: Common.

Local Distribution: Throughout the study area.

General Distribution: India; Asia, West Indies (Cuba), Central America (Honduras), South America, Africa, Pacific Islands.

Fimbristylis tenera Schultes, Mantissa. 2: 57. 1824; Hooker *f.*, Fl. Brit. Ind. 6: 642. 1893. *Scirpus tenellus* Roxburgh, Fl. Indica 1: 227. 1820. *F. tenera* var. *oxylepis* (Steudel) Hooker *f.*, Fl. Brit. Ind. 6: 642. 1893; *F. oxylepis* Steudel, Syn. Pl. Glum. 2: 110. 1855.

Tufted annual sedges. Roots fibrous. Stem irregularly angular to compressed, deeply grooved, grey – green, papillose and finely scabrous. Leaves to half of stem length; ligule 0. Inflorescence small anthelodium of 3-5 spikes; stamen 1, stigmas 3. Nut globose to obovoid, stipitate, reticulate and tuberculate, brownish white to brown.

Flowers & Fruits: February – August

Exiccatus: Doumahoni Beel, **Anurag & AP Das 0174**, dated 02.02.2011; Gossaihat Beel, **Anurag & AP Das 0411**, dated 17.08.2012.

Status: Common.

Local Distribution: Throughout the study area.

General Distribution: India, (S E coast, Punjab); Pakistan, Sri Lanka, tropical Africa.

Fimbristylis argentea (Rottboøll) Vahl, Enum. 2: 294. 1805; Hooker *f.*, Fl. Brit. Ind. 6: 640. 1893; Prain, Beng. Pl. 2: 1151. 1903. *Scirpus argenteus* Rottboøll, Progr. 27. 1772.

A tufted, annual, marshy, sedges. Stems striate, trigonous. Leaves shorter than stem, slender, acute, sheath red-dotted. Spikelets in a capitate cluster, sessile, cylindrical, obtuse. Acenes obovoid, biconvex, pale, bordered.

Flowers & Fruits: November – March

Exiccatus: Mahananda Barrage, **Anurag & AP Das 0300**, dated 26.11.2011; Gajoldoba, **Anurag & AP Das 0392**, dated 08.03.2012.

Status: Common.

Local Distribution: Throughout the study area.

General Distribution: India, Australia.

Fimbristylis quinquangularis (Vahl) Kunth, Enum. Pl. 2: 229 1837. *Fimbristylis miliacea* (Linnaeus) Vahl, Enum. 2: 287. 1806; Hooker *f.*, Fl. Brit. Ind. 6: 544. 1893. Prain, Beng. Pl. 2: 869. 1903. *Scirpus miliaceus* Linnaeus, Syst. Veg. (ed. 10) 868. 1759. *Scirpus tetragonus* Poiret, Encyl. Method 6: 767. 1844.

Annual, marshy, glabrous sedges. Stem tufted, erect, slender, compressed. Leaves flat, sheath decomposed, bract filiform. Spikelets brown, sub-globose or ovoid, rachilla stout. Glumes closely

imbricate, yellow, transversely strwanous, faintly nerved, ovate or elliptic. Nuts obovoid, trigonous, brownish yellow.

Flowers & Fruits: Throughout the year

Exiccatus: Gajoldoba, **Anurag & AP Das 0122**, dated 12.09.2010; Mahananda Barrage, **Anurag & AP Das 0580**, dated 13.11.2013..

Status: Common.

Local Distribution: Throughout the study area.

General Distribution: Pantropic.

Fimbristylis littoralis Gaudichaud in Freyn, Voy. Bot. 413, 1826; Blake in Jour. Arn. Arbor. 35: 217. 1954. *Fimbristylis miliacea sensu* Benthum, Al. Aus. 316. 1878; Hooker *f.*, Fl. Brit. Ind. 6: 644. 1893.

Tufted, marshy, erect, annual sedges. Stems up to 50 cm high. Leaf-sheaths subdisitichous, strait with scarious margins. Inflorescence a decomound umbel, filiform. Spikelets subglobose, reddish-brown. Glumes ovate, obtuse, rounded on the back, membranous, brown. Stamens 1-3. Achenes narrowly obovate, trigonous, surface yellow.

Flowers & Fruits: January – December

Exiccatus: Mahananda Barrage, **Anurag & AP Das 0038**, dated 12.05.2010; Gajoldoba, **Anurag & AP Das 0350**, dated 08.03.2012.

Status: Common.

Local Distribution: Throughout the study area.

General Distribution: India (N. E. part & Central and Peninsular part); Myanmar, Malaysia, Tropical Africa, Australia.

FUIRENA Rottboøll, Descr. Icon. Rar. Pl. 70. 1773

Fuirena ciliaris (Linnaeus) Roxburgh, Fl. Ind. 1: 184. 1820; Noltie, Fl. Bhutan 3 (1): 282. 1994. *Scirpus ciliaris* Linnaeus, Mant. Ail. 182. 1771. *Fuirena glomerata* Lamarck, Encyl. 1: 150. 1791; Hooker *f.*, Fl. Brit. Ind. 6: 666. 1893; Prain, Beng. Pl. 2: 1158. 1903.

Erect, marshy annual sedges. Rhizome absent. Stems tufted, striate, sparsely hairy. Leaves linear-lanceolate, acuminate, hairy; sheaths striate, hispid. Spikelets in clusters of 3 – 10, gray – green or brownish, ovoid or oblong; glumes obovate or oblong; keel green, bristles 6; outer 3 short, linear, slightly shorter than the achene; inner 3 quadrate, strongly 3-ribbed, hastate or cordate at base, claw straight. Achenes triquetrous, obovoid, surface smooth, pale.

Flowers & Fruits: October – February

Exiccatus: Doumahoni Beel, **Anurag & AP Das 0166**, dated 02.02.2011; Mahananda Barrage, **Anurag & AP Das 0577**, dated 13.11.2013.

Status: Common.

Local Distribution: Throughout the study area.

General distribution: Cosmopolitan to tropical and sub-tropical regions.

KYLINGA Rottboøll, Descr. Icon. Rar. Pl. 12. 1773, *nom. cons.***Key to the Species:**

- 1a. Keel of achene glume winged; head greenish *K. brevifolia*
 1b. Keel of achene glume not winged; head whitish *K. nemoralis*

Kyllinga brevifolia Rottboøll, Descr. 13. t. 4. f. 3. 1773; Hooker *f.*, Fl. Brit. Ind. 6: 588. 1893; Noltie, Fl. Bhut. 3(1): 324. 1994; Prain, Beng. Pl. 2: 1135. 1903; Hajra *et al.*, Fl. Sikkim 1:227. 1996. *Cyperus brevifolius* (Rottboøll) Hasskarl, Cat. Hort. Bogor. 24. 1844.

Annual, marshy sedges; rhizome slender, creeping, brown scaly. Leaves radical, linear. Inflorescence a single globose terminal head, white. Spikelets ovate-lanceolate. Stamens 2. Nuts ellipsoid, obtuse.

Flowers & Fruits: June – November

Exiccatus: Gajoldoba, **Anurag & AP Das 0095**, dated 12.09.2010; Doumahoni Beel, **Anurag & AP Das 0464**, dated 12.06.2013.

Status: Common.

Local Distribution: Throughout the study area.

General distribution: India, tropical and warm regions.

Kyllinga nemoralis (J. Reinhold & C. Forster) Dandy *ex* Hutchinson, Fl. W. Trop. Afr. 2: 487. 1936; Noltie, Fl. Bhut. 3(1): 325. 1994; Hajra *et al.*, Fl. Sikkim 1: 227. 1996. *Kyllinga monocephala* Rottboøll, Descr. 13, t. 4, F. 4. 1773, *nom. Superfl.*; Prain, Beng. Pl. 2: 1141. 1903. *Thryocephalon nemorale* J. Reinhold & C. Forster, Char. Gen. Pl. 130. 1776. *Cyperus kyllinga* Endlicher, Cat. Hort. Ac.Vindob.1: 94. 1842.

Rhizome slender, marshy, creeping sedges. Stems distant, slender. Leaves linear – lanceolate; bracts 3 – 4. Spikelets 2.5 – 3 mm long. Achene bearing glumes broadly – dotted. Achenes 15 mm long, obovoid, yellowish-brown.

Flowers & Fruits: Throughout the year

Exiccatus: Gajoldoba, **Anurag & AP Das 0093**, dated 12.09.2010; Mahananda Barrage, **Anurag & AP Das 0597**, dated 13.11.2013.

Status: Common.

Local Distribution: Throughout the study area.

General Distribution: Pantropical.

SCHOENOPLECTIELLA Lye, Lidia 6(1): 20. 2003**Key to the species:**

- 1a. Stems terete 2
 1b. Stems triquetrous *S. mucronata*
 2a. Glumes distinctly keeled and Spikelets angular 3
 2b. Glumes faintly not keeled and Spikelets terete 4
 3a. Spikelets 2 – 9 in a cluster *S. supina*

- 3b. Spikelets 1 – 3 in a cluster *S. lateriflora*
 4a. Nut plano-convex, axillary 2 – 4 spikelet *S. juncooides*
 4b. Nut triquetrous, more than 10 spikelets, round head *S. articulata*

Schoenoplectiella articulata (Linnaeus) Lye Lidia 6: 20 2003. *Schoenoplectus articulatus* (Linnaeus) Palla in Bot. Jahrb. 10: 229. 1888; *Scirpus articulatus* Linnaeus, Sp. Pl. 47. 1753; Hooker f., Fl. Brit. Ind. 6: 656. 1893; Prain, Beng. Pl. 2: 1160. 1903. *Isolepis articulate* Nees in Wight, Contrib. 108. 1834.

[PLATE 4.16. Figs. 86]

A glabrous, annual, tufted robust marshland sedges. Stem terete, spongy, transversely septate. Leaves reduced to sheaths. Inflorescence of many sessile spikelets, capitate; spikelets ovoid to cylindrical – oblong. Glumes ovate, concave, acute, Hypogynous bristles absent. Achenes obovate, triquetrous, black, smooth; style linear.

Flowers & Fruits: October – January

Exiccatus: Mahananda Barrage, **Anurag & AP Das 0313**, dated 26.11.2011; Mahananda Barrage, **Anurag & AP Das 0578**, dated 13.11.2013..

Status: Common.

Local Distribution: Throughout the study area.

General distribution: Tropical Asia, Africa, Australia.

Schoenoplectiella juncooides (Roxburgh) Lye Lidia 6: 25 2003. *Schoenoplectus juncooides* (Roxburgh) Palla in Bot. Jahrb. 10: 299. 1888; *Scirpus juncooides* Roxburgh, Fl. Ind. 1: 218. 1820; *Scirpus erectus sensu* Clarke in Hooker f., Fl. Brit. Ind. 6: 656. 1893, *non* Poiret, 1804; Prain, Beng. Pl. 2: 1160. 1903.

Vernacular name: *Chechur*

Tufted annual, marshland sedges. Stems flaccid or rigid. Leaves reduced to sheaths. Spikelets sessile, 2 – 5 in a lateral cluster, ovoid – oblong. Glumes suborbicular, concave, acute, pale brown, keeled, 1-nerved. Hypogynous bristles 5 – 6, unequal, retrorsely scarbid, shorter or longer than achenes. Styles linear, branches 2. Achenes globose obovoid, unequally biconvex, brown to black.

Flowers & Fruits: July – December

Exiccatus: Gajoldoba, **Anurag & AP Das 0110**, dated 12.09.2010; Gossaihat Beel, **Anurag & AP Das 0422**, dated 17.08.2012.

Status: Common.

Local Distribution: Throughout the study area.

General distribution: India, China, Japan, Malaysia, Australia.

Schoenoplectiella supina (Linnaeus) Lye Lidia 6: 27. 2003. *Schoenoplectus supinus* (Linnaeus) Palla Bot. Jahrb. Syst. 10(4): 299. 1888; *Scirpus supinus* Linnaeus Sp. Pl. 1: 49. 1753; Hooker f., Fl. Brit. Ind. 6: 655. 1893; Prain, Beng. Pl. 2: 1160. 1903; Majumdar, Bull. Bot. Soc. Beng. 19: 16. 1965.

Annual, glabrous sedges with fibrous roots. Stem densely tufted, slender, obtusely triquetrous. Leaves very short, sheath sort. Spikelets 2 – 9 in a cluster, ellipsoid or oblong, green, sessile; rachilla sessile. Glumes ovate. Nuts globose.

Flowers & Fruits: August – December

Exiccatus: Gajoldoba, **Anurag & AP Das 0109**, dated 12.09.2010; Mahananda Barrage, **Anurag & AP Das 0324**, dated 26.11.2011.

Status: Common.

Local Distribution: Throughout the study area.

General distribution: India (throughout), Sri Lanka, Temperate areas.

Schoenoplectiella lateriflora (J.F. Gmel.) Lye Lidia 6: 25 2003. *Schoenoplectus lateriflorus* (J.F. Gmelin) Lye in Bot. Nat. 290. 1971; Bhat *et al.*, Sedg. & Gras. 82. 2001. *Scirpus lateriflorus* J.F. Gmelin in Syst. Nat. 2, 1: 127. 1791. *Scirpus supinus* Linnaeus var. *uninoides* Clarke in Hooker *f.*, Fl. Brit. Ind. 6: 656. 1893 *non Isolepis unilodis* Delile, 1813; Prain, Beng. Pl. 2: 1160. 1903. *Scirpus supinus* var. *lateriflorus* (J.F. Gmelin) Koyama, Jour. Fac. Sci. Univ. Tokyo sect. 3, Bot. 7: 302. 1958; Noltie, Fl. Bhut. 3(1): 284. 1994. *Scirpus supinus auct non* Linnaeus, Sp. Pl. 1: 49. 173; Hara *et al.*, En. Fl. Pl. Nep. 1: 119. 1978.

Aquatic or marshy, annual, erect, tufted sedges. Stem glabrous, trigonous. Leaves short, sheath short. Spikelets in axillary clusters, ovate, oblong, sessile, rachilla slender. Glumes ovate, membranous. Nuts transversely lineolate.

Flowers & Fruits: August – December

Exiccatus: Gajoldoba, **Anurag & AP Das 0118**, dated 12.09.2010; Mahananda Barrage, **Anurag & AP Das 0318**, dated 26.11.2011.

Status: Common.

Local Distribution: Throughout the study area.

General distribution: India, Tropical Asia, N. America, Australia.

Schoenoplectiella mucronata (Linnaeus) J. Jung & H.K. Choi J. Pl. Biol. 53(3): 230 2010. *Schoenoplectus mucronatus* (Linnaeus) Palla Bot. Jahrb. Syst. 10(4): 299. 1888. *Scirpus mucronatus* Linnaeus, Sp. Pl. 1: 50. 1753; Hooker *f.*, Fl. Brit. Ind. 6: 657. 1893; Prain, Beng. Pl. 2: 874. 1903; Datta & Majumdar, Bull. Bot. Soc. Beng. 20(2): 35. 1966.

Tall, annual, sedges. Stem stout, acutely triquetrous. Leaf blade absent. Spikelets single lateral cluster nearer to the top. Glumes obovoid. Nuts shining black.

Flowers & Fruits: August – January

Exiccatus: Gajoldoba, **Anurag & AP Das 0113**, dated 12.09.2010; Doumahoni Beel, **Anurag & AP Das 0181**, dated 02.02.2011.

Status: Common.

Local Distribution: Throughout the study area.

General distribution: India (throughout), Asia, Europe, Algeria.

ACTINOSCIRPUS (Ohwi) R.W. Haines & Lye, Bot. Not. 124: 481. 1971

Actinoscirpus grossus (Linnaeus *f.*) Goetgh. & D.A. Simpson, Kew Bull. 46: 171. 1991. *Scirpus grossus* Linnaeus *f.*, Suppl. 104. 1781; *Schoenoplectus grossus* (Linnaeus *f.*) Palla in Allg. Bot. Z. 17; Biebl 3. 1911; Srivastava in Hajra *et al.*, Fl. Sikkim 1: 234. 1996; Bora & Kumar, Flor. Div. Ass., 393. 2003. Hooker *f.*, Fl. Brit. Ind. 6: 659. 1896; Prain, Beng. Pl. 2: 1160. 1903.

Perennial, aquatic, glabrous sedges. Rootstock stout, stotons produces tubers; roots fibrous, triquerous spongy. Leaves few, radical, concave, strongly keeled, spongy; sheath long open. Inflorescence decomound, terminal open, ovoid, dark brown. Glumes broadly elliptic concave. Nuts elliptic – obovoid.

Flowers & Fruits: September – December

Exiccatus: Gajoldoba, **Anurag & AP Das 0090**, dated 12.09.2010; Mahananda Barrage, **Anurag & AP Das 0592**, dated 13.11.2013.

Status: Abundant

Local Distribution: Throughout the study area.

General distribution: India (throughout), Malaysia, Philippines, Sri Lanka.

RHYNCHOSPORA Vahl, Enum. Pl. 2: 229. 1805

Rhynchospora corymbosa (Linnaeus) Britton in Trans. New York Acad. Sci. 11: 84. 1892; Noltie, Fl. Bhut. 3(1): 329. 1994; Hajra *et al.*, Fl. Sikkim 1: 233. 1996. *Scirpus corymbosus* Linnaeus, Cent. Pl. 2: 7. 1956.

Rhizome short. Culms erect, trigonous. Leaves basal and cauline, blades broadly linear, long acuminate; sheaths membranous. Bracts shorter than large compound paniculate inflorescence; anthela 2 – 5, distant corymbiform. Spikelets many, lowest flower bisexual, upper 1 – 2 male. Glumes ovate to ovate lanceolate. Stamens 3. Achenes oblong-obovate to obovate, brown.

Flowers & Fruits: June – November

Exiccatus: Gossaihat Beel, **Anurag & AP Das 0237**, dated 14.07.2011; Doumahoni Beel, **Anurag & AP Das 0491**, dated 12.06.2013.

Status: Common.

Local Distribution: Throughout the study area.

General distribution: Pantropical.

CAREX Linnaeus, Sp. Pl. 2: 972. 1753

Carex phacota Sprengel, Syst. Veg. 3: 826. 1826; Cook, Aqua. Wetl. Pl. Ind. 98, 1996.

Annual short rhizomatous herbs. Culms tufted, trigonous. Leaves subequalling culm, lamina linear, 3 – 4 mm wide, flat, revolute. Lower involucral bracts leaflike. Spikes ca. 3 – 5; terminal spike male, rarely female flowers at apex. Utricles dark brown. Nutlets brown, slightly loosely enveloped, suborbicular or broadly ovate.

Flowers & Fruits: March – April

Exiccatus: Doumahoni Beel, **Anurag & AP Das 0182**, dated 02.02.2011.

Status: Rare.

Local Distribution: Found only in one wetland.

General distribution: India, China, Indonesia, Japan, Malaysia, Myanmar, Nepal, Sri Lanka, N Thailand, Vietnam.

Note: This species has been recorded as a new occurrence for the state of West Bengal.

PYCREUS P. Beauv. Fl. Oware 2: 48, t. 86. 1816

Key to the species:

- 1a. Plants stoloniferous; stems 1.5 – 3.5 mm; lamina 2 – 4 mm wide 2

- 1b. Plants not stoloniferous; stems 0.5 – 1.2 mm, lamina 1 – 2 mm wide *P. flavidus*
 2a. Stamens 2; spikelets reddish-brown, lanceolate, 1.5 – 2 mm wide *P. polystachyos*
 2b. Stamen 3; spikelets purplish, oblong-elliptic, > 2.5 mm *P. sanguinolentus*

Pycreus sanguinolentus (Vahl) Nees, Linnaea 9: 283. 1834. *Cyperus sanguinolentus* Vahl, Enum. 2: 351. 1805; Blatter & Mc Cann, J. Bombay Nat. Hist. Soc. 37: 28. 1935; Datta & Majumdar, Bull. Bot. Soc. Beng. 20(2): 32. 1966. *Pycreus sanguinolentus* (Vahl) Nees., Linnaea 9: 283; Clarke in Hooker f. Fl. Brit. Ind. 6: 590. 1893; Prain, Beng. Pl. 2: 1137. 1903.

Erect, aquatic, annual sedges. Rhizome creeping; stem triquetrous, compressed. Leaves shorter than stem. Spikelets simple umbel, compressed, ovate to linear – oblong, reddish – brown; glumes loosely imbricate, obtuse. Nuts dark brown, laterally compressed biconvex.

Flowers & Fruits: January – July

Exiccatus: Doumahoni Beel, **Anurag & AP Das 0173**, dated 02.02.2011; Gajoldoba, **Anurag & AP Das 0349**, dated 08.03.2012.

Status: Abundant.

Local Distribution: Throughout the study area.

General Distribution: India, Sri Lanka and warmer part of eastern hemisphere.

Pycreus flavidus (Retzius) T. Koyama, Jour. Jap. Bot. 51: 316 1976. *Cyperus flavidus* Retzius, Obs. fasc. 5: 13. 1789; Hooker f., Fl. Brit. Ind. 6: 600. 1893; Prain, Beng. Pl. 2: 859. 1903; Datta & Majumdar, Bull. Bot. Soc. Beng. 20(2): 31. 1966. *Cyperus haspan* var. *indicus* Boeckeler, Linnaea 35: 574. 1868.

Annual, aquatic, tufted sedges root fibrous. Leaves shorter than stem, linear, broad. Inflorescence compound or decomposed; spikelets linear lanceolate. Nuts globose, trigonous, rounded.

Flowering & Fruiting: July – October

Exiccatus: Gajoldoba, **Anurag & AP Das 0084**, dated 12.09.2010; Doumahoni Beel, **Anurag & AP Das 0519**, dated 12.06.2013.

Status: Common.

Local Distribution: Throughout the study area.

General Distribution: India (throughout), Sri Lanka and warmer part of world.

Pycreus polystachyos (Rottboøll) P. Beauvois, Fl. Oware 2: 48. 1816. *Cyperus polystachyos* Rottboøll, Progr. 21. 1772 & Descr. 21. 1772; Hooker f., Fl. Brit. Ind. 6: 598. 1893. *Cyperus odoratus* Linnaeus, Sp. Pl. 46. 1753. Prain, Beng. Pl. 2: 856. 1903.

Rhizome small, stem tufted, erect, compressed, trigonous. Leaves almost half of the stem. Umbels few to many rayed, often compact. Spikelets many flowered, brownish green, compressed, linear, acute. Glumes imbricate, elliptic. Nuts black, ellipsoid, obovate oblong.

Flowers & Fruits: July – October

Exiccatus: Gajoldoba, **Anurag & AP Das 0115**, dated 12.09.2010; Doumahoni Beel, **Anurag & AP Das 0534**, dated 12.06.2013.

Status: Common.

Local Distribution: Throughout the study area.

General Distribution: India, warmer countries of world.

ERIOCAULACEAE Martinov, Tekhno-Bot. Slovar 237. 1820

ERIOCAULON Linnaeus, Sp. Pl. 1: 87. 1753

Key to the species:

- 1a. Anthers white or pale yellow; leaves needle like and forming cushion like cluster *E. cinereum*
- 1b. Anthers black, leaves usually flattened forming rosettes 2
- 2a. Leaf-sheaths and scapes flushed with red, purple or pink *E. quinquangulare*
- 2b. Leaf-sheaths and scapes green, whitish or brown, not flushed 3
- 3a. Involucral bracts longer than heads; heads straw-coloured 5
- 3b. Involucral bracts as long as or shorter than heads 4
- 4a. Involucral bracts broadly ovate-orbicular to narrowly lanceolate *E. minimum*
- 4b. Involucral bracts oblong-obovate *E. sollyanum*
- 5a. Sepals of female flowers usually 2 *E. truncatum*
- 5b. Sepals of female flowers 3 *E. setaceum*

Eriocaulon cinereum R. Brown, Prodr. 254. 1810. *Eriocaulon sieboldianum* Siebold & Zuccarini ex Steudel, Syn. Pl. Glum. 2: 272. 1855; Hooker f., Fl. Brit. Ind. 6: 577. 1893; Prain, Beng. Pl. 2: 848. 1903; Haines, Bot. Bihar & Orissa Pt. VI: 1068. 1924; Mooney, Suppl. Bot. Bihar & Orissa 196. 1950. [PLATE 4.15. Figs. 79]

Small, stemless, tufted annual sedge. Leaves 2–5 cm long, narrowly linear, glabrous. Peduncle numerous, aggregated, glabrous, 5 ribbed. Head small, whitish globose or ovoid; bracts glabrous.

Flowers & Fruits: September – February

Exiccatus: Doumahoni Beel, **Anurag & AP Das 0221**, dated 02.02.2011; Gossaihat Beel, **Anurag & AP Das 0419**, dated 17.08.2012.

Status: Abundant.

Local Distribution: Throughout the study area.

General Distribution: India and Tropical part of world.

Eriocaulon setaceum Linnaeus, Sp. Pl. 1: 87. 1753; Cook, Aqua. Wetl. Pl. Ind. 201. 1996.

[PLATE 4.15. Figs. 78]

Annual herbs. Leaves filiform; scapes 6-ribbed. Involucral bracts reflexed, straw-colored, ovate membranous, glabrous; floral bracts orbicular to oblanceolate. Male flowers: sepals spathe-like, abaxially shortly hairy toward apex 2–3 lobed; petals 3, elliptic to subulate; anthers black. Female flowers: sepals 3, free, boatlike to obovate; petals 3, free, oblanceolate-linear; ovary 3-loculed; style 3-cleft. Seeds narrowly ovoid,

Flowers & Fruits: August – November

Exiccatus: Gajoldoba, **Anurag & AP Das 0149**, dated 12.09.2010; Doumahoni Beel, **Anurag & AP Das 0556**, dated 27.08.2013.

Status: Rare.

Local Distribution: Throughout the study area.

General Distribution: India, China, Bangladesh, Cambodia, Indonesia, Japan, Laos, Myanmar, Sri Lanka, Thailand, Vietnam; N Australia.

Note: It is found only at 3 places. However, the habitat in these locations is destroying quite fast.

Eriocaulon minimum Lamarck, *Encycl.* 3: 275, 1789. Cook, *Aqua. Wetl. Pl. Ind.* 197. 1996.

[PLATE 4.15. Figs. 82]

Delicate, tufted annual herbs. Lamina linear, sub-acute. Scapes capillary, 5-ribbed, slightly twisted; sheaths shorter than leaves. Heads globose; receptacle cylindrical, pubescent. Seeds ovoid ellipsoid.

Flowers & Fruits: July – October

Exiccatus: Gossaihat Beel, *Anurag & AP Das 0231*, dated 14.07.2011; Doumahoni Beel, *Anurag & AP Das 0555*, dated 27.08.2013.

Status: Rare.

Local Distribution: Throughout the study area.

General Distribution: India, S & SW Asia.

Eriocaulon quinqueangulare Linnaeus, *Fl. Zey.* 48. 1747 & sp. *Pl.* 87, 1753; Hooker *f.*, *Fl. Brit. Ind.* 6: 582. 1892; Prain, *Beng. Pl.* 2: 1127. 1903; Cook, *Aqua. Wetl. Pl. Ind.* 199. 1996.

Annual erect herbs. Leaves rosette; lamina linear, entire. Scapes many, 5 ribbed, glabrous. Heads globose, whitish. Seeds ellipsoid, oblong.

Flowers & Fruits: October – January

Exiccatus: Doumahoni Beel, *Anurag & AP Das 0212*, dated 02.02.2011; Gossaihat Beel, *Anurag & AP Das 0601*, dated 13.11.2013.

Status: Rare.

Local Distribution: Throughout the study area.

General Distribution: India, Sri Lanka, Bangladesh, Myanmar.

Eriocaulon sollyanum Royle, *Ill. Bot. Himal. Mts.* 409, pl. 97. 1840. Santapau, *Rec. Resume Eriocau., Georg. Dist. & syn.* 162. 1959; Cook, *Aqua. Wetl. Pl. Ind.* 203. 1996. *Eriocaulon trilobum* Buchanan-Hamilton *ex Körnicke*, *Linnaea* 27: 645. 1856. [PLATE 4.15. Figs. 81]

Annual herbs; Lamina linear. Scapes 5 – 10; receptacle glabrous, slimy; heads black; involucre bracts oblong-obovate; floral bracts blackish, oblong to obovate. Male flowers: sepals spathe-like, apex 3-cleft; petals 3, small. Female flowers: sepals 3, blackish, free; petals 3, oblanceolate-linear; ovary 3-loculed; style 3-parted. Seeds ovoid.

Flowers & Fruits: July – January

Exiccatus: Gossaihat Beel, *Anurag & AP Das 0439*, dated 17.08.2012; Mahananda Barrage, *Anurag & AP Das 0621*, dated 13.11.2013.

Status: Less common.

Local Distribution: Throughout the study area.

General Distribution: India, Nepal, Bangladesh, Sri Lanka, China, Indonesia, Thailand.

Eriocaulon truncatum Buchanan-Hamilton *ex* Martius in Wallich, Pl. Asiat. Rar. 3: 29. 1832; Hooker *f.*, Fl. Brit. Ind. 6: 578. 1892; Prain, Beng. Pl. 2: 1126. 1903. [PLATE 4.15. Figs. 80]

Annual herbs. Lamina linear. Scapes ribbed; receptacle subglabrous to villous; heads straw-coloured, subglobose to hemispheric; bracts obovate to oblanceolate. Male flowers: sepals blackish; petals 3; anthers 5–6. Female flowers: sepals blackish, free; petals 3; ovary 3-loculed. Seeds ovoid to subglobose.

Flowers & Fruits: July – December

Exiccatus: Mahananda Barrage, *Anurag & AP Das* 0335, dated 26.11.2011; Kathambari Beel, *Anurag & AP Das* 0685, dated 03.09.2014.

Status: Very common.

Local Distribution: Throughout the study area.

General Distribution: India, China, Indonesia, Japan, Philippines, Thailand.

POACEAE Branhart, Bull. Torrey Bot. Club. 22: 7. 1895, *nom. alt.* [**GRAMINEAE** *nom. cons.*]

Key to the Tribes:

- 1a. Male and female spikelets different, in separate inflorescence or if in same inflorescence then in different parts of it **MAYDEAE**
- 1b. Male and female spikelet's not different (only the florets may so); mixed in the same Inflorescence 2
- 2a. Culms woody (bamboo like) branches never equaling the main culms 3
- 2b. Culms herbaceous (grass like) or semi woody (reed like); if branched then branches equaling the main culms 4
- 3a. Culm leaves similar to foliage leaves; panicle densely plumose **ARUNDINEAE**
- 3b. Lower culm leaves (or culm sheath) with comparatively very minute, rudimentary blade, distinct from foliage leaves; inflorescence not as above 5
- 4a. Spikelets strictly with 2 florets, upper floret hermaphrodite (bisexual) and the lower male or sterile or often reduced to lemma, rachilla not extended 6
- 4b. Spikelets with 1 to many florets, if 2-flowered then both hermaphrodite (bisexual), or upper floret male or barren, rachilla usually extended 7
- 5a. Spikelets usually solitary, rarely paired (if paired both alike and pedicelled); dark and geniculate awns not formed, (only bristles may present and sometimes glumes and lemmas long aristate), upper lemma usually crustaceous 8
- 5b. Spikelets usually paired or in triads, usually dissimilar, usually awned (usually upper lemma), awns usually dark and geniculate, upper lemma not crustaceous; lower spikelet often sessile or pedicel shorter **ORYZAE**
- 6a. Spikelets falling entire at maturity **PANICEAE**
- 6b. Spikelets disarticulating at maturity above glumes, glumes often persistent **ISACHNEAE**
- 7a. Spikelets disarticulating at maturity above glumes, glumes persistent **ARUNDINELLEAE**
- 7b. Spikelets (and often other parts of inflorescence) falling entire at maturity..... **ANDROPOGONEAE**

- 8a. Spikelets with 1 bisexual floret 9
- 8b. Spikelet with 2 to many florets **THYSANOLAENEAE**
- 9a. Inflorescence a single unbranched spike like raceme **ERAGROSTIDEAE**
- 9b. Inflorescence digitate **CYNODONTEAE**

ANDROPOGONEAE Dumortier

Key to the Genera:

- 1a. Inflorescence smooth, linear raceme borne on terminal or axillary peduncle singly or in clusters **Rottboellia**
- 1b. Inflorescence not smooth, linear raceme but variously panicle or spike-like, ± hairy 2
- 2a. Inflorescence much branched panicle, nodes subtended by bladeless bracts or spathes 3
- 2b. Inflorescence nodes not subtended by bladeless bracts or spathes 4
- 3a. Plants aromatic, (if not) racemes borne in pairs **Cymbopogon**
- 3b. Plants not aromatic, racemes borne singly **Themeda**
- 4a. Inflorescence plumose panical, callus and internodes densely soft, long hairy; panicles single terminal or laterals 5
- 4b. Inflorescence not plumose, callus and internodes smooth or short stiff hairy 6
- 5a. Culms well developed inflorescence divergent 7
- 5b. Culms not formed, inflorescence very narrow, spike-like **Imperata**
- 7a. Inflorescence axis shorter than racemes, so inflorescence appears as sub-digitate ...
..... **Miscanthus**
- 7b. Inflorescence axis longer than racemes **Saccharum**
- 6a. Inflorescence terminal digitate or sub-digitate 8
- 6b. Inflorescence terminal whorled **Chrysopogon**
- 8a. Pedicelled spikelet awned **Ischaemum**
- 8b. Pedicelled spikelet unawned **Dichanthium**

ARUNDINEAE Dumortier

Key to the Genera:

- 1a. Florets dissimilar, the lowest one male and other upper bisexual; glumes much shorter than the spikelets; lemmas glabrous but callus hairy **Phragmites**
- 1b. Florets all bisexual; glumes almost equalling the spikelet; lemmas long hairy **Arundo**

ERAGROSTIDEAE Stapf

Key to the Genera:

- 1a. Inflorescence inserted along a long axis or a single spike 2
- 1b. Inflorescence digitate 4

- 2a. Spikelets with a single floret *Sporobolus*
 2b. Spikelets with several florets 3
 3a. Ligule membranous; lemmas hairy *Leptochloa*
 3b. Ligule ciliate; lemmas glabrous *Eragrostis*
 4a. Racemes spreading horizontally; upper glumes mucronate *Dactyloctenium*
 4b. Racemes stout or oblique or incurved; upper glumes not mucronate *Eleusine*

ORYZAE Dumortier

Key to the Genera:

- 1a. Culms floating, leaf base rounded or cordate, lamina elliptic, obtuse *Hygroryza*
 1b. Culms not floating, leaf base normal, lamina linear lanceolate, acute 2
 2a. Two glumes like sterile lemmas present; fertile lemma keel spines appressed *Oryza*
 2b. Sterile lemmas absent; fertile lemma compressed, with stiff spiny keel *Leersia*

PANICEAE R. Brown

Key to the Genera:

- 1a. Inflorescence cylindrical or a single panicle or if branched then branches appressed so Spike-like 2
 1b. Inflorescence shortly or diffusely branched panicle, or otherwise 5
 2a. All or some of the spikelets subtended by few to many stiff bristles 3
 2b. Spikelets not subtended by any bristle 4
 3a. Bristles few (1 – 12), clustered in one side of spikelet *Setaria*
 3b. Bristles more than 12, surrounding the spikelet *Pennisetum*
 4a. Lateral branches normal but erect and appressed so inflorescence spike-like *Panicum*
 4b. lateral branches absent or much reduced *Sacciolepis*
 5a. Inflorescence digitate to sub-digitate or racemes paired, opposite 6
 5b. Inflorescence otherwise, not digitate 8
 6a. Plants perennial, with creeping rhizomes or stolons, often compressed (at least at base); racemes 2 or 3, spikelets oblong-lanceolate to ovate 7
 6b. Plants annual, tufted, not creeping; not compressed; racemes more than 3 (if 2 or 3, then spikelets linear-lanceolate, appressed) *Digitaria*
 7a. Spikelets oblong-lanceolate; under 1 mm wide; leaf apex obtuse *Axonopus*
 7b. Spikelets oblong-ovate, over 1.5 mm wide; leaf apex acute or acuminate *Paspalum*
 8a. Spikelets awned or long aristate or subtended by bristle 9
 8b. Spikelets unawned and without bristle and aristae; rather the parts may be mucronate or apiculate 10

- 9a. Glume(s) long aristate, aristae over 3 times longer than spikelet ***Oplismenus***
 9b. Lower lemma awned or aristate ***Echinochloa***
 10a. Base of the branches naked for at least 1/3 length, spikelets borne only on the terminal part of the branches, pedicels long.....***Cyrtococcum***
 10b. Spikelets borne upto the base of the branches, pedicels short11
 11a. Racemes inserted distantly gapping, erect, not overlapping; spikelets glabrous, to 2.5 mm ***Paspalidium***
 11b. Racemes inserted closely, spreading or oblique, if slightly erect then overlapping; spikelets hispid, spinulose or hairy, if glabrous then over 3.5 mm12
 12a. Inflorescence composed of racemes along an un-branched central axis ***Brachiaria***
 12b. Inflorescence an open panicle, central axis branched ***Ottochloa***

CYNODONTEAE Dumortier

Key to the Genera:

- 1a. Inflorescence digitate ***Cynodon***
 1b. Inflorescence a single spike ***Perotis***

ARUNDINELLA Raddi, Agrostogr. Bras. 37, t. 1. 1823

Arundinella bengalensis (Sprengel) Druce, Bot. Soc. Exch. Club Brit. Isles. 4: 605. 1917; Noltie, Fl. Bhut. 3(2): 749. 2000. *Panicum bengalense* Sprengel, Syst. Veg. 1: 311. 1825.

Perennial, with branched scaly rhizomes. Culms solitary, erect, moderately slender to stout. Leaf-sheaths densely tuberculate-hispid; lamina broadly linear, tuberculate-hispid on both surfaces; ligule 0.3 – 0.7 mm. Panicle narrowly cylindrical; pedicels short, densely scabrid; upper glume 5-veined.

Flowers & Fruits: July – October

Exiccatus: Gossaihat Beel, **Anurag & AP Das 0251**, dated 14.07.2011; Doumahoni, **Anurag & AP Das 0551**, dated 27.08.2013.

Status: Less common.

Local Distribution: Found in only few wetlands of the study area.

General Distribution: India, Bhutan, China, Myanmar, Nepal, Thailand, Vietnam.

ARUNDO Linnaeus, Sp. Pl. 1: 81. 1753

Arundo donax Linnaeus, Sp. Pl. 81: 1753; Hooker *f.*, Fl. Brit. Ind. 7: 302. 1897; Prain, Beng. Pl. 2: 1218. 1903; Cook, Aqua. Wetl. Pl. Ind. 284.1996. *Arundo bifaria* Retzius, obs. Bot. 4: 21. 1786. *Arundo latifolia* Salisbury, Prodr. Strip. 24: 1796.

Rhizomatous, tall, stout, perennial grass. Lamina linear lanceolate; ligule a row of hairs. Leaf sheaths longer than internodes. Panicles large; spikelets long, light brown; lower glumes acute, upper glumes sharply acuminate; lemmas linear-lanceolate.

Flowers & Fruits: August – December

Exiccatus: Gajoldoba, **Anurag & AP Das 0120**, dated 12.09.2010; Sova-Bari Beel, **Anurag & AP Das 0704**, dated 03.12.2014.

Status: Common.

Local Distribution: Throughout the study area.

General Distribution: India, Nepal, Bangladesh, Bhutan, Myanmar.

AXONOPUS P. Beauvois, Ess. Agrostogr. 12. 1812

Axonopus compressus (Swartz) P. Beauvois, Ess. Agrost. 12: 154, 167. 1812; Noltie, Fl. Bhut. 3(2): 717. 2000. *Milium compressus* Swartz, Prodr. Veg. Ind. Occ. 24. 1788.

Perennial ascending tufted grass, culms slender, compressed. Leaves oblong, linear-lanceolate; sheath keeled; ligules thin, fimbriate. Panicle branches generally 2, long, slender, racemose; upper glumes elliptic-lanceolate, hairy on side; lemma ovate, acute.

Flowers & Fruits: June – December

Exiccatus: Doumahoni Beel, **Anurag & AP Das 0487**, dated 12.06.2013; Katham-Bari Beel, **Anurag & AP Das 0688**, dated 03.09.2014.

Status: Abundant.

Local Distribution: Throughout the study area.

General Distribution: India, Myanmar, Australia, America, Brazil, Mexico.

BRACHIARIA (Trinius) Grisebach, Ledeb, Fl. Ross. 4: 469. 1853

Key to the species:

- 1a. Lamina linear-lanceolate, margins hispid *B. distachya*
 1b. Lamina ovate-lanceolate, amplexicaul, hairy *B. reptans*

Brachiaria distachya (Linnaeus) Stapf in Prain, Fl. Trop. Afr. 9: 565. 1919; Haines, Bot. Bihar & Orissa Pt. V: 1004. 1924; Cook, Aqua. Wetl. Pl. Ind. 285. 1996; Panda & Das, Fl. Sambalp. 417. 2004. *Panicum distachyum* Linnaeus, Mant. 1: 138. 1767; Hooker f., Fl. Brit. Ind. 7: 37. 1896; Prain, Beng. Pl. 2: 1178. 1903;

Annual; decumbent creeping grass. Leaves linear-lanceolate, hispid at margin; ligule with ring of hairs. Panicle with few distichous branches. Spikelets elliptic-obovate. Caryopsis oblong.

Flowers & Fruits: September – December

Exiccatus: Gajoldoba, **Anurag & AP Das 0146**, dated 12.09.2010; Sova-Bari Beel, **Anurag & AP Das 0690**, dated 03.12.2014.

Status: Common.

Local Distribution: Throughout the study area.

General Distribution: Plains of India, Myanmar, Malaysia, China, Australia.

Brachiaria reptans (Linnaeus) Gardner & C. E. Hubbard in Pl. sub. t. 3363. 1938; Guha Bakshi, Fl. Mur. Dist. 378. 1984; Cook, Aqua. Wetl. Pl. Ind. 286. 1996; Panda & Das, Fl. Sambalp. 418. 2004. *Panicum reptans* Linnaeus, Syst. Nat. ed. 10. 870. 1759.

Annual; culms long, creeping below, nodes glabrous; much branched. Lamina amplexicaul, hairy, ovate-lanceolate, sheaths ciliate not up to the next node. Panicle with distichous racemes, spreading usually

crowded, rachis hairy, trigonous, pedicels with cilia longer than spikelets, crowded, sub-sessile, ellipsoid, glabrous.

Flowers & Fruits: March – December

Exiccatus: Gajoldoba, **Anurag & AP Das 0396**, dated 08.03.2012; Sova-Bari Beel, **Anurag & AP Das 0689**, dated 03.12.2014.

Status: Common.

Local Distribution: Throughout the study area.

General Distribution: Pantropic.

CHLORIS Swartz, Prodr. 25. 1788.

Chloris barbata Swartz, Fl. Ind. Occid. 1: 200. 1797. *Chloris inflata* Link, Enum. Pl. 1: 105. 1821. *Andropogon barbatus sensu* Linnaeus, Mantissa 2: 302. 1771. *Chloris barbata sensu* Swartz, Prodr. 1: 200. 1797; Hooker f., Fl. Brit. Ind. 7: 292. 1897; Prain, Beng. Pl. 2: 1228. 1903; Guha Bakshi, Fl. Mur. Dist. 379. 1984.

Perennial tufted grass; culms erect, stout with creeping branched base; nodes with large tuft of leaves. Lamina flat, sometimes folded, mouth of the sheath ciliate, ligules a narrow membranous ring. Inflorescence a whorl of 4 – 22 spikes, sub-erect, rachis scabrid.

Flowers & Fruits: June – October

Exiccatus: Gossaihat Beel, **Anurag & AP Das 0289**, dated 14.07.2011.

Status: Common at places.

Local Distribution: Throughout the study area.

General Distribution: Pantropical.

CHRYSOPOGON Trinius, Fund. Agrost. (Trinius) 187. 1820

Chrysopogon zizanioides (Linnaeus) Roberty, Bull. Inst. Franç. Afrique Noire, A 22: 106 1960. *Phalaris zizanioides* Linnaeus, Mant 2: 183. 1771. *Vetiveria zizanioides* (Linnaeus) Nash in Small, Fl. South-East U.S. 67. 1903; Haines, Bot. Bihar & Orissa Pt. V: 132. 1924; Bor, Grass. Bur. Cey. Ind. & Pak. 258. 1960; Panda & Das, Fl. Sambalp. 441. 2004. *Andropogon squarrosus auct. non* Linnaeus f.: Hooker f., Fl. Brit. Ind. 7: 186. 1896.

Vernacular name: *Birna*

Strong densely tufted large perennial grass. Culms long, erect; root-stock rhizomatous. Leaves long, scabrid on margins; sheath glabrous; ligule membranous minute. Panicle contracted; spikelets paired, lanceolate. Caryopsis linear from middle, broader at base.

Flowers & Fruits: August – December

Exiccatus: Gajoldoba, **Anurag & AP Das 0164**, dated 12.09.2010; Mahananda Barrage, **Anurag & AP Das 0574**, dated 13.11.2013.

Status: Abundant.

Local Distribution: Throughout the study area

General Distribution: India, Java, Myanmar, Sri Lanka, Tropical Africa.

COIX Linnaeus, Sp. Pl. 2: 972. 1753

- 1a. Spikelets not drooping; lamina ovate-lanceolate; glume narrowly winged *C. lachrymal-jobi*
 1b. Spikelets slightly drooping; lamina lanceolate; glume broadly winged *C. aquatica*

Coix lachryma-jobi Linnaeus, Sp. Pl. 2: 972. 1753; Hooker *f.*, Fl. Brit. Ind. 7: 100. 1897; Noltie, Fl. Bhut. 3(2): 839. 2000; Prain, Beng. Pl. 2: 1210. 1903; Hajra *et al.*, Fl. Sikkim 1: 248. 1996. *Coix lachrymal* Linnaeus, Syst. Nat. (ed. 10) 1261. 1759. *Coix arundinacea* Lamark, Encycl. Meth. Bot. 3: 422. 1791.

Tall densely tufted or perennial, marshy grass; culms much branched, rooting at lower nodes, robust, spongy, glabrous. Lamina flat, firm, acuminate, cordate at base; inflorescence sub erect, false spikes, peduncles.

Flowers & Fruits: October – March

Exiccatus: Mahananda Barrage, **Anurag & AP Das 0644**, dated 13.11.2013; Katham-Bari Beel, **Anurag & AP Das 0658**, dated 03.09.2014.

Status: Abundant.

Local Distribution: Throughout the study area.

General Distribution: India; Tropical Asia, Africa, America.

Coix aquatica Roxburgh, Hort. Beng., 66. 1814; Fl. Ind. III. 571; Hooker *f.*, Fl. Brit. Ind. 7: 100; Prain, Beng. Pl. 2: 1210. 1903; Noltie, Fl. Bhut. 3(2): 839. 2000. *Coix gigantea* Konig ssp. *aquatica* (Roxburgh) Bhattacharya in S. Moulik, Grass. & Bambo. Ind. 1: 175. 1996.

Tall annual. Culms rambling; spongy, nodes glabrous. Leaves all cauline; ligule an eciliate membrane; lamina linear or lanceolate, pilose adaxially. Racemes axillary; deciduous as a whole; spikelets in threes. Fertile spikelets sessile; Male spikelets sessile, or pedicelled, 2–3 in a cluster. Glumes dissimilar; reaching apex of florets. Caryopsis with adherent pericarp.

Flowers & Fruits: September – December

Exiccatus: Gajoldoba, **Anurag & AP Das 0159**, dated 12.09.2010.

Status: Rare.

Local Distribution: Found only one wetland of the study area.

General Distribution: India, China, Asia-tropical, Australia.

CYMBOPOGON Sprengel, Pl. Min. Cogn. Pug. 2: 14. 1815

Cymbopogon jwarancusa (Jones) Schultes, Mant. 2: 458. 1824; Noltie, Fl. Bhut. 3(2): 808 – 809. 2000. Blatter & Mc Cann, Bombay Grasses 102. 1935; Bor in Jour. Bombay nat. Hist. Soc. 52: 178. 1955; Sultan & Stewart, Grasses W. Pak. 1: 114. 1958; Bor, Grasses Burma Ceyl. Ind. Pak. 128. 1960; Bor in Rechinger *f.*, Fl. Iran. 70: 542. 1970; Soenarko in Reinwardtia 9: 305. 1977. *Andropogon jwarancusa* Jones, Asiat. Res. 109 1798.

Shortly rhizomatous, perennial herbs. Culms densely tufted; lower internodes short, crowded. Leaf-sheaths smooth, glabrous, congested and overlapping at base; lamina glaucous, glabrous, apex filiform; ligule 0.5 – 3.8 mm. Spikelets heteromorphic; sessile spikelet narrowly lanceolate; upper lemma 2-lobed; awn almost straight.

Flowers & Fruits: March–August

Exiccatus: Gajoldoba, **Anurag & AP Das 0389**, dated 08.03.2012; Gossaihat Beel, **Anurag & AP Das 0461**, dated 17.08.2012.

Status: Very common.

Local Distribution: Throughout the study area

General Distribution: India, Nepal, China, Afghanistan, Bhutan, Pakistan, SW Asia.

CYNODON Richard in Persoon, Syn. Pl. 1: 85. 1805

Cynodon dactylon (Linnaeus) Persoon, Syn. Pl. 1: 85. 1805; Hooker *f.*, Fl. Brit. Ind. 7: 288. 1896; Prain, Beng. Pl. 2: 1227. 1903; Bor, Grass. Bur. Cey. Ind. & Pak. 269, t. 52. 1960; Guha Bakshi, Fl. Mur. Dist., 381. 1984; Hajra *et al.*, Fl. Sikkim 1: 285. 1996; Noltie, Fl. Bhut., 3(2): 678. 2000. *Panicum dactylon* Linnaeus, Sp. Pl. 58. 1753.

Vernacular Name: *Durba ghaas*

Perennial prostrate or creeping grass; rooting at nodes of runners. Leaves linear-lanceolate or ovate-lanceolate, hairy; sheath ciliate on margin; ligule membranous. Panicle of radiating spikes from top of peduncle. Spikelets pedicelled, 2 flowered. Lower florets sterile; upper bisexual, glumes 3–5 nerved.

Flowers & Fruits: Throughout the year

Exiccatus: Mahananda Barrage, **Anurag & AP Das 0070**, dated 12.05.2010; Doumahoni Beel, **Anurag & AP Das 0518**, dated 12.06.2013.

Status: Abundant.

Local Distribution: Throughout the study area.

General Distribution: India, S. E. Asia.

CYRTOCOCCUM Stapf, Fl. Trop. Afr. 9(1): 15, in clavi. 1917

Cyrtococcum patens var. *lactifolium* (Honda) Chwi, Acta Phytotax. Geobot. 11: 47. 1942. Naskar, Aqua. & semi aqua. Pl. Lower Beng., 338. 1990. *Panicum patens* f. *latifolium* Honda, Bot. Mag. (Tokyo) 37: 25 1923. *Panicum accrescens* Trinius, Sp. Gram. 1: t. 88. 1827. *Cyrtococcum accrescens* (Trinius) Stapf in Hooker, Icon pl. sub. Tab., 3096. 1922; Majumdar, Bull. Bot. Soc. Beng., 10(1 & 2): 54. 1956.

Perennial tall grass, culms decumbent; leaves at the tops, nodes glabrous. Lamina linear-lanceolate, margin scarcely thickened; ligule a narrow membranous rim. Panicle branched; spikelets pediceled, spikelets slightly compressed and cup shaped.

Flowers & Fruits: June – October

Exiccatus: Gajoldoba, **Anurag & AP Das 0133**, dated 12.09.2010.

Status: Less common.

Local Distribution: Found only in one or two wetlands of the study area.

General Distribution: India (throughout) and Tropics of South-East Asia.

DESMOSTACHYA (Stapf) Stapf in Dyer, Fl. Cap. 7: 316. 1898

Desmostachya bipinnata (Linnaeus) Stapf, Fl. Cap. 7: 632. 1900; Majumdar, Bull. Bot. Soc. Beng. 10(1 & 2): 30. 1956; Guha Bakshi, & Sen, Bull. Bot. Soc. Beng. 23: 34. 1964. *Briza bipinnata* Linnaeus, Syst. Nat. (ed. 10) 2: 875. 1759. *Uniola bipinnata* Linnaeus, Sp. Pl. (ed.2) 104. 1762. *Cynosurus durus* 911. Forsskål, Fl. Aegypt. Arab., 21. 1775. *Eragrostis cynosuroides* Beauverd, Agrost. 71:162. 1812; Hooker *f.*, Fl. Brit. Ind. 7: 324. 1896; Prain, Beng. Pl. 2: 1223. 1903.

Perennial, giant grass, branches from base, tufted, sub-erect. Root stock very stout. Stolons with shiny sheath. leaves many, basal, rigid, margin hispid, apex filiform, sheath with long hairs; ligule a ciliate, ridge. Panicles strict and erect, rachis puberulous. Spikelets sessile, jointed. Caryopsis obliquely obovoid-ovate, oblong.

Flowers & Fruits: April – January

Exiccatus: Mahananda Barrage, **Anurag & AP Das 0004**, dated 12.05.2010.

Status: Less common.

Local Distribution: Found in few wetlands of the study area.

General Distribution: India (plains), Persia, Arabia, North Africa to Tropical Africa.

DACTYLOCTENIUM Willdenow, Enum. Pl. 2: 1029. 1809

Dactyloctenium aegyptium (Linnaeus) Willdenow, Enum. Pl. Horti. Berol. 1029. 1809, as “*aegypticum*”; Bor, Grass. Bur. Cey. Ind. & Pak. 489, t. 52. 1960; Hajra *et al.*, Fl. Sikkim, 1: 285. 1996. *Cynosurus aegyptius* Linnaeus, Sp. Pl. 1: 72. 1753. *Eleusine aegyptiaca* (Linnaeus) Desfontaines, Fl. Atlant. 1: 85. 1798; Prain, Beng. Pl. 2: 1230. 1903. *Panicum dactylon* Linnaeus, Sp. Pl. 1: 58. 1753; Hooker *f.*, Fl. Brit. Ind. 7: 295. 1896.

Annual herbs; rooting at nodes. Leaves linear-lanceolate, distichous, flat, ciliate on margin; ligule membranous. Inflorescence 2-6 digitate spike. Spikelets long, compressed, sessile, densely crowded. Glumes unequal. Stamens 3. Caryopsis laterally flattened.

Flowers & Fruits: December – July

Exiccatus: Sova-Bari Beel, **Anurag & AP Das 0706**, dated 03.12.2014.

Status: Very common.

Local Distribution: Throughout the study area.

General Distribution: India, tropical parts of the worlds.

DICHANTHIUM Willemet, Annalen der Bot. 18. 1796

Dichanthium annulatum (Forsskål) Stapf. In Prain, Fl. Trop. Afr. 9: 178. 1917; *Andropogon annulatus* Forsskål, Fl. Aegypt. – Arab. 173. 1775; Hooker *f.*, Fl. Brit. Ind. 7: 196. 1896; Prain, Beng. Pl. 2: 1205. 1903.

Perennial grass, forming dense tufts, with erect culms up to 1 m tall nodes pubescent. Lamina flat. Racemes sub-digitately arranged; peduncle glabrous; not more than 3 pairs of the lowest spikelets sterile; sessile and pedicellate spikelets alike; lower glumes of pedicellate spikelets not armed with marginal bulbous-based bristles; lower glume of sessile spikelet oblong, obtuse or truncate, keel not winged, median vein present; sheaths terete; ligule longish; upper lemma with hyaline base of the awn.

Flowers & Fruits: November – February

Exiccatus: Doumahoni Beel, **Anurag & AP Das 0224**, dated 02.02.2011; Mahananda Barrage, **Anurag & AP Das 0330**, dated 26.11.2011.

Status: Rare.

Local Distribution: Throughout the study area.

General Distribution: India, Tropical & North Africa, Southeast Asia to China, Australia, Fiji, New Guinea.

DIGITARIA Haller, Hist. Stirp. Helv. 2: 244. 1768

Key to the Species:

- 1a. Racemes 2 – 9; decumbent *D. bicornis*
 1b. Racemes 2; erect *D. ciliaris*

Digitaria bicornis (Lamarck) Roemer & Schultes, Syst. 2: 470. 1817; Guha Bakshi, Fl. Mur. Dist. 384. 1984. *Paspalum bicorne* Lamarck, Encycl. 1: 176. 1791. *Digitaria biformis* Willdenow, Enum. Pl. Hort. Berol. 1: 92. 1809. *Paspalum sanguinale* Lamarck var. *commutatum* Hooker f., Fl. Brit. Ind. 7: 15. 1896. *Digitaria sanguinalis* Scopoli var. *commutata* J.D. Hooker *sensu* Haines, Bot. Bihar & Orissa V: 1007. 1924; Prain, Beng. Pl. 2: 1181. 1903.

Erect, annual herbs. Lamina linear, scabrid, sparsely soft-hairy; sheath glabrous to pilose. Spikelets binate, glabrous to slightly hairy, sessile spikelet slightly pubescent; stamens 3. Caryopsis elliptic, 0.25 cm long.

Flowers & Fruits: July – November

Exiccatus: Gossaihat Beel, **Anurag & AP Das** 0288, dated 14.07.2011; Mahananda Barrage, **Anurag & AP Das** 0328, dated 26.11.2011.

Status: Abundant.

Local Distribution: Throughout the study area.

General Distribution: India, Tropical and Sub tropical Asia and Africa.

Digitaria ciliaris (Retzius) Koeler, Descr. Gram. 27. 1802; Guha Bakshi, Fl. Mur. Dist. 385. 1984; Hajra *et al.*, Fl. Sikkim 1: 251. 1996; Noltie, Fl. Bhut. 3(2): 728. 2000. *Panicum ciliare* Retzius, Obs. Bot 4: 16. 1786. *Paspalum sanguinale* Lamarck Var *ciliaris* (Retzius) Hooker f., Fl. Brit. Ind. 15. 1896.

Erect or decumbent, annual grass. Lamina linear-lanceolate, glabrous, ligule truncate. Racemes 2 – 9, sub digitate. Spikelets in pairs, oblong, acute, awnless. Stamens 3. Caryopsis 0.2 cm long.

Flowers & Fruits: May – December

Exiccatus: Mahananda Barrage, **Anurag & AP Das** 0072, dated 12.05.2010.

Status: Common.

Local Distribution: Throughout the study area.

General Distribution: Pantropical.

ECHINOCHLOA P. Beauvois, Ess. Agros. 53. I. 11. 1812

Key to the Species:

- 1a. Stem slender, decumbent *E. colona*
 1b. Stem stout, erect 2
 2a. Spikes erect *E. crus-galli*

2b. Spikes drooping *E. stagnina*

Echinochloa colona (Linnaeus) Link, Enum. Hort. Berol. 2: 209. 1833; Noltie, Fl. Bhut. 3(2): 702. 2000; Hajra *et al.*, Fl. Sikkim 1: 253. 1996; Bor, Grass. Bur. Cey. Ind. & Pak. 308. 1960; Guha Bakshi, Fl. Mur. Dist. 387. 1984. *Panicum colonum* Linnaeus Syst. 870. 1759; Hooker *f.*, Fl. Brit. Ind. 7: 295. 1896; Prain, Beng. Pl. 2: 1177. 1903.

Marshland annual, prostrate, slender grass; branched at lower parts, glabrous and smooth. Lamina narrow, linear, glabrous; sheath loose, smooth, compressed. Panicle branches 6-many, sometimes solitary. Spikelets ovate or elliptic, nearly sessile, glabrous, crowded, 4-ranked. Caryopsis elliptic.

Flowers & Fruits: July – December

Exiccatus: Mahananda Barrage, **Anurag & AP Das 0637**, dated 13.11.2013.

Status: Abundant.

Local Distribution: Throughout the study area.

General Distribution: India, Tropical Asia and Australia.

Echinochloa crus-galli (Linnaeus) Beauverd, Ess. Agrost. 53: 161. 1812; Guha Bakshi, Fl. Mur. Dist. 387. 1984; Hajra *et al.*, Fl. Sikkim 1: 254. 1996; Noltie, Fl. Bhut. 3(2): 703. 2000. *Panicum crusgalli* Linnaeus, Sp. Pl. 1: 56. 1753; Hooker *f.*, Fl. Brit. Ind. 7: 30. 1896; Prain, Beng. Pl. 2: 1177. 1903.

Annual, aquatic, floating ascending, glabrous grass. Lamina linear, tapering to the acute point, subflaccid, margin finely cartilaginous. Inflorescence erect, pedicles binate or flaccid, very short. Spikelets crowded, ovate elliptic, cuspidate or awned. Caryopsis broadly elliptic.

Flowers & Fruits: June – February

Exiccatus: Doumahoni Beel, **Anurag & AP Das 0540**, dated 12.06.2013.

Status: Very common.

Local Distribution: Throughout the study area

General Distribution: India, Myanmar, S. E. Asia, Sri Lanka, Africa.

Echinochloa stagnina (Retzius) P. Beauverd, Ess. Agrost. 53: 161 – 171. 1812; Bor, Fl. Assam 5: 244. 1940; Shukla, grass. N. E. India 325. 1996; Cook, Aqua. Wetl. Pl. Ind. 292. 1996. *Panicum stagninum* Retzius, Obs. Bot. 5: 17. 1789; Prain, Beng. Pl. 2: 1177. 1903.

Perennial grass; rhizomes elongated. Culms decumbent, or prostrate; ligule a fringe of hairs. Lamina 10 – 45 cm long; 3 – 20 mm wide. Inflorescence composed of racemes. Spikelet packing irregular; 4 – rowed. Spikelets in pairs. Fertile spikelets sessile. Glumes dissimilar; upper glume ovate; membranous; without keels; 5 -veined.

Flowers & Fruiting: September – January

Exiccatus: Mahananda Barrage, **Anurag & AP Das 0307**, dated 26.11.2011; Katham-Bari Beel, **Anurag & AP Das 0705**, dated 03.12.2014.

Status: Less common.

Local Distribution: Found only in few wetlands of the study area.

General Distribution: India, China, Malaysia, Tropical Africa, Tropical Asia.

ELEUSINE Gaertner, Fruct. Sem. Pl. 1: 7. 1788

Eleusine indica (Linnaeus) Gaertner, Fruct. 1: 8. 1788; Hooker *f.*, Fl. Brit. Ind. 7: 293. 1896; Prain, Beng. Pl. 2: 1229. 1903; Bor, Grass. Bur. Cey. Ind. & Pak. 493. 1960; Hajra *et al.*, Fl. Sikkim 1: 288. 1996; Noltie, Fl. Bhut. 3(2): 667. 2000. *Cynosurus indicus* Linnaeus, Sp. Pl. 1: 72. 1753.

Annual tufted grass. Culms long, compressed. Leaves distichous, linear, flat; sheath ciliate; ligule membranous. Inflorescence a terminal umbel of 2–4 digitate spikes. Spikelets 2 seriate, elliptic, flowered, sessile. Caryopsis oblong.

Flowers & Fruits: July – November

Exiccatus: Katham-Bari Beel, **Anurag & AP Das 0671**, dated 03.09.2014.

Status: Abundant.

Local Distribution: Throughout the study area

General Distribution: India, Tropical and Subtropical part of world.

ERAGROSTIS Wolf, Gen. Pl. 23. 1776**Key to the species:**

- 1a. Rachilla jointed; spikelets drops on maturity 2
- 1b. Rachilla tough; spikelets persistent 3
- 2a. Caryopsis ovoid; stamens 3 *E. tenella*
- 2b. Caryopsis obovoid; Stamens 2 *E. diarrhena*
- 3a. Spikelets flat, elliptic-oblong *E. uniloides*
- 3b. Spikelets less compressed, linear-oblong..... 4
- 4a. Spikelets fascicled *E. gangetica*
- 4b. Spikelets not fascicled 5
- 5a. Leaf margin glandular..... *E. minor*
- 5a. Leaf margin not glandular 6
- 6a. Spikelets 0.75 – mm wide, annual *E. pilosa*
- 6b. Spikelets 2 – 2.5 mm wide, perennial *E. atrovirens*

Eragrostis atrovirens (Desfontaines) Trinius *ex* Steudel, Nom. Bot. ed. 2, 1: 562. 1840. *Poa atrovirens* Desfontaines, Fl. Atlant. 1: 73, t. 14. 1798.

Tufted, perennial grass. Leaves acuminate, flat or rolled, glabrous, sheath glabrous. Panicle ovate, spikelet more or less fascicled; pedicles upto 3mm long; rachilla persistent. Glumes sub-equal, ovate. Lemmas elliptic-oblong; stamen-3. Caryopsis oblong.

Flowers & Fruits: August – December

Exiccatus: Katham-Bari Beel, **Anurag & AP Das 0681**, dated 03.12.2014.

Status: Rare.

Local Distribution: Found only in one wetland of the study area.

General Distribution: India, North Africa to Zambia and Angola; Mauritania to the Philippines.

Eragrostis japonica (Thunberg) Trinius, Mém. Acad. Imp. Sci. St.-Petersbourg, Sér. 6, Sci. Math. 1: 405. 1830. *Eragrostis diarrhena* (Schultes) Steudel, Syn. Pl. Glum. 1: 266. 1854; Majumdar, Bull. Bot. Soc. Beng. 10(1 & 2): 24. 1956; Datta & Majumdar, Bull. Bot. Soc. Beng. 20: 26. 1966. *Poa diarrhena* Schultes & Schultes f., Syst. Veg. Z. Ment. 3: 616. 1827. *Poa diandra* Roxburgh Fl. Ind. 1: 337. 1820. *Eragrostis interrupta* sensu Hooker f., var. *diarrhena* Stapf ex Hooker f., Fl. Brit. Ind. 7: 316. 1896; Prain, Beng. Pl. 2: 1222. 1903.

Erect, glabrous, annual grass. Leaf blades linear, acuminate, upper surface rough, flat. Sheath loose. Ligules membranous and short. Panicles colourless; spikelets equal or longer than pedicel, reddish, linear, ovate.

Flowers & Fruits: March – November

Exiccatus: Mahananda Barrage, **Anurag & AP Das 0329**, dated 26.11.2011.

Status: Common.

Local Distribution: Throughout the study area

General Distribution: India, South-East Asia, Tropical & Sub-Tropical Africa.

Eragrostis gangetica (Roxburgh) Steudel, Syn. Pl. Glum. 1: 266. 1854; Prain, Beng. Pl. 2: 1222. 1903; Guha Bakshi, Fl. Mur. Dist. 389. 1984. *Poa gangetica* Roxburgh, Fl. Ind. 1: 340. 1820; Prain, Beng. Pl. 2: 1222. 1903.

Tufted, annual, marshland grass. Lamina rigid stout, flat. Inflorescence panicles, oblong, branches solitary, sprading. Spikelets linear, purplish or green, glabrous. Caryopsis oblong, brown.

Flowers & Fruits: June – March

Exiccatus: Gajoldoba, **Anurag & AP Das 0367**, dated 08.03.2012.

Status: Less common.

Local Distribution: Found only in few wetlands of the study area.

General Distribution: India, Myanmar, Sri Lanka, Tropical Asia and Africa.

Eragrostis minor Host, Gram. Austr. 4: 15. 1809. Hooker f., Fl. Brit. Ind. 7: 321. 1896; Prain, Beng. Pl. 2: 1223. 1903; Blatter & McCann, Bombay Grasses 238. 1935; Tzvelev, Poaceae URSS 634. 1976; Tutin *et al.*, Fl. Eur. 5: 257. 1980.

Annual grass. Culms ascending; ligules a fringe of hairs. Lamina long; 1–5 mm wide, margins glandular or eglandular. Racemes in erect panicle; spikes compressed; spikelets solitary. Fertile spikelets pedicelled; pedicels oblong; eglandular or glandular. Glumes deciduous, similar, shorter than spikelets; lower glume ovate; upper glume acute. Stamens 3. Caryopsis with adherent pericarp; oblong; dark brown.

Flowers & Fruits: May – September

Exiccatus: Gajoldoba, **Anurag & AP Das 0086**, dated 12.09.2010.

Status: Less common.

Local Distribution: Found only in few wetlands of the study area.

General Distribution: India, Indo-China, Malaysia, Asia, Arabia, China, Mongolia, and eastern Asia, Australia, North America, Europe, Africa

Eragrostis pilosa (Linnaeus) P. Beauvois, Ess. Agrost. 71. 162. 175. 1812; Hooker f., Fl. Brit. Ind. 7: 323. 1896; Prain, Beng. Pl. 2: 1223. 1903; Hajra *et al.*, Fl. Sikkim 1: 291; Noltie, Fl. Bhut. 3(2): 665. 2000. 1996; *Poa pilosa* Linnaeus, Sp. Pl. 1: 68. 1753.

Annual grass. Culms tufted. Leaves finely acuminate. Sheath glabrous, ligule a ridge of hairs. Panicle long, pyramidal, spikelets linear, purplish; rachilla persistent. Glumes unequal, ovate; stamens 3. Caryopsis ellipsoid.

Flowers & Fruits: June – August

Exiccatus: Gossaihat Beel, **Anurag & AP Das 0267**, dated 14.07.2011.

Status: Common.

Local Distribution: Throughout the study area

General Distribution: Tropical & warm region of world.

Eragrostis tenella (Linnaeus) Beauverd *ex* Roemer *et* Schultes, Syst. Veg. 2: 576. 1817; Prain, Beng. Pl. 2: 1221. 1903; Guha Bakshi, Fl. Mur. Dist. 392. 1984; Hajra *et al.*, Fl. Sikkim 1: 291. 1996; Noltie, Fl. Bhut. 3(2): 657. 2000. *Poa tenalla* Linnaeus, Sp. Pl. 1: 69. 1753. *Eragrostis tenella* var. *plumosa* (Retzius) Stapf, 315. 1896; Prain, Beng. Pl. 2: 1220. 1903.

Annual, erect, tufted grass. Leaves narrowly linear, sheath ciliate at the mouth; ligule ciliate. Panicles loose, plumose. Spikelets oblong. Glumes ovate-oblong. Caryopsis ovoid.

Flowers & Fruits: August – February

Exiccatus: Gajoldoba, **Anurag & AP Das 0103**, dated 12.09.2010; Doumahoni Beel, **Anurag & AP Das 0184**, dated 02.02.2011.

Status: Abundant.

Local Distribution: Throughout the study area

General Distribution: India; tropical parts of the world.

Eragrostis uniolooides (Retzius) Nees *ex* Steudel, Syn. Pl. Glum. 1: 264. 1854; Hajra *et al.*, Fl. Sikkim 1: 292. 1996. *Poa uniolooides* Retzius, Obs. Bot. 5: 19. 1789. *Eragrostis amabilis* auct. non Wight & Arnott in Hooker *f.*, Fl. Brit. Ind. 317. 1896; Prain, Beng. Pl. 2: 1222. 1903.

Annual, marshland, erect, tufted grass. Leaves flat, sheath striate, ligules membranous. Spikelets ovate-oblong, obtuse, pinkish white. Caryopsis pointed.

Flowers & Fruits: August – March

Exiccatus: Gajoldoba, **Anurag & AP Das 0354**, dated 08.03.2012; Doumahoni Beel, **Anurag & AP Das 0552**, dated 27.08.2013.

Status: Common.

Local Distribution: Throughout the study area

General Distribution: India, Myanmar, Sri Lanka, S.E. Asia.

HYGRORYZA Nees, Edinb. New Philos. Jour. 15: 380. 1833

Hygroryza aristata (Retzius) Nees *ex* Wight & Arnott, Edinb. New Phil. Jour. 15: 380. 1838; Hooker *f.*, Fl. Brit. Ind. 7: 95. 1896; Prain, Beng. Pl. 2: 1185. 1903.

Free floating glabrous grass; culms spongy soft, multiple branched, feathery whorled; roots from nodes, branches short, erect, leafy. Lamina oblong or linear-oblong, acute. Panicles broad; spikelets solitary; flowers pale green, bisexual. Caryopsis oblong narrowed at base.

Flowers & Fruits: October – December

Exiccatus: Mahananda Barrage, **Anurag & AP Das 0565**, dated 13.11.2013; Sova-Bari Beel, **Anurag & AP Das 0699**, dated 03.12.2014.

Status: Abundant.

Local Distribution: Throughout the study area

General Distribution: India, Myanmar, S.E. Asia.

IMPERATA Cirillo, Pl. Rar. Neapol. 2: 26. 1792

Imperata cylindrica (Linnaeus) Raeuschel, Nom. Bot. ed. 3: 10. 1797; Bor, Grass. Bur. Cey. Ind. & Pak. 169. 1960; Hajra *et al.*, Fl. Sikkim 1: 257. 1996. *Lagurus cylindricus* Linnaeus, Syst. Nat. ed. 10, 2: 878. 1759. *Imperata arundinacea* Cyrillo, Pl. Rar. Neap. 2: 26. 1792; Hooker *f.*, Fl. Brit. Ind. 7: 106. 1896; Prain, Beng. Pl. 2: 1188. 1903. *Imperata cylindrica* var. *major* (Nees) Hubbard & Vaughan, Grasses Maur. 96. 1940. *Cynosurus indicus* Linnaeus, Sp. Pl. 1: 72. 1753.

Perennial, tufted, erect, long grass. Rootstock hard, creeping with sobol. Leaves linear-lanceolate, scabrid margined; ligule membranous. Panicle compact; spikelets lanceolate, silky-white hairy; stamens 2; stigmas 2. Caryopsis oblong.

Flowers & Fruits: February – May

Exiccatus: Doumahoni Beel, **Anurag & AP Das 0202**, dated 02.02.2011; Gajoldoba, **Anurag & AP Das 0361**, dated 08.03.2012.

Status: Abundant.

Local Distribution: Throughout the study area.

General Distribution: India, Asia, Australia, S.E. Africa.

ISCHAEMUM Linnaeus, Sp. Pl. 2: 1049. 1753

Ischaemum rugosum Salisbury, Icon. Strip. Rar. 1. t. w. 1791; Hooker *f.*, Fl. Brit. Ind. 7: 127. 1896; Prain, Beng. Pl. 2: 1196. 1903.

Mershy, annual, branched, erect, tufted grass, nodes hairy. Lamina filiform, tip pointed, hairy. Raceme spiciform, rachis much fragile, trigonous, silky-hairy. Caryopsis, oblong, compressed.

Flowers & Fruits: December – March

Exiccatus: Gajoldoba, **Anurag & AP Das 0370**, dated 08.03.2012.

Status: Common.

Local Distribution: Throughout the study area

General Distribution: India (throughout the plains and hills), Myanmar, Malaysia, China.

ISACHNE R. Brown, Prodr. 196. 1810

Key to the species:

- 1a. Ligules 1 – 2.2 mm; lower florets usually bisexual, upper ones usually female *I. albens*
- 1b. Ligules 1–1.5 mm, lower floret male, upper floret female *I. globosa*

Isachne albens Trinius, Sp. Gram. 1(8): t. 85. 1828; Hooker *f.*, Fl. Brit. Ind. 7: 22. 1896; Cook, Aqua. Wetl. Pl. Ind. 297. 1996; Gierson & Long, Fl. Bhutan 3(2): 743. 2000.

Erect or decumbent herbs. Leaf sheaths glabrous or outer margin often ciliate; lamina narrowly lanceolate, abaxial surface glabrous, strongly veined, adaxial surface glabrous to hispidous, margins thickened,

acuminate; ligule 1 – 2.2 mm. Spikelets elliptic-globose, whitish green; florets similar, lower florets usually bisexual, upper florets usually female; lower lemma very slightly longer than upper, leathery, globose to elliptic-ovate, puberulous or subglabrous.

Flowers & Fruits: June – February

Exiccatus: Doumahoni Beel, **Anurag & AP Das 0512**, dated 12.06.2013; Katham-Bari Beel, **Anurag & AP Das 0665**, dated 03.09.2014.

Status: Abundant.

Local Distribution: Throughout the study area

General Distribution: SE Asia, Himalayas.

Isachne globosa (Thunberg) Kuntze, Revis. Gen. Pl. 2: 778. 1891; Cook, Aqua. Wetl. Pl. Ind. 298.1996; Gierson & Long, Fl. Bhut. 3(2): 746. 2000. *I. miliacea* Roth ex Romer & Schultes, Syst. Veg. 2:476.1817; Hooker f., Fl. Brit. Ind. 7: 25. 1896; prain, Beng. Pl. 2: 1172. 1903.

Perennial, erect or decumbent, glabrous herbs. Leaf sheaths shorter than internodes, glabrous; lamina narrowly lanceolate, glabrous, scabrid, acute, base rounded; ligule 1–1.5 mm. Spikelets elliptic-globose, greenish or purplish brown; lower floret male, upper floret female; lower lemma oblong, shallowly convex, smooth, glabrous; upper lemma slightly rough, back glabrous or puberulous.

Flowers & Fruits: May – November

Exiccatus: Mahananda Barrage, **Anurag & AP Das 0020**, dated 12.05.2010; Katham-Bari Beel, **Anurag & AP Das 0667**, dated 03.09.2014.

Status: Abundant.

Local Distribution: Throughout the study area

General Distribution: India, Bangladesh, Sri Lanka, Nepal, Bhutan, China, Indonesia, Japan, Korea, Malaysia, New Guinea, Philippines, Thailand, Vietnam, Australia, Pacific Islands.

LEERSIA Solander ex Swartz, Prodr. 21. 1788, *nom. cons.*

Leersia hexandra Swartz, Prodr. 1: 21. 1788; Hooker f., Fl. Brit. Ind. 7: 94. 1896; Prain, Beng. Plants 2: 1185. 1903; Bor, Fl. Ass. 65; 173. 1940. Bora & Kumar, Flor. Div. Ass. 412. 2003. *Leersia australis* R. Brown, Prodr. 210. 1810.

Annual, aquatic, erect grass. Lower stem slender, creeping and rooting at base. Lamina flat, linear, acuminate, rigid, sheath somewhat loose, ligules glaucous and truncate. Panicles oblong, contracted, branches few; spikelets, oblong, closely imbricate, pale brown, sparsely hispidous, keels bristly ciliate. Caryopsis narrowly oblong.

Flowers & Fruits: October – December

Exiccatus: Sova-Bari Beel, **Anurag & AP Das 0702**, dated 03.12.2014.

Status: Less common.

Local Distribution: Found in only one or two wetlands of the study area.

General Distribution: India (Lower Himalaya); Tropical Africa, Australia, Myanmar.

LEPTOCHLOA P. Beauvois, Ess. Agro. 71. 1812

Key to the species:

- 1a. Ligules 5 – 10 mm long; p spikelets 5 – 12 mm long; florets 5 – 12 *L. fusca*

- 1b. Ligules 1 – 5 mm long; spikelets 1.5 – 4 mm long; florets 2 – 6 2
 2a. Upper glumes mucronate, ligule obtuse, 1–2 mm *L. panicea*
 2b. Upper glumes not mucronate; ligule truncate, 1 – 5 mm *L. chinensis*

Leptochloa panicea (Retzius) Ohwi, Bot. Mag. Tokyo 55: 311. 1941; Bor, Grass. Burma, Ceyl., Ind. & Pak. 517. 1960. *Poa panicea* Retzius, Obs. 3: 11. 1783. *Leptochloa filiformis* Roemer & Schultes, Syst. 2: 580. 1870; Hooker *f.*, Fl. Brit. Ind. 7: 298. 1896; Prain, Beng. Pl. 2: 1225. 1903. *Aira filiformis* Koenig *ex* Roxburgh, Fl. Ind. 1: 328. 1820.

Annual, slender, aquatic grass. Lamina narrow, flat, finely tapering, sheath papillose-pilose, lacerate; ligule obtuse, 1 – 2 mm long. Panicle diffuse; spikelets 2 – 4 fid, almost sessile, unilateral, alternate; upper glumes mucronate.

Flowers & Fruits: May – October

Exiccatus: Mahananda Barrage, **Anurag & AP Das 0033**, dated 12.05.2010.

Status: Common.

Local Distribution: Throughout the study area

General Distribution: India (throughout), Sri Lanka, Asia, Tropical Africa, America.

Leptochloa fusca (Linnaeus) Kunth, Révis. Gramin. 1: 91. 1829. *Diplachne fusca* (Linnaeus) P. Beauv, Ess. Agrost 80: 163. 1812; Hooker *f.*, Fl. Brit. Ind. 7: 329. 1896; Prain, Beng. Pl. 2: 1225. 1903. *Festuca fusca* Linnaeus, Sp. Pl. (ed.2) 109. 1962. *Festuca Indica* Retzeus, Obs. Bot. 4: 21. 1786.

Vernacular name: *Nikri*

Perennial, glabrous, tall tufted, stout, erect or geniculately ascending branched clothed with leaf sheaths. Lamina convolute, sheaths smooth, ligule large, 5 – 10 mm long, membranous lacerate. Spikelets 5 – 12 mm long, oblong, distant, short pedicelled. Caryopsis oblong, compressed.

Flowers & Fruits: June – September

Exiccatus: Gajoldoba, **Anurag & AP Das 0129**, dated 12.09.2010.

Status: Abundant.

Local Distribution: Throughout the study area

General Distribution: India; Egypt, Tropical and South – East Africa to Australia.

Leptochloa chinensis (Linnaeus) Nees, Syll. Pl. Nov. 1: 4. 1824; Hooker *f.*, Fl. Brit. Ind 7: 299. 1896; Prain, Beng. Pl. 2: 1225. 1903. *Poa chinensis* Linnaeus, Sp. Pl. 1: 69. 1753.

Annual or sometimes perennial. Culms erect, geniculate or decumbent. Leaf sheaths glabrous; lamina flat or slightly involute, ligule truncate. Racemes numerous; Spikelets purplish or brownish green, narrowly elliptic-oblong; glumes scabrid along keels; upper glume elliptic-oblong; lemmas elliptic-oblong. Caryopsis oblong.

Flowers & Fruits: April – August

Exiccatus: Mahananda Barrage, **Anurag & AP Das 0004**, dated 12.05.2010; Gossaihat Beel, **Anurag & AP Das 0426**, dated 17.08.2012.

Status: Very common.

Local Distribution: Throughout the study area.

General Distribution: India; Egypt, Tropical and South-East Africa to Australia.

MISCANTHUS Andersson, Öfvers. Kongl. Vetensk.-Akad. Förh. 165. 1855

Miscanthus fuscus (Roxburgh) Benth, Fl. Trop. Afr. 9: 583. 1920. *Saccharum fuscum* Roxburgh, Fl. Brit. Ind. 1: 241. 1820; Hooker *f.*, Fl. Brit. Ind. 7: 120. 1896; Prain, Beng. Pl. 2: 1189. 1903. *Sclerostachya fusca* (Roxburgh) A. Camus in Lecomte, Fl. Gen. de l'Indo-China 7: 243. 1922; Bor. Fl. Assam 5: 313. 1940.

Perennial erect grass. Lamina linear-lanceolate, margin scabrid; sheath longer than internodes; ligule ciliate. Panicle dense; branches whorled; axis angular, pubescent. Spikelets long, ovate-oblong, brownish. Upper florets bisexual. Caryopsis obovoid.

Flowers & Fruits: May – September

Exiccatus: Doumahoni Beel, **Anurag & AP Das 0525**, dated 12.06.2013.

Status: Less common.

Local Distribution: Throughout the study area

General Distribution: India, Indo-China, Myanmar, Thailand, Vietnam, S.E. Asia.

OTTOCHLOA Dandy, Jour. Bot. 69: 54. 1931

Ottochloa nodosa (Kunth) Dandy in Jour. Bot. 69: 55. 1931; Bor. Fl. Assam 5: 249. 1940; Bora & Kumar, Flors. Div. Assam, 417. 2003. *Panicum nodosum* Kunth, Enum. Pl. 1; 97. 1833; Hooker *f.*, Fl. Brit. Ind. 7: 43. 1896; Prain, Beng. Pl. 2: 1175. 1903.

Perennial grass, culms creeping, long, rooting at lower nodes. Leaves ovate-lanceolate; sheaths ciliate on margins; ligules membranous, ovate. Panicle lax; spikelets elliptic-lanceolate. Stamens 3.

Flowers & Fruits: July – December

Exiccatus: Mahananda Barrage, **Anurag & AP Das 0553**, dated 27.08.2013.

Status: Very common.

Local Distribution: Throughout the study area.

General Distribution: India (North – East and South India), Malaysia, Myanmar.

OPLISMENUS P. Beauvois, Fl. Oware 2: 14. 1810

Oplismenus burmannii (Retzius) P. Beauverd, Ess. Agrost. 54: 168 – 169. 1812; Hooker *f.*, Fl. Brit. Ind. 7: 68. 1896; Prain, Beng. Pl. 2: 1173. 1903; Hajra *et al.*, Fl. Sikkim 1: 261. 1996; Gierson & Long, Fl. Bhut. 3(2): 684. 2000. *Panicum burmannii* Retzius, Obs. Bot. 3: 10. 1783.

[PLATE 4.16. Figs. 89]

Annual, prostrate grass; rooting at nodes. Leaves ovate-elliptic lanceolate, pubescent; sheath compressed, ciliate. Inflorescence a panicle 4 – 7 racemes. Spikelets elliptic – lanceolate. Caryopsis convex.

Flowers & Fruits: August – December

Exiccatus: Sova-Bari Beel, **Anurag & AP Das 0708**, dated 03.12.2014.

Status: Abundant.

Local Distribution: Throughout the study area

General Distribution: India, Bangladesh, China, Japan, Sri Lanka.

ORYZA Linnaeus, Sp. Pl. 1: 333. 1753**Key to the species:**

- 1a. Spikelets long awned, awn over 2 cm. *O. rufipogon*
 1b. Spikelets unawned, or awns under 1 cm 2
 2a. Lamina 1.5-3.5 cm, ligules 3-5 mm *O. latifolia*
 2b. Lamina 0.5-2cm, ligules 10-40 mm *O. sativa*

Oryza rufipogon Griffith, Notul. 3: 5. 1851; Hooker *f.*, Fl. Brit. Ind. 7: 92. 1896; Cook, Aqua. Wetl. Pl. Ind. 304 – 305. 1996; Shukla, Grass. North East Ind. 301. 1996. *Oryza sativa* Linnaeus var. *fatua* Prain, Beng. Pl. 1184. 1903. *Oryza nivara* Sharma & Shastri, Ind. I. Genet. Pl. Breed. 25: 161. 1965; Cook, Aqua. Wetl. Pl. Ind. 304. 1996.

Annual grass; culms long, spongy bellow. Leaves linear, acuminate, scabrid on margins; sheath loose; ligules splitting at tip. Spikelets long, long awned. Caryopsis elliptic or oblong.

Flowers & Fruits: October – January

Exiccatus: Mahananda Barrage, **Anurag & AP Das 0618**, dated 13.11.2013.

Status: Rare.

Local Distribution: It is only found in few wetlands of the study area.

General Distribution: India, Tropical Australia, Peru.

Oryza sativa Linnaeus, Sp. Pl. 1: 333. 1753; Hooker *f.*, Fl. Brit. Ind. 7: 92. 1896; Prain, Beng. Pl. 2: 1184. 1903; Cook, Aqua. Wetl. Pl. Ind. 304. 1996. Gierson & Long, Fl. Bhut. 3(2): 517. 2000. *O. communissima* Lourer, Fl. Cochinch. 215. 1790. *Oryza glutinosa* Lourer, Fl. Cochinch. 215. 1790. *Oryza perennis* Moench, Methodus 197. 1794.

Vernacular name: *Dhaan*

Annual, aquatic, tufted. Culms erect, often rooting at lower submerged nodes. Leaf sheaths slightly inflated below, upper sheaths tight, glabrous, auricles falcate, ciliate; glabrous, smooth or scabrid on both sides, acuminate. Spikelets oblong to oblong-lanceolate, persistent; sterile lemmas lanceolate, acuminate; fertile lemma papillose, spinulose, acuminate; awn very variable, slender or stout. Caryopsis ovate or elliptic.

Flowers & Fruits: June – December

Exiccatus: Mahananda Barrage, **Anurag & AP Das 0302**, dated 26.11.2011; Doumahoni Beel, **Anurag & AP Das 0508**, dated 12.06.2013.

Status: Abundant.

Local Distribution: Throughout the study area

General Distribution: India (Northern part, Andaman & Nicobar Islands, West Bengal), China, Tropical and Temperate America.

Note: Main cultivated crop of the area; often escapes.

Oryza latifolia Desv., Jour. Bot. Agric. 1: 77. 1813; Prain, Beng. Plants 2: 1184. 1903. *Oryza sativa* var. *A3. latifolia* Doell in Mart. Fl. Bras. 23:7. 1871.

Annual grass. Culms 1-2 m. high, succulent, sheaths elongate, longer than the internodes, ligule 3 – 5

mm. long, hispid; lamina mostly 32–40 cm. long, 1.5–3.5 cm. wide, scabrous and sparsely pubescent on both surfaces; spikelets 5 mm. long, short-pedicellate, oblong, sparsely hispid, the awns 1–2.5 cm. long.

Flowers & Fruits: June – September

Exiccatus: Forest Jhoras of Bengdubi, **Anurag & AP Das 01213**, dated 03.07.2014.

Status: Rare.

Local Distribution: Found in only one wetland of the study area.

General Distribution: India, West Indies to Brazil.

PANICUM Linnaeus, Sp. Pl. 1: 55. 1753

Key to the species:

- 1a. Spikelets long, elliptic-lanceolate *P. repens*
 1b. Spikelets short, narrowly lanceolate *P. paludosum*

Panicum repens Linnaeus, Sp. Pl. 2: 87. 1762; Hooker *f.* Fl. Brit. Ind. 7: 49. 1896; Prain, Beng. Pl. 2: 1179. 1903. Hajra *et al.*, Fl. Sikkim 1: 263. 1996.

Perennial, tufted, erect, marshland grass. Rooting at nodes. Lamina long, linear-lanceolate; sheaths ciliate at throat. Spikelets long, elliptic-lanceolate. Caryopsis oblong.

Flowers & Fruits: September – December

Exiccatus: Doumahoni Beel, **Anurag & AP Das 0475**, dated 12.06.2013; Mahananda Barrage, **Anurag & AP Das 0564**, dated 13.11.2013.

Status: Common.

Local Distribution: Throughout the study area

General Distribution: India, S. Europe, Asia, Africa, and America.

Panicum paludosum Roxburgh (Hort. Beng. 8. 1814) & Fl. Ind. 1: 310. 1820; Prain, Beng. Pl. 2: 1179. 1903; Bor, Grass Burma Ceyl. Ind. & Pak. 329. 1960.

Perennial, culms erect hollow from floating base. Lamina linear, serrulate. Inflorescence panicle, spikelets short padicelled, narrowly lanceolate. Caryopsis enclosed in glume.

Flowers & Fruits: June – March

Exiccatus: Mahananda Barrage, **Anurag & AP Das 0026**, dated 12.05.2010.

Status: Very common.

Local Distribution: Throughout the study area

General Distribution: South Asia (Pakistan, Nepal, Bhutan, India, Sri Lanka, Myanmar) to SE Asia, China and tropical Australia.

PASPALUM Linnaeus, Syst. Nat., ed. 10, 2: 855. 1759

Key to the species:

- 1a. Rachilla narrower than distichous spikelets *P. distichum*
 1b. Rachilla as wide as Spikelets 2
 2a. Spikelets glabrous *P. scrobiculatum*

2b. Spikelets ciliate *P. conjugatum*

Paspalum conjugatum Bergius, Acta Helv. Phys.–Math. 7: 129. 1772; Hooker *f.*, Fl. Brit. Ind. 7: 11. 1897; Prain, Beng. Pl. 2: 1182. 1903; Hajra *et al.*, Fl. Sikkim 1: 264. 1996; Shukla, Grass. North East. Ind. 345. 1996.

Perennial grass with long stolons. Culms in small tufts, compressed. Leaf sheaths keeled, glabrous or pilose along upper margins and mouth, a line of hairs abaxially at junction with blade; lamina lanceolate-linear, acute, thin, glabrous or papillose-pilose along margins. Racemes 2; spikelets single, in 2 rows, pale yellow, ovate to suborbicular, upper glume hyaline, ciliate along margins with long silky hairs; lower lemma similar but not ciliate; upper lemma pallid at maturity, ovate, as long as spikelet, crustaceous.

Flowers & Fruits: May – September

Exiccatus: Gossaihat Beel, **Anurag & AP Das 0233**, dated 14.07.2011.

Status: Common

Local Distribution: Throughout the study area.

General Distribution: India; Tropics and subtropics throughout the world.

Paspalum distichum Linnaeus, Syst. Nat. (ed.10) 11: 855. 1759; Hooker *f.*, Fl. Brit. Ind. 7: 12. 1896; Prain, Beng. Pl. 2: 1183. 1903.

Vernacular name: *Jawra ghaas*

Annual, creeping herbs; rooting at nodes, compressed below. Lamina narrow, distichous, strict, flat, ascending, hairy towards the sheath. Inflorescence racemes. Spikelets solitary, imbricate, ovate-oblong. Caryopsis elliptic.

Flowers & Fruits: June – December

Exiccatus: Mahananda Barrage, **Anurag & AP Das 0567**, dated 13.11.2013.

Status: Common.

Local Distribution: Throughout the study area

General Distribution: India, Tropical and Temperate America.

Paspalum scrobiculatum Linnaeus, Mant. 1: 29. 1767; Hooker *f.*, Fl. Brit. Ind. 7: 10. 1896; Haines, Bot. Bihar & Orissa Pt. V: 1000. 1924; Mooney, Suppl. Bot. Bihar & Orissa 176. 1950; Guha Bakshi, Fl. Mur. Dist. 403. 1984; Panda & Das, Fl. Sambalp. 435. 2004. *Paspalum orbiculare* G. Forster, fl. Insul. Austr. Prodr. 7. 1786. *Paspalum commersonii* Lamarck, Tab. Ency. Meth. Bot. 1: 175. 1791. *Paspalum longifolium* Roxburgh, Fl. Ind. 1: 283. 1820; Prain, Beng. Pl. 2: 1182. 1903.

Annual grass. Culms tufted, erect or ascending. Leaves long, linear-lanceolate; sheaths compressed; ligule membranous. Spikes 2 – 6; spikelets long, elliptic- ovate. Lower glumes absent. Stamens 3. Caryopsis ovoid or globose.

Flowers & Fruits: August – November

Exiccatus: Gossaihat Beel, **Anurag & AP Das 0414**, dated 17.08.2012.

Status: Common

Local Distribution: Throughout the study area

General Distribution: India (Plains), Warm countries of world.

PASPALIDIUM Stapf in Prain, Flora of Tropical Africa 9. 1918**Key to the species:**

- 1a. Spikes shorter than internodes *P. flavidum*
 1b. Spikes longer than internodes *P. punctatum*

Paspalidium flavidum (Retzius) A. Camus in Lecomte, Fl. Gen. De Indi – China 7: 419. 1922; Sukla, Grass. N. E. Ind. 343. 1996; Bora & Kumar, Flor. Div. Ass. 421. 2003. *Panicum flavidum* Retzius, Obs. Bot. 4: 15. 1786; Prain, Beng. Pl. 2: 1176. 1903.

Annual grass. Culms long, compressed. Leaves long, ovate-lanceolate; sheaths compressed; ligule hairy. Spikes shorter than internodes. Spikelets long, ovate-acute, solitary. Lower glumes membranous; caryopsis broadly elliptic.

Flowers & Fruits: August – December

Exiccatus: Gossaihat Beel, **Anurag & AP Das 0416**, dated 17.08.2012; Kathambari Beel, **Anurag & AP Das 0651**, dated 03.09.2014;

Status: Common.

Local Distribution: Throughout the study area

General Distribution: India (plains), Nepal, Sri Lanka, Tropical Asia, Africa.

Paspalidium punctatum (Burman) A. Camus in Lecomte, Fl. Gen. De 1 Indo – China 7: 419. 1922; Sukla, Grass. N. E. Ind. 344. 1996; Bora & Kumar, Flor. Div. Ass. 421. 2003. *Panicum punctatum* Burman, Obs. Bot. 4:15. 1786; Prain, Beng. Pl. 2: 1117. 1903;

Perennial grass. Culms long, floating, rooting at base, Spongy. Leaves long, linear, acute, scabrid margins; sheaths glabrous; ligule hairy. Spikes longer than internodes. Spikelets long, ovate-oblong, imbricate, sessile; glumes membranous. Caryopsis compressed.

Flowers & Fruits: August – December

Exiccatus: Gossaihat Beel, **Anurag & A. P. Das 0424**, dated 17.08.2012.

Status: Common.

Local Distribution: Throughout the study area

General Distribution: India, Tropical Asia, North Africa.

PENNISETUM Richard *ex* Persoon, Pers. Syn. 1: 72. 1805**Key to the species:**

- 1a. Ligules ciliated 2
 1b. Ligules not ciliated *P. polystachion*
 2a. Upper lemma coarsely rugose, boat-shaped *P. glaucum*
 2b. Upper lemma not coarsely rugose, lanceolate *P. pauperum*

Pennisetum glaucum (Linnaeus) R. Brown, Prodr. Fl. Nov. Holl. 195. 1810. *Panicum glaucum* Linnaeus, Sp. Pl. 56. 1753. *Setaria glauca* (Linnaeus) P. Beauvois, Ess. Agrost. 51: 178. 1812; Hooker

f., Fl. Brit. Ind. 7: 78. 1896; Haines, Bot. Bihar & Orissa Pt. V: 988. 1924; Bor, Grass. Bur. Cey. Ind. & Pak. 360. 1960; Panda & Das, Fl. Sambalp. 439. 2004.

Annual grass. Culms erect, prostrate below. Leaves linear, rough on margins; sheaths keeled; ligules ciliate. Spike dense, cylindrical; spikelets long, elliptic; upper lemma coarsely rugose, boat-shaped. Caryopsis rounded-elliptic.

Flowers & Fruits: February – August

Exiccatus: Doumahoni Beel, **Anurag & AP Das 0194**, dated 02.02.2011.

Status: Abundant.

Local Distribution: Throughout the study area

General Distribution: India; throughout the warm and temperate countries.

Pennisetum polystachion (Linnaeus) Schultes, Syst. Veg. Mant. 2: 146. 1824. *Panicum polystachion* Linnaeus, Syst. Nat. 10, 2: 870. 1759.

Annual grass; culms ±1 m. Leaves linear, acuminate, glabrous or hairy. Sheath glabrous. Ligule line fringed with soft hairs. Panicle purplish brown; rachis glabrous. Spikelet solitary, sessile; upper glumes oblong; lemma oblong, truncate, smooth; palea oblong, toothed or ciliate at tip.

Flowers & Fruits: October – November

Exiccatus: Mahananda Barrage, **Anurag & AP Das 0569**, dated 13.11.2013.

Status: Common.

Local Distribution: Throughout the study area

General Distribution: Tropical Africa to India.

Pennisetum pauperum Steudel, Syn. Pl. Glumac. 1: 102. 1854. *Pennisetum purpureum* Schumacher, Beskr. Guin. Pl. 44. 1827; Hsu, Fl. Taiwan 5: 592. 1978; Gierson & Long, Fl. Bhut. 3(2): 741 – 742. 2000.

Vernacular Name: *Hati-ghaash*

Perennials erect herbs. Ligules ciliated. Panicle cylindrical; spikelets 2-flowered, solitary, subsessile; glumes deltoid as long as spikelet; lower lemma lanceolate, minutely hispidous, 5-veined, palea absent; upper lemma lanceolate.

Flowers & Fruits: October – November

Exiccatus: Mahananda Barrage, **Anurag & AP Das 0573**, dated 13.11.2013.

Status: Common.

Local Distribution: Throughout the study area

General Distribution: Tropical Africa to India.

PEROTIS Aiton, Hortus Kewensis 1. 1789.

Perotis indica (Linnaeus) O. Kuntze, Rev. gen. Pl.2: 787. 1891; Majumdar, Bull. Bot. 10(1 & 2): 44. 1956. *Anthsanthum indicum* Linnaeus, Sp. Pl. (ed.1) 28. 1953. *Saccharum spicatum* Linnaeus, Sp. Pl. 54: 1753. *Perotis latifolia* Aiton, Hort. Kew 1: 85. 1789; Hooker *f.*, Fl. Brit. Ind. 7: 98. 1896; Prain, Beng. Pl. 2: 893. 1903.

Aquatic, soft, wiry, spongy grass. Sheathing leaf-base short, loose, striate, ligule short. Inflorescence terminal, rachis simple and scabrid. Spikelets 1-flowered; pedicels small. Stamens 3. Caryopsis free in glume, terete.

Flowers & Fruits: July – August

Exiccatus: Gossaihat Beel, **Anurag & AP Das 0234**, dated 14.07.2011.

Status: Common

Local Distribution: Throughout the study area.

General Distribution: India, Sri Lanka, Myanmar, Tropical Africa.

PHRAGMITES Adanson, Fam. Pl. 2: 34. 1763

Phragmites karka (Ret-zius) Trinius *ex* Steudel, Nomencl. Bot., ed. 2. 1: 144. 1840; Prain, Beng. Pl. 2: 1218. 1903. *Arundo karka* Retzius, Observ. Bot. 4: 21. 1786. *Phragmites vallatoria* (Pluk. *ex* Linnaeus) Veldkamp in Blumea 37 : 233. 1992. *Arundo vallatoria* Pluk. *ex* Linnaeus, Herb Amb. 15. 1754.

Vernacular Name: *Nal-Khagra*

Robust perennial from an extensive creeping rhizome. Culms very stout. Leaf sheaths greenish, glabrous; lamina erect-ascending. Spikelets 10 – 12 mm, florets 4 – 6; glumes lanceolate – elliptic, obtuse to acuminate; lowest lemma narrowly elliptic.

Flowers & Fruits: December – June

Exiccatus: Doumahoni Beel, **Anurag & AP Das 0470**, dated 12.06.2013.

Status: Common.

Local Distribution: Throughout the study area

General Distribution: India, Pakistan, tropical Africa, Polynesia, northern Australia, Tropical Asia.

ROTTBOELLIA Linnaeus *f.*, Suppl. Pl. 13, 114. 1782

Rottboellia cochinchinensis (Loureiro) W.D. Clayton in Kew Bull. 35(4): 817. 1981; Brummitt in Taxon 34(4): 659. 1985; Panda & Das, Fl. Sambalp. 437. 2004. *Stegosia cochinchinensis* Loureiro, Fl. Cochinch. 1: 51. 1790. *Rottboellia exaltata* Linnaeus *f.*, Suppl. Pl. 114. 1782, *non* (Linnaeus) Linnaeus *f.*, Nov. Gram. Gen. 23. 37, t. 1. 1779; Hooker *f.*, Fl. Brit. Ind. 7: 156. 1896; Prain, Beng. Pl. 2: 1192. 1903; Haines, Bot. Bihar & Orissa Pt. V: 1059. 1924.

Vernacular Name: *Khog*

Annual, stout grass. Culms terete, branched above. Lamina linear-lanceolate, glabrous; sheath terete; ligule membranous. Racemes spiciform; spike long, terete, long stalked; spikelets sessile, linear-lanceolate. Stamens 3; stigmas pilose.

Flowers & Fruits: August – December

Exiccatus: Kathambari Beel, **Anurag & AP Das 0654**, dated 03.09.2014.

Status: Common.

Local Distribution: Throughout the study area.

General Distribution: India, Tropics of Asia, Australia and Africa, introduced in West Indies.

SACCHARUM Linnaeus, Sp. Pl. 1: 54. 1753

Key to the Speices:

- 1a. Lower glumes glabrous on the back; lemmas not cuspidate *S. spontaneum*
 1b. Lower glumes with long hairs; lemmas cuspidate *S. arundinaceum*

Saccharum arundinaceum Retzius, Obs. Bot. 4: 14. 1786; Fl. Brit. Ind 7: 119. 1897; Prain, Beng. Pl. 2: 1189. 1903; Sedge. & gras. Dakh. Kan & Udu. Dist. 315. 2001. *Erianthus arundinaceus* (Retzius) Jews. In Arch. Suikerind. Ned.-Ind. 399. 1925.

A tufted large perennial grass. Culms upto 6 m high, erect from the root stock. Leaf sheath beaded about the mouth; ligule hairy. Panicle effuse, long, white villous. Spikelets lanceolate; hairs at callus silky. Lower lemma empty, oblanceolate; upper lemma bisexual; palea ovate.

Flowers & Fruits: January – March

Exiccatus: Doumahoni Beel, **Anurag & AP Das 0172**, dated 02.02.2011.

Status: Common.

Local Distribution: Throughout the study area

General Distribution: India (coastal area), E. Australia, S. Europe, Sri Lanka.

Saccharum spontaneum Linnaeus, Mant. Alt. 183. 1771; Hooker *f.*, Fl. Brit. Ind. 7: 118. 1896; Prain, Beng. Pl. 2: 1188. 1903; Hajra *et al.*, Fl. Sikkim 1: 271. 1996; Bor, Grass. Bur. Cey. Ind. & Pak. 214. 1960. *Imperata spontanea* (Linnaeus) Beauverd, Ess. Agro. 8. 1812.

Perennial, long grass. Culms high, erect; rhizomes thick, extensive. Leaves linear, acuminate, scabrid on margins; sheaths hairy at throat; ligule hairy. Inflorescence a lax panicle, silky hairy. Spikelets long, lanceolate. Stamens 3. Caryopsis narrowly lanceolate.

Flowers & Fruits: September – December

Exiccatus: Gajoldoba, **Anurag & AP Das 0101**, dated 12.09.2010; Doumahoni Beel, **Anurag & AP Das 0655**, dated 03.09.2014.

Status: Common

Local Distribution: Throughout the study area.

General Distribution: India (Warmer part), E. Australia, S. Europe, Sri Lanka.

SACCIOLEPIS Nash, Man. Fl. N. States 89. 1901

Key to the Speices:

- 1a. Panicle upto 4 cm long; Caryopsis elliptic *S. indica*
 1b. Panicle upto 18 cm long; Caryopsis obovoid *S. interrupta*

Sacciolepis indica (Linnaeus) Chase, Proc. Biol. Soc. Wash. 21: 8. 1908; Hajra *et al.*, Fl. Sikkim 1: 271. 1996; Bor, Grass. Bur. Cey. Ind. & Pak. 357. 1960. *Panicum indicum* Linnaeus, Mant. 2: 184. 1771 (non *P. indicum* Miller); Hooker *f.*, Fl. Brit. Ind. 7: 156. 1896; Prain, Beng. Pl. 2: 1178. 1903.

Erect, annual grass. Culms long, spreading. Lamina linear-acuminate, glabrous; sheath slightly keeled; ligule membranous. Spikes in panicle, terete, upto 4 cm long; spikelets shortly pedicelled, ovoid. Stamens 3. Caryopsis elliptic.

Flowers & Fruits: August – January

Exiccatus: Gossaihat Beel, **Anurag & AP Das 0415**, dated 17.08.2012.

Status: Common

Local Distribution: Throughout the study area

General Distribution: India, Tropical and sub Tropical Asia and Australia.

Sacciolepis interrupta (Willdenow) Stapf in Prain Fl. Trop. Afr. 9: 757.1920; Blatter & McCann, Bombay Grass. 167.1935; Majumdar, Bull. Bot.soc. Beng. 10(1&2): 58. 1956; Hajra *et al.*, Fl. Sikkim 1:272.1996. *Panicum interrupta* Willdenow, Sp. Pl. 1:341.1798; Hooker *f.*, Fl. Brit. Ind. 7:40.1896; Prain, Beng. Pl. 2:1178.1903.

Erect, branched, perennial, quite glabrous grass. Culms creeping, spongy, lower nodes rooting. Lamina soft, glabrous, base sub-cordate, ligule short. Spikes in panicles, cylindrical; spikelets lanceolate, densely imperfect, ovoid, turgid spreading. Caryopsis obovoid.

Flowers & Fruits: August – January

Exiccatus: Mahananda Barrage, **Anurag & AP Das 0583**, dated 13.11.2013.

Status: Common.

Local Distribution: Throughout the study area.

General Distribution: India, Assam, Sri Lanka, Myanmar, Malaysia, China.

SETARIA P. Beauvois, Ess. Agrostogr. 51: 178. 1812

Setaria intermedia Roth *ex* Roemer & Schultes, Syst. Veg. 2: 489. 1817; Hooker *f.* Fl. Brit. Ind. 7: 79. 1896; Prain, Beng. Pl. 2: 1170. 1903; Grierson & Long, Fl. Bhut. 3(2): 722. 2000. *Panicum tomentosum* Roxburgh, Fl. Ind. 1. 303. 1820. *Setaria tomentosa* (Roxburgh) Kunth, Rev. Gram. 1: 47. 1829; Grass. Bur. Ceyl. Ind. Pak. 365. 1960. *Oplismenus tomentosus* (Roxburgh) Schultes, Mant. 2: 272. 1824.

Tufted annual. Culms 30 – 60 cm tall, branched and rooting from nodes at base. Leaf: lamina linear-oblong, 5 – 15 × 0.3 – 0.7 cm, glabrous, sparsely hairy above towards base, apex acuminate; sheaths glabrous, keeled, margins ciliate, more near mouth; ligule truncate, a line of stiff cilia, ± 1 mm. Inflorescence a contracted panicle, 2 – 14 × 0.5 – 1 cm, distinctly branched, lowest branches 1 – 1.5 cm; rachis slender, minutely pubescent Spikelets borne singly, elliptic-ovate, subtended by 1 – 2 (or some times more), 3 – 10 mm, stiff, bristles, 2 – 2.5 mm, shortly pedicelled; glumes thin, membranous; lower glume 1/3 – 1/2 of spikelet length, ovate, obtuse to acute, 3-nerved; upper glume 1/2 – 2/3 of spikelet length, 5-veined; lower floret neuter; lower palea and lemma membranous; upper lemma transversely rugose, coriaceous, convex, boat-shaped.

Flowers & Fruits: June – September

Exiccatus: Doumahoni Beel, **Anurag & AP Das 0659**, dated 03.09.2014.

Status: Common.

Local Distribution: Throughout the study area.

General Distribution: India, Bhutan, China, Myanmar, Sri Lanka, Japan, Russia; E Africa.

SPOROBOLUS R. Brown, Prodr. 169. 1810

Sporobolus diander (Retzius) P. Beauvois, Ess. Agro. 26: 147 – 178. 1812; Hooker *f.*, Fl. Brit. Ind. 7: 247. 1896; Prain, Beng. Pl. 2: 1213. 1903; Hajra *et al.*, Fl. Sikkim 1: 303. 1996; Cook, Aqua. Wetl.

Pl. Ind. 281.1996; Bora & Kumar, Flor. Div. Ass. 427. 2003. *Agrostis diandra* Retzius, Obs. Bot. 5: 19. 1789.

Perennial grass. Culms long, tufted. Leaves linear, filiform; sheath glabrous; ligule hairy. Panicle, branches short, crowded at nodes; spikelets long, acute; lower glumes nerveless; lemma lanceolate. Caryopsis oblong-ovoid.

Flowers & Fruits: August – December

Exiccatus: Gajoldoba, **Anurag & AP Das 0117**, dated 12.09.2010.

Status: Abundant.

Local Distribution: Throughout the study area.

General Distribution: India, Sri Lanka, Australia.

THEMEDA Forsskål, Fl. Aegypt. Arab. 178. 1775

Themeda villosa (Lamarck) A. Camus, Fl. Indo-Chine. 7: 364. 1922 (*non*. Poiret); Fl. Bhut. 3(2): 822. 2000. *Anthistiria villosa* Lamarck, Tabl. Encycl. 5: t. 841, f. 3. 1799. *A. villosa* Poiret, Encycl. Suppl. 1: 396. 1812. *Arthistiria gigantea* Cavanilles subsp. *villosa* (Poiret) Hooker f., Fl. Brit. Ind. 7: 211. 1896. *Themeda gigantea* var. *villosa* (Lamarck) Hackel, Monogr. Phan. 6: 675. 1889.

Tufted Perennial. Culms, stout, 2 – 3.5 m tall, 1 – 2 cm in diameter Leaf: lamina 60 – 100 × 1 – 2 cm, lanceolate, gradually narrowed towards base to a thick white midrib, acuminate, scabrid or tubercled hairy along veins above, glabrous beneath, margins serrate; sheaths glabrous, compressed, margin hyaline, brown, mouth auricled; ligule 1 mm, ciliate, rounded. Inflorescence a compoundly branched panicle, 40 – 80 m, branches drooping, spathes subtending a further spathe and a spathole with a single raceme; spatheoles 2 – 3 cm, minutely hispid. Raceme composed of 4 homogamous spikelets, 1 spikelet pair and a terminal triad above. Homogamous spikelets, male or sterile, glumes 1 – 1.5 × 0.2 – 0.3 cm, lanceolate, shortly and sparsely pubescent. Sessile spikelet 0.5 – 0.8 mm; callus 1 – 2 mm, callus hairs 2 – 3 mm; both glumes densely covered with reddish-brown stiff hairs. Pedicelled spikelet 10 – 15 mm.

Flowers & Fruits: September – December

Exiccatus: Kathambari Beel, **Anurag & AP Das 0664**, dated 03.09.2014.

Status: Common.

Local Distribution: Throughout the study area

General Distribution: India, Nepal, Bhutan, Bangladesh, NE India, China, Sri Lanka, Indonesia, Malaysia, Philippines, Thailand.

THYSANOLAENA Nees in Edinb. N. Phil. Journ. 18: 180. 1835

Thysanolaena latifolia (Roxburgh *ex* Hornemann) Honda, Jour. Fac. Sci. Univ. Tokyo, Sect. 3, Bot. 3: 312. 1930. *Melica latifolia* Roxburgh *ex* Hornemann, Suppl. Hort. Bot. Hafn. 117. 1819; Prain, Beng. Pl. 2: 1172. 1903.

Perennial, hard, unbranched shrubs. Leaf sheaths smooth; lamina leathery, broadly lanceolate-oblong; ligule truncate. Spikelets 1.6 – 1.9 mm; glumes, ovate-lanceolate; lower lemma as long as spikelet; upper lemma slightly shorter than lower lemma. Anthers brown. Caryopsis oblong.

Flowers & Fruits: June – November

Exiccatus: Gajoldoba, **Anurag & AP Das 0090**, dated 12.09.2010.

Status: Common.

Local Distribution: Throughout the study area

General Distribution: India, Bangladesh, Bhutan, China, Cambodia, Indonesia, Laos, Malaysia, Myanmar, Nepal, New Guinea, Philippines, Sri Lanka, Thailand, Vietnam; Indian Ocean Islands.

TYPHACEAE A. L. de Jussieu, Gen. Pl. 25. 1789

TYPHA Linnaeus, Sp. Pl. 2: 971. 1753

Key to the Species:

- 1a. Rhizome not creeping, perianth hairy *T. angustifolia*
 1b. Rhizome creeping, perianth absent *T. elephantina*

Typha angustifolia Linnaeus, Sp. Pl. 971. 1753; Hooker *f.*, Fl. Brit. Ind. 6: 489. 1893; Prain, Beng. Pl. 2: 830. 1903 Haines, Bot. Bihar & Orissa Pt. V: 876. 1924; Suppl. Bot. Bihar & Orissa 142. 1950. *Typha domingensis* Persoon, Syn. Pl. 2: 532. 1807; Panda & Das, Fl. Sambalp. 384. 2004. **[PLATE 4.17. Figs. 94]**

Vernacular Name: *Hogla*

Perennial, 2 – 3m tall aquatic or marshy herb. Rhizome subterranean, prostrate. Leaves spongy, 1 – 3 broad, semi-cylindric above the sheath, erect and linear. Spikes 1.5 – 2.5 cm diam, cylindric, male and female zones separated. Perianth hairy.

Flowers & Fruits: September – December

Exiccatus: Gajoldoba **Anurag & AP Das 0154**, dated 12.09.2010; Kathambari Beel, **Anurag & AP Das 0652**, dated 03.09.2014.

Status: Common at places.

Local Distribution: In some wetlands of the study area.

General Distribution: India; Africa, S. Europe.

Typha elephantina Roxburgh, Fl. Ind. 3. 566. 1832; Hooker *f.*, Fl. Brit. Ind. 6: 489. 1892; Prain, Beng. Pl. 2: 1102. 1903; Noltie, Fl. Bhut. 3 (1): 177. 1994.

Perennial marsh herb with creeping rhizomes. Leaves distichous along flowering stem, linear, erect, obtuse, spongy, flat, entire, basal sheaths keeled and triangular. Flowering stems 2 – 3 m, taller than leaves, stout. Spikes terminal, cylindric, dark brown, densely flowered, males and females in different zones; Males with 1 – 3 stamens surrounded by several stiff hairs. Females with 1-loculed ovary with single ovule, on long capillary stalk surrounded by numerous fine hairs.

Flowers & Fruits: May – September

Exiccatus: Gajoldoba **Anurag & AP Das 0108**, dated 12.09.2010; Kathambari beel, **Anurag & AP Das 0661**, dated 03.09.2014.

Status: Rare in area.

Local Distribution: Found only in Terai regions.

General Distribution: India, Nepal, China, Pakistan, Tajikistan, Turkmenistan, Uzbekistan, Myanmar, Africa.

XYRIDACEAE C. Agardh, Aphor. Bot. 158. 1823

XYRIS Linnaeus, Sp. Pl. 1: 42. 1753

Xyris pauciflora Willdenow, Phytogr. 1: 2, t. f.1 & Sp. Pl. 1: 255. 1794; Hooker f., Fl. Brit. Ind. 6: 363. 1892; Prain, Beng. Pl. 2: 1080. 1903; Noltie, Fl. Bhut. 3(1): 242. 1994; Hajra *et al.*, Fl. Sikkim 1: 167. 1996; Cook, Aqua. Wetl. Pl. Ind. 369, 1996. *Xyris denticulata* R. Brown, Prodr. Fl. Nov. Holl. 256. 1810. *Xyris maritima* T. Koyama, Philipp. Jour. Sci. 84: 367. 1956. *Xyris dajacensis* P. Royen, Blumea 7: 208. 1953.

Tufted perennial herbs with few flowering stems and leaves. Leaves usually basal, sheathed, 1.5 – 5.2 cm; lamina linear, 8 – 18 cm × 1 – 2.4 mm, shorter than scapes, acute to acuminate. Scape 10 – 32 cm × 1 – 1.6 mm, terete, exceeding leaves. Spikes terminal, globose to ovoid; bracts reddish-brown, elliptic, sub-orbicular to broadly obovate, 3 – 4 × 3 – 3.5 mm, triangular, margins membranous, yellowish apex obtuse or emarginate. Lateral sepals membranous, translucent, boat-shaped. Petals 3, free; with a long and narrow claw below and a wide obovate, shallowly dentate, truncate yellow limb. Stamens 1 each adnate with petals, ± 1 mm. Ovary obovoid, 3 – 3.7 mm.

Flowers & Fruits: August – December

Exiccatus: Gajoldoba, **Anurag & AP Das 0135**, dated 12.09.2010; Mahananda Barrage, **Anurag & AP Das 0631**, dated 13.11.2013.

Status: Less common.

Local Distribution: In few wetlands of Terai & Duars.

General Distribution: India (throughout); native to Tropical Australia.

Order: Zingiberales

CANNACEAE A. Jussieu, Gen. Pl. 62. 1789, *nom. cons.*

CANNA Linnaeus, Sp. Pl. 1: 1. 1753

Canna indica Linnaeus, Sp. Pl. 1: 1. 1753; Prain, Beng. Pl. 2: 1047. 1903. *Canna orientalis* var. *flava* Roscoe, Monandr. Pl. Scitam. 40. 1826; Noltie, Fl. Bhut. 3(1): 212. 1994; *Canna montana* Blume, Enum. Pl. Javae. 35. 1827. *Canna indica* var. *rubra* Aiton, Hort. Kew. 1: 1. 1789.

Vernacular name: *Kala-bati*, *Kyana* (Bengali)

Rhizome much branched. Stems up to 2 m high. Leaf-sheath green to purple; petiole short; lamina adaxially green, 25 – 55 × 8 – 16 cm. racemes compact, branched; bracts ovate. Flowers 1 – 2 per cincinnus. Sepals pale. Corolla tube apricot yellow. Staminodes 2 or 3; labellum red, lanceolate. Ovary green, globose. Capsule broadly ovoid.

Flowers & Fruits: Throughout the year.

Exiccatus: Mahananda Barrage, **Anurag & AP Das 0299**, dated 26.11.2011; Gossaihat Beel, **Anurag & AP Das 0425**, dated 17.08.2012.

Status: Abundant.

Local Distribution: In periphery of most of the wetlands of Terai & Duars.

General Distribution: Native to tropical America; naturalized throughout the tropics.

COSTACEAE Nakai, J. Jap. Bot. 17: 203. 1941

CHEILOCOSTUS C.D. Specht, Taxon 55(1): 159. 2006

Cheilocostus speciosus (J. König) C. Specht, Taxon 55: 159. 2006. *Banksia speciosa* König, Retzius Obs. 3: 75. 1783. *Hellenia grandiflora* Retzius, Observ. Bot. 6: 18. 1791. *Costus speciosus* (J. König) J.E. Smith, Trans. Linnaeus, Soc. 1: 249. 1791; G. Watt, Dict. Econ. Prod. 2: 579. 1889; Hooker f., Fl. Brit. Ind. 6: 249. 1892; Prain, Beng. Pl. 2: 786. 1903; Noltie, Fl. Bhut. 3(1): 210. 1994; Hajra *et al.*, Fl. Sikkim 1: 124. 1996.

Stems up to 3 m. Petiole 5–7 mm; lamina oblong to lanceolate, 12–22 × 5–11 cm. Condensed spike terminal, ellipsoid to ovoid; bracts bright red, sometimes green, apex sharply pointed; bracteoles pale red or green; calyx red or green, apex 3 lobed; corolla tube 1 cm; lobes oblong-elliptic, apex white. Labellum white; staminodes petaloid, bright white with orange-yellow base. Capsules red or green, globose; seeds black.

Flowers & Fruits: July – November

Exiccatus: Gajoldoba, **Anurag & AP Das 0087**, dated 12.09.2010; Mahananda Barrage, **Anurag & AP Das 0600**, dated 13.11.2013.

Status: Abundant.

Local Distribution: In the forest wetlands of Terai & Duars.

General Distribution: India, Bangladesh, Sri Lanka, Java.

MARANTACEAE R. Brown, Voy. Terra Austral. 2: 575. 1814

Key to the Genera:

- 1a. Fruit indehiscent *Schumannianthus*
 1b. Fruit dehiscent 2
 2a. Flower pairs 2 to many per bract *Phrynium*
 2b. Flower pairs 1 – 5 per bract *Stachyphrynium*

PHRYNIUM Willdenow, Sp. Pl., 1: 1, 17. 1797

Phrynium pubinerve Blume, Enum. Pl. Javae 1: 38. 1827; Noltie, Fl. Bhut. 3(1): 214.1994. *Phrynium rheedei* Suresh & Nicolson, Taxon 35: 355. 1986.

Rhizomes tuberous. Basal leaves several; lamina ovate-oblong, glabrous, shortly acuminate, acute at base. Inflorescence sessile, capitate; bracts purple-red, oblong-lanceolate. Flower pairs 3 per bract, sessile. Sepals linear. Corolla tube violet, shorter than calyx; lobes dark red, oblong-obovate. Outer staminodes light red, obovate. Fruit dark red, shiny, pyriform.

Flowers & Fruits: April – July

Exiccatus: Gossaihat Beel, **Anurag & AP Das 1025**, dated 14.06.2013.

Status: Common

Local distribution: Throughout the study area.

General distribution: Tropical and Temperate Asia.

STACHYPHRYNIUM K. Schum., Pflanzenr. Marnt. 45. 1902

Stachyphrynium placentarium (Loureiro) Clausager & Borchsenius. Kew Bull. 58(3): 672. 2003 .
Phrynium placentarium (Loureiro) Merrill, Philipp. J. Sci. 15: 230. 1919; Noltie, Fl. Bhut. 3(1): 215. 1994. *Phyllodes placentaria* Loureiro, Fl. Cochinch. 1: 13. 1790.

Annual plants. Basal leaves 1 or 2; leaf sheath 3–47 cm; lamina ovate - elliptic, thinly leathery, glabrous, acuminate, rounded at base. Inflorescence sessile composed of 4 or 5 or more spikelets; bracts crowded, oblong, Flowers 2 per bract, white to yellowish white. Sepal's linear, Corolla lobes elliptic. Outer staminodes obovate. Ovary glabrous or apically puberulent. Fruit oblong.

Flowers & Fruits: June – December

Exiccatus: Doumahoni Beel, **Anurag & AP Das 01184**, dated 12.11.2013.

Status: Common.

Local distribution: Throughout the study area.

General distribution: India, Bhutan, China, Indonesia, Myanmar, Philippines, Thailand, Vietnam.

SCHUMANNIANTHUS Gagnepain, Bull. Soc. Bot. France 51: 169. 1904

Schumannianthus dichotomus (Roxburgh) Gagnepain, Bull. Soc. Bot. France 51: 176. 1904; Noltie, Fl. Bhut. 3(1): 215. 1994. *Phrynium dichotomum* Roxburgh, Asiat. Res. 11: 324. 1810; Prain, Beng. Pl. 2: 1048. 1903.

Vernacular Name: *Shital pati* or *Patipata*

Bushy shrubs, 1 – 3 m. Stem tufted, dichotomously much branched in upper part; inter-nodes smooth, nodes swollen. Leaves shortly petiolate to 5 – 8 mm; blades elliptic, smooth, shiny, coriaceous, mid-vein prominent, primary veins obliquely parallel. Inflorescence terminal on branches, racemose in 3 – 5 nodes. Rachis zigzag. Each node comprising a cluster of 5 – 9 flowers subtended by a bract. Bract lanceolate, acuminate. Flowers white, pedicel 8 – 10 mm, clove shaped; sepals triangular, corolla tube 3 – 4 mm.

Flowers & Fruits: June – September

Exiccatus: Gossaihat Beel, **Anurag & AP Das 0253**, dated 14.07.2011; Doumahoni Beel, **Anurag & AP Das 0484**, dated 12.06.2013.

Status: Doubtfully wild.

Local Distribution: Found in a large number of wetlands of the study area.

General Distribution: E Himalaya to Philippines

Note: Often cultivated as its bark is used for making good quality mats.

MUSACEAE A. L. de Jussieu, Gen. Pl. 61. 1789

MUSA Linnaeus, Sp. Pl. 2: 1043. 1753

Musa balbisiana Colla, Mem. Reale Accad. Sci. Torino 25: 384. 1820. & Mem. Gen. Musa. 56. 1820; Das & Chanda, Trans. Bose Res. Inst. 51(4): 120. 1987; Noltie, Fl. Bhut. 3 (1): 180. 1994; Hajra *et al.*, Fl. Sikkim 1: 135. 1996. *M. sapientum sensu* Baker in Hooker *f.*, Fl. Brit. Ind. 6: 262. 1892; Prain, Beng. Pl. 2: 1050. 1903. *non* Linnaeus 1753.

Vernacular Name: *Kala*

Pseudostems clumped, green, large, dark markings. Petioles 60–80 cm, margin open; lamina adaxially green, ovate oblong, base asymmetric. Spadix pendulous, 1–1.5 m; peduncle and rachis glabrous. Bracts of bisexual and male flowers adaxially purple red, abaxially yellowish green, ovate to lanceolate, persistent, obtuse, reflexed after flowering; bracts of female flowers deciduous. Berries pale green, obovoid, distinctly angled at maturity. Seeds numerous, brown, oblate, minutely warty.

Flowers & Fruits: Almost throughout the year

Exiccatus: Mahananda Barrage, *Anurag & AP Das 0025*, dated 12.05.2010; Gossaihat Beel, *Anurag & AP Das 0448*, dated 17.08.2012.

Status: Abundant.

Local Distribution: Found in the margin of almost all wetlands of Terai & Duars.

General Distribution: India, Nepal, Indonesia, Malaysia, Myanmar, New-Guinea, Philippines, Sikkim, Sri Lanka, Thailand.

ZINGIBERACEAE Martinov, *Tekhno-Bot. Slovar* 682. 1820

ALPINIA Roxburgh, *Asiat. Res.* 11: 350. 1810

Key to the Species:

- 1a. Ligules 0.7–2 mm; lamina 3–7 cm broad; bracteoles open, deciduous 2
- 1b. Ligules 4–6 mm; lamina 7–12 cm broad, bracteoles tubular, persistent *A. nigra*
- 2a. Leaves sessile; ligule 1–2 cm, obtuse, glabrous *A. calcarata*
- 2b. Leaves petiolate; ligule 0.7–1 cm, 2-lobed, tomentose *A. malaccensis*

Alpinia nigra (Gaertner) B.L. Burtt, *Notes Roy. Bot. Gard. Edenb.* 35: 213. 1977; Noltie, *Fl. Bhut.* 3(1): 205. 1994. *Zingiber nigrum* Gaertner, *Fruct.* 1: 35. 5–12. 1788. *A. allughas* (Retzius) Roscoe in *Trans. Linn. Soc.* 8. 146. 1807; Hooker *f.*, *Fl. Brit. Ind.* 6: 253. 1892; Prain, *Beng. Pl.* 2: 1047. 1903. *Heritiera allughas* Retzius, *Observ. Bot.* 6: 17. 1791.

Vernacular Name: *Purundi*

Perennial rhizomatous herb, thick & creeping rhizome. Pseudostems 1.4–3.2 m. Leaves alternate sessile or shortly petiolate; ligule glabrous, brown, orbicular, 4–6 mm; lamina lanceolate or elliptic-lanceolate, 25–45 × 7–12 cm, glabrous, acute at base and apex. Inflorescence a terminal panicle, many flowered; erect, 20–43 cm; branches 10–14, alternate, 5–9 cm; bracts 2, early deciduous; 2–4 flowers; bracteoles tubular, persistent. Pedicel variable, 3–7 mm. Calyx tubular, pubescent abaxially. Corolla lobes whitish-light pink, oblong, 1.3–1.6 cm. Stamen 1.4–1.5 cm; filament linear, 1–1.3 cm; anther pink, 2-lobed. Ovary pubescent. Capsule globose to oblong, 1–1.4 cm.

Flower & Fruits: May–September

Exiccatus: Mahananda Barrage, *Anurag & AP Das 0068*, dated 12.05.2010; Gajoldoba, *Anurag & AP Das 0151*, dated 12.09.2010.

Status: Abundant.

Local Distribution: Generally found in almost all the forest wetlands.

General Distribution: India, Bhutan, Sri Lanka, China, Thailand.

Alpinia malaccensis (N.L. Burman) Roscoe, Trans. Linn. Soc. London, Bot. 8: 345. 1807; Hooker *f.*, Fl. Brit. Ind. 6: 255. 1892; Prain, Beng. Pl. 2: 1046. 1903; Noltie, Fl. Bhut. 3(1): 206. 1994. *Maranta malaccensis* N.L. Burman, Fl. Indica, 2. 1768.

Vernacular Name: *Purundi*

Robust rhizomatous perennial herb. Pseudostems 1.2–3.5 m. Leaves alternate, petiolate to subsessile, 3.2–4.5 cm; ligule 0.7–1 cm, 2-lobed, tomentose; lamina lanceolate, acuminate, 32–63 × 5–7 cm, pubescent beneath. Inflorescence, raceme, erect, pubescent, 20–35 cm; bracts absent; bracteoles white, deciduous, after opening of flower, broadly elliptic, 1.4–2.5 cm, subtending two flowers each. Flowers white, often pink; pedicel 4–5.2 mm, densely pubescent; calyx campanulate; corolla white; lateral staminodes absent. Stamen ± 2 cm. Ovary pubescent. Capsule red, globose, 1.8–2.5 cm in diameter.

Flower & Fruits: April–July

Exiccatus: Doumahoni Beel, *Anurag & AP Das 0523*, dated 12.06.2013.

Status: Common.

Local Distribution: Generally found in almost all the forest wetlands.

General Distribution: India, Bhutan, Bangladesh, China, Indonesia (Java), W Malaysia, Myanmar, Thailand.

Alpinia calcarata Roscoe, Trans. Linn. Soc. London 8: 347. 1807; Hooker *f.*, Fl. Brit. Ind. 6: 254. 1892; Prain, Beng. Pl. 2: 1047. 1903; Noltie, Fl. Bhut. 3(1): 206. 1994. *Alpinia spicata* Roxburgh, Asiat. Res. 11: 356. 1810.

Rhizomatous perennial herb, pseudostems to 1–1.5 m. Leaves sessile alternate; ligule 1–2 cm, glabrous, obtuse; lamina linear-lanceolate, 18–34 × 2.2–4 cm, both surface glabrous, attenuate at base. Inflorescence panicle, 7–10 cm, 4-5 flowered; bracteoles membranous oblong, to 1.3–1.6 cm. Calyx membranous, slightly pubescent, 1–1.2 cm, apex toothed, brownish. Corolla tube 7.5–9 mm, white; petals oblong, 1.5–2.2 cm. Staminodes rudimentary, reduced to linear. Filament 1.1–1.4 cm; anther ± 4.5 mm, white, fleshy. Ovary 3.5–4 mm, pubescent. Capsule 1.2–1.3 cm, red, globose.

Flower & Fruits: May–August

Exiccatus: Doumahoni Beel, *Anurag & AP Das 0531*, dated 12.06.2013.

Status: Less common.

Local Distribution: Found in forest wetland.

General Distribution: India, Sri Lanka, China, Myanmar.

Probable sister eudicots

Order: Ceratophyllales

CERATOPHYLLACEAE Linnaeus, Sp. Pl. 2:992.1753

CERATOPHYLLUM Linnaeus, Sp. Pl. 2: 992.1753

Ceratophyllum demersum Linnaeus, Sp. Pl. 992. 1753; Hooker *f.*, Fl. Brit. Ind. 5: 639. 1888; Prain, Beng. Pl. 2: 743. 1903.

Ceratophyllum verticillatum Roxburgh (Hort. Beng. 68. 1814) & Fl. Ind. 3: 624. 1832. spended, delicate, rootless aquatic herbs. Lamina highly dissected into filiform segments. Flowers monoecious, solitary, axillary. Involucre 8–12 cleft, resembling perianth. Achenes with basal spines and persistent style.

Flowers & Fruits: August – December

Exiccatus: Gossaihat Beel, Anurag & AP Das 0418, dated 17.08.2012.

Status: Common.

Local Distribution: Throughout the study area.

General Distribution: India, cosmopolitan.

Eudicots

Order: Ranunculales

PAPAVERACEAE A. Jussieu, Gen. Pl. 235. 1789; *nom. cons.*

Key to the Genera:

- 1a. Tall erect prickly herbs; corolla rosaceous; stamens and seeds numerous ***Argemone***
- 1b. Small diffuse, non-prickly herbs; corolla asymitric; stamens definite; fruits 1-seeded ... ***Fumaria***

ARGEMONE Linnaeus, Sp. Pl. 2. 1753

Argemone mexicana Linnaeus, Sp. Pl. 508. 1753. Hooker *f.*, & Thomson in Fl. Brit. Ind. 1: 117. 1872; Mowat in Tutin *et al.*, Fl. Europ. 1: 251. 1964; Prain, Beng. Pl. 1: 215. 1903.

Vernacular Name: *Sialkata*

A Prickly glabrous annual herbs, branched. Leaves alternate, lamina elliptic – oblong, pinnatifid, sinuate – lobulated; variegated green and white, dentate, prickly on the margin, midrib and the veins beneath. Sepals with an acute, terete horn below the apex, very sparsely prickly outside, concave, imbricate caduceus; petals narrowed below, bright yellow, imbricate; stamens indefinite, anther curved after flowering. Ovary covered with long soft spines; stigma red, 3 – 6 lobed; lobes usually broad. Capsules oblong or elliptic – oblong, covered with sharp erect prickles; valves 3 – 6; seeds many, brown.

Flowers & Fruits: February – May

Exiccatus: Doumahoni Beel, **Anurag & AP Das 0210**, dated 02.02.2011; Gajoldoba, **Anurag & AP Das 0747**, dated 03.09.2014.

Status: Abundant.

Local Distribution: Throughout the study area.

General Distribution: Native of Tropical America naturalized in warmer countries.

FUMARIA Linnaeus, Gen. Pl. ed. 5. 1754

Fumaria indica (Hasskarl) Pugsley in Journ. L. Soc. Bot. 44. 313. 1919; Guha Bakshi, Fl. Mur. Dist. 53. 1984. *Fumaria vaillantii* Loisel var. *indica* Haussk, Fl. Ind. 56: 443. 1873. *Fumaria parviflora sensu* W. & A., Prodr. 1: 18. 1834, non Lamk. 1788; Prain, Beng. Pl. 1: 143. 1963.

Vernacular Name: *Ban dhania*

Annual, erect, much branched herbs. Lamina highly dissected, alternate. Inflorescence in terminal raceme. Flowers irregular, bisexual; sepals - 2, scale like; petals - 4, 2-seriate; stamens diadelphous, anther 1 celled; carpel - 2, ovary 1 - celled, slightly lobed. Fruits one seeded nutlets.

Flowers & Fruits: November – March

Exiccatus: Mahananda Barrage, **Anurag & AP Das 0636**, dated 13.11.2013; Gajoldoba, **Anurag & AP Das 0731**, dated 03.09.2014.

Status: Common.

Local Distribution: Throughout the study area

General Distribution: India, N. America, Europe and Central Asia.

RANUNCULACEAE A. Jussieu, Gen. Pl. 231. 1789 *nom. cons.*

RANUNCULUS Linnaeus, Sp. Pl. 1: 548. 1753

Ranunculus sceleratus Linnaeus, Sp. Pl. 551. 1753; Hooker *f.*, Fl. Brit. Ind. 1: 19. 1872; Kanjilal *et al.*, Fl. Ass. 1: 8. 1934; Guha Bakshi, Fl. Mur. Dist. 43. 1984. Sharma *et al.*, Fl. Ind. 1: 128. 1993. Prain, Beng. Pl. 1: 193. 1903. [PLATE 4.4. Figs. 11]

Annual, much branched, strongly aromatic, marshland herbs with upto 75 cm high. Stem succulent, hollow, deeply furrowed. Lamina of radical leaves reniform, deeply notched, glabrous, tripartite with linear entire segment. Cymes terminal; flowers small, yellow, numerous. Achenes numerous in oblong, turgid, pilose receptacle.

Flowers & Fruits: December – March

Exiccatus: Mahananda Barrage, *Anurag & AP Das 0297*, dated 26.11.2011; Gajoldoba, *Anurag & AP Das 0729*, dated 03.09.2014.

Status: Abundant.

Local Distribution: Throughout the study area

General Distribution: Asia, Europe, North Africa and temperate America.

Order: Proteales

NELUMBONACEAE A. Richard, Dict. Class. Hist. Nat. 11: 492. 1827

NELUMBO Adanson, Fam. Pl. 2: 76. 1763

Nelumbo nucifera Gaertner, Fruct. 1: 73. t. 19. f. 2. 1788; Subramanyam, Aquat. Angios. 6. 1962; Sharma *et al.*, Fl. India 1: 441. 1993. *Nelumbium speciosum* Willdenow, Sp. Pl. 2: 1258. 1799; Hooker *f.*, Fl. Brit. Ind. 1: 116. 1872; Prain, Beng. Plants 1: 214. 1903; Haines, Bot. Bihar & Orissa Pt. II: 22. 1921.

[PLATE 4.3. Figs. 4]

Vernacular Name: *Padda, Padma*

Aquatic, large, herbs with milky juice; root-stock stout, creeping. Leaves raised high above the water level; petiole finely prickly. Flowers white or rose, 10 – 20 cm diam.; petals elliptic, concave, veined; peduncle with scattered and weak prickles; ovules 1.

Flowers & Fruits: March – January

Exiccatus: Mahananda Barrage, *Anurag & AP Das 0062*, dated 12.05.2010; Doumahoni, *Anurag & AP Das 0728*, dated 03.09.2014.

Status: Common.

Local Distribution: Throughout the study area

General Distribution: Native to Asia.

Note: It is the National Flower of India. Widely cultivated mainly for its flowers. Underground stem is a delicacy and leaves are used as food-plate.

Core Eudicots**Order: Saxifragales**

HALORAGACEAE R. Brown -Voy. Terra Austral. 2: 549. 1814

MYRIOPHYLLUM Linnaeus, Gen. Pl. ed. 5. 1754

Key to the species:

- 1a. Flower white; bracts whitish; ridges rounded *M. indicum*
 1b. Flower pink; bracts reddish; ridges acute *M. tuberculatum*

Myriophyllum indicum Willdenow, Sp. Pl. 4: 407. 1805; Hooker *f.*, Fl. Brit. Ind. 2: 433. 1878; Prain, Beng. Pl. 1: 343. 1903. *Myriophyllum tetrandrum* Roxburgh, Fl. Ind. 1: 470. 1820.

Aquatic, partly submerged herbs. Leaves submerged lamina pertinently pinnatifid, verticillate, aerial serrate. Inflorescence verticillate; flower white, bracts deeply dissected whitish, stigma green. Fruits 4-furrowed. Ridges rounded.

Flowers & Fruits: July – January

Exiccatus: Doumahoni Beel, *Anurag & AP Das 0476*, dated 12.06.2013.

Status: Common

Local Distribution: Throughout the study area.

General Distribution: India, Sri Lanka.

Myriophyllum tuberculatum Roxburgh, Fl. Ind. 1: 451. 1820; Hooker *f.*, Fl. Brit. Ind. 1: 432. 1878; Prain, Beng. Pl. 1: 343. 1903.

Aquatic, partly submerged herbs. Leaves submerged, lamina pertinently pinnatifid, verticillate, aerial serrate. Inflorescence verticillate; flower pink, bracts deeply dissected reddish, stigma green. Fruits 4-furrowed. Ridges deeply acute.

Flowers & Fruits: July – January

Exiccatus: Gajoldoba, *Anurag & AP Das 0347*, dated 08.03.2012.

Status: Rare.

Local Distribution: In one or two wetlands of the study area.

General Distribution: India and Cosmopolitan.

Order: Caryophyllales

AMARANTHACEAE A. Jussieu, Gen. Pl. 87. 1789; *nom. cons.*

Key to the Genera:

- 1a. Ovules 2 – 9; spikes elongated, upper part pink, lower white *Celosia*
 1b. Ovule one; spike spherical to elongated, mostly green 2
 2a. Flower unisexual *Amaranthus*

- 2b. Flower bisexual 3
- 3a. Perianth succulent 4
- 3b. Perianth scarious 5
- 4a. Lamina nearly entire; flowers covered with white bloom; non-smelling plant *Chenopodium*
- 4b. Lamina strongly serrate; flowers not bloomy; strongly smelling *Dysphania*
- 5a. Perianth white, never producing hooks *Alternanthera*
- 5b. Perianth pink or reddish, hooked in fruits *Digera*

ALTERNANTHERA Forsskal, Flora Aegypt.-Arab. sive descript. Plant. 1775

Key to the Species:

- 1a. Internodes in stem hollowed; inflorescence globose on long erect peduncle ... *A. philoxeroides*
- 1b. Stem solid; inflorescence almost sessile 2
- 2a. Plants strictly prostrate, forming a compact mass; stem much hairy; inflorescence globose, sessile 3
- 2b. Plants prostrate, semi-erect, pendulous, do not form any compact mass; stem glabrous; compact spike become stalked due to gradual loss of lower flowers *A. sessilis*
- 3a. Perianth spinescent; seeds rounded *A. pungens*
- 3b. Perianth never spinescent; seeds discoid *A. paronychioides*

Alternanthera paronychioides St. Hill, Voy. Bres. 2: 439. 1833; Cook, Aqua. Wetl. Pl. Ind. 41. 1996; Panda & Das, Fl.Sambalp. 308. 2004.

Prostrate, creeping herbs with profusely branched stems; rooting at nodes. Lamina oblanceolate-elliptic to spatulate, entire, acute, base narrowed, hairy. Flower in axillary heads; tepals white, pilose on back, 3-nerved. Capsules compressed Seeds discoid.

Flowers & Fruits: January – December

Exiccatus: Mahananda Barrage, *Anurag & AP Das 0001*, dated 12.05.2010; Doumahoni Beel, *Anurag & AP Das 0407*, dated 12.06.2013.

Status: Common.

Local Distribution: Throughout the study area.

General Distribution: India, A native of tropical America; naturalized in tropics.

Alternantheara philoxeroides (Martius) Grisebach in Abh. Koen. Ges. Wiss. Goett. Phys. Cl. 24: 36. 1983. Maheshwari Bull. Surv. Ind. 6: 313. 1966; Deb, Fl. Tripura 2: 163. 1983; Guha Bakshi, Fl. Mur. Dist. 141. 1984. Bora & Kumar, Flor. Div. Assam, 275. 2004. *Bucholzia philoxeroides* Martius, Beitr. Amarantac. 107. 1825 & in Nova Acta Leop. 13: 315. 1826. [PLATE 4.11. Figs. 56 & 57]

Fleshy, prostrate, marshy annual herbs; stem fistular, base creeping; rooting at nodes; internodes long. Lamina linear-oblong or obovate, spatulate, narrowed down into base, entire. Flowers in axillary, solitary, globose pendunculate heads, corolla white; bracts deltoid, ovate; bracteoles ovate, acuminate. Urticles compressed.

Flowers & Fruits: September – February

Exiccatus: Gajoldoba, **Anurag & AP Das 0100**, dated 12.09.2010; Mahananda Barrage, **Anurag & AP Das 0303**, dated 26.11.2011.

Status: Abundant.

Local Distribution: Throughout the study area.

General Distribution: A native of tropical Brazil.

Alternanthera sessilis (Linnaeus) R. Brown ex A.P. de Candolle, Cat. Pl. Hort. Mon sp. 4: 77. 1813; Hooker f., Fl. Brit. Ind. 4: 731. 1885; Deb, Fl. Tripur. 2: 164. 1983; Guha Bakshi, Fl. Mur. Dist. 264. 1984. Chauhan *et al.* in Hajra, Fl. Namdap. 253. 1996. *Gomphrene sessilis* Linnaeus, Sp. Pl. 225. 1753. *Alternanthera nodiflora* R. Brown, Prodr. 417. 1810. *Alternanthera triandra* Lamarck, Encycl. 1:95. 1785. **[PLATE 4.11. Figs. 58]**

Vernacular Name: *Khenchi*

Prostrate or decumbent herbs, often perennial, stem hairy in 2 lines rooting at nodes. Leaves opposite; lamina oblanceolate or elliptic, acute, glabrous. Flowers in axillary sessile globose heads; tepals 5, membranous. Capsules rounded, compressed, emarginated; seeds with broad wings.

Flowers & Fruits: March – September

Exiccatus: Mahananda Barrage, **Anurag & AP Das 0003**, dated 12.05.2010; Gossaihat Beel, **Anurag & AP Das 0413**, dated 17.08.2012.

Status: Abundant.

Local Distribution: Throughout the study area.

General Distribution: India, Sri Lanka, and probably Pantropic.

Alternanthera pungens Humboldt, Bonpland & Kunth, Nov. Gen. & Sp. 2: 206. 1818; Datta & Majumdar, Bull. Bot. Soc. Beng. 20 (2): 50. 1966. *Achyranthus repens* Linnaeus, Sp. Pl. 205. 1753.

Prostrate or decumbent, spreading herb. Stems clothed with hairs. Lamina opposite, orbicular or ovate-orbicular, opposite pair's unequal, obtuse, entire, tapering at the base. Flowers small in axillary head, corolla white; bracts and bractioles scarious with spiny awans, keeled. Fruits urticulate; seeds round and brownish.

Flowers & Fruits: July – March

Exiccatus: Gajoldoba, **Anurag & AP Das 0116**, dated 12.09.2010.

Status: Rare.

Local Distribution: Only found in one or two places.

General Distribution: India, Native of Tropical America.

AMARANTHUS Linnaeus, Sp. Pl. 2: 989. 1753

Key to the Species:

- 1a. Stamens 5; with many axillary spines *A. spinosus*
- 1b. Stamens-3; leaf axils without spines 2
- 2a. Plants erect, lamina ovate, acute or obtuse..... *A. viridis*
- 2b. Plants diffused, lamina ovate-lanceolate, notched at tip *A. blitum* subsp. *oleraceus*

Amaranthus blitum* subsp. *oleraceus (Linnaeus) Costea, Sida 19: 984. 2001. *Amaranthus oleraceus* Sp. Pl. 1403 1753. *Amaranthus lividus* Linnaeus, Sp. Pl. 1: 990. 1753; Grierson & Long, Fl. Bhut. 1(2): 224. 1984. *Amaranthus blitum* Linnaeus, Sp. Pl. 1: 990. 1753; Hooker f., Fl. Brit. Ind. 4: 721. 1885.

Erect or prostrate annuals herbs, 10 – 50 cm tall. Lamina broadly ovate, subacute or obtuse. Spikes slender; flowers mostly female, males few above; tepals 3; stamens 3; stigmas 2 – 3, minute. Capsules distinctly exceeding perianth. Seeds strongly glossy faintly striate without scurfy warts.

Flowers & Fruits: January – December

Exiccatus: Mahananda Barrage, **Anurag & AP Das 0061**, dated 12.05.2010; Mahananda Barrage, **Anurag & AP Das 0572**, dated 13.11.2013.

Status: Common.

Local Distribution: Throughout the study area.

General Distribution: Widely distributed in tropical to temperate regions.

Amaranthus spinosus Linnaeus, Sp. Pl. 991. 1753; Hooker f., Fl. Brit. Ind. 4: 718. 1885; Grierson & Long, Fl. Bhut. 1(2): 225. 1984.

Vernacular Name: *Kata Khuria or Kanta note*

Erect much-branched armed herbs; spines axillary, straight, yellowish. Lamina ovate-lanceolate, entire, obtuse or mucronata, base cuneate, glabrous. Flower unisexual, in compact axillary and terminal branched spikes. Utricles ovoid, rugose; seed 1, shining, black.

Flowers & Fruits: May – December.

Exiccatus: Doumahoni Beel, **Anurag & AP Das 0529**, dated 12.06.2013; Mahananda Barrage, **Anurag & AP Das 0563**, dated 13.11.2013.

Status: Abundant.

Local Distribution: Throughout the study area.

General Distribution: Pantropical.

Amaranthus viridis Linnaeus, Sp. Pl. ed. 2: 1405. 1753; Hooker f., Fl. Brit. Ind. 4: 720. 1885; Prain, Beng. Plants 2: 651. 1903; Guha Bakshi, Fl. Mur. Dist. 266. 1984. Mukherjee in Mudgal *et al.*, Fl. M.P. 2: 460. 1997; Bora *et al.* Kumar, Flor. Div. Ass., 277. 2003. *A. gracilis* Desfontaines, tabl. Ecole Bot. 43. 1804. *A. polystachy* Willdenow, Sp. Pl. 4: 385. 1805.

Vernacular name: *Khuria note*

Erect annual unarmed herbs. Leaves alternate; lamina broadly ovate, subacute or obtuse, base attenuate, glabrous. Inflorescence compound spikes, flowers mainly female, males few, usually on the upper part of slender spikes; tepals 3, ovate-oblong; stamens-3. Capsules equal or slightly exceeding perianth; seeds glossy, scurfy warty.

Flowers & Fruits: April – July

Exiccatus: Mahananda Barrage, **Anurag & AP Das 0073**, dated 12.05.2010; Doumahoni Beel, **Anurag & AP Das 0493**, dated 12.06.2013.

Status: Abundant.

Local Distribution: Throughout the study area.

General Distribution: Pantropic weed.

CHENOPODIUM Linnaeus, Sp. Pl. 1: 218. 1753

Chenopodium album Linnaeus, Sp. Pl. 219. 1753; Hooker *f.*, Fl. Brit. Ind. 5: 3. 1886. Prain, Beng. Pl. 2: 657. 1903; Guha Bakshi, Fl. Mur. Dist. 270. 1984.

Vernacular Name: *Bothua shak*

Erect or ascending herbs, green, more or less coated with white, granular pubescence (bloom). Stems ridged, often tinged with red or purple. Lamina variable in size and shape, entire, toothed or lobed, oblong lanceolate or rhombic-lanceolate. Flowers in short axillary spikes. Seeds black & shining.

Flowers & Fruits: November – May

Exiccatus: Gajoldoba, *Anurag & AP Das 0128*, dated 12.09.2010; Mahananda Barrage, *Anurag & AP Das 0306*, dated 26.11.2011.

Status: Common.

Local Distribution: Throughout the study area.

General Distribution: Tropical America and common in tropics.

CELOSIA Linnaeus, Sp. Pl. 1: 205. 1753

Celosia argentea Linnaeus, Sp. Pl. 205. 1753; Hooker *f.*, Fl. Brit. Ind. 4: 714. 1885; Prain, Beng. Pl. 2: 867. 1903; Grierson & Long, Fl. Bhut. 1(2): 221. 1984; Guha Bakshi, Fl. Mur. Dist. 267. 1984.

Vernacular Name: *Suggi Shak*

Erect annual herbs; branches grooved. Leaves alternate, variable, shortly petiolate, linear-lanceolate, acute, base tapering, glabrous. Flowers bisexual, white or tinged pink in dense, terminal, lanceolate spikes. Capsules ellipsoid; seeds 4 – 8, sub-reniform, black and shining.

Flowers & Fruits: March – August

Exiccatus: Mahananda Barrage, *Anurag & AP Das 0005*, dated 12.05.2010.

Status: Common.

Local Distribution: Throughout the study area.

General Distribution: Tropical regions of Asia, Africa and America.

DIGERA Forsskal, Fl. Aegypt.-Arab. 65. 1775

Digera muricata (Linnaeus) Martius Beitr. Amar. 2: 77. 1825; Backer in FM 4: 80. 1949; Guha Bakshi, Fl. Mur. Dist. 268. 1984. *Achyranthes muricata* Linnaeus, Sp. Pl. (ed.2): 295. 1762. *Digera arvensis* Forsskal, Fl. Aeg. Arab. 65. v. 1775; Hooker *f.*, Fl. Brit. Ind. 4: 717. 1885; Prain, Beng. Pl. 2: 868. 1903.

Vernacular Name: *Jamaiya Shak*

Annual, erect, herbs; leaves alternate, entire, perianth submembranous, Stamens 5, hypogynous; ovary 1 celled; fruit sub globose; seed erect, sub globose; fruiting perianth hooked.

Flowers & Fruits: July – March

Exiccatus: Gajoldoba, *Anurag & AP Das 0348*, dated 08.03.2012.

Status: Common.

Local Distribution: Throughout the study area.

General Distribution: India (major part), Sri Lanka, Pakistan and N. Africa.

DYSPHANIA R. Brown, Prodr. Fl. Nov. Holland. 411. 1810

Dysphania ambrosioides (Linnaeus) Mosyakin & Clemants, Ukrayins'k. Bot. Zhurn. 59: 382. 2002. *Chenopodium ambrosioides* Linnaeus, Sp. Pl. 219. 1753; Hooker f., Fl. Brit. Ind. 5: 4. 1886; Prain, Beng. Pl. 2: 657. 1903.

Vernacular Name: *Chothua*

Erect, strong foetid, much branched under shrubs. Lamina lanceolate, sinuate-dentate. Flowers greenish, turning to purple. Urticles membranous, 1 seeded. Seeds brown, smooth.

Flowers & Fruits: February – August

Exiccatus: Mahananda Barrage, **Anurag & AP Das 0007**, dated 12.05.2010.

Status: Common.

Local Distribution: Throughout the study area.

General Distribution: India (Tropical part), Native to Tropical America.

CARYOPHYLLACEAE A. Jussieu, Gen. Pl. 299.1789

Key to the Genera:

- 1a. Styles 3 – 5, free; diffuse herbs *Stellaria*
- 1b. Styles 3, combined..... 2
- 2a. Pedicells present *Drymaria*
- 2b. Pedicells absent *Polycarpon*

DRYMARIA Willdniew ex Roem & Schultes, Syst. Veg. 21.1819

Drymaria cordata (Linnaeus) Willdniew ex Schultes, Syst. Veg. 5:406.1819. *Holosteum cordatum* Linnaeus, Sp. Pl. 1:88.1753.

Annual plants with straggling stems, usually rooting from lower nodes. Stipules membranous. Lamina ovate-cordate, 3-veined, sub-acute. Petals white, obovate-cuneate. Stamens 3-5, shorter than sepals. Styles 3. Capsules obovoid. Seeds brown sub-orbiculate.

Flowers & Fruits: April – December

Exiccatus: Doumahoni Beel, **Anurag & AP Das 0486**, dated 12.06.2013; Mahananda Barrage, **Anurag & AP Das 0595**, dated 13.11.2013.

Status: Abundant.

Local Distribution: Throughout the study area.

General Distribution: Cosmopolitan.

STELLARIA Linnaeus, Sp. Pl. 1:421.1753

Key to the Species:

- 1 a. Leaves sessile, lamina lanceolate to oblong-lanceolate *S. uliginosa*
 1b. Leaves petiolate 2
 2a. Stamens 3 – 5 *S. media*
 2b. Stamens – 10 *S. wallichiana*

Stellaria media (Linnaeus) Villars, Hist. Pl. Dauphine. 3: 615. 1789; Prain, Beng. Pl. 1: 237. 1903; Majumder, Fl. W. Beng. 1: 250. 1997. *Alsine media* Linnaeus, Sp. Pl. 1: 272. 1753.

Annual, biennial or perennial herbs. Basal leaves long petiolate, distal leaves sessile or shortly petiolate; lamina broadly ovate to ovate – orbicular. Flowers in sparse terminal or axillary cymes; sepals 5; petals oblong; stamens 3 – 5 styles 3, linear. Capsule ovoid.

Flowers & Fruits: October – February

Exiccatus: Magurmar (NBU), **Anurag & AP Das 01289**, dated 2.11.2013.

Status: Abundant.

Local distribution: Throughout the study area.

General distribution: Europe, Afghanistan, India, Bhutan, China, Japan, Korea, Pakistan, Russia.

Stellaria uliginosa Murray, Prod. Stirp. Gotting. 55. 1770; Majumder, Fl. W. Beng. 252. 1997; Grierson & Long, Fl. Bhut. 1(2): 208. 1987. *Stellaria alsine* Grimm, Nov. Actorum Acad. Caes. Leop.-Carol. Nat. Cur. 3. App. 313. 1767.

Annual, ascending, glabrous herbs. Lamina sessile, lanceolate to oblong – lanceolate. Flowers 3 – 5 in cymes or solitary, terminal or axillary; sepals 5, lanceolate, glabrous; petals 5; stamens 5 – 10; ovary ovoid; styles 3. Capsule ovoid – orbicular.

Flowers & Fruits: October – February

Status: Abundant.

Exiccatus: Magurmar (NBU), **Anurag & AP Das 01290**, dated 2.11.2013.

Local distribution: Throughout the study area.

General distribution: Europe, Indian sub continent, China, Japan, Korea, Vietnam.

Stellaria wallichiana Bentham ex Haines in Bull. Mosc. Inf. Kew 1920: 66. 1920; Sharma et al., Fl. Ind 2: 591. 1993; Hajra et al., Materials for the Fl. Arunachal Prad. 1: 176. 1996; Bora & Kumar, Flor. Div. Ass., 56. 2003. *Stellaria media* (Linnaeus) Villars, Hist. Pl. Dauph 3: 615. 1789, p.p.; Edgewath & Hooker f., Fl. Brit. Ind. 1: 230. 1874.

Decumbent or prostrate, diffuse annual herbs. Lamina flat, entire, simple. Inflorescence cymose. Flower actinomorphic; corolla white, bisexual; sepals – 5, petals 5, stamens – 10, hypogynous. Capsules with many compressed seeds; embryo annular.

Flowers & Fruits: February – May

Exiccatus: Doumahoni Beel, **Anurag & AP Das 0189**, dated 2.2.2011; Gajoldoba, **Anurag & AP Das 0356**, dated 08.03.2012.

Status: Common.

Local Distribution: Throughout the study area.

General Distribution: Cosmopolitan.

POLYCARPON Linnaeus, Syst. Ed. 10:881.1759

Polycarpon prostratum (Forsskål) Ascherson & Schwein. F. Ost. Bot. Zoitschr. 39: 128. 1889. Guha Bakshi, Fl. Mur. Dist. 57. 1984. *Alsine protrata* Forsskål, Fl. Aegypt. – Arab. 207. 1775. *Hepalasia loeflingiae* Wught & Arnott, Prodr. 358. 1834. *Polycarpon loeflingiae* (Wight & Arnott) Benth in Benth & Hooker f., Gen. Pl. 1: 153. 1862; Edgworth & Hooker f., in Fl. Brit. Ind. 1: 245. 1874.

Prostrate, branched herbs. Lamina acute or obtuse, linear oblong or spatulate, scarious white stipulates. Cymes fascicled or paniced. Flowers 3 mm in diam.; corolla entire or notched, white; sepals acute, strongly keeled at the midrib which is green, the rest being usually white. Seeds many, sub-cylindric; embryo straight.

Flowers & Fruits: November – May

Exiccatus: Mahananda Barrage, *Anurag & AP Das 0320*, dated 26.11.2011.

Status: Abundant.

Local Distribution: Throughout the study area.

General Distribution: Tropical region of Asia & Africa.

DROSERACEAE Salisbury, Parad. Lond. 2: ad t. 95. 1808

DROSERA Linnaeus, Sp. Pl. 2. 1753

Drosera burmannii Vahl, Symb. Bot. 3: 50. 1794; Cook, Aqua. Wetl. Pl. Ind. 183. 1996; Prain, Beng. Pl. 1: 472. 1903.

Annual small rosette herb. Stem unbranched. Leaves sub-sessile or shortly petiolate; stipule 3.2 – 7.5 mm; lamina yellowish green or red, cuneate to obovate – spatulate with numerous glandular trichomes above. Racemes 2 – 19 flowered; bracts simple, hastate. Sepals 5, united at base. Petals white to light red to reddish-violet, obovate. Stamens 5. Ovary glabrous, subglobose. Seeds dark-brown – black.

Flowers & Fruits: September – January

Exiccatus: Gajoldoba, *Anurag & AP Das 0099*, dated 12.09.2010.

Status: Common.

Local Distribution: Throughout the study area.

General distribution: India, Sri Lanka, Malaya, S.E. Asia, Australia and Africa.

MOLLUGINACEAE Bartling, Beitr. Bot. 2: 158. 1825; *nom. cons.*

Key to the Genera:

- 1a. Cymes terminal; stamens 3-5; plants erect *Mollugo*
- 1b. Cymes axillary; stamens 5 or 10; plants prostrate *Glinus*

GLINUS Linnaeus, Sp. Pl. 1: 463. 1753**Key to the Species:**

- 1a. Plants glabrous; leaves opposite; stamens 10; capsule oblong *G. oppositifolus*
 1b. Plants pubescent; leaves whorled; stamens 5; capsule ovoid *G. lotoides*

Glinus lotoides Linnaeus, Sp. Pl. 463. 1753; Deb, Fl. Tripura 2: 189. 1983; Guha Bakshi, Fl. Mur. Dist. 148. 1984; Bora et Kumar, Flor. Din. Assam 169. 2003. *Molluga hirta* Thunberg, Prodr. Pl. Cap. 24. 1794; Hooker f., Fl. Brit. Ind. 2: 662. 1879; Prain, Beng. Plants 1: 533. 1903; Kanjilal et al., fl. Assam 2: 338. 1938.

Prostrate much branched pubescent herb. Leaves opposite or in whorls of 3-5, suborbicular or spatulate, obtuse or apicular, cuneate at base. Flowers greenish- white, 2-3 in sublateral fascicules, subsessile. Sepals acute, hairy. Stamens 5. Styles 5. Capsules ovoid, 5-valved with elongated calyx.

Flowers & Fruits: April – August

Exiccatus: Gossaihat Beel, **Anurag & AP Das 0253**, dated 14.07.2011.

Status: Common.

Local Distribution: Found in some wetlands of the study area

General Distribution: Pantropical.

Glinus oppositifolius (Linnaeus) A. A.P. de Candolle, Bull. Herb. Boiss. 2, 1: 552. 1901; Guha Bakshi, Fl. Mur. Dist. 148. 1984. *Mollugo oppositifolia* Linnaeus, Sp. Pl. 89. 1753; Mooney, l. c. 25. 1950. *Molluga spergula* Linnaeus, Syst. Ed. 10: 881. 1759. Prain, Beng. Plants 1: 533. 1903.

Vernacular Name: *Gima Shak*

Prostrate, annual herbs; stem slender, glabrous. Leaves opposite, oblanceolate or elliptic – obovate, entire. Flowers 2 – 9 in axillary cymes; tepals 5, white; stamens 5; ovary 3 locular. Capsules oblong; seeds reddish, reniform.

Flowers & Fruits: January – December

Exiccatus: Gajoldoba, **Anurag & AP Das 0156**, dated 12.09.2010; Kathambari Beel, **Anurag & AP Das 0721**, dated 03.09.2014.

Status: Common.

Local Distribution: Found in some wetlands of the study area

General Distribution: Pantropical.

POLYGONACEAE A. Jussieu, Gen. Pl. 82. 1789**Key to the Genera:**

- 1a. Plant scrambling herb; Raceme ovoid or sub globose *Persicaria*
 1b. Plant herb, soft; Raceme Spike like 2
 2a. Perianth 4 – 5 fid, stigmas capitate *Polygonum*

2b. Perianth 6 fid, stigmas horse shoe shaped **Rumex**

PERSICARIA (Linnaeus) Miller, Gard. dict. Abr. 3. 1754

Key to the Species:

- 1a. Inflorescence capitates *P. chinensis*
 1b. Inflorescence racemose 2
 2a. Stem armed *P. strigosa*
 2b. Stem unarmed 3
 3a. Nutlets biconvex 4
 3b. Nutlets distinctly trigonous 6
 4a. Bract coarsely hairy or strigose; lamina ovate.....5
 4b. Bract densely woolly, white; lamina lanceolate *P. lapathifolia*
 5a. Orchea ciliate *P. orientalis*
 5b. Orchea not ciliate *P. glabra*
 6a. Raceme filiform, long, distant bracts; ocreae cilia short7
 6b. Raceme stout, short, spicate..... 8
 7a. Petiole glabrous; Achenes biconvex *P. hydropiper*
 7b. Petiole pubescence; Achenes trigonous *P. pubescens*
 8a. Bract hairy or strigose; without gland *P. stagnina*
 8b. Bract glabrous 9
 9a. Lamina tapering at base; cilia larger than ocreae tube *P. barbata*
 9b. Lamina round at base; cilia shorter than ocreae tube 10
 10a. Styles 3 *P. decipiens*
 10b. Styles 2..... *P. tenella*

Persicaria barbata (Linnaeus) Hara in Fl. Eastern. Himal. 1: 68. 1966; Hara *et al.*, Fl. Nep. 3: 175. 1982; Cook, Aqua. Wetl. Pl. Ind. 325. 1996. *Polygonum barbatum* Linnaeus Sp. Pl. 362. 1753; Hooker *f.*, Fl. Brit. Ind. 5: 37. 1886; Prain, Beng. Pl. 2: 887. 1903. *Polygonum rivulare* Roxburgh Fl. Ind. 2: 290. 1824. **[PLATE 4.8. Figs. 38]**

Undershubs, quite glabrous stems and peduncles; branches stout erect and peduncle glabrous, long bearded stipules. Lamina lanceolate or linear lanceolate. Racemes slender, erect, bracts closed glabrous sparingly and shortly ciliate, perianth glandular white; stamens 5 – 8.

Flowers & Fruits: July – December

Exiccatus: Gossaihat Beel, **Anurag & AP Das** 0287, dated 14.07.2011; Doumahoni Beel, **Anurag & AP Das** 0526, dated 12.06.2013.

Status: Common.

Local Distribution: Throughout the study area.

General Distribution: India (warmer parts), Tropical part of Asia, Africa, America.

Persicaria stagnina (Buch.-Ham. ex Meisn.) Qaiser, Fl. Pakistan 205: 44. 2001. *Persicaria barbata* (Linnaeus) Hara subsp. *stagnina* (Buch.-Ham. ex Meisn.) Sojak in Preslia 46(2): 152. 1974. *Persicaria barbata* var. *stagnina* (Ham. Ex Meisn.) Grieson in notes Roy. Bot. Gard. Edinb. 40: 128. 1982. *Polygonum conspersum* Meisn. in Wall., Fl. As. Rar. 3: 56. 1832. *Polygonum stagninum* Buch.-Ham. ex Meisn. in Wall. Fl. As. Rar. 3: 56. 1832; Hooker f., Fl. Brit. Ind. 5: 37. 1886; Prain, Beng. Pl. 2: 887. 1903. [PLATE 4.8. Figs. 33]

Erect, branched from base, annual herbs. Stem woody at base, densely strigose-pubescent above, sometimes glabrous below. Lamina linear-lanceolate, elliptic or lanceolate, strigose – tomentose more on the lower surface, sessile to subsessile. Ochrea strigose – tomentose, tubular, ovate, ciliate, cilia much shorter than the tube. Inflorescence simple-branched, pedunculate, spicate many flowered raceme, not interrupted; peduncle densely strigose. Ocreae tubular, imbricate, ciliate, strigose. Stamens 8, exerted-subexerted, filaments long, filiform. Ovary trigonous, with 3 long styles, connate at base, stigmas three, capitate. Nuts trigonous.

Flowers & Fruits: June – January

Exiccatus: Doumahoni Beel, **Anurag & AP Das 0522**, dated 12.06.2013.

Status: Rare.

Local Distribution: Found only two wetlands of the study area.

General Distribution: India, Pakistan (Hazara), Bangladesh and Myanmar.

Persicaria hydropiper (Linnaeus) Spach, Hist. Veg. 10: 536. 1841; Fl. Eastern. Himal. 2: 23. 1971; Grierson & Long, Fl. Bhut. 1(1): 162. 1983; Cook, Aqua. Wetl. Pl. Ind. 327. 1996. *Polygonum hydropiper* Linnaeus Sp. Pl. 361. 1753; Hooker f., Fl. Brit. Ind. 5: 39. 1886; Datta & Majumdar, Bull. Bot. Soc. Beng. 20(2): 49. 1966; Prain, Beng. Pl. 2: 887. 1903.

Erect or decumbent, bushy, glabrous, marshy herbs. Lamina sub sessile, oblong-lanceolate, glabrous, stipule glabrous with short ciliate. Racemes filiform, decurved, parianth glandular, pink. Nut trigonous.

Flowers & Fruits: May – December

Exiccatus: Doumahoni Beel, **Anurag & AP Das 0532**, dated 12.06.2013; Mahananda Barrage, **Anurag & AP Das 0639**, dated 13.11.2013.

Status: Abundant.

Local Distribution: Throughout the study area.

General Distribution: India (Plains and wet places), Europe and N. Africa.

Persicaria lapathifolia (Linnaeus) S.F. Gray. Nat. Arr. Br. Pl. 2: 270. 1821; Cook, Aqua. Wetl. Pl. Ind. 327. 1996. *Polygonum lapathifolia* Linnaeus, Sp. Pl. 360. 1753; Hooker f., Fl. Brit. Ind. 5: 35. 1886.

[PLATE 4.8. Figs. 34]

Erect glabrous herbs. Lamina lanceolate; ochrea 1 – 2 cm, sparsely lanate; racemes often drooping, racemosely arranged; flowers 2mm, white or pink; stamens 5; style 2; achenes 2 mm, compressed, concave, blackish, persistent style base.

Flowers & Fruits: September – December

Exiccatus: Mahananda Barrage, **Anurag & AP Das 0635**, dated 13.11.2013.

Status: Common.

Local Distribution: Throughout the study area.

General Distribution: India, Bangladesh and Bhutan.

Persicaria orientalis (Linnaeus) Assenov, Fl. Reip. Pop. Bulgar.3: 250. 1966; Cook, Aqua. Wetl. Pl. Ind. 325. 1996. *Polygonum orientale* Linnaeus, Sp. Pl. 1: 362. 1753. Hooker f, Fl. Brit. Ind. 5: 30. 1886; Prain, Beng. Pl. 2: 886. 1903. [PLATE 4.8. Figs. 32]

Annual, tall, marshy herbs. Lamina broadly ovate, broadly elliptic, or ovate-lanceolate, both surfaces densely pubescent, along veins densely villous, base rounded or subcordate, margin densely ciliate, apex acuminate; ochrea tubular, membranous, villous, margin truncate, long ciliate. Inflorescence terminal or axillary, spicate, slightly pendulous, spikes aggregated and panicle-like; bracts green, broadly funnel shaped, margin long ciliate, each 3 – 5 flowered. Flowers dimorphic, Perianth pink or white, 5-parted; tepals elliptic; Stamens 7, exserted. Styles 2, connate to below middle, included or stamens included and styles exserted on separate plant; stigmas capitate. Achenes included in persistent perianth, black-brown, shiny, nearly orbicular, biconcave.

Flowers & Fruits: March – August

Exiccatus: Doumahoni Beel, **Anurag & AP Das 0539**, dated 12.06.2013.

Status: Abundant.

Local Distribution: Throughout the study area.

General Distribution: India, China, Bhutan, Bangladesh, Indonesia, Japan, Korea, Myanmar, Philippines, Russia, Sri Lanka, Thailand, SW Asia, Australia and Europe.

Parsicaria tenella (Blume) Hara in Jour. Jap. Bot. 44: 375. 1969; Cook, Aqua. Wetl. Pl. Ind. 325. 1996. *Polygonum tenellum* Blume, Bijdr. 530. 1969. *Polygonum minus* Hudson sensu Fl. Brit. Ind. 5: 36. 1886; Prain, Beng. Pl. 2: 886. 1903.

Annual, erect herbs. Stem branched, ribbed, glabrous; Lamina glabrous, sessile, linear-lanceolate, acute; ochrea cylindric, cilia with bristles; inflorescence terminal or axillary. Flower bisexual, tepals-5, stamens 5, style 2. Achene with biconvex seed.

Flowers & Fruits: August – October

Exiccatus: Doumahoni Beel, **Anurag & AP Das 0547**, dated 12.06.2013.

Status: Common.

Local Distribution: Throughout the study area

General Distribution: India (Warmer part), Russia, temperate Asia and Europe.

Persicaria decipiens (R. Brown) K.L. Wilson, Telopea 3: 178. 198. *Persicaria salicifolium* Brouss. ex Willd., Enum. Pl. 428. 1809. *Polygonum serrulatum* Lag. Gen. Sp. Pl. 14. 1816; Srivastava et al. in Mudgal et al., Fl. M. P. 2: 487. 1997. *P. barbatum* Woodr. In J. Bom. Nat. Hist. Soc. 12. 214. 1899, non Linn. 1753.

Marshy, slender herbs. Lamina linear – lanceolate or oblong, acute, round base, sparsely hairy, subsessile; stipules truncate, ciliate. Flower greenish white in racemose spikes; bracts membranous hairy. Style 3; Nutlets trigonous.

Flowers & Fruits: May – November

Exiccatus: Doumahoni Beel, **Anurag & AP Das 0542**, dated 12.06.2013.

Status: Rare.

Local Distribution: In one or two wetlands of the study area.

General Distribution: India, Africa, America, Australia, West Asia and South Europe.

Persicaria glabra (Willdenow) M. Gómez, *Anales Inst. Segunda Enseñ.* 2: 278. 1896; Cook, *Aqua. Wetl. Pl. Ind.* 326. 1996. *Polygonum glabrum* Willdenow, *Sp. Pl.* 2: 447. 1799.

Rhizomatous perennial herbs. Stems branched decumbent to erect, glabrous or rarely pubescent. Ocrea cylindrical, light brown; petiole scabrous; lamina lanceolate, tapered at base, margins glabrous or strigose, apex acute – acuminate. Inflorescences mostly terminal, sometimes axillary; peduncle 10 - 55 mm, glabrous or scabrid. Pedicels erect to spreading. Flowers; perianth greenish white to white or pink, glabrous, not glandular; tepals 5, connate, obovate; stamens 5 – 7; anthers pink or red. Achenes dark brown to brownish black.

Flowers & Fruits: July – December

Exiccatus: Doumahoni Beel, **Anurag & AP Das 0557**, dated 27.08.2013.

Status: Common.

Local Distribution: Throughout the study area

General Distribution: India, China, Central America, South America, Asia, Africa, Pacific Islands.

Persicaria chinensis (Linnaeus) H. Gross, *Bot. Jahrb. Syst.* 49: 269. 1913; Hara *et al.*, *Enum. Fl. Pl. Nepal* 3: 175. 1982; Grierson & Long, *Fl. Bhut.* 1(1): 163. 1983. *Polygonum chinense* Linnaeus, *Sp. Pl.* 1: 363. 1753; Prain, *Beng. Plants* 2: 887. 1903. **[PLATE 4.8. Figs. 45]**

Rhizomatous perennial herbs. Stems ascending to erect, glabrous or retrorsely hispid. Ocrea cylindrical, brownish, proximally coriaceous; petiole 1 – 3 cm; lamina lanceolate to ovate or elliptic; base truncate to broadly cordate, margins glabrous; apex acuminate. Inflorescences terminal; peduncle 10 – 33 mm, Pedicels ascending, 2 – 3.2 mm. Flowers; perianth campanulate, glabrous, white to pink; tepals 5; stamens 8. Achenes fleshy, bluish black.

Flowers & Fruits: May – November

Exiccatus: Sova-Bari Beel, **Anurag & AP Das 0781**, dated 03.09.2014.

Status: Abundant.

Local Distribution: Throughout the study area

General Distribution: India, Africa, America, Australia, West Asia and South Europe.

Persicaria strigosa (R. Brown) Nakai, *Rigakkwai* 24: 299. 1926; Cook, *Aqua. Wetl. Pl. Ind.* 325. 1996. *Polygonum strigosum* R. Brown, *Prodr.* 420. 1810.

Annual herbs. Stems erect or decumbent, branched, angulate, with retrorse prickles. Petiole with recurved prickles; lamina elliptic or lanceolate, usually abaxial side glabrous, midvein retrorse prickly, adaxial side glabrous or sparsely strigose, base cordate, truncate, margin ciliate, apex acuminate or acute; ocrea membranous, tubular, with retrorse prickles at base. Inflorescence spicate; peduncle branched, densely pubescent; bracts elliptic or ovate, usually strigose. Pedicels glabrous. Perianth white or pinkish, 5-segmented; tepals elliptic. Stamens 5 – 7. Achenes dark brown, orbicular.

Flowers & Fruits: August – December

Exiccatus: Sova-Bari Beel, **Anurag & AP Das 0789**, dated 03.09.2014.

Status: Common.

Local Distribution: Throughout the study area

General Distribution: India, Bangladesh, Nepal, Bhutan, Sikkim, China, Indonesia, Malaysia, Myanmar, New Guinea, Thailand, Vietnam; Australia.

POLYGONUM Linnaeus, Sp. Pl. 1: 359. 1753

Key to the species:

- 1b. Stems prostrate, procumbent, ascending, or erect; flowers in axillary fascicles.....*P. plebeium*
- 1a. Stems erect; inflorescence spicate, terminal 2
- 2a. Not retrorsely pricked *P. pubescens*
- 2b. Retrorsely pricked herbs 3
- 3a. Lamina triangular-peltate, base truncate – subcordate *P. perfoliatum*
- 3b. Lamina lanceolate or elliptic, base sagittate or subhastate *P. hastatosagittatum*

Polygonum plebeium R. Brown, Prodr. 420. 1810 (“*Plebejum*”); Hooker f., Fl. Brit. Ind. 5: 27. 1886; Prain, Beng. Pl. 2: 885. 1903; Guha Bakshi, Fl. Mur. Dist. 274. 1984; Cook, Aqua. Wetl. Pl. Ind. 327. 1996.

Annual, prostrate, diffusely branched herbs. Stem grooved. Lamina sub sessile, ovate – lanceolate. Stipules hyaline, short, lacerate with fimbriate nerve. Flowers 1-3 nate, petiole short. Nuts rhomboid, trigonous, shining.

Flowers & Fruits: January – May

Exiccatus: Doumahoni Beel, **Anurag & AP Das 0222**, dated 02.02.2011; Gajoldoba, **Anurag & AP Das 0403**, dated 08.03.2012.

Status: Common.

Local Distribution: Throughout the study area

General Distribution: India (tropical part), Tropical and Sub-tropical Asia, Africa, Australia.

Polygonum pubescens Blume, Bijdr. Fl. Ned. Ind. 2: 532. 1825; Steward Contr. Gray Herb. 88: 62. 1930; Cook, Aqua. Wetl. Pl. Ind. 327. 1996. *Persicaria pubescens* (Blume) Hara in Jour. Jap. B 17: 334. 1941; Fl. Eastern. Himal. 73: 1966. *Polygonum burbatum sensu* Willdenow., Roxburgh Fl. Ind. 2: 289. 1832 non L. *Polygonum flaccidum* Meisn., A.P. de Candolle Prodr. 14: 107. 1856; Hooker f., Fl. Brit. Ind. 5: 39. 1886; Prain, Beng. Pl. 2: 887. 1903.

Marshy, small shrubs. Lamina long, peteolate, lanceolate – elliptic, stipules strigose, cilia half as long as the tube. Raceme very long, filiform, bracts glabrous, mouth ciliate. Nuts trigonous, compressed.

Flowers & Fruits: March – October

Exiccatus: Gajoldoba, **Anurag & AP Das 0399**, dated 08.03.2012.

Status: Common.

Local Distribution: Throughout the study area.

General Distribution: India, Malayaan Archipelago.

Polygonum perfoliatum Linnaeus, Syst. Nat., ed. 10. 2: 1006. 1759; Prain, Beng. Pl. 2: 887; Cook, Aqua. Wetl. Pl. Ind. 325. 1996. [PLATE 4.8. Figs. 36]

Annual herbs. Stems angulate, with retrorse prickles, branched. Petiole 2 – 8 cm. Lamina triangular – peltate, abaxial side sparsely retrorsely prickly along veins, adaxial side glabrous, apex subacute, truncate or subcordate at base; ocrea tubular, herbaceous orbicular wing at apex. Inflorescence terminal or axillary; bracts ovate – orbicular. Perianth white or pinkish, 5segmented; tepals elliptic, Stamens 8, in 2 whorls. Achenes black, shiny, globose & included in persistent perianth.

Flowers & Fruits: May –October

Exiccatus: Gajoldoba, **Anurag & AP Das 0398**, dated 08.03.2012; Doumahoni Beel, **Anurag & AP Das 0546**, dated 12.06.2013.

Status: Common.

Local Distribution: Throughout the study area

General Distribution: India, Bangladesh, Nepal, Bhutan, China, Japan, Indonesia, Korea, Malaysia, New Guinea, Philippines, Russia, Sikkim, Thailand, Vietnam.

Polygonum hastatosagittatum Makino, Bot. Mag. Tokyo. 17: 119. 1903. Liu, Ying & Lai, Fl. Taiwan 2: 270. 1976; Chowdhury *et al.*, Asian J. Biol. Life Sci.4(1): 38-40. 2015. [PLATE 4.8. Figs. 37]

Marshland annual ascending herbs, 50 – 90 cm long. Stem much branched, armed with recurved and retrorse prickles. Petiole 2 mm or sessile, retrorsely prickly; lamina lanceolate or elliptic, 80 – 84 mm long, 11 – 13 mm wide, acuminate, base sagittate or subhastate, pubescent, abaxially with retrorse prickles along the mid-vein, adaxially sometimes stellate pubescent; ocrea tubular, 18 – 22 x 7 – 8 mm, membranous, apex truncate, recurved retrorse at base. Inflorescence 2 – 3 flowered fascicles in repeatedly branched monochasium, terminal or axillary; peduncles glandular pubescent, bracts elliptic or ovate, 3 x 1.5 mm, margin ciliate; perianth light pink, 5 parted, 3 x 4 mm; tepals elliptic; stamens 8; styles 3, stigmas (14 mm) capitate. Achenes, trigonous, ovoid, dark brown, shiny.

Flowers & Fruits: June – September

Exiccatus: Sursuti forest (Lataguri), **Anurag & AP Das 03456**, dated 29.07.2014 (CAL); Sursuti forest (Lataguri), **Anurag & AP Das 03445**, dated 30.05.2014 (NBU).

Status: Endemic.

Local Distribution: Found in only one wetland of Sursuti reserve forest.

General Distribution: Siberia, China, Nepal (Sharma, 2008), Taiwan, Japan, and now in India (Sursuti forest, Lataguri, West Bengal).

Note: This species has been first time recorded from Sursuti forest, Lataguri (Opposite Gorumara National Park) and it is only endemic to Sursuti forest in India.

RUMEX Linnaeus, Sp. Pl. 2. 1753

Key to the Species:

- 1a. Flower short pedicelled; fruit with hard tooth *R. dentatus*
- 1b. Flower distinctly pedicelled; fruit with small tooth *R. maritimus*

Rumex dentatus Linnaeus Mant. 2: 226. 1771; Hooker *f.*, Fl. Brit. Ind. 5: 59. 1886; Prain Beng. Pl. 2: 889. 1903; Cook, Aqua. Wetl. Pl. Ind. 325. 1996.

Fleshy, bushy, annual herbs. Lamina oblong, cordate at base. Fruiting perianth ovate or oblong – ovate with an oblong smooth-tubercle and broad densely reticulated wings which are irregular, toothed, teeth short stout straight.

Flowers & Fruits: March – October

Exiccatus: Gajoldoba, **Anurag & AP Das 0401**, dated 08.03.2012.

Status: Abundant.

Local Distribution: Throughout the study area

General Distribution: India, Nepal, China, Afghanistan, Kazakhstan, Kyrgyzstan, Russia; N Africa, SE Europe.

Rumex maritimus Linnaeus, Sp. Pl. 335. 1753; Hooker *f.*, Fl. Brit. Ind. 5: 59. 1886; Prain Beng. Pl. 2: 888. 1903; Cook, Aqua. Wetl. Pl. Ind. 325. 1996.

Erect, marshy, bushy, fleshy herbs. Lamina lanceolate, lower oblong – lanceolate; stipules tubular. Flower greenish white, in racemose whorls. Perianth in 2 whorls, stamens 6. Nutlets ovate – oblong within the perianth.

Flowers & Fruits: December – April

Exiccatus: Doumahoni Beel, **Anurag & AP Das 0222**, dated 02.02.2011.

Status: Common.

Local Distribution: Throughout the study area

General Distribution: India, Asia, Europe, North, South America.

PORTULACACEAE A. Jussieu, Gen. Pl. 312. 1789

PORTULACA Linnaeus, Sp. Pl. 1: 445. 1753

Portulaca oleracea Linnaeus, Sp. Pl. 445. 1753; Hooker *f.*, Fl. Brit. Ind. 1: 246. 1872; Prain, Beng. Pl. 2: 240. 1903. Guha Bakshi, Fl. Mur. Dist. 58. 1984; Sharma *et al.* Fl. Ind. 3: 4. 1993.

Prostrate succulent, glabrous herbs, swollen at nodes. Leaves cuneiform, fleshy; stipules hairy. Flowers sessile, in terminal cluster, yellow; stamens 5 - 12; ovary ovoid, unilocular. Capsules ovoid, many seeded, covered with acrescent calyx.

Flowers & Fruits: July – October

Exiccatus: Doumahoni Beel, **Anurag & AP Das 0483**, dated 12.06.2013; Gajoldoba, **Anurag & AP Das 0742**, dated 03.09.2014.

Status: Abundant.

Local Distribution: Found in the marginal side of few wetlands of the study area

General Distribution: Pantropical.

TAMARICACEAE Link, Enum. Hort. Berol. Alt. 1: 291. 1821; *nom. cons.*

TAMARIX Linnaeus, Sp. Pl. 2. 1753

Tamarix dioca Roxburgh *ex* Roth, Nov. Pl. Sp. 185. 1821; Hooker *f.*, Fl. Brit. Ind. 1: 249. 1874; Prain, Beng. Pl. 1; 162. 1963; Shetty & Pandey in Sharma *et al.*, Fl. Ind. 3: 24. 1993.

Vernacular Name: *Jhaoa*

Shrubs or small trees. Lamina vaginate, free part broadly triangular. Racemes aestival, simple or compound. Flowers spirally arranged on the rachis, pink, unisexual. Female appear as bisexual but anthers are sterile. Capsules with persistent sepals. Seeds long.

Flowers & Fruits: July – January

Exiccatus: Doumahoni Beel, **Anurag & AP Das 0494**, dated 12.06.2012; Gajoldoba Beel, **Anurag & AP Das 0751**, dated 03.09.2014.

Status: Less common.

Local Distribution: Found in few bank of the wetland of the study area.

General Distribution: Myanmar, India, Bangladesh, Nepal, Pakistan, Afghanistan.

Fabids (Eurosids I)

Order: Oxalidales

OXALIDACEAE R. Brown, Narr. Exped. Zaire 433. 1818; *nom. cons.*

Key to the genera:

- 1a. Leaves pinnate; erect herbs; flower in terminal head ***Biophytum***
- 1b. Leaves trifoliate; semi-erect herbs with runners; flowers in axillary pseudoumbels ***Oxalis***

BIOPHYTUM A.P. de Candolle, Prodr. 1: 689. 1824

Biophytum sensitivum (Linnaeus) A.P. de Candolle, Prodr. 1: 690. 1824; Egdeworth & Hooker *f.*, Fl. Brit. Ind. 1: 436. 1874; Guha Bakshi, Fl. Mur. Dist. 77. 1984; Prain, Beng. Pl. 1: 204. 1903. *Oxalis sensitive* Linnaeus, Sp. Pl. 434. 1753.

Erect, annual herbs; stem hispidly pubescent. Leaves crowded into a rosette at the top of stem; leaflets 6–15 pairs, variable in size, oblong obliquely rounded, apiculate at the apex. Flowers yellow, peduncles very variable, sometime swollen at the tip. Capsules elliptic, shining; seeds minute.

Flowers & Fruits: July – December

Exiccatus: Kathambari Beel, **Anurag & AP Das 0740**, dated 03.09.2014.

Status: Common.

Local Distribution: Throughout the study area

General Distribution: Tropical Asia, Africa and America.

OXALIS Linnaeus, Sp. Pl. 2. 1753**Key to the Species:**

- 1a. Plant with runners; lamina not trichomatous, petals yellow *O. corniculata*
 1b. Plants with underground bulbs; lamina trichomatous, petals purplish pink
 *O. debilis* var. *corymbosa*

Oxalis corniculata Linnaeus, Sp. Pl. 41. 1753; Edgeworth & Hooker f., Fl. Brit. Ind. 1: 436. 1892; Guha Bakshi, Fl. Mur. Dist. 78. 1984; Prain, Beng. Pl. 1: 203. 1903; Dunn in Gamble, Fl. Pres. Madras 132. 1931; Vajravelu, Fl. Palghat Dt. 98. 1990. Pers. Plant. Bio. Diversity. 655. 2002.

Vernacular Name: *Amrul*

Small procumbent herbs, rooting from the nodes. Lamina digitately 3-foliolate, with slender petioles; leaflets subsessile, obcordate, cuneate at the base. Flowers yellow, in axillary, solitary, long peduncled, umbellate cyme. Stamens 10, alternately long and short. Capsule 2 cm long, linear brown.

Flowers & Fruits: Almost round the year.

Exiccatus: Mahananda Barrage, **Anurag & AP Das 0055**, dated 12.05.2010.

Status: Common.

Local Distribution: Throughout the study area.

General Distribution: Cosmopolitan.

Oxalis debilis var. *corymbosa* (A.P. de Candolle) Lourteig, Ann. Missouri Bot. Gard. 67: 840. 1980 publ. 1981. *Oxalis corymbosa* A.P. de Candolle, Prodr. 1: 696. 1824.

Perennial pubescent herb. Leaves basal; petiole 5–32 cm. Lamina obcordate, both surfaces trichomatous, deeply emarginate at apex. Inflorescences corymbose cyme, branched irregularly, 8–15 flowered; peduncle 8–35 cm; bracts membranous, lanceolate. Sepals pubescent, lanceolate, 4–7.2 mm. Petals obcordate, purplish pink. Ovary pubescent.

Flowers & Fruits: Almost round the year

Exiccatus: Gajoldoba, **Anurag & AP Das 0125**, dated 12.09.2010; Kathambari Beel, **Anurag & AP Das 0722**, dated 03.09.2014.

Status: Common.

Local Distribution: Throughout the study area.

General Distribution: Native to tropical South America cultivated as an ornamental and naturalized in warm temperate areas in many parts of the world.

Order: Malpighiales

ELATINACEAE Dumortier, Anal. Fam. Pl. 44, 49. 1829

BERGIA Linnaeus, Mantissa Plantarum Altera, 1771

Key to the Species:

- 1a. Stamens 5; seeds ellipsoidal *B. ammannioides*
 1b. Stamens 10; seeds oblong *B. capensis*

Bergia ammannioides Roxburgh [Hort. Beng. 34. 1814, *nom nud.*] ex Roth, Nov. pl. Sp. 219. 1821; & Fl. Ind. 2; 457. 1832, ut “*ammanoides*”; Dyer in Hooker *f.*, Fl. Brit. Ind. 1: 251. 1874; Prain, Beng. Pl. 1: 243. 1903. *Elatine ammannoides* (Roxburgh ex Roth) Wight & Arnott, Prodr. 41. 1834. *Bergia ammannioides* var. *pentandra* Wight, Ill. India. Bot. 54, t. 25a. 1840. Sharma *et al.* Fl. Ind. 3: 33. 1993.

Erect or suberect, much branched, annual herbs; branches often glandular, pubescent. Lamina sessile, oblanceolate, linear lanceolate or elliptic, acute, glandular, ciliate, serrate, finely hairy or glandular above, beneath hairy on veins; stipules membranous, linear acute. Flowers red in dense long pedicels. Stamens 5. Capsules 2 – 3 cm long ovoid dehiscent from the center axis, seeds numerous, ellipsoidal.

Flowers & Fruits: September – January

Exiccatus: Kathambari Barrage, **Anurag & AP Das 0662**, dated 03.09.2014.

Status: Common.

Local Distribution: Throughout the study area.

General Distribution: India, Tropical Asia from Iran to China, Philippines, Australia and Tropical Africa.

Bergia capensis Linnaeus, Mant. Pl. 2: 241. 1771; Cook, Aqua. Wetl. Pl. Ind. 185. 1996. *Bergia verticillata* Willd., Sp. Pl. 2: 770. 1799; Prain, Beng. Pl. 1: 243. 1903

Annual herbs. Stem terete, glabrous, prostrate and rooting in lower part. Stipules ovate – triangular, membranous, margin dentate – sinuate; petiole flattened; lamina elliptic – lanceolate, obovate – lanceolate; acuminate at base, apex acute. Flowers arranged into small, axillary cymes. Sepals erect, narrowly lanceolate. Petals pink, oblong. Stamens 10, free. Ovary subglobose. Seeds minute, oblong, angular or transversely striate.

Flowers & Fruits: September – January

Exiccatus: Kathambari Barrage, **Anurag & AP Das 0679**, dated 03.09.2014.

Status: Rare.

Local Distribution: In one or two wetlands of the study area.

General Distribution: India, China, Sri Lanka, Malaysia, Thailand, Africa, SW Asia (Iran), Europe, introduced in tropical America.

EUPHORBIACEAE Juss, Gen. Pl. 384. 1789; *nom. cons.*

Key to the Genera:

- 1a. Lamina palmately lobed ***Ricinus***
 1b. Lamina not palmately lobed..... 2
 2a. Flowers in cyathia ***Euphorbia***
 2b. Inflorescence racemose..... 3

- 3a. Raceme terminal; lamina lanceolate **Croton**
 3b. Raceme axillary, cluster or spike; lamina sub orbicular-ovate **Chrozophora**

CHROZOPHORA A. Jussieu, Euphorb. Gen. 27. 1824

Chrozophora rottleri (Geiseler) A. Jussieu ex Sprengel, Syst. Veg. 3; 850. 1826; Haines, Bot. Bihar & Orissa Pt. II: 103. 1921; Panda & Das, Fl. Sambalp., 327. 2004. *Croton rottleri* Geiseler, Crot. Monogr. 57. 1807. *Chrozophora plicata* A. Jussieu, Tent. Euphorb. 28. 1824; Hooker f., in Hooker f., Fl. Brit. Ind. 4: 409. 1887.

Much branched annual, under shrubs. Leaves alternate, lamina variable, sub-orbicular, entire, glandular at base. Flowers in axillary cymes; Stamens 15 in two whorls; ovary 3 locular, style 3. Capsules with 3 valves, reddish.

Flowers & Fruits: January – May

Exiccatus: Doumahoni Beel, **Anurag & AP Das 0186**, dated 02.02.2011; Gajoldoba, **Anurag & AP Das 0346**, dated 08.03.2012.

Status: Common.

Local Distribution: Throughout the study area.

General Distribution: India, Asia, Europe and Australia.

CROTON Linnaeus, Sp. Pl. 2. 1753

Croton bonplandianus Baillon in Adansonia 4: 339. 1864; Guha Bakshi, Fl. Mur. Dist. 283. 1984; Panda & Das, Fl. Sambalp., 328. 2004. *Croton sparsiflorus* Morung in Ann. N. Y. Acad. Sci. 7: 221. 1893; Haines, Bot. Bihar & Orissa Pt. II: 105. 1921.

Annual or perennial, erect herbs with watery latex. Leaves alternate, lamina lanceolate. Inflorescence terminal raceme with lower female and upper male flower; male flower with 5 sepals, 5-petals; numerous stamens. Female flower with 5 sepals, carpels-3. Fruits with three one-seeded cocci.

Flowers & Fruits: January – December

Exiccatus: Mahananda Barrage, **Anurag & AP Das 0010**, dated 12.05.2010; Doumahoni Beel, **Anurag & AP Das 0678**, dated 03.09.2014.

Status: Common.

Local Distribution: Throughout the study area.

General Distribution: India, Native to S. America, Pantropical.

EUPHORBIA Linnaeus, Genera Plantarum ed. 5. 1754

Key to the Species:

- 1a. Stipules subulate, perianth white *E. hirta*
 1b. Stipules minute, setaceous Perianth green..... *E. indica*

Euphorbia hirta Linnaeus, Sp. Pl. 454. 1753; Guha Bakshi, Fl. Mur. Dist. 286. 1984; Panda & Das, Fl. Sambalp., 331. 2004. *Euphorbia pilulifera auct. non* Linnaeus 1753;

Annual. Stem jointed, hairy, purplish. Leaves opposite, simple, base oblique, lanceolate, serrulate, acute, pubescent, stipules subulate. Flowers in terminal and axillary clustered cyathia; stamen – 1. Fruits

depressed, globose, hairy; cocci trigonous.

Flowers & Fruits: January – December

Exiccatus: Mahananda Barrage, **Anurag & AP Das 0016**, dated 12.05.2010; Mahananda Barrage, **Anurag & AP Das 0603**, dated 13.11.2013.

Status: Common.

Local Distribution: Throughout the study area.

General Distribution: Pantropical.

Euphorbia indica Lamarck, Encyl. 2: 243. 1786; Raju & Rao in Indian Jour. Bot 2: 205. 1979. *Euphorbia hypericifolia auct nom* Linnaeus, Fl. Brit. Ind. 5: 249. 1887; Pain, Beng. Pl., 2: 924. 1903; Guha Bakshi, Fl. Mur. Dist. 286. 1984.

Annual, slender sub-erect herbs. Leaves opposite, simple, base oblique, oblong to obovate, rounded, glabrous, stipules minute, setaceous. Flowers in small cymes; perianth white; gland 4-5; fruit depressed – globose. Seeds 3.

Flowers & Fruits: January – May

Exiccatus: Doumahoni Beel, **Anurag & AP Das 0200**, dated 02.02.2011.

Status: Common.

Local Distribution: Throughout the study area.

General Distribution: Pantropical.

RICINUS Linnaeus, Genera Plantarum ed. 5. 1754

Ricinus communis Linnaeus, Sp. Pl. 1007. 1753; Hooker f., Fl. Brit. Ind. 5: 457. 1887; Haines, Bot. Bihar & Orissa Pt. II: 112. 1921; Panda & Das, Fl. Sambalp., 340. 2004.

Tall annual, erect, fleshy, glabrous herbs. Lamina palmately 7 – 9 lobed. Racemes terminal with lower female and upper male flowers. Males bracteate, actinomorphic, perianth-5; stamens-5; carpels-3. Fruits 3 one seeded cocci.

Flowers & Fruits: January – December

Exiccatus: Mahananda Barrage, **Anurag & AP Das 0031**, dated 12.05.2010; Doumahoni Beel, **Anurag & AP Das 0683**, dated 03.09.2014.

Status: Common.

Local Distribution: Throughout the study area.

General Distribution: India, Africa.

HYPERICACEAE A. Jussieu, Gen. Pl. 254. 1789

HYPERICUM Linnaeus, Sp. Pl. 2: 783. 1753

Hypericum japonicum Thunberg *ex* Murray, Syst. Veg. Ed. 14, 1702; Hooker *f.*, Fl. Brit. Ind. 1: 256. 1874; Pain, Beng. Pl., 1: 244. 1903; Haines, Bot. Bihar & Orissa Pt. II: 52. 1921; Mooney, Suppl. Bot. Bihar & Orissa 26. 1950; Sharma *et al.*, Fl. Ind. 3: 69. 1993. Panda & Das, Fl. Sambalp., 51. 2004.

Erect or procumbent, slender herbs. Lamina sessile, elliptic-ovate or lanceolate. Cymes terminal, initially dichasial than monochasial; upper bracts linear-lanceolate. Petals yellow; stamens 10 – 25; ovary umilocular. Capsules sub-cylindric.

Flowers & Fruits: November – May

Exiccatus: Mahananda Barrage, **Anurag & AP Das 0293**, dated 26.11.2011; Gajoldoba, **Anurag & AP Das 0351**, dated 08.03.2012.

Status: Common.

Local Distribution: Found in some wetlands of the study area.

General Distribution: India, Sri Lanka, Bangladesh, Malaysia, Myanmar, china, Japan, Java, New Zealand and Australia.

PHYLLANTHACEAE Martinov, Tekhno-Bot. Slovar 369. 1820

Key to the Genera:

- 1a. Stamens 2-6, styles 3(-12) ***Phyllanthus***
 1b. Stamens 3, styles 3 ***Sauropus***

PHYLLANTHUS Linnaeus, Sp. Pl. 2. 1753

Key to the Species:

- 1a. Small diffused herbs; filaments free ***P. virgatus***
 1b. Small erect herb; filaments forming column 2
 2a. Whole plant reddish; capsule oblate; leaflets oblong ***P. urinaria***
 2b. Whole plant light green; capsule globose; leaflets elliptic ***P. fraternus***

Phyllanthus urinaria Linnaeus, Sp. Pl. 982. 1753; Hooker *f.*, l. c. 293. 1887; Haines, l. c. 125. 1921. Panda & Das, Fl. Sambalp., 340. 2004.

Annual, erect weak herbs; stem branched, terete, smooth. Leaves compound, alternate, leaflets obovate, oblong. Flowers in axillary, unisexual; all male flower succeeding axils with bisexual cymules, calyx lobes 5, sub equal, acute, stamen-3; Female flowers with 5 sepal, sub equal, style 3, free, shallowly bifid. Capsules obovate. Seeds triangular.

Flowers & Fruits: June. – February

Exiccatus: Doumahoni Beel, **Anurag & AP Das 0217**, dated 02.02.2011; Kathambari Beel, **Anurag & AP Das 0741**, dated 03.09.2014.

Status: Common.

Local Distribution: Throughout the study area.

General Distribution: Pantropical, Native to South America.

Phyllanthus fraternus G.L. Webster in Contr. Gray. Herb. 176. 53. 1955 and in Jour. Arnold Arbor. 38: 308. 1957. *Phyllanthus niruri auct. pl. non l.* 1753, Fl. Brit. Ind. 5: 298. 1887; Prain, Beng. Plants 2: 936. 1903.

Annual, erect herbs. Leaves alternate, compound, subsessile, elliptic to oblong, base rounded. Male flowers greenish yellow, axillary, solitary, filament united to a column. Female flowers greenish yellow, axillary solitary, style 3, recurved. Capsules depressed globose.

Flowers & Fruits: June. – February

Exiccatus: Doumahoni Beel, **Anurag & AP Das 0497**, dated 12.06.2013; Kathambari Beel, **Anurag & AP Das 0745**, dated 03.09.2014.

Status: Less common.

Local Distribution: Found in few wetlands of the study area.

General Distribution: Pantropical, Native to South America.

Phyllanthus virgatus Froster f., Fl. Ins. Austrl. Prodr. 65. 1766. (*ut virgata*) Airy Shaw, Kew. Bull. 26; 325. 1972; Guha Bakshi, Fl. Mus. Dist. 294. 1984. *Phyllanthus simplex* Retzius, Obs. Bot. 5; 29. 1789; Hooker f., Fl. Brit. Ind. 5: 295. 1887; Prain, Beng. Pl. 2: 936. 1903.

Annual, erect or diffused herbs. Stem glabrous, branched from lower node. Lamina distichous, base rounded; stipule sagittate; reddish brown. Flowers solitary axillary, stamens free. Capsules trilobed, long stalked; seeds red.

Flowers & Fruits: June – February

Exiccatus: Gajoldoba, **Anurag & AP Das 0739**, dated 03.09.2014.

Status: Less common.

Local Distribution: Found in few wetlands of the study area.

General Distribution: India, South Asia to Pacific Islands.

SAUROPLUS Blume, Bijdragen tot de Flora van Nederlandsch Indie No. 7. 1827

Sauropus quadriangularis (Willdenow) Müll. Arg. in Linnaea 32: 73. 1863 & in A.P. de Candolle, Prodr. 15(2): 242. 1866; Hooker f., Fl. Brit. Ind. 5: 335. 1887. *Phyllanthus quadriangularis* Klein ex Willd., Sp. Pl. 4: 585. 1805.

Shrub, erect; leaves compound, alternate, petiolod. Stipule minute. Flowers monoecious, minute, axillary; perianth simple. Pelals absent; Sepals connate; stamens 3, truncate; Ovary 3 celled, globose, style 3. fruit globose, compressed with 3 cocci.

Flowers & Fruits: January – May

Exiccatus: Gajoldoba, **Anurag & AP Das 0384**, dated 08.03.2012; Kathambari Beel, **Anurag & AP Das 0740**, dated 03.09.2014.

Status: Common.

Local Distribution: Throughout the study area.

General Distribution: India.

Order: Fabales

FABACEAE Lindley, Intr. Nat. Syst. Bot., ed. 2. 148. 1836; *nom. alt.* [**LEGUMINOSAE** *nom. cons.*]

Key to the sub-families:

- 1a. Flowers actinomorphic; petals valvate in bud; stamens many, free, fertile **Mimosoideae**
- 1b. Flowers zygomorphic; petals imbricate in bud; stamens 10 ... 2
- 2a. Corolla not papilionaceous, uppermost petal overlapped on each side by adjacent lateral petals (when present); stamens free with few staminodes **Caesalpinioideae**
- 2b. Corolla papilionaceous, standard outside wings, keel basally connate; stamens diadelphous, (9) +1 or monadelphous, rarely free, all fertile **Papilionoideae**

CAESALPINIOIDEAE A.P. de Candolle, Prodr. 2: 473. 1825

SENNA Miller, the Gardeners' Dictionary abr. ed. 4. 1754

Key to the Species:

- 1a. Leaflets 8 – 12 pairs, oblong, acute..... 2
- 1b. Leaflets 3 pairs, oval, obtuse, leaflets *S. tora*
- 2a. Petiolar gland sessile, globose or ovoid; pods flattened *S. occidentalis*
- 2a. Petiolar gland narrow, clavate to subulate; pods terete *S. sophera*

Senna occidentalis (Linnaeus) Link, Handb. 2: 140. 1831. *Cassia occidentalis* Linnaeus, Sp. Pl. 1: 377. 1753; Prain, Beng. Pl. 1: 437. 1903.

Annual erect herbs. Leaves ca. 20 cm, unipinnate, leaflets 3 – 5 pairs, ovate to ovate-oblong; stipules caducous, triangular to lanceolate. Corymbs few flowered, axillary or terminal, bracts caduceous; sepals unequal; petals yellow; fertile stamens 7; ovary tomentose. Pods brown, flattened.

Flowers & Fruits: July – December

Exiccatus: Gajoldoba, **Anurag & AP Das 0098**, dated 12.09.2010; Kathambari Beel, **Anurag & AP Das 0674**, dated 03.09.2014.

Status: Common.

Local Distribution: Throughout the study area

General Distribution: Pantropical.

Senna sophera (Linnaeus) Roxburgh, Fl. Ind., ed. 2: 347. 1832. *Cassia sophera* Linnaeus, Sp. Pl. 379. 1753; Hooker f., Fl. Brit. Ind. 2: 262. 1878; Prain, Beng. Pl. 1: 438. 1903; Guha Bakshi, Fl. Mur. Dist. 117. 1984. *Cassia purpurea* Roxburgh, Hort. Beng. 31. 1814, *nom.nud.* *Senna exculenta* Roxburgh, Fl. Ind. Ed. Carey 2: 346. 1832.

Vernacular Name: *Chakanda*

Erect, bushy, small shrubs. Leaves unipinnate, leaflets 8 – 12 pairs, oblong to lanceolate, acute. Flowers in short axillary or terminal branched corymbs; sepals obscure; petals 5, yellow; fertile stamens 7. Pods slightly curved, terete. Seeds dark brown, ovoid, compressed.

Flowers & Fruits: August – April

Exiccatus: Gajoldoba, **Anurag & AP Das 0104**, dated 13.09.2010.

Status: Common.

Local Distribution: Throughout the study area

General Distribution: Pantropical.

Senna tora (Linnaeus) Roxburgh, Fl. Ind., ed. 2: 340. 1832; Prain, Beng. Pl. 1: 438. 1903. *Cassia tora* Linnaeus, Sp. Pl. 376. 1753; Hooker f., Fl. Brit. Ind., 2: 265. 1878; Gamble, Fl. Pres. Madras, 401. 1919; Vajravelu, Fl. Palghat Dist. 182. 1990. *Cassia obtusifolia* Linnaeus, Sp. Pl. 377. 1753.

Small annual, woody herbs. Leaves unipinnate, leaflets 3 pairs oblong-oboovate with subulate glands. Flowers 5 – 6, yellow. Pods long (10 – 15 cm), slender, curved.

Flowers & Fruits: July – December

Exiccatus: Gossaihat Beel, **Anurag & AP Das 0241**, dated 14.07.2011; Gajoldoba, **Anurag & AP Das 0684**, dated 03.09.2014.

Status: Abundant.

Local Distribution: Throughout the study area

General Distribution: Pantropical.

MIMOSOIDEAE A.P. de Candolle, Prodr. 2: 424. 1825

Key to the Genera:

- 1a. Bushy, prickly herb; head pink; stamens definite ***Mimosa***
- 1b. Small tree, not prickly but with a pair of long white stipular spines; heads yellow; stamens indefinite ***Acacia***

ACACIA Miller, Gard. Dict. Abr., ed. 4. 1754; Druce in Rep. Bot. Exch. Cl. Brit. Isles, 3: 428. 1913.

Acacia nilotica subsp. ***cupressiformis*** (J.L. Stewart) Ali & Faruqi in Pak. Jour. Bot. 1: 4. 1969; Shetty & Singh, Fl. Raj. 1: 298. 1987. *A. arabica* (Lamarck) Willidenow var. *cupressiformis* J.L. Stewart, Punj. Pl. 51. 1869; Pain, Beng. Pl., 1: 458. 1903. *Mimosa nilotica* Linnaeus, Sp. Pl. 1: 521. 1753.

Vernacular Name: Babla

Terrestrial invaders; small trees with a pair of long white straight spines; resin exudes from cracked bark. Leaves bipinnate. Flowers in axillary, yellow globose heads, bracteate, sub-sessile; sepals 5; corolla 5; stamens numerous, polyandrous; styles long. Fruits many seeded, lomentum.

Flowers & Fruits: March – June

Exiccatus: Mahananda Barrage, **Anurag & AP Das 0045**, dated 12.05.2010.

Status: Rare.

Local Distribution: Only in one wetland of the study area.

General Distribution: India, Bangladesh, Malaysia, Tropical Africa.

MIMOSA Linnaeus, Sp. Pl. 1: 516. 1753**Key to the Species:**

- 1a. Stamens 4; small herb *M. pudica*
 1b. Stamens 8; erect shrub *M. himalayana*

Mimosa himalayana Gamble in Kew Bull. 1920: 4. 1920; Grierson & Long, Fl. Bhut. 1 (3): 639. 1987. *Mimosa rubricaulis* subsp. *himalayana* (Gamble) H. Ohashi,

Large straggling, branches ribbed, densely hairy, deciduous shrub with hooked prickles. Leaves bipinnate; rachis prickly, hairy, ribbed; leaflets 6 – 15 pairs, oblong, mucronate, glabrous above. heads globose; flowers pinkish; bracts small, linear, ciliate. Calyx hairy; corolla tubular; stamens 8; glabrous. Lomentum strap-shaped, glabrous.

Flowers & Fruits: June – September

Exiccatus Gossaihat Beel, *Anurag & AP Das 0246*, dated 14.07.2011.

Status: Less common.

Local Distribution: In only few wetlands of the study area.

General Distribution: India, Bhutan, Myanmar, Malaysia and Tropical Africa.

Mimosa pudica Linnaeus, Sp. Pl. 518. 1753; Prain, Beng. Pl. 1: 456. 1903; Panda & Das, Fl. Sambalp. 135. 2004.

Vernacular Name: *Lajjabati*

Bushy, prickly, rigid, low annual herbs. Leaves many bipinnate, pale green, closing with sysmonastic movement when disturbed. Flowers pale pink, in globose heads; sepals 4, campanulate; petals 4, connate; stamens 4; ovary many ovulate, style filiform. Lomenta crowded, flat, prickly; seeds rounded, brown.

Flowers & Fruits: February – July

Exiccatus: Mahananda Barrage, *Anurag & AP Das 0046*, dated 12.05.2010.

Status: Very Common.

Local Distribution: Throughout the study area

General Distribution: India, Mauritius, China, Malaysia, Indonesia, Philippines, Australia America.

PAPILIONOIDEAE A.P. de Candolle, Prodr. 2: 94. 1825. *nom. cons.* [**FABOIDEAE** *nom. alt.*]**Key to the Genera:**

- 1a. Pods flattened; much longer than calyx *Medicago*
 1b. Pod not flattened, mostly terete 2
 2a. Leaves exstipulate; unipinnate *Aeschynomene*
 2b. Leaves stipulate; 1 or 3 foliate 3
 3a. Pods not inflated, joints turgid; leaves unifoliate *Alysicarpus*
 3b. Pods inflated, not jointed; leaves trifoliate or unifoliate *Desmodium*

AESCHYNOMENE Linnaeus, Sp. Pl. 2. 1753**Key to the Species:**

- 1a. Tall erect plant, branches few upwards; stem generally puffed; calyx hispid; pods echinulate
 *A. aspera*
- 1b. small bushy plant much branched; stem to not puffed; calyx glabrous, pods smooth *A. indica*

Aeschynomene aspera Linnaeus, Sp. Pl. 713. 1753; Hooker *f.*, Fl. Brit. Ind. 2: 152. 1876; Prain, Beng. Pl. 2: 299. 1903; Majumdar, Bull. Bot. Soc. Beng. 20 (2): 64. 1966.

Local name: *Shola, Bhaat Shola*

Aquatic, erect stout tall herbs with few branches upward; stem generally soft and puffing and with numerous nodules. Leaves exstipular. Flowers yellow. Stamens in two lateral bundles of 5 each; calyx and corolla hispid. Pods echinulates, straight; separating at joints.

Flowers & Fruits: July – December

Exiccatus: Gajoldoba, *Anurag & AP Das 0105*, dated 12.09.2010; Kathambari Beel, *Anurag & AP Das 0691*, dated 03.09.2014.

Status: Abundant.

Local Distribution: Throughout the study area

General Distribution: India, Bangladesh, Myanmar, Malaysia, Tropical Africa.

Aeschynomene indica Linnaeus, Sp. Pl. 713. 1753; Hooker *f.*, Fl. Brit. Ind. 2: 151. 1876; Prain, Beng. Pl.1: 418. 1903; Majumdar, Bull. Bot. Soc. Bengal 20 (2): 64. 1966. [**PLATE 4.13. Figs. 67**]

Shrubby annual herbs; stem do not puff, with nodules. Leaflets numerous small, sessile, alternate, linear, obtuse, the upper one smallest; stipules linear lanceolate, acuminate, with acute auricled base. Flowers yellow, in axillary racemes; calys glabrous. Pods 6 – 10 jointed, dotted with black.

Flowers & Fruits: September – December

Exiccatus: Mahananda Barrage, *Anurag & AP Das 0610*, dated 13.11.2013.

Status: Common.

Local Distribution: Throughout the study area

General Distribution: India, Nepal, Bhutan, Sri Lanka, China, Japan, Kashmir, Korea, Laos, Malaysia, Myanmar, Thailand, Vietnam; tropical Africa, SW Asia, Australia, Pacific islands, South America.

ALYSICARPUS Neck *ex* Desvaux, Jour. Bot. Agric. 1(2): 120. 1813; *nom. cons.*

Alysicarpus bupleurifolius (Linnaeus) A.P. de Candolle, Prodr.2: 352. 1825; Hooker *f.*, Fl. Brit. Ind. 2: 158. 1876; Prain, Beng. Pl. 1: 307. 1903. *Hedysarum bupleurifolium* Linnaeus, Sp. Pl. 746. 1753.

Glabrous, slender, erect or diffuse herbs. Leaves 1-foliolate, shortly stalked, glabrous; leaflet 2.5 – 3 cm long, linear-lanceolate or oblong, acute, glabrous. Flowers shortly pedicelled, usually in pairs on spike like loose racemes; calyx much longer than lowest joint of pod; corolla pink. Pods stalked, moniliform.

Flowers & Fruits: August – December

Exiccatus: Gossaihat Beel, *Anurag & AP Das 0420*, dated 17.08.2012; Doumahoni Beel, *Anurag & AP Das 0692*, dated 03.09.2014.

Status: Common.

Local Distribution: In some wetlands of the study area

General Distribution: India; Sri Lanka, Malaysia, Island, China, Philippines, Mauritius, Polynesia.

DESMODIUM Desvaux, Jour. Bot. Agric. 1: 122. 1813

Key to the Species:

- 1a. Plants prostrate herb; flowers 1 – 3, axillary *D. triflorum*
- 1b. Plants erect, bushy, shrubby; flowers in raceme or spike 2
- 2a. Leaves unifoliolate *D. gangeticum*
- 2b. Leaves 3-foliolate 3
- 3a. Lateral leaflets very small; terminal one oblong, obtuse *D. gyroides*
- 3b. Lateral leaflets slightly smaller; terminal one ovate – elliptic *D. triangulare*

Desmodium gangeticum (Linnaeus) A.P. de Candolle, Prodr. 2: 327. 1825; Prain, Beng. Pl. 1: 424. 1903. *Hedysarum gangeticum* Linnaeus, Sp. Pl. 746. 1753. Panda & Das, Fl. Sambalp. 102. 2004.

Erect, pubescent undershrub. Leaves one-foliolate, ovate-lanceolate or elliptic, acute. Stipules linear, acuminate, persistent. Flowers purplish white, terminal or axillary cymose panicle. Pods falcate, 3 – 8 jointed, slightly hairy.

Flowers & Fruits: April – November

Exiccatus: Mahananda Barrage, *Anurag & AP Das 0612*, dated 13.11.2013.

Status: Common.

Local Distribution: Throughout the study area

General Distribution: India, Sri Lanka, Bangladesh, China, Malaysia, Philippines, Tropical part of Africa West Indies.

Desmodium gyroides (Roxburgh ex Link) A.P. de Candolle, Prodr. 2: 326. 1825; Hooker f., Fl. Brit. Ind. 2: 175. 1876; Prain, Beng. Pl. 1: 425. 1903. *Hedysarum gyroides* Roxburgh ex Link, Enum Alt. 2: 247. 1822.

Small erect, bushy shrubby annual. Leaves 1 – 3 foliate, lateral leaflets very small, narrowly oblong, with motor movement; terminal one much larger, oblong or obovate-oblong, obtuse, truncate at base; stipules linear, acuminate, filiform. Flowers purplish pink, in axillary or terminal racemes; bracts ovate. Pods linear, hairy, 3 – 10 jointed.

Flowers & Fruits: September – January

Exiccatus: Mahananda Barrage, *Anurag & AP Das 0611*, dated 13.11.2013.

Status: Common.

Local Distribution: Throughout the study area

General Distribution: India, Malaysia, Sri Lanka.

Desmodium triangulare (Retzius) Merrill in Jour. Arn. Rb. 23: 170. 1942; Hajra *et al.*, Materials Fl. Arunachal. Prad. 1: 367. 1996. *Hedysarum triangulare* Retzius, Obs. Bot. 3: 40. 1783. *H. cephalotes*

Roxburgh, Fl. Ind. 3: 360. 1832. *Desmodium cephalotes* (Roxburgh) Wight & Arnott, Prodr. 224. 1834; Hooker f., Fl. Brit. Ind. 2: 161. 1876; Prain, Beng. Pl. 1: 424. 1903.

Helophyte; much branched, erect, small shrubs. Leaves trifoliolate, leaflets elliptic – lanceolate or oblong – elliptic, grey silky beneath, acute. Flowers reddish yellow, in axillary umbels. Pods 2-4 jointed, grey silky hairy.

Flowers & Fruits: June – November

Exiccatus: Gossaihat Beel, **Anurag & AP Das 0435**, dated 17.08.2012.

Status: Common.

Local Distribution: Throughout the study area.

General Distribution: India and Pantropical.

Desmodium triflorum (Linnaeus) A.P. de Candolle, Prodr. 2: 334. 1825; Prain, Beng. Plants 1: 307. 1903. *Hedysarum triflorum* Linnaeus, Sp. Pl. 749. 1753. Panda & Das, Fl. Sambalp. 103. 2004.

Prostrate, mat-forming, branched, tomentose herbs, rooting from node. Leaves 3 foliate, leaflets obovate, obcordate, sparsely hairy beneath; bracts linear, acuminate. Flowers purplish, 1 – 3 together, axillary. Calyx hairy. Pods curved, flat, pubescent, 3 – 5 jointed.

Flowers & Fruits: June – February

Exiccatus: Gossaihat Beel, **Anurag & AP Das 0247**, dated 14.07.2011.

Status: Common.

Local Distribution: Throughout the study area

General Distribution: India and Pantropical.

MEDICAGO Linnaeus, Sp. Pl. 2: 778. 1753

Medicago lupulina Linnaeus, Sp. Pl. 779. 1753; Hooker f., Fl. Brit. Ind. 2: 90. 1876; Prain, Beng. Pl. 1: 296. 1903.

Procumbent, much branched herb. Leaflets obovate or cuneate-obcordate, toothed, base deltoid, entire, silky beneath; stipules lanceolate, acuminate, toothed. Flowers yellow in dense ovoid heads; peduncles, exceeding leaves. Pods indehiscent, reniform, glabrous or downy, with 1 spiral or in way to spiral.

Flowers & Fruits: January – May

Exiccatus: Doumahoni Beel, **Anurag & AP Das 0192**, dated 02.02.2011; Gajoldoba, **Anurag & AP Das 0693**, dated 03.09.2014.

Status: Less common.

Local Distribution: In few wetlands of the study area.

General Distribution: India, Native to Europe and Asia.

POLYGALACEAE Hoffmann & Link, Fl. Portug. 1: 62. 1809

POLYGALA Linnaeu, Sp. Pl. 2. 1753

Polygala chinensis Linnaeus, Sp. Pl. 2: 704. 1753; Hooker f., Fl. Brit. Ind. 1: 204. 1872; Prain, Beng. Pl. 1: 235. 1903. *Polygala glomerata* Loureiro, Fl. Cochinch. 426. 1790.

Small, erect annual herbs, upto to 30 cm tall, densely pubescent. Leaves sessile, lamina linear-lanceolate, glabrous; racemes slightly extra-axillary, 2–3 flowered; flowers nodding, outer sepals acuminate, ciliate; wings acuminate, awned.

Flowers & Fruits: July – October

Exiccatus: Gossaihat Beel, **Anurag & AP Das 0285**, dated 14.07.2011; Doumahoni Beel, **Anurag & AP Das 0536**, dated 12.06.2013.

Status: Less common.

Local Distribution: In few wetlands of the study area.

General Distribution: Tropical Asia.

Order: Rosales

MORACEAE Charles Gaudichaud, Gen. Pl. 13. 1835; *nom. cons.*

FICUS Linnaeus, Sp. Pl. 2: 1059. 1753

Ficus heterophylla Linnaeus *f.*, Suppl. Pl. 442. 1781; Prain, Beng. Plants 2: 981. 1903; Guha Bakshi, Fl. Mur. Dist. 301. 1984. Panda & Das, Fl. Sambalpur, 346. 2004.

Scandent small shrubs. Lamina polymorphic, sub-entire, denticulate, base rounded – cordate, scabrid. Stipules ovate-anceolate. Figs solitary, axillary, globose, dark – orange when ripe.

Flowers & Fruits: January – July

Exiccatus: Gajoldoba, **Anurag & AP Das 0386**, dated 08.03. 2012; Kathambari Beel, **Anurag & AP Das 0726**, dated 03.09.2014.

Status: Less common.

Local Distribution: Found only in the margin of few wetlands

General Distribution: India, Sri Lanka, China and Malayan Island.

ROSACEAE A. Jussieu, Gen. Pl. 334. 1789

DUCHESNEA Focke, Nat. Pflanzenfam. 3: 33. 1888

Duchesnea indica (W. Jackson) Focke, Die nat. rlichen Pflanzenf. 1887. 33. 1894; Hooker *f.*, Fl. Brit. Ind. 2: 343-344. 1878, H. Hara, S. Kurosawa in J. Jap. Bot. 34: 161-166. 1959, Rech. *f.*, Fl. Iran. 77-78. 1969. **[PLATE 4.13. Figs. 71]**

Annual herbs, rosette with many runners. Petioles and pedicels hairy or densely villous. Stipules narrowly ovate – broadly lanceolate. Petiole long, erect; leaflets 3, almost sessile; median leaflet larger, rounded ovate to obovate, sharply serrate, both surfaces hairy. Flowers pilose or villous. Sepals ovate, acute. Petals shortly clawed, rounded. Stamens 20–30. Carpels free, numerous. Achenes ovoid, red on a spherical torus.

Flowers & Fruits: May – October

Exiccatus: Mahananda Barrage, **Anurag & AP Das 0063**, dated 12.05.2010; Kathambari Beel, **Anurag & AP Das 0717**, dated 03.09.2014.

Status: Rare.

Local Distribution: In few areas of Terai & Duars.

General Distribution: India, Bhutan, China, Afghanistan, Indonesia, Japan, Korea, Nepal, Sikkim; naturalized in Africa, Europe, North America.

URTICACEAE A. Jussieu, Gen. Pl. 400. 1789; *nom. cons.*

Key to the Genera:

- 1a. Leaves alternate or rarely opposite 2
- 1b. Leaves usually opposite or rarely alternate *Pilea*
- 2a. Styles absent; stigma penicillate *Elatostema*
- 2b. Styles present; stigma filiform *Pouzolzia*

POUZOLZIA Gaudich, Voy. Uranie, Bot. 503. 1830

Key to the Species:

- 1a. Leaves with triangular stipules; male perianth 4 lobed *P. zeylanica*
- 1b. Leaves with ovate stipule; male perianth 5 lobed *P. hirta*

Pouzolzia zeylanica (Linnaeus) Bennet, Pl. Jav. Rar. 67. 1838; Panda & Das, Fl. Sambalp. 351. 2004. *Perietaria zeylanica* Linnaeus, Sp. Pl. 1052. 1753. *Pouzolzia indica* (Linnaeus) Gaudichaud in Freyc., Voy. Bot. 503. 1826.

Annual to biennial erect or ascending herbs, rarely prostrate, almost simple or few branched at base. Leaves opposite, sometimes alternate on lower or upper stems; stipules triangular; lamina ovate or broadly ovate to lanceolate or narrowly lanceolate, secondary vein 1 or 2 pairs, sometimes abaxially strigose along veins, adaxially glabrous or sparsely strigulose; bracts triangular, ciliate. Male perianth tube 4-lobed, narrowly oblong or oblong-oblongate. Female perianth tube ellipsoid or rhombic. Achenes white, light to dark yellow or light brown, ovoid.

Flowers & Fruits: September – April

Exiccatus: Mahananda Barrage, **Anurag & AP Das 0322**, dated 26.11.2011; Gajoldoba, **Anurag & AP Das 0750**, dated 03.09.2014.

Status: Common.

Local Distribution: Found in the marginal side of few wetlands of the study area.

General Distribution: Tropical to sub-tropical India; Sri Lanka, Bangladesh, Myanmar, China.

Pouzolzia hirta (Blume) Hasskarl, Cat. Hort. Borger. 80. 1844; Hooker f., Fl. Brit. Ind. 5: 586. 1888; Panda & Das, Fl. Sambalp. 331. 2004. *Utrica hirta* Blume, Bijdr. 495. 1825. *Gonostegia hirta* Miquel, Ann. Mus. Bot. Lud. Bat. 4: 303. 1869.

Annual, prostrate or subprostrate to sub-erect, up to 90 cm tall, pubescent to glabrescent herbs. Leaves opposite, lamina sessile, narrowly ovate-lanceolate, entire, acute, rounded or cordate at the base, sparsely appressed hairy on both surfaces; stipules ovate, acuminate. Flowers yellowish, in dense axillary fascicles. Male perianth deeply 5-lobed, acuminate, incurved, sparsely ciliate; in female shallowly 4-lobed. Stamens 5, antisepalous. Achenes enclosed by persistent ribbed calyx.

Flowers & Fruits: January – September

Exiccatus: Doumahoni Beel, **Anurag & AP Das 0489**, dated 12.06.2012.

Status: Common.

Local Distribution: Found in the marginal side of few wetlands of the study area.

General Distribution: India (Sub tropical to temperate Himalayas); Malaysia, China, Australia.

ELATOSTEMA J.R. Forst. & G. Forst., Char. Gen. Pl., ed. 2: 105. 1776

Elatostema parvum (Blume) Blume ex Miquel, Syst. Verz. 102. 1855. *Procris parva* Blume, Bijdr. Fl. Ned. Ind. 10: 512 1825. *Elatostema reptans* Hooker f., Fl. Brit. India 5: 567. 1888.

Perennial herbs, monoecious or dioecious. Stems ascending or erect, branched or simple. Leaves alternate; stipules lanceolate or linear, glabrous; lamina obliquely obovate-oblanceolate, or oblong, herbaceous, abaxial surface strigillose along veins, adaxial surface sparsely strigillose or glabrescent, Male inflorescences solitary or in pairs, simple, sessile; bracts connate; bracteoles narrowly ovate or lanceolate, or linear. Female inflorescences solitary or in pairs, broadly elliptic. Achenes ovoid, ribbed.

Flowers & Fruits: February–September

Exiccatus: Doumahoni Beel, **Anurag & AP Das 0216**, dated 02.02.2011.

Status: Common.

Local Distribution: Found in the marginal side of few forest wetlands of the study area.

General Distribution: India, Bhutan, Nepal, China, Indonesia, Myanmar, Philippines.

PILEA Lindley, Coll. Bot. 1. 1821

Pilea microphylla (Linnaeus) Liebmann, Kongel. Danske Vidensk. Selsk. Skr., Naturvid. Math. Afd., ser. 5. 5(2): 302. 1851. *Parietaria microphylla* Linnaeus, Syst. Nat., ed. 10, 2: 1308. 1759.

Weak, glabrous, monoecious herbs. Stems erect or ascending, succulent. Stipules persistent, triangular, membranous; petiole slender, lamina abaxially pale green, adaxially green, obovate or spatulate, Inflorescences often androgynous, compactly cymose-capitate. Male flowers pedicellate, Female perianth lobes subequal, oblong. Achenes ovoid.

Flowers & Fruits: August–November

Exiccatus: Mahananda Barrage, **Anurag & AP Das 0296**, dated 26.11.2006.

Status: Abundant.

Local Distribution: Found in the marginal side of few wetlands of the study area.

General Distribution: India, Bhutan, China, Malaysia, Australia.

Malvids (Eurosids II)

Order: Myrtales

LYTHRACEAE J. St. Hilaire, Expos. Fam. Nat. 2: 175. 1805; *nom. cons.*

Key to the Genera:

- 1a. Flowers in whorls of cymes or clusters at node *Ammannia*

- 1b. Flower axillary or termina 2
 2a. Sessile, solitary or in spikes; fruits without spines **Rotala**
 2b. Short pedicelate; fruits with spines **Trapa**

AMMANNIA Linnaeus, Gen. Pl. ed. 5. 1754

Key to the Species:

- 1a. Leaves lanceolate, tapering at base; shortly petiolate *A. baccifera*
 1b. Leaves rounded or sub-auricled at base; lanceolate-elongated 2
 2a. Flowers in peduncled cymes *A. multiflora*
 2b. Flowers sessile in axillary cymes *A. auriculata*

Ammannia auriculata Willdenow, Hort. Berol. 1: 7. 1803; Cook, Aqua. Wetl. Pl. Ind. 249. 1996.
A. auriculata var. *arenaria* (Kunth) Koehne, Bot. Jahrb. Syst. 1: 245. 1880.

Marshy, weak herbs. Stems branched. Leaves opposite; lamina lanceolate or oblong-lanceolate, base cordate-auriculate, clasping. Flowers in axillary cymes; bracteoles linear, not reaching floral tube. Floral tube campanulate to urceolate; epicalyx segments minute, thickened. Petals rose-purple, suborbicular, sometimes absent. Stamens 4 – 8, long, exerted. Style longer than ovary.

Flowers & Fruits: August – December

Exiccatus: Gossaihat Beel, **Anurag & AP Das 0450**, dated 17.08.2012; Doumahoni Beel, **Anurag & AP Das 0715**, dated 03.09.2014.

Status: Rare.

Local Distribution: Only in one wetland the study area.

General Distribution: Pantropic.

Ammannia baccifera Linnaeus, Sp. Pl. 120. 1753; Hooker *f.*, Fl. Brit. Ind. 2: 569. 1879; Koehna in Pfreich. 17: 53. 1903; Prain, Beng. Pl. 1: 500. 1903; Guha Bakshi, Fl. Mur. Dist. 131. 1984; Cook, Aqua. Wetl. Pl. Ind. 249. 1996.

Annual, erect, glabrous, marsh herbs. Stem reddish, quadrangular, rigid. Leaves opposite decussate; lamina almost sessile, oblong or narrowly elliptic, narrowed at base. Flowers in axillary, sessile clusters, often from the knot on axils. Fruits globose, irregularly dehiscent, depressed with black seeds.

Flowers & Fruits: July – March

Exiccatus: Gossaihat Beel, **Anurag & AP Das 0271**, dated 14.07.2011; Gajoldoba, **Anurag & AP Das 0724**, dated 03.09.2014.

Status: Common.

Local Distribution: Throughout the study area.

General Distribution: Pantropical.

Ammannia multiflora Roxburgh, Fl. Ind. 1: 447. 1820; Hooker *f.*, Fl. Brit. Ind. 570. 1879; Prain, Beng. Pl. 1: 500. 1903; Cook, Aqua. Wetl. Pl. Ind. 250. 1996. Panda & Das, Fl. Sambalp. 340. 2004. **[PLATE 4.12. Figs. 62]**

Erect branched herbs. Stem quadrangular, rigid. Lamina sessile, elliptic. Flowers reddish, axillary peduncled compound cymes. Capsules small, globose, tipped with persistent style.

Flowers & Fruits: November – February

Exiccatus: Mahananda Barrage, **Anurag & AP Das 0625**, dated 13.11.2013.

Status: Common.

Local Distribution: Throughout the study area.

General Distribution: India, Japan, Malaysia, Australia.

ROTALA Linnaeus, Mant. Pl. 2: 143. 1771

Key to the Species:

- 1a. Leaves (at least at submerged nodes) in whorls 2
- 1b. Leaves opposite 3
- 2a. Raceme terminal; petals present4
- 2b. Flowers axillary-solitary; petals absent; stamens 1 – 4 *R. mexicana*
- 3a. Flowers in terminal spikes; stigma massive, discoid *R. rotundifolia*
- 3b. Flowers in axillary spikes; stigma capitate to punctiform *R. indica*
- 4a. Petals 4, stamens 4 *R. macrandra*
- 4b. Petals 5, stamens 5 *R. densiflora*

Rotala densiflora (Roth) Koehne, Bot. Jahrd. 1:164. 1880; Datta & Majumdar, Bull. Bot. Soc. Beng. 20(2): 89. 1966; Cook, Aqua. Wetl. Pl. Ind. 255.1996. *Ammannia densiflora* Roth, R. & S. Syst. Veg. 3: 394. 1818. *Ammannia pentandra* Roxburgh. Fl. Ind. 1: 488. 1820; Hooker f., Fl. Brit. Ind.2; 568. 1879; Prain, Beng. Pl. 1: 500. 1903.

Spreading herbs with divarcatng floriferous branches, fleshy pink. Leaves elliptic-oblong. Flowers small, axillary, solitary, bracteate, bracteoles scarious. Capsules 3 – 4 valved. Seeds black.

Flowers & Fruits: August – February

Exiccatus: Gajoldoba, **Anurag & AP Das 0137**, dated 12.09.2010; Doumahoni Beel, **Anurag & AP Das 0718**, dated 03.09.2014.

Status: Rare.

Local Distribution: Found in few wetlands of the study area.

General Distribution: India (Throughout), Sri Lanka, China, Malaysia, Australia and tropical Africa.

Rotala indica (Willdenow) Koehne, Bot. Jahrb. Syst. 1: 172. 1880; Cook, Aqua. Wetl. Pl. Ind. 257. 1996. *Peplis indica* Willdenow, Sp. Pl. 2: 244. 1799.

Annual amphibious herbs. Stem terete, erect, creeping and branched at base. Leaves decussate, obovate-elliptic or obovate-oblong, obtuse, base cuneate. Spikes axillary, sessile. Floral tube tetramerous. Sepals 4, lanceolate-deltate; epicalyx absent. Petals 4, pink. Stamens 4. Ovary ellipsoidal. Capsule ellipsoidal.

Flowers & Fruits: September – January

Exiccatus: Gajoldoba, **Anurag & AP Das 0124**, dated 12.09.2010; Mahananda Barrage, **Anurag & AP Das 0304**, dated 26.11.2011.

Status: Common.

Local Distribution: Throughout the study area.

General Distribution: India, Nepal, Bhutan, Sri Lanka, China, Cambodia, Indonesia, Japan, Korea, Laos, Malaysia, Myanmar, Philippines, Thailand, Vietnam.

Rotala macrandra Koehne, Bot. Jahrb. Syst. 1(2): 176.1880. Cook, Aqua. Wetl. Pl. Ind. 258.1996.

Annual decumbent herbs; stem terete, creeping and rooting below. Submerged leaves in whorls; aerial leaves decussate, sessile; lamina ovate-orbicular, reddish tinged. Spikes terminal; bracts broadly ovate, acute; bracteoles linear. Calyx tube campanulate, lobes 4, pink; petals 4, rose; stamens 4; ovary globose. Capsules globose, 4-valved. Seeds semi-ellipsoidal.

Flowers & Fruits: July – October

Exiccatus: Panga River, **Anurag & AP Das 01043**, dated 12.07.2010.

Status: Rare.

Local Distribution: Throughout the Terai and Duars of West Bengal.

General Distribution: Endemic to India.

Notes: This species has been reported as a new record for the flora of West Bengal from the Panga River (near Jalpaiguri).

Rotala mexicana Chamisso & D.F.L. Schlechtendal, Linnaea. 5: 567. 1830. Fl. Bhut. 2(1): 274. 1991; Cook, Aqua. Wetl. Pl. Ind. 259. 1996. *Ammannia pygmaea* O. Kuntz, Jour. Bot. 5: 376. 1867; Prain, Beng. Pl. 1: 500. 1903.

Annual, aquatic, amphibious minute herbs; creeping, floating or erect and ascending, branching. Leaves whorled; aerial leaves narrowly to broadly lanceolate. Flowers solitary, sessile, axillary; bracteoles linear; floral tube campanulate; Petals absent; stamens (1 or) 2 or 3(or 4), included; ovary subglobose. Fruits capsule.

Flowers & Fruits: September – January

Exiccatus: Gajoldoba, **Anurag & AP Das 0130**, dated 12.09.2010; Kathambari Beel, **Anurag & AP Das 0719**, dated 03.09.2014.

Status: Rare.

Local Distribution: In only one or two wetlands of the study area.

General Distribution: Tropics and warm-temperate regions of the world.

Rotala rotundifolia (Buchanan-Hamilton) Koehne in Bot. Jahrb. 1: 175. 1881; Cook, Aqua. Wetl. Pl. Ind. 260. 1996; Bora & Kumar, Flor. Div. Ass. 158. 2003. *Ammannia rotundifolia* Buchanan Hamilton in D. Don Prodr. Fl. Nep. 220. 1825; Hooker f., Fl. Brit. Ind. 2: 566. 1828; Prain, Beng. Pl. 1: 500. 1903. **[PLATE 4.4. Figs. 10]**

Extensively creeping and rooting herbs with red stem. Lamina sessile, orbicular or broadly elliptic-rounded. Flowers sessile, closely packed in terminal simple or paniced spikes; calyx tube campanulate; petals 4, pink. Capsules 4-valved ellipsoid; seeds elliptic peltate.

Flowers & Fruits: November – April

Exiccatus: Mahananda Barrage, **Anurag & AP Das 0627**, dated 13.11.2013.

Status: Abundant.

Local Distribution: Throughout the study area.

General Distribution: India, China.

TRAPA Linnaeus, Sp. Pl. 1: 120. 1753

Key to the Species:

- 1a. Leaves densely villose beneath; fruits with 2 soft spines *T. incisa*
 1b. Leaves slightly villose beneath; fruits with 4 bony spines *T. natans*

Trapa incisa Siebold & Zuccarini, Abh. Math.-Phys. Cl. Königl. Bayer. Akad. Wiss. 4(2): 134. 1846; Cook, Aqua. Wetl. Pl. Ind. 363. 1996. *Trapa bispinosa* var. *incisa* (Siebold & Zuccarini) A.R. Franchet & Savatier, Enum. Pl. Jap. 1: 171. 1875. **[PLATE 4.17. Figs. 30]**

Vernacular Name: *Jal-singara*

Floating herbs. Floating leaves in rosettes, crowded in the upper part of stem; lamina rhomboid. Submerged ones dissected. Flowers solitary axillary. Calyx lanceolate, acute; corolla white; pubescent. Stamens 4. Fruits angled nuts, 2 horned.

Flowers & Fruits: September – January

Exiccatus: Mahananda Barrage, **Anurag & AP Das 0058**, dated 12.05.2010; Gajoldoba, **Anurag & AP Das 0138**, dated 12.09.2010.

Status: Rare.

Local Distribution: In few wetlands of the study area.

General Distribution: Throughout India: Nepal, China, Java, Malaysia, Philippines and Sri Lanka.

Trapa natans Linnaeus, Sp. Pl. 120. 1753; Prain, Beng. Pl. 2: 1276. 1903. Cook, Aqua. Wetl. Pl. Ind. 35. 1996. *Trapa acornis* Nakano, Bot. Mag. (Tokyo) 77: 165. 1964.

[PLATE 4.17. Figs. 31]

Floating herbs. Floating lamina in rosettes, rhomboid, glossy, dark green adaxially, green or sometimes purplish abaxially, often black-brown or with 2 dark spots basally, glabrous or sparsely pubescent on veins, adaxially glabrous, base broadly cuneate, margin coarsely and sharply incised-dentate distally. Petals pink to pale purplish or white, 5 – 7 mm. Fruits narrowly rhombic, 4-horned, surface variously ribbed, crest absent, crown dome-shaped to inconspicuous; horns conic, lower horns descending, upper horns horizontal to ascending.

Flowers & Fruits: May – November

Exiccatus: Gossaihat Beel, **Anurag & AP Das 0281**, dated 14.07.2011; Mahananda Barrage, **Anurag & AP Das 0629**, dated 13.11.2013.

Status: Common.

Local Distribution: Throughout the study area.

General Distribution: India, China Indonesia, Japan, Korea, Laos, Malaysia, Thailand, Vietnam.

ONAGRACEAE. Jussieu, Gen. Pl. 317. 1789; *nom. cons*

LUDWIGIA Linnaeus, Sp. Pl. 1: 118. 1753

Key to the Species:

- 1a. Plants creeping or floating; petals 5, creamy white *L. adscendens*
- 1b. Plants erect; petals 4, yellow or white 2
- 2a. Petals white, pedicels quadrangular *L. peruviana*
- 2b. Petals yellow, pedicels not quadrangular 3
- 3a. Stamens 8; flowers large; petals notched at tip; fruits cylindrical
..... *L. octovalvis* sub sp. *sessiliflora*
- 3b. Stamens 4; flowers small; petals acute; fruits ridged, small *L. perennis*

Ludwigia adscendens (Linnaeus) Hara in J. Jap. Bot. 28: 291. 1953; Raven in Reinw. 6 (4): 387. 1963; Guha Bakshi, Fl. Mur. Dist. 135. 1984. Bora *et* Kumar, Flor. Div. Ass. 159. 2003. *Jussiaea repans* Linnaeus, Sp. Pl. 388. 1753; Hooker *f*, Fl. Brit. Ind. 2: 587. 1879; Prain, Beng. Pl. 1: 368. 1903.

[PLATE 4.7. Figs. 26]

Aquatic or semi aquatic herbs; stem creeping and floating, rooting at nodes. Leaves alternate, lamina obovate to oblanceolate, obtuse, clawed at base. Stamens 10. Ovary pubescent. Capsules cylindrical.

Flowers & Fruits: September – June

Exiccatus: Gajoldoba, **Anurag & AP Das 0138**, dated 12.09.2010; Doumahoni Beel, **Anurag & AP Das 0748**, dated 03.09.2014.

Status: Abundant.

Local Distribution: Found in all wetlands of the study area.

General Distribution: Pantropical.

Ludwigia octovalvis (Jacquin) Raven sub sp. *sessiliflora* (Micheli) Raven in Reinw. 6: 362. 1963; Hajra *et al.*, Materials for the Fl. Arunachal Prad. 1: 504. 1996. *Oenothera octavulvis* Jacquin, Enum. 19. 1760. *Jussiaea suffruticosa* Linnaeus, Sp. Pl. 388. 1753; Hooker *f.*, Fl. Brit. Ind. 2: 587. 1879. Prain, Beng. Pl. 1: 368. 1903. [

[PLATE 4.7. Figs. 28]

Tall herbs. Leaves sessile, lamina linear-lanceolate, acute or acuminate, sessile. Flowers axillary, solitary. Sepals 4, obovate, cuneate; corolla yellow; petals notched at tip; Stamen 8. Capsules cylindric, obscurely 8-ribbed.

Flowers & Fruits: August – February

Exiccatus: Gossaihat Beel, **Anurag & AP Das 0283**, dated 14.07.2011; Doumahoni Beel, **Anurag & AP Das 0732**, dated 03.09.2014.

Status: Abundant.

Local Distribution: Found in all wetlands of the study area.

General Distribution: Pantropical.

Ludwigia perennis Linnaeus, Sp. Pl. 1: 119. 1753; Raven in Reinw. 6: 367. 1964; Islam, Fl. Majuli 139. 1990. Guha Bakshi, Fl. Mur. Dist. 136. 1984. *Ludwigia oppositifolia* Linnaeus, Syst. Nat. ed. 12:

125. 1767. *Ludwigia parviflora* Roxburgh, Hort. Beng. 11. 1814, *nom. nud.* & Fl. Ind.1: 440. 1820; Clarke in Hooker f., Fl. Brit. Ind. 2: 588. 1879. Prain, Beng. Pl. 1: 368. 1903. [PLATE 4.7. Figs. 27]

Erect, much branched, annual herb. Lamina linear – lanceolate or elliptic, narrow down into a petiole. Flower yellow, axillary, solitary or paired; sepals 4, deltoid; petals 4, elliptic; stamens 4. Capsules linear-oblong, strongly ridged, 1 cm. long.

Flowers & Fruits: August – April.

Exiccatus: Gossaihat Beel, **Anurag & AP Das 0457**, dated 17.08.2012.

Status: Abundant.

Local Distribution: Found in all wetlands of the study area

General Distribution: India, Sri Lanka, Madagascar, S. E. Asia, Malaysia to tropical Africa, Australia and New Caledonia.

Ludwigia peruviana (Linnaeus) H. Hara in Jour. Jap. Bot. 28: 293. 1953; Raven in Reinwardtia 6: 345. 1963; Paul in Bull. Bot. Surv. India 40: 19. 1998. Cook, Aqua. & Wetl. Pl. India 278. 1996; Chowdhury *et al.*, Pleione. 7(1): 286 - 289. 2013. *Jussiaea peruviana* Linnaeus, Sp. Pl. 1: 388. 1753. *Jussiaea speciosa* Ridley in Jour. Bot. (Lond.) 59: 259. 1921; Gamble, Fl. Madras 3: 1298. 1957.

[PLATE 4.7. Figs. 29]

Perennial, marshland shrubs, upto 4 m high, villous throughout. Stem cylindric, hollow, much branched. Tap Root system, thread like pneumatophores arises from submerged roots. Leaves lamina lanceolate or broadly ovate – lanceolate, base narrowly cuneate, margin entire, apex acute or sub – acuminate, coriaceous, lateral nerves 12 – 22 on either side of midrib, lamina with petioles 5.6 – 6.1 cm long, 0.7 – 1.1 cm wide. Flowers solitary in upper leaf axils, showy, pedicels quadrangular, 2.6 – 3.5 cm long, villous; bracteoles 2, 1.2 mm – 1.5 mm long, reduced or subulate, borne at sepal base. Sepals 4 (or 5), lanceolate to lanceolate, or deltoid – acuminate, 1.4 – 2.2 x 0.5 – 1 cm, margin irregularly serrulate, fleshy, villous outside, glabrous inside, 9 – nerved. Petals 4 (or 5), sub – orbicular, 1.6 – 2.5 x 1.5 – 2.6 cm, shortly clawed, shallowly emarginate, yellow with brownish nerves. Stamens 8 or 10, subequal, yellow, filaments 1.4 – 3.1 mm long, anthers 1.8 – 3.2 mm long, apparently basifixed by reduction; disc much elevated; nectary depressed, U- or C-shaped, densely white hairy, surrounding the base of each petaliferous stamen. Ovary quadrangular, 9 – 11 mm long, pubescent, 4-loculed, ovules 3 per locule, style 1 mm long, thick, stigma elongated-hemispherical to ellipsoid, longer than style, 3 mm across. Capsules sharply quadrangular, villous, 2.5 – 3.4 long, with 4 prominent deep brown ribs, villous, irregularly loculicidal. Seeds pluriseriate, free, ellipsoid, 0.60 x 0.90 x 0.37 mm, with a prominent nipple and transversely striped integument, brown, raphe 0.74 x 0.16 mm.

Flower & Fruits: Almost throughout the year.

Exiccatus: Mahananda Barrage, **Anurag & AP Das 0738**, dated 22.05.2011.

Status: Rare.

Local Distribution: Only in one wetland.

Distribution: India (Nilgiri hills of South India, South Andaman, Assam and West Bengal), Indonesia (Java and Sumatra), Malaysia, Singapore, Sri Lanka and Native of New World.

Note: This species has been first time recorded for the state of West Bengal.

Order: Brassicales

BRASSICACEAE Burnett, *Outlines Bot.* (Burnett) 854, 1093, 1123. 1835; *nom. alt.*
 [CRUCIFERAE A. Jussieu, *Fl. Eston. SSR*, 5: 308. 1973. *nom. cons.*]

Key to the Genera:

- 1a. Pods terete; corolla yellow; seeds 2 – seriate *Rorippa*
 1b. Pods compresses; corolla white; seeds 1 – seriate *Cardamine*
CARDAMINE Linnaeus, *Sp. Pl.* 2: 654. 1753

Cardamine hirsuta Linnaeus, *Sp. Pl.* 2: 655. 1753; *Fl. W. Beng.* 1: 188. 1997. *Cardamine hirsuta* var. *formosana* Hayata, *Mat. Fl. Formosa* 30. 1911.

Helophyte; annual, erect, ascending, or decumbent, hirsute herbs. Basal leaves rosulate, lamina lyrate – pinnatisect. Cauline leaves rarely absent, oblanceolate or linear, dentate. Sepals oblong; petals white, spatulate; stamens 4 and lateral pair often absent; ovules 14 – 40 per ovary. Fruit linear.

Flowers & Fruits: March – May

Exiccatus: Mahananda Barrage, *Anurag & AP Das 0043*, dated 12.05.2010.

Status: Abundant.

Local Distribution: Throughout the study area.

General Distribution: India, China, Indonesia, Japan, Laos, Malaysia, New Guinea, Pakistan, Philippines, Sri Lanka, Thailand, Turkmenistan, Vietnam.

RORIPPA Scopoli, *Fl. Carniol.* 520. 1760

Key to the Species:

- 1a. Racemes bracteates throughout or rarely along lowermost one-third *R. Benghalensis*
 1b. Raceme ebracteate, rarely lowermost 1 or 2 flowers braceate *R. indica*

Rorippa benghalensis (A.P. de Candolle). *Hara in Jap. Bot.* 49: 132. 1974. *Nasturtium benghalense* A.P. de Candolle, *Syst. Nat.* 2: 198. 1821. *Sinapis benghalensis* Roxburgh ex A.P. de Candolle, *Syst. Nat.* 2: 198. 1821 (*prosyn.*). *Nasturtium indicum* Linnaeus var. *benghalensis* (A.P. de Candolle) Hooker f., & T. Anderson in *Fl. Brit. Ind.* 1: 134. 1872.

Annual, erect herbs. Lower lamina pinnatifid, petioled; upper entire, sessile. Racemes many, bracts linear-lanceolate. Fruits brown on long pedicel.

Flowers & Fruits: March – May

Exiccatus: Mahananda Barrage, *Anurag & AP Das 0036*, dated 12.05.2010.

Status: Abundant.

Local Distribution: Throughout the study area.

General Distribution: Nepal, Bangladesh, Indo- china and Java.

Rorippa indica (Linnaeus) Hiern, *Cat. Afr. Pl.* 1: 26. 1896; Grierson & Long, *Fl. Bhut.* 1(2): 437. 1984; Cook, *Aqua. Wetl. Pl. Ind.* 78. 1996. *Sisymbrium indicum* Linnaeus, *Sp. Pl.*, ed. 2, 2: 917. 1763.

Annual herbs, glabrous or rarely sparsely pubescent. Stems often branched basally and apically. Basal leaves withered by flowering. Lower and middle cauline leaves auriculate or not. Flowers ebracteate; sepals often green or pinkish; corolla yellow, obovate or spatulate, Fruits green on short pedicel.

Flowers & Fruits: March – May

Exiccatus: Mahananda Barrage, **Anurag & AP Das 0050**, dated 12.05.2010; Gajoldoba, **Anurag & AP Das 0364**, dated 08.03.2012.

Status: Abundant.

Local Distribution: Throughout the study area.

General Distribution: India, Bangladesh, China, Indonesia, Japan, Korea, Laos, Malaysia, Myanmar, Nepal, Pakistan, Philippines, Thailand, Vietnam.

CLEOMACEAE Horan. Prim. Lin. Syst. Nat. 92. 1834

CLEOME Linnaeus, Sp. Pl. 2: 671. 1753

Key to the Species:

- 1a. Gynophore absent in flowers *C. viscosa*
- 1b. Gynophore present in flowers 2
- 2a. Leaves 7- foliolate; flowers in terminal corym *C. spinosa*
- 2b. Leaves tri foliolate; flowers axillary, solitary *C. rutidosperma*

Cleome viscosa Linnaeus, Sp. Pl. 672. 1753; Hooker *f.*, Fl. Brit. Ind. 1: 170. 1872; Prain, Beng. Pl. 1: 225. 1903; Bot. Bihar & Orissa 2: 29. 1921; Guha Bakshi, Fl. Mur. Dist. 55. 1984. *Polanisia viscosa* (Linnaeus) A.P. de Candolle, Prodr. 1: 242. 1842.

Annual, erect, glandular-pubescent herbs; stem grooved, hairs simple, glandular. Leaves digitately 3–7 foliolate. Leaflets ovate to obovate, acute. Flowers in long racemes, pediceled; sepals 4, glandular; petals 4, oblong to obovate, clawed, yellow; stamens 15–20. Capsules terete, glandular; style persistent; seeds brown, sub-globose.

Flowers & Fruits: July – February

Exiccatus: Doumahoni Beel, **Anurag & AP Das 0187**, dated 2.2.2011; Gossaihat Beel, **Anurag & AP Das 0256**, dated 14.7.2011.

Status: Abundant.

Local Distribution: Throughout the study area.

General Distribution: Native to West Indies; India, Tropical Africa, Malagasy, America, and Mexico to Argentina.

Cleome rutidosperma A.P. de Candolle in A. P. de Candolle & A.L.P.P. de Candolle, Prodr. 1: 241. 1824.

Annual herbs. Stems weak, with few branches, glabrous.; stipules 0–0.6 mm; Leaves long petiolate, trifoliate; lamina oblanceolate to rhomboid–elliptic, entire, acute to obtuse. Flowers axillary, solitary, gradually into a raceme; bracts trifoliate to simple. Pedicels 11–23 mm. Sepals lanceolate, yellow; petals white or purple; stamens yellow; gynophore 4–11 mm in fruit. Seeds reniform, reddish brown to black.

Flowers & Fruits: February – July

Exiccatus: Doumahoni Beel, **Anurag & AP Das 0195**, dated 2.2.2011; Doumahoni Beel, **Anurag & AP Das 0541**, dated 12.06.2013.

Status: Abundant.

Local Distribution: Throughout the study area.

General Distribution: Tropical Asia; Africa; introduced also in Mexico, West Indies, Central America, South America.

Cleome spinosa Jacquin, Pl. Carib. 26. 1760; Linnaeus, Sp. Pl. ed. 2: 939. 1762; A. Gray, New Manual of Bot. ed., 7.439.1908. [PLATE 4.4. Figs. 12]

Hyperhydate; annual or biennial, viscid, pubescent, strong-scented herbs. Leaves large, 5–7 foliolate; leaflets oblong – lanceolate with 2 small spiny stipules. Racemes corymbose, many flowered, conspicuously bracteate; sepals 5–8 mm long; petals white or pinkish; stamens 6; gynophore 6–8 cm long. Fruits cylindrical – linear.

Flowers & Fruits: January – June

Exiccatus: Gajoldoba, **Anurag & AP Das 0360**, dated 08.03.2012.

Status: Common.

Local Distribution: Throughout the study area.

General Distribution: Native of Trop. South America.

Order: Malvales

MALVACEAE A. Jussieu, Gen. Pl. 271. 1789; nom. cons.

Key to the Genera:

- 1a. Epicalyx absent; corolla tip oblique *Sida*
- 1b. Epicalyx present; corolla tip rounded 2
- 2a. Ovary many locular *Malva*
- 2b. Ovary 3 locular *Corchorus*

CORCHORUS Linnaeus, Sp. Pl. 2. 1753

Key to the Species:

- 1a. Stigma beaklike, ovary cylindrical *C. aestuans*
- 1b. Stigmas capitate, ovary oblong-ovate *C. fascicularis*

Corchorus aestuans Linnaeus, syst. Nat. ed. 10. 1079. 179; Sharma et al., Fl. Ind. 3: 485. 1993. *C. acutangularis* Lamarck, Encycl. 2: 104. 1786. Hooker f., Fl. Brit. Ind. 1: 398. 1874; Pain, Beng. Pl. 1: 286. 1903 Haines, Bot. Bihar & Orissa 2: 87. 1921.

Vernacular Name: Jangli pat

Annual herbs much branched from base. Stem woody. Lamina ovate, serrate, acute, base sub-cordate; petiole hairy. Flowers 2–3 on axillary cymes; corolla yellow, stamens many, Ovary 3-locular. Capsules elongated, 6 winged.

Flowers & Fruits: October – January

Exiccatus: Mahananda Barrage, **Anurag & AP Das 0650**, dated 13.11.2013; Gajoldoba, **Anurag & AP Das 0743**, dated 03.09.2014.

Status: Common.

Local Distribution: Throughout the study area

General Distribution: India, Sri Lanka, Africa and America.

Corchorus fascicularis Lamark, Encycl. 2: 104. 1786; Hooker f., Fl. Brit. Ind. 1: 398. 1874; Pain, Beng. Pl. 1: 286. 1903; Bot. Bihar & Orissa 2: 87. 1921.

Vernacular Name: Jangli pat

Erect, marshy, annual herbs. Stem woody. Leaves simple, serrate, elliptic – oblong, apiculate. Flower yellow, axillary. Carpel 3, stigma capitate. Capsules elongated, trilocular, triangle, shortly beaked. Seeds long, wedge shaped, black.

Flowers & Fruits: October – January

Exiccatus: Mahananda Barrage, **Anurag & AP Das** 0338, dated 26.11.2011.

Status: Common.

Local Distribution: Throughout the study area

General Distribution: India, Sri Lanka, Africa and America.

MALVA Linnaeus, Sp. Pl. 2. 1753

Malva verticillata Linnaeus, Sp. Pl. 689. 1753; Masters in Fl. Brit. Ind. 1: 320. 1874; Prain, Beng. Pl. 1: 256. 1903. *Malva neilgherrensis* Wight, Icon. Ind. Orient., t. 950. 1845. Sharma et al, Fl. Ind. 3: 363. 1993.

Vernacular Name: *Laffa shak*

Annual, erect herbs. Lamina cordate. Flowers axillary solitary, bracteoles 3. sepals 5, connate at base; petals 5, connate at base with staminal column, pink or white with pink to red longitudinal markings; stamens numerous, monoadelphous; ovary many locular, style as many carpels, stigmas linear. Locules 1-seeded.

Flowers & Fruits: December – March

Exiccatus: Doumahoni Beel, **Anurag & AP Das** 0201, dated 02.02.2011.

Status: Common.

Local Distribution: Throughout the study area.

General Distribution: Asia, Europe, Egypt and S. Africa.

SIDA Linnaeus, Sp. Pl. 2. 1753

Key to the Species:

- 1a. Pair of stipules unequal; lamina elongated ovate, dark green; awns as long as mericarp .. *S. acuta*
- 1b. Pairs of stipules similar; lamina rounded ovate, whitish; awn 1/3 of mericarp *S. cordifolia*

Sida acuta Burman f., Fl. Ind. 147. 1768; Haines, Bot. Bihar & Orissa Pt. II: 61. 1921; Sharma et al., Fl. Ind. 3: 281. 1993; Panda & Das, Fl. Sambalp. 58. 2004. *Sida carpinifolia* sensu Masters in Hooker f., Fl. Brit. Ind. 1: 323. 1874 (non Linnaeus f. 1781); Prain, Beng. Pl. 1: 259. 1903.

Erect annual, tall herbs. Branchlets pilose. stipules filiform, each pair unequal, often longer than petiole, usually persistent; sparsely pilose. Lamina ovate, oblong, lanceolate, or linear – lanceolate, dentate, acute or acuminate, base obtuse. Flowers solitary or paired, axillary, Pedicel pilose, articulate at middle. Calyx shallowly cup-shaped, margins often ciliate; corolla yellow; filaments sparsely hirsute. Schizocarp

nearly globose; basally transversely ridged, side walls reticulate-veined, glabrous, mericarps beaked. Seeds trigonous, glabrous except around hilum.

Flowers & Fruits: July – April

Exiccatus: Gossaihat Beel, **Anurag & AP Das 0289**, dated 14.07.2011; Doumahoni Beel, **Anurag & AP Das 0721**, dated 03.09.2014.

Status: Abundant.

Local Distribution: Throughout the study area.

General Distribution: Pantropical.

Sida cordifolia Linnaeus, Sp. Pl. 684. 1753; Panda & Das, Fl. Sambalp. 58. 2004. Prain, Beng. Pl. 1: 258. 1903.

Annual, subshrubs, erect. Branchlets, stipules, petioles, and leaves densely stellate strigose; branchlets and petioles velutinous. Stipules filiform, equal; lamina cordate or rounded, crenate, obtuse to rounded. Flowers solitary or fascicled, axillary or terminal. Pedicel densely stellate, articulate in distal part. Calyx lobes triangular; corolla yellow; Filament tube hirsute; mericarps 10, with vertical grooves. Seeds long ovoid, apex hairy.

Flowers & Fruits: July – January

Exiccatus: Mahananda Barrage, **Anurag & AP Das 0626**, dated 13.11.2013; Gajoldoba, **Anurag & AP Das 0727**, dated 03.09.2014.

Status: Abundant.

Local Distribution: Throughout the study area.

General Distribution: Pantropical.

Asterids

Order: Ericales

PRIMULACEAE Batsch ex Borkh., Bot. Wörterb. 2: 240. 1797; *nom. cons.*

ANAGALLIS Linnaeus, Sp. Pl. 1: 148. 1753

Anagallis arvensis Linnaeus, Sp. Pl. 148. 1753; Hooker *f.*, Fl. Brit. Ind. 3: 506. 1882; Prain Beng. Pl. 1: 640. 1903.

Erect or procumbent, glabrous, annual herbs. Branches many, from the base, quadrangular, glabrous. Lamina sessile, cordate, ovate or lanceolate, entire, acute, gland dotted. Flowers blue, solitary, axillary, ebracteate, recurved in fruit; stamens 5. Capsules dehiscent transversely; seeds many, trigonous.

Flowers & Fruits: December – February

Exiccatus: Doumahoni Beel, **Anurag & AP Das 0206**, dated 02.02.2011; Kathambari Beel, **Anurag & AP Das 0703**, dated 03.09.2014.

Status: Common.

Local Distribution: Throughout the study area

General Distribution: India, Sri Lanka, Europe, W. Asia, Most of North Temperate region.

Lamiids (Euasterids I)**BORAGINACEAE** A. Jussieu, Gen. Pl. 128. 1789; *nom. cons.***Key to the Genera:**

- 1a. Styles 2; stigma punctuate; plants not rosette 2
- 1b. Style 1; Stigma capitate or conical; rosette plant with erect spreading inflorescence ... *Cyanoglossm*
- 2a. Drupes 4 lobed; prostrate to slightly procumbent herb with crispy leaves *Coldenia*
- 2b. Drupes 2 lobed; erect herbs with rugose or prostrate with plain leaves *Heliotropium*

COLDENIA Linnaeus, Sp. Pl. 1: 125. 1753

Coldenia procumbens Linnaeus, Sp. Pl. 125. 1: 1753; Hooker *f.*, 4: 144. 1883; Prain, Beng. Pl. 2: 718. 1903; Khanna in Mudgal *et al.*, Fl. M.P. 2: 117. 1997; Bora & Kumar, Flor. Div. Assam, 222. 2003.

Prostrate or slightly procumbent, deeply rooted, pubescence herbs. Leaves alternate; lamina crisped-rugose, coarsely serrate. Flowers minute, sub-sessile, solitary, axillary, sessile; corolla white; Fruits drupe of 4 pyrens.

Flowers & Fruits: January – August

Exiccatus: Mahananda Barrage, *Anurag & AP Das 0009*, dated 12.05.2010; Doumahoni Beel, *Anurag & AP Das 0183*, dated 2.02.2011.

Status: Common.

Local Distribution: Throughout the study area.

General Distribution: Tropical India, Africa, America, Asia, Australia.

CYNOGLOSSUM Linnaeus, Sp. Pl. 1: 134. 1753

Cyanoglossum lanceolatum Forsskal, Fl. Aegypt. – Arab. 41. 1775; Hooker *f.*, Fl. Brit. Ind. 4: 156. 1883; Grierson & Long, Fl. Bhut. 2(2): 907. 1999. *Cyanoglossum micranthum* Desfontaines, Tab. Ecol. ed. 1: 220. 1804; Hooker *f.*, Fl. Brit. Ind. 4: 156. 1883.

Rosette, annual with erect much branched inflorescence, softly hirsute. Leaves simple, alternate, sessile; Inflorescence in long racemose, flowers of only on lower fourth of inflorescence, distinctly pedicellate; flowers bisexual; corolla whitish-blue. Stamens 5; carpel connate, ovary 4-lobed, stigma small. Nutlets 4, margined.

Flowers & Fruits: April – December

Exiccatus: Mahananda Barrage, *Anurag & AP Das 0011*, dated 12.05.2010; Mahananda Barrage, *Anurag & AP Das 0584*, dated 13.11.2013.

Status: Common

Local Distribution: Throughout the study area.

General Distribution: N. E. India, Indo-Malayan.

HELIOTROPIUM Linnaeus, Sp. Pl. 1: 130. 1753**Key to the Species:**

- 1a. Plants erect, dark green; lamina rugose without silky hairs; nutlet 2, glabrous *H. indicum*
 1b. Plants prostrate with smooth leaves with silky hairs; nutlet 4, hairy *H. ovalifolium*

Heliotropium indicum Linnaeus, Sp. Pl., 130. 1753; Hooker f., Fl. Brit. Ind. 4: 152. 1883; Bora & Kumar, Flor. Div. Ass., 222. 2003. *Tiaridium indicum* (Linnaeus) Lehmann, Pl. Asperif. Nacif. 14. 1818.

Vernacular Name: *Hatisnur*

Annual, erect, scabrid herbs. Lamina simple, ovate, alternate, petiolate, strongly rugose. Flowers in dichotomous cyme, bisexual; corolla bluish; Stamens -5, connate, filaments very short; carpels connate. Fruits not enveloped by calyx, separating into two 2-seeded nutlets.

Flowers & Fruits: September – August

Exiccatus: Mahananda Barrage, **Anurag & AP Das 0015**, dated 12.05.2010; Gajoldoba, **Anurag & AP Das 0660**, dated 03.09.2014.

Status: Abundant.

Local Distribution: Throughout the study area.

General Distribution: India, America, Tropical Africa, Malaysia.

Heliotropium ovalifolium Forsskål, Fl. Aegypt. – Arab. 38. 1775; Prain, Beng. Pl. 2: 716. 1903; Bora & Kumar, Flor. Div. Ass., 222. 2003.

Semi-erect herbs, branching from base; stem covers with long silky hairs. Lamina elliptic-obovate or oblanceolate, entire with white hairs. Flowers 2 ranked in scorpioid cymes; corolla white, hairy. Nutlets 4, densely white hairy.

Flowers & Fruits: January – August

Exiccatus: Doumahoni Beel, **Anurag & AP Das 0188**, dated 2.02.2011.

Status: Rare.

Local Distribution: Found in only one or two wetlands of the study area.

General Distribution: India, tropical Africa, Australia.

GENTIANACEAE V.V Zuev in Bot Zhum., 75(9): 1304**CENTAURIUM** Borckh in Roem. Arch. i. 1796**Key to the genera:**

- 1a. Flowers pink, capsules narrowly oblong ***Centaurium***
 1b. Flowers blue, capsules sub-globose ***Exacum***

Centaurium centaurioides (Roxburgh) S.R. Rao & Hemadri, Jour. Bombay Nat. Hist. Soc. 67: 357. 1970. *Chironia centaurioides* Roxburgh, (Hort. Beng. 16: 1814, *nom. nud.*) & ed. Carey. 1:585. 1832. *Centaurium roxburghii* (D. Don.) Druce, Rep. Bot. Exch. Cl. Brit. Isles. 4:614. 1916; Datta &

Majumder, Bull. Bot. Soc. Beng. 20(2): 96. 1966. *Erythraea roxburghii* G. Don., Jour. Soc. 8: 77. 1836; Hooker f., Fl. Brit. Ind. 4: 102. 1883; Prain, Bengal. Pl. 1: 525. 1903.

Erect, rarely branched, small annual herbs; stem quadrangular. Leaves simple, rosette, obovate or oblong, obtuse, cauline, opposite, sessile. Flowers pink in dichotomous cymes. Capsule narrowly oblong.

Flowers & Fruits: January – March

Exiccatus: Gajoldoba, **Anurag & AP Das 0369**, dated 08.03.2012.

Field Status: Common

Local Distribution: Found in some wetlands of the study area.

General Distribution: India and cosmopolitan.

EXACUM Linnaeus, Diss. Dass. 6:1747

Exacum tetragonum Roxburgh, Fl. Ind. 1: 413. 1820; Prain, Bengal. Pl. 2: 706. 1903.
Canscora justicioides Griff. ex Voigt, Hort. Suburb. Calcutta 520. 1845.

Plants annual. Stems erect 4angled. Leaves sessile, lamina ovate-lanceolate to ovate; base rounded, apex acute; veins 3–5, abaxially prominent. Pedicel 3–11 mm. Calyx 5–6 mm; lobes ovate, margin broadly membranous, apex caudate, midvein keeled. Corolla blue; tube cylindrical, margin entire, apex short acuminate. Filaments linear. Style linear, stigma lobes orbicular. Capsules subglobose. Seeds ellipsoid.

Flowers & Fruits: June – September

Exiccatus: Lachka river bed, **Anurag & AP Das 0896**, dated 08.03.2012.

Field Status: Rare.

Local Distribution: Found in few wetlands of the study area.

General Distribution: India, Nepal, China, Malaysia, Myanmar, Laos, Cambodia, New Guinea, Philippines, Vietnam, Australia.

RUBIACEAE A. Jussieu, Gen. Pl. 196. 1789

Key to the Genera:

- 1a. Prostrate or creeping herb; fruits indehiscent ***Dentella***
1b. Erect or diffused herb; fruits dehiscent ***Oldenlandia***

DENTELLA J.R. Forster & G. Forster, Char. Gen. Pl., ed. 2. 25. 1776

Dentella repens (Linnaeus) J. & G. Forster, Charact. 26, t. 13. 1776; Hooker f., Fl. Brit. Ind. 3: 42. 1880; Prain, Beng. Pl. 1: 555. 1903; Haines, Bot. Bihar & Orissa Pt. IV: 443. 1922; Mooney, Suppl. Bot. Bihar & Orissa 71. 1950; Panda & Das, Fl. Sambalp., 168. 2004. *Oldenlandia repens* Linnaeus, Mantius 40. 1767.

Slender prostrate annual herbs. Rooting at the nodes; dichotomously branched. Flowers solitary, axillary; corolla white, hairy within; pale green in appearance. Ovary and fruit globose, covered with trichomes.

Flowers & Fruits: August – February

Exiccatus: Mahananda Barrage, **Anurag & AP Das 0069**, dated 12.05.2010; Gajoldoba, **Anurag & AP Das 0711**, dated 03.09.2014.

Status: Abundant.

Local Distribution: Throughout the study area

General Distribution: India, Sri Lanka, Myanmar, Singapore, Malayan Island to N. Australia, Polynesia.

OLDENLANDIA Linnaeus, Gen. Pl. 1: 362. 1737

Key to the Species:

- 1a. Erect herbs; seeds ellipsoid *O. herbacea*
- 1b. Plants diffus or prostrate; seeds angular..... 2
- 2a. Capsules didymous, ovate *O. corymbosa*
- 2b. Capsules not didymous sub-globose or ovoid 3
- 3a. Capsules sub-globose; calyx lobes acute *O. diffusa*
- 3b. Capsules ovoid, anthers exerted or not 4
- 4a. Anthers exerted, seeds foveolate *O. Verticillata*
- 4b. Anthers not exerted, seeds sub-globose *O. biflora*

Oldenlandia corymbosa Linnaeus, Sp. Pl. 119. 1753; Prain, Beng. Pl. 1: 559. 1903. Guha Bakshi, Fl. Mur. Dist. 154. *Hedyotis corymbosa* (Linnaeus) Lamarck, Tab. Encl. 1; 272. 1791; Panda & Das, Fl. Sambalp., 172. 2004. 1984.

Variable annual, glabrous, prostrate herbs; very slender, dichotomously branched; rooting at nodes. Lamina lanceolate, sessile, linear or linear-lanceolate elliptic. Corymbose on a short peduncle at node, corolla white. Capsules didymous; seeds angular.

Flowers & Fruits: January – December

Exiccatus: Mahananda Barrage, **Anurag & AP Das 0071**, dated 12.05.2010; Doumahoni Beel, **Anurag & AP Das 0482**, dated 12.06.2013.

Status: Abundant.

Local Distribution: Throughout the study area.

General Distribution: Pantropical.

Oldenlandia diffusa (Willdenow) Roxburgh, Hort. Beng. 11. 1814 & Fl. Ind. 1: 444. 1820; Prain, Beng. Pl. 1: 559. 1903; Guha Bakshi, Fl. Mur. Dist. 157. 1984. *Hedyotis duffusa* Willdenow, Sp. Pl. 1: 566. 1797; Panda & Das, Fl. Sambalp., 172. 2004.

Diffuse glabrous annual prostrate herbs. Branches few, often rooting from nodes. Leaves linear, acute. Flowers solitary sessile or shortly stalked; corolla white. Capsules sub-globose, smooth; seeds irregularly angular.

Flowers & Fruits: January – December

Exiccatus: Mahananda Barrage, **Anurag & AP Das 0298**, dated 26.11.2011; Kathambari Beel, **Anurag & AP Das 0736**, dated 03.09.2014.

Status: Common.

Local Distribution: Throughout the study area

General Distribution: Tropical and sub-tropical Asia, India, S. China, Japan, Malaysia, Borneo, Philippines.

Oldenlandia herbacea (Linnaeus) Roxburgh, Fl. Ind. 1: 424. 1820. *Hedyotis herbacea* Linnaeus, Sp. Pl. 102. 1753. Willdenow, Sp. Pl. 1: 566. 1797; Panda & Das, Fl. Sambalp. 172. 2004. *Oldenlandia heynei* G. Don, Gen. Syst. 3: 531. 1934; Prain, Beng. Pl. 1: 559. 1903.

Erect glabrous annual or biennial herbs; branches numerous, dichotomous, slender, 4-gonous, divaricate. Leaves sessile, linear or linear lanceolate, acute, glabrous, margins recurved. Flowers on solitary peduncles or paniculate cymes. Capsules ovoid or sub-globose, somewhat didymous. Seeds somewhat ellipsoid.

Flowers & Fruits: January – December

Exiccatus: Gajoldoba, **Anurag & AP Das 0744**, dated 03.09.2014.

Status: Rare.

Local Distribution: In one or two wetlands of the study area.

General Distribution: India, Sri Lanka, Malay Islands, Tropical Africa.

Oldenlandia biflora Linnaeus, Sp. Pl. 41. 1753; Hooker f, Fl. Brit. Ind. 3: 70. 1880; Prain, Beng. Pl. 1: 559. 1903. *Oldenlandia paniculata* Linnaeus, Sp. Pl. 1667. 1753. [PLATE 4.13. Figs. 17]

Slender annual succulent herbs. Leaves opposite, small ovate-lanceolate. Flowers in dichotomous cymes, small, peduncles solitary, 1 – 2 flowered; corolla white. Capsules on slender pedicels; seeds sub-globose.

Flowers & Fruits: September – February

Exiccatus: Mahananda Barrage, **Anurag & AP Das 0301**, dated 26.11.2011; Mahananda Barrage, **Anurag & AP Das 0623**, dated 13.11.2013.

Status: Common.

Local Distribution: Throughout the study area

General Distribution: India, Bangladesh and Malayan Peninsula.

Oldenlandia verticillata Linnaeus, Mant. Pl. 1: 40. 1767; Grierson & Long, Fl. Bhut. 2(2): 763. 1999. *Hedyotis verticillata* (Linnaeus) Lamarck, Tabl. Encycl. 1: 271. 1792.

Annual or perennial herbs, often decumbent, to 27 – 32 cm tall. Stems subterete, flattened. Leaves sessile – petiolate; petiole 2.3 mm, hispidous – glabrescent; Lamina leathery, narrowly elliptic or linear – lanceolate. acute or acuminate at apex; secondary veins not showing; stipules fused with petiole bases; bracts linear – lanceolate. Flowers sessile – subsessile, Calyx densely hispidous. Corolla white, tube ca. 2.5 mm, glabrous. Anthers exserted. Stigma ca. 0.4 mm. Fruit ovoid, capsular; seeds numerous.

Flowers & Fruits: April – December

Exiccatus: Mahananda Barrage, **Anurag & AP Das 0624**, dated 13.11.2013.

Status: Rare.

Local Distribution: In one or two wetlands of the study area

General Distribution: India, Nepal, Bhutan, China, Bangladesh, Indonesia, Japan, Malaysia, Myanmar, Philippines, Singapore, Thailand, Vietnam.

Order: Lamiales

ACANTHACEAE A. Jussieu, Gen. Pl. 102. 1789

Key to the Genera:

- 1a. Seeds not supported by tough retinacula *Nelsonia*
 1b. Seeds supported by tough retinacula 2
 2a. Corolla lobes twisted in buds; bracteoles large *Hygrophila*
 2b. Corolla lobes imbricate in buds 3
 3a. Flowers in 1- sided (second) compressed spike *Rungia*
 3b. Flowers in compact terete spike *Justicia*

HYGROPHILA R. Brown, Prodr. Fl. Nov. Holland. 479. 1810

Key to the species:

- 1a. Herbs with axillary spines & flowers *H. auriculata*
 1b. Herbs with terminal dense spikes 2
 2a. Aromatic, leaves dimorphic, submerged ones dissected *H. difformis*
 2b. Non-aromatic, lamina entire, simple..... 3
 3a. Small diffuse hers; bracts narrowly elliptic; stamens 2; capsule < 8 mm *H. polysperma*
 3b. Erect strong herbs; bracteoles linear oblong; stamens 4; capsule > 10 mm. 4
 4a. Lamina glabrous or slightly pubescent; corolla glabrous *H. ringens*
 4b. lamina densely strigose or hirsute on both surfaces; corolla hairy.....5
 5a. Lamina strongly repund; bracteoles oblong *H. quadrivalvis*
 5b. Lamina entire; bracteoles linear – oblong6
 6a. Calyx ca 0.7 cm; corolla ca. 1.5 cm *H. erecta*
 6b. Calyx ca 1.1 cm; corolla ca. 1.7 – 2.7 cm *H. phlomoides*

Hygrophila auriculata (Schumach.) Heine, Kew Bull. 16(2): 172. 1962; Majumdar, Bull. Bot. Soc. Beng. 19(1): 13. 1965; Guha Bakshi, Fl. Mur. Dist. 239. 1984. Cook, Aqua. Wetl. Pl. Ind. 35. 1996. *Hygrophila spinosa* Anderson in Thwerts, Enum. Pl. Zeyl. 225. 1860 & Jour. Lin. Soc. (Bot) 7: 22. 1864; Hooker f., Fl. Brit. Ind. 4: 408. 1884; Prain, Beng. Plants 2: 802. 1903. *Astercanthus longifolia* (Linnaeus) Nees in Wallich, Pl. As. Rar. 3: 90. 1832 & A.P. de Candolle, Prodr. 11: 247. 1887.

Vernacular Name: *Kulekhara* (Beng.), *Dangrakanta* (Toto) [PLATE 4.12. Figs. 60]

Vigorous perennial, spiny erect, hispid herbs. Leaves sessile, lanceolate or oblong-lanceolate, acute at both ends, sparsely hispid. Flowers in dense axillary whorls with 6 spines, bracts linear-lanceolate, hispid, calyx lobes linear-lanceolate, corolla bright bluish purple, glabrous or finely puberulent, Capsule linear oblong; 4 – 8 seeded.

Flowers & Fruits: July – December

Exiccatus: Doumahoni Beel, *Anurag & AP Das 0466*, dated 12.06.2013; Mahananda Barrage, *Anurag & AP Das 0560*, dated 13.11.2013.

Status: Abundant.

Local Distribution: Throughout the study area.

General Distribution: Tropical regions of Asia, Africa and America.

Hygrophila difformis (Linnaeus) Sreem. & Bennet, Bull. Bot. Surv. India 10: 223. 1968; *Ruellia difformis* Linnaeus f. Suppl. 289. 1781; Guha Bakshi, Fl. Mur. Dist. 238. 1984. Cook, Aqua. Wetl. Pl. Ind. 32, 1996. *Cardanthera triflora* Buchanon-Hamilton ex Hooker, Gen. Pl. 2: 1074. 1876; Hooker f., Fl. Brit. Ind. 4: 403. 1884; Prain, Beng. Plants 2: 799. 1903. [PLATE 4.12. Figs. 61 & 62]

Perennial or occasionally annual aromatic, pubescent, decumbent, fleshy herbs. Stem 25-55 cm long, basal nodes rooting. Leaves mostly decussate, sessile or shortly petiolate; leaf blades elliptical to ovate with short glandular hairs. Flowers 1-3 in axils, sometimes forming terminal spikes, deep violet, bracteoles up to 6.5 mm long. Capsule linear oblong, 2-valved with 38 – 58 Seeds.

Flowers & Fruits: February – August

Exiccatus: Doumahoni Beel, **Anurag & AP Das 0196**, dated 02.02.2011; Sursuti Forest wetland, **Anurag & AP Das 0431**, dated 17.08.2012.

Status: Rare.

Local Distribution: Only found in one or two places of study areas.

General Distribution: Tropical regions of Asia, Africa and America.

Hygrophila erecta (Burman f.) Hochreutiner, Candollea 5: 230. 1934. *Ruellia erecta* N. L. Burman, Fl. Indica, 135. 1768; Chowdhury & Das in Pleione 8(1): 207 – 209. 2014. *Hygrophila phlomoides* var. *roxburghii* C. B. Clarke in Wallich, Pl. Asiat. Rar. 3: 80. 1832. [PLATE 4.12. Figs. 59]

Perennials, Stems erect, 4 angled, bisulcate. Petiole sulcate, hispid; lamina elliptic, obovate, or oblong, entire or slightly repund; both surfaces densely strigose, base decurrent onto petiole, entire or slightly undulate, acute to obtuse. Flowers several clustered in leaf axils, sessile; bracteoles linear-oblong, densely hispid-ciliate. Calyx lobes linear-lanceolate, densely white hispid-ciliate. Corolla purplish blue, pilose; tube basally cylindrical Stamens 4; filaments glabrous.

Flowers & Fruits: July – December

Exiccatus: Dash-Dargaon, Jalpaiguri, **Anurag & AP Das 3105**, dated 15.10.2013; Pani-kouri, Jalpaiguri, **Anurag & AP Das 3132**, dated 12.11.2013.

Status: Rare.

Local Distribution: Found only two places of study areas.

General Distribution: India, China, Laos, Myanmar, Thailand, Vietnam.

Notes: This species has been first time reported for West Bengal from Terai & Duars (Chowdhury & Das 2014b).

Hygrophila phlomoides Nees in Wallich, Pl. Asiat. Rar. 3: 80. 1832; Prain, Beng. Plants 2: 802. 1903; Cook, Aqua. Wetl. Pl. Ind. 31, 1996.

Perennials to 1 m tall, erect. Stems 4, angled, brown strigose. Petiole hirsute; lamina elliptic, obovate, or oblong, both surfaces hirsute, base usually attenuate and decurrent onto petiole, entire or undulate, acute to sometimes obtuse. Flowers axillary, several clustered or in whorls upward; bracteoles linear-oblong, hirsute. Calyx white hirsute; lobes linear. Corolla pubescent; lower lip oblong, sparsely pilose, Stamens 4; filaments glabrous,

Flowers & Fruits: February – August

Exiccatus: Doumahoni Beel, **Anurag & AP Das 0218**, dated 02.02.2011; Gajoldoba, **Anurag & AP Das 0352**, dated 08.03.2012.

Status: Common.

Local Distribution: Throughout the study area.

General Distribution: India, China, Cambodia, Indonesia, Laos, Myanmar, Pakistan, Philippines, Thailand, Vietnam.

Hygrophila polysperma (Roxburgh) T. Anderson, Jour. Linn. Soc. (Bot.) 9: 456. 1867; Hooker. *f.*, Fl. Brit. Ind. 4: 406. 1884; Prain, Beng. Plants 2: 801. 1903; Majumdar, Bull. Bot. Soc. Bengal 20(2): 112. 1966. Cook, Aqua. Wetl. Pl. Ind. 35, 1996. *Justicia polysperma* Roxburgh, Fl. Ind. 1: 119. 1832. *Hemiadelphis polyspermus* Nees in Wallich, Pl. As. Rar. 3: 80. 1832; Guha Bakshi, Fl. Mur. Dist. 238. 1984.

Flashy, weak much branched herb with creeping stems. Lamina oblong-ovate, sub-sessile, almost entire. Flowers minute in dense terminal spikes; bracts narrowly elliptic; corolla pinkish blue, white or pale blue, blipped. Capsules linear oblong; seeds 22 – 40, minute.

Flowers & Fruits: March – August.

Exiccatus: Mahananda Barrage, **Anurag & AP Das 0014**, dated 12.05.2010; Gajoldoba, **Anurag & AP Das 0357**, dated 08.03.2012.

Status: Abundant.

Local Distribution: Throughout the study area.

General Distribution: Tropical regions of Asia, Africa and America.

Hygrophila quadrivalvis (Buchanan – Hamilton) Nees in Wallich, Pl. As. Rar. 3: 89. 1832. in A.P. de Candolle, Prodr. 11: 89. 1847; Hooker *f.*, Fl. Brit. Ind. 4: 408. 1884; Rani & Mathew in Mathew, F. Tamilnadu Carnatic 3(1): 1179. 1983. *Ruellia quadrivalvis* Buchanan-Hamilton, Trans. Linn. Soc. London. 14: 291. 1824.

Hyperhydric or helophytes; perennial herbs. Lamina elliptic-ovate to obovate, strongly repund, slightly hirsute on both sides. Flowers in axillary fascicles, bluish-purple; bracts herbaceous, oblong-obovate; calyx 5-lobed, lobes lanceolate; corolla hairy, limb 2-lipped; stamens 4, cells unequal; ovary oblong. Capsule longer than calyx.

Flowers & Fruits: October – January

Exiccatus: Mahananda Barrage, **Anurag & AP Das 0319**, dated 26.11.2011; Gossaihat Beel, **Anurag & AP Das 0462**, dated 17.08.2012.

Status: Common.

Local Distribution: Throughout the study area.

General Distribution: Tropical regions of Asia, Africa and America.

Hygrophila ringens (Linnaeus) R. Brown *ex* Spreng., Syst. Veg. 2: 828. 1825. Cook, Aqua. Wetl. Pl. Ind. 34, 1996. *Ruellia ringens* Linnaeus, Sp. Pl. 2: 635. 1753; Prain, Beng. Plants 2: 803. 1903.

Perennials, branched. Stems erect or decumbent at base, 4-angled, slightly pubescent. Petiole glabrous; lamina narrowly lanceolate to oblanceolate, base attenuate and decurrent onto petiole, entire or slightly undulate, acute to obtuse. Flowers solitary or clustered in leaf axils, sessile; bracteoles narrowly ovate, obtuse, margins pubescent. Calyx narrowly campanulate, lobes linear-lanceolate, grayish pubescent or fulvous strigose, acuminate. Corolla pale purple, glabrous; lobes ovate with an obtuse apex; upper lip elliptic, Stamens 4, included; filaments glabrous.

Flowers & Fruits: June – December

Exiccatus: Gajoldoba, **Anurag & AP Das 0080**, dated 12.09.2010; Mahananda Barrage, **Anurag & AP Das 0305**, dated 26.11.2011.

Status: Common.

Local Distribution: Throughout the study area.

General Distribution: India, China, Bhutan, Cambodia, Indonesia, Japan, Laos, Malaysia, Myanmar, Nepal, Pakistan, Philippines, Thailand, Vietnam.

JUSTICIA Linnaeus, Sp. Pl. 2. 1753

Key to the species:

- 1a. Herbs, bracts hairy 2
- 1b. Undershrubs, bracts glabrous *J. genderussa*
- 2a. Bracts & bracteoles as long as or longer than calyx *J. japonica*
- 2b. Bracts & bracteoles shorter than calyx *J. diffusa*

Justicia japonica Thunberg, Fl. Jap. 20. 1784. *Justicia simplex* D. Don, Prodr. 118. 1825; Hooker.f., Fl. Brit. Ind. 4: 539. 1885; Prain, Beng. Plants 2: 818. 1903; Grierson & Long, Fl. Bhut. 2(3): 1288. 2001.

Prostrate or semi-erect herbs. Stems angular and grooved, hairy, swollen above the nodes. Lamina ovate or elliptic oblong obtuse. Flowers pale-purple or whitish, in erect, axillary and terminal spikes; bracts hairy. Capsules elliptic oblong, hairy at top; seeds sub orbicular cordate.

Flowers & Fruits: August – November

Exiccatus: Gajoldoba, **Anurag & AP Das 0141**, dated 12.09.2010; Gossaihat Beel, **Anurag & AP Das 0437**, dated 17.08.2012.

Status: Common.

Local Distribution: Throughout the study area.

General Distribution: India, Nepal, Bhutan, Sri Lanka, Myanmar, Thailand and Malaysia.

Justicia diffusa Willdenow, Sp. Pl. 1: 87. 1797; Hooker.f., Fl. Brit. Ind. 4: 538. 1885; Grierson & Long, Fl. Bhut. 2(3): 1288. 2001. *Justicia procumbens* Linnaeus, Sp. Pl. 15. 1753. Prain, Beng. Plants 2: 818. 1903.

Much branched, perennial diffuse hairy herbs. Lamina ovate-lanceolate, entire, acute, nerves 6 – 7 pairs. Flowers in erect terete dense spikes; bracts linear lanceolate, scarious margined; corolla pink, brown spotted near throat. Capsules oblong, glabrous.

Flowers & Fruits: October – May

Exiccatus: Gossaihat Beel, **Anurag & AP Das 0444**, dated 17.08.2012; Mahananda Barrage, **Anurag & AP Das 0593**, dated 13.11.2013.

Status: Common.

Local Distribution: Throughout the study area.

General Distribution: India, Nepal, Bhutan, Sri Lanka, Myanmar and Thailand.

Justicia gendarussa Burman *f.*, Fl. Indica 10. 1768; Roxburgh, Fl. Ind. 1: 129. 1820; Hooker *f.*, Fl. Brit. Ind. 4:532. 1885; Prain, Beng. Plants 2: 818. 1903; Grierson & Long, Fl. Bhut. 2(3): 1287. 2001.

Undershrubs, much branched. Stems subterete, glabrous, blackish-brown, swollen at nodes. Petioles 3 – 11 mm; lamina narrowly lanceolate, subsinuate, acute to shortly acuminate base cuneate to attenuate, glabrous. Spikes terminal or axillary; peduncle 0.5–1.8 cm; bracts triangular; bracteoles elliptic to linear-lanceolate, Calyx 5-lobed; lobes linear – lanceolate, apex acuminate. Corolla creamy white, cylindrical. Stamens exerted, glabrous. Ovary glabrous.

Flowers & Fruits: May – October

Exiccatus: Mahananda Barrage, **Anurag & AP Das 0057**, dated 12.05.2010; Doumahoni Beel, **Anurag & AP Das 0473**, dated 12.06.2013.

Status: Common.

Local Distribution: Throughout the study area.

General Distribution: Native to or naturalized in Cambodia, India, Indonesia, Laos, Malaysia, Myanmar, Papua New Guinea, Philippines, Sri Lanka, Thailand, and Vietnam; widely cultivated.

NELSONIAR. Brown, Prodr. Fl. Nov. Holland. 1810.

Nelsonia canescens (Lamarck) Sprengel in Linnaeus, Syst. Veg. ed. 16.1: 42. 1824. 1884; Grierson & Long, Fl. Bhut. 2(3): 1250. 2001. *Justicia canescens* Lamarck, Tab. Encycl. Method Bot. 1: 40. 1791. *Nelsonia campestris* R. Brown, Prodr. Fl. Nov. Hall. 1: 481. 1810; Hooker *f.*, Fl. Brit. Ind. 4: 394. 1885; Prain, Beng. Plants 2: 797. 1903.

Perennial, pubescent, prostrate, much branched herbs. Stems 4 angled. Lamina opposite, ovate or elliptic lanceolate, acute. Flowers in axillary and terminal spikes; bracts linear – lanceolate, or linear than the calyx, sepals not hairy. Capsules oblong, glabrous.

Flowers & Fruits: February – April

Exiccatus: Doumahomi Beel, **Anurag & AP Das 0168**, dated 02.02.2011; Gajoldoba, **Anurag & AP Das 0397**, dated 08.03.2012.

Status: Common.

Local Distribution: Throughout the study area.

General Distribution: Pantropical.

RUNGIANees, Plantae Asiaticae Rariores 3. 1832

Rungia pectinata (Linnaeus) Nees in DC., Prodr. 11: 469. 1847; Guha Bakshi, Fl. Mur. Dist. 244. 1984. *Justicia pectinata* Linnaeus in Torner, Cent. II Pl. 3. 1756. *Rungia parviflora* (Retzius) Nees var. *pectinata* (Linnaeus) Clarke in Hooker *f.*, Fl. Brit. Ind. 4: 550. 1985. Prain, Beng. Plants 2: 821. 1903.

Prostrate or procumbent or diffuse annual herbs. Lamina variable, narrowly lanceolate to narrowly elliptic, narrowed at both ends. Spike second, compact. Flowers small, corolla bi-lipped, blue or purplish; stamens 2. Capsules ellipsoid, compressed.

Flowers & Fruits: September – May

Exiccatus: Gajoldoba, **Anurag & AP Das 0143**, dated 12.09.2010; Mahananda Barrage, **Anurag & AP Das 0323**, dated 26.11.2011.

Status: Common.

Local Distribution: Throughout the study area.

General Distribution: India, Sri Lanka, Bangladesh, Myanmar, Nepal, and Malaysia.

LABIATAE A. Jissieu, Gen. Pl. 110. 1789, *nom. cons.* [*nom. alt.*: **LAMIACEAE**]

Key to the Genera:

- 1a. Plants non-aromatic 2
- 1b. Plants aromatic; stem 4-angled; leaves opposite **Ocimum**
- 2a. Herbs, annual; flowers verticillasters, sometimes spicate 3
- 2b. Shrubs, perennial; flowers in spreading panicles **Clerodendrum**
- 3a. Leaves in whorls **Pogostemon**
- 3b. Leaves opposite 4
- 4a. Plants \pm 1 m tall; stem woody; corolla purple to pink **Anisomeles**
- 4b. Plants \pm 30 cm tall; stem herbaceous **Leucas**

ANISOMELES R. Brown, Prodr. Fl. Nov. Holland. 503. 1810

Anisomelis indica Linnaeus, Sp. Pl. 571. 1753; Bora & Kumar, Flor. Div. Assam. 267. 2003. **Anisomelis ovata** R. Brown in Aiton, Hort. Kew 3: 364. 1811; Hooker *f.*, Fl. Brit. Ind. 4: 672. 1885; Prain, Beng. Pl. 2: 853. 1903. Kanjilal et al., Fl. Ass. 3: 521. 1939.

Erect, pubescent, shrubs, sparingly branched. Stem quadrangular. Lamina ovate, acute, sub-cordate at base, pubescent. Flowers in axillary whorls; bracts linear; corolla purple to pink. Nutlet broadly ovoid, black, shining.

Flowers & Fruits: September – March

Exiccatus: Gajoldoba, **Anurag & AP Das 0102**, dated 12.09.2010; Mahananda Barrage, **Anurag & AP Das 0562**, dated 13.11.2013.

Status: Common.

Local Distribution: Throughout the study area.

General Distribution: India, temperate Asia and Australia.

CLERODENDRUM Linnaeus, Sp. Pl. 2: 637. 1753

Key to the species:

- 1a. Leaves opposite, petiolate; lamina rounded-ovate to elliptic, glandular, pubescent **C. infortunatum**
- 1b. Leaves whorled, sub-sessile, lanceolate-oblong, glabrous **C. indicum**

Clerodendrum indicum (Linnaeus) O. Kuntze, Rev. Gen. 586. 1891. **Siphonanthus indica** Linnaeus, Sp. Pl. 109. 1753; **Clerodendrum siphonanthud** R. Brown in Ait. F., Hort. Kew. 4: 65. 1812; Hooker *f.*, Fl. Brit. Ind. 4: 593. 1885; Haines, Bot. Bihar & Orissa pt. IV: 722. 1922; Mooney, Suppl. Bot. Bihar & Orissa 121. 1950.

Tall, glabrous shrub. Leaves whorled, sub-sessile, lanceolate-oblong; bracts reddish when young. Calyx 5 fid, glandular; corolla white. Nutlets 4, with persistent bright red enlarged calyx.

Flower & Fruits: June – February

Exiccatus: Doumahoni Beel, **Anurag & AP Das 0205**, dated 02.02.2011.

Status: Common.

Local Distribution: Throughout the study area.

General Distribution: India, Bangladesh, Sri Lanka, Myanmar, Nepal, S. China, Malaysia.

Clerodendrum infortunatum Linnaeus, Sp. Pl. 637. 1753; Prain, Beng. Pl. 2: 835. 1903.

Clerodendrum viscosum Ventenat, Jord. Malm. f. 25. 1803.

Vernacular Name: *Bhant* (Bengali)

Terrestrial invaders; erect, bushy, undershrubs. Lamina ovate to elliptic, denticulate, glandular. Panicle terminal. Calyx with 5 toothed, red in fruit; corolla white; stamens 4, exerted; ovary 4 lobed. Drupes globose.

Flower & Fruits: January – September

Exiccatus: Mahananda Barrage, **Anurag & AP Das 0041**, dated 12.05.2010; Gajoldoba, **Anurag & AP Das 0687**, dated 03.09.2014.

Status: Common.

Local Distribution: Throughout the study area.

General Distribution: India, Sri Lanka, Myanmar, Australia and China.

LEUCAS R. Brown, Prodr. Fl. Nov. Holland. 504. 1810

Leucas Indica (Linnaeus) R. Brown ex Vatke, in Oesterr. Bot. Zeits. 25: 95. 1875. Panda & Das, Fl. Sambalp., 301. 2004. *Leonurus indicus* Linnaeus, Syst. ed 10: 1101. 1760. *Leucas linifolia* (Rothmaler) Sprengel, Syst. 2: 743. 1825; Prain, Beng. Pl. 2: 856. 1903.

Vernacular Name: *Danda-kalas*

Erect, much branched herbs. Stem quadriangular. Leaves opposite, linear – lanceolate, distantly serrate. Flowers in verticillaster; corolla bilabiate, white; stamens didynamous; carcerules black.

Flowers & Fruits: August – February

Exiccatus: Mahananda Barrage, **Anurag & AP Das 0021**, dated 12.05.2010; Gajoldoba, **Anurag & AP Das 0091**, dated 12.09.2010.

Status: Abundant.

Local Distribution: Throughout the study area.

General Distribution: India, Bangladesh, Sri Lanka, Myanmar, Malaya, China, Nepal, Temperate Asia and Australia.

OCIMUM Linnaeus, Sp. Pl. 2: 597. 1753

Ocimum basilicum Linnaeus, Sp. Pl. 597. 1753; Hooker f., Fl. Brit. Ind. 4: 608. 1885; Prain, Beng. Pl. 2: 842. 1903; Haines, Bot. Bihar & Orissa Pt. IV: 728. 1922; Mooney, Suppl. Bot. Bihar & Orissa. 122. 1950. Panda & Das, Fl. Sambalp., 300. 2004.

Erect, strongly aromatic much branched herbs. Stem 4 angled. Lamina ovate-lanceolate, entire, hairy. Flowers in whorls; corolla whitish-pink, bilabiate, stamens 4. Nutlets 4, black.

Flowers & Fruits: April – August

Exiccatus: Mahananda Barrage, **Anurag & AP Das 0039**, dated 12.05.2010.

Status: Common.

Local Distribution: Throughout the study area.

General Distribution: India, warmer parts of Asia, Africa and America.

POGOSTEMON Desfontaines, Mém. Mus. Hist. Nat. 2: 154. 1815

Key to the species:

- 1a. Leaves opposite *P. auricularius*
- 1b. Leaves in whorl 2
- 2a. Stem rust-colored, glandular pilose *P. linearis*
- 2b. Stem green or red and white 3
- 3a. Sepals in fruits stellately spreading, disclosing the nutlets *P. stellatus*
- 3b. Sepals in fruits erect or incurve, not disclosing the nutlets *P. pumilus*

Pogostemon auricularius (Linnaeus) Hasskarl, Tijdsch. Nat. Geschied. 10: 127. 1843. *Mentha auricularia* Linnaeus, Mant. Pl., ed. 1, 81. 1767; *Dysophylla auricularia* (Linnaeus) Blume Bijdr. Fl. Ned. Ind. 14: 826. 1826; Prain, Beng. Pl. 2: 850. 1903.

Annual herbs. Stems 0.4 – 2 m tall, prostrate basally, rooting at nodes, hirsute. Leaves subsessile; lamina oblong to ovate-oblong. Spikes 6 – 18 cm, apex caudate-acuminate; bracts ovate-lanceolate, as long as corolla; calyx campanulate, glabrous, yellow glandular; corolla purplish to white; stamens much exerted. Nutlets brown, subglobose.

Flowers & Fruits: April – November

Exiccatus: Kathambari Barrage, **Anurag & AP Das 0686**, dated 03.09.2014.

Status: Common.

Local Distribution: Throughout the study area.

General Distribution: India, Bangladesh, Bhutan, Nepal.

Pogostemon linearis (Bentham) Kuntze, Revis. Gen. Pl. 2: 530. 1891. *Dysophylla linearis* Bentham, Prodr. [A.P. de Candolle] 12: 157. 1848. **[PLATE 4.11. Figs. 53]**

Annual, erect or decumbent herbs. Stems rust colored, glandular pilose. Leaves in whorls; lamina linear-lanceolate, papery, adaxially puberulent, abaxially glandular pubescent on midrib otherwise glandular. Spikes upto 5 cm long, base interrupted; bracts lanceolate; calyx narrowly campanulate, teeth suberect; corolla violate-pink, limb subequally 4-lobed; stamens much exerted; filaments bearded.

Flowers & Fruits: November – March

Exiccatus: Mahananda Barrage, **Anurag & AP Das 0606**, dated 13.11.2013.

Status: Rare.

Local Distribution: In only one or two wetlands of the study area.

General Distribution: India, China.

Pogostemon pumilus (Graham) Press in Bull. Brit. Mus. (Natural History). 10, 1: 74. 1982. Cook, Aquat. Wetl. Pl. Ind. 225. 1995. [PLATE 4.11. Figs. 55]

Helophyte; annual herbs. Leaves in whorls of 2 – 6; lamina linear to linear lanceolate, sessile, densely gland-dotted below. Inflorescence a continuous terminal spike, verticillasters many-flowered. Bracts purplish, deciduous; calyx purplish with 5 equal teeth, campanulate; corolla pink to lilac, scarcely bilabiate; staminal filaments densely hairy; style deeply 2-lobed. Nutlets pale brown, ovoid.

Flowers & Fruits: September – January

Exiccatus: Mahananda Barrage, **Anurag & AP Das 0608**, dated 13.11.2013; Doumahoni Beel, **Anurag & AP Das 0682**, dated 03.09.2014.

Status: Less common.

Local Distribution: Throughout the study area.

General Distribution: India, Bangladesh, Bhutan, Nepal, Burma.

Pogostemon stellatus (Loureiro) Kuntze, Revisio Generum Pl. 2. 1891. *Eusteralis stellata* (Loureiro) Panigrahi in Phytologia 32: 474. 1976. Murata in S.E. As. Stud. 14: 86. 1976. Hara *et al.*, Fl. Nep. 3: 154. 1982. *Mentha stellata* Loureiro, Fl. Cochinch. 2: 361. 1970. *Dysophylla verticillata* Benth in Wallich, Pl. As. Rar. 1: 30. 1830; Hooker *f.*, Fl. Brit. Ind. 4: 639. 1885; Prain, Beng. Pl. 2: 850. 1903. [PLATE 4.11. Figs. 54]

Aquatic, fleshy, erect, branched herbs. 4 – 6 leaves in whorls. Flowers minute, in very dense, terminal long, tomentose or villose spikes. Sepals 5; petals 4-fid, minute; stamens 4, subequal; carpels connate in 4-partite ovary; styles 2-fid. Nutlets 4, ovoid, smooth, dry.

Flowers & Fruits: November – February

Exiccatus: Mahananda Barrage, **Anurag & AP Das 0317**, dated 26.11.2011.

Status: Abundant.

Local Distribution: Throughout the study area.

General Distribution: India, Bangladesh, Sri Lanka, Myanmar, Malaysia, China, Nepal, Temperate Asia and Australia.

LINDERNIACEAE Borsch, Kai Müll. & Eb. Fisch. Pl. Biol. (Stuttgart) 7(1): 76. 2005

LINDERNIA Allioni, Mélanges Philos. Math. Soc. Roy. Turin 3: 178. t. 5. 1766

Key to the species:

- 1a. Plants generally erect when mature with normal growth, lower branches sometimes decumbent and rooting from nodes 2
- 1b. Plants generally prostrate, mat forming, rooting from nodes 6
- 2a. Lower leaves (at least) petiolate, succulent 3
- 2b. Leaves sessile 5
- 3a. Stem with long hispid white hairs; corolla bluish *L. palustris*
- 3b. Stem glabrous; corolla white 4

- 4a. Lamina ovate-oblong, crenate *L. multiflora*
 4b. Lamina oblong, sharply serrate, serrations long aristate *L. ciliata*
 5a. Lamina linear-oblong, serrulate..... *L. oppositifolia*
 5b. Lamina ovate-attenuate, serrate..... *L. parviflora*
 6a. Lamina cordate at base; perfect stamens 4..... *L. cordifolia*
 6b. Lamina otherwise; perfect stamens 2 or 4..... 7
 7a. Lamina entire..... *L. pyxidaria*
 7b. Lamina serrate or crenate 8
 8a. Capsule globose 9
 8b. Capsule cylindrical or ovate cylindrical 10
 9a. Stamens long exserted; plants green *L. pusilla*
 9b. Stamens inserted; plants purplish at least at nodes and petioles *L. crustacean*
 10a. Fertile stamens 4 *L. anagalis*
 10b. Fertile stamens 2..... 11
 11a. Lamina (lower leaves) obovate or oblanceolate 12
 11b. Lamina ovate-lanceolate; corolla red/ purple, 2 convex linea at the throat ... *L. hyssopoides*
 12a. Lamina obovate; corolla white/ bluish with purple spot at the throat *L. rotundifolia*
 12b. Lamina oblanceolate; corolla bluish with two yellow elevated lines at the throat ... *L. antipoda*

Lindernia crustacea (Linnaeus) F. Mueller, Cens. Austral. Pl. 97. 1882; Pennell, Scroph. West. Himal. 29. 1943; Guha Bakshi, Fl. Mur. Dist. 227. 1984. *Capraria crustacea* Linnaeus Mant. 87. 1767. *Vandellia crustacea* Bentham Scroph Ind. 35. 1835; Hooker f., Fl. Brit. Ind. 4: 279. 1884; Prain, Beng. Pl. 2: 768. 1903.

Diffusely branched, annual, prostrate, erect when small, glabrous herbs. Lamina shortly petiolate, serrate, ovate-lanceolate, glabrous. Flowers solitary, axillary, glabrous or minutely pubescent; calyx tubular, shortly 5 lobed, corolla blue, purple or lilac, glabrous. Capsules oblong-ovoid to sub globose, obtuse, pale brown; seeds pale orange, scrobiculate.

Flowers & Fruits: August – January

Exiccatus: Gajoldoba, **Anurag & AP Das 0112**, dated 12.09.2010.

Status: Abundant.

Local Distribution: Throughout the study area.

General Distribution: India; Tropics and old world, Sri Lanka.

Lindernia parviflora (Roxburgh) Haines, Bot. Bihar Oris. 635. 1922; Pennell, Scroph. West Himal. 29. 1943; Santapau in Jour. Bombay Nat. Hist. Soc. 49: 38. 1950; Cook, Aqua. Wetl. Pl. Ind. 357. 1996. [PLATE 4.10. Figs. 47]

Marshy, annual, erect herbs with tetragonal stem. Leaves opposite, sessile, ovate-lanceolate, base attenuate. Inflorescence axillary or terminal raceme. Corolla bilabiate, white; stamens 2, staminode 2. Capsule cylindrical to elliptic longer than calyx.

Flowers & Fruits: August – May

Exiccatus: Gossaihat Beel, **Anurag & AP Das 0252**, dated 14.07.2011.

Status: Abundant.

Local Distribution: Throughout the study area.

General Distribution: Tropical part of Asia and Africa.

Lindernia cordifolia (Colsmann) Merrill, Enum. Philip. Pl. 3: 437. 1923; Mukherjee, Jour. Ind. Bot. Soc. 24: 132. 1945; Chatterjee & Bharadwaja, Bull. Bot. Soc. Beng. 9(2): 144. 1955. *Gratiola cordifolia* Colsmann, Prodr. Desc. Grat. 15. 1793. Bentham, Scroph. Ind. 37. 1835; Hooker f., Fl. Brit. Ind. 4: 282. 1884; Prain, Beng. Pl., 2: 769. 1903.

Marshy, annual, diffused herbs with root from lower node. Lamina ovate-oblong, base cordate, subsessile; flower axillary, solitary; corolla bilabiate, white – pale blue; stamens 4, didynamous, all perfect. Capsule linear-lanceolate with persistent style; seeds ellipsoid.

Flowers & Fruits: July – January

Exiccatus: Mahananda Barrage, **Anurag & AP Das 0616**, dated 13.11.2013.

Status: Rare.

Local Distribution: In one or two wetlands of the study area.

General Distribution: India, Sri Lanka, Borneo and China.

Lindernia oppositifolia (Retzius) Mukerjee, Jour. Ind. Bot. Soc. 24: 134. 1945; Bennet, Jour. Bombay Nat. Hist. Soc. 62: 600. 1966; Cook, Aqua. Wetl. Pl. Ind. 357. 1996. *Gratiola oppositifolia* Retzius, Obs. 4: 8. 1786. *Bonnaya oppositifolia* Spr., syst. 1: 41. 1825; Hooker f., Fl. Brit. Ind. 4: 286. 1884. *Vandellia oppositifolia* Haines, Bot. Bihar Oris. 4: 634. 1922. [**PLATE 4.10. Figs. 49**]

Annual, erect herbs. Stem quadriangular; lamina sessile or subsessile, linear-oblong, obtuse, serrate or serrulate, narrowed down at base. Flowers usually solitary, rarely passing into terminal racemes; pedicels long. Capsules long, linear-oblong. Seeds minute.

Flowers & Fruits: August – December

Exiccatus: Mahananda Barrage, **Anurag & AP Das 0622**, dated 13.11.2013; Kathambari Beel, **Anurag & AP Das 0701**, dated 03.09.2014.

Status: Common.

Local Distribution: Throughout the study area.

General Distribution: India, Nepal, Bhutan.

Lindernia multiflora (Roxburgh) Mukherjee in Jois 24: 131. 1945; Philcox in Kew Bull. 22: 36. 1938; Cook, Aqua. Wetl. Pl. Ind. 360. 1996. *Torenia multiflora* Roxburgh, Fl. Ind. 3: 96. 1832. *Vandellia multiflora* (Roxburgh) G. Don, Gen. Syst. 4: 549. 1838; Hooker f., Fl. Brit. Ind. 4: 280. 1884; Prain, Beng. Pl. 2: 768. 1903.

Marshy, annual, erect, succulent, glabrous herbs. Leaves petiolate, ovate-oblong, base obtuse. Inflorescence racemose; flowers bisexual; corolla bilabiate, white; calyx segment partite to the base, shorter than capsule. Capsules orbicular.

Flowers & Fruits: June – April

Exiccatus: Doumahoni Beel, **Anurag & AP Das 0198**, dated 02.02.2011.

Status: Rare.

Local Distribution: Only in one wetland of the study area.

General Distribution: Tropical Asia including India.

Lindernia pusilla (Willdenow) Boldingh, Zakfl Landbouwster Java 165. 1916; Cook, Aqua. Wetl. Pl. Ind. 358. 1996. *Gratiola pusilla* Willdenow, Sp. Pl. 1: 105. 1797. *Selago pusilla* Thunberg, Prodr. Pl. Cap. 99. 1800. *Vandellia scabra* Bentham, Scroph. Ind. 36. 1835; Hooker *f.*, Fl. Brit. Ind. 4: 281. 1884; Prain, Beng. Pl. 2: 768. 1903. *Torenia hirta* (Cham. & Schlecht.) Pennell, Jour. Arnold Arb. 24: 250. 1943; Mukerjee, Jour. Indian Bor. Soc. 24: 131. 1945.

Slender diffused or prostrate herbs. Lamina sessile or sub-sessile, broadly ovate, obtuse or rounded at apex, serrate or crenate. Flowers terminal, which later come to axillary position; peduncle 5 – 8 cm long. Capsule globose.

Flowers & Fruits: August – December

Exiccatus: Mahananda Barrage, **Anurag & AP Das 0617**, dated 13.11.2013; Kathambari Beel, **Anurag & AP Das 0698**, dated 03.09.2014.

Status: Common.

Local Distribution: Throughout the study area.

General Distribution: India and Southeast Asia.

Lindernia anagallis (Burmanf.,) Pennell in Jour. Arn. Arbor. 24: 252. 1943; Mooney, Suppl. Bot. Bihar & Oris. 100. 1950; Cook, Aqua. Wetl. Pl. Ind. 351. 1996; Panda & Das, Fl. Sambalp. 252. 2004. *Ruellia anagallis* N. Burnan., fl. Ind. 135. 1768. *Vandellia penunculata* Bentham, Scroph. India. 37. 1835; Hooker. *f.*, Fl. Brit. Ind. 4: 282. 1884; Prain, Beng. Pl., 2: 769. 1903. *Vandellia cordifolia* (Colsmann) G. Don, Gen. Syst. 4: 549. 1838; Haines, Bot. Bihar & Oris. pt. IV: 610. 1922; Mooney, Suppl. Bot. Bihar & Oris. 94. 1950. **[PLATE 4.10. Figs. 46]**

Annual, stem creeping rooting at lower node, ascending, branched herbs. Leaves subsessile or shortly petiolate; lamina linear-lanceolate, ovate, serrate. Flowers solitary, axillary. Calyx deeply 5 lobed, corolla white to pale purple. Capsule cylindrical, acuminate, glabrous.

Flowers & Fruits: January – February

Exiccatus: Doumahoni Beel, **Anurag & AP Das 0199**, dated 02.02.2011; Gajoldoba, **Anurag & AP Das 0709**, dated 03.09.2014.

Status: Abundant.

Local Distribution: Throughout the study area.

General Distribution: India, Sri Lanka, Malaya, Indonesia, Siam, China, Philippines islands and Java.

Lindernia palustris A. Chowdhury, M. Chowdhury & A.P Das, *sp. nov.* **[Plate No. 4.2]**

Annuals, marshy herbs, upto 20 cm tall. Roots fibrous, fascicled. Stems suberect-erect or prostrate basally and rooting from lower nodes then ascending, many branched, densely hirsute, 4-angled. Leaves opposite, sessile or petiole minute wide, lamina ovate-cordate, base cuneate to rounded, 1.2 – 1.6 X 0.8 – 1 cm, densely pubescent on both surfaces, margin obscurely to sharply serrate or subentire, apex acute to rounded. Flowers axillary and solitary or in short apical racemes. Pedicel slender, 0.9 – 1.5 cm, densely hairy. Calyx urnlike, 3 – 5 mm, shallowly lobed; lobes triangular-ovate, outside and outside ridges sparsely red granular hairy. Corolla purple-violet, 6 – 8 mm; tube slightly longer than calyx; lower

lip 3-lobed, middle lobe larger and slightly longer than upper lip; upper lip ovate, sometimes shallowly 2-lobed. Stamens didynamous. Gynocium 5 – 6 mm, Style long, glabrous, style bifid, ovary oblong sparsely hairy. Capsule broadly ellipsoid, almost as long as persistent calyx. Seeds pale yellow-brown, subglobose, scrobiculate.

Flowers & Fruits: September – December

Exiccatus: Type: INDIA: Nearby Teesta Bridge, Jalpaiguri, West Bengal, *Chowdhury et al.*, 01543, dated 13.11.2014 (Holotypus: CAL). Roadside ditches, NBU gate no. 1, Darjeeling, West Bengal, *Chowdhury et al.*, 01653, dated 15.12.2014 (Paratypus: NBU)

Status: Rare.

Local Distribution: In only two places of the study area.

General Distribution: India [sub-Himalayan terai of Darjeeling and Jalpaiguri district, West Bengal].

Lindernia pyxidaria Allioni, Misc. Maxim 3: tab. 5: 178. 1766; Mukhrjee, Jour. Ind. Bot. Soc. 24: 113. 1945; Datta & Majumdar Bull. Bot. Soc. Beng. 20(2): 108. 1967; Cook, Aqua. Wetl. Pl. Ind. 358. 1996. *Gratiola integrifolia* Roxburgh, Fl. Ind. 3: 137. 1832. *Vandellia erecta* Benth Scrop. Ind. 36. 1835; Hooker f., Fl. Brit. Ind. 4: 281. 1884.

Annual, glabrous branched herbs. Leaves opposite, lamina sessile, elliptic to oblong, obtuse, entire. Flowers axillary, solitary, pedicels, slender; calyx polysepalous, corolla bilabiate, white; stamens 4, all perfect, didynamous. Capsules broadly ellipsoid. Seeds many.

Flowers & Fruits: June – January

Exiccatus: Doumahoni Beel, *Anurag & AP Das 0477*, dated 12.06.2013; Kathambari Beel, *Anurag & AP Das 0707*, dated 03.09.2014.

Status: Common.

Local Distribution: Throughout the study area.

General Distribution: India and Polynesia.

Lindernia antipoda (Linnaeus) Alston in Trim. Handb. Fl. Ceyl. Suppl. 6: 214. 1931; Cook, Aqua. Wetl. Pl. Ind. 352. 1996. *Ruellia antipoda* Linnaeus, Sp. Pl. 635. 1753. *Bonnaya veronicifolia* (Retzius) Sprengel, Syst. 1: 41. 1824; Hooker f., Fl. Brit. Ind. 4: 285. 1884. [PLATE 4.10. Figs. 45]

Diffusely branched, annual, erect or prostrate, glabrous herbs, sometimes rooting at base. Leaves sessile, ovate-oblong, oblanceolate, glabrous. Pedicel glabrous; calyx deeply 5 lobed; corolla pale purple and white. Fertile stamens 2, posterior; 2 staminodes anterior; Capsule cylindrical, acuminate.

Flowers & Fruits: July – September

Exiccatus: Kathambari Beel, *Anurag & AP Das 0710*, dated 03.09.2014.

Status: Common.

Local Distribution: Throughout the study area.

General Distribution: India, China, Java, Philippines

Lindernia ciliata (Colsmann) Pennell, Brittonia. 2: 182. 1936; Cook, Aqua. Wetl. Pl. Ind. 352. 1996. *Gratiola ciliata* Colsmann, Prodr. Descr. Gratiol. 14. 1793.

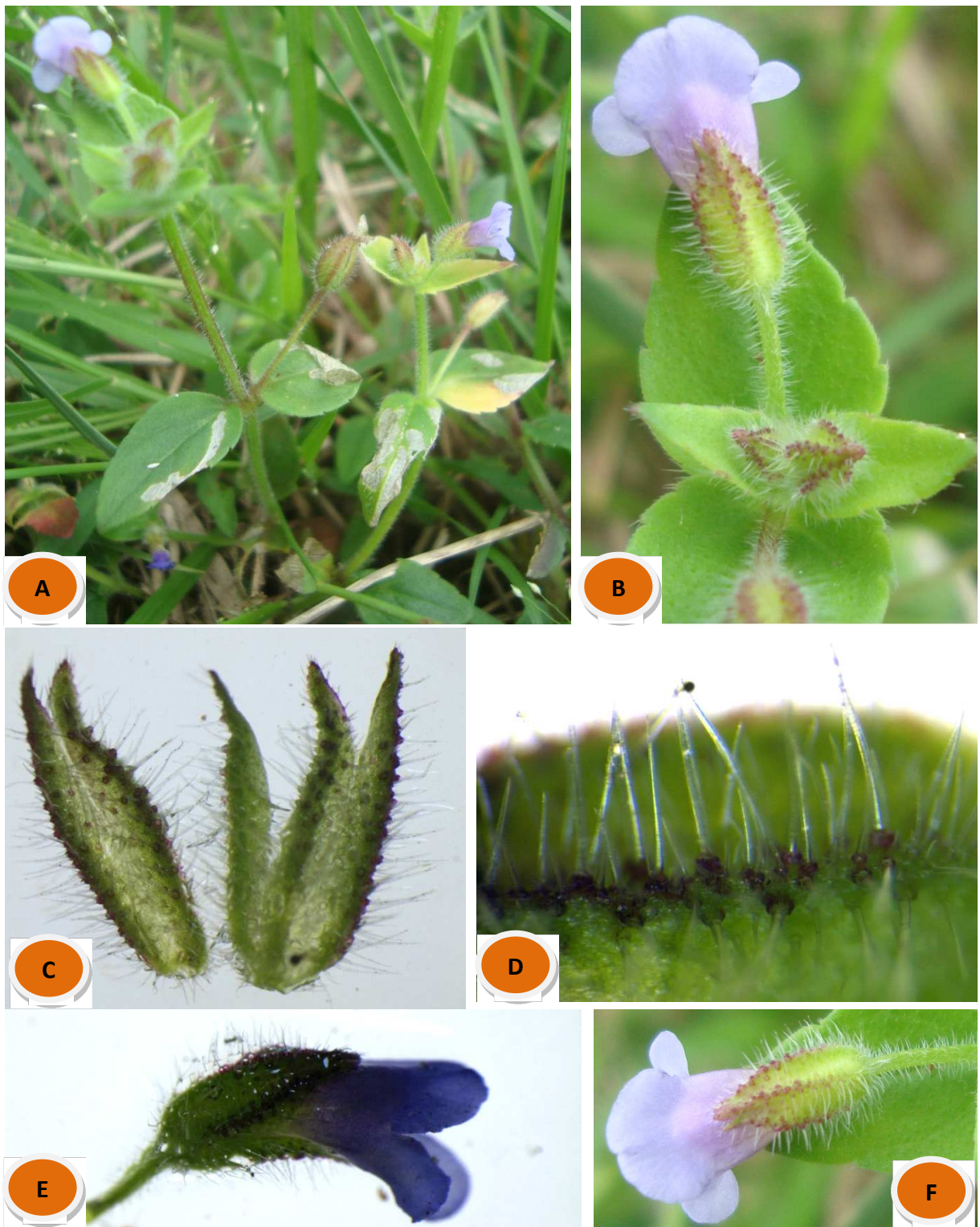


PLATE – 4.2: A. Plant in the habitat; B. Shoot tip with flower and flower-buds; C. Calyx split open; D. Hairs on ridges; E. Flower just after blooming (corolla deep coloured), F. Old flower (corolla light coloured)

Annuals, erect or diffuse herbs, sometimes rooting from last node. Leaves sessile or short petiolate; lamina oblong to lanceolate-oblong, glabrous, apex acute to obtuse. Racemes terminal; bracts lanceolate; calyx lobes narrowly lanceolate; corolla light purple or white; fertile stamens 2, posterior; reduced stamens 2, anterior; style as long as fertile stamens. Capsules cylindrical.

Flowers & Fruits: May – January

Exiccatus: Gossaihat Beel, **Anurag & AP Das 0254**, dated 14.07.2011; Mahananda Barrage, **Anurag & AP Das 0618**, dated 13.11.2013.

Status: Less common.

Local Distribution: Throughout the study area.

General Distribution: India, China, Japan, Cambodia, Laos, Malaysia, Myanmar, Philippines, Vietnam. N Australia.

Lindernia hyssopioides (Linnaeus) Haines, Bot. Bihar Orissa 4: 666. 1922; Cook, Aqua. Wetl. Pl. Ind. 354. 1996. *Gratiola hyssopoides* Linnaeus, Mant. Pl. 174. 1771. [PLATE 4.11. Figs. 51]

Helophyte; annual, decumbent herbs. Stems erect or somewhat ascending, simple, striate, glabrous. Leaves sessile, subamplexicaul; lamina narrowly ovate to ovate-lanceolate, 5–15 × ca. 4 mm, glabrous, margin entire or with 2 or 3 pairs of inconspicuous small teeth. Flowers in axils of upper leaves, solitary. Calyx lobes lanceolate; corolla red, purple, or white, with 2 convex lines at throat; fertile stamens 2, posterior, staminodes 2; style short, apex 2-lamellate. Capsule narrowly ovoid.

Flowers & Fruits: June – November

Exiccatus: Mahananda Barrage, **Anurag & AP Das 0619**, dated 13.11.2013.

Status: Common.

Local Distribution: Throughout the study area.

General Distribution: India, China, Sri Lanka, Indonesia, Vietnam.

Lindernia rotundifolia (Linnaeus) Alston, Handb. Fl. Ceylon 6 (Suppl.) 214. 1931; Cook, Aqua. Wetl. Pl. Ind. 358. 1996. *Gratiola rotundifolia* Linnaeus, Mant. Pl. 2: 174. 1771.

[PLATE 4.9. Figs. 44]

Trailing annual herb. Stem green, rooting at lower part of all nodes, glabrous. Leaves sessile, palmately nerved; lamina elliptic, ovate, or obovate; base cuneate to rounded; margin serrate; apex acute or obtuse. Flowers solitary in axils; pedicels generally alternate. Calyx 5 segmented zygomorphic or irregular. Corolla white or light blue with purple spot on throat. Stamen 4, 2 fertile & 2 staminodes. Ovary ellipsoid. Capsule ovate to ellipsoid. Seeds yellow, oblong.

Flowers & Fruits: July – November

Exiccatus: Mahananda Barrage, **Anurag & AP Das 0054**, dated 12.05.2010; Kathambari Beel, **Anurag & AP Das 0725**, dated 03.09.2014.

Status: Abundant.

Local Distribution: Throughout the study area.

General Distribution: India, Srilanka, Madagascar.

LENTIBULARIACEAE Richard, Fl. Paris. 1: 26. 1808

UTRICULARIA Linnaeus, Sp. Pl. 1: 18. 1753**Key to the Species:**

- 1a. All leaves divided into narrowly linear or capillary segments; suspended aquatics ... 2
- 1a. Submerged leaves narrowly segmented; arial leaves entire, linear to obovate or orbicular; emergent aquatics or helophytes 4
- 2a. Peduncle without floats; flowers on long rachis *U. gibbosa* var. *exoleta*
- 2b. Peduncle with several floats; flowers on long rachis 3
- 3a. Corolla yellow; capsules sub-globose *U. aurea*
- 3b. Corolla pale yellow, violet-spotted; capsules globose *U. inflexa* var. *stellaris*
- 4a. Bracts subtending flowers, attached at some point above the base 5
- 4b. Bracts subtending flowers attached at the base 6
- 5a. Lamina linear to narrowly obovate, vein 1; scales numerous *U. caerulea*
- 5b. Lamina reniform, orbicular, veins dichotomously branched; scales few *U. striatula*
- 6b. Raceme stalk twining; pedicels deflexed in fruit *U. scandens*
- 6a. Raceme stalk not twining; pedicels remain erect in fruit *U. bifida*

Utricularia striatula Smith in Rees, Cycl. 37:17. 1818; Cook, Aqua. Wetl. Pl. Ind. 245. 1995; Grierson & Long, Fl. Bhut. 2(3): 1337. 2001. *Utricularia striatula* var. *minor* Ridl., Trans. Linn. Soc. London, Bot. 9: 122. 1916.

Perennial herbs. Submerged leaves and stolons capillary, simple. Traps on leaf-segments stalked, ovoid, deeply 2-cleft, fringed with multicellular stipitate glands. Arial leaves numerous in rosette from peduncle base and stolons, subsessile to petiolate; lamina obovate to orbicular. Racemes erect, peduncle terete, glabrous; bracteoles similar to bract but slightly smaller. Lower lobe of calyx oblong-elliptic; corolla white or violet; filaments straight, anther-thecae distinct; ovary ovoid to depressed globose; style very short. Capsules globose.

Flowers & Fruits: June – November

Exiccatus: Mahananda Barrage, **Anurag & AP Das 0613**, dated 13.11.2013.

Status: Less common.

Local Distribution: In few wetlands of the study area.

General Distribution: SE Asia, Papua New Guinea, tropical Africa, Indian Ocean islands (N Andaman Islands); moist rock-walls in hilly areas of Darjeeling Himalaya

Utricularia aurea Loureiro, Fl. Cochinch. 26. 1790; Cook, Aqua. Wetl. Pl. Ind. 235. 1995; Grierson & Long, Fl. Bhut. 2(3): 1339. 2001. *U. flexuosa* Vahl, Fnum. Pl.1: 198. 1804; Hooker f., Fl. Brit. Ind. 4: 329. 1884. **[PLATE 4.14. Figs. 73]**

Herbs, stolons much branched. Leaves submerged; whorled, multifid into filiform segments, interspersed with bladders. Flowers pedicelate in erect slender racemes; bracts basifixed. Calyx lobes ovate, enlarged in fruits; corolla yellow. Capsules globose.

Flowers & Fruits: September – January

Exiccatus: Gajoldoba, **Anurag & AP Das 0106**, dated 12.09.2010; Kathambari Beel, **Anurag & AP Das 0694**, dated 03.09.2014.

Status: Abundant.

Local Distribution: Throughout the study area.

General Distribution: SE Asia, Papua New Guinea, Australia; throughout the Bengal-plains.

Utricularia scandens Benjamin, Linnaea 20: 309. 1847. Cook, Aqua. Wetl. Pl. Ind. 243. 1995; Prain, Beng. Pl. 2: 781. 1903. *U. wallichiana* Wight, Icon. Pl. Ind. Orient. 4. 1850.

[PLATE 4.14. Figs. 74]

Annual herbs. Stolons capillary, branched. Traps on leaf segments and stolons stalked, globose. Lamina narrowly linear. Recemes erect or twining, 3 – 8 flowered, glabrous; peduncle terete but somewhat angular; bracts basifixed, broadly ovate-deltoid. Pedicels suberect, filiform, winged; bracteoles basifixed, narrowly linear to subulate. Calyx lobes ovate to elliptic. Corolla yellow, lower lip suborbicular; filaments, straight; ovary ovoid, dorsiventrally compressed; style short. Capsules ovoid.

Flowers & Fruits: June – October

Exiccatus: Gossaihat Beel, **Anurag & AP Das 0440**, dated 17.08.2012; Kathambari Beel, **Anurag & AP Das 0697**, dated 03.09.2014.

Status: Rare.

Local Distribution: In one or two wetlands of the study area.

General Distribution: Africa, SE Asia, Papua New Guinea, N Australia.

Utricularia bifida Linnaeus, Sp. Pl. 1: 18. 1753; Prain, Beng. Pl. 2: 781. 1903; Grierson & Long, Fl. Bhut. 2(3): 1340. 2001. Cook, Aqua. Wetl. Pl. Ind. 236. 1995.

Annual herbs. Leaves and stolon branches capillary. Aerial leaves arise from stolons, petiolate, one nerved, linear. Traps ovoid, subulate. Peduncle erect, glabrous. Flowers 1 – 10, pedicels slender, broadly winged. Capsules broadly ellipsoid; seeds obliquely obovoid.

Flowers & Fruits: June – January

Exiccatus: Gossaihat Beel, **Anurag & AP Das 0446**, dated 17.08.2012.

Status: Common.

Local Distribution: Throughout the study area.

General Distribution: SE Asia, N Australia, Pacific islands

Utricularia caerulea Linnaeus, Sp. Pl. 1: 18. 1753; Cook, Aqua. Wetl. Pl. Ind. 237. 1995. *Utricularia albina* Ridl., Fl. Malay. Penin. 2: 493. 1923.

Annual herbs. Aerial leaves 1 nerved, petiolate, obovate. Traps ovoid, dimorphic. Peduncle erect, glabrous above. Flowers 1 – 20 or more, distant to congested. Corolla white or yellowish to pinkish. Capsules globose or ellipsoid; seeds obovoid.

Flowers & Fruits: June – February

Exiccatus: Mahananda Barrage, **Anurag & AP Das 0614**, dated 13.11.2013.

Status: Rare.

Local Distribution: Only in one wetland of the study area.

General Distribution: India, Australia, Madagascar, Pacific islands.

Utricularia gibbosa subsp. *exoleta* (R. Brown) P. Taylor, Mitt. Bot. Staat. Munchen 4: 101. 1961 & Kew Bull. 18(1): 204. 1954. *Utricularia exoleta* R. Brown, Prodr. 430: 1810; Hooker f., Fl. Brit. Ind. 4: 329. 1884; Prain, Beng. Pl. 2: 781. 1903. *Utricularia gibba* Linnaeus, Sp. Pl. 1: 18. 1753; Cook, Aqua. Wetl. Pl. Ind. 239. 1995.

Pleustophyte; small herbs, usually floating at maturity. Stolons very slender. Leaves variable, sparsely filiform simple or divided with capillary segments; spur of corolla conical, obtuse. Capsules globose; seeds orbicular, flat.

Flowers & Fruits: September – January

Exiccatus: Kathambari Beel, **Anurag & AP Das 0696**, dated 03.09.2014.

Status: Common.

Local Distribution: Throughout the study area

General Distribution: SE Asia, Africa, tropical America, Europe, N & S America, Pacific islands.

Utricularia inflexa Forsskål, Fl. Aegypt.-Arab. 9.1775. *Utricularia inflexa* Forsskål var. *stellaris* (Linnaeus f.) P. Taylor, Mitt. Bot. Staat. Munchen 4: 96. 1961 & Kew Bull. 18: 204. 1964. *Utricularia stellaris* Linnaeus f., Suppl. 86. 1781; Hooker f., Fl. Brit. Ind. 4: 328. 1884.

Pleustophyte; herbs with exposed scapes, supported on whorls of spongy floats. Leaves highly dissected. Flowers in aerial racemes; calyx enlarged in fruits; corolla yellow or cream-coloured. Capsules globose.

Flowers & Fruits: September – January

Exiccatus: Gajoldoba, **Anurag & AP Das 0092**, dated 12.09.2010.

Status: Rare.

Local Distribution: In one or two wetlands of the study area.

Distribution: Africa, Asia, Australia.

PHRYMACEAE Schauer, Prodr. 11: 520. 1847

MAZUS Loureiro, Fl. Cochinch. 385. 1790

Mazus pumilus (Burman f.) van Steenis in Nova guinea n. sect.9: 31. 1958. *Lobelia pumila* Burman f., Fl. Ind. 186. t. 60, f. 3. 1768; Panda & Das, Fl. Sambalp. 254. 2004. *Mazus rugosus* Loureiro, Fl. Cochinch. 385. 1790; Hooker f., Fl. Brit. Ind. 4: 259. 1884; Prain, Beng. Pl. 2: 759. 1903; Haines, Bot. Bihar & Orissa pt. IV: 621. 1922.

Annual, fleshy, procumbent to sub-erect herbs; stems very sparingly eglandular-puberulent throughout and with sparse sessile glands in inflorescence. Lamina unlobed at base, entire, shallowly dentate or crenate above. Racemes 2 – 11 flowered; corolla white or bluish. Seeds with two tiny projections.

Flowers & Fruits: Almost throughout the year.

Exiccatus:, Mahananda Barrage **Anurag & AP Das 0067**, dated 12.05.2010; Doumahoni Beel, **Anurag & AP Das 0712**, dated 03.09.2014.

Status: Common.

Local Distribution: Found in almost all wetlands of the study area.

General Distribution: India, Myanmar, Malaysia, Afghanistan, China, Japan, Java, Philippines.

PLANTAGINACEAE A. Jussieu, Gen. Pl. 89. 1789

Key to the Genera:

- 1a. Bractioles absent; leaves hetero- or mono-philous *Limnophilla*
- 1b. Bractioles present; leaves monophilous 2
- 2a. Corolla actinomorphic ... 3
- 2b. Corolla zygomorphic 4
- 3a. Diffuse soft herb *Bacopa*
- 3b. Erect rigid herb *Scoparia*
- 4a. Stamens 4, fertile 5
- 4b. Stamens 2, fertile 6
- 5a. Capsules ellipsoid; plants prostrate *Mecardonia*
- 5b. Capsule orbicular; plants diffuse *Veronica*
- 6a. Plants erect; stamnodes 2; lamina 7.0 x 3.0 mm *Dopatrium*
- 6a. Plants prostrate; staminode absent; lamina 3.0 x 0.70 mm *Microcarpaea*

BACOPA Aublet, Hist. Pl. Guiane. 1. 1775 as t. 48 in textu

Bacopa monnieri (Linnaeus) Pennell, Proc. Acad. Nat. Sci. Philadelphia 98: 96. 1946; Grierson & Long, Fl. Bhut. 2(3): 1112. 2001. *Lysimachia monniere* Linnaeus Cent. Pl. II. t. 9. 1756.

Vernacular Name: *Brahmi*

Amphibious, procumbent diffuse annual herbs, glabrous, floating roots from nodes. Leaves smelling camphor, opposite, sessile, ovate-elliptic or linear-lanceolate. Flowers solitary-axillary. Bracts, linear-oblong. Calyx usually 4–6 mm; corolla white or mauve, villose within; all filaments glabrous. Capsules ovoid, 3–4 mm.

Flowers & Fruits: September – February

Exiccatus: Gajoldoba, *Anurag & AP Das 0152*, dated 12.09.2010; Doumahoni Beel, *Anurag & AP Das 0737*, dated 03.09.2014.

Status: Common.

Local Distribution: Throughout the study area

General Distribution: India, tropical & warm-temperate part of world, Australia.

DOPATRIUM Buchanan-Hamilton, Edwards's Botanical Register 21. 1835

Dopatrium junceum (Roxburgh) Buchanan-Hamilton in Bentham, Scroph. Ind.31. 1835; Hooker *f*, Fl. Brit. Ind.4: 274. 1884; Prain, Beng. Pl. 2: 766. 1903. *Gratiola juncea* Roxburgh, Pl. Cor. 2: 61. t. 129. 1798. Grierson & Long, Fl. Bhut. 2(3): 1114. 2001.

Slender fleshy erect, succulent herbs, branched from base, lower portion swollen and spongy. Leaves opposite; lamina sessile, lower ones oblong or obovate, entire, obtuse or sub-acute, upper ones much

smaller. Flowers in opposite distinct pairs, shortly stalked; corolla white, light violet towards base. Capsules globose; seeds minute, tuberculate.

Flowers & Fruits: August – November

Exiccatus: Gajoldoba, **Anurag & AP Das 0150**, dated 12.09.2010.

Status: Common.

Local Distribution: Throughout the study area.

General Distribution: India, Sri Lanka, Malayan Islands, China, Japan, Philippines and Australia.

LIMNOPHILA R. Brown, Prodr. Fl. Nov. Hollandiae 442. 1810

Key to the Species:

- 1a. Leaves dimorphic, lower leaves filiform 5
- 1b. leaves monomorphic; leaves sessile or sub-sessile 2
- 2a. Petals 6 – 10 mm long *L. repens*
- 2b. Petals 10 – 18 mm long 3
- 3a. Plant glabrous; flower solitary or in leafy spike 4
- 3b. Plant pubescent; flower solitary *L. sessiliflora*
- 4a. Leaf blade sessile, linear – lanceolate *L. heterophylla*
- 4b. Leaf blade petiolate, ovate – lanceolate *L. rugosa*
- 5a. Flower pedicillate *L. indica*
- 5b. Flower sessile or sub-sessile *L. aromatica*

Limnophila aromatica (Lamarck) Merrill, Interpr. Herb. Amboin. 466. 1917; Cook, Aqua. Wetl. Pl. Ind. 344. 1996. *Ambulia aromatica* Lamarck, Encycl. 1: 128. 1783. [PLATE 4.6. Figs. 24]

Helophyte; glabrous or glandular, annuals or perennials herbs. Leaves opposite or in whorls, sessile; lamina ovate-lanceolate to lanceolate-elliptic. Flowers solitary in leaf axils or in terminal or axillary racemes. Bracteoles linear to linear-lanceolate; calyx glabrous or glandular pubescent; corolla white or blue-purple, sparsely and finely glandular; style apex dilated, stigma short.

Flowers & Fruits: February – October

Exiccatus: Doumahoni Beel, **Anurag & AP Das 0208**, dated 02.02.2011.

Status: Abundant.

Local Distribution: Throughout the study area.

General Distribution: India, Bhutan, China, Indonesia, Japan, Korea, Laos, Philippines, Vietnam, Australia.

Limnophila heterophylla (Roxburgh) Benth, Scroph. Ind. 25. 1835; Hooker *f*, Fl. Brit. Ind. 4: 270. 1884; Prain, Beng. Pl. 2: 764. 1903; Islam Fl. Majuli 223. 1990; Cook, Aqua. Wetl. Pl. Ind. 346. 1996. *Columnea heterophylla* Roxburgh, Fl. Ind. 3: 97. 1832. *Limnophila reflexa* Benth, Scroph. Ind. 25. 1835. [PLATE 4.6. Figs. 25]

Almost submerged, glabrous herbs. Aerial upper leaves sessile; lamina oblong-lanceolate, semiplexicaule; lower ones whorled, pinnatisect; submerged ones whorled, ca 2.5 cm long pinnatifid into filiform

segments. Flowers pinkish blue, axillary, solitary or in terminal leafy spikes, sessile or sub-sessile. Calyx ca 0.3 cm long, lobes acuminate, glandular; corolla ca 0.6 cm long, tubular, hairy inside. Capsules compressed spherical, pale brown.

Flowers & Fruits: October – February

Exiccatus: Mahananda Barrage, **Anurag & AP Das 0291**, dated 26.11.2011.

Status: Abundant.

Local Distribution: Throughout the study area

General Distribution: India (northern part & all Bengal), Native to tropical Asia.

Limnophila indica (Linnaeus) Druce, Rep. Bot. Exch. Club. Brit. Is. 3: 420. 1914; Datta, Bull. Bot. Soc. Beng. 29: 5. 1975; Cook, Aqua. Wetl. Pl. Ind. 346. 1996. *Hottonia indica* Linnaeus, Syst. Nat. ed. 10. 919. 1759 et. St. Pl. ed. 2: 208. 1762. *Limnophila gratioloides* R. Brown, Prodr. Fl. Nov. Holland. 442. 1810; Hooker f., Fl. Brit. Ind. 4: 271. 1884; Prain, Beng. Pl. 2: 764. 1903.

[PLATE 4.6. Figs. 23]

Submerged herbs. Stem much branched, slender, pubescent or hirsute; rooting from lower nodes, striate. Leaves whorled, sometime opposite; lamina oblong. Flowers solitary, axillary or in terminal racemes, pedicels short or long; bracteoles linear-subulate. Corolla white or pinkish or pale-purple or bluish, bilabiate, upper lip outside in bud, suberect, lobes rounded; lower lip spreading, lobes acute, tube yellow; stamens 4, didynamous; anther cells usually separate and stipate. Capsules broadly ellipsoid or globose. Seeds truncate.

Flowers & Fruits: July – March

Exiccatus: Gossaihat Beel, **Anurag & AP Das 0269**, dated 14.07.2011.

Status: Common.

Local Distribution: Throughout the study area.

General Distribution: India, Malaya Island, China, Australia, Tropical Africa and Baluchistan.

Limnophila repens Bentham in A.P. de Candolle, Prodr. 10: 387. 1846; Miquel, Fl. Ind. Bat. 2: 680. 1857; Cook, Aqua. Wetl. Pl. Ind. 349. 1996. *Limnophila sessilis* (Bentham) Fischer, Bull. Misc. Inf. Kew 62. 1962. *Limnophila conferta* Bentham in A.P. de Candolle, Prodr. 10: 367. 1845; Hooker f., Fl. Brit. Ind. 4: 266. 1884; Prain, Beng. Pl. 2: 764. 1903; Grierson & Long, Fl. Bhut. 2(3): 1112. 2001.

Annual herbs; stems erect or procumbent, often branched, glabrous. Leaves opposite; lamina narrowly elliptic-lanceolate. Flowers in axillary cymes, short pedicellate, bi-bracteolate. Calyx hirsute or hispid to sub glabrous. Corolla white to mauve, glabrous without adaxial lip sub-truncate. Stamens glabrous. Capsules ovoid brown.

Flowers & Fruits: November – February

Exiccatus: Mahananda Barrage, **Anurag & AP Das 0308**, dated 26.11.2011; Gajoldoba, **Anurag & AP Das 0720**, dated 03.09.2014.

Status: Rare.

Local Distribution: Only in two wetlands of the study area.

General Distribution: India, Sri Lanka.

Limnophila rugosa (Roth) Merrill, Interpr. Herb. Amboin. 466. 1917; Cook, Aqua. Wetl. Pl. Ind. 349. 1996. *Herpestis rugosa* Roth, Nov. Pl. Sp. 290. 1821.

[PLATE 4.6. Figs. 22]

Perennials herbs. Leaves opposite; lamina ovate, rhomboid-elliptic, adaxially glabrous or sparsely hispidulous, crenate. Bracts subspatulate-oblong. Flowers axillary, solitary, sessile; bracteoles absent; calyx 6-8 mm; corolla purple-red to blue; style slender, apically cylindrical, pubescent. Capsules pale brown, ovoid.

Flowers & Fruits: August – November

Exiccatus: Gossaihat Beel, **Anurag & AP Das 0274**, dated 14.07.2011; Kathambari Beel, **Anurag & AP Das 0723**, dated 03.09.2014.

Status: Rare.

Local Distribution: Only in two wetlands of the study area.

General Distribution: India, Bhutan, China, Indonesia, Japan, Philippines, Vietnam, Australia.

Limmophila sessiliflora (Vahl) Blume, Bijdr. 750. 1826; Hooker f., Fl. Brit. Ind. 4: 270. 1884; Prain, Beng. Pl. 2: 764. 1903; Kanjilal *et al.*, Fl. Ass. 3: 379. 1939; Cook, Aqua. Wetl. Pl. Ind. 350. 1996. *Hottonia sessiliflora* Vahl, Symb. Bot. 2: 36. 1791.

Slender pubescent herbs. Leaves whorled, sessile, lobular or pinnatisect; upper ones opposite, elliptic-lanceolate, crenate-serrate, acute. Flowers ca 1.2 cm long, sessile, axillary, solitary; bracts linear; calyx ca 0.4 cm long, hirsute; corolla ca 1.1 cm long, pale purple, cylindrical. Capsules subglobose.

Flowers & Fruits: September – February

Exiccatus: Mahananda Barrage, **Anurag & AP Das 0649**, dated 13.11.2013; Gajoldoba, **Anurag & AP Das 0738**, dated 03.09.2014.

Status: Common.

Local Distribution: Throughout the study area.

General Distribution: India, Japan, Java, Sri Lanka.

MECARDONIA Ruiz & Pavon, Fl. Peruv. Prodr. 95. 1794.

Mecardonia procumbens (Miller) Small. Fl. Southerest U.S. 1065: 1838. 1903; D Arey in Ann. Miss. Bot. Gard. 66. 240. 1979; Guha Bakshi, Fl. Mur. Dist 229. 1984. *Herpestris chamaedroides* Humboldt, Bonpland & Kunth, Nov. Gen. Sp. 2: 369; Prain, Beng. Pl. 2: 765. 1903; Mooney, Suppl. Bot. Bihar and Orissa 95, 256. 1950.

Stems 10 – 15 cm, rather rigid, prostrate, with ascending tips. Lamina ovate, serrate. Corolla yellow, tube pubescent, upper lip obovate. Capsules ovoid to ellipsoid. Seeds ellipsoid.

Flowers & Fruits: September – March

Exiccatus: Mahananda Barrage, **Anurag & AP Das 0640**, dated 13.11.2013.

Status: Common.

Local Distribution: Throughout the study area.

General Distribution: India, Native to America.

MICROCARPAEA R. Brown, Prodr. Fl. Nov. Holland. 435. 1810.

Microcarpaea minima (Retzius) Merrill, Philip. Jour. Sc. Bot. 7: 1912; Grierson & Long, Fl. Bhut. 2(3): 1126. 2001. *Microcarpaea muscosa* R. Brown. Prodr. Fl. Nov. Holland. 436. 1810. *Ammannia dentelloides* Kurtz, Jour. As. Soc. Beng. 39(2): 76. 1876.

Aquatic, submerged, very small, prostrate, glabrous herbs. Leaves opposite; lamina sessile, oblong, obtuse. Flowers minute, axillary, solitary, sessile. Sepals 5, connate; petals 5, connate, tubular; stamens 2, perfect, filament filiform, anthers one celled; carpels connate; ovary 2 celled, style filiform; stigma recurved. Capsules 2 grooved with persistent calyx; seeds ovoid, few.

Flowers & Fruits: November – January

Exiccatus: Mahananda Barrage, **Anurag & AP Das 0315**, dated 26.11.2011; Gajoldoba, **Anurag & AP Das 0746**, dated 03.09.2014.

Status: Common.

Local Distribution: Throughout the study area.

General Distribution: India, Bhutan, Bangladesh.

SCOPARIA Linnaeus, Syst. ed. 4, 87. 1748.

Scoparia dulcis Linnaeus, Sp. Pl. 116. 1753; Hooker *f.*, Fl. Brit. Ind. 4: 289. 1884; Prain, Beng. Pl. 2: 772. 1903; Haines, Bot. Bihar & Orissa pt. IV: 637. 1922; Guha Bakshi, Fl. Mur. Dist. 229. 1984; Panda & Das, Fl. Sambalp. 257. 2004.

Annual to perennial erect, bushy, woody herbs; lamina linear-oblongate, narrowly elliptic or narrowly obovate, serrate distally, subacute. Racemes with many flowered; Pedicels filiform. Corolla white, glabrous outside, with dense tuft of long silky white hairs surrounding stamens. Capsules yellowish-brown, glabrous. Seeds brown.

Flowers & Fruits: June – May

Exiccatus: Mahananda Barrage, **Anurag & AP Das 0052**, dated 12.05.2010.

Status: Abundant.

Local Distribution: Throughout the study area.

General Distribution: Tropical Asia, Africa, and America.

VERONICA Linnaeus, Sp. Pl. 2. 1753

Veronica anagallis-aquatica Linnaeus, Sp. Pl. 12: 1753; Hooker *f.*, Fl. Brit. Ind. 4: 293. 1884. *Veronica punctata* Buchanan - Hamilton Don. Prod. 93. 1825; Prain, Beng. Pl. 2: 773. 1903.

Annual, erect, glabrous, herbs. Stems hollow, lower ones creeping. Leaves sessile or short stalked; lamina triangular oblong-lanceolate, serrate. Flowers in axillary racemes. Corolla white. Capsules compressed, orbicular.

Flowers & Fruits: November – January

Exiccatus: Mahananda Barrage, **Anurag & AP Das 0316**, dated 26.11.2011.

Status: Less common.

Local Distribution: Found in one or two wetlands of the study area.

General Distribution: India, Europe, N. America and all warm & temperate region of World.

VERBENACEAE J. St. Hilaire, Expos. Fam. Nat. 1: 245. 1805

Key to the Genera:

- 1a. Herb; flower in long dense globose *Phyla*

1b. Bushy shrub; flower in long dense head, axillary *Lippia*

LIPPIA Linnaeus, Sp. Pl. 2. 1753

Lippia javanica (Burman f.) Sprengel, Syst. 2: 752. 1825. *Verbena javanica* Burman f., Fl. Ind. 12. t. 6, f. 2. 1768. *Lippia geminata* Humboldt, Bonpland & Kunth, Nov. Gen. et Sp. 2: 266. 1818; Hooker f., Fl. Brit. Ind. 4: 563. 1885. Haines, Bot. Bihar & Orissa pt. IV: 706. 1922; Mooney, Suppl. Bot. Bihar & Orissa. 120: 1950.

Small pubescent shrubs; branches slender erect or sub-erect. Leaves opposite, lamina ovate-elliptic to ovate or elliptic-oblong, finely crenate-serrete, acute, truncate to cuneate at base. Heads axillary, bracts pubescent, lower ones broad, higher ones becoming smaller and narrower. Fruits globose.

Flowers & Fruits: January – August

Exiccatus: Gajoldoba, **Anurag & AP Das 0366**, dated 08.03.2012; Kathambari Beel, **Anurag & AP Das 0749**, dated 03.09.2014.

Status: Common.

Local Distribution: Found in the marginal side of few wetlands of the study area

General Distribution: Pantropical.

PHYLA Loureiro, Fl. Cochinch. 1.1790

Phyla nodiflora (Linnaeus) Greene in Pittonia 4: 46. 1899; Guha Bakshi, Fl. Mur. Dist. 250. 1984. *Verbena nodiflora* Linnaeus, Sp. Pl. 20. 1753. *Lippia nodiflora* (Linnaeus) Michaux, Fl. Bor. Amer. 2: 15. 1803; Hooker f., Fl. Brit. Ind. 4: 563. 1885. Haines, Bot. Bihar & Orissa pt. IV: 706. 1922; Mooney, Suppl. Bot. Bihar & Orissa. 120: 1950.

Annual creeping herbs; strongly aromatic. Lamina cuneate-spathulate, serrate, fleshy. Flowers small, sessile, numerous in dense globose, axillary peduncled heads. Corolla bilabiate, white or purple; stamens 4, didynamous. Drupes globose, enclosed by calyx.

Flower & Fruits: January – August

Exiccatus: Doumahoni Beel, **Anurag & AP Das 0207**, dated 02.02.2011; Doumahoni Beel, **Anurag & AP Das 0488**, dated 12.06.2013.

Status: Common.

Local Distribution: Found in the marginal side of few wetlands of the study area.

General Distribution: Pantropical.

Order: Solanales

CONVOLVULACEAE A. Jussieu, Gen. Pl. 132. 1789; *nom. cons.*

Key to the Genera:

- 1a. Parasitic plants, yellowish green, twiner *Cuscuta*
- 1b. Non parasitic 2
- 2a. Capsule densely pubescent *Dichondra*
- 2b. Capsule finely pubescent or glabrous 3

- 3a. Prostrate, stem solid *Evolvulus*
 3b. Climber; stem hollow *Ipomoea*

DICHONDRA J.R. Forst. & G. Forster, Char. Gen. Pl., ed. 2. 39. 1776

Dichondra repens J.R. & G. Foster, Bot. Bihar & Orissa 4: 584. 1922; Grierson & Long, Fl. Bhut. 2(2): 861. 1999.

Stem procumbent, forming extensive mats, rooting at nodes, appressed hairs. Petioles longer than lamina; lamina reniform to cordate-orbicular, usually 7 veined from base, densely and minutely papilose above, hirsute with relatively long hairs beneath, axillary peduncles. Corolla whitish-green, hairy. Capsule lobes dark brown, hairy.

Flowers & Fruits: April– June

Exiccatus: Gossaihat Beel, *Anurag & AP Das 0429*, dated 07.08.2012.

Status: Common.

Local Distribution: Throughout the study area.

General Distribution: Wide distribution in both hemispheres.

EVOLVULUS Linnaeus, Sp. Pl. ed. 2. 1763

Evolvulus nummularius (Linnaeus) Linnaeus, Sp. Pl. (ed. 2) 391. 1762; Mooney, Suppl. Bot. Bihar & Orissa 91. 1950; Guha Bakshi, Fl. Mur. Dist. 208. 1984; Panda & Das, Fl. Sambalp. 236. 2004.

Prostrate or creeping herbs; rooting from nodes. Lamina ovate to orbicular, apex rounded; Flowers axillary, solitary, corolla white; style bifid, Capsule globose, 4 valved.

Flowers & Fruits: March – December

Exiccatus: Kathambari Barage, *Anurag & AP Das 0661*, dated 03.09.2014.

Status: Abundant.

Local Distribution: Throughout the study area.

General Distribution: India, Tropical Africa, Madagascar, Malaya Peninsula, Mexico and West Indies.

IPOMOEA Linnaeus, Sp. Pl. ed. 2. 1763

Key to the Species:

- 1a. Erect large shrub; stem fistular *I. carnea*
 1b. Climber, herbaceous twiner; stem soft *I. aquatica*

Ipomoea aquatica Forsskal, Fl. Aegypt. Arab. 44. 1775; Hooker f., Fl. Brit. Ind. 4: 210. 1883; Majumder, Bull. Bot. Soc. Bengal 19: 13. 1965; Guha Bakshi, Fl. Mur. Dist. 210. 1984. Bora *et* Kumar in Flor. Div. Assam, 229. 2003. *Ipomoea reptans* Poiret in Lamarck, Suppl. 3: 460. 1814; Prain Beng. Pl. 2: 547. 1903.

VernacularName: *Kolmi-Shak*

Aquatic trailing herb; rooting at nodes; stem hollow. Lamina usually hastate, ovate-oblong, acute to acuminate. Flowers ca 6 cm long, solitary or in few flowered peduncled cymes; Sepals ca 0.6 cm. long, ovate-oblong; corolla pale purple. Capsule ovoid, globose.

Flowers & Fruits: August – February

Exiccatus: Mahananda Barrage, **Anurag & AP Das 0022**, dated 12.05.2010; Gajoldoba, **Anurag & AP Das 0673**, dated 03.09.2014.

Status: Abundant.

Local Distribution: Throughout the study area.

General Distribution: Throughout the India; Tropical Asia, Australia and Africa.

Ipomoea carnea Jacquin, Enum. Syst. Pl. 13. 1760; Haines, *l.c.* 60. 1922 ssp. *fistulosa* (Choisy) D. Austin in Taxon 26: 237. 1977; Panda & Das, Fl. Sambalp., 238. 2004. *Ipomoea fistulosa* C. Martius ex Choisy in A.P. de Candolle, Prodr. 9: 349. 1845.

VernacularName: *Dal-Kalmi*

Shrubs with milky juice, stem erect or ascending; young parts puberulent by age, glabrous. Lamina ovate-oblong, acuminate at apex, cordate at base; midrib below with 2 small glands at the base of the petiole. Inflorescences axillary and terminal; pedicels longer than the calyx; bracts minute, ovate, caduceous. Capsule pale-brown, finely pubescent at base, ovoid, mucronate, 4-celled, 4-valved. Seeds 4 or less, black sericeous.

Flowers & Fruits: August – March.

Exiccatus: Gossaihat Beel, **Anurag & AP Das 0428**, dated 17.08.2012.

Status: Abundant.

Local Distribution: Throughout the study area.

General Distribution: India, Native to America.

CUSCUTA Linnaeus, Sp. Pl. 1: 124. 1753

Cuscuta reflexa Roxburgh, Pl. Coromandel. 2: 3, t. 104. 1798; Prain Beng. Pl. 2: 723. 1903.

Stem yellow or yellowish green. Inflorescences racemes, few to many flowered; bracts and bractoles scalelike. Pedicel 2 – 3.5 mm. Sepals 5, broadly ovate. Corolla white, tubular. Stamens inserted. Ovary ovate. Capsule conical-globose. Seeds 1 – 4, dark brown, oblong.

Flowers & Fruits: July – February

Exiccatus: Mahananda Barrage, **Anurag & AP Das 0040**, dated 12.05.2010; Gajoldoba, **Anurag & AP Das 0656**, dated 03.09.2014.

Status: Rare.

Local Distribution: In one or two wetlands of the study area.

General Distribution: India, Nepal, Sri Lanka, China, Afghanistan, Indonesia, Malaysia, Myanmar, Pakistan, Thailand.

Notes: This plants sometimes found in parasitic condition on wetland marginal plants.

HYDROLEACEAE R. Brown ex Edwards, Bot. Reg. 7: 566. 1821

HYDROLEA Linnaeus, Gen. Pl. 6. 1764

Hydrolea zeylanica (Linnaeus) Vahl, Symb. Bot.2: 46. 1791; Hooker *f.*, Fl. Brit. Ind. 4: 133. 1883; Deb, Fl. Tripura 2: 310. 1983; Guha Bakshi, Fl. Mur. Dist. 202. 1984. Prain, Beng. Pl. 2: 528. 1903. Hajra *et al.*, Fl. Namdapha 224. 1996; Bora *et al.* Fl. Div. Ass., 220. 2003. *Nama zeylanica* Linnaeus, Sp. Pl. 226. 1753; Roxburgh Fl. Ind. 2: 73. 1824.

Annual aquatic herbs, erect, rooting from lower nodes, unarmed. Lamina lanceolate, narrow at the base, petioles up to 9 mm long, glandular – hairy. Flowers blue. Capsule up to 4 x 2 mm, ovoid – oblong, enclosed in the enlarged persistent sepals. Seeds brown, oblong or oval.

Flowers & Fruits: November – March

Exiccatus: Mahananda Barrage, **Anurag & AP Das 0605**, dated 13.11.2013.

Status: Abundant.

Local Distribution: Found in almost all the wetlands of the study area.

General Distribution: India, S. E. Asia, Malaya, Australia, Tropical Africa and America.

SOLANACEAE A. Jussieu, Gen. Pl. 124. 1789

Key to the Genera:

- 1a. Capsules dehiscent by separate valves 2
- 1b. Berries indehiscent 3
- 2a. Flower axillary, solitary; capsules armed ***Datura***
- 2b. Flowers in terminal panicles; capsules unarmed ***Nicotiana***
- 3a. Berries enveloped in bladder like calyx ***Physalis***
- 3b. Berries not enveloped by calyx..... ***Solanum***

DATURA Linnaeus, Sp. Pl. 1: 179. 1753

Key to the Species:

- 1a. Veins 3 – 5 pairs, Pedicel 6 – 12 mm, anthers 3-4 mm, seeds black ***D. stramonium***
- 1b. Veins 4 – 6 pairs, Pedicel 1 cm, anthers 1-1.1 cm, seeds pale brown ***D. metel***

Datura stramonium Linnaeus, Sp. Pl. 179. 1753; Hooker *f.*, Fl. Brit. Ind. 4: 242.. 1883; Bamber, Fl. Punj. 383. 1916; Parker, For. Fl. Punj. 371. 1918.

Vernacular name: *Dhutra*

Erect branched annual to biennial undershrubs, sometimes woody at base. Leaves long petiolate, lamina ovate to rhomboid or elliptic, dentate, base unequal, cuneate. Flowers solitary, axillary, erect; corolla white or purplish. Capsule ovoid, pericarp very sharply spiny. Seed black, slightly reniform.

Flower & Fruits: August – April

Exiccatus: Mahananda Barrage, **Anurag & AP Das 0075**, dated 12.05.2010; Doumahoni Beel, **Anurag & AP Das 0500**, dated 12.06.2013.

Status: Common.

Local Distribution: Throughout the study area

General Distribution: Temperate region of world.

Datura metel Linnaeus, Sp. Pl. 179. 1753; Grierson & Long, Fl. Bhut. 2(3): 1067. 2001. ***Datura alba*** F. Muell., Fragm. 6: 144. 1868.

Annual erect herbs. Stems often violet. Petiole 2 – 5 cm; lamina ovate to broadly ovate, membranous, glabrescent, base truncate or cuneate, margin irregularly sinuate-dentate, lobed, or entire, acuminate;

veins 4 – 6 pairs. Flowers erect. Pedicel ca. 1 cm. Calyx tubular. Corolla white, yellowish, or pale purple, funnel form, sometimes doubled or tripled, Anthers 1 – 1.1 cm. Capsules subglobose, tuberculate, irregularly 4-valved, subtended by remnants of persistent calyx. Seeds pale brown.

Flower & Fruits: May – December

Exiccatus: Doumahoni Beel, **Anurag & AP Das 0502**, dated 12.06.2013.

Status: Common.

Local Distribution: Throughout the study area.

General Distribution: Native of the Americas, long introduced and naturalized in Asia.

NICOTIANA Linnaeus, Sp. Pl. 1: 180. 1753

Nicotiana plumbaginifolia Viviani in Planchon, Pl. Hort. Dinegro, 26. t. 5, 1802; Hooker f., Fl. Brit. Ind. 4: 246. 1883; Prain, Beng. Pl. 2: 559. 1903; Guha Bakshi, Fl. Mur. Dist. 218. 1984.

Vernacular name: *Ban tamak*

Rosette annual herbs, becomes 0.7 – 1 m high on flowering. Leaves radical, sessile, up to 17 x 9 cm, obovate or spatulate, obtuse or rounded at apex; upper ones becoming smaller and passing into bracts, sessile, elliptic, elliptic lanceolate, oblong, acute or acuminate. Flowers in lax racemes. Pedicels 7 – 9 mm long. Capsules 0.7 – 1 cm long, oval, glabrous, 2 or 4 valved. Seeds dark brown.

Flower & Fruits: March – November

Exiccatus: Gajoldoba, **Anurag & AP Das 0114**, dated 12.09.2010; Doumahoni Beel, **Anurag & AP Das 0752**, dated 03.09.2014.

Status: Very common

Local Distribution: Throughout the study area

General Distribution: India; Native to Mexico and West Indies.

PHYSALIS Linnaeus, Sp. Pl. 2. 1753

Physalis minima Linnaeus, Sp. Pl. 183. 1753; Fl. Brit. Ind. 4: 238. 1883; Prain, Beng. Pl. 2: 750. 1903; Guha Bakshi, Fl. Mur. Dist. 219. 1984. *Physalis pubescent* Wight, IC. T. 166. 1838.

Erect, annual herbs. Lamina ovate, acute sinuate-toothed or lobulate, acuminate. Flowers yellow, solitary, on long slender deflexed pedicels; corolla often with small spot at base within. Berries completely enclosed by enlarged membranous 5 – 10 ribbed calyx. Seeds discoid or reniform.

Flower & Fruits: April – January

Exiccatus: Doumahoni Beel, **Anurag & AP Das 0499**, dated 12.06.2013; Mahananda Barrage, **Anurag & AP Das 0648**, dated 13.11.2013.

Status: Common.

Local Distribution: Throughout the study area

General Distribution: Pantropic.

SOLANUM Linnaeus, Sp. Pl. 2. 1753

Key to the Species:

- 1b. Herbs without spines, weak; ripe fruits black *S. americanum*
- 1a. Herbs or shrubs with spines 2
- 2a. Plants prostrate; ripe fruits yellow *S. surattense*
- 2b. Plants erect 3

3a. Leaves entire, lobulated; corolla blue; ripe fruits small, yellowish *S. torvum*

3b. Leaves highly dissected, corolla white; ripe fruits crimson red *S. sisymbriifolium*

Solanum torvum Swartz, Prodr. 47. 1788; Hooker *f.*, Fl. Brit. Ind. 4: 234. 1883; Prain, Beng. Plants 2: 746. 1903; Grierson & Long, Fl. Bhut. 2(3): 1053. 2001.

Armed shrubs, branches densely stellate-pubescent when young, prickles few, usually confined to stems and mid-veins. Leaves ovate with deeply 2 – 3 sinuate, lobes acute. Cymose panicle pedunculate, dense, extra-axillary, corymbose. Corolla bluish; anthers yellow. Young berries green, turning bright yellow, glabrous. Seeds pale olive, almost smooth.

Flower & Fruits: November – March

Exiccatus: Doumahoni Beel, **Anurag & AP Das 0213**, dated 0.02.2011; Kathambari Beel, **Anurag & AP Das 0760**, dated 03.09.2014.

Status: Common.

Local Distribution: Throughout the study area

General Distribution: Tropical India, China, Malaysia, Philippines and Tropical America.

Solanum americanum Miller, Gard. Dict. (ed. 8) no. 5. 1768. *Solanum nigrum* Linnaeus, Sp. Pl. 183. 1783. Hooker *f.*, Fl. Brit. Ind. 4: 229. 1883; Haines, Bot. Bihar & Orissa pt. IV: 610. 1922; Mooney, Suppl. Bot. Bihar & Orissa 94. 1950; Guha Bakshi, Fl. Mur. Dist. 221. 1984; Panda & Das, Fl. Sambalp. 246. 2004.

Weak, branched erect herbs or under shrubs, annual to biennial. Leaves ovate-oblong, toothed and lobed. Flowers in extra-axillary drooping cymes; corolla white. filaments hairy at base. Berries globose, black and shiny on ripening.

Flower & Fruits: November – March

Exiccatus: Doumahoni Beel, **Anurag & AP Das 0501**, dated 12.06.2013.

Status: Common.

Local Distribution: Throughout the study area.

General Distribution: India, Tropical Africa, S. E. Asia, Australia, America.

Solanum surattense Burman *f.*, Fl. Ind. 7. 1768 (excl. syn. Pluk. *ex* Raj.). *S. xanthocarpum* Schard. *ex* Wendl., Sert. 1; 8, t. 2. 179; Clarke, l. c. 236. 1883; Panda & Das, Fl. Sambalp. 246. 2004.

Prostrate or diffuse, much prickly annual herbs, pubescent; prickles yellow. Lamina pinatifid, prickly, acute at both end, petiole pubescent. Flowers in extra-axillary cymes; corolla bluish-violet. Berries globose, yellow when ripe. Seed numerous, discoid.

Flower & Fruits: January – December

Exiccatus: Mahananda Barrage, **Anurag & AP Das 0642**, dated 13.11.2013; Doumahoni Beel, **Anurag & AP Das 0753**, dated 13.11.2013.

Status: Common.

Local Distribution: Throughout the study area

General Distribution: India, Tropical Asia, Australia, extending to Polynesia.

Solanum sisymbriifolium Lamark, Tab. Encyl. 2: 25. 1794; Prain, Beng. Plants 2: 746. 1903. Zhang *et al.*, Fl. China 17: 324. 1996.

Erect, bushy, much prickly, annual herbs. Cymes extra-axillary or terminal; corolla white. Berries small, globose, crimson red when ripe. Seeds numerous, discoid.

Flower & Fruits: January – December

Exiccatus: Doumahoni Beel, **Anurag & AP Das 0505**, dated 12.06.2013.

Status: Common.

Local Distribution: Throughout the study area

General Distribution: India, Tropical America; naturalized pantropically.

SPHENOCLEACEAE T. Baskerville, Affinities Pl. 110. 1839; *nom. cons.*

SPHENOCLEA Gaertner, Fruct. Sem. Pl. i. 113. t. 24. 1788

Sphenoclea zeylenica Gaertner, Fruct. 1:113. t. 24, f.5. 1788; Hooker *f.*, Fl. Brit. Ind.3: 438. 1881; Prain, Beng. Pl. 1: 467. 1903.

Erect, simple or branched annual, fleshy herbs. Stem terete, hollow, spongy. Lamina oblong or oblong-lanceolate. Spikes up to 4 cm long, compact; peduncles nearly as long as the spikes. Flowers bracteate, greenish; corolla white. Fruits elongated with overarching calyx. Seeds yellowish-brown, 0.3-0.5 mm long.

Flowers & Fruits: January – September

Exiccatus: Doumahoni Beel, **Anurag & AP Das 0495**, dated 12.06.2013; Kathambari Beel, **Anurag & AP Das 0756**, dated 03.09.2014.

Status: Common.

Local Distribution: Found in the marginal side of few wetlands of the study area.

General Distribution: India; throughout warmer regions of World.

Campanulids (Euasterids II)

Order: Asterales

ASTERACEAE Berchtold & J. Presl, Priir. Rostlin 254. 1820; *nom. alt.* [**COMPOSITAE** Giseke, *nom. cons.*]

Key to the Genera:

Major Groups

- 1a. Florets all ligulate **Group A**
 1b. All florets not ligulate 2
 2a. Inner florets all disc but ligulate ones in the margin **Group B**
 2b. Florets all discs **Group C**

Group A

- 1a. Plants tall; capitula in panicle **Sonchus**
 1b. Plants small; capitula solitary on an erect peduncle **Launea**

Group B

- 1a. Heads compound, i.e. composed of many very small few-flowered units 2
- 1b. Capitula simple, i.e. not composed of many few-flowered units 4
- 2a. A rosette plant with all leaves radical; one head on an erect peduncle; lamina not dissected
..... ***Elephantopus***
- 2b. Plants with elongated prostrate stem with cauline leaves; lamina deeply dissected ... 3
- 3a. Heads discoid, small, yellow ***Grangea***
- 3b. Heads oblong, larger, purple ***Sphaeranthus***
- 4a. Normal leaves in basal rosette 5
- 4b. Leaves not in basal rosette 11
- 5a. Capitula almost sessile, touching or half-embedded in soil ***Soliva***
- 5b. Capitula not sessile, produced on elongated shoot 6
- 6a. Lamina entire, spatulate or obovate or linear-oblong; plants white-hairy 7
- 6b. Lamina not entire 8
- 7a. Florets blackish-brown; lower lamina largely spatulate ***Gnaphalium***
- 7b. Florets yellow; lamina slightly spatulate to linear-oblong ***Pseudognaphalium***
- 8a. Lamina spinescent ***Cirsium***
- 8b. Plants not spinescent 9
- 9a. Flowering stem prostrate; capitula greenish ***Cotula***
- 9b. Flowering stem erect; capitula otherwise 10
- 10a. Capitula yellow, globose, aggregated, not drooping; involucre multilayered ***Blumea***
- 10b. Capitula violet, solitary on a long and slender branch of panicle, generally drooping ***Emilia***
- 11a. Leaves opposite on vegetative shoot 12
- 11b. Leaves alternate 16
- 12a. Plants herbaceous, annual or perennial..... 13
- 12b. Plants shrubby or climbing 15
- 13a. Tall erect annual; capitula discoid in terminal corymbose cyme ***Ageratum***
- 13b. Diffuse, much branched, lower stem prostrate; capitula solitary, axillary 14
- 14a. Capitula stalked; corolla bright white; cypsela black; pappus missing ***Eclipta***
- 14b. Capitula sessile; corolla dull greenish-white; cypsela not black; pappus scaly ***Enhydra***
- 15a. Large climber, stem green; capitula slender, few-flowered, dull white ***Mikania***
- 15b. Suffrutescent shrub, stem brown or green; capitula globose, many flowered, white ***Eupatorium***
- 16a. Capitula unisexual; female florets only 2; involucre in fruit with numerous hooked spines.. ***Xanthium***
- 16b. Capitulum not unisexual 17
- 17a. Stem weak, prostrate or trailing 18

- 17b. Stem erect 19
- 18a. Capitulum axillary-sessile, enclosed in sheathing leaf base; lamina linear-lanceolate ... *Caesulia*
- 18b. Capitulum short-stalked, not enclosed in leaf base; lamina obovate with few deep serrations ... *Centipeda*
- 19a. Lamina deeply dissected *Athroisma*
- 19b. Lamina serrate 20
- 20a. Capitula terminal but solitary or very few, discoid-globose; lamina regularly and prominently serrate *Thespis*
- 20b. Capitula in terminal crowded clusters, stalked, ovate-oblong; lamina irregularly and shallowly serrate to nearly entire *Cyanthillium*

Group C

- 1a. Plants rosette 2
- 1b. Plants not rosette 3
- 2a. Basal leaves large, deeply pinnatifid; all florets white *Parthenium*
- 2b. Basal leaves small, linear, nearly entire; rays yellow *Ixeris*
- 3a. Leaves alternate; linear to linear-spathulate; whole plant softly hairy *Erigeron*
- 3b. Leaves opposite 4
- 4a. Capitula white, globose, involucre and cypsella glandular-hairy..... *Adenostemma*
- 4b. Capitula yellow; receptacle and so the capitulum conical 5
- 5a. Plants erect, much hairy; involucre glandular-hairy *Galinsoga*
- 5b. Plants with procumbent or semi-erect branches, glabrous; involucre not glandular *Acmella*

AGERATUM Linnaeus, Sp. Pl. 2: 839. 1753

Key to the Species:

- 1a. Leaf base obtuse or broadly cuneate, corolla white *A. conyzoides*
- 1b. Leaf base cordate or truncate, corolla purplish *A. houstonianum*

Ageratum conyzoides Linnaeus, Sp. Pl. 839. 1753, Hooker *f.*, Fl. Brit. Ind. 3: 243. 1881; Prain, Beng. Pl. 1: 591.1903 Guha Bakshi, Fl. Mur. Dist. 160. 1984. Hajra *et al.* Fl. Ind. 12: 348. 1995; Grierson & Long, Fl. Bhut. 2(3): 1627. 2001.

Erect annuals to 95 cm high, pilose herbs. Lamina ovate, ovate-rhomboid, crenate- serrate, obtuse – acute, base cuneate, 3-nerved. Capitula discoid, all discs, white. Involucral bracts, lanceolate. Achenes blackish-brown; pappus scales 5, flattened at base.

Flowers & Fruits: January – December

Exiccatus: Mahananda Barrage, *Anurag & AP Das 0018*, dated 12.05.2010; Doumahoni Beel, *Anurag & AP Das 0666*, dated 03.09.2014.

Status: Abundant.

Local Distribution: Throughout the study area.

General Distribution: Pantropical.

Ageratum houstonianum Miller, Gard. Dict., ed. 8. 1768; Grierson & Springate, Fl. Bhut. 2(3): 1627. 2001; A.P. Das, Jour. Econ. Tax. Bot. 26(1): 33. 2002.

Erect annual herbs. Lamina broadly ovate or triangular-ovate; base cordate or truncate, margin crenate-serrate, apex rounded or acute; Corymbose, 2 – 4 cm in diam.; peduncle densely pubescent or powdery pubescent. Capitula 5 – 15 or more; involucre campanulate, Achenes black, 5- angled.

Flowers & Fruits: January – December

Exiccatus Mahananda Barrage, **Anurag & AP Das 0035**, dated 12.05.2010; Doumahoni Beel, **Anurag & AP Das 0670**, dated 03.09.2014.

Status: Abundant.

Local Distribution: Throughout the study area.

General Distribution: India, Nepal, China, Myanmar, Thailand, Africa

ATHROISMA A.P. de Candolle in Guillem. Arch. Bot. (Paris) 2: 516. 1833

Athroisma laciniatum A.P. de Candolle, Prodr. 5: 369. 1836; Hooker *f.*, Fl. Brit. Ind. 3: 276. 1881; Prain, Beng. Pl. 1: 601. 1903.

Marshy, annual, erect, glabrous herbs. Leaves alternate, lamina pinnatifid, toothed. Heads in globose or terminal clusters, sessile. Involucral bracts elliptic. Ray florets with filiform corolla. Achenes black, compressed. Pappus of two minute scales.

Flowers & Fruits: April – August

Exiccatus: Mahananda Barrage, **Anurag & AP Das 0048**, dated 12.05.2010.

Status: Rare.

Local Distribution: Found in only one places.

General Distribution: India, Indonesia, Malaysia.

BLUMEA A.P. de Candolle, in Guill., Arch. Bot. (Paris) ii. 514. 1833; *nom. cons.*

Key to the Species:

- 1a. Rosette herb; involucre 5-seriate *B. lacera*
 1b. Erect herb; involucre 4 – 5 seriate *B. hieracifolia*

Blumea hieracifolia (D. Don) A.P. de Candolle in Wight, Contrib. Bot. Ind. 15. 1834; Hooker *f.*, Fl. Brit. Ind. 3: 263. 1881; Prain, Beng. Pl. 1: 598. 1903; Hara, Fl. Easter. Himal. 1: 333. 1966; 2: 134. 1971; Hajra *et al.*, Fl. Ind. 13: 125. 1995; Grierson & Long, Fl. Bhut. 2(3): 1502. 2001. *Erigeron hieraciifolium* D. Don, Prodr. Fl. Nep. 172. 1825. *B. sericans* Hooker *f.*, Fl. Brit. Ind. 3: 262. 1881.

Erect herbs, 25 – 70 cm tall, densely villous; usually unbranched or few branches at tip. Leaves cauline, sessile; Lamina pubescent, elliptic-oblong, serrate-dentate, acute, silky. Capitula globose, fascicled. Involucral bracts lanceolate to oblanceolate. Outer florets female. Achenes oblong, hairy, brown. Pappus white.

Flowers & Fruits: April – September

Exiccatus: Gajoldoba, **Anurag & AP Das 0669**, dated 03.09.2014.

Status: Common.

Local Distribution: Throughout the study area.

General Distribution: Subtropical-temperate regions of Nepal, India, Myanmar, Bangladesh, China, S.E. Asia, Philippines, New Guinea, Australia.

Blumea lacera (Burman f.) A.P. de Candolle in Wight, Contrib. Bot. Ind. 14. 1834; Hooker f., Fl. Brit. Ind. 3: 263. 1881; Prain, Beng. Pl. 1: 598. 1903; Guha Bakshi, Fl. Mur. Dist. 161. 1984; Hajra *et al.*, Fl. Ind. 13: 128. 1995; Grierson & Long, Fl. Bhut. 2(3): 1504. 2001. *Conyza lacera* Burman f., Fl. Ind. 180. t. 59. f. 1. 1768.

Vernacular Name: *Kukur sunga*

Annual rosette herbs, strongly aromatic. Lamina pinnatisect, terminal lobe obovate or oblanceolate, acute. Involucres 5-seriate; all linear. Receptacle pubescent; florets all disc; corolla yellow. Pappus white.

Flowers & Fruits: March – June

Exiccatus: Gajoldoba, **Anurag & AP Das 0368**, dated 08.03.2012; Doumahoni Beel, **Anurag & AP Das 0479**, dated 12.06.2013.

Status: Abundant.

Local Distribution: Throughout the study area.

General Distribution: India, Nepal, Bhutan, China, Sri Lanka, Australia, Tropical Africa.

CAESULIA Roxburgh, Pl. Coromandel i. 64. t. 93. 1759

Caesulia axillaris Roxburgh, Pl. Cor. 1: 64. t. 93. 1798 & Hort. Beng. 62: 1814; Hooker f., Fl. Brit. Ind. 3: 291. 1881; Prain, Beng. Pl. 2: 227. 1903.

Vernacular name: *Keneghas*

Glabrous, marshy, erect or procumbent herbs. Leaves alternate; Lamina narrow, lanceolate, entire, acuminate. Heads sessile, axillary, half embedded amplexicaule leaf-base; flowers white, small tubular. Achenes flat. Pappus absent.

Flowers & Fruits: October – February

Exiccatus: Mahananda Barrage, **Anurag & AP Das 0321**, dated 26.11.2011.

Status: Common.

Local Distribution: Throughout the study area.

General Distribution: India, Bangladesh.

CENTIPEDA Loureiro, Flora Cochinchinensis 1790

Centipeda minima (Linnaeus) A. Brown & Ascherson, Ind. Sem. Fl. Berol. App. 6: 1867. *Artemosoa minima* Linnaeus, Sp. Pl. 849. 1753. *C. orbicularis* Loureiro, Fl. Cochinch. 493. 1790; Hooker f., Fl. Brit. Ind 3; 317. 1881. Prain, Beng. Pl. 1: 620. 1903.

Annual, prostrate herbs. Stem sparsely araneous and glandular. Lamina oblanceolate or spatulate, 3 – 7 toothed, acute, somewhat fleshy. Phyllaries oblong, capitula green; flowers yellowish. Cypsela including corona, puberulous and sessile – glandular.

Flowers & Fruits: Throughout the year

Exiccatus: Mahananda Barrage, **Anurag & AP Das 0060**, dated 12.05.2010; Kathambari Beel, **Anurag & AP Das 0695**, dated 03.09.2014.

Status: Very Common.

Local Distribution: Throughout the study area.

General Distribution: India; Africa, Asia, Australia.

CIRSIUM P. Miller, Gard. Dict. Abr., ed. 4. 1754

Cirsium arvense (Linnaeus) Scopoli, Fl. Carn. 2: 126. 1772; Guha Bakshi, Fl. Mur. Dist. 164. 1984; Fl. Ind. 12: 155. 1995. *Cnicus arvensis* (Linnaeus) Roth. Catalecta Bot. 1: 622. 1903; Hooker f., Fl. Brit. Ind. 3: 362. 1881.

Vernacular Name: *Borakata*

Erect 30 – 80 cm herbs; root stock creeping, stem sparsely araneous. Lamina oblanceolate in outline with 4 – 6 pairs of spine-fringed lobes. Capitula several, cymose. Phyllaries sparsely araneous, acuminate; male and female flowers in separate plants; corolla purplish-pink. Pappus white or stramineous.

Flowers & Fruits: January – March

Exiccatus: Doumahoni Beel, *Anurag & AP Das 0177*, dated 02.02.2011; Gajoldoba, *Anurag & AP Das 0345*, dated 08.03.2012.

Status: Rare.

Local Distribution: Distributed in one or two places.

General Distribution: India, Sri Lanka, Java, Malaysia, Western Polynesia.

COTULA Linnaeus, Sp. Pl. 2. 1753

Key to the Species:

- 1a. Cypsella of disc florets not winged *C. hemisphaerica*
- 1b. Cypsella of disc florets winged *C. anthemoides*

Cotula anthemoides Linnaeus, Sp. Pl. 891. 1753; Hooker f., Fl. Brit. Ind. 3: 316. 1881; Prain, Beng. Pl. 1: 620. 1903.

Much branched herbs, sub glabrous. Lamina segments sub-acute with very short hyaline tip; phyllaries pale brown. Capitula at anthesis 2 – 5 mm in diameter, often subsessile. Involucre bi-seriate; female florets 5 – 6 seriate; disc flowers with thin wing around ovary and vestigial corolla. Cypsella pale, with thickened wing.

Flowers & Fruits: December – March

Exiccatus: Mahananda Barrage, *Anurag & AP Das 0585*, dated 13.11.2013.

Status: Rare.

Local Distribution: It is only found in one place.

General Distribution: India, China, N & S Africa.

Cotula hemisphaerica (Roxburgh) Wallich ex Clarke, Comp. Ind. 150. 1876; Prain, Beng. Pl. 1: 620. 1903. *Artemisia hemisphaerica* Roxburgh, Fl. Ind. ed. 2, 3: 422. 1832. Hooker f., Fl. Brit. Ind. 3: 316. 1881.

Annual, prostrate to semi-erect much branched herbs. Lower lamina 1 – 2 pinnatisect, obovate in outline, primary segments 2 – 6 pairs, ultimate segments narrowly oblong or linear, Upper leaves smaller, usually 1-pinnatisect. Capitula at anthesis 2 – 5 mm in diameter, often sub-sessile. Involucre biseriate, female florets 5 – 6 seriate, without corollas; Cypsela angled, not winged.

Flowers & Fruits: January – March

Exiccatus: Gajoldoba, **Anurag & AP Das 0359**, dated 08.03.2012.

Status: Common.

Local Distribution: Throughout the study area.

General Distribution: India, China and Japan.

ECLIPTA Linnaeus, Mant. Pl. Altera, 157. 1771. *nom. cons.*

Eclipta prostrata (Linnaeus) Linnaeus, Mart 2: 286. 1753, ed. 2; 1227. 1763; Santapou, Jour. Bombay. Nat. Hist. Soc. 54: 475 – 476. 1957 & Bull. Bot Surv. India 3: 16. 1961; Das & Panda, Fl. Sambalp. 187. 2004. *Verbesina prostrata* Linnaeus, Sp. Pl. 902. 1753. *Eclipta alba* (Linnaeus) Hasskarl, Pl. Jav. Rav. 528. 1848; Clarke, Comp. India. 134. 1876; Hooker *f.*, Fl. Brit. Ind. 3: 304. 1881; Prain, Beng. Pl. 1: 610. 1903; Bot. Bihar & Orissa 4: 480. 1992. Guha Bakshi, Fl. Mur. Dist. 165. 1984. *Eclipta alba* Linnaeus *ex* B.D. Jackson, Index Linn. Herb. 71. 1912.

Vernacular Name: *Keshut*

Erect or prostrate, rough, diffuse, variable annual herbs. Stems often rooting from nodes. Leaves opposite, lamina elliptic. Flower heads small, discoid, heterogamous, almost sessile; florets white. Cypsela laterally winged on the margins, compressed, black. Pappus obsolete.

Flowers & Fruits: Throughout the year

Exiccatus: Mahananda Barrage, **Anurag & AP Das 0017**, dated 12.05.2010; Kathambari Beel, **Anurag & AP Das 0672**, dated 03.09.2014.

Status: Abundant.

Local Distribution: Throughout the study area.

General Distribution: Pentropical.

ELEPHANTOPUS Linnaeus, Sp. Pl. 2. 1753

Elephantopus scaber Linnaeus, Sp. Pl. 814. 1753; Hooker *f.*, Fl. Brit. Ind. 3: 242. 1881; Hajra *et al.*, Fl. Ind. 13: 333. 1995; Grierson & Long, Fl. Bhut. 2(3): 1489. 2001.

Rhizomatous rosette with stems appressed, stiffly white pubescence. Basal lamina obtuse or sub-acute, base attenuate, sparsely hirsute above, pubescent and glandular beneath, margin crenate-serrate; cauline leaves shorter, ovate or oblong, semi-amplexicaul at base. Flowers lilac or white. Cypsela oblong, black. Pappus spinous hairy.

Flowers & Fruits: November – January

Exiccatus: Mahananda Barrage, **Anurag & AP Das 0590**, dated 13.11.2013.

Status: Abundant.

Local Distribution: Throughout the study area.

General Distribution: Tropical Asia, Australia, Africa.

EMILIA Cassini, Bull. Sci. Soc. Philom. Paris in Dict. Sc. Nat. 14. 405. 1819

Emilia sonchifolia (Linnaeus) A.P. de Candolle in Wight, Contrib. Bot. Ind. 24. 1834; Prain, Beng. Pl. 1: 444. 1903; Hajra *et al.*, Fl. Ind. 13: 212. 1995; Guha Bakshi, Fl. Mur. Dist. 166. 1984. *Cacalia sonchifolia* Linnaeus, Sp. Pl. 1835. 1753; Hooker *f.*, Fl. Brit. Ind. 3: 336. 1881.

Annual soft erect herbs. Leaves weakly dentate; basal lamina lyrate, sessile; upper lamina ovate, long petiolate. Capitula oblong, drooping; phylliaris narrowly oblong – lanceolate; corolla deep pink. Pappus soft, white.

Flowers & Fruits: June – October

Exiccatus: Doumahoni Beel, **Anurag & AP Das 0471**, dated 12.06.2013; Kathambari Beel, **Anurag & AP Das 0663**, dated 03.09.2014.

Status: Abundant.

Local Distribution: Throughout the study area.

General Distribution: India, China, Asia, Africa.

ENYDRA Loureiro, Flora Cochinchinensis 1790

Enydra fluctuans Loureiro. Fl. Cochinch. 511. 1790; Hooker *f.*, Fl. Brit. Ind. 3: 304. 1881; Prain, Beng. Pl. 1: 448. 1903; Grierson & Long, Fl. Bhut. 2(3): 1614. 2001.

Profusely branched, aquatic herbs, puberulent. Leaves opposite, lamina oblong or linear – oblong, acute at apex, margins distinctly dentate. Heads terminal or axillary, heterogamous, pale yellowish green. Achenes black, glabrous.

Flowers & Fruits: January – April

Exiccatus: Doumahoni Beel, **Anurag & AP Das 0180**, dated 02.02.2011.

Status: Abundant.

Local Distribution: Throughout the study area.

General Distribution: Tropical regions of Asia and Africa.

EUPATORIUM Linnaeus, Sp. Pl. 2. 1753

Eupatorium odoratum Linnaeus, Syst. ed. 10: 1205. 1759; Hooker *f.*, Fl. Brit. Ind. 3: 244. 1881; Prain, Beng. Pl. 1: 592. 1903; Uniyal in Hajra *et. al.*, Fl. Ind. 12. 354. 1995.

Erect aromatic, shrubs. Leaves opposite; lamina, ovate-lanceolate, serrate, puberulose beneath. Flowers in terminal corymbose heads. Involucral bracts ovate- lanceolate. Corolla 0.5 cm long. Achenes ribbed, base narrowed. Pappus 5, white.

Flowers & Fruits: Throughout the year.

Exiccatus: Mahananda Barrage, **Anurag & AP Das 0023**, dated 12.05.2010; Gajoldoba, **Anurag & AP Das 0700**, dated 03.09.2014.

Status: Abundant.

Local Distribution: Throughout the study area.

General Distribution: Native to America; naturalized in tropical countries.

GNAPHALIUM Linnaeus, Sp. Pl. 850. 1753**Key to the Species:**

- 1a. Pappus hairs coherent at base to form a ring *G. purpureum*
 1b. Pappus hairs free *G. polycaulon*

Gnaphalium purpureum Linnaeus, Sp. Pl. 854. 1753; Hooker *f.*, Fl. Brit. Ind 3: 289. 1881; Hajra *et al.*, Fl. Ind. 13: 92. 1995.

Erect annual to 48 cm tall, tomentose herbs. Basal branches procumbent. Lamina sessile spathulate, base narrowed, entire, shortly mucronate/broadly rounded, pubescent. Heads in spicate globose clusters; involucre bracts many-seriate, brownish. Ligules female; discs bisexual. Pappus white.

Flowers & Fruits: February – July

Exiccatus: Doumahoni Beel, **Anurag & AP Das 0191**, dated 02.02.2011.

Status: Abundant.

Local Distribution: Throughout the study area.

General Distribution: India, Pakistan, N. & S. America.

Gnaphalium polycaulon Persoon, Syn. Pl. 2: 421. 1807. *G. indicum auct. non* Linnaeus (1753); Hooker *f.*, Fl. Brit. Ind 3: 289. 1881. *G. strictum* Roxburgh, Fl. Ind. 3: 424. 1832. *G. multicaule* Roxburgh, Fl. Ind. ed. 2.3: 425. 1832; Prain, Beng. Pl. 1: 602. 1903; Hajra *et al.*, Fl. Ind. 13: 90. 1995.

Herbs, slender, erect – decumbent with soft wooly tomentum, branched herbs. Lamina sessile, linear-obovate or spathulate, obtuse. Heads in dense, terminal or axillary. Involucre bracts pale brown-glistening white. Cypselas oblong, minute, minutely papillose. Pappus hairy white.

Flowers & Fruits: February – July

Exiccatus: Doumahoni Beel, **Anurag & AP Das 0474**, dated 12.06.2013.

Status: Abundant.

Local Distribution: Throughout the study area.

General Distribution: India, Nepal, Egypt, China, Japan, Senegal, Brazil, Australia, Tropical Africa.

LAPHANGIUM (Hilliard & B.L. Burt) Tzvelev - Byull. Moskovsk. Obshch. Isp. Prir., Otd. Biol. 98(6): 105. 1994

Laphangium luteoalbum (Linnaeus) Tzvelev, Byull. Moskovsk. Obshch. Isp. Prir., Otd. Biol. 98(6): 105. 1994. *Gnaphalium luteo-album* Linnaeus, Sp. Pl. 851. 1753; Hooker *f.*, Fl. Brit. Ind 3: 288. 1881; Prain, Beng. Pl. 1: 602. 1903; *Gnaphalium affine* D. Don, Prodr. Fl. Nep. 173. 1825; *G. luteo-album* var. *multiceps* A.P. de Candolle, Prodr. 6: 222. 1838; Hooker *f.*, Fl. Brit. Ind 3: 288. 1881.

Annual erect, 14-25 cm tall. Stem unbranched, white hairy. Leaves sessile, half – clasping, oblong spathulate, entire, acute to rounded white wooly. Flower-heads globular, clustered, bracts yellow or dark brown, many seriate. Rays florets female, filiform 3-4 toothed. Disc florets bisexual, 5 toothed. Achene linear, papillose. Pappus white.

Flowers & Fruits: February – July

Exiccatus: Gossaihat Beel, **Anurag & AP Das 0240**, dated 14.07.2011.

Status: Abundant.

Local Distribution: Throughout the study area.

General Distribution: India, Nepal, Egypt, China, Japan, Senegal, Brazil, Australia, Tropical Africa.

PSEUDOGNAPHALIUM Kirpicznikov, Trudy Bot. Inst. Akad. Nauk S.S.S.R., Ser. 1, Fl. Sist. Vyssh. Rast. 9: 33. 1950

Pseudognaphalium affine (D. Don) Anderberg, Opera Bot. 104: 146. 1991. *Gnaphalium luteo-album* Linnaeus *subsp. affine* (D. Don) J. Koster in Blumea 4(3): 484. 1941. *G. affine* D. Don., Prodr. Fl. Nep. 173. 1825. *G. luteo-album* var. *multiceps* A.P. de Candolle, Prodr. 6: 222. 1838; Hooker *f.*, Fl. Brit. Ind. 3: 288. 1881; Prain, Beng. Pl. 1: 602. 1903.

Annual erect herbs. Stem hairy. Leaves sessile, oblong spatulate, entire, acute to rounded white woolly – haired. Flower-heads globular, clustered, bracts yellow or dark brown, many seriate. Rays florets female, filiform 3 – 4 toothed. Disc florets bisexual, 5 toothed. Achene linear, papillose. Pappus hairs white.

Flowers & Fruits: December – May

Exiccatus: Mahananda Barrage, **Anurag & AP Das 0591**, dated 13.11.2013.

Status: Very common.

Local Distribution: Throughout the study area.

General Distribution: India, Nepal, Bhutan, China, Afghanistan, Indonesia, Japan, Korea, Myanmar, Pakistan, Philippines, Vietnam; SW Asia (Iran), Australia.

GRANGEA Adamson, Fam. Pl. (Adanson) 2: 121. 1763

Grangea maderaspatana (Linnaeus) Poiret in Lamarck, Encycl. Suppl. 2: 825. 1811; Hooker *f.*, Fl. Brit. Ind 3: 247. 1881; Prain, Beng. Pl. 1: 442. 1903; Grierson & Long, Fl. Bhut. 2(3): 1529. 2001. *Artemisia maderaspatana* Linnaeus, Sp. Pl. 849. 1753.

Annual rosette herbs, branches long, prostrate villose. Lamina sessile, sinuate pinnatifid, dark green. Heads solitary, heterogamous, corolla yellow; anther base obtuse. Achenes pale brown, glabrous; phyllaries oblong. Pappus hairy connate into a fimbriate cup.

Flowers & Fruits: February – May

Exiccatus: Doumahoni Beel, **Anurag & AP Das 0185**, dated 2.2.2011.

Status: Abundant.

Local Distribution: Throughout the study area.

General Distribution: India, Africa, Si Lanka, China, Malaysia.

IXERIS Cassini, Bull. Sci. Soc. Philom. Paris (1821) 173; et Dict. Sc. Nat. 24. 49. 1822.

Ixeris polycephala Cassini in Dict. Sci. Nat. 24: 50. 1822; Hajra *et. al.*, Fl. Ind. 12: 279. 1995; Grierson & Long, Fl. Bhut. 2(3): 1467. 2001. *Lactuca polycephala* (Cassini) Benth & Hooker *f.*, Gen. Pl. 2: 526. 1873; Hooker *f.*, Fl. Brit. Ind 3: 410. 1881.

Small rosette herbs, scapes to 45 cm. Basal lamina oblong lanceolate, cauline lamina lanceolate to linear, acuminate, sessile, radicals sagittate-auriculate. Capitula terminal; outer phyllaries 5 – 6, ovate, inner phyllaries 7 – 8, linear-lanceolate. Ligules yellow. Pappus yellowish, simple.

Flowers & Fruits: November – May

Exiccatus: Mahananda Barrage, **Anurag & AP Das 0602**, dated 13.11.2013.

Status: Less common.

Local Distribution: In few wetlands of the study area.

General Distribution: India, China, Japan.

LAUNAEA Cassini, Dictionnaire des Sciences Naturelle 25. 1822

Launaea aspleniifolia (Willdenow) Hooker f., Fl. Brit. Ind. 3: 415. 1881; Prain, Beng. Pl. 1: 630. 1903; Guha Bakshi, Fl. Mur. Dist. 169. 1984. *Prenanthes aspleniifolia* Willdenow, Sp. Pl. 3. 1804.

Vernacular Name: *Tikchana*

Annual, glabrous herbs. Lamina linear-oblongate, acuminate, entire or remotely or shallowly dentate, often sparsely denticulate. Inflorescence racemose, usually few capitula. Involucre bract 3mm diameter. Cypsela oblong-lanceolate, compressed, pappus 6.6 mm.

Flowers & Fruits: January – April

Exiccatus: Gajoldoba, **Anurag & AP Das 0358**, dated 08.03.2012.

Status: Rare.

Local Distribution: Found only in one field of study area.

General Distribution: Nepal, India, Pakistan.

MIKANIA Willdenow, Sp. Pl., ed. 4 [Willdenow] 3(3): 1742. 1803

Mikania micrantha Kunth in Humboldt, Bonpland & Kunth, Nov. Gen. Sp. 4: 134. 1820; Hajra *et. al.*, Fl. Ind. 12: 357. 1995; Grierson & Long, Fl. Bhut. 2(3): 1625. 2001. *Mikania scandens auct.* Clarke, Comp. India 34. 1876, *non* Willdenow. Prain, Beng. Pl. 1: 434. 1903.

Extensive climbers, branches hairy. Lamina triangular-ovate, acute or acuminate, cordate, pubescent. Capitula numerous in dense compound cymose corymbs. Phyllaries oblong, acute or shortly acuminate; corolla greenish white. Cypsela ribbed, glandular; pappus longer than achenes.

Flowers & Fruits: June – December

Exiccatus: Doumahoni Beel, **Anurag & AP Das 0513**, dated 12.06.2013; Gajoldoba, **Anurag & AP Das 0676**, dated 03.09.2014.

Status: Abundant.

Local Distribution: Throughout the study area.

General Distribution: India, Tropical America. Nepal, Myanmar, Malaysia, China, Philippines, Taiwan, Tropical Africa.

PARTHENIUM Linnaeus, Sp. Pl. 2. 1753

Parthenium hysterophorus Linnaeus, Sp. Pl. 988. 1753; Hajra *et. al.*, Fl. Ind. 12: 403. 1995; Grierson & Springate, Fl. Bhut. 2(3): 1622. 2001.

Flatly rosette annual herb; flowering shoot erect, profusely branched annual; stems stiffly appressed white puberulous. Lamina white pubescent, often pilose on veins. Basal leaves ovate, long petiolate; cauline leaves more finely cut, short petiolate; upper leaves smaller narrower, sub-sessile. Capitula 3 mm with white corolla. Cypsela compressed, pappus of two lateral, reflexed awns.

Flowers & Fruits: January – December

Exiccatus: Mahananda Barrage, **Anurag & AP Das 0064**, dated 12.05.2010; Doumahoni Beel, **Anurag & AP Das 0216**, dated 02.02.2011.

Status: Abundant.

Local Distribution: Throughout the study area.

General Distribution: Native of America; widely naturalized in India.

SPHAERANTHUS Linnaeus, Sp. Pl. 2. 1753

Sphaeranthus indicus Linnaeus, Sp. Pl. 927. 1753; Hooker *f.*, Fl. Brit. Ind. 3: 275. 1881; Prain, Beng. Plants 1: 441. 1903; Guha Bakshi, Fl. Mur. Dist. 174. 1984. Grierson & Long, Fl. Bhut. 2(3): 1508. 2001.

Vernacular Name: *Bhuikadam*

Prostrate annual herbs, scented. Stem winged. Leaves alternate. Flower-heads purple, heterogamous, with compact unit of numerous minute capitula; anther base sagittate. Fruits oblong, achenes hairy glandular. Pappus absent.

Flowers & Fruits: January – April.

Exiccatus: Gajoldoba, **Anurag & AP Das 0365**, dated 08.03.2012.

Status: Less common.

Local Distribution: Throughout the study area; more common after harvest paddy-fields

General Distribution: India, Nepal, Bangladesh, Myanmar, Sri Lanka, Africa, Islands, Australia.

ACMELLA L.C.M. Richard *ex* Persoon, Syn. Pl. 2. 1807

Acmella paniculata (Wallich *ex* A.P. de Candolle) R.K. Jansen, Syst. Bot. Monogr. 867. 1985. *Spilanthes calva* A.P. de Candolle in Wight, Contr. Bot. Ind. 19. 1834; Hajra *et al.* Fl. Ind. 12: 409. 1995. *S. acmella* var. *calva* (A.P. de Candolle) Clarke, Comp. Ind. 138. 1876; Hooker *f.*, Fl. Brit. Ind. 3: 307. 1881. *S. acmella* Linnaeus *sensu* Prain, Beng. Pl. 1: 614. 1903.

Tall or diffuse annual herbs. Leaves opposite; lamina ovate, serrate, acute, 3-nerved. Capitula 0.7 – 0.82 cm in diameter, either in solitary or paniculate, peduncled, ovoid, receptacle conical; corolla yellow. Involucral bracts biseriate, ovoid. Rays uniseriate, yellow. Discs tubular. Pappus absent.

Flowers & Fruits: July – November

Exiccatus: Mahananda Barrage, **Anurag & AP Das 0319**, dated 26.11.2011; Kathambari Beel, **Anurag & AP Das 0668**, dated 03.09.2014.

Status: Abundant.

Local Distribution: Throughout the study area.

General Distribution: India, Nepal, Sri Lanka, China, Myanmar, Indonesia, Malaysia.

SONCHUS Linnaeus, Sp. Pl. 2. 1753

Sonchus asper (Linnaeus) A.W. Hill, Herb. Brit. 1:47.1769; Hooker *f.*, Fl. Brit. Ind. 3: 414. 1881; Prain, Beng. Pl. 1: 629.1903. *Sonchus oleraceus* var. *asper* Linnaeus, Sp. Pl. 794. 1753.

Fleshy, erect, annual, glabrous herbs. Leaves variable in shape, lanceolate-ovate-oblongate; cauline pinnatifid, spinous-toothed. Heads erect, peduncle flat. Involucral bracts on many series; Ligule yellow. Achenes compressed, ribbed. Pappus creamy white.

Flowers & Fruits: May – August

Exiccatus: Mahananda Barrage, **Anurag & AP Das 0027**, dated 12.05.2010.

Status: Common.

Local Distribution: Throughout the study area.

General Distribution: India, Pakistan, Afghanistan, Iran, Iraq, C. Asia, Egypt, Libya, Ethiopia, Europe, Africa, N & S America.

THESPIS A.P. de Candolle, in Guillaumin, Arch. Bot. (Paris) 2: 517. 1833

Thespis divaricata A.P. de Candolle, in Guillaumin, Arch. Bot. 2: 517. 1833; Hooker *f.*, Fl. Brit. Ind. 3: 259. 1881; Prain, Beng. Pl. 1: 595.1903. *Cotula divaricata* Wallich [Cat. 3238 A 1831; *nom. nud.*] *ex* A.P. de Candolle, Prodr. 5: 375. 1836. *Cotula sinapifolia* Roxburgh in Wallich. Cat. 3287 G. *Thespis erecta* A.P. de Candolle, Prodr. 5: 375. 1836.

Annual, erect glabrous herbs. Lamina elliptic to oblong, toothed, attenuate at base. Heads crowded. Ray florets fertile, often without corolla. Disc florets sterile. Involucral bracts ovate. Achenes small, papillose.

Flowers & Fruits: April – August

Exiccatus: Gajoldoba, **Anurag & AP Das 0371**, dated 08.03.2012.

Status: Rare.

Local Distribution: Throughout the study area.

General Distribution: India, Nepal, Bangladesh, Myanmar, S.W. China, Thailand, Indo-China.

CYANTHILLIUM Blume, Bijdr. Fl. Ned. Ind. 15: 889. 1826

Cyanthillium cinereum (Linnaeus) H. Robinson, Proc. Biol. Soc. Wash. 103. 252. 1990. *Conyza cinerea* Linnaeus, Sp. Pl. 862. 1753. *Vernonia cinerea* (Linnaeus) Less in Linnaea 4: 291. 1829; Hooker *f.*, Fl. Brit. Ind 3: 233. 1881; Prain, Beng. Pl. 1: 601.1903; Guha Bakshi, Fl. Mur. Dist. 175. 1984. Hajra *et al.*, Fl. Ind. 13: 367. 1995.

Erect, branched annual herb, stem slender. Leaves alternate, lamina ovate-lanceolate. Flowers homogamous, pink or purple, small, in terminal corymbose, violet. Pappus white. Achenes terete, hairy, not ribbed.

Flowers & Fruits: January – January

Exiccatus: Doumahoni Beel, **Anurag & AP Das 0203**, dated 02.02.2011.

Status: Abundant.

Local Distribution: Throughout the study area.

General Distribution: Pantropical.

XANTHIUM Linnaeus, Sp. Pl. 2. 1753

Xanthium strumarium Linnaeus, Sp. Pl. 987. 1753; Prain, Beng. Pl. 1: 607.1903 *Xanthium indicum* Koenig ex Roxburgh, Fl. Ind. 3: 601. 1832; Prain, Beng. Pl. 1: 601.1903; Guha Bakshi, Fl. Mur. Dist. 176. 1984. Hajra *et al.*, Fl. Ind 12: 427. 1995. *Xanthium strumarium* Linnaeus, Sp. Pl. 987. 1753, *p.p.*; Hooker *f.*, Fl. Brit. Ind 3: 303. 1881; Haines, Bot. Bihar & Orissa pt. IV: 478. 1922.

Scabrous, erect, annual herbs; Stem terete, stout. Lamina broadly ovate or sub- orbicular. Irregularly toothed. Capitula unisexual, monoecious, globose, axillary or terminal. Cypsela 2, oblong ovoid with hooked persistent style and involucre.

Flowers & Fruits: August – April

Exiccatus: Mahananda Barrage, **Anurag & AP Das 0049**, dated 12.05.2010; Gossaihat Beel, **Anurag & AP Das 0421**, dated 17.08.2012.

Status: Abundant.

Local Distribution: Throughout the study area.

General Distribution: Pantropical.

GALINSOGA Ruiz & Pavon, Prod. Fl. Per. 110. t. 24. 1794

Galinsoga parviflora Cavanilles, Icon. 3: 41. 1795; Prain, Beng. Pl. 1: 618. 1903. Grierson & Long, Fl. Bhut. 2(3): 1610. 2001; A.P. Das, Jour. Econ. Tax. Bot. 26(1): 34. 2002.

Annual herbs. Peduncles 1 – 43 mm; involucre campanulate. Ray florets: corollas usually dull white; Disk florets 15 – 50. Pappus absent or of 5 – 10 lacinate scales 0.5 – 1 mm; disk achenes glabrous or strigose; pappus absent.

Flowers & Fruits: August – April

Exiccatus: Gossaihat Beel, **Anurag & AP Das 0432**, dated 17.08.2012.

Status: Common at places.

Local Distribution: Throughout the study area.

General Distribution: India, China and native to South America.

ERIGERON Linnaeus, Sp. Pl. 2: 863. 1753

Erigeron canadensis Linnaeus, Sp. Pl. 2: 863. 1753; Grierson & Long, Fl. Bhut. 2(3): 1627. 2001.

Sparsely hirsute, annual, erect herbs. Lower leaves petiolate; lamina oblanceolate, sparsely serrate or entire. Capitula numerous, terminal, peduncles slender. Involucre sub-cylindric; phyllaries 2 – 3 seriate, greenish, linear-lanceolate. Ray florets white; disk florets yellowish, tube sparsely puberulent. Achenes linear-lanceoloid, compressed.

Flowers & Fruits: May – September

Exiccatus: Mahananda Barrage, **Anurag & AP Das 0034**, dated 12.05.2010; Gajoldoba, **Anurag & AP Das 0677**, dated 03.09.2014.

Status: Very common.

Local Distribution: Throughout the study area.

General Distribution: Pantropical.

ADENOSTEMMA Char. Gen. Pl., ed. 2. 89. 1776

Adenostemma suffruticosum Gardner in London Jour. Bot. 6: 433. 1847; Hattori & Nakajima in Hoehnea, 38(2): 44. 2011; Chowdhury *et al.*, Pl. 7(2): 589 - 593. 2013. *Adenostemma scaevolifolium* Martius *ex* Baker, Fl. Bras. (Martius) 6(2): 186. 1876. **[PLATE 4.4. Figs. 9]**

Undershrub, upto 1.5 m high. Stem angular, puberulous. Lower leaves opposite, alternate above, sessile or sometimes shortly (upto 2 cm in vegetative phase) petiolate; lamina 1.5 – 12 × 0.5 – 07 cm, ovate-elliptic to slightly oblanceolate, crenate, acute or acuminate to obtuse, base attenuate, both surfaces glabrous. Capitula discoid in spreading panicles; peduncle 4.5 – 8.5 cm; involucre campanulate, bracts connate at base, glutinous, 3 – 5 × 0.5 – 1 mm, lanceolate or narrowly oblong, entire, acute to obtuse. Bracteoles connate at base, 3 – 4 × 0.4 – 0.6 mm, linear lanceolate, entire, obtuse. Receptacle convex, naked, foveolated. Externally visible parts of all florets white; ray florets absent; disc florets 40 – 50, corolla tubular, glandular-tomentose outside, 5-lobed (0.5 mm); anther base obtuse, terminal appendage missing, approximately 1 mm; style branches 2, 3 mm long, clavate. Cypsela remain exposed, slightly spreading, obconical, glutinous, 2 mm long with glandular trichomes, black; pappus represented by 3 – 4 small caecum like oblong or slightly spatulate structures.

Flowers & Fruits: September – January

Exiccatus: Teesta Barrage (Gajoldoba), **Anurag & AP Das 2105**, dated 22.10.2013; **Anurag & AP Das 2109**, dated 09.12.2013.

Status: Rare

Local Distribution: In two wetlands of Terai region.

General Distribution: Southeast and West-Central Brazil and now from the Terai and Duars of West Bengal in India.

Notes: This species has been reported as a new record for Indian flora from Gajoldoba and Mahananda Barrage.

SOLIVA Ruiz & Pavon, Fl. Peruv. Prodr. 113, t. 24. 1794

Soliva anthemifolia (A. Jussieu) R. Brown, Trans. Linn. Soc. London 12: 102. 1818; Chowdhury *et al.*, Pleione 5(2): 352 – 356. 2011. *Gymnostyles anthemifolia* Jussieu, Ann. Mus. Natl. Hist. Nat. 4: 262. 1804.

Vernacular Name: *Matikamra*

Annual, pubescent, prostrate herbs with cauline base. Leave base sheathing. Capitulum or head clustered in leaf axils, mature one fixed with soil, round, solitary, ray florets absent; involucral bract in two rows; disc florets ligulate, hermaphrodite, epigynous; corolla long, pale yellow, petals 3; syngeneis; gynoeceium distinct, ovary long, style unequally bifid, tip round. Cypsela light brown with deep brown centre, persistent style, spinescent.

Flowers & Fruits: March – August

Exiccatus: Gajoldoba, **Anurag & AP Das 0379**, dated 08.03.2012.

Status: Rare.

Local Distribution: Found only one or two places.

General Distribution: Pantropical.

CAMPANULACEAE A. Jussieu, Gen. Pl. 163. 1789; *nom. cons.***Key to the Genera:**

- 1a. Flowers actinomorphic, corolla campanulate; lamina oblanceolate, seeds compressed – ellipsoid **Wahlenbergia**
 1b. Lamina suborbicular to broadly ovate, Seeds triangular **Lobelia**

WAHLENBERGIA Schrad *ex* Roth, Nov. Pl. Sp. 399. 1821

Wahlenbergia marginata (Thunberg) A. DC. Mon. Camp. 143. 1830; Majumder, Ind. Agr. 6: 156. 1962. *Campanula marginata* Thunberg, Fl. Jap. 89. 1784. *Wahlenbergia gracilis* Schreber, Blumend. 38. 1827; Hooker f., Fl. Brit. Ind. 3: 429. 1881; Prain, Beng. Pl. 1: 468. 1903.

Annual, glabrous or sparsely hairy, erect or procumbent herbs. Lamina oblanceolate, margin undulate, denticulate, sparsely pilose. Flowers erect, pedicels up to 7 cm, calyx linear, corolla campanulate, blue. Capsules obconical; seeds compressed-ellipsoid.

Flowers & Fruits: December – April

Exiccatus: Doumahoni Beel, **Anurag & AP Das 0189**, dated 2.2.2011.

Status: Common.

Local Distribution: Throughout the study area

General Distribution: India, E. Asia, Australia, New Zealand and S. Africa.

LOBELIA Linnaeus, Sp. Pl. 2: 929. 1753

Lobelia alsinoides Lamarck, Dict. Bot. 3: 588. 1791; Cook, Aqua. Wetl. Pl. Ind. 82. 1996.

Annual succulent, glabrous herbs. Stems angular. Leaves alternate; petiole glabrous 1 – 3.4 mm; lamina suborbicular to broadly ovate, elliptic, or lanceolate, rounded, cuneate at base. Flowers in axillary raceme; pedicels glabrous, slender. Calyx lobes linear to subulate. Corolla bi-lipped, pale blue or white. Stamens connate. Seeds numerous, triangular, dark brown.

Flowers & Fruits: Throughout the year.

Mahananda Barrage, **Anurag & AP Das 0047**, dated 12.05.2010; Kathambari Beel, **Anurag & AP Das 0680**, dated 03.09.2014.

Status: Common.

Local Distribution: Throughout the study area.

General Distribution: India, Nepal, Sri Lanka, Bangladesh, China, Japan, Laos, Malaysia, Myanmar, New Guinea, Thailand, Vietnam.

MENYANTHACEAE Dumortier, Anal. Fam. Pl. 20: 25. 1829; *nom. cons.***NYMPHOIDES** Seguiet, Pl. Veron. 3: 121. 1754**Key to the Species:**

- 1a. Plants small; corolla lobes entire *N. hydrophylla*
 1b. Plants giant; corolla lobes fimbriate *N. indicum*

Nymphoides hydrophylla (Loureiro) Kuntze, Rev. Gen. Pl. 429. 1891; Panda & Das, Fl. Sambalp. 27. 2004. *Menyanthes hydrophylla* Loureiro, Fl. Cochinch. 1: 129. 1790. *Limnanthemum cristatum* (Roxburgh) Grisebach, Gen. Sp. Gent. 342. 1839; Hooker f., Fl. Brit. Ind. 4: 131. 1883; Prain, Beng. Pl. 2: 527. 1903; Haines, Bot. Bihar & Orissa Pt. IV: 571. 1922. [PLATE 4.4. Figs. 7]

Aquatic, floating herbs occasionally grow in paddy fields, during rainy season. Lamina deeply cordate, alternate, orbicular and green above, greenish – pink beneath. Flower many in dense clusters at the nodes. Sepals-5, may be 4, petals 4-5, slightly attached at the base, corolla lobes entire, with longitudinal fold down the middle, stamens epipetalous; ovary 1- celled. Capsules 2.

Flowers & Fruits: January –December

Exiccatus: Mahananda Barrage, **Anurag & AP Das 0076**, dated 12.05.2010; Kathambari Beel, **Anurag & AP Das 0735**, dated 03.09.2014.

Status: Abundant.

Local Distribution: Throughout the study area.

General Distribution: India, S. China, Myanmar, Java and Malaysia.

Nymphoides indica (Linnaeus) O. Kuntze, Rev. Gen. Pl. 429. 1891; Panda & Das, Fl. Sambalpur, 227. 2004. *Menyanthes indica* Linnaeus, Sp. Pl. 145. 1753. *Limnanthemum indicum* (Linnaeus) Thwaites, Enum. 205. 1850; Hooker f., Fl. Brit. Ind. 4: 131. 1883; Prain, Beng. Pl. 1: 527. 1903.

[PLATE 4.4. Figs. 8]

Aquatic herbs, lamina floating fleshy, bilocular, cordate, margins more or less sinuate. Flowers white with a yellow center, in clusters, appearing above the surface of the water; corolla lobes densely papillose, not crested down the middle. Capsules subglobose; seeds many obovate.

Flowers & Fruits: January – December

Exiccatus: Gajoldoba, **Anurag & AP Das 0378**, dated 08.03.2012.

Status: Abundant.

Local Distribution: Throughout the study area.

General Distribution: Afghanistan, India, S. E. Asia, Malaysia, Australia to Fiji.

Order: Apiales

APIACEAE Lindley, Intr. Nat. Syst. Bot., ed. 2. 21. 1836. *Nom. alt.* [UMBELLIFERAE A. Jussieu, *nom. cons.*]

Key to the Genera:

- 1a. Umbels simple axillary; lamina reniform *Centella*
- 1b. Umbels compound terminal; Leaves compound 2
- 2a. Lamina 1 – 3 pinnate; fruits elliptical *Oenanthe*
- 2b. Lamina 2 pinnate; fruits sub-globose *Seseli*

CENTELLA Linnaeus, Sp. Pl., ed. 2. 2: 1393. 1763

Centella asiatica (Linnaeus) Urban, Martius Fl. Brass. 11: 287. 1879; Guha Bakshi, Fl. Mur. Dist. 149. 1984. *Hydrocotyle asiatica* Linnaeus, Sp. Pl. 234. 1753; Hooker f., Fl. Brit. Ind. 2: 669. 1879; Prain, Beng. Pl. 1: 391. 1903.

Vernacular Name: *Thankuni*

Annual, fleshy, weak, creeping runner, rooted at nodes. Lamina orbicular-reniform.

peduncle almost missing. Involucral bracts ovate, embracing the flowers. Umbels simple, 3 – 6 pink flowered, axillary. Fruits not vittate, pericarps not thickened. Seeds compressed laterally.

Flowers & Fruits: July – February

Exiccatus: Gajoldoba, **Anurag & AP Das 0085**, dated 12.09.2010; Gossaihat Beel, **Anurag & AP Das 0239**, dated 14.07.2011.

Status: Abundant.

Local Distribution: Throughout the study area.

General Distribution: Pantropical.

OENANTHE Linnaeus, Sp. Pl. 1: 254. 1753

Oenanthe javanica (Blume) A.P. de Candolle, Prodr. 4: 138. 1830; Buwalda, Blumea 2: 194. 1936 & Fl. Males 4: 136. 1949. *Sium javanicum* Blume, Bijdr. 15: 881. 1826. *Oenanthe bengalensis* Benth & Hooker, Gen. Pl. 1: 906: 1862; Hook. f., Fl. Brit. Ind. 2: 696. 1879; Prain, Beng. Pl. 1: 394. 1903.

Herbs, annual, growing in wet places, especially on the shade of other plants. Lamina 1 – 3 pinnate, secondary pinnae lanceolate-ovate, deeply pinnatifid, pale green. Flowers often polygamous. Calyx teeth minute. Fruits ellipsoid, nearly terete, furrowed, forrows 1-vittate, carpophore 0.

Flowers & Fruits: January – April

Exiccatus: Doumahoni Beel, **Anurag & AP Das 0179**, dated 2.02.2011.

Status: Common.

Local Distribution: Throughout the study area.

General Distribution: India, China, Japan and Java.

SESELI Linnaeus Sp. Pl. 1: 259. 1753

Seseli diffusum (Roxburgh ex J.E. Smith) Santapou & Wagh, Bull. Bot. Surv. Ind. 5(2): 108. 1963. *Ligusticum diffusum* Roxburgh ex J.E. Smith, Rees Cyclop 21: 11. 1812. *Cnidium diffusum* A.P. de Candolle, Prodr. 4: 153. 1830. *Seseli indicum* Wight & Arnott, Prodr. 371. 1874; Hook. f., Fl. Brit. Ind. 2: 693. 1879; Prain, Beng. Plants 1: 393. 1903.

Vernacular name: *Ban Jawan*

Diffuse or erect, annual herb with pubescent branches from the root-top. Lamina oblong, lanceolate, petiolate, 2-pinnate or pinnae, pinnatisect 2 – 3 pairs; cauline similar but smaller and more crisped, all hairy, especially beneath with short white hairs. Flowers pink or white in compound umbels. Fruit subglobose, glabrous or hispid; ridges thick.

Flowers & Fruits: January – April

Exiccatus: Doumahoni Beel, **Anurag & AP Das 0171**, dated 2.02.2011.

Status: Common

Local Distribution: Throughout the study area.

General Distribution: India (throughout the plains) and Bangladesh.

ARALIACEAE A. Jussieu, Gen. Pl. 217. 1789

HYDROCOTYLE Linnaeus, Sp. Pl. 1: 234. 1753

Key to the Species:

- 1a. Plants prostrate *H. javanica*
 1b. Plants decumbent.....2
 2a. Petals white, fruits cordate – globose, brown *H. himalaica*
 2b. Petals greenish white, fruit broadly globose, greenish yellow; leaves very small
 *H. sibthorpioides*

Hydrocotyle himalaica P.K. Mukherjee, Indian Forester. 95: 470. 1969; Grierson & Long, Fl. Bhut. 2(2): 443. 1999. *Hydrocotyle javanica* var. *podantha* C.B. Clarke in J.D. Hooker, Fl. Brit. India 2: 668. 1879.

Annual decumbent herbs, stems, petioles & peduncles moderately to densely pubescent with dark purple-brown hairs. Petioles 3–18 cm; lamina orbicular or reniform, obtuse rounded, main nerves 9. Umbels many flowered; pedicels 1–2 mm. Petals white. Fruits cordate-globose, brown.

Flowers & Fruits: May – August

Exiccatus: Mahananda Barrage, **Anurag & AP Das 0008**, dated 12.05.2010; Gossaihat Beel, **Anurag & AP Das 0240**, dated 14.07.2011.

Status: Common.

Local Distribution: Throughout the study area.

General Distribution: N India, China, Bhutan, Myanmar, Nepal.

Hydrocotyle javanica Thunberg, Dissert. 2: 415. t. 3. 1800. Grierson & Long, Fl. Bhut. 2(2): 444. 1999.

Prostrate. Stem slender, rooting at the nodes. Leaves pubescent, reniform, 2 – 5 cm in diameter; lobes 7, triangular; crenate; upper part of the petioles densely pubescent. Umbels 10 – 30 flowered, compact. Petals white. Fruit suborbicular, 1.5 mm broad; surface rugulose, mottled.

Flowers & Fruits: March- April

Exiccatus: Gajoldoba, **Anurag & AP Das 0350**, dated 08.03.2012.

Status: Abundant.

Local Distribution: Throughout the study area.

General Distribution: Tropical Asia to Indonesia, Australia, Pacific Islands, China, Korea, Himalayas.

Hydrocotyle sibthorpioides Lamarck, Encycl. 3: 153. 1789; Cook, Aqua. Wetl. Pl. Ind. 35. 1996; Grierson & Long, Fl. Bhut. 2(2): 444. 1999.

Annual aromatic, decumbent herb. Stem slender, filiform, creeping. Petioles glabrous or sparsely pubescent; lamina membranous, reniform-rounded, cordate at base. Umbels solitary at nodes, sessile; bracts ovate to ovate-lanceolate. Petals greenish-white. Fruits broadly globose, greenish yellow.

Flowers & Fruits: May – October

Exiccatus: Kathambari Beel, **Anurag & AP Das 0657**, dated 03.09.2014.

Status: Common.

Local Distribution: Throughout the study area.

General Distribution: India, Bhutan, Nepal, China, Indonesia, Japan, Korea, Philippines, Thailand, Vietnam; tropical Africa.



PLATE 4.3. Figs. 1 – 6. Floristic elements: 1. *Nymphaea rubra*; 2. *Nymphaea nauchali*; 3. *Nymphaea pubescence*; 4. *Nelumbo nucifera*; 5. *Monochoria vaginalis*; 6. *Monochoria hastata*

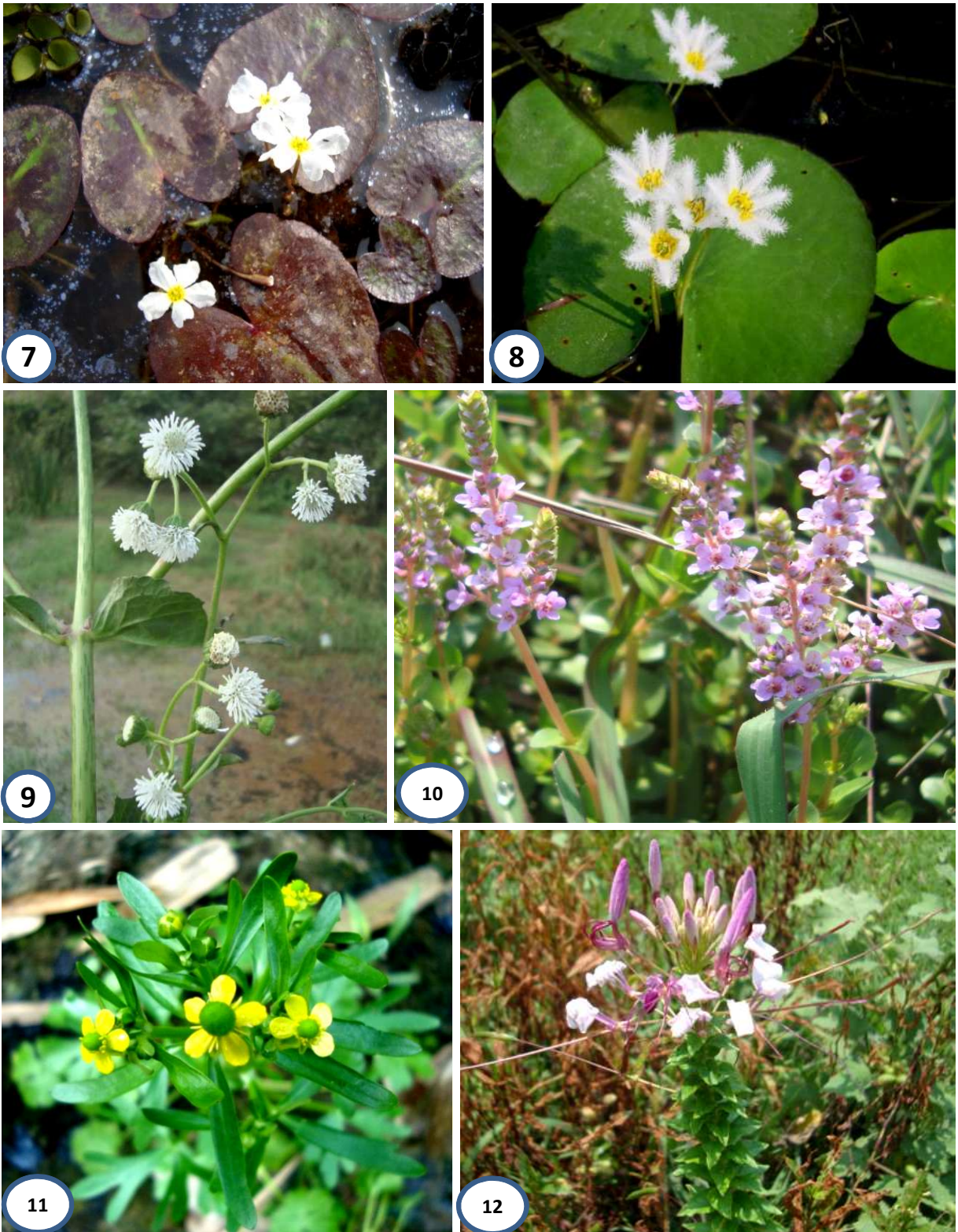


PLATE 4.4. Figs. 7 – 12. Floristic elements: 7. *Nymphoides hydrophylla*; 8. *Nymphoides indica*; 9. *Adenostemma suffruticosum*; 10. *Rotala rotundifolia*; 11. *Ranunculus sceleratus*; 12. *Cleome spinosa*

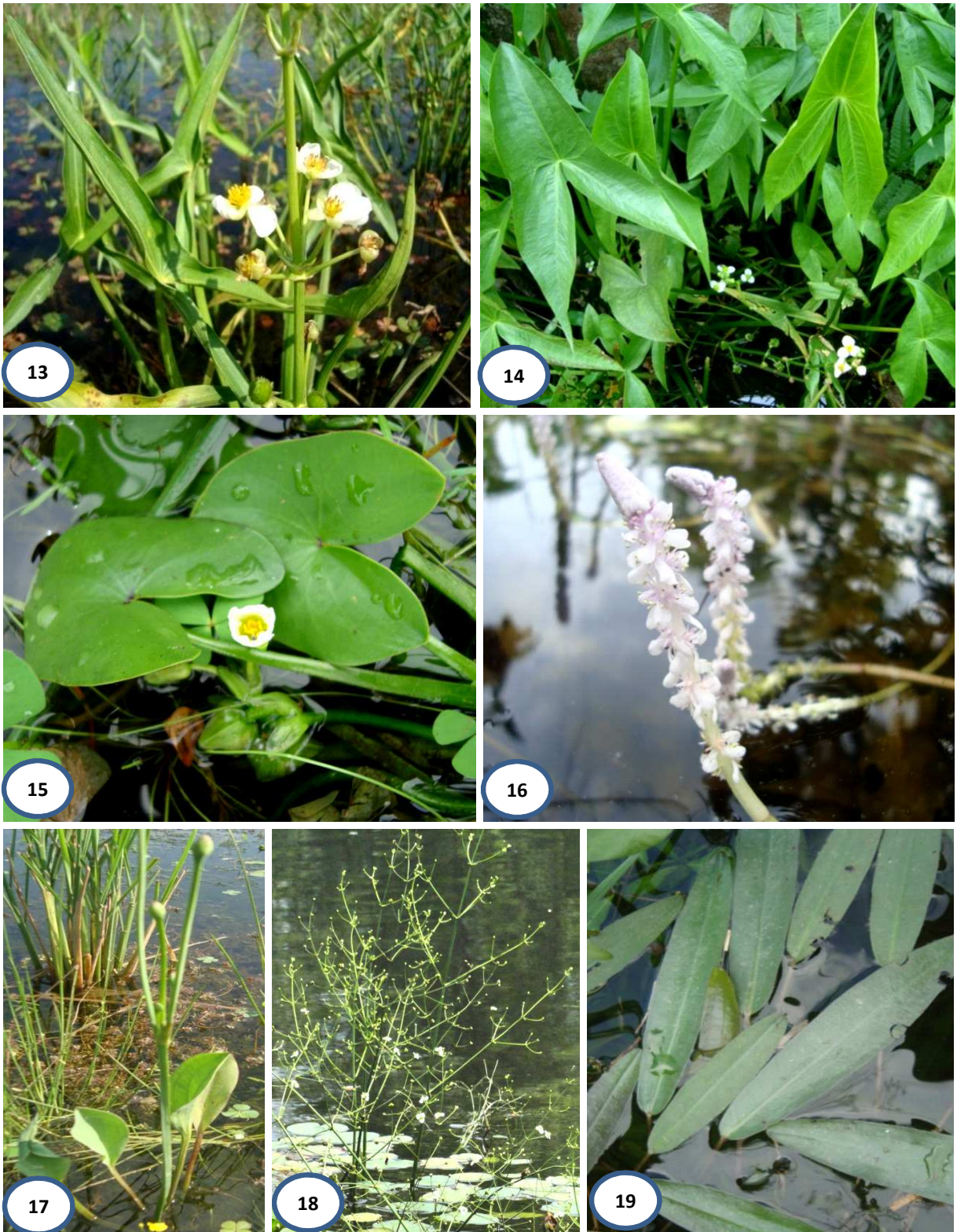


PLATE 4.5. Figs. 13 – 19. Floristic elements: 13. *Sagittaria sagittifolia*; 14. *Sagittaria latifolia*; 15. *Sagittaria guwanensis*; 16. *Aponogeton crispus*; 17. *Butomopsis latifolia*; 18. *Caldesia parnassifolia*; 19. *Aponogeton natans*



PLATE 4.6. Figs. 20 – 25. Floristic elements: 20. *Potamogeton crispus*; 21. *Potamogeton gramineus*; 22. *Linnophila rugosa*; 23. *Linnophila indica*; 24. *Linnophila aromatica*; 25. *Linnophila heterophylla*



PLATE 4.7. Figs. 26 – 31. Floristic elements: 26. *Ludwigia adscendens*; 27. *Ludwigia perennis*; 28. *Ludwigia octavalvis*; 29. *Ludwigia peruviana*; 30. *Trapa incisa*; 31. *Trapa natans*

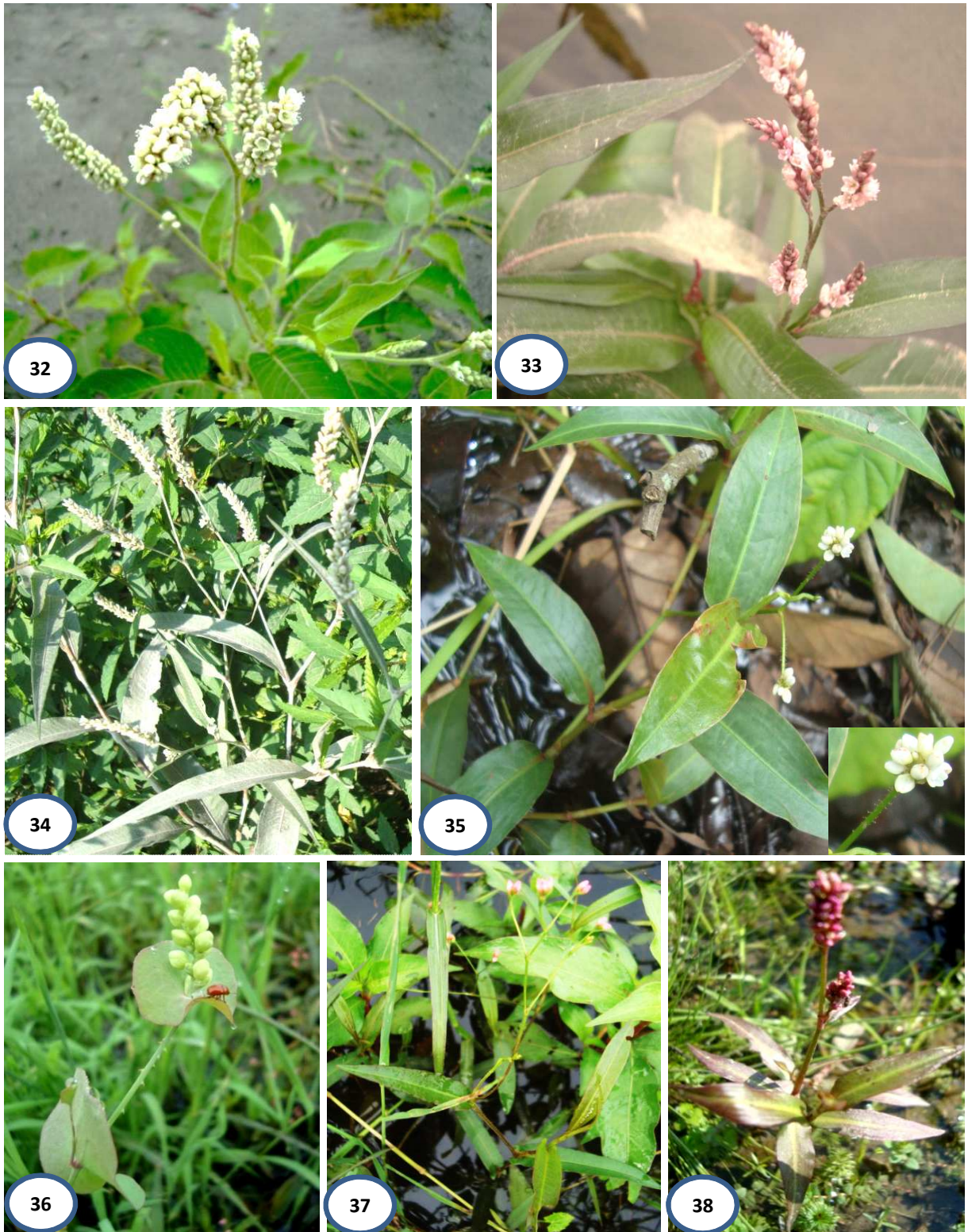
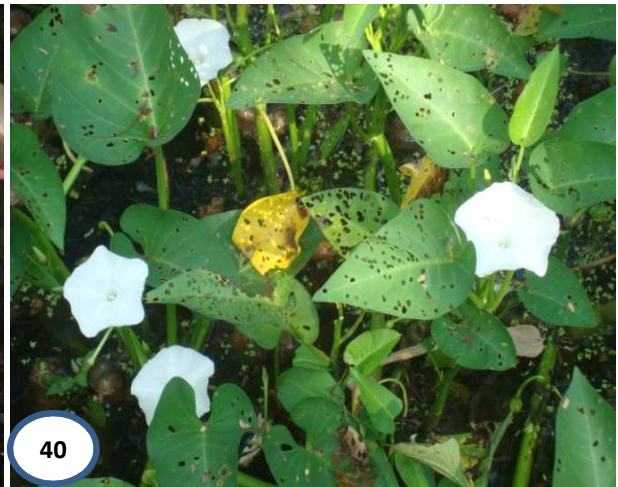


PLATE 4.8. Figs. 32 – 38. Floristic elements: 32. *Persicaria orientalis*; 33. *Persicaria maculosa*; 34. *Persicaria lapathifolia*; 35. *Persicaria chinensis*; 36. *Persicaria perfoliata*; 37. *Polygonum hastatosagittatum*; 38. *Persicaria barbata*



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PLATE 4.9. Figs. 39 – 44. Floristic elements: 39. *Ipomoea aquatica*; 40. *Ipomoea aquatica* (white flowered variant); 41. *Ipomoea carnea*; 42. *Hydrolea zeylanica*; 43. *Bacopa monnieri*; 44. *Lindernia rotundifolia*



PLATE 4.10. Figs. 45 – 50. Floristic elements: 45. *Lindernia antipoda*; 46. *Lindernia anagalis*; 47. *Lindernia parviflora*; 48. *Mazus pumilus*; 49. *Lindernia oppositifolia*; 50. *Eichhornia crassipes*

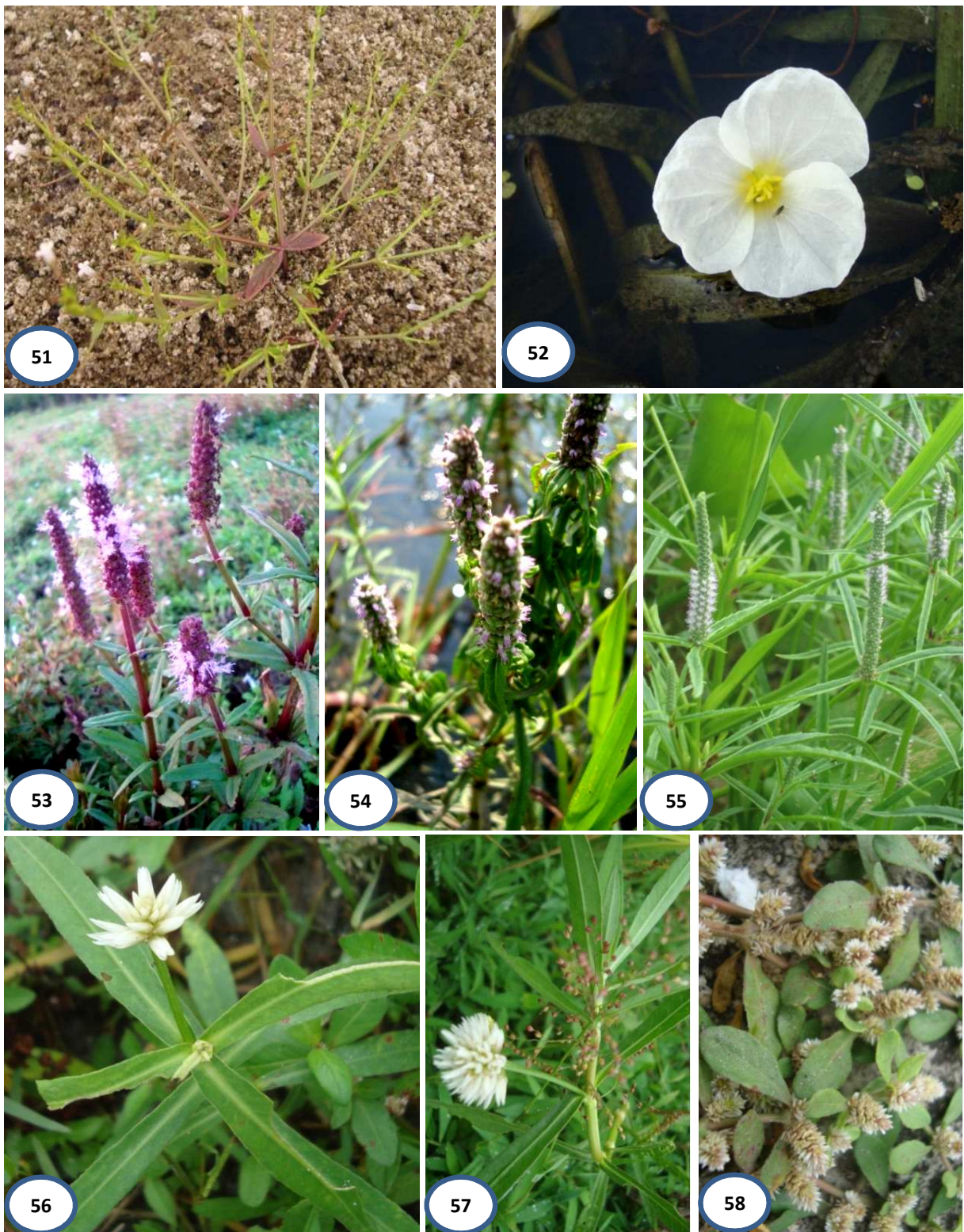


PLATE 4.11. Figs. 51 – 58. Floristic elements: 51. *Lindernia hyssopoides*; 52. *Ottelia alismoides*; 53. *Pogostemon linearis*; 54. *Pogostemon stellatus*; 55. *Pogostemon pumilus*; 56. & 57. *Alternanthera philoxeroides*; 58. *Alternanthera sessilis*

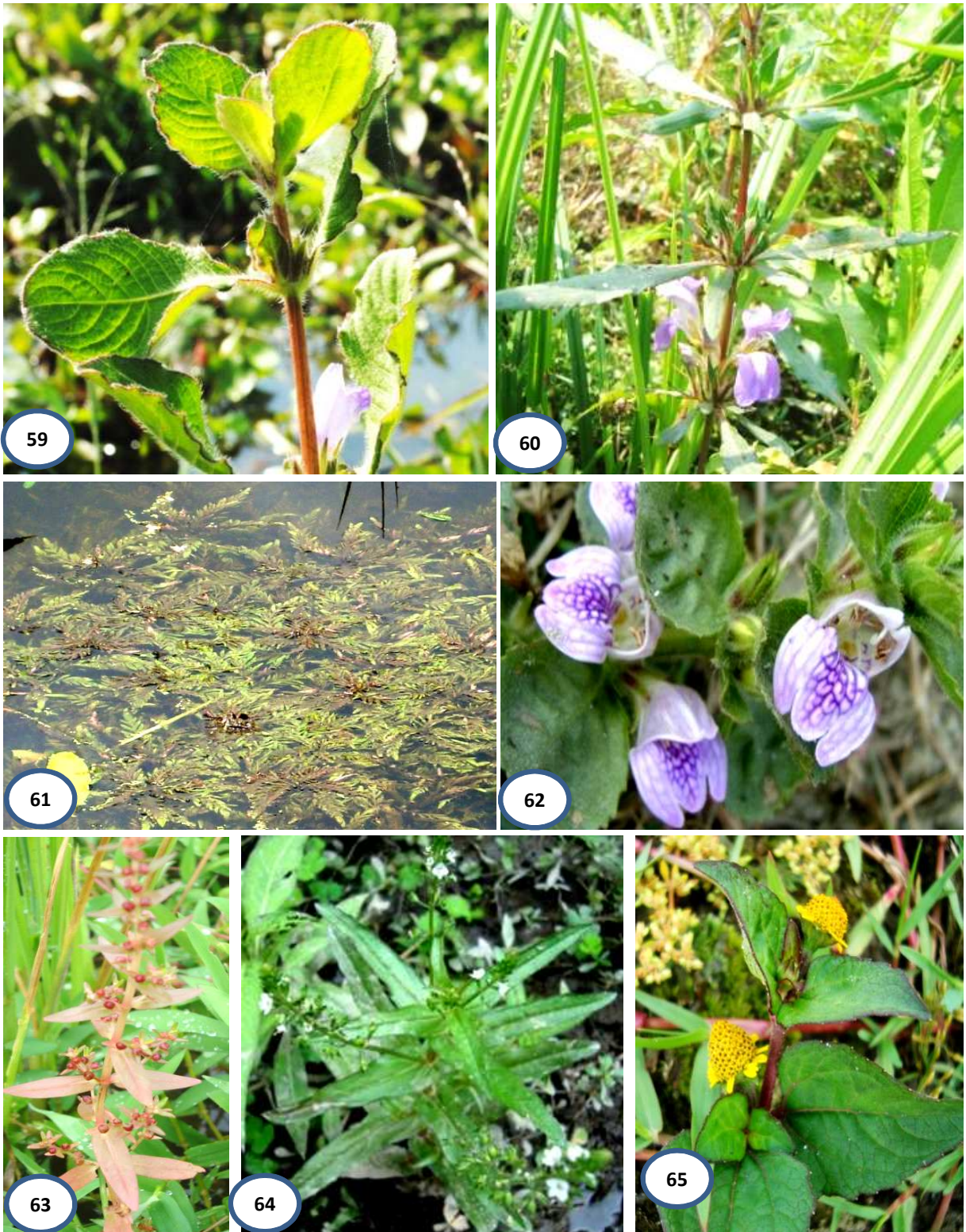


PLATE 4.12. Figs. 59 – 65. Floristic elements: 59. *Hygrophila erecta*; 60. *Hygrophila auriculata*; 61. *Hygrophila difformis* (Vegetative); 62. Flowering of *Hygrophila difformis* 63. *Ammania multiflora*; 64. *Veronica anagalis-aquatica*; 65. *Acmella paniculata*



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PLATE 4.13. Figs. 66 – 71. Floristic elements: 66. *Enydra fluctuens*; 67. *Aeschynomene indica*; 68. *Oxalis debilis* var. *corymbosa* , 69. *Heliotropium indicum*; 70. *Oldenlandia biflora*; 71. *Duchesnia indica*



PLATE 4.14. Figs. 72 – 77. Floristic elements: 73. *Utricularia aurea*; 74. *Utricularia scandens* 75. *Utricularia gibbosa* var. *exoleta*; 76. *Utricularia inflexa* ; 77. *Drosera burmanii*;78. *Oenanthe javanica*

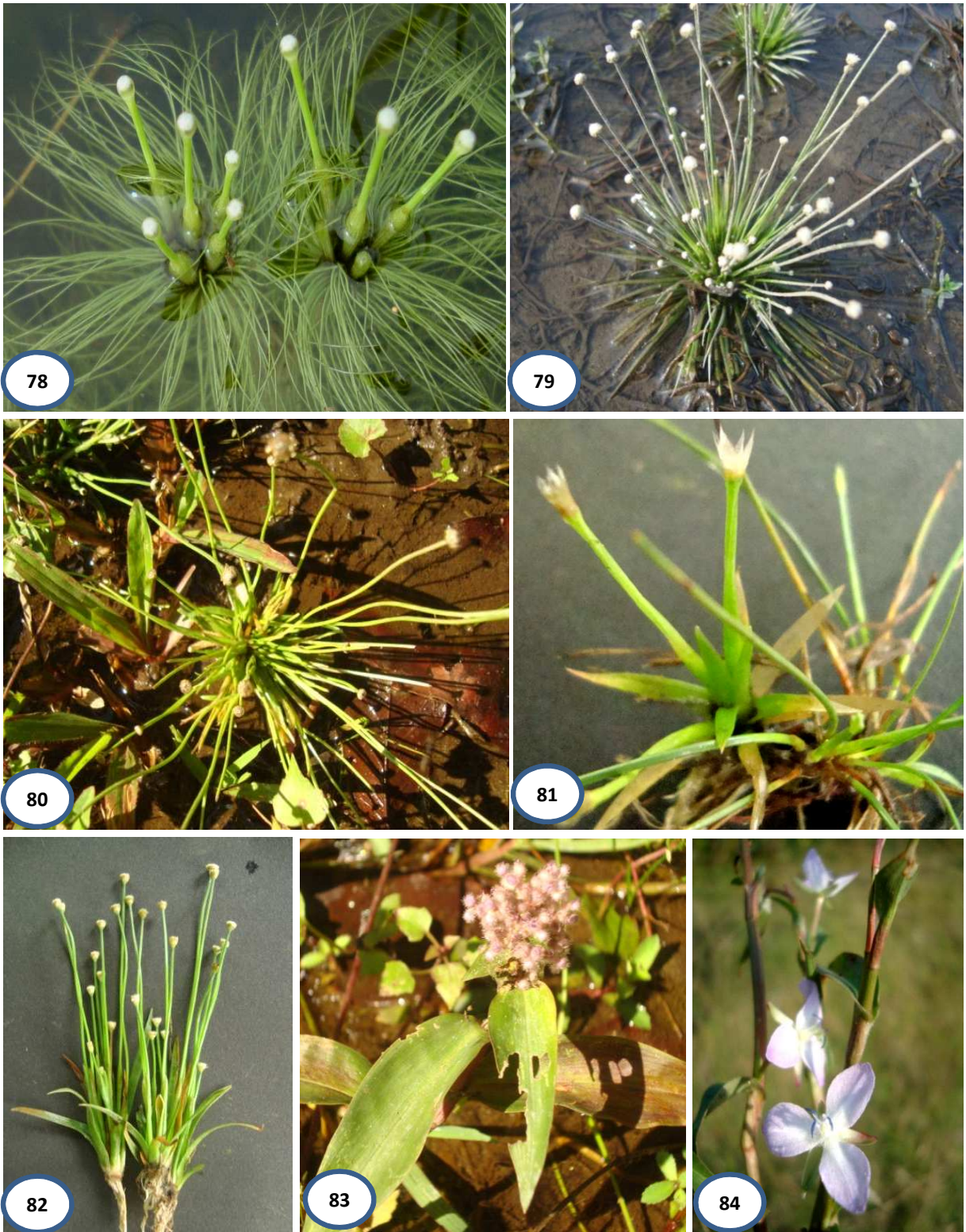


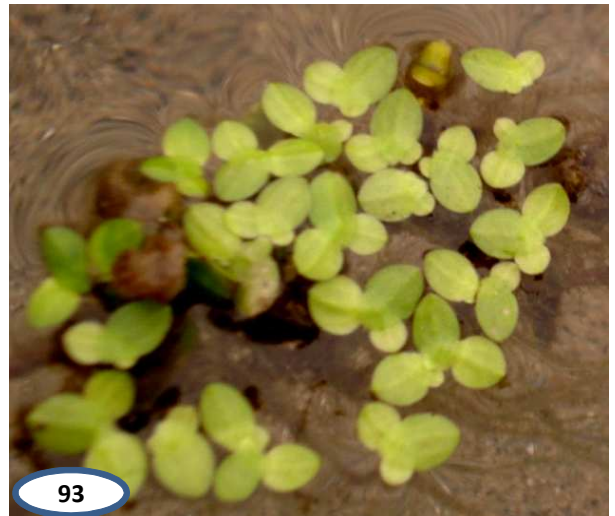
PLATE 4.15 Figs. 78 – 84. Floristic elements: 78. *Eriocaulon setaceum*; 79. *Eriocaulon cinereum*; 80. *Eriocaulon truncatum*; 81. *Eriocaulon sollyanum*; 82. *Eriocaulon minimum*; 83. *Floscopa scandens*; 84. *Murdannia keisaak*



PLATE 4.16. Figs. 85 – 91. Floristic elements: 85. *Eleocharis tetraquetra*; 86. *Schoenoplectiella articulate*; 87. *Cyanotis axilaris*; 88. *Hygrorrhiza aristata*; 89. *Oplismenus burmannii* ;90. *Fimbristylis dipsacea* ; 91. *Lasia spinosa*



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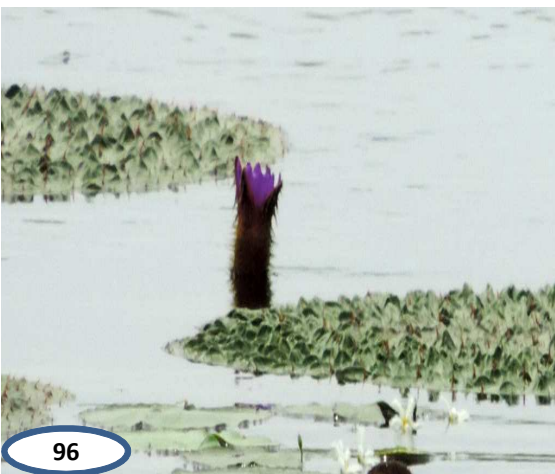
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PLATE 4.17. Figs. 92 – 98. Floristic elements: 92. *Spirodella polyrrhiza*; 93. *Spirodela punctata*; 94. *Typha angustifolia*; 95. *Acorus Calamus*; 96. *Euryale ferox*; 97. *Blyxa japonica*; 98. *Najas minor*

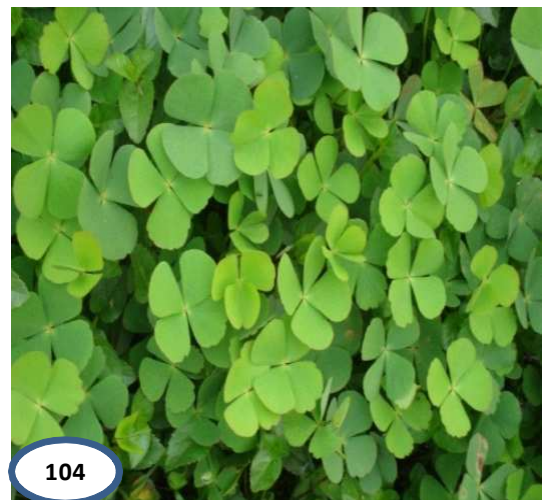
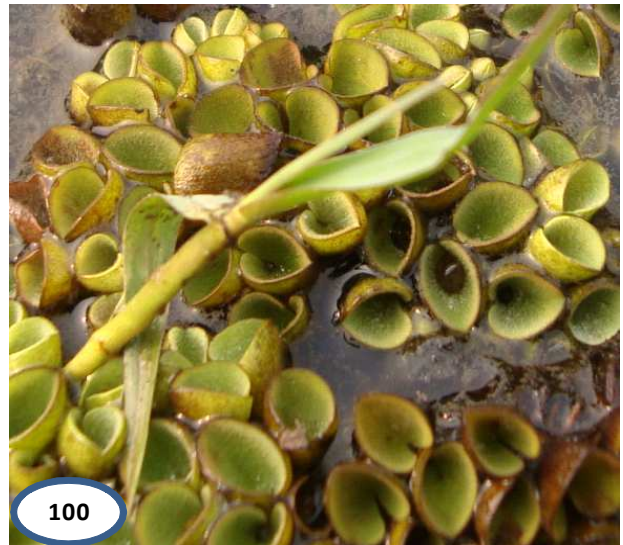


PLATE 4.18. Figs. 99 – 104. Floristic elements: 99. *Salvinia natans*; 100. *Salvinia cucullata*, 101. *Salvinia adnata*; 102. *Azolla pinnata* ssp. *africana*; 103. *Ceratopteris thalictroides*; 104. *Marsilea minuta*.



PLATE 4.19. Figs. 105 – 108. Floristic elements: 105. *Blechnum orientale*; 106. *Lycopodiella cernua* ; 107. *Diplazium esculentum*; 108.. *Selaginella monospora*

Chapter **5**
Phenology

Phenology

5.1. Introduction

Phenology is defined as a branch of science dealing with the relations between climate and periodic biological phenomena. Phenology is the study of the times of recurring natural phenomena. The word Phenology, derived from the Greek word “*phaino*” which means to show or appear, of periodic plant life cycle events that are influenced by environmental changes, especially seasonal variations in Rainfall, temperature and precipitation driven by weather and climate. The Belgian biologist, Charles Morren (1853) first coined the term Phenology. Phenology means the study of life cycle of annual and perennial plants throughout the year. Phenology can be defined as relationship between climate and biological phenomena (Lieth, 1974). Phenology is the study of response of living organisms to seasonal and climatic changes to the environment in which they live. Seasonal changes include variations in the duration of sunlight, precipitation, temperature and other life-controlling factors.

In simpler way phenology means, study of complete life cycle of plants including its germination, fertile form and death phase relating to month of particular season. The periodical climate change of a particular area is directly affects the plants’ life cycle. Phenological study helps us to understand the rhythm of changes in life cycle of plants that indicates the proper time of showing, flowering, fruiting and death especially for the agricultural crops.

The periodical proper such records also bears scientific value for understanding the interactions between organisms and their environment and for assessing the impacts of climate change.

The phenological study of any vegetation is very much useful tool for understanding of nature of vegetation in an area in better way. There are several authors who studied the detailed phenology of different species like (Ihne, 1884); (Harper, 1906); (Koelmyer, 1959); (Frankie *et al.*, 1974); (Wang, 1967); (Leith, 1970); (Caprio, 1966); (Croat, 1975) and (Putz, 1979).

In the field of phenological study of different weeds and other plants there are some works also reported from India. Such phenological studies performed on several species by Bhoj & Ramkrishnan (1981); Sundriyal (1990); Sivaraj & Krishnamurthy (1989) on Eastern Ghats and Himalayan plants. Hooker (1872); Hara *et al.* (1966 & 1971); Ohashi (1975); Grierson & Long (1983-1987, & 1994, 1991, 1999 & 2001), Noltie (1994-2000); Pearce & Cribb (2002) explored the flora of Eastern Himalaya. The Phenology of weeds of Darjeeling Hills and plains were also studied by Das & Chanda (1987); and Ghosh (2006).

Several works on the flora of aquatic and wetland plants are also available (Kachroo, 1955; Haq, 1955; Ghosh, 1967). Duthie (1903 – 1929) worked on the flora of upper Gangetic plain and adjoining Siwalik and sub-Himalayan region. Naskar (1990) explored the aquatic and semi aquatic flora of lower Gangetic plains. After considering all these important works, it is noted that knowledge on the phenology of plants of Terai and Duars is yet to study in detail. Chowdhury (2009) reported the phenology of 120 species of wetland plants of Maldah district and Acharyya (1998) reported the phenology of 129 species of crop field weeds of Maldah district. But, no other significant work from these areas has been reported so far.

Water pollination is limited to about 150 angiosperm species in 31 genera and 11 families (Cox, 1988). Almost half of these species are marine or grow in brackish water, and 9 of the families are monocotyledonous. Pollens may be transported above, on, or below the water surface. Plants those pollinate under water often have filamentous, or eel-shaped, pollen borne in mucilaginous strands.

One of the longest known and most fascinating examples of water pollination is *Vallisneria spiralis*. In this genus, plants grow submerged. Their staminate flowers are released from the plant and float to the water surface, where they open and float about. At the same time, carpellate flowers rise to the surface on long peduncles and create a slight depression in the water surface, into which staminate flowers fall and are captured. Pollination follows this capture.

However, for better understanding of the flora and vegetation of the wetlands of the Terai-Duars areas of West Bengal, the phenological data was almost completely lacking. During present investigation it was taken as an important aspect for observation and then aggregated and analysed.

5.2. Result and Discussion

The phenology of wetland plants growing in Terai and Duars of West Bengal has been attempted. As much as 244 species of wetland angiosperms were chosen for such study. The observation has been made during 2010 – 2014. During the study several data have been collected regarding plant growth and different successive stages of their life cycle *in vivo*. The following phenological parameters were studied during the survey:

1. Period of seedling appearance or sprouting
2. Period of vegetative growth
3. Period of Flowering
4. Pollination method
5. Period of Fruit ripening and seed dispersal
6. Period of death or rest

All the above mentioned phenophases were observed month wise, sometimes in different vegetation in the entire study area. Sometimes, little variation has been observed in different location and the total period has been considered in such cases. The pollination patterns of wetland plants are very interesting. Three major pollination modes have been found to be recognized among the wetland plants, namely anemophily, zoophily and hydrophily. Apart from these three major types. So, after careful observation the different modes of pollination have been recognized as (i) *Anemophilous*, (ii) *Entomophilous*, (iii) *Hydrophilous*, (iv) *Anemo-Entomophilous*, (v) *Entomo-Hydrophilous* and (vi) *Anemo-Hydrophilous*.

The nature and time of seedling appearance is somehow different from terrestrial plants. During phenological study of wetland plants it was noted that maximum number of aquatic and wet loving plants seedling appear during April to December. Those species, which appear from bulb, rhizome, rootstalk etc., the phenomenon of new flash or new shoot appearance is treated as the start of new life cycle. Similarly, drying up or passing into the dormant phase has been treated as the completion of life cycle.

5.3. Habit groups

Following the works of Tansley (1949); Sculthorpe (1967) and Chowdhury (2009), wetland plants can be classified into 8 categories on the basis of their habit, namely: (i) *Free floating hydrophytes*, (ii) *Rooted with floating leaf hydrophytes*, (iii) *Submerged hydrophytes*, (iv) *Suspended hydrophytes*, (v) *Emerged hydrophytes*, (vi) *Annual moist loving herbs*, (vii) *Perennial moist loving herbs* (viii) *Simulated wetland plants*.

Among 428 angiosperms, 244 species of angiosperms have been taken from the wetland vegetation in Terai and Duars for the phenological study [Table 5.1]. Of these 132 species (54.10 %) are annuals. They complete their life cycle within a span of one year, from appearance to death, to avoid drought and flood. They are followed by 67 species (27.45 %) of emerged or marshy species, 10 species (4.10 %) of rooted with floating leaf hydrophytes, 09 species (3.69 %) of submerged hydrophytes, 09 species (3.69 %) of perennial herbs, 06 species (2.46 %) of suspended hydrophytes, 04 species (1.64 %) of under shrubs, and 04 species (1.64 %) of free floating hydrophytes. In addition, there are 03 species (1.22 %) of trailer hydrophytes.

Table 5.1. Habit group classification of recorded wetland plants

Sl. No.	Habit Groups	No. of Species	Percentage (%)
01.	Free floating Hydrophytes(HFF)	4	1.64
02.	Rooted with floating leaf Hydrophytes (HRF)	10	4.10
03.	Submerged Hydrophytes (HS)	9	3.69
04.	Suspended Hydrophytes (HSP)	6	2.46
05.	Emerged or marshy Hydrophytes (HE)	67	27.46
06.	Annual wetland herbs (HA)	132	54.10
07.	Perennial wetland herbs (HP)	9	3.69
08.	Trailer Hydrophytes (HT)	3	1.22
09.	Under shrub (SU)	4	1.64
Total		244	100

The wetland plants complete their life cycle easily during rainy season, when almost all the wetlands remain flooded. After that the dry-season vegetation replace the marsh/ wet vegetation, though the submerged vegetation survive at some places; agricultural activity stops and a completely different picture prevails in all parts of the wetland dominating districts. But, after the monsoon, when the water level recedes and the dry-land agricultural activities regains. Removal of weeds manually or with the application of herbicides starts in large scale and disturb life cycle of all these plants.

5.4. Life forms or Growth forms

The 'growth-form' and the 'life-form' are synonymous concepts. According to Segal (1966), growth forms are morphological types adapted to their special environment and are considered principally or completely determined by the physical environment and distinguished growth forms on the basis of morphological dependences on atmospheric, aquatic, or edaphic conditions (Beeteswari *et al.*, 2009).

Life forms study of wetland plants of Terai and Duars have been recorded for 5 years (2010 – 2014). The observation shows (Table 5.2) the *Therophytes* are the most dominating group with 140 species (50.68 %). They are followed by *Cryptophytes* with 59 species (24.18 %), 27 species of *Chamaephytes*, 13 species of *Hemicryptophytes* and 5 species of *Phanerophytes*. As the study is restricted to the wetland so the *Cryptophytes* were studied in details and result shows that these are 34 *Hydrophytes* and 25 *Helophytes*. The vegetation in Terai and Duars wetlands are mainly dominating with *Therophytes* and *Cryptophytes*.

The present life forms of wetland plants also can be compared with Raunkiaers value of Biological Spectrum. Among the wetland vegetation *Therophytes* contributed maximum value with 57.38 % that is four times more than of Raunkiaers normal value, and the *Cryptophytes* with 24.17 % is four times more than normal spectrum value. Third largest group is *Chamaephytes* with 11.06 % which is quite nearer to the normal value. Last two groups show reverse value, where *Hemicryptophytes* and *Phanerophyte*

Table 5.2. Life forms distribution among the wetland plants

Sl. No.	Life Forms	Sub-Classes	No. of Species	Percentage (%)		Raunkiaer's Normal value (%)
01.	Phanerophytes	-	05	2.05	2.05	46.00
02.	Chamaephytes	-	27	11.06	11.06	9.00
03.	Hemicryptophytes	-	13	5.33	5.33	26.00
04.	Cryptophytes	Helophytes	25	10.24	24.17	6.00
		Hydrophytes	34	13.93		
05.	Therophytes	-	140	57.38	57.38	13.00

5.5. Phenology of Wetland plants

Phenology covers different stages in the life of a plant. It starts from germination or sprouting after a resting period and ending with the death or entering into the next rest period. It is true for almost all plants and is directly related with the set of total environmental conditions. The result of the present investigation is presented below considering such stages separately. [Table 5.3]

Table 5.3. Phenology, Life forms, Habit groups and modes of Pollination for wetland flora of Terai & Duars. [T = Therophytes Ch = Chamaephytes, HD = Hydrophytes, HH = Helophytes, Free floating Hydrophytes (HFF), Rooted with floating leaf Hydrophytes (HRF), Submerged Hydrophytes (HS), Suspended Hydrophytes (HSP), Emerged or marshy Hydrophytes (HE), Annual wetland herbs (HA), Perennial wetland herbs (HP), Trailer Hydrophytes (HT), Under shrub (SU)]

Name of Plants	Life forms	Habit groups	Germination	Vegetative growth	Flowering	Fruiting	Death/ Rest	Pollination
<i>Acmella paniculata</i>	Ch	HA	Jul-Sept	Jul-Mar	Sept-Feb	Nov-Mar	Feb-May	E
<i>Adenostemma suffruticosum</i>	Ch	HA	Jul-Sept	Jul-Mar	Sept-Feb	Nov-Mar	Feb-May	E
<i>Aeschynomene aspera</i>	HH	HE	Jun-Aug	Jun-Apr	Aug-Dec	Sep-Feb	Jan-Apr	E/A
<i>Aeschynomene indica</i>	HH	HE	Jul-Sept	Jul-Feb	Sept-Dec	Oct-Mar	Feb-May	E
<i>Ageratum conyzoides</i>	T	HA	Dec-Jan	Dec-Mar	Jan-Mar	Feb-Apr	Mar-May	E
<i>Ageratum haustonianum</i>	T	HA	Dec-Jan	Dec-Mar	Jan-Mar	Feb-Apr	Mar-May	E
<i>Alternanthera paronychioides</i>	Ch	HA	Nov-Feb	Dec-Sep	Feb-Aug	Jul-Sep	Aug-Sep	E
<i>Alternanthera philoxeroides</i>	T	HA	Aug-Oct	Jan-Dec	Jan-May	Apr-Jun	Jun-Sep	E
<i>Alternanthera pungens</i>	T	HA	Nov-Jan	Nov-Aug	Jan-May	Apr-Aug	Jul-Sep	E
<i>Alternanthera sessilis</i>	Ch	HA	Jul-Aug	Jan-Dec	Oct-May	Mar-Jul	Jul-Sep	A
<i>Alysicarpus bupleurifolius</i>	Ch	HA	Jul-Aug	Jul-Feb	Aug-Dec	Sep-Jan	Jan-Feb	A
<i>Alysicarpus monilifer</i>	Ch	HA	Jul-Aug	Jul-Feb	Aug-Dec	Sep-Jan	Jan-Feb	A
<i>Alysicarpus vaginalis</i>	Ch	HA	Jul-Aug	Jul-Feb	Aug-Dec	Sep-Jan	Jan-Feb	A
<i>Amaranthus spinosus</i>	T	HA	Oct-Dec	Oct-Jun	Dec-Apr	Jan-Jun	May-Jul	A
<i>Amaranthus blitum</i> ssp. <i>oleraceus</i>	T	HA	Oct-Dec	Oct-Jun	Dec-Apr	Jan-Jun	May-Jul	A
<i>Amaranthus viridis</i>	T	HA	Jul-Sept	Aug-Mar	Sept-Jan	Dec-Mar	Feb-Apr	A
<i>Ammannia auriculata</i>	T	HA	Dec-Jan	Jan-Mar	Dec-Feb	Jan-Mar	Mar-Apr	A
<i>Ammannia baccifera</i>	T	HA	Nov-Jan	Nov-May	Dec-Mar	Feb-May	Mar-Jun	E
<i>Ammannia multiflora</i>	T	HA	Dec-Jan	Jan-Mar	Dec-Feb	Jan-Mar	Mar-Apr	E
<i>Anagallis arvensis</i>	T	HA	Nov-Dec	Nov-Jan	Jan-Feb	Feb-Apr	Mar-May	E/A
<i>Aponogeton appendiculatus</i>	HD	HRF	Aug-Oct	Aug-Mar	Sept-Feb	Oct-Mar	Feb-Apr	E/H
<i>Aponogeton crispus</i>	HD	HRF	Aug-Oct	Aug-Mar	Sept-Feb	Oct-Mar	Feb-Apr	E/H
<i>Aponogeton lakhonensis</i>	HD	HRF	Aug-Oct	Aug-Mar	Sept-Feb	Oct-Mar	Feb-Apr	E/H
<i>Aponogeton natans</i>	HD	HRF	Jul-Sept	Jan-Dec	Aug-Jan	Sept-Feb	Feb-Apr	H
<i>Aponogeton undulatus</i>	HD	HRF	Jul-Sept	Jan-Dec	Aug-Jan	Sept-Feb	Feb-Apr	H
<i>Arundo donax</i>	H	HE	Aug-Oct	Jan-Dec	Nov-Feb	Jan-Mar	May-Jul	A

Name of Plants	Life forms	Habit groups	Germination	Vegetative growth	Flowering	Fruiting	Death/Rest	Pollination
<i>Athroisma laciniatum</i>	T	HA	Dec-Jan	Jan-Jun	Mar-Jul	Apr-Jun	May-Jul	E
<i>Bacopa monnieri</i>	Ch	HA	Aug-Nov	Jan-Dec	Sept-Feb	Jan-Apr	Apr-Jun	E
<i>Bergia ammannioides</i>	T	HA	Jul-Aug	Jul-Feb	Sept-Jan	Dec-Feb	Feb-Apr	A
<i>Bergia capensis</i>	T	HA	Jul-Aug	Jul-Feb	Sept-Jan	Dec-Feb	Feb-Apr	A
<i>Blumea hieracifolia</i>	T	HA	Jan-Feb	Jan-Apr	Feb-May	Apr-Jun	May-Jul	E
<i>Blumea lacera</i>	T	HA	Dec-Feb	Dec-Mar	Feb-May	Apr-Jun	May-Jul	E
<i>Blyxa japonica</i>	HD	HS	Jul-Aug	Jul-Jan	Nov-Feb	Jan-Mar	Feb-Mar	H
<i>Blyxa octandra</i>	HD	HS	Jul-Aug	Jul-Jan	Nov-Feb	Jan-Mar	Feb-Mar	H
<i>Bulbostylis densa</i>	T	HA	Jul-Aug	Jul-Jan	Sept-Feb	Oct-Mar	Jan-Mar	E
<i>Caesulia axillaris</i>	T	HE	Aug-Sept	Aug-Mar	Oct-Feb	Nov-Mar	Feb-Apr	A/E
<i>Caldesia parnassifolia</i>	T	HE	Aug-Sept	Aug-Mar	Oct-Feb	Nov-Mar	Feb-Apr	A/E
<i>Celosia argentea</i>	T	HA	Dec-Jan	Dec-Mar	Dec-Feb	Jan-Mar	Feb-Apr	E
<i>Centaurium centaurioides</i>	T	HA	Dec-Jan	Dec-Mar	Jan-Mar	Feb-Apr	Feb-May	A/E
<i>Centella asiatica</i>	Ch	HA	Dec-Jan	Jan-Dec	Sept-Dec	Oct-Jan	**	E
<i>Ceratophyllum demersum</i>	HD	HSP	Aug-Oct	Jan-Dec	Oct-Dec	Nov-Jan	Apr-Jun	H
<i>Chloris barbata</i>	T	HA	Mar-May	Mar-Sept	May-Sept	Jun-Oct	Sept-Nov	A
<i>Chrozophora rotleri</i>	P	SU	Jan-Apr	Jan-Jun	Jan-Jul	Jan-May	May-Jul	E
<i>Cirsium arvense</i>	T	HA	Dec-Jan	Dec-Mar	Jan-Mar	Mar-May	Feb-Jun	E
<i>Clerodendrum indicum</i>	H	SU	Mar-Jun	Mar-Jul	Jun-Jan	Jul-Feb	Dec-Jan	E
<i>Coix aquatica</i>	H	HE	Sept-Oct	Sept-Dec	Oct-Dec	Oct-Jan	Dec-Feb	A
<i>Coldenia procumbens</i>	Ch	HA	Dec-Feb	Dec-Apr	Jan-Jun	Feb-Aug	Jul-Aug	A
<i>Commelina benghalensis</i>	Ch	HA	Nov-Feb	Nov-Jul	Jan-Aug	Feb-Sept	Oct-Jan	E
<i>Commelina diffusa</i>	Ch	HA	Nov-Feb	Nov-Jul	Jan-Aug	Feb-Sept	Oct-Jan	E
<i>Commelina longifolia</i>	Ch	HA	Jun-Sept	Jun-Dec	Jul-Dec	Aug-Jan	Jan-Feb	E
<i>Commelina paludosa</i>	Ch	HA	Nov-Feb	Nov-Jul	Jan-Aug	Feb-Sept	Oct-Jan	E
<i>Commelina suffruticosa</i>	H	HA	Nov-Jan	Nov-Feb	Jan-Feb	Feb-Mar	Mar-Apr	E
<i>Cotula anthemoides</i>	T	HA	Nov-Dec	Nov-Jan	Dec-Feb	Jan-Mar	Feb-May	A
<i>Cotula hemisphaerica.</i>	T	HA	Dec-Jan	Dec-Feb	Jan-Feb	Jan-Mar	Feb-May	A
<i>Cryptocoryne ciliata</i>	C	HE	Jan-May	Dec-Jun	May-Aug	Jun-Sept	Sept-Nov	E
<i>Cryptocoryne retrospiralis</i>	C	HE	Jan-May	Dec-Jun	May-Aug	Jun-Sept	Sept-Nov	E
<i>Cyanoglossum lanceolatum</i>	T	HA	Jun-Aug	Jun-Oct	Jul-Nov	Oct-Dec	Dec-Jan	E
<i>Cynodon dactylon</i>	Ch	HP	Jan-Dec	Jan-Dec	Jan-Dec	Jan-Dec	**	A
<i>Cyanotis axillaris</i>	Ch	HA	Jul-Sept	Jul-Nov	Jul-Dec	Aug-Jan	Dec-Feb	E
<i>Cyperus compactus</i>	HH	HE	Jul-Aug	Jul-Oct	Aug-Nov	Aug-Dec	Nov-Dec	A
<i>Cyperus compressus</i>	T	HE	Jul-Sept	Jul-Jan	Jul-Dec	Aug-Jan	Jan-Mar	A
<i>Cyperus difformis</i>	HH	HE	Jan-Dec	Jan-Dec	Jan-Dec	Jan-Dec	Mar-Jul	A
<i>Cyperus digitatus</i>	HH	HE	Jul-Sept	Jul-Jan	Aug-dec	Sept-Jan	Dec-Feb	A
<i>Cyperus distans</i>	HH	HE	Jul-Sept	Jul-Dec	Aug-dec	Sept-Jan	Dec-Feb	A
<i>Cyperus halpan</i>	HH	HE	Apr-Sept	Apr-Oct	May-Dec	Jun-Jan	Dec-Mar	A
<i>Cyperus imbricatus</i>	HH	HE	Apr-Sept	Apr-Oct	May-Sept	May-Oct	Oct-Dec	A
<i>Cyperus iria</i>	T	HA	Jul-Nov	Jul-Jan	Aug-Jan	Sept-Feb	Feb-Mar	A
<i>Cyperus niveus</i>	HH	HE	Apr-Sept	Apr-Oct	May-Sept	Jun-Oct	Nov-Dec	A
<i>Cyperus pilosus</i>	HH	HE	Jul-Sept	Jul-Oct	Aug-Dec	Sept-Feb	Dec-Mar	A
<i>Cyperus rotundus</i>	T	HE	Jul-Dec	Jul-Jan	Jul-Dec	Aug-Jan	Jan-Mar	A
<i>Cyperus squarrosus</i>	HH	HE	Apr-Sept	Apr-Dec	Jun-Feb	Jun-Mar	Feb-May	A
<i>Dactyloctenium aegyptium</i>	Ch	HA	Jun-Sept	Jun-Nov	Jul-Nov	Aug-Jan	Dec-Feb	E

Name of Plants	Life forms	Habit groups	Germination	Vegetative growth	Flowering	Fruiting	Death/ Rest	Pollination
<i>Dentella repens</i>	Ch	HA	May-Aug	Mar-Dec	Aug-Dec	Oct-Feb	Dec-Mar	E
<i>Desmodium gangeticum</i>	T	HA	Oct-Dec	Oct-Nov	Apr-Oct	May-Nov	Oct-Jan	E
<i>Desmodium gyroides</i>	T	HA	Oct-Dec	Oct-Nov	Apr-Oct	May-Nov	Oct-Jan	E
<i>Desmodium triflorum</i>	T	HA	Oct-Dec	Oct-Nov	Apr-Oct	May-Nov	Oct-Jan	E
<i>Desmostachya bipinnata</i>	H	HP	Feb-May	Feb-Sept	Apr-Dec	May-Jan	Jan-Mar	A
<i>Digera muricata</i>	T	HA	May-Aug	May-Oct	Jul-Dec	Aug-Feb	Jan-Mar	E
<i>Dopatrium junceum</i>	T	HA	Jul-Aug	Jul-Oct	Aug-Oct	Sept-Nov	Nov-Dec	E
<i>Echinochloa colona</i>	T	HE	Jul-Oct	Jul-Oct	Jul-Nov	Aug-Dec	Dec-Mar	A
<i>Echinochloa crus-galli</i>	HH	HE	Jul-Oct	Jul-Oct	Aug-Nov	Sept-Dec	Dec-Mar	A
<i>Echinochloa stagnina</i>	HH	HE	Aug-Sept	Aug-Nov	Sept-Dec	Oct-Dec	Dec-Jan	A
<i>Eclipta prostrata</i>	T	HA	Jan-Dec	Jan-Dec	Jan-Dec	Jan-Dec	Mar-Jul	A/E
<i>Eichhornia crassipes</i>	HD	HFF	Jul-Dec	Jan-Dec	Sept-Jan	Sept-Feb	Apr-Jun	E
<i>Eleocharis congesta</i>	HH	HE	Jul-Dec	Sept-Jan	Jul-Nov	Aug-Dec	Nov-Jan	A
<i>Eleocharis palustris</i>	HH	HE	Sept-Dec	Sept-Jan	Nov-Feb	Dec-Mar	Feb-May	A
<i>Eleocharis retroflexa</i>	HH	HA	Jul-Dec	Sept-Jan	Jul-Nov	Aug-Dec	Dec-Jan	A
<i>Eleocharis tetraquetra</i>	HH	HE	Sept-Dec	Sept-Jan	Oct-Nov	Nov-Dec	Dec-Jan	A/E
<i>Eleusine indica</i>	T	HA	Jun-Aug	Jun-Nov	Jul-Nov	Jul-Dec	Dec-Jan	E
<i>Enydra fluctuans</i>	Ch	HA	Nov-Dec	Jan-Dec	Jan-Mar	Feb-Apr	Apr-Jul	A/E
<i>Eragrostis gangetica</i>	T	HA	Jul-Aug	Jul-Dec	Aug-Dec	Sept-Feb	Dec-Feb	A
<i>Eragrostis minor</i>	T	HA	Mar-Jun	Mar-Dec	Jun-Feb	Jul-Mar	Feb-Apr	E
<i>Eragrostis pilosa</i>	T	HA	Jul-Aug	Jul-Dec	Aug-Feb	Sept-Mar	Jan-Mar	A
<i>Eragrostis tenella</i>	T	HA	Jul-Aug	Jul-Dec	Aug-Feb	Sept-Mar	Jan-Mar	A
<i>Eragrostis uniolooides</i>	T	HA	Mar-Jun	Mar-Dec	Jun-Feb	Jul-Mar	Feb-Apr	E
<i>Eriocaulon cinereum</i>	HH	HE	Aug-Oct	Aug-Dec	Oct-Jan	Nov-Mar	Dec-Apr	A/E
<i>Eriocaulon minimum</i>	HH	HE	Aug-Oct	Aug-Dec	Oct-Jan	Nov-Mar	Dec-Apr	A/E
<i>Eriocaulon setaceum</i>	HH	HE	Aug-Oct	Aug-Dec	Oct-Jan	Nov-Mar	Dec-Apr	A/E
<i>Eriocaulon sollyanum</i>	HH	HE	Aug-Oct	Aug-Dec	Oct-Jan	Nov-Mar	Dec-Apr	A/E
<i>Euphorbia indica</i>	T	HA	Dec-Mar	Dec-Apr	Jan-Apr	Jan-May	Mar-May	E
<i>Euryale ferox</i>	HD	HRF	Dec-Feb	Dec-May	Apr-Jun	May-Jul	Jul-Aug	E
<i>Ficus heterophylla</i>	H	HP	Nov-Feb	Nov-Mar	Jan-May	Feb-Jun	Jun-Sept	E
<i>Fimbristylis aestivalis</i>	T	HA	Mar-Oct	Mar-Dec	Aug-Jan	Sept-Feb	Jan-Mar	A
<i>Fimbristylis argentia</i>	T	HE	Feb-Jun	Feb-Jul	Feb-Jun	Mar-Jul	Jun-Aug	E
<i>Fimbristylis dichotoma</i>	T	HA	Mar-Sept	Mar-Dec	May-Oct	Jun-Nov	Oct-Jan	A
<i>Fimbristylis dipsacea</i>	T	HA	Mar-Sept	Mar-Dec	May-Oct	Jun-Nov	Oct-Jan	A
<i>Fimbristylis littoralis</i>	HH	HE	Feb-Jun	Feb-Jul	Feb-Jun	Mar-Jul	Jun-Aug	A
<i>Fimbristylis squarrosa</i>	T	HE	Feb-Jun	Feb-Jul	Feb-Jun	Mar-Jul	Jun-Aug	E
<i>Fimbristylis tetragona</i>	T	HA	Mar-Sept	Mar-Dec	May-Oct	Jun-Nov	Oct-Jan	A
<i>Fimbristylis tetragona</i>	T	HA	Jul-Oct	Jul-Dec	Oct-Dec	Oct-Jan	Dec-Feb	E
<i>Fuirena ciliaris</i>	T	HA	Sept-Nov	Sept-Nov	Oct-Nov	Nov-Dec	Dec-Jan	E
<i>Fumaria indica</i>	T	HA	Oct-Dec	Oct-Dec	Nov-Feb	Dec-Mar	Feb-Apr	A/E
<i>Glinus lotoides</i>	Ch	HA	Feb-Jun	Feb-Jul	Apr-Jul	May-Aug	Jul-Aug	E
<i>Glinus oppositifolius</i>	Ch	HA	Jan-Apr	Jan-Dec	Feb-Jun	Mar-Jul	Jul-Aug	E
<i>Gnaphalium purpureum</i>	T	HA	Jan-Mar	Jan-Dec	Feb-Oct	Mar-Non	Nov-Jan	A
<i>Gnaphalium polycaulon</i>	T	HA	Jan-Mar	Jan-Apr	Feb-Jun	Mar-Jul	May-Aug	E
<i>Grangea maderaspatana</i>	Ch	HA	Jan-Feb	Jan-Mar	Feb-Apr	Mar-May	Apr-Jun	E
<i>Heliotropium indicum</i>	T	HA	Aug-Nov	Aug-Mar	Sept-Jun	Oct-Jul	Jul-Aug	E
<i>Heliotropium ovalifolium</i>	T	HA	Jan-Mar	Jan-Jun	Jan-Jul	Jun-Aug	Aug-Sept	E

Name of Plants	Life forms	Habit groups	Germination	Vegetative growth	Flowering	Fruiting	Death/ Rest	Pollination
<i>Hydrilla verticillata</i>	HD	HS	Jul-Aug	Jul- Mar	Nov-Jan	Dec-Feb	Feb-Apr	H
<i>Hydrolea zeylanica</i>	HH	HE	Aug-Dec	Aug-Jan	Nov-Feb	Dec-Mar	Feb-Apr	A/E
<i>Hygrophila auriculata</i>	T	HA	Nov-Dec	Nov-May	Jan-Apr	Feb-Jul	Aug-Sept	E
<i>Hygrophila difformis</i>	Ch	HA	Sept-Nov	Oct-Mar	Jan-May	Feb-Jul	Jul-Aug	E
<i>Hugrophila erceta</i>	T	HE	Oct-Dec	Oct-Aug	Mar-Jul	Apr-Jul	Jul-Aug	A/E
<i>Hygrophila polysperma</i>	T	HE	Oct-Dec	Oct-Aug	Mar-Jul	Apr-Jul	Jul-Aug	A/E
<i>Hygrophila phlomoides</i>	T	HE	Oct-Dec	Oct-Aug	Mar-Jul	Apr-Jul	Jul-Aug	A/E
<i>Hygrophila quadrivalvis</i>	T	HE	Oct-Dec	Oct-Aug	Mar-Jul	Apr-Jul	Jul-Aug	A/E
<i>Hygrophila ringens</i>	T	HE	Oct-Dec	Oct-Aug	Mar-Jul	Apr-Jul	Jul-Aug	A/E
<i>Hygroyza aristata</i>	Ch	HE	Aug-Oct	Aug-Nov	Oct-Nov	Oct-Dec	Dec-Jan	E
<i>Imperata cylindrica</i>	H	HP	Jan-Apr	Jan-Dec	Feb-Apr	Mar-May	Aug-Dec	A
<i>Ipomoea aquatica</i>	Ch	HE	Jul-Dec	Jan-Dec	Aug-Feb	Sept-Feb	Feb-Apr	E
<i>Ipomoea carnea</i>	H	SUA	Jul-Sept	Jul-Dec	Aug-Feb	Sept-Mar	Feb-May	E
<i>Ixeris polycephala</i>	T	HA	Nov-Jan	Nov-Feb	Nov-Apr	Dec-May	May-Jul	E
<i>Justicia diffusa</i>	T	HA	Aug-Oct	Aug-Apr	Oct-Feb	Jan-Apr	Mar-May	A
<i>Justicia gendarussa</i>	T	HA	Aug-Oct	Aug-Apr	Oct-Feb	Jan-Apr	Mar-May	A
<i>Justicia japonica</i>	T	HA	Jul-Aug	Jul-Dec	Aug-Oct	Sept-Dec	Oct-Jan	A
<i>Kyllinga brevifolia</i>	T	HA	Dec-Jan	Dec-Mar	Jan-Mar	Feb-Apr	Mar-May	A
<i>Kyllinga nemoralis</i>	T	HA	Dec-Jan	Dec-Mar	Jan-Mar	Feb-Apr	Mar-May	A
<i>Laphangium luteoalbum</i>	T	HA	Nov-Dec	Nov-Apr	Dec-Apr	Jan-May	Apr-Jul	A
<i>Lasia spinosa</i>	C	HA	Jun-Aug	Jan-Dec	Nov-Jan	Dec-Feb	Feb-Jun	E
<i>Launaea aspleniifolia</i>	T	HA	Dec-Feb	Dec-May	Jan-Apr	Feb-May	Apr-Jul	E
<i>Leersia hexandra</i>	T	HA	Aug-Oct	Aug-Oct	Oct-Nov	Nov-Dec	Nov-Dec	A
<i>Leptochloa panicea</i>	T	HA	Mar-May	Mar-Nov	May-Sept	Jun-Oct	Oct-Jan	A
<i>Limnophila aromatica</i>	HD	HE	Aug-Oct	Aug-Jan	Oct-Jan	Nov-Feb	Jan-Mar	E
<i>Limnophila heterophylla</i>	HD	HE	Aug-Oct	Aug-Jan	Oct-Jan	Nov-Feb	Jan-Mar	E
<i>Limnophila indica</i>	HD	HE	Jul-Aug	Jul-Jan	Aug-Feb	Sept-Mar	Jan-Apr	E
<i>Limnophila repens</i>	HD	HE	Sept-Nov	Sept-Dec	Nov-jan	Dec-Feb	Jan-Mar	E/H
<i>Limnophila rugosa</i>	HD	HE	Jul-Aug	Jul-Jan	Aug-Feb	Sept-Mar	Jan-Apr	E
<i>Limnophila sessiliflora</i>	HD	HE	Jul-Sept	Jul-Dec	Sept-Jan	Nov-Feb	Jan-Mar	E/H
<i>Lindernia anagallis</i>	T	HA	Nov-Dec	Nov-Mar	Jan-Feb	Jan-Mar	Feb-Apr	E
<i>Lindernia ciliata</i>	T	HA	Nov-Dec	Nov-Mar	Jan-Feb	Jan-Mar	Feb-Apr	E
<i>Lindernia cordifolia</i>	T	HA	Mar-Jun	Mar-Dec	Jul-Dec	Aug-Dec	Nov-Mar	A
<i>Lindernia crustacea</i>	Ch	HA	Jul-Aug	Jul-Dec	Aug-Dec	Oct-Dec	Nov-Mar	A
<i>Lindernia hirsuta</i>	T	HA	Jun-Jul	Jun-Dec	Jun-Nov	Oct-Dec	Nov-Jan	E
<i>Lindernia oppositifolia</i>	T	HA	Jul-Aug	Jul-Dec	Aug-Dec	Oct-Dec	Nov-Mar	E
<i>Lindernia pusilla</i>	T	HA	Jul-Aug	Jul-Nov	Aug-Nov	Oct-Jan	Dec-Feb	A/E
<i>Lindernia pyxidaria</i>	T	HA	May-Aug	Jul-Dec	June-Jan	Aug-Dec	Nov-Feb	E
<i>Lindernia rotundifolia</i>	T	HA	Jul-Aug	Jul-Nov	Aug-Nov	Oct-Jan	Dec-Feb	A/E
<i>Lindernia viscosa</i>	T	HA	Jul-Aug	Jul-Nov	Aug-Nov	Oct-Jan	Dec-Feb	A/E
<i>Lippia javanica</i>	P	HA	Jan-Apr	Jan-Sept	Jan-Jul	Feb-Aug	Sept-Nov	E
<i>Lobelia alsinoides</i>	T	HE	Sept-Nov	Sept-Nov	Sept-Nov	Oct-Dec	Nov-Dec	E
<i>Ludwigia adscendens</i>	HD	HT	Jul-Aug	Jan-Dec	Sept-May	Oct-Jun	Jun-Jul	E
<i>Ludwigia octavalvis</i>	T	HE	Jul-Aug	Jul-Dec	Aug-Jan	Sept-Feb	Dec-Feb	E
<i>Ludwigia peruviana</i>	T	HE	Jul-Aug	Jul-Dec	Aug-Jan	Sept-Feb	Dec-Feb	E
<i>Ludwigia perennis</i>	T	HE	Jul-Aug	Jul-Feb	Aug-Mar	Sept-Apr	Jan-Mar	E
<i>Mazus pumilus</i>	T	HA	Oct-Dec	Jan-Dec	Nov-Mar	Dec-Apr	Mar-May	E
<i>Mecardonia procumbens</i>	Ch	HA	Jul-Aug	Jul-Jan	Sept-Mar	Oct-Mar	Feb-Jun	E
<i>Medicago lupulina</i>	T	HA	Jan-Mar	Jan-Apr	Jan-Jun	Feb-Jul	Jun-Aug	E

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<i>Microcarpaea minima</i>	Ch	HA	Oct-Dec	Oct-Dec	Nov-Dec	Dec-Jan	Dec-Feb	E/H
<i>Mollugo pentaphylla</i>	Ch	HA	Dec-Mar	Dec-Sept	Jan-Sept	Feb-Oct	Oct-Nov	E
<i>Monochoria hastata</i>	HD	HE	Jul-Dec	Jul-Jan	Aug-Sept	Aug-Oct	Nov-Feb	A/E
<i>Monochoria vaginalis</i>	HD	HE	Jul-Jan	Jul-Jan	Sept-Apr	Oct-May	Apr-Jun	A
<i>Murdannia nudiflora</i>	T	HA	Aug-Oct	Aug-Nov	Sept-Nov	Oct-Dec	Nov-Jan	E
<i>Murdannia spirata</i>	T	HA	Jul-Aug	Jul-Nov	Aug-Nov	Oct-Dec	Dec-Jan	E
<i>Myriophyllum indicum</i>	HD	HE	Aug-Nov	Aug-Dec	Jul-Dec	Aug-Jan	Dec-Mar	A/H
<i>Myriophyllum tuberculatum</i>	HD	HE	Jul-Nov	Aug-Dec	Jul-Dec	Aug-Jan	Dec-Mar	A/E
<i>Najas graminea</i>	HD	HS	Aug-Oct	Aug-Dec	Oct-Mar	Nov-Apr	Apr-Jun	H
<i>Najas indica</i>	HD	HS	Aug-Oct	Aug-Dec	Nov-Jan	Nov-Feb	Apr-Jun	H
<i>Najas minor</i>	HD	HS	Aug-Oct	Aug-Dec	Oct-Mar	Nov-Apr	Apr-Jun	H
<i>Nechamandra alternifolia</i>	HD	HS	Aug-Oct	Aug-Apr	Nov-Feb	Jan-Apr	Mar-May	H
<i>Nelsonia canescens</i>	Ch	HA	Dec-Jan	Dec-Apr	Feb-Mar	Mar-May	May-Jun	E
<i>Nicotiana plumbaginifolia</i>	T	HA	Oct-Dec	Oct-Jan	Nov-Feb	Dec-Mar	Mar-May	E
<i>Nymphaea nouchali</i>	HD	HRF	Jul-Aug	Jul-Dec	Aug-Dec	Sept-Jan	Dec-Feb	E
<i>Nymphaea pubescens</i>	HD	HRF	Jul-Aug	Jul-Dec	Aug-Dec	Sept-Jan	Dec-Feb	E
<i>Nymphaea rubra</i>	HD	HRF	Jul-Aug	Jul-Dec	Aug-Dec	Sept-Jan	Dec-Feb	E
<i>Nymphoides hydrophylla</i>	HD	HRF	Jul-Oct	Jan-Dec	Jan-Dec	Jan-Dec	Feb-Jun	E
<i>Nymphoides indica</i>	HD	HRF	Jul-Oct	Jan-Dec	Jan-Dec	Jan-Dec	Feb-Jun	E
<i>Oenanthe javanica</i>	T	HA	Dec-Feb	Jan-Mar	Jan-Mar	Feb-Apr	Mar-May	A/E
<i>Oldenlandia biflora</i>	T	HA	Jul-Sept	Jul-Jan	Sept-Jan	Oct-Feb	Feb-Mar	A
<i>Oldenlandia corymbosa</i>	T	HA	Jan-Apr	Jan-Dec	Feb-Jun	Mar-Jul	Jul-Aug	E
<i>Oldenlandia diffusa</i>	T	HA	Dec-Feb	Jan-Mar	Jan-Mar	Feb-Apr	Mar-May	A/E
<i>Oldenlandia verticillata</i>	T	HA	Dec-Feb	Jan-Mar	Jan-Mar	Feb-Apr	Mar-May	A/E
<i>Oryza latifolia</i>	T	HA	Oct-Dec	Oct-Nov	Nov-Dec	Dec-Jan	Jan-Mar	A
<i>Oryza nivara</i>	T	HA	Oct-Dec	Oct-Nov	Nov-Dec	Dec-Jan	Jan-Mar	A
<i>Oryza rufipogon</i>	T	HA	Oct-Dec	Oct-Nov	Nov-Dec	Dec-Jan	Jan-Mar	A
<i>Ottelia alismoides</i>	HD	HS	Jul-Aug	Aug-Mar	Oct-Feb	Dec-Mar	Feb-Mar	E
<i>Panicum paludosum</i>	T	HA	Jul-Oct	Jul-Nov	Sept-Nov	Sept-Dec	Dec-Feb	A
<i>Panicum repens</i>	T	HA	Jul-Oct	Jul-Nov	Sept-Nov	Sept-Dec	Dec-Feb	A
<i>Parthenium hysterophorus</i>	T	HA	Jun-Jul & Nov-Dec	Jan-Dec	Jan-Dec	Jan-Nov	Sept-Nov	A
<i>Paspalidium flavidum</i>	T	HA	Jul-Oct	Jul-Oct	Aug-Nov	Sept-Dec	Nov-Jan	E
<i>Paspalidium punctatum</i>	T	HA	Jul-Sept	Jul-Nov	Aug-Nov	Sept-Dec	Nov-Dec	A
<i>Paspalum distichum</i>	T	HA	Mar-May	Mar-Nov	Jun-Nov	Jul-Dec	Nov-Feb	A
<i>Paspalum conjugatum</i>	T	HE	Jun-Aug	Jun-Nov	Aug-Sept	Sept-Nov	Nov-Dec	A
<i>Pennisetum glaucum</i>	T	HA	Jan-Mar	Jan-Jun	Feb-Jul	Mar-Aug	Jul-Aug	A
<i>Persicaria barbata</i>	T	HA	Jul-Jan	Jul-Feb	Jul-Nov	Aug-Dec	Jan-Mar	A/E
<i>Persicaria chinensis</i>	T	HA	Jul-Jan	Jul-Feb	Jul-Nov	Aug-Dec	Jan-Mar	A/E
<i>Persicaria glabra</i>	T	HA	Jul-Jan	Jul-Feb	Jul-Nov	Aug-Dec	Jan-Mar	A/E
<i>Persicaria hydropiper</i>	T	HE	Mar-May	Mar-Nov	May-Nov	Jun-Dec	Dec-Mar	E
<i>Persicaria lapathifolia</i>	T	HE	Apr-Sept	Apr-Dec	May-Oct	Jun-Nov	Nov-Jan	E
<i>Physalis orientalis</i>	T	HA	Mar-May	Mar-Nov	Apr-Jan	May-Feb	Nov-Mar	A/E
<i>Persicaria pubescens</i>	T	HA	Apr-Sept	Apr-Dec	Jun-Dec	Jul-Jan	Jan-Mar	E
<i>Persicaria strigosa</i>	T	HE	Apr-Sept	Apr-Dec	May-Oct	Jun-Nov	Nov-Jan	E
<i>Pilea microphylla</i>	T	HA	Mar-May	Mar-Nov	Jun-Nov	Jul-Dec	Nov-Feb	A
<i>Pistea stratiotes</i>	HD	HFF	Apr-Sept	Apr-Dec	May-Sept	Jun-Oct	Nov-Feb	E
<i>Polygonum hastatosagittatum</i>	T	HA	Feb-Jun	Feb-Sept	Mar-Aug	Apr-Sept	Aug-Sept	A/E

Name of Plants	Life forms	Habit groups	Germination	Vegetative growth	Flowering	Fruiting	Death/Rest	Pollination
<i>Polygonum plebeium</i>	T	HA	Feb-Jun	Feb-Sept	Mar-Aug	Apr-Sept	Aug-Sept	A/E
<i>Polygonum perfoliatum</i>	T	HA	Feb-Jun	Feb-Sept	Mar-Aug	Apr-Sept	Aug-Sept	A/E
<i>Potamogeton alpinus</i>	HD	HRF	Jul-Aug	Jul-Dec	Sept-Feb	Oct-Mar	Feb-Apr	H
<i>Potamogeton crispus</i>	HD	HS	Jul-Oct	Jan-Dec	Aug-Nov	Aug-Dec	Dec-Mar	A/H
<i>Potamogeton distinctus</i>	HD	HS	Jul-Oct	Jan-Dec	Aug-Nov	Aug-Dec	Dec-Mar	A/H
<i>Potamogeton gramineus</i>	HD	HS	Jul-Oct	Jan-Dec	Aug-Nov	Aug-Dec	Dec-Mar	A/H
<i>Potamogeton nodosus</i>	HD	HRF	Jul-Aug	Jul-Dec	Sept-Feb	Oct-Mar	Feb-Apr	H
<i>Potamogeton octandrus</i>	HD	HS	Jul-Oct	Jan-Dec	Aug-Nov	Aug-Dec	Dec-Mar	A/H
<i>Pouzolzia hirta</i>	HH	HE	Jul-Aug	Jul-Oct	Sept-Nov	Oct-Dec	Nov-Dec	E
<i>Pouzolzia zeylanica</i>	HH	HE	Jul-Aug	Jul-Oct	Sept-Nov	Oct-Dec	Nov-Dec	E
<i>Pseudognaphalium affine</i>	T	HA	Nov-Jan	Nov-Apr	Jan-Mar	Feb-Jun	May-Jul	A
<i>Pycnus flavidus</i>	HH	HE	Jun-Aug	Jun-Sept	Jul-Sept	Jul-Oct	Oct-Dec	A
<i>Ranunculus sceleratus</i>	T	HA	Oct-Jan	Oct-Feb	Dec-Mar	Jan-Apr	Mar-Apr	E
<i>Rotala densiflora</i>	T	HA	Jul-Oct	Jul-Dec	Aug-Nov	Sept-Dec	Dec-Jan	E
<i>Rotala indica</i>	T	HA	Jul-Oct	Jul-Dec	Aug-Nov	Sept-Dec	Dec-Jan	E
<i>Rotala mexicana</i>	T	HA	Jul-Oct	Jul-Dec	Aug-Nov	Sept-Dec	Dec-Jan	E
<i>Rotala macrandra</i>	T	HA	Jul-Oct	Jul-Dec	Aug-Nov	Sept-Dec	Dec-Jan	E
<i>Rotala rotundifolia</i>	T	HA	Oct-Jan	Oct-Mar	Nov-Mar	Dec-Apr	Apr-May	E
<i>Rottboellia cochinchinensis</i>	T	HA	Jul-Oct	Jul-Dec	Aug-Nov	Sept-Dec	Dec-Feb	A
<i>Rumex dentatus</i>	T	HA	Feb-May	Feb-Jul	Mar-Sept	Apr-Oct	Nov-Dec	E
<i>Rumex maritimus</i>	T	HA	Nov-Feb	Nov-Apr	Dec-Mar	Jan-Apr	Apr-May	E
<i>Rungia pectinata</i>	T	HA	Aug-Oct	Aug-May	Nov-Mar	Jan-Apr	Mar-Jul	A
<i>Saccharum spontaneum</i>	H	HP	Jun-Sept	Jun-Oct	Sept-Nov	Oct-Dec	Dec-Jan	A
<i>Saccharum arundinaceum</i>	H	HP	Jun-Sept	Jun-Oct	Sept-Nov	Oct-Dec	Dec-Jan	A
<i>Sacciolepis indica</i>	T	HA	Jul-Oct	Jan-Dec	Aug-Dec	Sept-Jan	Jan-Apr	A
<i>Sacciolepis interrupta</i>	H	HP	Jul-Nov	Jul-Dec	Aug-Jan	Sept-Feb	Dec-Apr	E
<i>Sagittaria guayanensis</i>	HD	HRF	Jul-Aug	Jul-Oct	Aug-Nov	Aug-Dec	Nov-Jan	E
<i>Sagittaria sagittifolia</i>	C	HE	Jan-Mar	Jan-Apr	Feb-Aug	Mar-Aug	Jul-Sept	E
<i>Schoenoplectus articulatus</i>	H	HE	Aug-Dec	Aug-Jan	Oct-Dec	Nov-Jan	Dec-Mar	A
<i>Schoenoplectus laterifolius</i>	HH	HE	Jul-Aug	Aug-Jan	Aug-Dec	Sept-Jan	Dec-Jan	A
<i>Schoenoplectus juncoides</i>	HH	HE	Jun-Jul	Jun-Nov	Jul-Jan	Aug-Feb	Jan-Apr	A
<i>Schoenoplectus mucronatus</i>	T	HA	Jun-Oct	Jun-Nov	Aug-Dec	Sept-Jan	Dec-Feb	A
<i>Schoenoplectus supinus</i>	HH	HE	Jul-Aug	Aug-Jan	Aug-Dec	Sept-Jan	Dec-Feb	A
<i>Seseli diffusum</i>	T	HA	Dec-Feb	Jan-Mar	Jan-Mar	Feb-Apr	Mar-May	E
<i>Solanum americanum</i>	T	HA	Sept-Nov	Sept-Jan	Nov-Mar	Nov-Apr	Mar-May	E
<i>Solanum sisymbriifolium</i>	T	HA	Sept-Nov	Sept-Jan	Nov-Mar	Nov-Apr	Mar-May	E
<i>Solanum torvum</i>	T	HA	Sept-Nov	Sept-Dec	Nov-Mar	Nov-Apr	Mar-Apr	E
<i>Soliva anthemifolia</i>	T	HA	Dec-Feb	Jan-Mar	Jan-Mar	Feb-Apr	Mar-May	E
<i>Sphaeranthus indicus</i>	Ch	HA	Dec-Jan	Dec-Mar	Jan-Mar	Feb-May	Apr-Jun	E
<i>Sphenoclea zeylanica</i>	T	HA	Dec-Aug	Dec-Sept	Jan-Sept	Jan-Oct	Oct-Nov	E
<i>Thespis divaricata</i>	T	HA	Feb-Mar	Feb-May	Apr-Jul	May-Jul	Jul-Aug	E
<i>Typhonium flagelliforme</i>	C	HE	Jul-Sept	Jul-Dec	Aug-Oct	Sept-Nov	Oct-Dec	E
<i>Utricularia aurea</i>	HD	HSP	Jul-Sept	Jul-Oct	Sept-Jan	Oct-Feb	Jan-Mar	A
<i>Utricularia bifida</i>	HD	HSP	Jul-Sept	Jul-Oct	Sept-Jan	Oct-Feb	Jan-Mar	A
<i>Utricularia gibbosa</i> var. <i>exoleta</i>	HD	HSP	Jul-Oct	Jul-Dec	Sept-Jan	Oct-Feb	Feb-Mar	A
<i>Utricularia inflexa</i> var. <i>stellaris</i>	HD	HSP	Jul-Nov	Jul-Oct	Sept-Jan	Oct-Feb	Jan-Mar	A
<i>Utricularia scandens</i>	HD	HSP	Jul-Sept	Jul-Oct	Sept-Jan	Oct-Feb	Jan-Mar	A

Name of Plants	Life forms	Habit groups	Germination	Vegetative growth	Flowering	Fruiting	Death/Rest	Pollination
<i>Utricularia striatula</i>	HD	HSP	Jul-Sept	Jul-Oct	Sept-Jan	Oct-Feb	Jan-Mar	A
<i>Vallisneria spiralis</i>	HD	HS	Dec-Jan	Dec-Sept	Jan-May	Feb-Jul	Jun-Sept	H
<i>Veronica anagallis-aquatica</i>	T	HA	Sept-Oct	Sept-Dec	Nov-Jan	Dec-Jan	Jan-Mar	E
<i>Vetiveria zizanioides</i>	H	HP	Jul-Sept	Jul-Oct	Aug-Oct	Sept-Dec	Nov-Jan	A
<i>Wahlenbergia marginata</i>	T	HA	Oct-Nov	Oct-Jan	Nov-Feb	Jan-Apr	Mar-May	A/E
<i>Xanthium indicum</i>	P	HA	Dec-Jan	Jan-Dec	Aug-Mar	Aug-Apr	Jul-Oct	E
<i>Xyris pauciflora</i>	T	HE	Oct-Nov	Oct-Dec	Oct-Jan	Dec-Jan	Dec-Feb	E
<i>Zeuxine strateumatica</i>	T	HE	Dec-Jan	Feb-Mar	Mar-Apr	Mar-May	Apr-Jun	E

5.5.1. Seedling appearance

In field observation, it has been recorded that in wetland systems of Terai and Duars region most of the plants are breaking their dormancy during July to December. As the wetlands always maintain few watery areas long after the monsoon is over, the soil remain highly moist in all the sectors almost round the year and that is why most of the species extend their period of seed germination. This starts with the receiving of first shown of rain in monsoon that comes at Terai and Duars during 2nd or 3rd week of July. During these 124 out of 244 species break their seed dormancy. The seedlings or new shoots of perennial plants appear from the ground during this month, when 98 species were recorded in their seedling stage. The maximum seed germination was recorded in the month of August when 120 species found in their seedling stage followed by September (94 species), October (74 Species), December (73 species) and November (61 species). The wetland plants prolong their period of seed germination or new shoot appearance up to a period of 9 months. Seeds of *Eclipta prostrata*, *Cynodon dactylon* and *Cyperus difformis* were recorded to germinate throughout the year. *Parthenium hysterophorus* shows two distinct germination periods, June – July and November – December.

On the other hand with the withdrawal of water from the wetlands, some normal terrestrial plants too start breaking of their dormancy. It has been observed that January is the peak month for such plants when 59 species starts their seed germination followed by February (37 species), June (36 Species), March (35 Species), April (33 Species) and May (32 species). All these species maintain their germination period for 2 – 7 months.

5.5.2. Vegetative growth

Most of the angiosperms showed their maximum vegetative growth during August to October (fig. 5.1). During October \pm 172 species remain in vegetative stage followed by September (163 species), August (156), November (152 species), December (153 species), and January (119 Species). There are 31 species, those show their vegetative growth round the year and also produce flower for some period. The vegetative growth declines during dry period.

5.5.3. Flowering

The vegetative phase is ending or interrupted by the initiation of a plant's reproductive state i.e. flowering. It has been observed that most interesting period is September – January when highest number of wetland plants (aquatic and amphibian) found in blooming stage. The peak month is November when 145 plants were recorded in their flowering condition followed by September to December (121 species) and January (115 species).

During dry period, February (109 species) and March (73 Species) show highest number of species in flowering stage. During April to June when the flowering phase declines fast and most of the aquatic and amphibian plants disappear. On the other hand, during dry period, wetlands become the house for few terrestrial plants (terrestrial invaders) and most of them remain in flower during March to

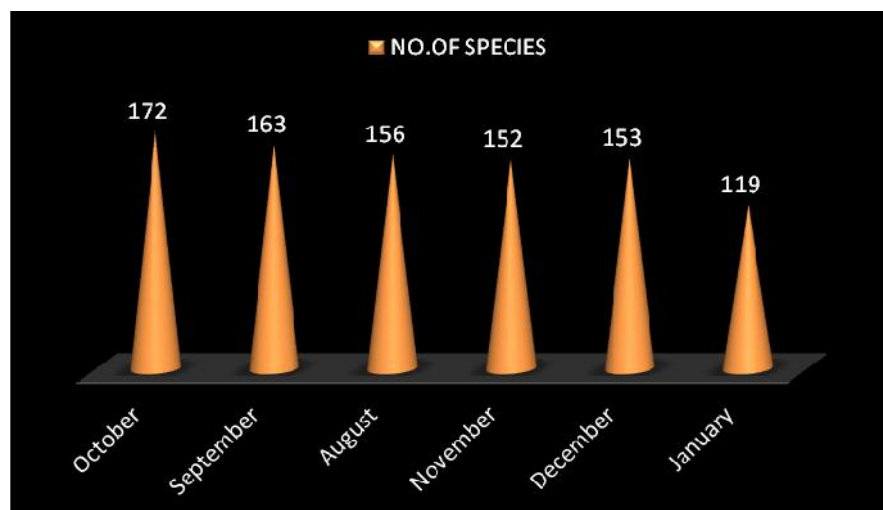


Fig. 5.1. Graphical representation of number of species showing vegetative growth

June. So, the monsoon and winter are the two main flowering periods for most of the wetland plants. There are 5 species *Cyperus difformis*, *Nymphoides hydrophylla*, *Nymphoides indica*, *Oldenlandia corymbosa* and *Eclipta prostrata* those extend their flowering phase round the year.

5.5.4. Pollination

Pollination is one extremely important step towards the reproduction of plants. Pollination helps the fertilization to produce proper seeds. The pollination of wetland plants is somehow interesting. All three major pollination types i.e. *Anemophily*, *Zoophily* (mostly *Entomophilous*) and *Hydrophily* are common for wetland plants. From the direct on-field observation of 244 angiosperms, it has been recorded that around 116 (47.54 %) species are *Entomophilous* followed by *Anemophilous* (90 species) and *Hydrophilous* (04 species). Some species utilized two or more ways for to ensure their effective pollination. So, there are 21 *anemo-entomophilous*, 4 *entomo-epihydrophilous* and only 2 *anemo-epihydrophilous* plants. Among the 9 *hydrophilous* plants, 4 species (*Najas indica*, *N. graminea*, *Nechamandra alternifolia* and *Ceratophyllum demersum*) are hypohydrophilous (fertilization takes place under water) and rests 5 species (*Hydrilla verticillata*, *Nechamandra alternifolia*, *Blyxa octandra*, *Vallisneria spiralis* var. *denseserrulata* and *Potamogeton crispus*) are epihydrophilous (fertilization takes place on the water surface). Table 5.4 shows the numerical distribution of different categories of pollination in these plants.

Table 5.4. Numerical distribution of different categories of pollination

Sl. No.	Pollination type	No. of Species	Percentage (%)
01.	Anemophilous	90	36.88
02.	Entomophilous	116	47.54
03.	Hypohydrophilous	4	1.63
04.	Epihydrophilous	5	2.04
05.	Anemo-Entomophilous	21	8.60
06.	Entomo-Epihydrophilous	4	1.63
07.	Anemo-Epihydrophilous	2	0.81
Total:		244	

5.5.5. Fruit Ripening

After the effective pollination, followed by fertilization, the ovaries transform into fruits. As for the other plants, wetland plants also bear fruits simultaneously with flower. Similarly, fruit ripening, leading to dehiscence or seed dispersal also continued parallel with the flowering and fruit-setting. The herbaceous flora of wetlands bears fruits along with flowers for most part of their life span. It is observed that during October to February most of the plants remain in fruiting stage. The peak month is December when around 141 species bear fruits. The next peak month is November (129 species) and is followed by October (120 species), January (114 species) and February (104 species). June and July shows lowest number of plants in their fruiting stage. Six species, namely *Cynodon dactylon*, *Cyperus difformis*, *Eclipta prostrata*, *Nymphoides hydrophylla*, *N. indica* and *Parthenium hysterophorus* produce fruits round the year.

5.5.6. Seed Dispersal

Seed dispersal is another important stage in the life cycle of a plant. The fruit of aquatic plants are generally indehiscent so the dispersal occurs only by the degradation of fruit wall. But there are several semi-aquatics, marshy and wetland plants those bear dehiscent fruits. So, various mode of seed dispersal have been recognized in the recorded flora. Accordingly, different recorded modes of dispersal are:

- i. **Zoochorous** (by animals): The seeds of aquatic or marshy plants of families like Asteraceae, Poaceae, Cyperaceae etc. are mainly dispersed by the aquatic birds, fishes, snails, cattle, etc.
- ii. **Anemochorous** (by wind): The species of Asteraceae, Solanaceae etc used this process for seed dispersal.
- iii. **Hydrochorous** (by water flow): Fruits or seeds of Nelumbonaceae, Nymphaeaceae, Menyanthaceae, Hydrocharitaceae, Cyperaceae, Poaceae etc. are dispersed by this process.
- iv. **Special mechanical process**: Species of Acanthaceae used explosive mechanism for dispersal seed.

5.5.7. Death or Withdrawal

It is observed that most of the herbaceous species do not pass through any resting phase i.e. with no any definite period of dormancy, in between seed dispersal and germination. But, in wetland climate, some species or some population of a species are forced to remain dormant for variable period. And, the length of such imposed dormancy is directly related to the habitat conditions. Mainly the species of true aquatic plants those are not able to germinate or sprout in dry period because that wants enough water for germination and growth, that is why they wait for the arrival or change of the habitat which will favor their seeds to germinate. Similarly some terrestrial weeds grown during dry period cannot live during monsoon. The death or resting phase of aquatic and amphibian plants is maximum during February and March when 106 and 95 species respectively proceed to the resting conditions. On the other hand, dry season plants become dead or in resting phase during July and August when 37 and 29 species respectively were shown behave like this.

The phonological study of wetland plants helps us to understand the life cycle pattern of the wetland flora of Terai and Duars region. The wetland plants are always struggling for their existence with the local climate that does not remain favorable round the year. Most of the aquatic or semi-aquatic plants complete their life cycle before the dry season prevail and the seeds remain dormant during the entire dry period. These seeds, in turn, will again start germinating with the initial showers of rain before the actual appearance of monsoon. On the other hand, few terrestrial plants avoid the flood during rainy season. They complete their life cycle before monsoon starts and seeds remain dormant during monsoon in the soil under water. The plants those grow in the wetlands of Terai and Duars show such interesting phenophasic characters.

During the present investigation several interesting points have been noted on the phenology of the wetland species of the study area. Some true aquatic plants belonging to the families like Nymphaeaceae, Menyanthaceae, Araceae and Pontederiaceae are generally regenerate and propagate vegetatively from the last year's seeds and rhizomes. But, most of the marshland and submerged plants regenerate through the germination of their seeds. Seedling appearance or breaking the dormancy of seeds, in some aquatic species depends on rainfall and ambient temperature during August to December. However, several semi-aquatic or terrestrial plants start appearing with the withdrawal of water and the increase of ambient temperature during April-May. It is very interesting feature of wetland plant that aquatic and semi-aquatic plants start their life cycle with the first shower of rain during monsoon and completes before the onset of dry and most unfavorable season. On the other hand, several terrestrial plants grow in wetland during dry period. These plants also start life cycle during December – March and completes before the start of monsoon showers during July – August. So the wet loving plants remain dormant during summer whereas dry soil lovers remain dormant during rainy season. There are so many perennial plants those grow in wetlands throughout the year. Few plants like *Coix aquatica*, *Xyris pauciflora*, *Typhonium flagelliforme* shows very short life cycle of only about 3 months. They start producing new shoots after the withdrawal of water and with the onset of rains, rootstalk become dormant, withdraw the aerial branches and wait up to the next dry period.

Chapter **6**
ETHNOBOTANY

ETHNOBOTANY

6.1. Introduction

Since the beginning of civilization, people have used plants mainly for their sustenance. In addition to their food, fodder, house building materials, making hunting fishing and war equipments, etc. plants have been used in big way, both, for the prevention and cure of various diseases of humans and their pets. Even today plants form the main basic source for the innumerable articles. Whatever might the nature and structure of processed food in present in industry and/or commodity based society, basically those are coming from plants. Sources of food for man's pets are also plants. The present society with innumerable synthetic materials, life style remain lifeless in absence of plant-materials including flowers.

Even the pre-historic man felt the need of medicines to get relief from their various bodily discomforts. Looking at the life in the societies of primitive people, it is not difficult to understand that the materials required to cure their discomforts, i.e. medicines were prepared mainly from different species of plants. With the advent of human civilization, many systems of therapy have been developed primarily based on plants. *Ayurveda*, *Homeopathy*, *Siddha*, *Unani*, etc. are different traditional systems of medicines developed in different countries by different people. These plant-based traditional medical systems continued to provide the primary health care to more than three-quarters of the world's populace. In India, the use of plants for medicinal treatment dates back to 5000 years B.C. It was officially recognized that 2500 plant species have medicinal value while over 6000 plants are estimated to be explored in traditional, folk and herbal medicines.

Along with the advancement of the civilization the society is frequently facing with the new disease causing enemies. It require many more formulations or medicines to tackle such situations. Ethnobotanical studies provide leads for new drug development. Kirtikar & Basu (1935); Chopra *et al.* (1956); Molla & Roy (1985); Das & Mandal (2003); Das *et al.* (2010) prepared lists of Indian medicinal plants. Now-a-days survey for the documentation of knowledge on traditional medicines in different parts of the world is given much importance. In India too numerous such works are publishing regularly. Compilation of such knowledge is found in literature like (Biswas & Chopra, 1956); (Hajra & Chakraborty, 1981); (Aditya *et al.*, 1988); (Das & Chanda, 1990); (Jain, 1991 & 1966); (Asolkar *et al.*, 1992); (Pandey *et al.*, 2002); (Misra & Dash, 2002); (Dubey *et al.*, 2002); (Rai & Bhujel, 2002); (Sarkar, 2011) and (Chowdhury, 2015).

The main focus of the ethnobotanical investigation is how the plants have been used, managed and perceived in human societies and includes plants used for food, medicine, divination, use and cosmetics, dyeing, textiles, for building, tools, currency, clothing, rituals, social life and music.

6.1.1. Definition of Ethnobotany

The name **Ethnobotany** was coined by Harshberger in 1896 [*“ethnocos,”* meaning *‘the human race’* & *“botany”* means the *‘Plant Science’*]. Ethnobotany is the study of the relationship which exists between people of primitive societies and their plant environment. Wickens (1991) distinguished ethnobotany from economic botany by considering ethnobotany as *“the study of useful plants prior to their commercial exploitation and eventual domestication”*.

6.1.2. Ethnobotany in India

India with its diverse flora coupled with large number of aboriginal tribes, inhabiting different pockets in the country, offer immense scope to the Ethnobotanists to work with and to record their age old like sustaining traditional knowledge. Over 53 million tribal people and over 550 tribal communities coming under 227 linguistic groups are present in India. They include major tribes like *Santal*, *Munda*, *Oraon*, *Naga*, *Mompa*, *Karbis*, *Saora*, *Sarasia*, *Irulus*, *Chenchus*, *Kharia*, *Baigas*, *Bando*, etc. Along with some degenerating communities like *Ongae*, *Great Andamanies*, *Jarawa*, *Sentinelese*, *Shompen*, *Toda*, *Toto*, *Asur*, *Birhore*, *Lodha* etc. These people can utilize the resources without disturbing the extremely delicate balance of the ecosystem.

6.1.3. Scope of Ethnobotany in the Study Area

Vincent Smith (1976) called India as the ethonological museum of the world and it may also be called that the Duars of West Bengal as the ethnobotanical museum of India. Following tea plantations in the Duars under the British, thousands of labourers were brought from Jharkhand and Nepal and this influx of new people changed the demographic features and conditions of the area. There are not less than 36 different stocks of peoples in the Duars of whom the most prominent are: *Rajbanshis*, *Toto*, *Rava*, *Mech*, *Dhimal*, *Santal*, *Munda*, *Malpahari*, *Oraon* etc. Ethnobotanical scope of North Bengal is mainly based on the following way: Good number of ethnic communities living in almost complete isolation for a few hundred years, rich bioresource, ethnic people mainly living near forest areas, majority of them cannot pay for costly marketed products and their love and inclination for the use of traditional knowledge based materials.

6.2. RESULT

The life of a man needs innumerable materials for his survival. All these materials they were collecting from nature in early days. But with development of science and technology now man started using artificially made or synthetic or modified materials.

But, in tribal life even today the importance of naturally produced materials forms the main resources for survival. However, all recorded resources are grouped under some categories for better understanding as follows: (i) Edible Plants, (ii) Fodder Plants, (iii) Medicinal Plants, (iv) Fencing & House Building Plants, (v) Plants used as Fire Wood, (vi) Magico-Religious Plants, (vii) Ornamental & Decorative Plants, (viii) Plants in Folklores and (ix) Multipurpose useful plants.

6.2.1. EDIBLE PLANTS

The present study documented the uses of 31 species covering 23 genera from 18 families of wild wetland leafy vegetables collected and eaten by the ethnic peoples. Such plants are classified and enumerated below along with their vernacular names, edible parts, mode of consumption and reference to voucher specimens with their market price:

6.2.1.1. Vegetables for cooking: As much 31 species are taken as kitchen vegetable and consume after cooking

A. Leafy Vegetable: Only leaves of these plants are used as vegetable in their different stages of maturity. A high number of species are recognized under this category.

- i. **Very young leaves:** *Diplazium esculentum*, *Marsilea minuta* etc.
- ii. **Young leaves:** *Amaranthus blitum* ssp. *oleraceus*, *Amaranthus spinosus*, *Amaranthus viridis*, *Cassia occidentalis*, *Colocasia esculenta*, *Hygrophila auriculata*, *Ipomoea aquatica*, *Lippia javanica*, *Typhonium trilobatum*, etc.

iii. **Young & mature leaves:** *Acmella calva*, *Alternanthera philoxeroides*, *Alternanthera paronichioides*, *Alternanthera sessilis*, *Bacopa monnieri*, *Centella asiatica*, *Chenopodium album*, *Commelina benghalensis*, *Corchorus capsularis*, *Drymaria cordata*, *Enhydra fluctuans*, *Euphorbia hirta*, *Glinus oppositifolius*, *Marsilea minuta*, *Oldenlandia corymbosa*, *Polycarpon prostratum*, *Polygonum plebeium*, *Portulaca oleracea*, *Solanum nigrum*, *Stellaria wallichiana* etc.

B. Petiole Vegetable: In some plants entire leaf is not eaten. Only the leaf petiole is taken separately from plants like *Alocasia macrorrhizos*, *Colocasia esculenta*, *Lasia spinosa*, *Nymphaea pubescens*, *Monochoria vaginalis*, etc. These are generally eaten after cooking.

C. Leaf-Sheath/ Pseudostem as vegetable: In a pseudostem inner sheaths are generally soft and are used as food by many ethnic people. During the present survey this found for the plants like *Musa balbisiana*, *Cheilocostus speciosus*, *Alpinia nigra* and *Calamus erectus*. Out of these only first species is under cultivation and the populations of last two are decreasing quickly due to over exploitation and habitat loss.

D. Rhizome vegetable: Rhizomes of one species of aroids *Colocasia esculenta* is also much favoured food. These two are semi-cultivated plants.

E. Flower/ Inflorescence vegetable: Flowers of *Colocasia esculenta*, *Eichhornia crassipes* *Musa balbisiana*, *Amaranthus blitum* ssp. *oleraceus*, *Amaranthus spinosus* etc. are used as vegetable in tribal's kitchen.

G. Seed vegetable: The seeds of *Nymphaea spp*, *Nelumbo nucifera* and *Euryale ferox* are also used for different types of preparations.

H. Spices & Condiments: Infructescence of *Piper longum* is regularly used as spices and condiments. The species is abundant in the study area.

I. Aromatic plants: Leaves of *Lippia javanica* are used for their aroma. Raw matured leaves are added to the meat curry.

6.2.1.2. Eaten Raw: There are many plants or plant parts those are eaten raw by the Ethnic people or people of the remote areas.

A. Fruits: There are several green and/or ripe fruits are recorded to eat by *Ethnic* people without cooking. Recorded such plants are *Trapa natans*, *Duchesnea indica*, *Calamus erectus*, *Musa balbisiana*, *Solanum nigrum*.

B. Leaves: Raw leaves of *Oxalis corniculata*, is made into 'chatni' and taken along with other food.

C. Bulb: The underground bulbs of *Aponogeton sp*, *Potamogeton sp*, and *Oxalis corymbosa* are eaten raw by children.

6.2.1.3. Classifications of Edible Parts: All parts of all plants are not edible. And, that is clear from the above discussion. Man has recognized edible part of different plants through trial and error method. Following is an account of edible parts for different plants eaten by them.

A. Whole plants/ Leafy shoots: 24 species has been recorded such as *Acmella calva*, *Alternanthera philoxeroides*, *Alternanthera paronichioides*, *Alternanthera sessilis*, *Amaranthus blitum* subsp. *oleraceus*, *Amaranthus spinosus*, *Amaranthus viridis*, *Bacopa monnieri*, *Centella asiatica*, *Chenopodium album*, *Commelina benghalensis*, *Drymaria cordata*, *Enhydra fluctuans*, *Glinus oppositifolius*, *Ipomoea aquatica*, *Leucas indica*, *Oldenlandia corymbosa*, *Polygonum plebeium*, *Portulaca oleracea*, *Stellaria wallichiana*.

B. Leaves: 15 species has been recorded such as *Cassia occidentalis*, *Colocasia esculenta*, *Corchorus capsularis*, *Diplazium esculentum*, *Euphorbia hirta*, *Hygrophila auriculata*, *Lippia javanica*, *Marsilea minuta*, *Oxalis corniculata*, *Typhonium trilobatum*.

C. Fruits: 15 species, 12 genera, 9 families *Trapa natans*, *Calamus erectus*, *Duchesnea indica*, *Musa balbisiana*, *Solanum nigrum*, *Solanum torvum*.

D. Flowers/Calyx/Inflorescence: 7 species has been recorded such as *Colocasia esculenta*, *Eichhornia crassipes*, *Musa balbisiana* etc.

6.2.1.4. Enumeration of Recorded Edible Plants

Alternanthera sessilis (Linnaeus) R. Brown ex de Candolle [Amaranthaceae]; L.N.: *Khenchi shak*, *Nunia shak*;

Exsiccatae: Naxalbari, Darjeeling, *Anurag & AP Das 075*, dated 05.04.2011

Edible parts: Young twigs, leaves, sometimes whole plant except root.

Mode of use: Fried and eaten as vegetable and also as curry mixed with some other vegetables.

Market price: In towns and villages: Rs. 10 – 15 and Rs. 06 – 08 respectively for a bundle of ± 500 gm.

Alternanthera philoxeroides (Marttius) Grisebach [Amaranthaceae]; L.N.: *Panimatikaduri*;
Exsiccatae: Maynaguri, Jalpaiguri, *Anurag & AP Das 046*, dated 01. 02.2010.

Edible parts: Young twigs, leaves, sometimes whole plant except root.

Mode of use: Fried and eaten as vegetable and also as curry mixed with other vegetables.

Market price: In towns and villages: Rs. 08 – 10 and Rs. 05 – 07, respectively for a bundle of ± 500 gm.

Alternanthera paronichioides St. Hilaire [Amaranthaceae]; L.N.: *Vucuhra katha* ; *Exsiccatae*:
Changrabandha, Indo-Bangla Border, Coochbehar, *Anurag & AP Das 035*, dated 13.04.2009.

Edible parts: Tender shoot

Mode of use: Fried singly or in mixed with other leafy vegetables.

Market price: In towns and villages: Rs. 05 – 06 and Rs. 03 – 05 respectively for a bundle of ± 500 gm.

Amaranthus spinosus Linnaeus [Amaranthaceae]; L.N.: *Kanta-notey*

Exsiccatae: Haldibari, Jalpaiguri, *Anurag & AP Das 061*, dated 06.05.2010.

Edible parts: Young twigs, leaves and inflorescence

Mode of use: Fried and eaten as vegetable with Bringal or with others as mixed vegetables.

Market price: In towns and villages: Rs. 06 – 07 and Rs. 03 – 04 respectively for a bundle of ± 500 gm.

Amaranthus viridis Linnaeus [Amaranthaceae]; L.N.: *Ban-note*

Exsiccatae: Naxalbari, *Anurag & AP Das 076*, dated 05.04.2011.

Edible parts: Young twigs, leaves and inflorescence.

Mode of use: Fried and eaten as vegetable and often mixed with Bringal or other suitable vegetables.

Market price: In towns and villages: Rs. 08 – 10 and Rs. 05 – 07 respectively for a bundle of ± 500 gm.

Amaranthus blitum subsp. oleraceus (Linnaeus) Costea [Amaranthaceae]; L.N.: *Khuria*; Exsiccatae: Kumargram, *Anurag & AP Das 008*, dated 12. 02.2009.

Edible parts: Young twigs, leaves and inflorescence.

Mode of use: Fried and eaten as vegetable and often used with bringal or others as a mixed vegetable.

Market price: In towns and villages: Rs. 08 – 10 and Rs. 05 – 07, respectively for a bundle of \pm 500 gm

Alocasia fallax Schott [Araceae]; L.N.: *Kala-kachu*

Exsiccatae: Das Para, Jalpaiguri, *Anurag & AP Das 058* dated 04.04.2010.

Edible parts: Young leaves, petioles and rhizomatous part.

Mode of use: Fried young leaves with black cumin; petioles are cut into small pieces, boiled and fried with black cumin; rhizome part is also cooked as curry with other vegetables and sometimes with fishes.

Market price: In towns and villages, one bundle of leaves (\pm 500 gm): Rs 08 – 10, 05 – 07, petioles, Rs 10 – 15, 06 – 10, and one rhizomatous part is Rs 15 – 20, 8 – 12 respectively.

Argemone mexicana Linnaeus [Papaveraceae]; L.N.: *Seyal-kanta*

Exsiccatae: Rajgonj, Jalpaiguri, *Anurag & AP Das 064*, dated 10.08.2010.

Edible parts: Young shoot.

Mode of use: Cooked with various vegetables and spices, generally used in remote areas.

Market price: In villages: Rs. 03 – 05 for a bundle of \pm 500 gm.

Bacopa monnieri (Linnaeus) Wettstein [Plantaginaceae]; L.N.: *Brahmi shak*

Exsiccatae: Kumargram, Jalpaiguri, *Anurag & AP Das 005*, dated 12.02.2009.

Edible parts: Tender shoots.

Mode of use: Taken fried, generally mixed with bringal and potato.

Market price: In towns and villages: Rs.10 – 15 and Rs. 08 – 10 respectively for a bundle of \pm 500 gm

Centella asiatica (Linnaeus) Urban [Apiaceae]; L.N.: *Thankuni shak, Baro Maanimuni Exsiccatae*: Totopara, Madarihhat, Jalpaiguri, *Anurag & AP Das 002*, dated 04.01.2009.

Edible parts: Leaves, sometimes entire plants.

Mode of use: Pounded with black cumin and green chilies and added to curry with other vegetables.

Market price: In towns and villages: Rs.08 – 10 and Rs. 05 – 07 respectively for a bundle of \pm 100 gm.

Chenopodium album Linnaeus [Amaranthaceae]; L.N.: *Bathua, Betho, Bothua-shak Exsiccatae*: Kumargram, Jalpaiguri, *Anurag & AP Das 003*, dated 12. 02.2009.

Edible parts: Tender shoots.

Mode of use: Fried with brinjals and chilies. Sometimes cooked as curry with other vegetables.

Market price: In towns and villages: Rs.08 – 10 and Rs. 05 – 07 respectively for a bundle of \pm 250 gm.

Colocasia esculenta (Linnaeus) Schott [Araceae]; L.N.: *Sola Kachu*

Exsiccatae: Dhupguri, Jalpaiguri, *Anurag & AP Das 026*, dated 28.03.2009.

Edible parts: Young leaves, petioles and rhizome.

Mode of use: Fried young leaves with black cumin, petioles are cut into small pieces, boiled and fry with black cumin and rhizomes also cooked in curry with other vegetables and sometimes used with fishes.

Market price: In towns and villages: one bundle of leaves (\pm 500gm) is Rs 08 – 10, petioles Rs 10 – 15 and one whole plant Rs.15 – 20.

Cyperus rotundus Linnaeus [Cyperaceae]; L.N.: *Mutha ghash*

Exsiccatae: Kumargram, Jalpaiguri, *Anurag & AP Das 004*, dated 12.02.2009.

Edible parts: Rhizomes.

Mode of use: Cut into small pieces and roasted with pieces of brinjal.

Market price: It is not sold in market but tribal people collect it for consumption.

Diplazium esculentum (Koenig ex Retzius) Swartz [Woodsiaceae]; L.N.: *Dheki shak*

Exsiccatae: Madarihata, Jalpaiguri, *Anurag & AP Das 001*, dated 04.01. 2009.

Edible parts: Young circinate fronds.

Mode of use: Cut into small pieces and fried with black cumin and chilies and sometimes, a dish is prepared using black cumin, garlic paste, chilies and with different vegetables.

Market price: In towns and villages: Rs.08 – 10 and Rs. 05 – 07, respectively for a bundle of \pm 250 gm.

Enydra fluctuans A.P. de Candolle [Asteraceae]; L.N.: *Helenchashak*

Exsiccatae: Panitanki, Indo-Nepal Trans-boundary region, Darjeeling, *Anurag & AP Das 079*, dated 21.03.2009.

Edible parts: Young leaves and tender shoots.

Mode of use: Cut into small pieces and fried with black cumin and chilies and sometimes, a dish is prepared using black cumin, garlic paste, chilies and with different vegetables.

Market price: In towns and villages: Rs.10 – 15 and Rs. 08 – 10, respectively for a bundle of \pm 500 gm.

Euryale ferox W. Salisbury, Koenig & Sims [Nymphaeaceae]; L.N.: *Makhna*

Exsiccatae: Chaterhat, Jalpaiguri, (Found in few of the survey areas) *Anurag & AP Das 069*, dated 21.03.2009.

Edible parts: Tender shoots.

Mode of use: Cut into small pieces and fried with chilies and black cumin. It is also used in curry with other vegetables.

Market price: In villages: one bundle (\pm 500 gm) is sold in Rs. 08 – 12.

Glinus oppositifolius (Linnaeus) A. DC. [Molluginaceae]; L.N.: *Geemashak*

Exsiccatae: Lataguri, Jalpaiguri, *Anurag & AP Das 051*, dated 04.04.10

Parts used: Leaves and tender shoots

Mode of use: Fried with brinjal and potatoes mixed with chilies and black or white cumin, sometimes used in mixed vegetables.

Market price: In towns and villages: Rs.08 – 10 and Rs. 05 – 07 respectively for a bundle of \pm 500 gm.

Hydrolea zeylanica Vahl [Hydroleaceae]

Exsiccatae: Samuktala, *Anurag & AP Das 016* dated 15.03.2009.

Edible parts: Young leaves are eaten.

Mode of use: Fried with brinjal and potatoes mixed with chilies and black or white cumin, sometimes used in mixed vegetables.

Market price: In villages: Rs 03 – 05 for a bundle of \pm 500 gm.

Hygrophila auriculata (Schumacher) Heine [Acanthaceae]; L.N.: *Kule khara*

Exsiccatae: Ghoshpukur, Darjeeling, *Anurag & AP Das 065*, dated 10.08.2010.

Edible parts: Young leaves and Tender shoots.

Mode of use: Fried singly or with other leafy vegetables and potatoes and in curry with potatoes using garlic paste.

Market price: In towns and villages: Rs.15 – 20 and Rs. 08 – 10 respectively for a bundle of \pm 500 gm.

Ipomoea aquatica Frosskal [Convolvulaceae]; L.N.: *Kalmi shak, Jal kalmi*

Exsiccatae: Kumargram, Jalpaiguri, *Anurag & AP Das 008*, dated 12.02.2009.

Edible parts: Young leaves and shoot-tips.

Mode of use: Cutting leaves and shoots into small pieces and are fried with cumin and chilies. Sometimes used as curry with other vegetables and garlic paste. Sometimes young twigs are used in salad.

Market price: In towns and villages: Rs.10 – 12 and Rs. 08 – 10 respectively for a bundle of \pm 500 gm.

Marsilea minuta Linnaeus [Marsileaceae]; L.N.: *Sunshni shak,*

Exsiccatae: Changrabandha, Indo-Bangla Border, Coochbehar, *Anurag & AP Das 038*, dated 13.04.2009.

Edible parts: Young leaves and sprouts.

Mode of use: Fried with brinjal and cumin.

Market price: In towns and villages: Rs. 08 – 10 and Rs. 04 – 07 respectively for a bundle of \pm 500 gm.

Monochoria hastata (Linnaeus) Solms [Pontederiaceae]; L.N.: *Nukha*

Exsiccatae: Jalpesh, Jalpaiguri, *Anurag & AP Das 043* dated 26.04.2009.

Edible parts: Tender stalk and leaves are eaten as vegetable.

Mode of use: Shoots are cut into small pieces and cooked with other vegetables; also cooked with fishes.

Market price: In villages: Rs 03 – 05 for a bundle of \pm 500 gm.

Monochoria vaginalis (N. L. Burman) C. Presl [Pontederiaceae]; L.N.: *Nukha*

Exsiccatae: Jalpesh, *Anurag & AP Das 04*, dated 26.04.2009.

Edible parts: Entire plant except the roots is eaten as vegetable.

Mode of use: Shoots are cut into small pieces and cooked with other vegetables in curries; also cooked with fishes.

Market price: In villages: Rs 03 – 05 for a bundle of \pm 500 gm.

Nelumbo nucifera Gaertner [Nelumbonaceae]; L.N.: *Padma*

Exsiccatae: Matigara, Darjeeling, *Anurag & AP Das 063*, dated 02.01.2011.

Edible parts: Young stems and fruits

Mode of use: Stems and petioles are cut into small pieces and cooked as curries with different vegetables.

Market price: In towns and villages: Rs.15 – 20 and Rs. 10 – 12 respectively for a bundle of \pm 500 gm.

Nymphaea nouchali Burman f. [Nymphaeaceae]; L.N.: *Nil-shapla*

Exsiccatae: Bagdogra, Darjeeling, *Anurag & AP Das 071*, dated 02.01.2011.

Edible parts: Root-stock and pedicels.

Mode of use: cut into small pieces and cooked as curries with different other vegetables.

Market price: In towns and villages: Rs.08 – 10 and Rs. 05 – 07 respectively for a bundle of \pm 500 gm.

Nymphaea pubescens Willdenow [Nymphaeaceae]; L.N.: *Vat or Sada-shapla*

Exsiccatae: Doumahani, Jalpaiguri, *Anurag & AP Das 053*, dated 04.04.2010.

Edible parts: Rhizome (root-stock), pedicels.

Mode of use: Rhizome, peduncles and petioles are cut into small pieces and cooked as curries with different vegetables.

Market price: In villages: Rs. 04 – 05 respectively for a bundle of \pm 500 gm.

Nymphaea rubra Roxburgh *ex* Andrews [Nymphaeaceae]; L.N.: *Lal Shapla*

Exsiccatae: Doumahani, Jalpaiguri, *Anurag & AP Das 056*, dated 04.04.2010.

Edible parts: Root-stock and pedicels.

Mode of use: Stems and petioles are cut into small pieces and cooked as curries with different vegetables.

Market price: In towns and villages: Rs.06 – 08 and Rs. 05 – 07 respectively for a bundle of \pm 500 gm.

Oxalis corniculata Linnaeus [Oxalidaceae]; L.N.: *Aamrul shak*

Exsiccatae: Panitanki, Indo-Nepal Trans boundary region, Darjeeling, *Anurag & AP Das 081*, dated 05.04. 2011.

Edible parts: Tender shoots and leaves.

Mode of use: Fried with cumin and chilies, sometimes into chutney.

Market price: In towns and villages: Rs.05 – 07 and Rs. 04 – 05 respectively for a bundle of \pm 500 gm.

Rumex dentatus Linnaeus [Polygonaceae]; L.N.: *Kukur jibwa*

Exsiccatae: Dhupguri, Jalpaiguri, *Anurag & AP Das 021*, dated 28.03.2009.

Edible parts: Tender shoots.

Mode of use: Cut into small pieces and cooked with other vegetables as curries; also cooked with fishes.

Market price: In towns and in villages: Rs.04 – 06 and Rs. 03 – 05 respectively for a bundle of \pm 500 gm.

Typhonium trilobatum (Linnaeus) Schott [Araceae]; L.N.: *Kharkon*

Exsiccatae: Samuktala, Alipurduar, (found in most of the survey areas) *Anurag & AP Das 017*, dated 15.03.2009.

Edible parts: Young leaves and petioles.

Mode of use: Pounded with garlic, dried chilly and black-cumin, sometimes used in mixed vegetables.

Market price: In towns and in villages: Rs. 10 – 15 and Rs. 05 – 07, respectively, for a bundle of \pm 250 gm.

Xanthium indicum Roxburgh [Asteraceae]; L.N.: *Aagra, Onkra*

Exsiccatae: Changrabandha, Indo-Bangla Border, Coochbehar, *Anurag & AP Das 036*, dated 13.04.2009.

Edible parts: Young shoots.

Mode of use: Young shoots are cut into small pieces and cooked with other vegetables as curries; also cooked with fishes.

Market price: Sold only in villages: Rs. 03 – 05 for a bundle of \pm 500 gm.

6.2.2. MEDICINAL PLANTS

During the survey of wetlands of Terai and Duars 83 plant species were recorded those are used for their medicinal value by the local poor villagers and ethnic community who inhabit around the wetlands. These plants are used for curing more than 30 diseases like cough and cold, fever, stomach ulcer, bleeding of piles, whooping cough, blood dysentery, snake bites, skin diseases, anemia, blood vomiting, hypertension, bronchitis, asthma and jaundice (hepatitis). Some wetland medicinal plants are: *Acorus calamus*, *Aeschenomene aspera*, *Alternanthera philoxeroides*, *Alternanthera sessilis*, *Amischotolype hookerii*, *Centella asiatica*, *Commelina benghalensis*, *Cheilocostus speciosus*, *Enydra fluctuens*, *Hydrilla verticillata*, *Hydrolea zeylanica*, *Hygroryza aristata*, *Ipomoea aquatica*, *Lemna perpusilla*, *Limnophila indica*, *Ludwigia adscendens*, *Marsilea minuta*, *Monochoria hastata*, *Monochoria vaginalis*, *Nelumbo nucifera*, *Nymphaea nouchali*, *Nymphaea pubescens*, *Nymphaea rubra*, *Ottelia alismoides*, *Pistia stratiotes*, *Ranunculus scleratus*, *Sagittaria sagittifolia*, *Trapa natans*, *Vallisneria spiralis*, etc.

6.2.2.1. Enumeration of Recorded Wetland Medicinal Plants

Acmella calva (A.P. de Candolle) R.K. Jansen [Asteraceae]; L.N.: *Jang* (Toto)

V.N.: *Anurag & AP Das* 02681.

Uses: (i) Flower heads are chewed once daily against toothache and affections of throat and gums and tongue paralysis.

(ii) Shoot apex is a popular remedy for stammering.

(iii) Two teaspoonful of boiled plant extract with water is given against dysentery, twice a day.

(iv) Decoction of whole plant in water is used as bath in rheumatism and as a lotion in scabies.

Acorus calamus Linnaeus [Acoraceae]; L.N.: *Boch* (Bengali), *Bongabari* (Santal), *Buch* (Malpahari), *Bojo* (Nepali)

V.N.: *Anurag & AP Das* 02060.

Uses: (i) Two tea spoonful rhizome extract is given to cure cough and cold, fever and stomach ulcer twice daily before meal.

(ii) Rhizome oil is applied around the piles twice a day to get relief from pain.

(iii) Dried rhizome pieces are worn along with neck chain to cure whooping cough in children.

(iv) Tender leaf is an ingredient for the preparation of traditional hair lotion. The leaf paste is applied as wounds of animals.

(v) Rhizome is emetic, stomachic, carminative, and used in dyspepsia, colic, fever, bronchitis, diarrhea, dysentery and snake bite. Pounded rhizome used for repelling insects from crop seeds.

(vi) Root decoction is triturated with curd water then decoction is mixed with oil of *Sesamum indicum* and cooked. The massage with thus prepared hot oil relieves fever. This is advised only after fourth month of pregnancy.

Aeschynomene aspera Linnaeus [Fabaceae]; L.N.: *Bhaat-Shola* (Bengali)

V.N.: *Anurag & AP Das* 02061.

Uses: (i) One tea spoonful extract of aerial part is given four times a day to cure cough, cold and fever.

(ii) Dried young shoot powder with half teaspoonful powdered sugar candy is given 3 – 4 times in a week to increase the consistency of semen.

Ageratum conyzoides Linnaeus [Leguminosae]; L.N.: *Elame Jhar* (Munda), *Ahemnangmi* (Toto)

V.N.: *Anurag & AP Das* 02012.

Uses: (i) Leaf paste is applied in fresh cuts as haemostat, also for wounds and skin diseases as required.

- (ii) Shoots are used to prepare traditional hair lotion and is used on the scalp before 10 minutes of bath 2 – 3 times in a week or as required.

Alpinia nigra (Gaertn.) Burtt, [Zingiberaceae]; L.N.: *Ajintia* (Rhabha), *Purunding* (Santal), *Jal purundi* (Bengali)

V.N.: *Anurag & AP Das* 02008.

Uses: (i) Rhizome decoction is taken to cure dyspepsia and fever.

- (ii) Rhizome extract is used as vermifuge for children.

Alternanthera philoxeroides (C. Martius) Grisebach [Amaranthaceae]; L.N.: *Panimatkaduri* V.N.: *Anurag & AP Das* 02003.

Uses: (i) Shoot extract along with little salt is administered in dysentery.

- (ii) Two tea spoonful leaf extract is taken daily in early morning.

Alternanthera sessilis (Linnaeus) R. Brown *ex* A.P. de Candolle [Amaranthaceae]; L.N.: *Khenchi shak* (Rabha), *Nunia shak* (Bengali)

V.N.: *Anurag & AP Das* 02029.

Uses: (i) One teaspoonful of leaf extract along with little sugar is given once daily for 5 – 6 days to cure headache and dizziness.

- (ii) Crashed plants, especially root juice are used in snakebites and also applied to cure stomachache and to cure sore in finger.

- (iii) Plant roots, pepper and head of earthworm are mixed and given to a pregnant woman in empty stomach to avoid any complications after child birth.

- (iv) Two to three teaspoonful of leaf extract is given to cure blood vomiting, bronchitis, asthma, hepatitis, cramps, diarrhea, dysentery and hypertension.

- (v) Two teaspoonful leaf extract with one cup of lukewarm water is given before sleeping at night for 10 – 15 days to enhance milk secretion in lactating mother.

- (vi) Leaf paste is used in fever as a cooling agent for two to three days.

Amaranthus spinosus Linnaeus [Amaranthaceae]; L.N.: *Kanta-note* (Bengali), *Parucka* (Toto)

V.N.: *Anurag & AP Das* 02057.

Uses: (i) Root extracts are used in gonorrhoea, menorrhagia, eczema and treated as tonic.

- (ii) Leaves and roots are used as laxative.

Amaranthus viridis Linnaeus [Amaranthaceae]; L.N.: *Note* (Bengali), *Ahmicha* (Toto)

V.N.: *Anurag & AP Das* 02060.

Uses: (i) Leaf juice is administered to give relief from scorpion stings and centipede bites.

Ammannia baccifera Linnaeus [Lythraceae]

V.N.: *Anurag & AP Das* 02047.

Uses: (i) Plant extract is used for fever, rheumatic pains, and hepatic eruption.

Argemone mexicana Linnaeus [Papaveraceae]; L.N.: *Bharbhara* (Malpahari)

V.N.: *Anurag & AP Das* 02024.

Uses: (i) The latex of this plant is given in toothache, dropsy, asthma, jaundice and eye diseases.

(ii) Root decoctions are used in scabies.

Bacopa monnieri (Linnaeus) Wettst. [Plantaginaceae]; L.N.: *Brahmmi* (Bengali)

V.N.: Anurag & AP Das 02054.

Uses: (i) Two teaspoonful leaf juice and one teaspoonful honey are mixed in one cup of lukewarm water and is given in empty stomach early in the morning to enhance memory power.

(ii) Root juice is applied dropwise into the eyes to cure cataract.

(iii) Leaf juice is administered to the babies suffering from asthma and constipation and also given for the treatment of epilepsy with little honey.

(iv) Warmed leaves are applied on the chest of the patient who is suffering from cough and cold.

Calamus erectus Roxburgh [Arecaceae]; L.N.: *Bet* (Bengali), *Betang* (Oraon)

V.N.: Anurag & AP Das 02058.

Uses: (i) Root is crushed and cooked with a mixture of water and milk ($\frac{1}{2} + \frac{1}{2}$) and filtrated paste is given twice a day for constipation with little amount of salt.

Cardamine hirsuta Linnaeus [Brassicaceae]; L.N.: *Buno-Sarish* (Malpahari)

V.N.: Anurag & AP Das 02052.

Uses: (i) Cooked plant is eaten for 2 – 3 days every week to cure the stangury and other urinary complicacies.

(ii) Juice of one leaf is taken once daily to control the blood pressure.

Canna indica Linnaeus [Cannaceae]; L.N.: *Kalabati* (Bengali), *Srijal* (Santal)

V.N.: Anurag & AP Das 02051.

Uses: (i) Root juice is applied twice daily in headache, cough and cold.

Centella asiatica (Linnaeus) Urban [Apiaceae]; L.N.: *Thankuni*, *Manimuni* (Bengali), *Dholmamon* (Santal), *Thunkuni* (Malpahari), *Baro Maanimuni* (Mech), *Tioha* (Toto)

V.N.: Anurag & AP Das 02032.

Uses:

(i) Paste of freshly collected leaves is boiled in 1 glass of cow milk and taken in the early morning for 7 days to cure jaundice and leucorrhea.

(ii) Fresh tender leaves are chewed to relieve from acidity and peptic ulcer in the early morning to till cure.

(iii) Plant paste is used externally in skin diseases and leprosy, twice a day.

(iv) Two teaspoonful shoot extract is used for memory improvement, treatment of mental fatigue, bronchitis, asthma, dysentery and kidney trouble.

(v) Plant juice mixed with sugarcane molasses is taken twice a day for 10 – 15 days against urinary calculus.

(vi) The plant is boiled with the leaves of *Oxalis corniculata* and *Ocimum sanctum* in water and the decoction is taken against dysentery.

(vii) Plant paste and extract is effective in treating pediatric diseases, throat disorders and piles.

(viii) A mixture of 5 – 6 teaspoonful leaf juice with a cup of cow's milk and little luke-warm water with honey is taken to check premature hair fall.

Chenopodium album Linnaeus [Amaranthaceae]; L.N.: *Bathua shak* (Bengali), *Bothu* (Malpahari)
V.N.: Anurag & AP Das 02050.

- Uses:** (i) Freshly prepared leaf paste with coconut oil is given in boils and burns, Kalla Jaar.
(ii) One teaspoonful shoot extract is used once in a day in empty stomach for 15 days against strangury.
(iii) Shoot decoction is given twice daily for increasing milk amount in puerperum women.

Clorodendrum indicum (Linnaeus) O. Kuntze [Lamiaceae]; L.N.: *Ghato* (Rabha), *Ghaton* (Oraon), *Bhant* (Santal)

V.N.: Anurag & AP Das 02019.

Uses:

- (i) Tender leaves is pasted with the leaves of *Azadiracta indica* and bark of *Shorea robusta* and applied on sores.
(ii) In diarrhea, one teaspoonful juice of fresh root is given with little amount of common salt twice daily for 10–15 days.
(iii) Leaves and roots powder is applied externally to tumours.
(iv) Fresh leaf juice is consumed as health tonic by the local poor and ethnic people and also given to anaemic patient. Leaf extract is administered to check the bleeding of teeth.

Commelina benghalensis Linnaeus [Commelinaceae]; L.N.: *Kanshira* (Bengali), *Kan-Chirang* (Toto)
V.N.: Anurag & AP Das 02007.

- Uses:** (i) Fried leaves are taken as vegetable to cure constipation.
(ii) Warm leaf juice is dropped in ear to get relief from earache twice a day minimum for 10–12 days.
(iii) Leaf juice with coconut oil is applied externally at least for a month to cure leprosy and skin inflammations.
(iv) Warm dried leaves are given twice daily to cure rheumatic pain.
(v) Leaf-paste is applied on boils and burns.
(vi) Plant extract along with little honey is effective in cough and cold.
(vii) Root juice with mustard oil is prescribed in headache.

Commelina diffusa N.L. Burman [Commelinaceae]; L.N.: *Kane Jhar* (Toto)

V.N.: Anurag & AP Das 02044.

- Uses:** (i) The bruised plant is used locally against burns, itches and boils.
(ii) Leaves are used in dysentery.
(iii) Leaf-paste is applied to stop bleeding from cuts and wounds.

Cheilocostus speciosus (J. König) C. Specht [Costaceae]; L.N.: *Kesut* or *Keu* (Bengali), *Orop* (Santal)
V.N.: Anurag & AP Das 02011.

Uses:

- (i) Root powder is used as dysgenic and precursors of steroids like sex hormones and oral contraceptives.
(ii) Root juice is used as tonic.
(iii) It is considered as tonic, anthelmintic, astringent and also used in snake bite.

(iv) Fried rhizome with molasses is administered to cure jaundice.

Celosia argentea Linnaeus [Amaranthaceae]; L.N.: *Murag-jaba* (Bengali), *Murga* (Santal); V.N.: Anurag & AP Das 02025.

Uses: (i) Seeds are given in diarrhea, some blood diseases and in mouth sores.
(ii) Flowers are boiled and administered in abdominal pain.

Crinum asiaticum Linnaeus [Amaryllidaceae]; L.N.: *Birpiaj* (Rabha) V.N.: Anurag & AP Das 02063.

Uses: Root-pest is administered externally against dermatitis for at least seven days.

Cuscuta reflexa Roxburgh [Cuscutaceae]; L.N.: *Swarnalata* (Bengali), *Alagdani* (Santal) V.N.: Anurag & AP Das 02043.

Uses: (i) The paste of whole plant is given to cure abdominal pain.
(ii) The poultice of the whole plant is applied externally to cure swelling of the testes.

Cynodon dactylon (Linnaeus) Persoon [Poaceae]; L.N.: *Durba-ghash* (Bengali), *Duba* (Toto) V.N.: Anurag & AP Das 02061.

Uses:

- (i) Decoction of \pm 20 gm of stolon is soaked in half a liter of drinking water for 2 – 3 hours and is taken in empty stomach with one spoonful of honey, twice daily for a week to cure strangury.
- (ii) Plant is chewed in dysmenorrheal disorders; 10 gm thrice a day for 2 – 3 days. Root decoction is diuretic, used in dropsy, piles and secondary syphilis.
- (iii) Plant paste is also used in fresh cuts, wounds and epilepsy.
- (iv) Sometimes it is also used to check bleeding from wounds.

Cyperus rotundus Linnaeus [Cyperaceae]; L.N.: *Mutha ghash* (Bengali); *Takudara* (Rabha) V.N.: Anurag & AP Das 02055.

Uses:

- (i) Fresh rhizomes boiled with cow milk are given to children in the early morning and in empty stomach to get relief from stomachache.
- (ii) Roots and tubers are prescribed as excellent antidote to all kind of poisons.
- (iii) One teaspoonful of root juice is given once daily for 2 – 3 months for developing high memory power.
- (iv) Sometimes it is prescribed as anti-fungal, anti-parasitic, and anti-rheumatic medicine.
- (v) It cures dyspepsia, vomiting, indigestion, cough, bronchitis, and toxic affections.
- (vi) Root pest is given against paralysis. Tubers are diuretic, anthelmintic and stimulant.

Desmodium triflorum (Linnaeus) A.P. de Candolle [Leguminosae]; L.N.: *Charali* (Toto) V.N.: Anurag & AP Das 02039.

Uses: The plant ashes are given with 'Paan' (betel-leaf) to cure wounds.

Diplazium esculentum (Retzius) Swartz [Woodsiaceae]; L.N.: *Dheki-shaak* (Bengali), *Bigdhakia* (Rabha)

V.N.: *Anurag & AP Das* 02046.

Uses: The root paste is applied on septic ulcers.

Drymaria cordata (Linnaeus) Willdenow *ex* Schultes [Caryophyllaceae]; L.N.: *Avijal* (Bengali), *Abijalo* (Lepcha, Nepali), *Makaibi* (Toto)

V.N.: *Anurag & AP Das* 02062.

Uses: (i) Plant is given to use externally twice a day against muscular pain.

(ii) Plant juice is taken in gastro-intestinal disorder.

(iii) Roasted leaves inhaled by ethnic people for recovery from cough and cold.

(iv) Plant decoction is administered in fever, diarrhea and dysentery.

(v) About ½ teaspoonful leaf juice is administered thrice daily to children suffering from stomach pain for seven days.

Duchesnea indica (G. Jackson) Focke [Rosaceae]; L.N.: *Jangli-haldiar* (Rabha), *Chinising* (Toto)

V.N.: *Anurag & AP Das* 02040.

Uses: Juice of the flowers is mixed with mustard oil and used as an eye drop in eye inflammation.

Dysphania ambrosioides (Linnaeus) Mosyakin & Clemants [Amaranthaceae]; *Ghora-bothua* (Bengali), *China-jhar* (Dukpa)

V.N.: *Anurag & AP Das* 02049.

Uses: Plant is used as anthelmintic.

Echinochloa colona (Linnaeus) Link [Poaceae]

V.N.: *Anurag & AP Das* 02064.

Uses: Plant is sweat acrid, oleaginous, cooling, and digestive. Useful in biliousness and constipation and causes flatulence.

Echinochloa crus-galli (Linnaeus) P. Beauvois [Poaceae]

V.N.: *Anurag & AP Das* 02056.

Uses: Plant is used in diseases of spleen and to check hemorrhage.

Eclipta prostrata (Linnaeus) Linnaeus [Asteraceae]; L.N.: *Kesut* (Bengali), *Kesuting* (Toto)

V.N.: *Anurag & AP Das* 02056.

Uses:

(i) One table spoonful of fresh plant juice is given twice daily for 2 months against chronic ulcer.

(ii) Shoot juice is recommended as tonic against spleen swelling.

(iii) The leaf paste is applied externally once daily against skin diseases.

(iii) Application of leaf paste is suggested to get relief from toothache and headache.

(iv) Leaf juice is mixed with *Sessamum* oil to prepare a hair-gain lotion which is applied directly on scalp to prevent hair loss and dandruff. Leaf juice is used as black dye for hair and also used in scorpion stings.

(v) Root paste is administered to cure diarrhea and respiratory troubles.

(vi) The leaf extract is mixed with black pepper and sugar and is given to cure body inflammations.

Enydra fluctuens A.P. de Candolle [Asteraceae]; L.N.: *Shanchi, Hingcha, Helencha* (Bengali), *Hencha* (Santal), *Hungchi* (Toto)

V.N.: Anurag & AP Das 02013.

Uses:

- (i) Two teaspoonful of boiled plant extract with 50 ml water is given twice a day for 10–15 days to cure calculus.
- (ii) One teaspoonful of shoot extract in a day is given as antidote to food poisoning.
- (iii) Juice of twigs mixed with a cup of luke-warm cow's milk is given to improve the vision.

Euphorbia hirta Linnaeus [Euphorbiaceae]; L.N.: *Pushi-dudh* (Bengali), *Dudejhar* (Mech), *Chapangging* (Toto)

V.N.: Anurag & AP Das 02028.

Uses: (i) The plant decoction is used in cough, cold and asthma.

- (ii) Leaf juice with cow milk is administered in gonorrhoea.
- (iii) Plant extract is given in asthma and bronchial affections.

Euryale ferox Salisbury in Koeing and Sims. [Nymphaeaceae]; L.N.: *Makhna* (Bengali) V.N.: Anurag & AP Das 02037.

Uses: Seeds are tonic, astringent, and deobstruent and used in spermatorrhoea.

Fumaria indica (Hasskarl) Pugsley [Papavaraceae]; L.N.: *Ban dhania* (Toto)

V.N.: Anurag & AP Das 02059.

Uses: (i) The leaf decoctions are administered externally in skin diseases.

- (ii) Dried plants are used as diuretic, diaphoretic, anthelmintic and blood purifier.
- (iii) Plant decoction is given in dysentery.

Glinus oppositifolius (Linnaeus) A.P. de Candolle [Molluginaceae]; L.N.: *Gimma shak*, (Bengali), *Gimai* (Santal)

V.N.: Anurag & AP Das 02018.

Uses: (i) The leaf juice is recommended once daily against gastrointestinal disorders.

- (ii) Paste of whole plant is applied externally twice daily for 2–3 weeks against various types of skin diseases like scabies and itches; also used in joint pains, inflammations, fever, malaria and wounds.
- (iii) Roots extract is given in vaginal white discharge.

Grangea maderaspatana (Linnaeus) Poiret [Asteraceae]; L.N.: *Krena* (Rabha)

V.N.: Anurag & AP Das 02001.

Uses: Flowers are wrapped in betel leaf and taken orally, thrice daily in empty stomach in the morning to cure from asthma and cough.

Heliotropium indicum Linnaeus [Boraginaceae]; L.N.: *Hati-sur* (Bengali), *Hati-sura* (Malpahari)

V.N.: Anurag & AP Das 02041.

Uses:

- (i) Paste of tender shoots is applied externally against skin inflammations for two weeks, twice daily. Paste of fresh whole plant is applied on affected area against scorpion sting, thrice daily for a week.

- (ii) Leaf juice is strained and dropped into eyes to cure conjunctivitis. Paste of whole plant along with the rhizome of *Curcuma longa* Linnaeus and applied externally on cuts and wounds as antiseptic.

Hydrilla verticillata (Linnaeus f.) Royle [Hydrocharitaceae]; L.N.: *Jhangi* (Bengali), *Jhajang* (Toto)
V.N.: *Anurag & AP Das* 02020.

Uses: Leaves are crushed with black pepper and made into pills; one pill once daily against toxic fever and gastrointestinal disorders is recommended.

Hydrolea zeylanica (Linnaeus) Vahl [Hydroleaceae]; L.N.: *Indroni* (Munda)
V.N.: *Anurag & AP Das* 02031.

Uses: (i) Shoots are crushed and applied against leprosy.

(ii) The leaves are used as antiseptic.

(iii) Boiled plant paste with coconut oil is applied in minor cuts and wounds.

Hygrophila auriculata (Schumacher) Heine [Acanthaceae]; L.N.: *Kulekhara* (Bengali), *Dangrakata* (Santal)

V.N.: *Anurag & AP Das* 02053.

Uses:

(i) Two spoonful of leaf extract diluted in 50 ml of water is given once daily for 3 months to cure anemia.

(ii) Powdered dry seeds mixed with goat milk are taken in the morning for treating impotency. Powdered dry seeds mixed with milk and sugarcane molasses is taken twice daily to cure spermatorrhoea.

(iii) Leaf decoction is administered in dropsy, jaundice, rheumatism and body pain.

(iv) The seed powder is given in obstruction of hepatic and of the genitourinary tracts.

(v) Root paste mixed with cow ghee and put inside the vaginal canal in abnormal delivery.

Hygroryza aristata (Retzius) Nees ex Wight & Arnott [Poaceae]; L.N.: *Dol-ghash* (Munda)

V.N.: *Anurag & AP Das* 02042.

Uses:

(i) Powder of one table spoonful of grains is given with half cup of lukewarm water in indigestion, once daily.

(ii) Leaves are recommended to use externally against skin inflammations. It causes constipation.

Ipomoea aquatica Forsskål [Convolvulaceae]; L.N.: *Jal-Kalmi* (Bengali), *Ektadi* (Munda), *Kulming-lato* (Toto)

V.N.: *Anurag & AP Das* 02021.

Uses: (i) The leaf juice is given in burns.

(ii) Fried leaves are taken to cure headache and is recommended as blood purifier.

(iii) The stem extract is given once daily in empty stomach for a week against ring worm.

(iv) The plant juice is given to the mentally retarded persons.

(v) Two spoonful of leaf juice along with little amount of cow ghee is given once daily for at least one month to cure gonorrhoea.

(vi) About 2–3 tablespoonful leaf juice is given once daily as oral dose, during loose motion.

(vii) Leaf paste is applied externally to stop bleeding of piles.

(viii) Shoot decoction is administered once a day to increase milk in women.

(ix) About 50 ml of leaf extract is taken orally to control bleeding during child birth.

Ipomoea carnea Jacquin [Convolvulaceae]; L.N.: *Dhal Kalmi* (Bengali); *Parkamkuthi* (Oraon)
V.N.: Anurag & AP Das 02036.

Uses: (i) Leaves are crushed into a paste and applied on affected tongue and tonsil.

(ii) Latex is used against wounds.

Lasia spinosa (Linnaeus) Thwaites [Araceae]; L.N.: *Kanta-kachu* (Bengali), *Kantasaru* (Santal)
V.N.: Anurag & AP Das 02045.

Uses: Leaf extract is taken in asthma and also used as blood purifier.

Lemna minor Linnaeus [Araceae]; L.N.: *Khudipana* (Bengali), *Punai* (Mech)
V.N.: Anurag & AP Das 02027.

Uses: (i) Extract of the shoot part is used against skin diseases.

(ii) Extract of young fronds is applied drop wise, twice in a day as ophthalmic wash.

Linnophila indica (Linnaeus) Druce [Plantaginaaceae]; L.N.: *Karpur* (Bengali), *Kera-lata* (Mech)
V.N.: Anurag & AP Das 02048.

Uses:

(i) Shoot extract with ginger and black pepper is prescribed once daily in empty stomach for 15 days to cure dysentery.

(ii) Shoot paste is applied externally on cuts and wounds as antiseptic.

(iii) The plant paste with coconut oil is externally used in elephantiasis.

Lindernia crustacea (Linnaeus) F. von Mueller [Linderniaceae]; L.N.: *Bhumi-nim* (Bengali), *Kashidori* (Malpahari)

V.N.: Anurag & AP Das 02030.

Uses:

(i) Three spoonful of leaf paste is given orally in early morning to cure dysentery and ring worm.

(ii) The plant is crushed, mixed with little amount of lukewarm water and is taken in the early morning in empty stomach to cure indigestion and it is also applied to cure excess bile secretion.

Ludwigia adscendens (Linnaeus) H. Hara [Onagraceae]; L.N.: *Kessardam* (Bengali), *Pani-daichung* (Toto)

V.N.: Anurag & AP Das 02035.

Uses: The paste of whole plant along with the rhizome of *Curcuma longa* Linnaeus is applied against peptic ulcers and skin diseases.

Ludwigia octovalvis (N. Jacquin) P.H. Raven [Onagraceae]; L.N.: *Polte-pata* (Bengali), *Pani-jalkia* (Rabha)

V.N.: Anurag & AP Das 02033.

Uses: (i) Paste of the areal part of the plant is applied externally on forehead, thrice a day, in fever.

(ii) Leaf juice is given in intestinal worm and in dysentery.

Marsilea minuta Linnaeus [Marsiliaceae]; L.N.: *Sushni Saak* (Bengali), *Pani-suni* (Oraon)

V.N.: Anurag & AP Das 02034.

Uses: (i) 10 grams of raw leaf paste is applied twice daily on forehead to cure headache.

(ii) Plants are used to cure pain of calf muscles in leg and also given in insomnia.

(iii) Leaf juice along with root extract of *Asparagus racemosus* Willdenow is taken orally with honey to enhance spermatozoa formation.

Mimosa pudica Linnaeus [Leguminosae : Mimosoideae]; L.N.: *Lajja-bati* (Bengali), *Lazaoni* (Rabha), *Lazaoki* (Oraon), *Buharijhar* (Lepcha)

V.N.: Anurag & AP Das 02065.

Uses: (i) The root decoction is given in gum trouble and toothache.

(ii) The root juice is administered in every three hours for three days to get cured from throat ulcers.

Monochoria hastata (Linnaeus) Solms [Pontederiaceae]; L.N.: *Baro Nukha* (Bengali), *Metka* (Malpahari)

V.N.: Anurag & AP Das 03681.

Uses: (i) Root extract is used in insanity twice a day for 12 days.

(ii) Leaf-paste is applied on burns and boils. Roots are chewed to get relief from toothache.

Monochoria vaginalis (Burman f.) Presl [Pontederiaceae]; L.N.: *Nukha* (Bengali), *Nera-Metka* (Malpahari)

V.N.: Anurag & AP Das 02088.

Uses: (i) Powder of dried root is used to get relief from toothache.

(ii) Leaf-juice is given twice daily for cough and also useful for stomach and liver complications and in stomach pain.

(iii) Paste of whole plant is recommended to join cracked bones.

Murdannia nudiflora (Linnaeus) Brenan [Commelinaceae]

V.N.: Anurag & AP Das 02115.

Uses: (i) 10 grams of plant paste is applied twice daily for 6 months on leprosy.

(ii) Leaf paste is used on forehead to cure from headache.

(iii) One table spoonful of leaf juice is given to cure asthma, piles, stomach and urinary complications.

Musa balbisiana Colla [Musaceae]; L.N.: *Kala* (Bengali), *Dairakala* (Santal)

V.N.: Anurag & AP Das 02078.

Uses: Two teaspoonful rhizome extract is given once daily in empty stomach for seven days to cure dysentery.

Nelumbo nucifera Gaertner [Nelumbonaceae]; L.N.: *Padma*

V.N.: Anurag & AP Das 02104.

Uses:

(i) Two spoonful paste of its rhizome along with the shoots of *Andrographis paniculata* (Burman f.) Nees is applied in ring worm.

(ii) The milky juice of leaves and flowers are used against toxic infections and to check vomiting and diarrhea.

- (iii) Paste of young leaf is applied on forehead to get relief from headache.
- (iv) One spoonful paste of flower buds with little water is prescribed twice daily for one month as cardiac tonic and also in fever and liver complications.
- (v) Paste of young seed is used externally once daily in skin diseases.
- (vi) 5 gm of root paste in 20 ml of lemon juice is taken twice daily for the treatment of piles. (vii) Ash of dry leaf with coconut oil is used for curing foot cracks.
- (viii) One spoonful of petiole juice is given once daily regularly in peptic ulcer.
- (ix) One spoonful of rhizome paste along with little honey is taken once daily against diabetes for 4 weeks.

Nymphaea nouchali N.L. Burman [Nymphaeaceae]; L.N.: *Neel Shapla* (Bengali), *Apulbaha* (Santal)
V.N.: Anurag & AP Das 02072.

Uses:

- (i) Paste of rhizomes and seeds is given in dysentery, one spoonful daily for 30 days.
- (ii) Flowers and seeds are soaked in water for overnight and 50 ml of decanted water is given once daily for 30 days against various cardiac problems.
- (iii) Dry seed powder is applied locally for the treatment of skin infection. Rhizome powder is given in piles.

Nymphaea pubescens Willdenow [Nymphaeaceae]; L.N.: *Sada Shapla* (Bengali), *Apulbaha* (Santal)
V.N.: Anurag & AP Das 02130.

Uses:

- (i) Paste of its petals and shoots of *Centella asiatica* are given twice daily for 15 days in blood dysentery.
- (ii) Juice of only one rhizome is given against leucorrhoea and menorrhagia.
- (iii) One spoonful of rhizome powder with honey is given for piles and dyspepsia, - once daily for 30 days.
- (iv) Two spoonful paste of roots and flowers of *Hibiscus rosa-sinensis* Linnaeus, bark of *Ficus religiosa* Linnaeus and seeds of *Sesamum indicum* Linnaeus are taken once daily to induce abortion.
- (v) Flower paste is given against the white discharge, rootstocks and seeds are used as food.

Nymphaea rubra Roxburgh ex Andrews [Nymphaeaceae]; L.N.: *Lal Shapla* (Bengali)
V.N.: Anurag & AP Das 02079.

- Uses:** (i) Root powder is used externally in piles to check bleedings and in skin diseases.
(ii) 3 – 4 petals are taken directly in diarrhea.
(iii) The paste of flower is administered to cure from piles and blood dysentery.

Nymphoides indica (Linnaeus) Kuntze [Menyanthaceae]; L.N.: *Bara-panchuli* (Bengali)
V.N.: Anurag & AP Das 02126.

- Uses:** (i) Plant paste is applied on cuts and wounds as cooling agent.
(ii) Paste of dried rhizome along with little honey is taken in urinary complications.

Oryza rufipogon Griffith [Poaceae]; L.N.: *Jangli Dhaan* (Bengali), *Dhann* (Munda)
V.N.: Anurag & AP Das 02100.

- Uses:** (i) The ash of burnt rice is given to orally children in diarrhea.

- (ii) The rice-wash is taken by women in villages for cure of leucorrhoea.
- (iii) The husk of the grain is considered anti-dysentric.

Ottelia alismoides (Linnaeus) Pearson [Hydrocharitaceae]; L.N.: *Jal-kala* (Bengali, Munda)
V.N.: Anurag & AP Das 02066.

- Uses:** (i) Paste of dry seed is used externally on boils to get relief from burning sensation.
(ii) Dry leaf powder is applied externally on several skin diseases.
(iii) Leaves are used in fever

Oxalis corniculata Linnaeus [Oxalidaceae]; L.N.: *Amrul* (Bengali), *Amrul* (Santal), *Korning-lata* (Toto)
V.N.: Anurag & AP Das 02082.

- Uses:** (i) Leafy shoot is crushed along with the leaves of *Cajanus cajan* (Linnaeus) Millspaugh and used for preventing jaundice, - two spoonful, thrice daily.
(ii) 10 ml juice of freshly collected plant is taken once daily against piles, indigestion and dysentery.
(iii) Plant is also used as refrigerant and used to cure from stomach pain and scurvy.
(iv) Leaf juice is administered externally with little honey on the backbone in rickets.

Peperomia pellucida (Linnaeus) Kunth [Piperaceae]; L.N.: *Luchi-paata* (Bengali), *Luchai-pata* (Toto)
V.N.: Anurag & AP Das 02107.

- Uses:** (i) The leaves crushed are used in fever and headache.
(ii) Leaf juice is administered against abdominal pains.

Persicaria hydropiper (Linnaeus) Delarbre [Polygonaceae]; L.N.: *Jal pepper* (Bengali), *Pani-khul* (Rabha)
V.N.: Anurag & AP Das 02125.

- Uses:** (i) Paste of freshly collected shoot is applied as pultice on forehead to reduce the body temperature during fever.
(ii) One teaspoonful of seed powder is soaked in 50 ml lukewarm water for 1 – 2 hours and the decant is given twice a day for 30 days to cure dysentery.

Persicaria barbata (Linnaeus) H. Hara [Polygonaceae]; L.N.: *Pani-khul* (Rabha)
V.N.: Anurag & AP Das 02097.

- Uses:** (i) One teaspoonful of freshly prepared shoot and leaf extract is given against stomach disorder and constipation once a day for 30 days.
(ii) Leaf-paste is applied externally against skin infection.

Phragmites karka (Retzius) Trinius ex Steudel [Poaceae]; L.N.: *Nal-khagra* (Bengali), *Nakat* (Oraon)

V.N.: Anurag & AP Das 02087.

- Uses:** (i) Roots are refrigerant, diuretic, and diaphoretic.
(ii) Useful in biliousness, urinary trouble, vaginal and uterine complaints, erysipelas and heart disease.

Phyllanthus urinaria Linnaeus [Phyllanthaceae]; L.N.: *Bhnui Amla* (Bengali), *Aamchi* (Toto)
V.N.: *Anurag & AP Das* 02073.

Uses: Plant is used as diuretic and also used in gonorrhoea and other genito-urinary complications.

Physalis minima Linnaeus [Solanaceae]; L.N.: *Handikundi* (Santal)
V.N.: *Anurag & AP Das* 02105.

Uses: The paste of whole plant is administered externally against dermatitis for at least seven days.

Pistia stratiotes Linnaeus [Araceae]; L.N.: *Baro-paana* (Bengali), *Barojhanji* (Toto)
V.N.: *Anurag & AP Das* 02071.

Uses: (i) Leaf extract is used as drops to cure ENT complications.

(ii) The leaf paste is used in eczema, leprosy, ulcers and piles.

(iii) Leaf-juice is boiled with coconut oil and applied externally to cure skin diseases including leprosy and eczema.

(iv) Whole plant is boiled and tied on the swollen parts of body to reduce the rheumatic swellings.

(v) Two teaspoonful of plant extract is applied twice daily for curing urinary complications.

Ranunculus sceleratus Linnaeus [Ranunculaceae]; L.N.: *Polica* (Bengali)
V.N.: *Anurag & AP Das* 02132.

Uses:

(i) Fresh plant is wrapped with banana leaf, burnt slightly and applied on burns for 15 days.

(ii) 20 gm of shoots is boiled with 50 ml of water and the residue is applied externally, once a day for 20 – 30 days on eczema.

Ricinus communis Linnaeus [Euphorbiaceae]; L.N.: *Rehri, Gaab* (Bengali), *Andi ko bot* (Toto)
V.N.: *Anurag & AP Das* 02098.

Uses: (i) Two spoonful of fresh leaf-juice is administered in dysentery.

(ii) The seed-oil (*Castor oil*) is administered orally to cure from intestinal worms.

(iii) Rheumatic swellings are treated by warmed leaf with little mustard oil.

Rotala rotundifolia (Buchanan-Hamilton *ex* Roxburgh) Koehne [Lythraceae]; L.N.: *Panijhuri* (Bengali), *Jal-latkan* (Rabha)
V.N.: *Anurag & AP Das* 02080.

Uses:

(i) Dry plant powder is mixed with little lime and applied locally, once daily for one week, to cure eczema.

Rumex maritimus Linnaeus [Polygonaceae] L.N.: *Pahari palong* (Bengali)
V.N.: *Anurag & AP Das* 02106.

Uses:

(i) Leaf paste is wrapped with banana-leaf and half-burnt in wooden fire and then applied externally on burns and injuries.

(ii) Warmed stem juice is dropped in the ear against ear-pain.

Sagittaria sagittifolia Linnaeus [Alismataceae]; L.N.: *Chhot-kut* (Bengali)

V.N.: Anurag & AP Das 02083.

Uses: 15 – 20 gm of freshly prepared root-paste is taken along with 10 ml of honey in cough and cold, once daily for 7 days.

Scoparia dulcis Linnaeus [Plantaginaceae]; L.N.: *Chini paata* (Bengali), *Mashlam* (Rabha), *Chinighash* (Toto), *Masola* (Oraon)

V.N.: Anurag & AP Das 02103.

Uses:

- (i) 10 ml of plant extract, mixed in fresh raw cow milk is given for relieving urinary complications and removing kidney stones, - once daily for 30 – 45 days.
- (ii) Root and leaf extracts are given in malaria, - two teaspoonfuls twice daily till cured.
- (iii) Flowers and the tuber of *Aponogeton undulatus* Roxburgh are mixed and administered once daily for seven days in the rheumatic swelling of joints.
- (iv) Young twigs are mixed with *Cynodon dactylon* (Linnaeus) Persoon and prepared a paste and applied to get relief from headache.

Thysanolaena latifolia (Roxburgh ex Hornemann) Honda [Poaceae]

V.N.: Anurag & AP Das 02070.

Uses: (i) Roots are used as an abortifacient.

- (ii) The decoction of the root is used as mouth wash during fever.

Typha angustifolia Linnaeus [Typhaceae]; L.N.: *Hogla* (Bengali), *Hangola* (Santal)

V.N.: Anurag & AP Das 02131.

Uses: Paste of rhizome is given to cure blood dysentery, gonorrhoea and measles, once daily for 10 – 15 days. It is used as astringent.

Trapa natans Linnaeus [Lythraceae]; L.N.: *Paniphal* (Bengali)

V.N.: Anurag & AP Das 02102.

Uses:

- (i) Seeds are pasted with little lukewarm water and are given to cure dysentery and menstrual disorders, twice daily for 21 days.
- (ii) Powdered nuts are used in diarrhea with some water.
- (iii) The dried fruits are given in ulcers and stomach disorders.

Vallisneria spiralis Linnaeus [Hydrocharitaceae]; L.N.: *Pata Syola* (Bengali), *Saeoli* (Munda)

V.N.: Anurag & AP Das 02069.

Uses: Paste of whole plant is used externally on rheumatic swelling to cure rheumatism, once daily for 15 days. Plant is also used as stomachic.

6.2.2.2. Enumeration of Recorded Formulations in Medicine

The result of the search for the use of individual species of plants for the treatment of diseases has already been presented. But, to treat some of the diseases, *Ethnic* medical practitioners generally use more than one plant together in definite formulations for the preparation of drugs. Some such formulations have been recorded during the survey and are now presented below. The recorded formulations have

been clubbed together under different groups like Gastro-intestinal diseases, Hepatic diseases, Circulatory diseases, Gynaecological problems, Eye Diseases, etc.

I. GASTRO-INTESTINAL DISEASES

Dysentery:

FORMULA 1:

Ingredients: (i) *Musa balbisiana* Colla [Anurag & AP Das 1224], (ii) *Cynodon dactylon* (Linnaeus) Persoon [Anurag & AP Das 1134] and (iii) *Centella asiatica* (Linnaeus) Urban [Anurag & AP Das 0985]

Preparation: Equal quantities of roots of *Musa balbisiana*, whole part of *Cynodon dactylon* (Linnaeus) Persoon and *Centella asiatica* (Linnaeus) Urban are crushed and mixed with sufficient cold water and filtered.

Dose: One cup of extract is given at an interval of one hour for 10 – 15 days.

FORMULA 2:

Ingredients: (i) *Oxalis corniculata* Linnaeus [Anurag & AP Das 0981], (ii) *Ocimum basilicum* Linnaeus [Anurag & AP Das 0768]

Preparation: Equal quantities of leafy twigs and 10 – 15 leaves are crushed and mixed with sufficient cold water and filtered.

Dose: Three teaspoonful of extract is given at an interval of three hours for at least seven days.

FORMULA 3:

Ingredients: (i) *Amaranthus philoxeroides* (Martius) Grisebach [Anurag & AP Das 0977], (ii) *Centella asiatica* (Linnaeus) Urban [Anurag & AP Das 0930]

Preparation: *Amaranthus philoxeroides* (Martius) Grisebach is boiled and mixed with extract of shoot apex of *Centella asiatica* (Linnaeus) Urban and with some amount of water.

Dose: Two teaspoonful of extract is administered in twice daily for at least 10 – 15 days.

FORMULA 4:

Ingredients: (i) *Acmella calva* (A.P. de Candolle) R.K. Jansen [Anurag & AP Das 1110], (ii) *Centella asiatica* (Linnaeus) Urban [Anurag & AP Das 0960] (iii) Bark of *Terminalia arjuna* (Roxburgh ex A.P. de Candolle) Wight & Arn. [Anurag & AP Das 0913]

Preparation: The shoot of *Acmella calva*, whole plant of *Centella asiatica* (Linnaeus) Urban are crushed and mixed with bark extract of *Terminalia arjuna* (Roxburgh ex A.P. de Candolle) Wight & Arn. and cold water.

Dose: Two teaspoonful of mixture is administered in empty stomach for seven days to cure from dysentery.

II. HEPATIC DISEASES

Jaundice & Liver Disorder:

FORMULA 1:

Ingredients: (i) *Centella asiatica* (Linnaeus) Urban [Anurag & AP Das 0654], (ii) *Cheilocostus speciosus* (J. König) C. Specht [Anurag & AP Das 0955], (iii) *Hygrophila auriculata* (Schumach.) Heine [Anurag & AP Das 0877]

Preparation: Entire plants of *Centella asiatica* crushed and mixed with the rhizome extract of *Cheilocostus speciosus* (J. König) C. Specht and the leaf extract of *Hygrophila auriculata* (Schumach.) Heine in boiled water

Dose: Two teaspoonfuls are given in jaundice in empty stomach for seven days.

FORMULA 2:

Ingredients: (i) *Oxalis corniculata* Linnaeus [Anurag & AP Das 0772], (ii) *Argemone maxicana* Linnaeus [Anurag & AP Das 0980]

Preparation: Leaf extract of *Oxalis corniculata* Linnaeus mixed with the latex of *Argemone maxicana* Linnaeus with cold water.

Dose: Two teaspoonful is administered twice daily at interval of four hours for 10 – 15 days.

6.2.2.3. Efficacy of Drugs

For the treatment of as much as 21 types of diseases at least 16 formulations were recorded during the present survey among traditional healers of different tribal communities like *Rabha*, *Toto*, *Oraon*, *Munda*, *Santal*, *Mech*, etc. The efficacies of these medicines were also studied and the result has been presented in Table 6.1.

Table 6.1. Efficacy status of the recorded formulations

Diseases		Total No. of patients	Fully cured	Partly cured	Not cured
GASTRO-INTESTINAL DISEASES					
Dysentery	<i>Formula 1</i>	12	9	3	0
	<i>Formula 2</i>	7	6	0	1
	<i>Formula 3</i>	11	5	4	2
	<i>Formula 4</i>	6	4	2	0
TOTAL		36	24	09	03
HEPATIC DISEASES					
Jaundice & Liver Disorder	<i>Formula 1</i>	17	13	4	0
	<i>Formula 2</i>	11	8	2	1
TOTAL		28	21	06	01
GRAND TOTAL		64	45	15	04

6.2.3. Recorded Plants for Building & Fencing Materials

Local poor tribal's use some wild plants for the construction of their houses and protect their court-yard through fencing. Nine species of angiosperms have been recorded during the study. Among all the monocotyledonous species two are trees, one is shrub and rests are grasses.

Phoenix sylvestris (Linnaeus) Roxburgh [Arecaceae]; L.N.: *Khejur* [Bengali]
V.N.: Anurag & AP Das 02129.

Uses:

- (i) Dried leaves are used to prepare the roof (as thatch) and wall along with Bamboos in the construction of houses.
- (ii) The Stem is used as pillar of house.

Leptochloa fusca (Linnaeus) Kunth [Poaceae]

V.N.: Anurag & AP Das 02101.

Uses: Local poor people used the dried plants as roof and wall materials along with Bamboos in preparation of houses.

Saccharum arundinaceum Retzius [Poaceae]

V.N.: Anurag & AP Das 02068.

Uses: (i) Local poor people used the dried plants for thatching their houses.

(ii) It is also used for making walls on bamboo frame.

Imperata cylindrica (Linnaeus) Raeuschel [Poaceae] L.N.: *Kush*

V.N.: Anurag & AP Das 02099.

Uses: Web into mat like structure for making their houses. Also, used for thatching.

Ipomoea carnea Jacq. [Convolvulaceae]; L.N.: *Kolmi* (Bengali)

V.N.: Anurag & AP Das 02127.

Uses: Dried plants and sometimes living plants along with bamboos are used to develop

fencing along the boundary of houses and vegetable gardens.

Saccharum spontaneum Linnaeus [Poaceae]; L.N.: *Kash*

V.N.: Anurag & AP Das 02167.

Uses: the dried plants are used for thatching and for making walls on bamboo frame

Chrysopogon zizanioides (Linnaeus) Roberty [Poaceae]; L.N.: *Binna*

V.N.: Anurag & AP Das 02074.

Uses: Local people use the dried plants as roof and wall materials along with Bamboos in making their houses.

Typha angustifolia Linnaeus [Typhaceae]; L.N.: *Hogla* (Bengali)

V.N.: Anurag & AP Das 02108.

Uses: Local people use its dried long leaves for making both roof as well as walls on bamboo frame.

6.2.4. Plants for Broom, Utensils, and Ornaments/ Decoration

During the survey 12 such species has been recorded which are used for making brooms, utensils and ornaments. Among these 3 species of grasses are used for making brooms and mats.

Aeschynomene aspera Linnaeus [Fabaceae]; L.N.: *Bhat-Sola* (Bengali)

V.N.: Anurag & AP Das 02084.

Uses:

- (i) The dried stem used in preparation of different ornaments and for ornamentation/ decoration.

(ii) It mainly used in preparation of different types of tyos.

Aeschynomene indica Linnaeus [Fabaceae]; L.N.: *Sola* (Bengali)

V.N.: Anurag & AP Das 02124.

Uses: The dried stem used in preparation of different decorative items.

Chrysopogon zizanioides(Linnaeus) Roberty [Poaceae]; L.N.: *Binna* (Bengali)

V.N.: Anurag & AP Das 02075.

Uses: (i) Dried leaves are used for preparation of different type of good quality brooms and tools.

(ii) These products are also marketed in huge amount.

Calamus erectus Roxburgh [Arecaceae]; L.N.: *Bet* (Bengali)

V.N.: Anurag & AP Das 02123.

Uses: Stem is used for making furnitures and utensils, e.g. tables, chairs, baskets, etc.

Imperata cylindrica (Linnaeus) Raeuschel [Poaceae]; L.N.: *Kush* (Bengali)

V.N.: Anurag & AP Das 02096.

Uses: Leaves are used in making ropes, small mats, etc.

Saccharum spontaneum Linnaeus [Poaceae]; L.N.: *Kash* (Bengali)

V.N.: Anurag & AP Das 02122.

Uses: (i) Dried straw is used for the preparation of different type of brooms and tools.

(ii) These products are also marketed in huge amount.

Schumannianthus dichotomus (Roxburgh) Gagnepain [Marantaceae]; L.N.: *Shital pati or Patipata* (Bengali)

V.N.: Anurag & AP Das 02109.

Uses:

(i) Dried stem bark is used for the preparation of different type of mats, locally called *pati*. The famous 'Sheetal Pati' made in this region is quite famous and having high demand in domestic and international market.

(ii) The plant is cultivated here over considerable amount of wetland areas.

Phragmites karka (Retzius) Trinius *ex* Steudel [Poaceae]; L.N.: *Nal-khagra* (Bengali)

V.N.: Anurag & AP Das 02076.

Uses: (i) The culm is used for making mats and huts.

(ii) Mats produced from its roots are used for cooling houses during summer.

Sporobolus diander (Retzius) P. Beauvois [Poaceae]

V.N.: Anurag & AP Das 02095.

Uses: (i) Inflorescence is used for making broom.

(ii) These products are also marketed in huge amount.

Sida acuta Burman *f.* [Malvaceae]

V.N.: Anurag & AP Das 02121.

Uses: Whole plant used for making brooms and is marketed.

Thysanolaena latifolia (Roxburghex Hornemann) Honda [Poaceae]

V.N.: Anurag & AP Das 02077.

Uses: Inflorescence used for making broom and is marketed.

Vallisneria spiralis Linnaeus [Hydrocharitaceae]; L.N.: Jhaji (Bengali)

V.N.: Anurag & AP Das 02085.

Uses: The plant used as ornamental in aquarium

6.2.5. Fodder Plants

Several wetland angiosperms are recorded to use as most important fodder plants. However, the list is dominated by grasses and sedges. Young twigs, straw and leaves of fodder plants are mainly given to the domestic cattles. Among the dicotyledons *Alternanthera philoxiroides*, *Alternanthera paronychioides*, *Amaranthus spinosus*, *Stellaria wallichiana*, *Mollugo pentaphylla*, *Oenanthe javanica* etc. are very much used as fodder plants and are collected by local people in good amount. On the other hand grasses and sedges like *Axonopus compressus*, *Coix aquatica*, *Cynodon dactylon*, *Perotis indica*, *Echinochloa crus-galli*, *Echinochloa colona*, *Sacciolepis indica*, *Sacciolepis interrupta*, *Sporobolus diander*, *Setaria glauca*, *Chloris inflata*, *Digitaria bicornis*, *Eleusine indica*, *Oplismenus burmannii*, *Paspalum scrobiculatum*, *Eragrostis gangetica*, *Cyperus difformis*, *Cyperus rotundus*, *Kyllinga brevifolia* etc. are mostly used fodder species along with some other monocotyledons like *Eichhornia crassipes* *Monochoria hastata*, *Commelina benghalensis*, *C. diffusa*, *C. longifolia*, *Murdannia nudiflora*, *Sagittaria sagittifolia*, *Monochoria vaginalis*, *Alpinia malaccensis*, *Pennisetum glaucum*, *Pistia stratiotes* etc.

6.2.6. Fuel Plants

During dry period local poor people, mostly women and children collect several dried plants and/or plant parts to use as fuel. Out of these, 8 most important species have been recorded.

Clerodendrum indicum, *Ficus heterophylla*, *Ipomoea carnea*, *Ludwigia octovalvis*, *Ludwigia perennis*, *Melochia corchorifolia*, *Saccharum spontaneum* and *Xanthium stramonium* are major species that are used by the local needy people as well as the ethnic people.

6.2.7. Green manure

Few plants are directly or indirectly used by local people for making green manure.

- i. *Azolla pinnata* is used as very good manure for its high nitrogen fixing capacity through its symbiont *Anabaena azollea* which lies inside it. *Lemna perpusilla*, *Salvinia cucullata*, *Spirodela polyrrhiza* along with *Pistia stratiotes* also produce very good green manure. The village people directly apply it on newly prepared crop field. Different species of *Nechamandra*, *Vallisneria*, *Ottelia* and *Najas* also used for making green manure.
- ii. *Eichhornia crassipes* also used as green manure in two different ways:
 - a. The fresh plant collected from wetlands are directly spread on the crop field; after few days, plants dried up, decomposed and gradually get slowly mixed with the soil.
 - b. On the other hand, the dried plants burnt on the field along with *Monochoria hastata* and *Monochoria vaginalis* to makes ash, which is used as mannure.

All these plants are available in the area in huge amount and the villagers need to be trained with the proper methodology for the preparation and use of green manure.

6.2.8. Religious plants

During the survey 09 species have been recorded and these are used for Hindu and tribal deities and in different occasions as Holistic or Religious activities which are stated below:

Aeschynomene aspera Linnaeus [Fabaceae]; L.N.: *Bhat-Sola* (Bengali)

V.N.: *Anurag & AP Das* 02110.

Uses: It mainly used in preparation of different crowns, neckles etc. for God and Goddess and for human beings too.

Clerodendrum indicum (Linnaeus) O. Kuntze L.N.: *Bhnat* (Bengali)

V.N.: *Anurag & AP Das* 02086.

Uses: The flowers used by the local people in worship of lord shiva and treated as very important flowers for it. These flowers are also marketed in town market in package with *Cynodon dactylon*, *Datura stramonium*, and leaves of *Aegle marmelos*.

Cynodon dactylon (Linnaeus) Pers. [Poaceae]; L.N.: *Durbaghas* (Bengali)

V.N.: *Anurag & AP Das* 02091.

Uses: This plant is generally used with flower in different Hindu occasions.

Datura stramonium Linnaeus [Solanaceae]; L.N.: *Dhutra* (Bengali)

V.N.: *Anurag & AP Das* 02120.

Uses: The flowers used by the local people in worship of lord shiva and treated as very important flowers for it. These flowers are also marketed in town market in package with *Cynodon dactylon*, *Tegetes minuta* and leaves of *Aegle marmelos*.

Imperata cylindrica (Linnaeus) Raeuschel [Poaceae]; L.N.: *Kush* (Bengali)

V.N.: *Anurag & AP Das* 02094.

Uses: Dried plants are used in different Hindu occasions.

Nymphaea rubra Roxburgh *ex* Andrews [Nymphaeaceae]; L.N.: *Lal Sapla* (Bengali)

V.N.: *Anurag & AP Das* 02117.

Uses: Flowers and flower buds used in different Hindu temple for worship. Flowers and flower buds are marketed in village and town market for this purpose.

Nymphaea pubescens Willdniew [Nymphaeaceae]; L.N.: *Sada Sapla* (Bengali)

V.N.: *Anurag & AP Das* 02089.

Uses: Flowers and flower buds used in different Hindu temple for worship. Flowers and flower buds are marketed in village and town market.

Nymphaea nouchali Burman *f.* [Nymphaeaceae]; L.N.: *Neel sapla* (Bengali)

V.N.: *Anurag & AP Das* 02111.

Uses: Flowers and flower buds used in different Hindu temple for worship. Flowers and flower buds are marketed in village and town market.

Nelumbo nucifera Gaertn. [Nelumbonaceae]; L.N.: *Padma* (Bengali)

V.N.: *Anurag & AP Das* 02093.

Uses: (i) Flowers, flower buds and fruits are used in different Hindu temple for worship.

(ii) The leaves are used as plates in different occasions. The leaves, Flowers and flower buds are marketed in village and town market.

6.2.9. Bio-fertilizer

15 wetland plants are directly or indirectly used by local people for making the bio fertilizer such as *Azolla pinnata*, *Lemna perpusilla*, *Salvinia cucullata*, *Spirodela polyrrhiza*, *Pistia stratiotes*, *Nehamandra alternifolia*, *Vallisneria spiralis*, *Ottelia alismoides* and *Najas indica*, *Eichhornia crassipes*, *Monochoria hastata* and *Monochoria vaginalis*, *Ceratophyllum demersum*, *Limnophila heterophylla* used as biofertilizer in winter crops. *Najas graminea*, *Potamogeton crispus* and species of *Myriophyllum* are used as bio-fertilizer for raising vegetables.

Traditionally several species, such as *Azolla pinnata*, *Salvinia cucullata*, *Hydrilla verticillata* are used as green manure or as compost. *Azolla sp* is an important biofertilizer, extensively used in the rice fields of this region.

6.2.10. Miscellaneous

Apart from the major uses discussed above, some plants are also used for different other assorted purposes (Table 6.2).

Table 6.2. Plants used for other purposes

Scientific Name	Family	Vernacular name	Purpose of Use
<i>Eichhornia crassipes</i>	Pontederiaceae	<i>Kachuripana</i>	Petiole used as floating element for fishing instrument
<i>Rottboellia cochinchinensis</i>			Petiole used as floating element for fishing instrument
<i>Piper longum</i>	Piperaceae	-	The leaf and fruits are used in Haria (Traditional Rice beer) preparation by the Oraon people for improving the test
<i>Scoparia dulcis</i>	Scrophulariaceae	<i>Jastimadhu</i>	Leaf is used in Haria preparation (Traditional Rice beer of Santal, Oraon, Munda) as sweetening agent

6.2.11. DISCUSSION

A total 137 species covering 98 genera from 64 families of vascular plants have been recorded through the present ethnobotanical survey for the use of wetland plants among the tribal and other traditional people living nearby to such habitats. The survey exposed the importance and impact of wetland flora

on the sustenance and life of these people. They use these plants not just to meet up their hunger but also to accumulate food for their pets (herbivore), materials for making their houses, household materials, decorations, and also to fulfil their religious sentiments.

6.2.11.1. Edible plants: Plants are eaten mainly in two ways, cooked or uncooked (raw). While plants are eaten cooked then those are generally referred as 'shak' or 'saag' (leafy vegetable), (Chowdhury, 2014). However, for all the recorded plants edible parts are not leafy twigs or leaves. The cooking method is also different for different plants and taken in different sections of a meal taking period. On the other hand, there is no such overall terminology for those which are eaten uncooked.

Many poor villagers of Terai and Duars are directly dependent on these aquatic and semi aquatic plants. Forest dwellers are directly and indirectly dependent on these valuable plants. Maximum number of plants belongs to family Amaranthaceae followed by Nymphaeaceae. Amaranthaceae are the most popular family among the above survey. Most of the areas of Terai & Duars are basically remote. The peoples of these areas are generally poor and needy. Some of them are also belongs to Ethnic community. Different parts of several wetland plants used by us such as rootstock and stolons of *Aponogeton natans* and *Aponogeton crispum*, the grain of *Oryza rufipogon*, *Panicum repens* and *Paspalum distichum*. the grain of these plants are dried and crushed to prepare flour by this breads prepared and consumed.

Euryale ferox is one of the most interesting wetland vascular plants not growing abundantly, but now-a-days it is being cultivated almost throughout the North Bengal, starting from Malda to Darjeeling and Jalpaiguri. Its seeds are highly nutritious. The stem of *Nelumbo nucifera* is generally used as vegetable and the seeds eaten raw or after drying. One type of bread is also prepared from these highly starchy seeds.

Many wetland plants are often taken as major food supplement by the local inhabitants. Young leaves of *Marsilea minuta*, *Ipomoea aquatica*, *Monochoria vaginalis*, *Enydra fluctuens*, etc. are eaten as vegetable in many places of Terai & Duars. Stems and leaves of *Nymphaea nouchali* are also used as vegetables. Fruits of many species of macrophytes, like, *Trapa bispinosa*, *Nelumbo nucifera*, *Nymphaea nouchali*, *Euryale ferox*, *Otellia alismoides*, *Oryza rufipogon* etc. are known for their rich food value. Starch rich rhizomes of many of these species like *Colocasia esculenta*, *Nelumbo nucifera* are commonly used as food by local people. So, the poor and needy people of these areas are dependent on wetlands and its products for their sustenance. So, the need of conservation of wetland biodiversity through sustainable utilization is very much essential for the survivality of needy and poor Ethnic peoples.

6.2.11.2. Medicinal: Wetland plants are of great significance in Indian indigenous systems of medicine. *Nelumbo nucifera* is recommended as cardiac tonic, diuretic and fever. The seeds are also used as cooling balm in skin diseases. It is also prescribed for piles and its paste is used for elimination of ring worm. *Limnophila indica* is used as an antiseptic. Different parts of *Ludwigia sp* are used for poulticing skin complaints. Amongst the submerged species, *Otellia alismoides* has rubefacient properties. *Potamogeton natans* is said to be used in homeopathy for cough and cold.

6.2.11.3. Broom etc.: *Aeschynomene indica* is a very common plant in these wetland but is much commercial and aesthetic values. It is used for making artificial flowers, toys, baby hats, lift belts, and floats for the swimming jackets. The leaves of *Typha spp.* are used in weaving and thatching, besides in making of walking sticks and fishing rods from its peduncle. In tribal areas it is used as binding materials in the mud plastering for the walls of the rooms. *Nelumbo* leaves are used as plates for food by the ethnic people. The culm of *Phragmites karka*, *Typha angustifolia*, *Vetiveria zizanioides*, *Arundo donax*, and *Coix lacryma-jobi* are extensively used for thatching. These species are also used for making mats, baskets, trays, screen, fishing baskets and fancy materials.

6.2.11.4. Fodder: *Lemna perpusilla*, *Spirodela polyrhiza*, *Cyperus cephalotes*, *Cyperus haspans*, *Cyperus iria*, *Eleocharis dulcis*, *Hygrorhiza aristata*, *Echinochloa crusgalli* and *E. stagnina* etc. are used as fodder of pigs. Duckweeds like the species of *Lemna*, *Spirodela*, *Pistia* and *Salvinia* are used as poultry feed for domesticated ducks. It is used as manure for cultivation of vegetables and other crops. These are also important food for other water fowls and migratory birds and for the fishes.

Many aquatic species are good fodder for livestock. *Pistia stratoites*, *Ipomoea aquatica*, *Commelina benghalensis* and *Eichhornia crassipes* are preferred by pigs and cattle. Ducks relish *Lemna perpusilla* and *Azolla pinnata* to a large extent. Several species of cyperaceae and poaceae are valued as good fodder for cattle.

6.2.11.5. Religious plants: The seeds of *Euryale ferox* are highly nutritious and are consumed by the Hindu community on special occasions for breaking their fast. According to Hindu mythology *Nelumbo nucifera* holds a high position and is a symbol of cosmic creativeness. It is sold in the markets in huge quantity and is used for making bouquets are admired and liked by both local and foreign visitors.

6.2.11.6. Conclusion: In addition to their use as food, fodder, medicine, etc. macrophytes also provide suitable habitat for breeding and sheltering places of varied aquatic fauna. Many migratory ducks feed on inflorescence (*Potamogeton pectinatus*, *P. crispus*, *Paspalum distichum*, and *Ceratophyllum demersum*), young apical parts of *Paspalum distichum*, *Ludwigia adscendens*, *Hydrilla verticillata* and tuber of *Cyperus rotundus*, *Scirpus*, *Eleocharis sp.* Many species of waterfowl nest in the reed and sedge zones of the waterbody. They invariably use *Scirpus*, *Typha angustata*, *Phragmites karka* for the purpose. All these characters of wetland vegetation are related to the economy and survival of local people and their sustenance is, almost fully, dependent on wetlands.

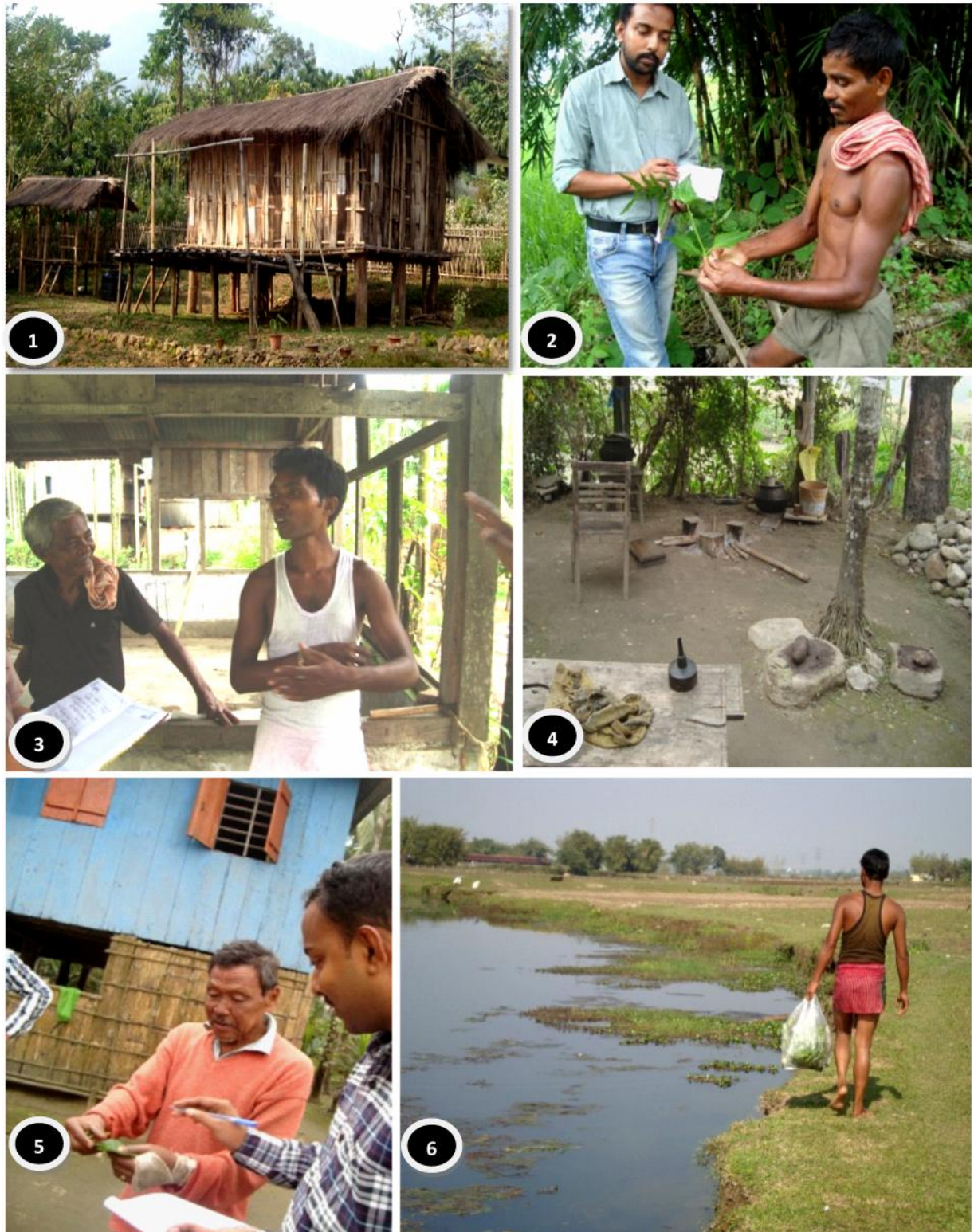


PLATE 6.1. Figs. 1 – 6. Ethnobotany: 1. Roof of a cottage made by *Typha sp.* Leaves; 2. *Ethnobotanical* interaction in the field; 3. Interaction with ethnic people; 4. Ethno-medical lab; 5. Interaction with ethno-medical practitioner; 6. A poor people collecting wetland products .

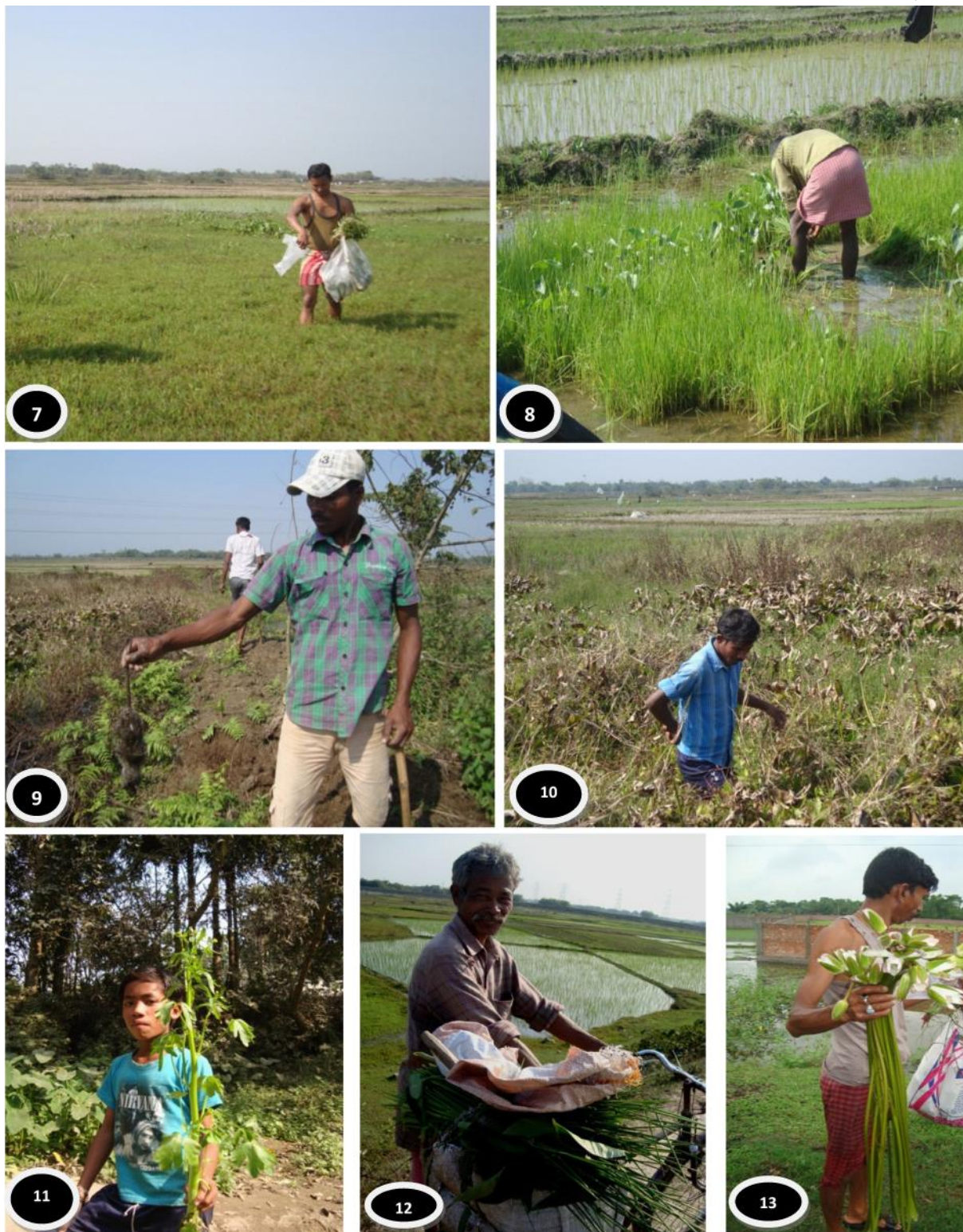


PLATE 6.2. Figs. 7 – 13. Ethnobotany: 7. Collection of edible wetland plants; 8. Fodder collection in wetland; 9. A tribal people collecting rat from wetlands for food; 10. Collection of leafy vegetables; 11. A child collecting *Ranunculus sceleratus* as vegetable; 12. A local tribe carrying foddors collected from wetlands; 13. A poor man collecting *Nymphaea* sp.



PLATE 6.3. Figs. 14 – 20. Ethnobotany: 14. Flowers made from *Aeschynomene aspera* stem; 15. Marriage crown prepared by *Aeschynomene aspera* stem; 16. Poor women collecting edible inflorescence of *Colocasia esculenta*; 17. A tribal man selling *Nymphaea pubescens* flowers; 18 – 19. Collection and processing of leafy vegetables; 20. Fruits of *Trapa natans*, ready for sale

Chapter **7**

GENERAL DISCUSSION

GENERAL DISCUSSION

7.1. Materials

Wetland plants of the Terai and Duars region of West Bengal have been surveyed during the period 2010 to 2014. The bulks of specimens collected were processed into mounted Herbarium sheets, identified using standard literature and matched at NBU and CAL Herbaria. After the completion of the work, first set of specimens will be deposited at NBU and the second set at CAL. Ethnobotanical specimens and photographs will be stored in the Taxonomy and Environmental Biology Laboratory of the Department of Botany, University of North Bengal for further references and use.

7.2. Flora

From the field survey in the study area a good number of 455 species of vascular plants have been recorded representing 244 genera and 84 families (Table 7.1). Among the Pteridophytes, the highest number of species have recorded from Salviniaceae (4 species) followed by Pteridaceae (3 species) and Dryopteridaceae (3 species). 192 species from only 22 Monocotyledonous families have been recorded. Poaceae with 64 species and Cyperaceae (45) are the largest families and are followed by Commelinaceae (13) and Araceae (13).

Table 7.1. Numerical representation of different major taxa in the flora

Taxa		Family	Genera	Species
Angiosperms	Dicotyledons	49	135	241
	Monocotyledons	22	92	192
Pteridophytes		13	17	22
Total		84	244	455

Hydrocharitaceae, Aponogetoaceae, Potamogetonaceae and Alismataceae show the significant number of species. Recorded 49 dicotyledonous families comprise of 135 genera and 241 species. Among these, Asteraceae is the dominating family contains 34 species followed by Polygonaceae (16), Fabaceae (14), Linderniaceae (13). Acanthaceae (12), Amaranthaceae (11), Lythraceae (10), Nympaceae (4).

7.2.1. Habit groups:

Among 433 species of angiosperms, 244 no. of species chosen for detailed phonological study, of these 132 species (54.10 %) are annuals. They complete their life cycle within a span of one year, from appearance to death. These are followed by 67 species (27.46 %) of emerged or marshy species, 10 species of rooted with floating leaf hydrophytes, 09 species of submerged hydrophytes, 09 species of perennial herbs, 06 species of suspended hydrophytes, 04 species of under shrubs, and 04 species of free floating hydrophytes. In addition, there are 03 species of aquatic trailer hydrophytes.

7.2.2. New Records: During the present survey, a good number of wetland species has been recorded as 'new reports' for the state, country, or even at the continent levels (Table 7.3).

Table 7.2. New records of vascular plants from the Terai-Duars region of West Bengal

Name	Family	New report for	Publication
<i>Adenostemma suffruticosum</i>	Asteraceae	Asia [for entire N. Hemisphere]	Pleione 7(2): 589 – 593. 2013.
<i>Potamogeton gramineus</i>	Potamogetonaceae	India	Intrn. J. Curr. Res. 7(2): 12362 – 12364
<i>Polygonum hastatogagittatum</i>	Polygonaceae	India	As. J. Biol. & Life Sci. 4(1): 38 – 40
<i>Ludwigia peruviana</i>	Onagraceae	West Bengal	Pleione 7(1): 286 – 289. 2013.
<i>Hygrophila erecta</i>	Acanthaceae	West Bengal	Pleione 8(1): 207 - 209. 2014.
<i>Soliva anthemifolia</i>	Asteraceae	Eastern India	Pleione 5(2): 352 – 356.2011.

- i. *Adenostemma suffruticosum* Gardner (Asteraceae), basically endemic to Brazil, previously known to grow only in few locations in Brazil. Its present report of occurrence from the Terai and Duars of West Bengal shows a transcontinental migration from a country in the Southern Hemisphere to a location in the Northern Hemisphere. Probably migratory birds are the carriers of its propagules.
- ii. *Potamogeton gramineus* Linnaeus (Potamogetonaceae), a new record of the pondweed from the sub-Himalayan wetland of West Bengal, India. This record extends the known geographical distribution of this species from Europe, North America, Russia, SW Asia (Iran), Japan, Mongolia, Pakistan, Kazakhstan, Turkmenistan, Uzbekistan and China, to sub- Himalayan region of West Bengal.
- iii. *Polygonum hastatogagittatum* Makino (Polygonaceae), has been collected from the natural water bodies in Duars of Himalayan Biodiversity Hotspot regions of West Bengal, India. This species is first time recorded from the territory of India. This species is now growing and reproducing nicely in the study area. It is not recorded from any other adjoining areas of this region and its distribution is still restricted. This piece of work is adding one more species in the flora of India.
- iv. *Ludwigia peruviana* (Linnaeus) H. Hara (Onagraceae), is a robust bushy wetland plant that has been collected first time from Mahananda river bed at Naukaghat near Siliguri and from the campus of North Bengal University of the Darjeeling district of West Bengal. These collections represent the first set of specimens of this species collected from the state of West Bengal and the local floras did not record it earlier from the state territory.
- v. *Hygrophila erecta* (N.L. Burman) Hochreutiner (Acanthaceae), an erect wetland plant have been collected first time for the main land of India from the margins of the roadside ephemeral water bodies at Dash-Dargaon and Pani-kouri of Jalpaiguri district of West Bengal. Previous record from Pakistan, India [Andaman & Nicobar Islands, Manipur and now from West Bengal.
- vi. *Soliva anthemifolia* (A. Jussieu) R. Brown (Asteraceae), is first time collected from Duars and Maldah district in turn for the entire Eastern India. This is also the addition at the generic level for the flora of this region.

7.2.3. Endemic Plants:

Few endemic plant species of Indian sub-continent have also been recorded growing in good condition in this area. In Indian more than 100 wetland species have been recorded as endemic and some more are extending their distribution only to the neighboring countries like Nepal, Bhutan or Bangladesh having similar physiographic conditions (Cook, 1996).

Few endemic plants like *Aponogeton crispus*, *Hygrophila difformis* and *Myriophyllum indicum* are widely grown over here.

7.2.4. Exotic Plants

In the wetland flora of Terai and Duars there are a good number of exotic species. The species are: *Parthenium hysterophorus*, *Alternanthera paronychioides*, *Argemone mexicana*, *Eclipta prostrata*, *Gnaphalium purpureum*, *Ipomoea carnea*, *Oxalis corniculata*, *Scoparia dulcis*, *Xanthium indicum*, *Evolvulus nummularius*, *Mikania micrantha*, *Nicotiana plumbaginifolia*, *Physalis minima*, *Croton bonplandianus*, *Eichhornia crassipes*, *Stellaria wallichiana*, *Persicaria hydropiper*, *Ottelia alismoides* etc.

7.3. Rare, Endangered and Threatened (RET) wetland plants

Among the collected specimens, several species have been recognized under the RET (Rare, Endemic and Threatened) categories. Some interesting wild plants like *Oryza latifolia*, *Oryza rufipogon* are still available in these areas but the population structures of these plants drastically decreasing due to several anthropogenic reasons. Plants like *Dopatrium junceum*, *Coix aquatica* and *Rotala mexicana* are quite rare in the study area.

Few threatened species of Indian sub-continent have also been recorded in very good condition from this area. In Indian more than 120 wetland species have been recorded as endemic and identified few extending neighbouring country (Cook, 1996).

Few endemic plants like *Aponogeton appendiculatus*, *Butomopsis latifolia* and *Potamogeton alpinus* are *Adenostemma suffruticosum* widely grown over here.

7.4. Phenology of Wetland plants

7.4. 1. Life forms

Life forms study of wetland plants of Terai and Duars have been recorded for 5 years (2010 – 2014). The observation shows *Therophytes* are the most dominating group with 111 species (50.68 %). They are followed by *Cryptophytes* with 64 species (29.23 %), 27 species of *Chamaephytes*, 13 species of *Hemicryptophytes* and 5 species of *Phanerophytes*. As the study was restricted to the wetland habitat, so the *Cryptophytes* were studied in details and result shows that there are 34 *Hydrophytes* and 30 *Helophytes*. The vegetation in Terai and Duars wetlands are mainly dominating with *Therophytes* and *Cryptophytes*.

7.4.2. Pollination

All the three major pollination types i.e. *Anemophily*, *Zoophily* (mostly *Entomophilous*) and *Hydrophily* are common for wetland plants. From the direct on-field observation of 244 angiosperms, it has been recorded that around 109 (49.77 %) species are *Entomophilous* followed by *Anemophilous* (75 species) and *Hydrophilous* (9 species). Some species utilize two or more ways for to ensure their effective pollination. So, there are 21 *anemo-entomophilous*, 4 *entomo-epihydrophilous* and only 2 *anemo-epihydrophilous* plants. Among the 9 *hydrophilous* plants, 4 species (*Najas indica*, *N.*

graminea, *Nechamandra alternifolia* and *Ceratophyllum demersum*) are hypohydrophilous (pollination takes place under water) and rests 5 species (*Hydrilla verticillata*, *Blyxa octandra*, *Nechamandra alternifolia*, *Vallisneria spiralis* var. *denseserrulata* and *Potamogeton crispus*) are epihydrophilous (pollination takes place on the water surface).

7.5. Wetland Degradation

Wetland loss may be defined as “the loss of wetland area, due to conversion of wetland to non-wetland areas as a result of human activity” (Chowdhury, 2009); (Chatrath, 1992) and wetland degradation is “the impairment of wetland functions as a result of human activity”. It is one of the most destructive causes that are destroying the ecological balance. About 50 % of the world’s wetlands have been lost in the last century, primarily through drainage for agriculture, urban development and water system regulations. It has been estimated that nearly one hectare of the world’s wetlands are getting degraded at the tick of every minute of the clock (Chatrath, 1992).

Dense human population in the catchments, urbanization, and various other anthropogenic activities has resulted in over exploitation of wetland resources, leading to degradation in their quality and quantity. Now, there is increasing concern to conserve and restore perishing wetlands and endangered habitats to achieve ecological sustainability. Some of the major threats to wetlands are:

7.5.1. Anthropogenic Causes:

- A. Over population & urbanization:** In modern world civilization is not possible without urbanization. The overpopulation in most part of the world is responsible for increasing developmental pressure for residential, industrial and commercial facilities. Large numbers of new villages are concentrated around or on catchments areas of wetlands, which greatly affects the existence wetland areas (i.e. habitat fragmentation). The wetlands like the river bed of *Mahananda*, *Balason*, *Karala*, *Jarda Teesta Domohani beel*, *Kathambari beel* etc. are modifying very fast for such invasive human activities.
- B. Agricultural activities & loss of ecosystem:** Excessive agricultural activities is one of the most destructive phenomenon of wetland degradation i.e. conversion of wetlands for paddy fields; construction of a large number of reservoirs, canals and dams; diversion of streams and rivers to provide water for irrigation. Farmers wipe out wild plants, before completing their life cycles; they prepare the soil mostly for Paddy, Jute, Jal-singara and Makhana cultivation. In this way the natural diversity of wetlands are being affected visibly.
- C. Deforestation:** Alternative land-uses for farming and fisheries production have replaced many forest areas and continued to facade threats to the forests. The loss of wetland forests reduces the ability of wetlands by slowing down flowing-speed of water and trapping the suspended particles as sediments at the bottom. The removal of vegetation in the catchments is also leading to rapid soil erosion and siltation in the down-stream.
- D. Pollution:** Pollution is one of the major causes of wetland degradation such as- unrestricted dumping of sewage, solid wastes and toxic chemicals from industries, agricultural fields and households. The primary pollutants causing degradation are sediments, nutrients, pesticides, salinity, heavy metals, weeds, low dissolved oxygen, pH and selenium concentration.
- E. Salinization:** Over withdrawal of groundwater has led to salinization and result of wetland degradation. It degrades the water quality and destroys the wetland plant diversity, both planktonic and macrophytic.
- F. Degradation of water and soil quality:** For the growing greedy and comfort-loving human population agriculture is the most common financial source of this village dominated country. For

the maximum amount of crop production and to avoid the loss from diseases and pests, various types of dangerously poisonous synthetic chemical substances are used in the crop fields. These chemicals gradually pollute and poison the water and soil of wetlands.

- G. *Creation of new Ponds for Aquaculture and Roads:*** Aquaculture, mainly Pisciculture is one of the most important and lucrative occupation of the inhabitants of Terai and Duars. Many families directly or indirectly attached to this occupation. For this occupation, they normally create artificial ponds and lakes by fragmenting the natural wetlands. These practices are destroying the natural wetlands-ecosystem. From two – three years observation it is understood that, this random practice gradually converts the natural wetlands into artificial small ponds, which creates pressure on natural habitat and biodiversity. To maintain the short-rout communication between two villages, the villagers creates new road by separating the wetlands with mud-bunds which also causes similar habitat fragmentation.
- H. *Selective fish culture & over harvesting:*** One of the most important threats to wetlands is regular cultivation of very few selected species of fishes and over fishing. In post monsoon period wetlands are treated as the houses of several wild fishes, snails, snakes, toads, and insects, which are good food for migratory and native birds and for some other local animals. During rainy season, people go for fishing in such wetlands using traditional fishing equipments. Such uncontrolled over fishing practice creates much pressure on wetland ecosystem and makes its biodiversity vulnerable.
- I. *Creation of brick field:*** This is the age of concrete, steel and plastic (Das, 2012). So, to fulfill the demand of growing greedy populations a number of brick factories are established outside the town areas, which are mostly found nearest to or directly on wetland areas. For the manufacture of bricks soil and water is taken from the wetlands. The temperature and humidity of the surrounding areas increases due to regular burning of bricks. The increasing temperature and humidity directly affects the wetland biodiversity of those areas.
- J. *Poaching and extinction of wildlife:*** Poaching is one of the major causes of wildlife extinction. From field and local market survey it is observed that a number of waterfowl or many migratory birds have been brutally killed, consumed and marketed by the neighboring people. As a result, the number of different species of waterfowl or of migratory birds is decreasing considerably during the last few years. The local villagers commonly catch or hunt different migratory birds specially *Bali Hans*, *Peeing Hans*, *Sharal*, *Jal-Pipi*, *Madantak*, *Samukh-Khol*, *Brahmni-Duc* etc. which are with good market demand.
- K. *Burial place and dumping ground:*** Being civilized, we are always destroying our land and environment where we live. If any kind of animal is found then we threw it in wetland without any sort of hesitation. Beside this, huge bulk of our domestic or other type of garbage is also thrown in to wetland because most of us think that wetlands are dirty land and we can use those as we like! As a result, water and soil quality has been enormously degraded affecting the habitat conditions and the biodiversity.
- L. *Deposition of degraded plant parts:*** Most of the wetlands of Terai & Duars are continuously losing their depth. One of the major causes is the accumulation of huge biomass of aquatic weeds. The degraded part of aquatic weed (*Eichhornia cressipes*, *Monochoria hastata*, *Nymphaea sp* etc) and cultivated plants such as *Euryale ferox*, *Trapa bispinosa*, *Nelumbo nucifera* and the after processing rejected parts of *Ananas coamosus* (Linnaeus) Merrill are deposited at the bottom and are affecting in the similar manner. Basically roadside ditches are under such threat because these are generally present beside the stretches of cultivated lands.

- M. Replacing native species by aggressive exotics:** Tropical wetlands in India are largely threatened by a few exotic species of which *Eichhornia crassipes* is the most aggressive. Other such plants include *Salvinia cuculata*, *S. natans* and *Pistia stratiotes*. These plants cover large areas of water surface and create innumerable disturbances. All these four species are free floating and can spread very fast. Their growth rate is also extremely fast and ecological amplitude is very broad. As habitat conditions are changed, the native weaker plants fail to survive there. When wetlands lose native species of animals and plants, they are thought to be of lower value making it tougher to justify their continuation and conservation.
- N. Climate changing:** Wetlands both contribute to and suffer from changes in climatic conditions. They are the single largest source of methane; a gas that is a major contributor to the atmospheric trapping of heat which leads to global warming. Unlike most regions of the world, the population of India has been high enough to cause change in the landscape. Continued degradation of water and wetland resources means that extensive regions will be marginalized or rendered less habitable by people and domestic animals if a warming and drying cycle of change affects India's climate.
- O. Uncontrolled dredging:** It is one of the destructive causes of wetland degradation. Wetland vegetation is also destroyed through this which greatly affects the successional changes in wetlands.

7.5.2. Natural stresses:

Additional pressures on wetlands from natural stresses like subsidence, drought, erosion, Excessive growth of weeds etc. are also destroying the biodiversity in our wetland.

- A. Subsidence:** Different parts of Duars are proving to recurring and devastating floods. Teesta, Jaldhaka, Shankosh, Dayna, Murti etc. are the main rivers passing through the Duars. All these rivers originated from Himalayan hills, flowing from North-east to South-West and, are rain fed, except Teesta which has its origin from the glaciers in North Sikkim. Flood is quite common and regular in these areas. Most of the blocks and towns are severely affected. During flood all the garbage's, different types of inorganic chemicals, plastics, non-degradable products, and burnt machine-oil come out with the water from the urban areas and deposited in wetlands and it destroy the wetland ecology.
- B. Soil runoff:** Huge amount of soil is carried to the wetlands from upland areas by streams and run-away water which is deposited as sediment at the bottom especially during rainy season. This is the major cause behind the loss of depth for different wetlands. The rain water also carries different non-degradable products from the urban and populated areas. This polluted water directly affects the biodiversity of wetland ecosystem.
- C. Drought:** Drought is one of the natural calamities of wetland destruction. If the wetland is fall in under prolonged drought conditions then it lost its phytodiversity and animal diversity.
- D. Erosion:** Soil erosion is one of the major causes of wetland destructions. The eroded soils from the surrounding areas are deposited in wetlands resulting the decrease of depth.
- E. Excessive growth of weeds:** Excessive growth of weeds in wetlands is another natural stress. It creates a devastating problem in wetland biodiversity. This natural hazard also reduces the water current and disturbed the wetland ecological balance. Too much of dense growth arrest the movement of water, reduce the oxygen content, lower strata of water become darker, produce more half-decomposed biomass to settle at the bottom, etc. are some of the disadvantages.

7.6. Need for Wetland Conservation

Understanding the multifarious services of wetlands for the biosphere as a whole, it is now well convinced that destruction of wetland means the invitation to early extinction of biological elements.



PLATE 7.1. Figs. 1 – 6. Stress on wetland vegetation: 1. Wetland used as burial ground; 2-4. Polluted by household garbage; 5-6. Excessive agricultural activities in non-private wetland areas



PLATE 7.2. Figs. 7 – 12. Floristic elements: 7. A house is built on wetland; **8.** Destruction of flora during fishing activities; **9 & 10.** Clearing wetland plants for agriculture and other use; **11.** A truck terminus on wetland; **12.** Plastic factory established on wetland



PLATE 7.3. Figs. 13 – 17. Floristic elements: 13. Killing of fishes by poisoning river water; **14.** Wetland used as washing and bathing places for man and domestic animals; **15.** Jute retting, **16.** Excessive agricultural activities, **17.** Poaching & dumping site, **18.** Polluted by end products of festival

Modern world knows, the development means urbanization through fragmentation of wetlands. It is found that wetlands are always treated as obnoxious and unproductive systems throughout the world. But, surprisingly, in 1971, at an International Convention that was held at Ramsar in Iran and organized by IUCN to draw attention for the wetland conservation for its great economics and ecological importance.

It was then expressed that wetlands are the most productive ecosystems among the living worlds. They are the cradles of biological diversity, providing the water and its primary products upon which innumerable species of plants and animals depend for their survival. They provide the shelter for birds, mammals, reptiles, amphibians, fishes and innumerable invertebrate species. Wetlands are also significant storehouses of plant genetic resources.

In addition, wetlands are important, and sometimes indispensable, for the health, welfare and safety of people and wildlife that live in or near such areas. But in recent years it has been increasingly understood the multiple roles of wetland ecosystems and their value to humanity.

To fulfil the demand of growing greedy populations of India wetlands are drastically fragmented and are converted into non-wetland areas. Like in the most other countries of the world, India has been drastically losing its wetland biodiversity

This scenario is not exceptional for West Bengal. So many wetlands have already been destroyed for urbanization, extensive agricultural activities, industrialization and over exploitation. One of the first six Ramsar sites recognized from India, the *East Calcutta Wetland* has already lost its vast area due to over population and industrial growth.

In Terai and Duars, wetland degradation has been occurring in each and every moment. Many wetlands are gradually losing their areas as well as their depth due to various reasons like urbanization, excessive agricultural activities, establishment of various kinds of industries and many other so-called developmental programs. Among these areas Duars basically over flooded in rainy season due to the increasing loss of depth of the wetlands. Some special and sustainable utility reasons for wetland conservation are discussed below:

7.6.1. Shoreline stabilization: Wetlands function like big sponges. Vegetated wetlands along the edges of streams help control erosion caused by stream currents and flood. They also protect lake shores from wind generated waves. For shoreline stabilization conservation of wetlands is very much essential.

7.6.2. Food and habitat of fishes and other wildlife:

- A. Fish:** Wetlands serve three major functions for fish communities. They provide breeding grounds, sources of food and provide cover from predators. Most species of freshwater fishes are dependent on wetlands for one or more of these functions.
- B. Wildlife:** Many varieties of waterfowl and non-game birds depend on wetlands for their feedings and resting areas. Other wildlife, such as a variety of reptiles, amphibians and mammalians depend on insect-based food webs and on water to drink. And wetlands also treated as a house of turtles, snakes, frogs and toads etc.
- C. Habitat for RET Species:** Wetlands are the life-land for the survival of various plants and animals, including threatened and endangered species. Approximately 30% of Michigan's threatened and endangered plants and 60% of the threatened and endangered animals are wetland species so the conservation of wetland is crucial.
- D. Flood control:** Being like a sponge they absorb large volumes of water and protect cities, towns and villages from flooding. To save ourselves from flood-damages wetland conservation is to be the first essential step.

- E. Recreation and aesthetics:** Wetlands are home to an ample diversity of animals, but also to human beings with diverse hobbies. Hikers, photographers, bird watchers, hunters and those with the gratitude of nature feel affection to visit wetlands.
- F. Scientific and educational value:** Wetland provides a unique outdoor ecological laboratory for the researchers. And, act as an outdoor nature-study classroom related to nature for the students.
- G. Source of natural products:** A variety of wetland products are consummated by us. Various types of food products include wildlife; fish, shellfish, wild rice, wild vegetables, medicinal plants, etc. are getting from wetlands. Wetlands also provide firewood, fencing materials, materials for the making of decorative items dried animal pelts used in clothing, etc.
- H. Groundwater recharge:** Wetland is the kidney for the living world. These areas are often connected to a groundwater system and may provide a site for water infiltration into the soil and recharge an underlying aquifer. This can be a very important function for individuals or drinking water systems of living organism.

7.7. Sustainable utilization: For sustainable utilization of bio-resources conservation of wetland is the basic and mandatory. Such sustainable utilizations include:

- i. Agriculture:** The depth of wetlands are not equal everywhere. So, during summer, when the water level recedes major part of marshy areas are exposed or with less than 1m deep water. Such land can be used for the cultivation of different crops. These lowlands are largely used for growing paddy. *Oryza sativa*, *Aeschynomene aspera* and *Corchorus capsularis* are cultivated in pre-monsoon season on dried or exposed land. during post-monsoon when water bodies again gradually dried up at that time shallow water bodies are being chosen for the cultivation of Makhana (*Euryale ferox*) and Paniphal or water-chestnut (*Trapa natans*). Upland areas are used for the cultivation of mustard and few other seasonal vegetables.
- ii. Irrigation:** In summer these area has been suffered from water crisis and that has been created due to excessive agricultural activities. The irrigation in this area is almost completely dependent on the wetlands. Wetlands store huge amount of water during rainy season or the water is stored in groundwater aquifers in those areas. Local people use this water for their post-monsoon crops, until and unless the wetlands are dried up.
- iii. Fisheries:** The wetlands of this area are the good habitat for different species of wild and cultured fishes. Most of these are coming from the nearby rivers and ponds during flood. Several marshes or lakes, which are permanent deep water bodies are also have been used for fish culture. Government provides many wetlands to the interested people on lease for this purpose. Wetlands like *Gajoldoba*, *Doumohani Beel*, *Mahananda Barrage*, *Rajbari dighi* etc. are used for pisciculture. The fishes like *Rahu*, *Katla*, *Mrigel*, *Bata* and some other varieties are cultured in these wetlands. But, some wetlands where fishes coming with flood water are used for fishing throughout the year by the local poor fishermen.
- iv. Ground water recharge and flood control:** Considerable amount of water moves down into the underground aquifer that is referred to as groundwater recharge. Such underground water is drawn up through deep tube wells, for human consumption including dry-season cultivation. The presence of numerous wetlands in Terai & Duars always save these areas from devastating flood because huge amount of flood water took place in the low-land areas. During rainy season all the water bodies (rivers, ponds, lakes and ephemeral water bodies) forming a single body. In 1968, Jalpaiguri town was affected by devastating flood and the life of at least 216 persons and 1370 cattle were lost (Sarkar *et al.*, 2001). Proper scientific management programs through the government agencies to maintain these wetlands can help the people of Terai & Duars to save much of their properties during flood.

- v. **Rural economy:** The local poor including tribal communities living near the wetland areas collect a good number of plant species for their daily use. They use numerous plants parts as food, fodder, medicine, building materials, decorative, etc. They also put several edible and medicinal plants for sale in the rural and urban markets. Many species of grasses and sedges are also sold as fodder in urban markets. Some tall grasses (*Saccharum arundinaceum*, *S. spontaneum*, *Vetiveria zizanioides* etc.) used as broom and building materials by the poor villagers. Poor villagers including children are generally catch good amount of fishes during post monsoon season in all the seasonal flooded wetlands of the study area. They drain out the water from wetlands areas and catch fishes like *Chana punctata*, *Clarias batrachus*, *Heteropneustes fossilis*, *Oreochromis mossambicus* (Telapia), *Trichogastes fasciatus*, *Puntius sarana*, *Channa striatus*, *Burbus tinto* (Titputi), *Puntius ticto*, *Anabas testudineus*, *Collisa fasclata* (Khalisa) etc. The *Daumohani Beel*, *Gajoldoba*, *Mahananda Barrage* produce huge amount of fishes and the economy of local fisherman are almost completely dependent on the extent of fishing. During the survey, it is roughly estimated that more than 250 families are depending on these wetlands for their survival through fishing.
- vi. **Jute retting:** Jute is another important crop of these areas. The presence of wide areas of wetlands encourage the farmers for jute cultivation during early monsoon. Jute retting is a common practice in these areas in different water bodies. Mainly the roadside ditches are largely used for jute retting during monsoon.
- vii. **Green manure:** It was found that farmers of these areas are using wetland weeds for the production of green manure to use in their cultivated lands for improving the soil fertility. A good number of plants like *Azolla pinnata*, *Salvinia cucullata*, *Eichhornia crassipes*, *Monochoria vaginalis*, *Monochoria hastate*, jute-leaves etc. are use by the farmers as green manure in different ways. In this manner, these people not only save good amount of money from purchasing chemical fertilizer, the practice is also desirable for the improvement of soil and maintaining the land culturable for a long period.

7.8. Conservation Strategies for the Prevention of Wetland Destruction:

In India, wetland conservation is indirectly influenced by an array of several policy and legislative measures (Parikh & Parikh, 1999). Apart from the government regulation, establishment of better monitoring methods are needed to increase the knowledge of the physical and biological characteristics of wetlands and their resources, and to gain, from this knowledge, a better understanding of wetland dynamics and their controlling processes (Prasad *et al.*, 2002). India being one of the mega biodiversity countries of the world should strive to conserve the ecological characters of these ecosystems along with their flora and fauna (MOEF, 2009). Understanding the status of wetlands can help to frame proper conservation strategies, which can be as follows:

i. Increasing the depth of wetlands

Most of the wetlands in these areas are very old so their depth has been decreased considerably due to siltation by rainwater, runoff and deposition of degraded plant biomass. To generate the wetlands healthy and productive good amount of silt may be removed by digging during dry season. By this way water holding capacity of these wetlands will increase so that they can perform as better buffer during floods.

ii. Periodical weed removal

Most of the wetlands are suffering from the invasion of few noxious aquatic weeds. The exotic weed *Eichhornia crassipes* is the most troublesome species in this region. Most of the wetlands

of these areas are dominating by this plant. The huge amount of biomass produce and contribute by this plant can reduce the depth of the wetlands quickly. Periodical removal of this weed [and converting those to green manure] can keep the wetlands healthy. It is very interesting and quite common practice in these areas is that the people of rural areas collect and use the *Eichhornia crassipes* biomass directly or after burning as agricultural manures. Such kind of practices should be encouraged by the government for the production of non-toxic crop through proper awareness programs. The plant body of *Makhana* and *Jal-singara* also decomposed quickly and reduces the depth of wetlands. So after fruiting season is over, the old plant bodies should be removed as soon as possible from the wetlands.

iii. Building public awareness

In these areas most of the people think that wetland is a wasteland and is a dirty place. In their everyday life they got several facilities from those wetlands but never try to understand its importance. The main cause is that the villagers of this region are not properly educated. For achieving any sustainable success in the protection of these wetlands, awareness among the general public, educational and corporate institutions must be created to help them to realize the future if the wetlands are missing from these region and some suggestions are:

- Launching various environmental awareness campaigns
- Organizing various programmes, workshops, folk dances, street theatre for creating awareness regarding wetlands
- Using both formal and non-formal education tools for awareness generation.
- Creation of environmental awareness through brochures, training programmes, padayatras, and hoardings
- Developing various publicity materials on wetlands
- Declaring awards for better maintenance of areas wetlands; etc.

iv. Creation of more bird sanctuaries

Department of Forest, govt. of West Bengal has already initiated plantation around or on the upland areas of different wetlands in the study area. The wetland areas are very important habitat and breeding sites for several important resident, resident migratory and migratory water birds. Among the various water birds many have been enlisted by the IUCN as endangered. But, some important wetlands hosting large flocks of visiting waterfowls like *Mahananda barrage*, *Gajoldoba*, *Doumohani beel* required immediate plantation with properly selected species of plants those are preferred by birds for nesting and for food. Forest department also takes care to the waterfowls for food supply and medicine. The local government should restrict much public infestation [including picnics and eco-tourism activities] into the dense and bushy wetland areas because several water birds mainly ducks, jacanas are nesting for breeding within those bushes during the post-monsoon period.

v. Protection and Monitoring

Today's primary necessity is to protect the existing wetlands. Patrolling and surveillance, setting up of watch-towers, socio-economic development through community participation, etc. can be of much help. Formation of advisory committees for regular mid-term reviews mainly by experts from universities and organizations working for conservation is very important. Of the many wetlands in Terai & Duars only one wetland is protected [Gossaihat, Khuttimar Beel under Moraghat Reserve forest]. But there are several wetlands which are biologically and economically significant but have no legal status for their protection and conservation.

vi. Control of over-fishing

The ichthiofaunal diversity of Terai & Duars of West Bengal is very rich and that proves the suitability of these water bodies as good habitat for fishes. Many species of fishes prefer many aquatic weed as their shelter and breeding ground. The fishes like *Channa marulius*, *Channa punctatus*, *Oreochromis mossambica*, *Heteropneustes fossilis*, etc. use the degraded plant parts as food. The fishes are coming to the wetlands from local rivers and fish-cultured ponds. Several hundred families survive through fishing in these wetlands. These fishes are also sources of food for resident and migrated waterfowls. Excessive fishing in these wetlands affects the food scarcity for waterfowls. This food scarcity, in turn, gradually leads to the reduction of waterfowl population structure in these areas. So, severe control over fishing in those areas should be limited. On the other hand, many fish species are now gradually become rarer or even extinct. Over fishing always disturb the biodiversity and a stable ecosystem.

vii. Control of excessive agricultural activities

We understand the value and/or importance of agriculture. Simultaneously, we have to understand the importance of the conservation of healthy and good ecosystems not only for the conservation of Biodiversity but also for human welfare. Excessive agricultural activities are destroying regularly the biodiversity of these wetlands. So, the ecosystems of these wetlands became unstable. The paddy, mustard and jute cultivation alter the natural vegetation in leading to the removal of the numerous local species of plants and animals. Not only that, maximum application of toxic chemicals as fertilizer, herbicide, pesticide, etc. for the production of higher amount of crop, polluting the wetland habitat, which is directly affecting the biodiversity killing and modifying numerous wild species. So, excessive agricultural activity should be controlled or need to be done scientifically to maintain the beauty and biology of natural ecosystem of the entire area.

On the other hand, the farmers should be trained to use more organic manure than synthetic fertilizer. They can produce more manure using some wetland plants like *Azolla pinnata*, *Eichhornia crassipes*, *Salvinia cucullata* etc.

viii. Control of monoculture

The wetlands of the study area have been used for Lotus (*Nelumbo nucifera*) and Chestnut (*Trapa natans*) cultivation since long. But, for the last 4 – 5 years, Makhna (*Euryale ferox*), a profitable crop, is widely cultivated in the wetlands of Shovabari Beel, Doumahoni Beel, etc. of the study area. The area of its cultivation is increasing very fast in this zone. This kind of monoculture is also seriously destroying the wetland ecosystem. For Makhna cultivation, seedling is planted only after the killing of all the fishes using poison because they eat its seedlings. This type of monoculture should be controlled in favour of the conservation of biodiversity.

ix. Control of bird poaching

Bird poaching is rampant and is increases during post-monsoon period when migratory birds visit these wetlands from different part of the world for food and for breeding. Present study revealed that the waterfowl count is reducing day by day in different wetlands. Many local people catch birds using fishing nets and fire guns for food and are quite often sold in village markets. The local administration fails to control it. Wetlands conservation in India is indirectly influenced by an array of policy and legislative measures (Parikh & Parikh 1999). Several acts on wetland, water, wildlife, biodiversity have created by Indian government in different years to protect the environment and ecosystem of such habitat. But, unless the implementing authority becomes serious in the implementation of such rules, it will become a menace leading to the destruction of local natural wealth.

x. Stop releasing urban and industrial influx or sewages in wetlands

Some wetlands of Terai & Duars are suffering from the release of huge quantity of urban sewages. The drains are directly or indirectly connected with the wetlands and local rivers. The *Mahananda Barrage, Gajoldoba* etc. that are composed of many smaller wetlands become highly polluted as most of the drains of main town is connected with its different part by a number of channels. It is used as the main sewage release and garbage deposition site of the nearby towns. Very soon, the developmental activities will increase like anything along with the establishment of a new regulated market and 2 or 3 new townships. All these activities will, no doubt, highly degrade the environmental status of these wetlands. There are several small and large industries in the study area. The influxes are releases into the nature directly from these factories without any proper pre-treatment. These poisonous chemicals first mix with ephemeral water bodies then, during flood, spreading to the other nearby important wetlands and river system and pollute those regularly. Immediate steps need to be taken by appropriate authorities strictly; otherwise wetlands in those areas become unhealthy and will suffer from critical eutrophication which will destroy the stable ecosystem of these wetlands.

xi. Research and Monitoring

The wetland and other water bodies of this area are very important in various aspects. But, the knowledge related to the resource, biodiversity, encroachment, injection of pollutants, etc. are not known to the authorities in detail. For such knowledge generation and to protect the wetlands detailed research works are required in the field of biodiversity, soil & water chemistry, soil, mapping, socio-economics, etc. need to be taken up immediately. The wetlands and river systems of Terai & Duars is also very rich in their faunal diversity. But, a good proportion of these, especially the fishes, reptiles, amphibians, waterfowls etc. are not recorded or poorly recorded from this region. It is very important for various stakeholders along with the local community and corporate sector to come together for an effective management plan to save our biological diversity in wetlands. So, the necessity for research in wetlands in the formulation of national strategy to realize the dynamics of these ecosystems and ultimately will help the planners to formulate the strategies for the mitigation of pollution. The local government authorities, mainly land reforms and forest department should monitor those wetlands properly with well developed management strategies and machineries. The proper wetland mapping of the different wetlands should be done using remote sensing to understand diversity and its present nature including biodiversity. The remote sensing data can help also to monitor the condition of these wetlands.

xii. Legislation

Although several laws are there to protect wetlands, but there is no special legislation pertaining specially to the wetland ecosystems. Environment Impact Assessment is needed for major development projects highlighting threats to wetland and its diversity need to be formulated with much more stricter parameters.

xiii. Comprehensive inventory

There has been no comprehensive inventory of all the Indian wetlands despite the efforts by the Ministry of Environment and Forests, Asian Wetland Bureau and World Wide Fund for Nature. The inventory should involve the flora, fauna, and biodiversity along with their values and different other useful academic and exploitable values.

xiv. Coordinated approach

Since the wetlands are common property with multi-purpose utility, their protection and management also need to be a common responsibility. An appropriate forum for resolving the conflict on

wetland issues has to be set up. It is important for the administration to allocate sufficient funds towards the conservation of wetland ecosystems.

Maintaining the proper health of wetlands is intimately related to the well-being and survival of survival of human societies. Man need to realize that “. . . commercial exploitation is only for today’s survival but conservation is for the long term survival”, otherwise our activities will invite the final disaster for the biosphere on this planet (Das 2012).

CONCLUSION

CONCLUSION

The present dissertation reflects the wetland wealth of Terai & Duars region of the Indian state of West Bengal and the present status of its wetland biodiversity in the region. The study area is the house of numerous large natural and a few artificial fresh water bodies with good biodiversity. From the floristic exploration as much as 433 species of flowering plants and 22 species of Pteridophytes has been recognized. Except these two major groups other major floristic groups like algae, fungi and bryophytes are also quite rich in all those wetlands but were not considered under the present survey. No species of gymnosperm has been recorded from these wetlands. Among the collected specimens, several species recognized under are endemic, exotic and *RET* categories. Some interesting wild relatives of cultivated plants like, *Oryza rufipogon*, *Oryza latifolia*, etc. are still available in these areas but the population structures of these plants are drastically decreasing due to several causes. Plants like *Dopatrium junceum*, *Coix aquatica* and *Rotala Mexicana*, *Rotala macrandra*, are quite rare. 43.46 % of the wetland flora of India is wildly growing here. Detailed phenological study including flowering and fruiting calendars as the primary data has been determined for 244 wild wetland species.

Two novelties [*Nymphaea abhayana* A. Chowdhury & M. Chowdhury of Nymphaeaceae and *Lindernia palustris* A. Chowdhury, M. Chowdhury & A.P Das of Linderniaceae] recoded during the present work express the capacity of the vegetation to maintain the forces of evolution in the area. In addition, the new records of as much as eight species of plants is also significant for the vegetation. Of these one [*Adenostemma suffruticosum* Gardner of Asteraceae] is new record for the entire northern hemisphere; three [*Potamogeton gramineus* Linnaeus of Potamogetonaceae, *Murdania keisak* (Hasskarl) Handel-Mazzetti of Commelinaceae and *Polygonum hastatogagittatum* Makino of Polygonaceae] are for the flora of the country; and, four [*Ludwigia peruviana* (Linnaeus) H. Hara of Onagraceae), *Hygrophila erecta* (N.L. Burman) Hochreutiner of Acanthaceae, *Soliva anthemifolia* (A. Jussieu) R. Brown of Asteraceae, *Carex phacota*, Sprengel of Cyperaceae] are forming the new records for the state of West Bengal.

The wetlands are also the houses for numerous economically important plants and those have very good socio-economic impact. The wetlands are also used by local people in various ways like agriculture, irrigation, fishing etc. for commercial benefits. Several natural and anthropological threats are also recognized those are responsible for gradual decrease in wetland areas and to make them unhealthy and unfavorable for the survival of existing biota.

The present dissertation is the first time report that reflects the actual status and biodiversity of wetlands of Terai & Duars. All these data were directly collected from the field for each of the selected 53 wetlands. The data extracted out from this work will be used as primary data for the proper delineation, classification and management program of Terai & Duars wetland for the policy makers. During field works, it is found that Govt. offices have no proper maps, land marks and detailed information about the wetlands of the study areas and only enlistment of few important wetlands has been prepared by them.

The wetlands like *Rasik Beel* (Coochbehar), *Ahiron Beel* (Murshidabad) and *Santragachhi Beel* (Hooghly) are enlisted under the national conservation project. But it is beyond expectation and unfortunate that no any wetland from Terai & Duars and also from the Maldah district has been selected for any such conservation project though these are very rich in their floral and faunal, especially avifaunal diversity. It is noteworthy that European small countries have declared numerous Ramsar wetlands starting from 5 hector areas whereas a large country like India declared only 26 Ramsar Sites till date.

Due to the lack of any proper and accepted conservation strategy, and the exploitive attitude of people, these areas are extracted and modified unscientifically leading to their gradual but fast destruction. The wetlands like *Doumahoni Beel*, *Gajoldoba Beel* and *Kathambari Beel* are almost filled up with eroded soil and people of surrounding villages are using it as cultivated land throughout the year. Several such wetlands of the district are now on the verge of extinction or these will be extinct within next few decades. So, the wetlands of Terai & Duars need immediate national and international recognition and nursing for their survival and for extending services for the humanity. Government should initiate various national and international projects and develop proper conservation strategies along with the remote sensing technology for mapping with view to conserve the wetlands and wetland biodiversity. Extension of tourism activities, in the name of ecotourism, is affecting the biodiversity and the conservation in such a manner that in future we have to forget that in those areas there were wetlands of wide biological importance. If proper initiatives are not taken immediately, it is quite possible that most of the wetlands of this area will lose their wilderness in the near future.

LIST OF PUBLICATIONS

Publications based of thesis:

- **Chowdhury, Anurag;** Chowdhury, M. & Das, A. P. 2015. *Potamogeton gramineus* Linnaeus (Potamogetonaceae): A New Record For Indian Sub-continent With A Complete Morphological Description. *International Journal of Current Research* Vol. 7(02): 12362 - 12364.
- **Chowdhury, Anurag;** Chowdhury, Monoranjan & Das, A. P. 2015. *Polygonum hastatosagittatum* Makino (Polygonaceae): a new distributional Record for India. *Asian Journal of Biological and life Sciences* 4(1): 38-39.
- **Chowdhury, Anurag &** Das, A. P. 2015. Ethnopharmacological Survey of Wetland Plants Used by Local Ethnic People in Sub- Himalayan Terai and Duars of West Bengal, India *American Journal of Ethnomedicine* 2(2), 122-135.
- Chowdhury, M.; **Chowdhury, Anurag &** Das, A. P. 2015. Notes on the aquatic ferns in West Bengal. *Pleione* 9(1): 160 - 166.
- **Chowdhury, Anurag &** Das, A. P. 2014. Conservation through sustainable utilization of wetland leafy vegetables of Terai and Duars, West Bengal, India. *International Journal of Advanced Life Sciences (IJALS)* 7 (4). 651-658.
- **Chowdhury, Anurag;** Biswas, Rajib & Das, A.P. 2014. Macrophytic flora of Gossaihat Beel, Jalpaiguri Forest Division, West Bengal, India: II. Pteridophyta and Liliopsida. *Pleione* 8(2): 293 - 310.
- **Chowdhury, Anurag &** Das, A. P. 2014. *Hygrophila erecta* (N.L. Burman) Hochreutiner [Acanthaceae] – a new record of occurrence for West Bengal, India. *Pleione* 8(1): 207 - 209.
- **Chowdhury, Anurag &** Das, A. P. 2013, Aquatic And Semi-aquatic Macrophytic diversity Of the river Karala at Jalpaiguri, West Bengal, India and their growth form analysis. *Int J Pharm Bio Sci.* 4(4): (B) 1336 – 1343.
- **Chowdhury, Anurag;** Chowdhury, M.; Choudhury, Debakar & Das, A. P. 2013. *Ludwigia peruviana* (Linnaeus) H. Hara [Onagraceae]: a new record for West Bengal, India. *Pleione* 7(1): 286 - 289.
- **Chowdhury, Anurag;** Chowdhury, M. & Das, A. P. 2013. Transcontinental migration of Brazilian *Adenostemma suffruticosum* Gardner (Asteraceae) to India in the Northern Hemisphere. *Pleione* 7(2): 589 - 593.
- Biswas, R.; **Chowdhury, A.** & Das, A. P. 2012. Macrophytic flora of Gossaihat Beel, Jalpaiguri Forest Division, West Bengal, India: I. Magnoliopsida. *Pleione* 6(1): 217-237.

- Chowdhury, M.; **Chowdhury, A.**; Sikdar, A.; Das, A.P. & Paul, T.K. 2011. Occurrence of *Soliva anthemifolia* (A. Jussieu) R. Brown (Asteraceae) in Eastern India. *Pleione* 5(2): 352 – 356.

Publications outside the thesis works:

- Panda, S. & **Chowdhury, A.** 2010. Notes on *Rhododendron vaccinoides* Hooker f. (Ericaceae) in India: insight from leaf and stem anatomy, seed and pollen morphology *Pleione*. 4(1): 54 – 62.
- Das, A.P.; Ghosh, C.; Sarker, A.; Biswas, R.; Biswas, K.; Choudhury, D.; Lama, A.; Moktan, S. & **Chowdhury, A.** 2010. Preliminary report on the Medicinal Plants from three MPCAs in Terai and Duars of West Bengal, India. *Pleione* 4(1): 90 – 101.

Appendix: B

SEMINARS & CONFERENCES ATTENDED

1. *National seminar on Biotechnology for people: Applications and awareness*, Department of Botany, PD women's college, West Bengal. 4th & 5th December, 2012.
2. *Diversity conservation and Sustainable Utilization of Plant and Traditional Knowledge in Eastern Himalaya*, Department of Botany, NBU, West Bengal. 16th December, 2010.
3. *The Exploration, Protection and Conservation of Biodiversity and Traditional Knowledge*, Gour Mahavidyalaya, Malda, West Bengal. 4th & 5th February, 2011.
4. *UGC sponsored Research Scholars' training programme*. Academic Staff College, NBU, West Bengal. 30th June – 1st July, 2011.
5. *Workshop on Bioinformatics*, Department of Botany, NBU, West Bengal. 19th September, 2011.
6. *Advances in Abiotic and Biotic Stress Management of Plants*, DRS- Department of Botany, NBU, West Bengal. 23rd & 24th September, 2011.
7. *Biology and Bioinformatics of Economically Important Plants and Microbes*. Department of Botany, NBU, West Bengal. 19th February, 2012.
8. *National symposium on Recent trends in plant and microbial research*, Department of Botany, NBU, West Bengal. 22nd & 23rd March, 2013.
9. *National conference on Recent trends in plant diversity study and conservation strategies* Department of Botany, Nagaland University. 29th & 30th September, 2012.
10. *Botanical Nomenclature Course*, BSI & ENVIS, 11th – 30th January, 2013.
11. *National Conference on New Frontiers in Medicinal Plant Research & Special Meeting on Medicinal Plants for Livelihood Security & Community Empowerment in Eastern Himalayas*, Department of Botany, Sikkim University, 3rd – 5th October, 2013.
12. *National Symposium on Himalayan Biodiversity: Prospects and Challenges*, Department of Botany, North-Eastern Hill University, 20th – 21st March, 2014.

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- Fishery Department, Jalpaiguri
- Agriculture Department, Jalpaiguri
- Land Reforms Department, Jalpaiguri
- WIMED, Salt Lake, Kolkata

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PUBLICATIONS

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AQUATIC AND SEMI-AQUATIC MACROPHYTIC DIVERSITY OF THE RIVER KARALA AT JALPAIGURI, WEST BENGAL, INDIA AND THEIR GROWTH FORM ANALYSIS

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ABSTRACT

River Karala is the most important natural drainage channel of Jalpaiguri town, West Bengal, India. At present the river is draining about 5.20 sq km or 40 % of the total municipal area. It originates from the Baikunthapur reserve forest. Due to its slow flowing nature, a large number of macrophytes grow abundantly. During our survey, 137 macrophytic species belonging to 107 genera are reported and classified according to their growth form and enumerated with floral diversity. Due to anthropogenic activity, the macrophytic diversity of the river is highly disturbed. The present status and need of conservation are also discussed in this paper.

KEYWORDS : Karala River, Diversity, Growth form, Stress.



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INTRODUCTION

The river *Karala*, also known as *Kalla*, is one of the tributaries of the river Teesta. The river divides Jalpaiguri divisional town [West Bengal, India] into two halves, the left bank i.e., Karala-Teesta interfluves, having administrative offices and the right bank, occupied by markets, residential and commercial areas. The present study area is around 141 sq km and is covered with forests and open land. This river has originated at 26°46'49.70" N latitude and 88°32'03.49" E longitude [inside Baikunthapur Forest] and then merged with the river Teesta at Das Para near the Jalpaiguri city at 26°28'43.04" N latitude and 88°44'26.61" E longitude. Near Jalpaiguri town, the river Karala maintains a good flow as it receives discharges from the nearby rivers Chukchuka and Rukruka and also due to seepage from the Teesta and the sewerage and the run-off rain water from the town area. The river Chukchuka is a small (10.98 sq km) left-hand tributary of the river Karala (Sarkar *et al.*, 2001). In 1968, Jalpaiguri town was affected by devastating flood and the life of at least 216 persons and 1370 cattle were lost (Sarkar *et al.*, 2001). In aquatic systems, respond to changes in water quality are used as bioindicator of pollution (Tripathi & Shukla, 1991). The objectives of the present study are to understand the floristic diversity and growth-form analysis of macrophytes in the Karala River.

MATERIALS AND METHODS

The periodical survey and sampling of the vegetation was done during December 2009 to March 2012 in the entire stretch of the Karala

River. The Growth-form classification of Hartog & Segal (1964) was followed. For basic Habit-group classification, plants were categorized into 5 groups viz., free floating, rooted floating, submerged, emergent, and marginal types (after Sculthorpe, 1967). Geographical locations of different places of the study area were determined using Garmin GPS. Collected specimens were processed and mounted on herbarium sheets following Jain & Rao (1977) and the specimens were identified by matching at CAL and NBU herbaria and also using different published literature. Information on the uses of these plants was basically collected from the local people and through the survey in the local markets.

RESULTS AND DISCUSSION

During the present study, a total of 137 species covering 107 genera in 52 families of macrophytes were recorded (Table 1). There were 10 free floating, 9 rooted floating, 5 submerged, 8 emergent and 105 marginal types of plants (Table 2). All the recorded species were classified into 15 growth forms (Table 3). However, the analysis of data, it is evident that there are 11 species of Ceratophyllids, 3Parvopotamids, 6Nymphaeids, 2Utriculareids, 46Helophytes, 4Marselids, 3Lemnids, 4Magnolemnids, 22Psuedohydrophytes, 17Rhizopleaustohelophytes, 15Tenagophytes and one species each for Eichhornids, Vallisnerids, Trapids and Myriophyllids. Information contained in Table 1 and 2 may be included in the text.

Table 1
Numerical taxonomic analysis of recorded aquatic plants

Taxa	Family	Genus	Species
Dicotyledons	34	71	87
Monocotyledons	12	30	42
Pteridophytes	5	5	7
Bryophyte	1	1	1
Total	52	107	137

Table 2
Presentation of Different Categories of Collected Specimens

Habit group		No. of species
Floating	Free floating	10
	Rooted floating	09
Submerged		05
Emergent		08
Marginal		105
Total:		137

In table 3, author name may be mentioned in the standard abbreviated form.

Table 3
Analytical data of the collected specimens according to their habit group and growth form
[FF = Free floating, RF = Rooted floating, SM = Submerged, EM = Emergent, M = Marginal]

Name [Family]; Voucher no.	Local Name	Habit group	Growth Form	Use
<i>Acmella calva</i> (DC.) R.K. Jansen [Asteraceae]; Anurag & A.P. Das 101	Jang	M	Hel	Pig's fodder & Inflorescence is edible
<i>Ageratum conyzoides</i> L. [Asteraceae]; Anurag & A.P. Das 209	Elame Jhar	M	Hel	Medicinal and pig's fodder
<i>Alternanthera philoxeroides</i> (C. Mart.) Griseb. [Amaranthaceae]; Anurag & A.P. Das 097	Nunia	M	Rhi	Leafy vegetables and medicinal
<i>Alternanthera sessilis</i> (L.) R. Br. ex DC. [Amaranthaceae]; Anurag & A.P. Das 096	Nunia Saak	M	Rhi	Leafy vegetables, medicinal
<i>Amaranthus spinosus</i> L. [Amaranthaceae]; Anurag & A.P. Das 111	Knata Notey	M	Hel	Leafy vegetables, fodder and medicinal
<i>Amaranthus viridis</i> L. [Amaranthaceae]; Anurag & A.P. Das 227	Notey	M	Hel	Leafy vegetables, fodder and medicinal
<i>Amischotolype hookeri</i> (Hassk.) Hara [Commelinaceae]; Anurag & A.P. Das 123	Panijhar	M	Ten	Specially fodder for cow and pig's
<i>Aponogeton crispus</i> C.P. Thunb. [Aponogetonaceae]; Anurag & A.P. Das 220	Ghenchu	EM	Par	Stolons are edible & Tuber used as pig's fodder
<i>Aponogeton undulatus</i> Roxb. [Aponogetonaceae]; Anurag & A.P. Das 194	Ghenchu	EM	Par	Tuber used as pig's fodder & root stock is edible
<i>Axonopus compressus</i> (Sw.) P. Beauv. [Poaceae]; Anurag & A.P. Das 100	Chepti	M	Ten	Specially fodder for cow and goats
<i>Azolla pinnata</i> R. Br. [Azollaceae]; Anurag & A.P. Das 092	-	FF	Lem	Used as a fertilizer in Potato field.
<i>Blumea lacera</i> (N.L. Burm. f.) DC. [Asteraceae]; Anurag & A.P. Das 200	-	M	Psu	Specially fodder for cow and goats
<i>Bulbostylis barbata</i> (Rottb.) C.B. Clarke [Cyperaceae]; Anurag & A.P. Das 140	-	M	Ten	Specially fodder for cow and goats
<i>Cardamine hirsuta</i> L. [Brassicaceae]; Anurag & A.P. Das 134	-	M	Hel	Specially fodder for cow and goats
<i>Centella asiatica</i> (L.) Urban [Apiaceae]; Anurag & A.P. Das 106	Thankuni	M	Hel	Leafy vegetables and medicinal
<i>Ceratophyllum demersum</i> L. [Ceratophyllaceae]; Anurag & A.P. Das 094	Jhungi	RF	Cer	Leafy vegetables, medicinal and fish fodder
<i>Ceratopteris thalictroides</i> (L.) Brongn. [Pteridaceae]; Anurag & A.P. Das 107	-	RF	Cer	Leafy vegetables, medicinal and fish fodder
<i>Chenopodium album</i> L. [Amaranthaceae]; Anurag & A.P. Das 185	Bathua saak	M	Hel	Leafy vegetables and fodder for cow and goats
<i>Chenopodium ambrosioides</i> L. [Amaranthaceae]; Anurag & A.P. Das 203	-	M	Hel	Leafy vegetables
<i>Chrozophora rotterli</i> A. Juss. [Euphorbiaceae]; Anurag & A.P. Das 217	-	M	Psu	Specially fodder for cow and goats
<i>Colocasia esculenta</i> (L) Schott [Araceae]; Anurag & A.P. Das 212	Shola Kachu	M	Rhi	Vegetables, medicinal
<i>Commelina benghalensis</i> L. [Commelinaceae]; Anurag & A.P. Das 170	Kanshira	M	Rhi	Specially fodder for cow and goats and medicinal
<i>Commelina diffusa</i> N.L. Burm.f [Commelinaceae]; Anurag & A.P. Das 181	Kanshira	M	Rhi	Specially fodder for cow and goats and

				medicinal
<i>Commelina suffruticosa</i> Blume [Commelinaceae]; Anurag & A.P. Das 108	Kanshira	M	Cer	Fodder for cow, goats and pigs
<i>Croton bonplandianus</i> Bail. [Euphorbiaceae]; Anurag & A.P. Das 117	Jhunjhuni	M	Hel	-
<i>Cuphea procumbens</i> Ortega [Lythraceae]; Anurag & A.P. Das 099	-	M	Hel	Fodder for cow, goats and pigs
<i>Cyanotis cristata</i> (L.) D. Don [Commelinaceae]; Anurag & A.P. Das 115	-	M	Hel	Specially fodder for cow and goats, medicinal
<i>Cynodon dactylon</i> (L.) Pers. [Poaceae]; Anurag & A.P. Das 190	Durba Ghas	M	Ten	Specially fodder for cow and goats, medicinal
<i>Cyperus cephalotes</i> Vahl [Cyperaceae]; Anurag & A.P. Das 176	Gota-habi	M	Ten	Specially fodder for cow and goats and medicinal
<i>Cyperus compressus</i> L. [Cyperaceae]; Anurag & A.P. Das 196	Gola-methi	M	Ten	Specially fodder for cow and goats and medicinal
<i>Cyperus cyperoides</i> (L.) Kuntze [Cyperaceae]; Anurag & A.P. Das 199	-	M	Ten	Specially fodder for cow and goats and medicinal
<i>Cyperus difformis</i> L. [Cyperaceae]; Anurag & A.P. Das 224	Behua ghass	M	Ten	Fodder and soil cover
<i>Cyperus haspan</i> L. [Cyperaceae]; Anurag & A.P. Das 221	Beretha	M	Ten	Specially fodder for cow and goats and medicinal
<i>Cyperus pilosus</i> Vahl [Cyperaceae]; Anurag & A.P. Das 126	-	M	Ten	Specially fodder for cow and goats
<i>Cyperus rotundus</i> L. [Cyperaceae]; Anurag & A.P. Das 192	Mutha Ghas	M	Ten	Specially fodder for cow and goats and medicinal
<i>Datura stramonium</i> L. [Solanaceae]; Anurag & A.P. Das 165	Kalo-dhutra	M	Hel	Medicinal
<i>Dentella repens</i> (L.) J. R. Forst. & G. Forst. [Rubiaceae]; Anurag & A.P. Das 137	Papri Ghas	M	Myr	Specially fodder for cow and goats
<i>Desmodium gangeticum</i> (L.) DC. [Leguminosae]; Anurag & A.P. Das 125	Salparni	M	Psu	Medicinal and fodder
<i>Desmodium triflorum</i> (L.) DC. andolle [Leguminosae]; Anurag & A.P. Das 112	-	M	Psu	Medicinal and fodder
<i>Diplazium esculentum</i> (Retz.) Sw. [Woodsiaceae]; Anurag & A.P. Das 103	Dhneki Saak	M	Rhi	Leafy vegetables
<i>Drymaria cordata</i> (L.) Willd. ex Schult. [Caryophyllaceae]; Anurag & A.P. Das 118	Abhijal	M	Hel	Medicinal and fodder
<i>Eclipta prostrata</i> (L.) L. [Asteraceae]; Anurag & A.P. Das 179	Kesut	M	Hel	Medicinal and leafy vegetables
<i>Eichhornia crassipes</i> (Mart.) Solms [Pontederiaceae]; Anurag & A.P. Das 183	Kachuri Pana	FF	Eic	Fodder and used as a manure in specially potato field
<i>Eleocharis retroflexa</i> (Poir.) Urban [Cyperaceae]; Anurag & A.P. Das 201	Chen-chka	M	Psu	-
<i>Elephantopus scaber</i> L. [Asteraceae]; Anurag & A.P. Das 207	Samdulun	M	Hel	Specially fodder for cow and goats
<i>Eleusine indica</i> (L.) Gaertn. [Poaceae]; Anurag & A.P. Das 215	-	M	Cer	Specially fodder for cow and goats
<i>Emelia shonchifolia</i> (L.) DC. [Asteraceae]; Anurag & A.P. Das 218	Sedi-modi	M	Psu	Specially fodder for cow and goats
<i>Enydra fluctuans</i> DC. [Asteraceae]; Anurag & A.P. Das 175	Helench	RF	Rhi	Leafy vegetables and medicinal
<i>Eragrostis tenella</i> (L.) Roem. & Schult. [Poaceae]; Anurag & A.P. Das 155	-	M	Cer	-
<i>Eupatorium odoratum</i> L. [Asteraceae]; Anurag & A.P. Das 127	-	M	Hel	-
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<i>Grangea maderaspatana</i> (L.) Desf. [Asteraceae]; Anurag & A.P. Das 226	Namuti	M	Rhi	Specially fodder for cow and goats
<i>Heliotropium indicum</i> L. [Boraginaceae]; Anurag & A.P. Das 223	Hati Snurh	M	Hel	-
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<i>Ipomoea aquatica</i> Forssk. [Convolvulaceae]; <i>Anurag & A.P. Das 149</i>	Jal-Kalmi	M	Rhi	Leafy vegetables and medicinal	
<i>Justicia diffusa</i> Willd. [Acanthaceae]; <i>Anurag & A.P. Das 139</i>	Gandharusa	M	Rhi	-	
<i>Kyllinga brevifolia</i> Rottb. [Cyperaceae]; <i>Anurag & A.P. Das 116</i>	Gothubi	M	Hel	Specially fodder for cow and goats	
<i>Kyllinga nemoralis</i> (J. R. Forst. & G. Forst.) Dandy ex Hutch & Dalz. [Cyperaceae]; <i>Anurag & A.P. Das 105</i>	-	M	Hel	Specially fodder for cow and goats	
<i>Lasia spinosa</i> (L.) Thwait. [Araceae]; <i>Anurag & A.P. Das 091</i>	Kantakachu	M	Rhi	Potted as ornamental	
<i>Lemna minor</i> L. [Araceae]; <i>Anurag & A.P. Das 119</i>	Topa Pana	FF	Lem	Used as a manure in agricultural field	
<i>Leucas indica</i> (L.) R. Br. [Lamiaceae]; <i>Anurag & A.P. Das 142</i>	Danda-Kalas	M	Hel	Leafy vegetables and medicinal	
<i>Limnophila heterophylla</i> Benth. [Plantaginaceae]; <i>Anurag & A.P. Das 158</i>	Karpur	EM	Cer	-	
<i>Lindenbergia indica</i> Kuntze [Scrophulariaceae]; <i>Anurag & A.P. Das 162</i>	Halud basanto	M	Hel	-	
<i>Lindernia crustacea</i> (L.) F. Muel. [Linderniaceae]; <i>Anurag & A.P. Das 177</i>	Bhumi-nim	M	Hel	-	
<i>Ludwigia adscendens</i> (L.) H. Hara [Onagraceae]; <i>Anurag & A.P. Das 214</i>	Kessardam	M	Rhi	Specially fodder for cow and goats	
<i>Ludwigia octovalvis</i> (N. Jaqin) Raven [Onagraceae]; <i>Anurag & A.P. Das 173</i>	-	M	Hel	Specially fodder for cow and goats	
<i>Ludwigia perennis</i> L. [Onagraceae]; <i>Anurag & A.P. Das 147</i>	Polte Pata	M	Hel	Fodder for pigs	
<i>Malva verticillata</i> L. [Malvaceae]; <i>Anurag & A.P. Das 152</i>	Lapha Saak	M	Hel	Leafy vegetables	
<i>Marsilea minuta</i> L. [Marsileaceae]; <i>Anurag & A.P. Das 130</i>	Susni Saak	M	Mar	Medicinal & leafy vegetables	
<i>Marsilea quadrifoliata</i> L. [Marsileaceae]; <i>Anurag & A.P. Das 133</i>	Shusni Saak	RF	Mar	Pollution indicator	
<i>Mazus pumilus</i> (Burm.f.) van Steen. [Phymaceae]; <i>Anurag & A.P. Das 090</i>	-	M	Hel	-	
<i>Mecardonia procumbens</i> J. Small [Plantaginaceae]; <i>Anurag & A.P. Das 205</i>	-	M	Psu	-	
<i>Melochia corchorifolia</i> L. [Malvaceae]; <i>Anurag & A.P. Das 197</i>	Tiki-okra	M	Psu	Specially fodder for cow and goats	
<i>Mikania micrantha</i> Kunth [Asteraceae]; <i>Anurag & A.P. Das 182</i>	Halkalmi	M	Hel	-	
<i>Mimosa pudica</i> L. [Mimosaceae]; <i>Anurag & A.P. Das 163</i>	Lajjabati	M	Hel	Medicinal and fodder	
<i>Monochoria hastata</i> (L.) Solms. [Pontederiaceae]; <i>Anurag & A.P. Das 169</i>	Bara nukha	M	Psu	Medicinal and fodder	
<i>Monochoria vaginalis</i> (Burm. f.) C. Presl [Pontederiaceae]; <i>Anurag & A.P. Das 132</i>	Chatto nukha	EM	Psu	Medicinal and fodder	
<i>Najas indica</i> (Willd.) Chamiiso [Hydrocharitaceae]; <i>Anurag & A.P. Das 141</i>	Kantajhingi	SM	Cer	Fish food	
<i>Nicotiana plumbaginifolia</i> Viv. [Solanaceae]; <i>Anurag & A.P. Das 128</i>	Ban tamak	M	Hel	Specially fodder for cow and goats	
<i>Nymphaea nouchali</i> Burm.f. [Nymphaeaceae]; <i>Anurag & A.P. Das 095</i>	Nil Shapla	RF	Nym	Medicinal and religious	
<i>Nymphaea pubescens</i> Willd. [Nymphaeaceae]; <i>Anurag & A.P. Das 110</i>	Sada Shapla	RF	Nym	Medicinal and religious	
<i>Nymphaea rubra</i> Roxb. ex Andr. [Nymphaeaceae]; <i>Anurag & A.P. Das 193</i>	Lal Shapla	RF	Nym	Medicinal and religious	
<i>Nymphoides hydrophylla</i> (Lour.) Kuntze [Menyanthaceae]; <i>Anurag & A.P. Das 186</i>	Pan-chuli	FF	Nym	Specially fodder for cow and goats	
<i>Nymphoides indica</i> (L.) Kuntze [Menyanthaceae]; <i>Anurag & A.P. Das 153</i>	Barapanchuli	FF	Nym	Medicinal	
<i>Oenanthe benghalensis</i> (Roxb.) Benth. & Hook. f. [Apiaceae]; <i>Anurag & A.P. Das 168</i>	Pan-turasi	M	Rhi	Specially fodder for cow and goats	
<i>Odenlandia corymbosa</i> L. [Rubiaceae]; <i>Anurag & A.P. Das 166</i>	Khet-papra	M	Hel	Specially fodder for cow and goats	
<i>Oryza rufipogon</i> Griff. [Poaceae]; <i>Anurag</i>	Buno-Dhan	M	Hel	Used as fencing and	

& A.P. Das 122				fuel materials
<i>Oxalis corniculata</i> L. [Oxalidaceae]; Anurag & A.P. Das 195	Amrul	M	Mar	Leafy vegetables
<i>Panicum repens</i> L. [Poaceae]; Anurag & A.P. Das 172	-	M	Ten	Specially fodder for cow and goats
<i>Parthenium hysterophorus</i> L. [Asteraceae]; Anurag & A.P. Das 121	Congress ghass	M	Hel	Fish poison
<i>Paspalum conjugatum</i> P.J. Berg. [Poaceae]; Anurag & A.P. Das 138	-	M	Hel	Specially fodder for cow and goats
<i>Peperomia pellucida</i> (L.) Kunth [Piperaceae]; Anurag & A.P. Das 156	Luchi pata	M	Mar	Bio- indicator
<i>Persicaria barbata</i> (L.) H. Hara [Polygonaceae]; Anurag & A.P. Das 136	Bekh- unjubaz	M	Psu	It is used to increase the goats milk
<i>Persicaria chinensis</i> (L.) H. Gross [Polygonaceae]; Anurag & A.P. Das 145	-	M	Psu	-
<i>Persicaria hydropiper</i> (L.) Delarbre [Polygonaceae]; Anurag & A.P. Das 154	Bish Katali	M	Hel	Specially fodder for cow and goats
<i>Persicaria orientalis</i> (L.) Spach [Polygonaceae]; Anurag & A.P. Das 202	Bara panimarich	M	Psu	-
<i>Phyla nodiflora</i> (L.) Greene [Verbenaceae] ; Anurag & A.P. Das 150	Bhui-okra	M	Hel	Increases yield of goat milk
<i>Pistia stratiotes</i> L. [Araceae]; Anurag & A.P. Das 161	Baro Pana	FF	Mag	Bio-fertilizer and medicinal
<i>Polycarpon prostratum</i> (Forssk.) Aschers. & Schweinf. [Caryophyllaceae]; Anurag & A.P. Das 211	Ginna	M	Hel	Specially fodder for cow and goats
<i>Portulaca oleracea</i> L. [Portulacaceae]; Anurag & A.P. Das 198	Bara Laniya	M	Hel	Specially fodder for cow and goats
<i>Potamogeton crispus</i> L. [Potamogetonaceae]; Anurag & A.P. Das 188	-	EM	Cer	Tuber is edible
<i>Potamogeton octandrus</i> Poir. [Potamogetonaceae]; Anurag & A.P. Das 164	-	EM	Cer	Tuber is edible
<i>Ranunculus sceleratus</i> L. [Ranunculaceae]; Anurag & A.P. Das 148	Polica	M	Rhi	Root stock poisonous
<i>Riccia fluitans</i> L. [Ricciaceae]; Anurag & A.P. Das 151	-	FF	Mag	Specially fodder for cow, goats and pigs
<i>Ricinus communis</i> L. [Euphorbiaceae]; Anurag & A.P. Das 109	Rehrhi	M	Hel	Oil is prepared from seed locally
<i>Rorippa indica</i> (L.) Hiern [Brassicaceae]; Anurag & A.P. Das 124	-	M	Psu	-
<i>Rotala rotundifolia</i> (Buch. – Ham. ex Roxb.) Koehne [Lythraceae]; Anurag & A.P. Das 191	-	M	Ten	Medicinal
<i>Rumex dentatus</i> L. [Polygonaceae]; Anurag & A.P. Das 159	Pahari palong	M	Psu	Specially fodder for cow and goats and also medicinal
<i>Rungia pectinata</i> (L.) Nees [Acanthaceae]; Anurag & A.P. Das 146		M	Hel	Specially fodder for cow and goats and medicinal
<i>Sagittaria sagittifolia</i> L. [Alismataceae]; Anurag & A.P. Das 143	Chhota-kut	M	Ten	Medicinal
<i>Salvinia cuculata</i> Roxb. ex Bory [Salviniaceae]; Anurag & A.P. Das 093	Cup-pana	FF	Mag	Used as manure
<i>Salvinia natans</i> All. [Salviniaceae]; Anurag & A.P. Das 113	Pana	FF	Mag	Used as manure
<i>Scirpus articulatus</i> L. [Cyperaceae]; Anurag & A.P. Das 102	Pappati- chikha	M	Hel	Increases yield of cow milk
<i>Scoparia dulcis</i> L. [Plantaginaceae]; Anurag & A.P. Das 208	Ban-dhane	M	Hel	Specially fodder for cow and goats and also medicinal
<i>Setaria glauca</i> (L.) P. Beauv. [Poaceae]; Anurag & A.P. Das 189	Dhoti-sara	M	Par	Fodder
<i>Solanum nigrum</i> L. [Solanaceae]; Anurag & A.P. Das 180	Kak-machi	M	Psu	Specially fodder for cow and goats
<i>Solanum torvum</i> Sw. [Solanaceae]; Anurag & A.P. Das 174	Gota-begun	M	Psu	Specially fodder for cow and goats
<i>Spermacoce alata</i> Aubl. [Rubiaceae]; Anurag & A.P. Das 167	-	M	Hel	Pig's fodder
<i>Spilanthes uliginosa</i> Sw. [Asteraceae]; Anurag & A.P. Das 222	Piraj	M	Hel	Medicinal
<i>Spridela polyrrhiza</i> L. [Lemnaceae]; Anurag & A.P. Das 206	Khudi-pana	FF	Lem	-
<i>Torenia cordifolia</i> Benth. [Liderniaceae]; Anurag & A.P. Das 178	-	M	Hel	Specially fodder for cow and goats
<i>Trapa natans</i> L. [Lythraceae]; Anurag & A.P. Das 129	Jal Singara	RF	Tra	Edible and medicinal

<i>Typha angustifolia</i> L. [Typhaceae]; Anurag & A.P. Das 114	Hogla	EM	Ten	Fencing materials
<i>Utricularia aurea</i> Lour. [Lentibulariaceae]; Anurag & A.P. Das 104	Jhanji	SM	Utr	Catching fishes
<i>Utricularia inflexa</i> Forssk. [Lentibulariaceae]; Anurag & A.P. Das 098	Jhanji	SM	Utr	-
<i>Vallisneria spiralis</i> L. [Hydrocharitaceae]; Anurag & A.P. Das 184	Pata Saoula	SM	Val	Medicinal and fodder
<i>Vernonia cinerea</i> (L.) Less. [Asteraceae]; Anurag & A.P. Das 157	Kuk-shim	M	Hel	Specially fodder for cow and goats
<i>Wahlenbergia marginata</i> (C. P. Thunb.) A. DC. [Campanulaceae]; Anurag & A.P. Das 120	-	M	Psu	Specially fodder for cow and goats and little bit used as medicinal
<i>Xanthium indicum</i> Koenig ex Roxb. [Asteraceae]; Anurag & A.P. Das 131	Ban Onkra	M	Psu	Vegetable in remote areas

Due to its slow flowing nature a rich aquatic and semi aquatic vegetation has developed in the river Karala. Among the recorded families of true aquatic plants there are 6 monocotyledonous, 5 dicotyledonous, 4 pteridophytic and 1 bryophyte families. Some terrestrial plant species have been found to grow in this river bed such as *Xanthium indicum*, *Vernonia cinerea*, *Wahlenbergia marginata*, *Torenia cordifolia*, *Scoparia dulcis*, *Solanum nigrum*, *Rungia pectinata*, *Ricinus communis*, *Malva verticillata*, *Melochia corchorifolia* etc. Of these, 25 species are medicinal and 41 species are fodder plants.

According to the growth from analysis Helophytes are dominating with 46 species, followed by Psuedohydrophytes (22) and Rhizopleustohelophytes (17). Tenagophytes (15) are also remarkable. *Aponogeton crispus*, rare and endemic to India and wild rice variety *Oryza rufipogon* have also been recorded. Due to fast pace of urbanization in the vicinity of river sides, excessive agricultural activities in riverine belt and addition of municipal waste are responsible for degradation of the river. There is an urgent need of developing proper strategies for the conservation of macrophytes in the river Karala.

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Transcontinental migration of Brazilian *Adenostemma suffruticosum* Gardner (Asteraceae) to India in the Northern Hemisphere

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Abstract

Adenostemma suffruticosum Gardner (Asteraceae) is basically an endemic plant of Brazil. Recently, it has been collected from Terai and Duars region of West Bengal in India recording its transcontinental migration to the Northern hemisphere. The species is now presented in this article with description, illustration and distribution map. The probable mode of its migration also has been discussed.

Key words: *Adenostemma suffruticosum*, Distribution, New record, India

INTRODUCTION

During recent floristic exploration (2009 – 2013) in Terai and Duars region of West Bengal, two small populations of one unknown member of Asteraceae was collected from marshy vegetation of Teesta and Mahananda Barrage areas, which is now identified as *Adenostemma suffruticosum* Gardner (Asteraceae). So far our literature and e-herbaria survey, the species is known to grow only from Latin America, particularly in Brazil.

Gardner (1847) recorded the species from 'Near Nossa Senhora d'Abadia', Brazil and published it in London Journal of Botany and the type specimens are preserved in Kew Herbarium (Hind 2012). After a long period, Eric Koiti Okiyama Hattori and Jimi Naoki Nakajima recorded this plant in Hoehnea from Panga Ecological Reserve, Uberlandia, Minas Gerais, Brazil. *Adenostemma suffruticosum* is an endemic and was known to grow only in the Northeastern and West-Central parts of Brazil, occurring in the states of Mato Grosso do Sul, Goiás, Minas Gerais and Distrito Federal. This species grows in moist or dry grassland and in semi-deciduous dry forest (Hattori & Nakajima 2011; Forzza 2010). In recent studies the species is found growing in the marginal areas of two wetlands in Terai-Duars areas of West Bengal in India.

From literature survey it is established that there is no record of occurrence of this species in India even not from Asia. In fact, the occurrence of *Adenostemma suffruticosum* was known only from Brazil (Fig 1; www.discoverlife.org) situated in the southern hemisphere of the globe. The image of Gardner's specimen in K, protologue description by Gardner (1847) and the descriptions presented in Baker (1876) and Hattori & Nakajima (2011) are

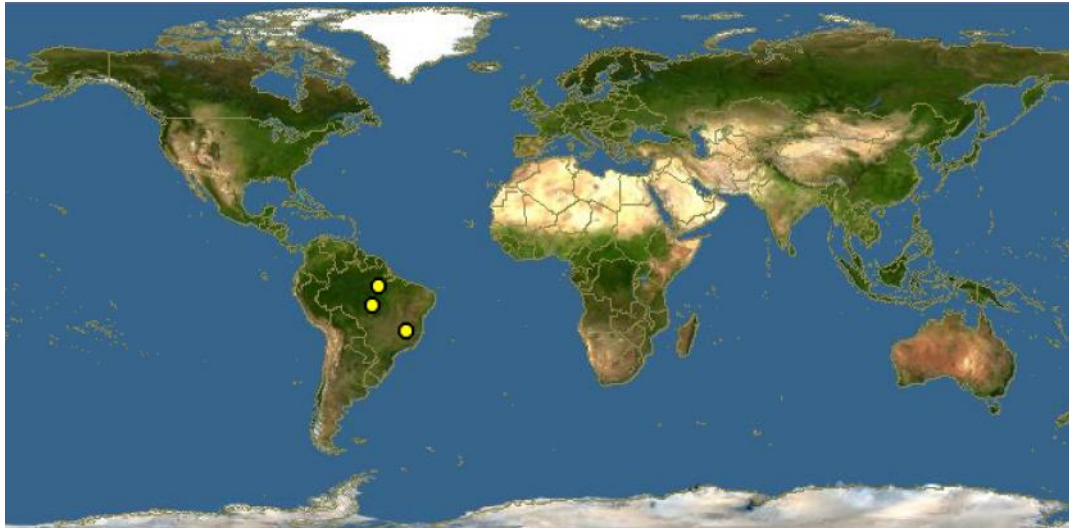


Fig. 1. Previously known distribution of *Adenostemma suffruticosum* (yellow dots on Brazil) [Map source: <http://www.discoverlife.org/mp/20m?kind=Adenostemma+suffruticosum>]

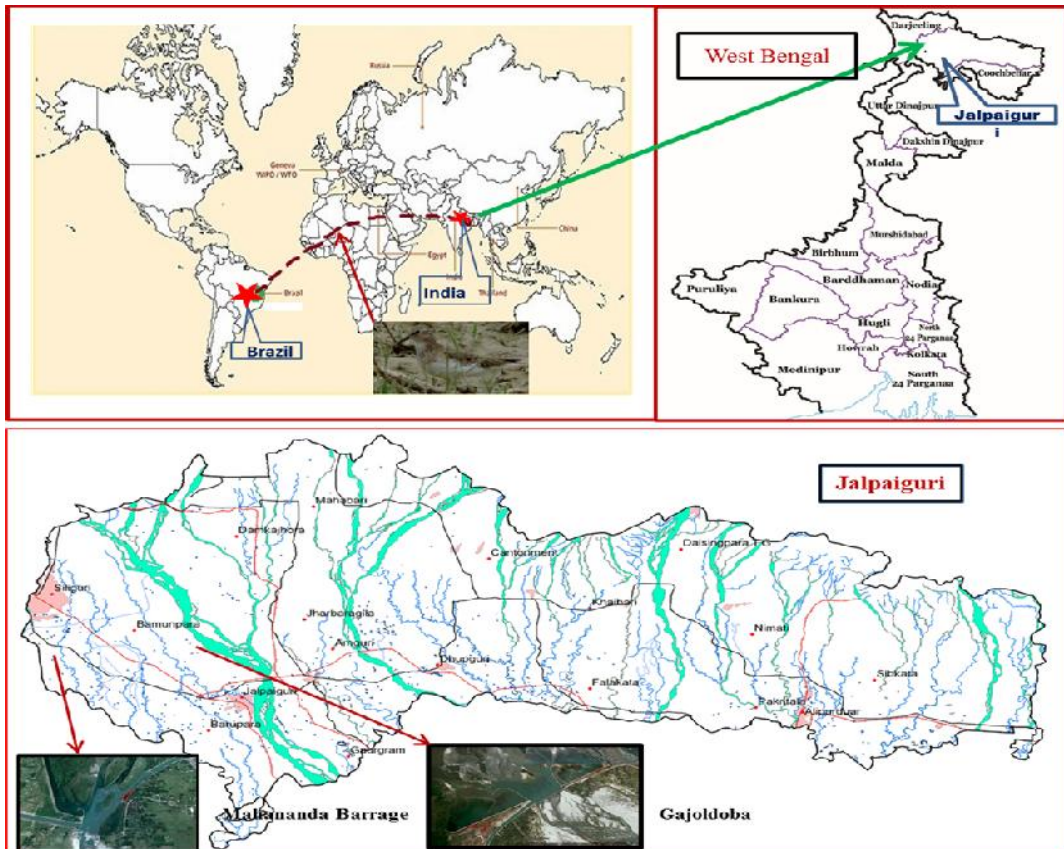


Fig. 2. Past and present distribution of *Adenostemma suffruticosum*, A. Locations in Brazil and in India (inset, *Pectoral sandpiper*); B. Location in West Bengal; C. Locations at Mahananda barrage (inset) and at Teesta barrage at Gajoldoba (inset).

matching nicely with the specimens collected from Teesta and Mahananda barrages. There is no specimen of *Adenostemma suffruticosum* in major Indian Herbaria including CAL.

Teesta and Mahananda barrages are favourite winter habitat in India for many long distant intercontinental migratory birds including Sandpiper, Brahmini duck, Bar-headed Goose, Poachard, Pintail, Shoveler, Mallard, Black Ibis, and many species of Stork, Cormorant and Duck etc. The Brazilian migratory birds, like *Calidris melanotos* (*Pectoral sandpiper*), also visit this area. The sticky cypsellas of *Adenostemma suffruticosum* can remain stick to the body of these birds and, subsequently, might have lodged in its presently discovered habitat leading to a successful trans-continental migration of the species. The geographical positions of the newly recognised habitats for this plant in India are 26°45'13.40" N latitude and 88°35'09.59" E longitude at Gajoldoba (Mahananda Barrage) and 26°39'20.46" N latitude and 88°24'34.65" E longitude at Teesta Barrage (Fig. 2).

For nomenclature www.theplantlist.org has been consulted and for description Gardner (1847) and Hattori & Nakajima (2011) were referred mostly. A brief description along with photographs (Plate I) is given below for easy recognition of the plant.

Adenostemma suffruticosum Gardner in London J. Bot. 6: 433. 1847; Hattori & Nakajima in Hoehnea, 38(2): 44. 2011. *Adenostemma scaevolifolium* Martius ex Baker, Fl. Bras. (Martius) 6(2): 186. 1876 [1 Feb 1876]

Undershrub, upto 1.5 m high. Stem angular, puberulous. Lower leaves opposite, alternate above, sessile or sometimes shortly (upto 2 cm in vegetative phase) petiolate; lamina 1.5 – 12 × 0.5 – 07 cm, ovate-elliptic to slightly oblanceolate, crenate, acute or acuminate to obtuse, base attenuate, both surfaces glabrous. Capitula discoid in spreading panicles; peduncle 4.5 – 8.5 cm; involucre campanulate, bracts connate at base, glutinous, 3 – 5 × 0.5 – 1 mm, lanceolate or narrowly oblong, entire, acute to obtuse. Bracteoles connate at base, 3 – 4 × 0.4 – 0.6 mm, linear lanceolate, entire, obtuse. Receptacle convex, naked, foveolated. Externally visible parts of all florets white; ray florets absent; disc florets 40 – 50, corolla tubular, glandular-tomentose outside, 5-lobed (0.5 mm); anther base obtuse, terminal appendage missing, approximately 1 mm; style branches 2, 3 mm long, clavate. Cypsela remain exposed, slightly spreading, obconical, glutinous, 2 mm long with glandular trichomes, black; pappus represented by 3 – 4 small caecum like oblong or slightly spatulate structures.

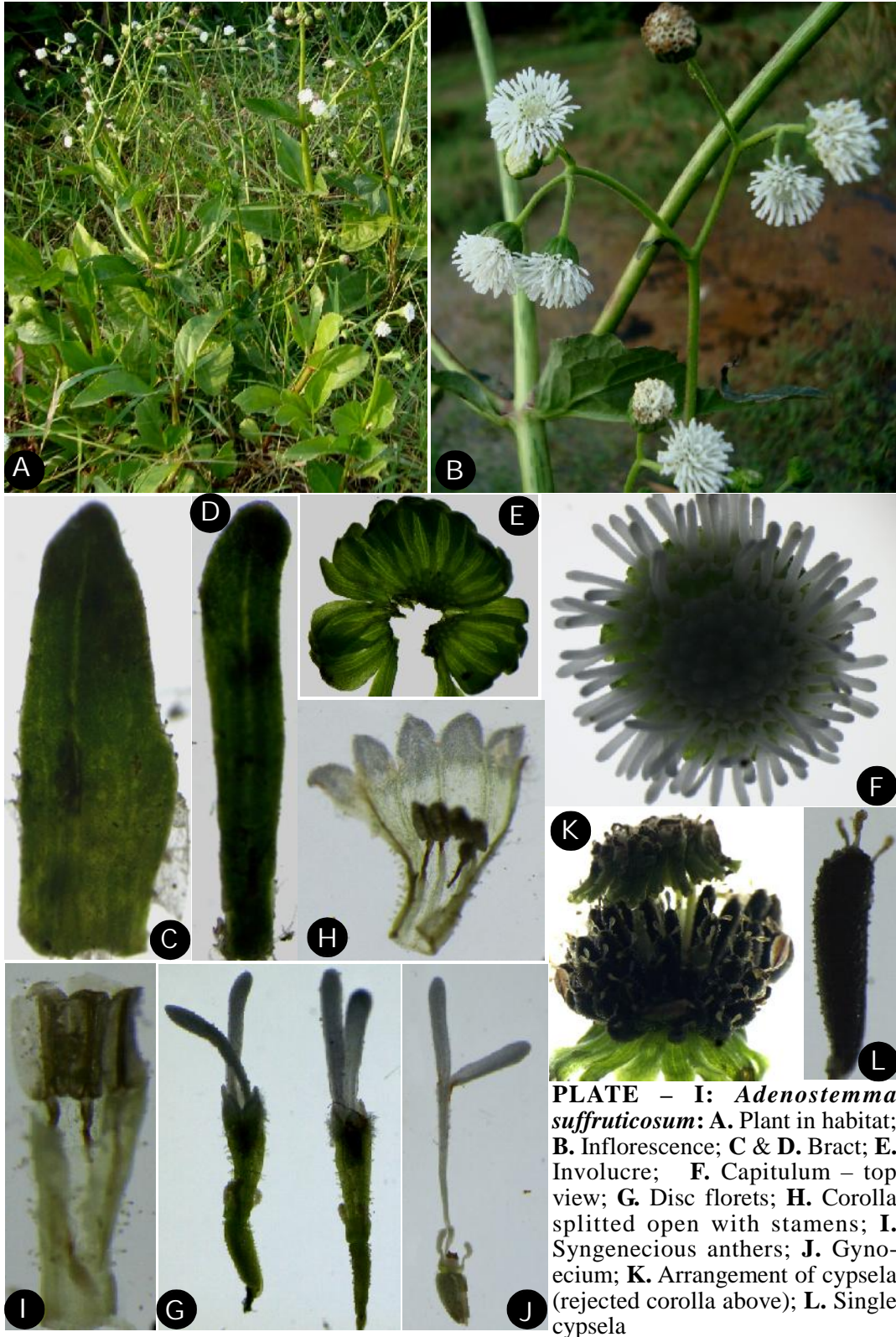
Material examined: Images of specimen of Harvard University Herbaria, Barcode-00000621; Type specimen at Kew Herbarium- K000677904 or Gardner-4204, Minas Gerais; Uberlandia, the Panga Ecological Reserve, 18-VI-1999, fl, fr., *Araújo Faria & sn* (HUFU20431), 11-VII-1997 and illustration of Eric Koiti Okiyama Hattori and Jimi Naoki Nakajima published in Hoehnea

Distribution: Southeast and West-Central BRAZIL and now from the Terai and Duars of West Bengal in INDIA.

Specimens cited: Teesta Barrage (Gajoldoba), *Anurag & AP Das 2105*, dated 22.10.2013; *Anurag & AP Das 2109*, dated 09.12.2013; and Mahananda Barrage, *Monoranjan & AP Das 3045*, dated 23.12.2013. [Specimens will be deposited at NBU and at CAL]

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***Hygrophila erecta* (N.L. Burman) Hochreutiner [Acanthaceae] – a new record of occurrence for West Bengal, India**

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Abstract

Hygrophila erecta (N.L. Burman) Hochreutiner [Acanthaceae], an erect wetland plant have been collected first time for the main land of India from the margins of the roadside ephemeral water bodies at Dash-Dargaon and Pani-kouri of Jalpaiguri district of West Bengal. The taxonomic description, photograph, distribution are provided for easy identification and enrichment of Indian flora.

Key words: *Hygrophila erecta*, New record, Jalpaiguri, West Bengal.

INTRODUCTION

Hygrophila R. Brown of Acanthaceae is one of the important cosmopolitan moisture loving genera comprising of about 100 species (Jiaqui *et al* 2011) and is widely distributed in tropical and subtropical regions of the world. But, Mabberley (2005) assigned only 25 species for the genus. According to APG III the family Acanthaceae is placed in the order Lamiales to the clade Lamiids under the core class Euasterids I of Core Eudicots (Chase & Reveal 2009). During the floristic explorations in various water bodies of *Terai* and *Duars* region of West Bengal, some specimens of *Hygrophila* R. Brown was collected by authors from the road side ephemeral wetlands of Siliguri – Jalpaiguri region along the NH-31 at Dash-Dargaon and at Pani-kouri during October-November, 2013. After critical investigations with the help of relevant literatures including Clarke (1884), Cook (1996), Ningombam & Singh (2010), matching specimens at CAL, consulting with the digital herbarium sheets from K and expert consultation at Botanical Survey of India, the identity of the plant has been confirmed as *Hygrophila erecta* (N.L. Burman) Hochreutiner. The up-to-date nomenclature has been verified with the www.theplantlist.org (2014). The species is known to grow in China, India (basically in North & South Andamans and Manipur), Indonesia, Japan, Laos, Malaysia, Myanmar, Nepal, Pakistan, Philippines, Thailand, Vietnam (Wu *et al* 2004; Ningombam & Singh 2010). However, the occurrence of the species in West Bengal was unknown. The plant was found growing in association with *Ludwigia adscendens* (Linnaeus) H. Hara, *Persicaria hydropiper* (Linnaeus) Spach, *Marsilea minuta* Linnaeus, *Lindernia crustacea* (Linnaeus) F. Müller, *Ipomoea carnea* N. Jacquine, *Acmella calva* (de Candolle) R.K. Jansen, *Ageratum conyzoides* Linnaeus, *Commelina benghalensis* Linnaeus, *Cyperus cephalotes* Vahl, *Cyperus haspan* Linnaeus and *Cynodon dactylon* (Linnaeus) Persoon.

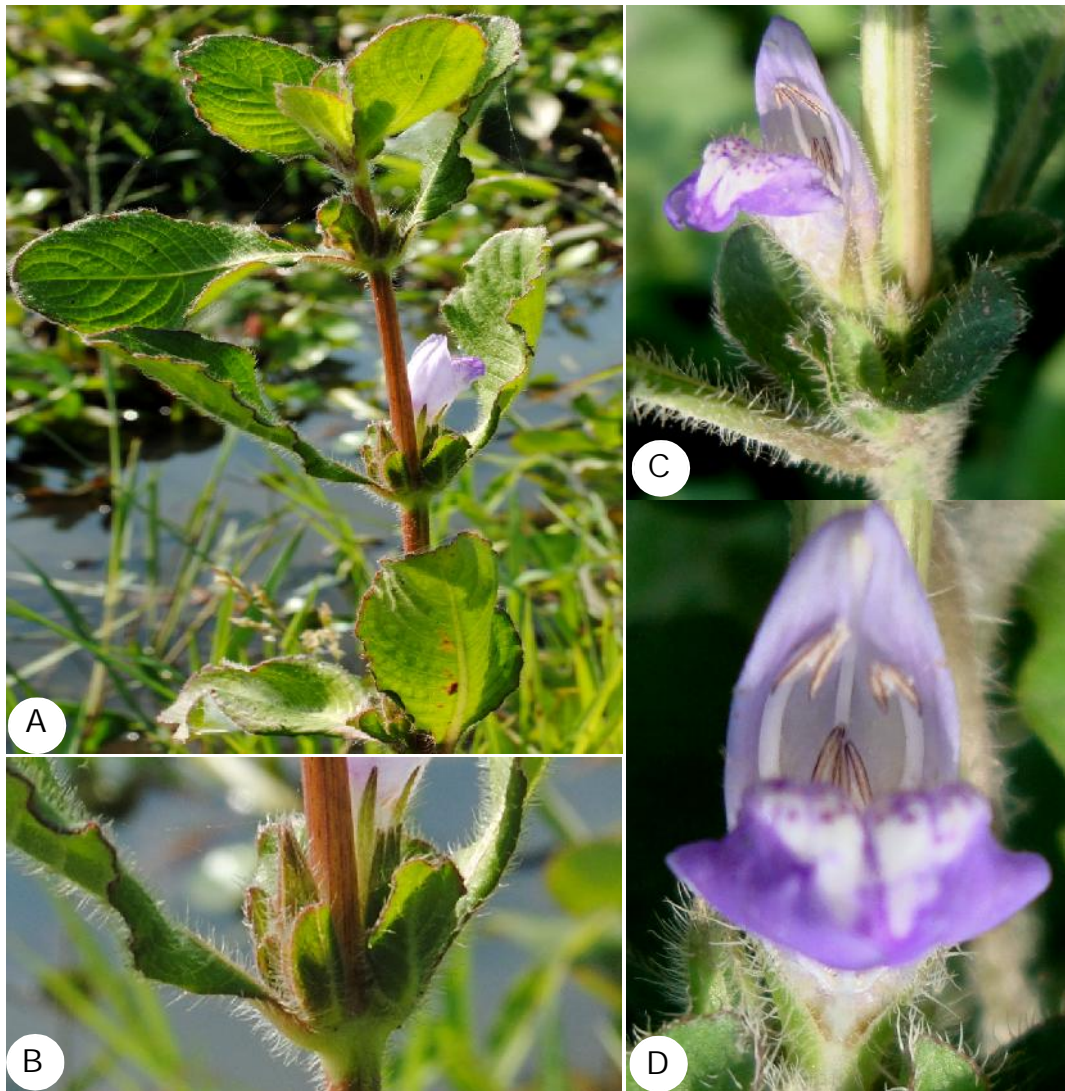


PLATE I. *Hygrophila erecta* (N.L. Burman) Hochreutiner : **A.** The plant in the habitat; **B.** Bracts with calyx inside; **C.** Flower with bracts, lateral view; **D.** Flower in front view showing short and long stamens.

The morphological description, photograph, distribution and ecology for the species are provided in this paper.

The voucher specimens will be deposited in CAL and NBU.

Hygrophila erecta (N.L. Burman) Hochreutiner, Candollea 5: 230. 1934; Ningombam & Singh in Pleione 4(2): 317 – 320. 2010. *Ruellia erecta* N.L. Burman, Fl. Indica, 135. 1768.

Plate I (A-D)

Annual erect herbs to 1.5 m tall. Stems quadrangular, hairy below the nodes. Petiole 3 – 6 mm long, sulcate, hispid; lamina elliptic or oblong-obovate, 2.8 – 8.5 cm x 1.9 – 4.8 cm, entire or slightly undulate, rounded, base cuneate, both surfaces densely hirsute, veins depressed

above, with cystoliths in mesophyll. Flowers 3 – 4, clustered in leaf axils, sessile; bracts oblong - lanceolate, numerous, ca. 2 – 3 cm long, densely white hairy; calyx ca. 1.7 x 0.6 cm, 5-lobed; lobes linear-lanceolate, densely hairy; corolla light blue-violet, 2.3 cm long, tube ca. 6 mm long, pilose; tube basally cylindric and ca. 2 mm wide, limb 2-lipped; lower lip oblong, 3-lobed, lobes broadly ovate, upper lip triangular, 2-lobed; stamens 4; filaments glabrous, longer pair ca. 7 mm long, shorter pair ca. 4 mm; ovary glabrous; style ca. 21 mm long, pilose. Capsule 1.3 – 1.6 cm long. Seeds blackish brown, pubescent.

Exsiccate: Dash-Dargaon, Jalpaiguri, *Anurag & AP Das 3105*, dated 15.10.2013 (CAL, NBU); Pani-kouri, Jalpaiguri, *Anurag & AP Das 3132*, dated 12.11.2013 (CAL, NBU).

Distribution: Pakistan, India [Andaman & Nicobar Islands, Manipur and now from West Bengal], Nepal, China, Japan, Laos, Myanmar, Thailand, Malaysia, Vietnam, Philippines.

Acknowledgments

Authors are thankful to the Director, Botanical Survey of India and to the Head of Central National Herbarium, Dr. P. Lakshminarashimhan for permitting us to consult the Herbarium. They are also thankful to Dr. T. K. Paul, Central National Herbarium for his valuable discussion. The financial support from UGC is thankfully acknowledged.

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REVIEW ARTICLE

POTAMOGETON GRAMINEUS LINNAEUS (POTAMOGETONACEAE): A NEW RECORD FOR INDIAN SUB-CONTINENT WITH A COMPLETE MORPHOLOGICAL DESCRIPTION

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ABSTRACT

We present a new record of the pondweed (*Potamogeton gramineus* Linnaeus) (Potamogetonaceae Berchtold & J. Presl) from the sub-Himalayan wetland of West Bengal, India. This record extends the known geographical distribution of *P. gramineus* Linnaeus from Europe, North America, Russia, SW Asia (Iran), Japan, Mongolia, Pakistan, Kazakhstan, Turkmenistan, Uzbekistan and China, to sub-Himalayan region of West Bengal. This discovery modified the current distribution and floral diversity of India.

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INTRODUCTION

Wetlands are the richest ecosystem after the tropical rain forests of the world. The Indian Wetlands support 20 % of total biodiversity of the country (Deepa et al., 1999). In India floristic studies of aquatic macrophytic vegetation were initiated by Biswas and Calder (1936). Sub-Himalayan wetland in West Bengal region is generally extended from Darjeeling to the Eastern bank of the River Ganga. These areas include Hilly areas of Darjeeling; Terai and Duars of Jalpaiguri and low land floodplains, lakes, streams of different forests, beels, seasonal waterlogged areas etc. *Potamogeton* Linnaeus of the family Potamogetonaceae Berchtold and J. Presl is one of the important aquatic genus comprising of about 89 species, widely distributed in tropical and subtropical wetlands. According to Guha and Mondal 2005, so far, 17 of its species have been recorded from India.

MATERIALS AND METHODS

During the floristic exploration and biodiversity survey of sub-Himalayan wetlands in West Bengal, in March 2014, few specimens of *Potamogeton* Linnaeus were collected in reproductive state. After critical investigations with the help of various relevant literatures (Cook, 1996; Youhao et al, 2010),

matching specimens with herbarium (CAL), and digital herbarium sheets and expert consultation, the identification of one specimen of *Potamogeton* Linnaeus is confirmed as *Potamogeton gramineus* Linnaeus (commonly known as variable leaf pondweed) (Fig.1). The up-to-date nomenclature has been verified with the www.theplantlist.org (2014). Hence, the present report of the occurrence of this species in West Bengal forms a new distributional record to India. A full description of the species is provided along with color photographs of the plant habit with dimorphic leaf and identification key.

Systematic treatment of available *Potamogeton* Linnaeus in Terai and Duars regions

Key to the species

- 1b. Leaves monomorphic, all submerged 2
- 1a. Leaves dimorphic, both submerged and floating leaves present 3
- 2a. Lamina linear-oblong, margins serrate; fruit beak equal to or longer than body of carpel *P. crispus*
- 2b. Lamina narrowly linear, margins entire, white; fruit beak shorter than body of carpel *P. pectinatus*
- 3a. Floating lamina less than 24 x 12 mm; submerged leaves sessile, filiform *P. octandrus*
- 3b. Floating lamina more than 29 x 16 mm; submerged lamina petiolate or sessile 4
- 4a. Submerged lamina phyllodial *P. natans*

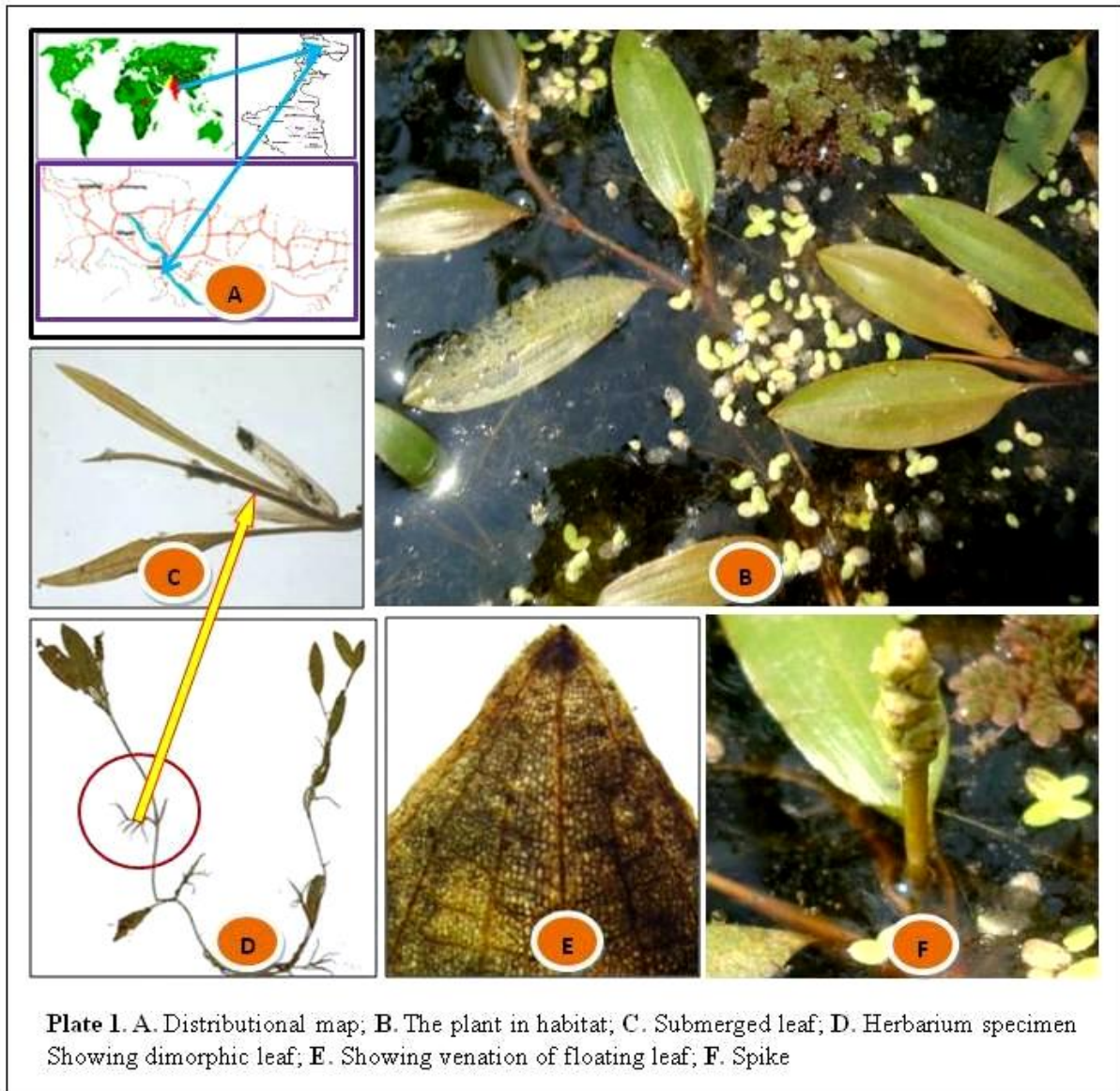
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- 4b. Submerged lamina with expanded blade..... 5
 5a. Submerged lamina petiolate *P. nodosus*
 5b. Submerged lamina sessile.....6
 6a. Plants usually unbranched, with distinct reddish tinge particularly when dry; submerged lamina 7-46 mm, 8-19 veined, margin entire, apex obtuse *P. alpinus*
 6b. Plants usually branched, without a distinct reddish tinge; lamina 20-35 mm, 7 veined, margin minutely denticulate, apex mucronate *P. gramineus*

Rhizome: slender, densely branched, with apical dormant buds.

Stem: terete, densely or sometimes sparsely branched, 1-1.5 mm in diam.

Leaves: dimorphic, floating lamina opaque, elliptic or ovate-elliptic to elliptic-lanceolate, leathery, 20 – 35 mm x 8 – 10 mm., 7 veined, base cuneate or rounded, margin entire, apex mucronate, petiole 12 – 10 mm; submerged leaves sessile, translucent, linear-oblong to oblanceolate, 12 – 16 mm x 1 mm., entire or minutely denticulate, mucronate, base cuneate,



Taxonomy

Potamogeton gramineus Linnaeus, Sp. Pl. 1: 127. 1753.
Potamogeton heterocaulis Diao, J. Yuzhou Univ., Nat. Sci. Ed. 11(1): 1 (3, 78; fig.). 1994. *P. heterophyllus* Schreber. Spicil. Fl. Lips. 21.1771.

Fresh water perennial soft herbs, anchored to the bottom at around 1.5 m depth.

herbaceous, petiole 8 – 10 mm. long; stipules axillary, convolute, conspicuous, 5.5-34 mm long, herbaceous, amplexicaule;

Spikes: cylindric, (13-36) mm long, densely flowered, with many whorls of opposite flowers; peduncles 13-17 mm. Stamens 4, united, anthers sessile; Carpels 4. Drupe with a short beak at tip.

Flowering and Fruiting: March – May

New Global Distribution: INDIA (West Bengal), Pakistan, China, Japan, Kazakhstan, Korea, Mongolia, Russia, Turkmenistan, Uzbekistan; SW Asia (Iran), Europe, North America.

Specimen examined: INDIA, West Bengal, Karala River, Kingshaheber ghat, at 26°28'43.04" N and 88°44'26.61" E, 21 March, 2014, Anurag Chowdhury and A.P. Das 03456 (CAL), Anurag Chowdhury and A.P. Das 03445 (NBU).

Ecological notes: It grows in water bodies such as ponds, lakes and streams. It may be found elsewhere as an introduced species. The species is growing in association with *Lemna sp*, *Spirodela sp*, *Azolla sp*, and also with the *P. pectinatus*. It is only known from a single locality in India apart from China and Pakistan.

Conservation status: This area increasingly facing several anthropogenic stresses and ultimately threatening its habitat. The key factors may be cited here as dense human population in catchments, urbanization, and various anthropogenic activities resulted in over exploitation of wetland resources leading to the large scale degradation in terms of their quality and quantity. Besides, unplanned fishing activities have degraded the wetland and its resources, so, some conservation strategies have to develop to save this species.

Acknowledgments

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Polygonum hastatosagittatum Makino (Polygonaceae): a new distributional record for India

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Abstract

Few specimens of *Polygonum hastatosagittatum* Makino, Polygonaceae, were recognized from the bulk collection of wetland plants from the natural water bodies in Duars of Himalayan biodiversity hotspot regions of West Bengal, India. This species is first time recorded from the territory of India. The taxonomic features, pollination, ecological notes and photographs of the species are provided.

Key words : *Polygonum hastatosagittatum* Makino, New record, Himalayan biodiversity hotspot, India.

INTRODUCTION

The Polygonaceae is comprising of approximately 46 genera and 1200 species and is mostly distributed in northern temperate regions of the world^[1]. In India, the family is represented by around 16 genera with 110 species of which majority are distributed in the Himalayan ranges from East to West including the Nepal^[2]. *Polygonum* L. is a genus of annual or perennial herbs or shrubs, cosmopolitan in distribution and is adopted to grow in very wide range of environmental conditions. However, species of *Polygonum* are having some preferences for the wet or marshy habitat conditions. It was estimated that around 150 species of *Polygonum* (*sensu lato*) are available worldwide^[3], while, in flora of China it was estimated to be around 230 species distributed mostly in Northern temperate region of the world^[4], of which around 80 species are common with India^[5]. Presently, 227 species of *Polygonum* (*sensu lato*) and 16 sub-species are recognized globally^[6]. Quite a high number of species of *Polygonum* (*sensu lato*) were accounted from undivided India^[7,8] and around 12 genera and 47 species were recorded from the state of West Bengal^[9,10,11,2,12].

During the floristic and ecological exploration (since 2007) in different water bodies in Terai and Duars region of West Bengal, some specimens were collected from a small and shallow stream in Sursuti Reserve Forest (near Gorumara National Park), that originates from the Neora River and passing through the entire forest and ultimately re-united with the Neora River, at 26°44'45.40" N latitude & 88°46'00.24" E longitude. The slow flowing nature of this channel creates several swamps covered with dense mat of aquatic vegetation within the forests. The specimen was critically investigated using various literature including *Flora of China*^[4], and *Flora of Taiwan*^[13] and matched with digital herbarium specimens of Taiwan National University Herbarium^[14] TAI (TAIID 042024, 041996, 173781), and was finally identified as *Polygonum hastatosagittatum* Makino. The specimens pertaining to this species will be deposited in the CAL and NBU herbaria. Characteristic morphology of leaves, glandular hairs, ocrea, and floral parts were examined and photographed. Detailed morphological description, photographs and ecological annotations for the plant are provided in the article.

Polygonum hastatosagittatum Makino, Bot. Mag. Tokyo. 17:

119. 1903. Liu, Ying & Lai, Fl. Taiwan 2: 270. 1976. [PLATE 1]

Marshland annual ascending herbs, 50 - 90 cm long. Stem much branched, armed with recurved and retrorse prickles. Petiole 2 mm or missing, retrorsely prickly; lamina lanceolate or elliptic, 80 - 84 mm long, 11 - 13 mm wide, acuminate, base sagittate or subhastate, pubescent, abaxially with retrorse prickles along the mid-vein, adaxially sometimes stellate pubescent; ocrea tubular, 18 - 22 x 7 - 8 mm, membranous, truncate, recurved retrorse at base. Inflorescence 2 - 3 flowered fascicles in repeatedly branched monochasium, terminal or axillary; peduncles glandular pubescent, bracts elliptic or ovate, 3 x 1.5 mm, margin ciliate; perianth light pink, 5 parted, 3 x 4 mm; tepals elliptic; stamens 8; styles 3, stigmas 1.4 mm, capitate. Achenes, trigonous, ovoid, dark brown, shiny.

Flowers & Fruits:

June - September.

Distribution:

Siberia, China, Nepal^[15], Taiwan, Japan, and now in India (Sursuti forest, Lataguri, West Bengal).

Specimen examined:

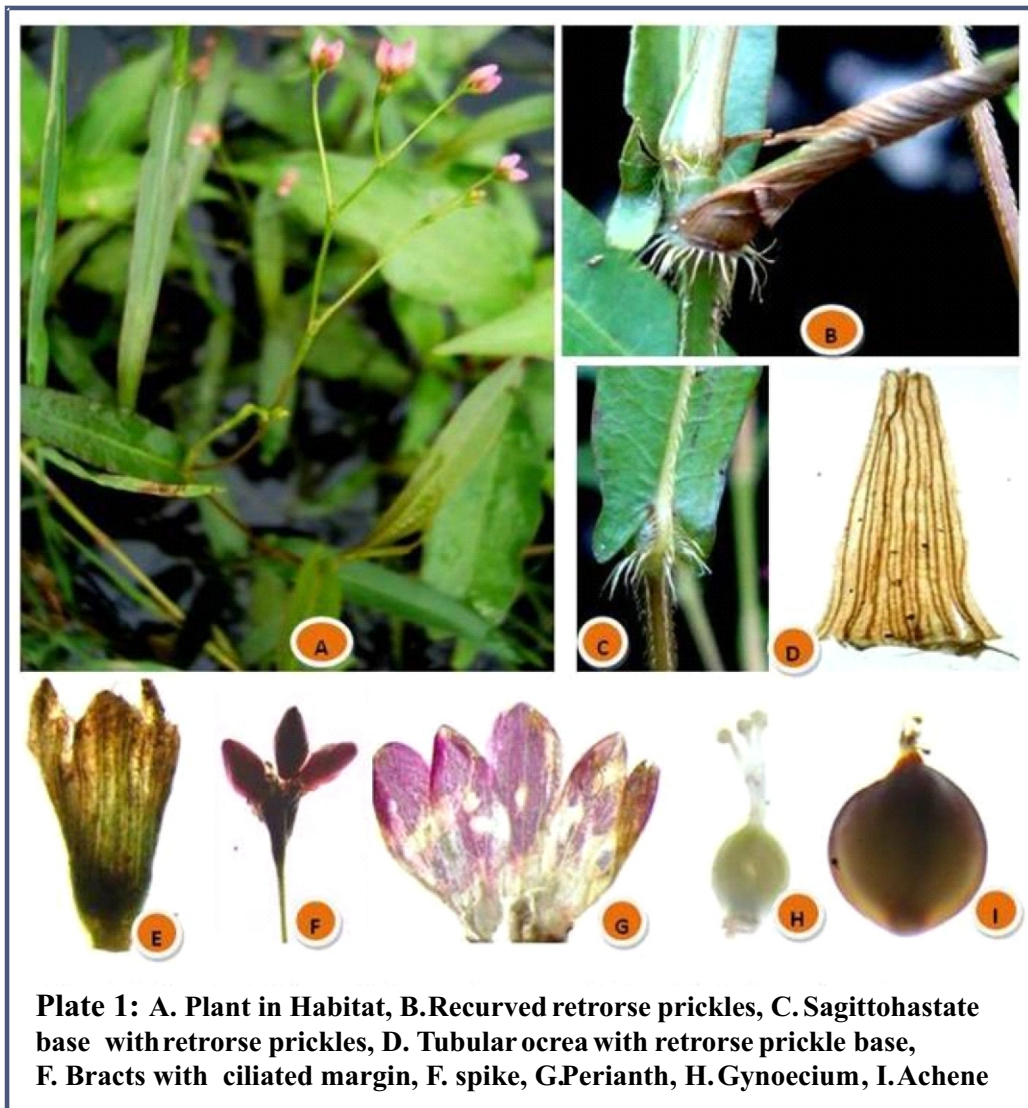
Sursuti forest (Lataguri, West Bengal), Anurag Chowdhury & A.P. Das 03456, dated 29.07.2014 (CAL) and Anurag Chowdhury & A.P. Das 03445, dated 30.05.2014 (NBU).

Ecological notes:

The species is growing in forest swamps in association with *Polygonum perfoliatum* Linnaeus, *Persicaria hydropiper* (Linnaeus) Spach, *Persicaria chinensis* (Linnaeus) H. Gross, *Sacciolepis interrupta* (Willdenow) Stapf, *Lasia spinosa* (Linnaeus) Thwaites, *Spirodela polyrrhiza* (Linnaeus) Schleiden, etc. It is now known only from one locality in India apart from China and Nepal parts of the Himalayas.

CONCLUSION

Polygonum hastatosagittatum Makino, Polygonaceae is recorded first time from the fresh water swamp within the territory of Gorumara National Park of Terai regions of Himalayan hotspots of India. Seeds of this species are light and



minute and probably it may come in this region through the rivers or streams way or with feather or feces of migratory birds coming from nearby countries, where it is available. The species is now growing and reproducing nicely in the study area. It is not recorded from any other adjoining areas of this regions and its distribution is still restricted. This piece of work is adding one more species in the flora of India.

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