

**SURVEY OF FLORISTIC DIVERSITY  
AND VEGETATION STRUCTURE OF  
RASIK BEEL IN THE COOCH BEHAR  
DISTRICT OF WEST BENGAL**

Thesis submitted to the University of North Bengal for the  
Award of Doctor of Philosophy in Botany

By  
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June, 2015

## DECLARATION

I, Rajib Biswas, hereby declare that the work embodied in my thesis entitled “SURVEY OF FLORISTIC DIVERSITY AND VEGETATION STRUCTURE OF RASIK BEEL IN THE COOCH BEHAR DISTRICT OF WEST BENGAL” has been carried out by me under the joint supervision of Dr. A.P. Das, Professor, Department of Botany, University of North Bengal and Dr. Tapas Kumar Paul, Scientist E, Botanical Survey of India, Howrah for the award of the Degree of Doctor of Philosophy in Botany. I also declare that, this thesis or any part of thereof has not been submitted for any other Degree/ Diploma either to this or other university.

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# ABSTRACT

Wetlands are important natural resources and critical for biodiversity of any country. They are significant in environmental functions and important in food chains and webs. Each wetland is an ecosystem with plants, animals and depends on each other. The role of wetlands has emerged as a key element in the delivery of inland freshwater and coastal ecosystem conservation through the Convention on Biological Diversity, 1992 and Ramsar Convention on Wetlands, 1971. Wetland means the areas with sufficient wetness. The wetlands soil is generally very rich in nutrients, which is very much responsible for its interesting floral and faunal diversity. These are the areas where terrestrial habitat meet with aquatic habitat and the depth is not more than 6 meters.

In West Bengal 3,44,570 hectares area is under fresh water wetlands and 4200 sq km area is under Mangrove ecosystem. 54 natural and 9 artificial wetlands are present in West Bengal which are covering 2,919,63 hectares and 52,564 hectares areas respectively. The wetland system of West Bengal is divided into in three regions based on land topography:

**1. Sub-Himalayan region** that generally extended from Darjeeling to eastern bank of Ganga river i.e. upto Maldah district.

**2. Gangetic region** that covers plains of entire Southern part of Bengal except the active delta and coastal areas.

**3. Coastal region** that covers only North and South 24-parganas and Coastal part of Purba Medinipur districts.

Majority of wetlands of Cooch Behar district are *Palustrine*, *Lacustrine* and *Riverine* types. Majority of the wetlands of the area originated mainly due to the shifting of the courses of different rivers flowing through the unstable soil of the rolling plains of Terai and Duars region. Large number of rivers are passing through the district and most of them have changed their courses very frequently, as a result abundant channels, meanders and ox-bow lakes of different sizes are very common. Tista, Mansai, Jaldhaka, Torsa, Raidak, Shutunga and Gadadhar are the important rivers. Some such wetlands like Rasik Beel, Gossanimari Beel, Sitai Beel and Rasomati Beel came into the focus of National Wetland Conservation programme. Wetlands having an area more than 2.25 ha altogether covering 4930.51 ha, which is almost 1.46 % of the total geographic area of the district. The Rasik Beel complex is lies between *Burah Raidak* and *Ghoramara* Rivers in the Salbari Block under Tufanganj Sub-Division of the District of Cooch Behar, West Bengal. The geographical location at the central part of the lake is 89°44' 10" E Longitude and 26° 25' 40" N Latitude.

In Champion & Seth's (1968) classification the vegetation of Rasik Beel complex and its surrounded areas matches partially with **4D/SS<sub>2</sub>** and **4D/SS<sub>4</sub>**, **Tropical Seasonal Forest: *Syzygium cumini* swamp forest** and **Low Swamp Forest**.

The central island is now planted with mainly *Salix tetrasperma*, *Terminalia arjuna* and *Lagerstroemia hirsuta*.

South-Western monsoon is the primary source of rainfall. Monsoon is quite broad, extending from the middle of June to the later part of September. Rains during winter months are rare but common during summer. Temperature of the Rasik Beel area begins to raise from the end of April and reaches its maximum during June - August.

**The Flora:** A total of 614 species of vascular plants has been recorded through the intensive survey in the area since the year 2007. Of these, angiosperms are represented by 581 species under

397 genera belonging to 124 families. In addition, 3 species of 3 genera from 3 families of gymnosperms and 30 species of fern and fern allies covering 25 genera belonging to 17 families have been recorded from the Rasik Beel wetland complex during the present exploration. 428 species under 300 genera are recorded from 96 dicotyledons families and 153 species belonging to 97 genera in 28 monocot families. Only 3 species of gymnosperm belonging to 3 genera under 3 families and a total of 30 species of ferns and fern-allies were recorded under 25 genera belonging to 17 families. The largest genus is *Ficus* of Moraceae with 7 species and is followed by *Cassia* of Fabaceae, *Solanum* of Solanaceae, *Persicaria* of Polygonaceae, *Cyperus* of Cyperaceae etc. are all with 6 species.

### **Invasive and Alien Species**

As much as 190 invasive alien species under 112 genera, belonging to 47 families has been recorded of which dicotyledons flora is represented by 170 species under 95 genera of 40 families and monocotyledons by 20 species belongs to 17 genera of 7 families. 95 species has been recognized as exotics of which 54 has been naturalized.

### **Useful Plants**

A total of 283 species of useful plants has been recorded from the Rasik Beel area of which 92 species are medicinal, 27 species in ethno-veterinary treatments, 54 species as vegetable or ripe fruits, 14 species used in various religious purposes, 4 species as spice, and 173 species used as fodder for their domestic animals.

### **Phytosociology**

In the pre-monsoon wetland vegetation, *Salvinia cucullata* showing highest frequency and *Salvinia cucullata* showing highest density. In monsoon season, whole wetland vegetation turns to change and highest frequency and density shows by *Najas graminea*. In post-monsoon wetland vegetation, *Salvinia natans* has highest frequency but highest density showing by *Azolla pinnata* subsp. *africana*.

Pre monsoon Wetland vegetation, 16 species showing highest SDI [Shannon – Weiner Index] 1. In monsoon, 21 species showing highest SDI 1. Highest SDI 1 presented by *Melastoma malabathricum*, *Ardisia solanacea*, *Capparis zeylanica*, *Grewia optiva* and *Streblus asper* presented in post monsoon wetland vegetation. Highest EH [Simpson's Index] showing by *Schoenoplectus juncooides* 177.79, *Nymphaea pubescens* and *Grangea maderaspatana* 40.38, *Cyanotis axillaris* 117.10, *Ranunculus sceleratus* 101.12. 21 species showing highest SDI 1 in the monsoon. Highest EH shows by *Colocasia esculenta* 241.29 and followed by *Typha elephantina* and *Wolffia arrhiza* 190.05. Lowest EH shows by *Najas graminea* 15.5. Post monsoon vegetation is very rich and 24 species showing highest SDI 1. *Typha elephantina* showing heist EH 535.84, *Ludwigia adscendens* 379.49. Lowest EH presented by *Azolla pinnata* subsp. *Africana* 19.95.

### **Changes in Vegetation**

Main reason behind the changes is the establishment of tourism center surrounding Rasik Beel. Clearing of local native vegetation developing plantations with desired species for ornamentation, fodder production, domestic requirement, etc. are the other important reasons of modification.

A large part of the Beel area is allowed free for fishing. The villagers cultivate economically important exotic fishes in that area. So, the original ichthyofauna of Rasik Beel regularly decreases or altering and changing its basic nature. Natural habitat of the local fishes has been damaged and due



to exotic fish culture, the food habit of local ichthyofauna has been changed. Local farmers use pesticide in their Beel side cultivation lands and make a great threats to the native fishes when enters there with run-away water from crop-fields. Local fishermen are also disturbing the local and migratory avifauna and damaging different formations of free-floating and other aquatic vegetation, etc. Poor knowledge of NTFP collection by local villagers is also one important cause of disturbing the food production and food-web leading to the food crisis of aquatic birds. Highly attractive ecotourism and its related activities are also seriously disturbing the local floral and faunal communities. Local people acquired submerge and immerse lands for paddy cultivation. After 2 – 3 years of acquiring the land, they construct houses there and through such encroachments the Wetland complex area is decreasing regularly.

Unless the authority become serious for conservation and can forget the commercial and sociological interaction, the originality of Rasik Beel vegetation along with its flora and fauna will be lost very soon.

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ABBREVIATIONS

**Names of the important books referred:**

Bengal Pl.	: Bengal Plants
En. Fl .Pl. Nepal	: An Enumeration of the Flowering Plants of Nepal
Fasc.Fl.India	: Fascicles, Flora of India
Fl.Brit.India	: Flora of British India
Fl.Bhutan	: Flora of Bhutan
Fl.E.Him.	: Flora of Eastern Himalaya
Fl.India	: Flora of India
Fl Indi.	: Flora Indica
Fl.West Bengal.	: Flora of West Bengal
Prodr.Fl.Nepal	: Prodromus florae Nepalensis
Pl.As.Rar.	: Plantae Asiaticae Rariores
Pl.Wilson	: Plantae Wilsonianae
Tr. Nor. Bengal.	: The Trees of Northern Bengal
FOC	: e-Flora of China
Nam. Change. Flr. Pl.	: Name changes in flowering plants by S. S. R. Bennett.

**Names of the journal referred:**

Bull.As.Soc.Beng.	: Bulletin of Asiatic Society of Bengal
Bull.Bot.Sur.Ind.	: Bulletin of Botanical Survey of India
Jour.Arn.Arb.	: Journal of Arnold Arboretum
Jour.Beng.Nat.Hist.Soc.	: Journal of Bengal Natural History Society
Jour.Bomb.Nat.Hist.Soc.	: Journal of Bombay Natural History Society
Jour.Econ.Tax.Bot.	: Journal of Economic and Taxonomic Botany
Jour.Jap.Bot	: Journal of Japanese Botany
Jour. R.A.S. Beng. Sci.	: Journal of Royal Asiatic Society of Bengal
Kew.Bull.	: Kew Bulletin
Jour. Ind. For.	: Indian forester, Dehradun.
Jour. Plione	: Plieoine

**Abbreviation used in Enumeration:**

<i>agg.</i>	: aggregated species
<i>auct.</i>	: of various authors ( <i>auctorum</i> )
<i>Cf.</i>	: compare ( <i>Confer</i> )



<i>f.</i>	: form ( <i>forma</i> )
<i>nom.illeg.</i>	: Illegitimate name ( <i>Nomen illegitimum</i> )
<i>nom.nud.</i>	: <i>Nomen nudum</i>
<i>p.p.</i>	: In Part ( <i>pro parte</i> )
<i>Sensu.</i>	: In the sense of author indicated and not as originally intended
<i>ssp.</i>	: Sub-species
<i>Var.</i>	: Variety
<i>Var. nov.</i>	: New variety

**Other abbreviations commonly used in enumeration:**

Acad.	: Academy	Ill.	: Illustration
Bull.	: Bulletin	J.	: Journal
Cat.	: Catalogue	no.	: Number
Contr.	: Contribution	Rep.	: Report
Faun.	: Fauna	Repert.	: Repertorium
Fl.	: Flora	Soc.	: Society
Ic.	: Icones	Contr.	: Contribution

**Description:**

Diam.	: Diameter
Fig.	: Figure

**Distributions:**

C.	: Central
E.	: Eastern
S.	: Southern
W.	: Western
N.	: North
NE.	: North-eastern

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# **CHAPTER - I**



## *Chapter - I*

# INTRODUCTION

Wetlands have been identified as one of the key life-support systems on this planet in addition to the agricultural lands and forested vegetation. They form a vital element of national and global ecosystems and economies (Senaratna, 2011). Wetlands are important natural resources and critical for the biodiversity stock and its maintenance for any country. They are significant in environmental functions and important in all food chains (Rouvalis, 1998) and food-webs. Each wetland is an ecosystem with microbes, plants and animals where they depend on each other for their sustenance. The role of wetlands has emerged as a key element in the delivery of inland freshwater and coastal ecosystem conservation through the Convention on Biological Diversity (CBD, 1992) and Ramsar Convention on Wetlands (RCW, 1971).

Wetland means the areas with sufficient wetness. The wetland soil is generally very rich in nutrients, which is very much responsible for its interesting floral and faunal diversity. These are the areas where terrestrial habitat meets with the aquatic habitat and the depth of water is not more than 6 meters. Wetlands are the richest ecosystems after the tropical rain forests of the world (Chowdhury, 2009). According to Tiner (1999) it is a generic term used to define universe of wet habitats including marshes, swamps, bogs, fens and similar areas.

From the ancient time the wetlands have been considered as of great importance for the human society and settlements. For that all the civilization, business, and population grown and migrated along with larger water bodies and river courses. Majority of the large wetlands were used and modified as ports for trade related activities. But, since around 200 years ago, the British Government concentrates their trade policy through improving road communications and the wetlands and rivers lost their status. After that the wetlands were started to be neglected and treated as *wastelands* throughout the world, but people always use or take all sorts of facilities from such places. In recent years, during the last 6 – 7 decades, it drew the attention of scientists and environmentalists throughout the world for its great importance from different points of view.

Wetlands, which are covering aquatic, marshy and terrestrial habitat are also considered as *ecotonal* habitat (Mitsch and Gosselink, 1993). These clearly show their capacity to hold rich biodiversity that support aquatic, marsh and land vegetation. It is a transition zone of tension between two or more communities (Clark, 1954; Odum, 1959). But, few wetlands are surrounded by the upland areas those are not supporting the *ecotonal* habitat. The combination of biotic and abiotic systems of such areas is maintained by its annual periodic hydrological cycle, which can maintain the nutrient and pollutant concentration of water and soil.

## 1.1. Ramsar Convention

An intergovernmental treaty has been adopted on February 2, 1971 in Ramsar city of Iran through a convention entitled “*The Convention on Wetlands of International Importance especially as Waterfowl Habitat*”, reflects the original emphasis upon the conservation and wise use of wetlands primarily as habitat for water birds”. The convention is now called as “Convention on Wetlands” Ramsar, Iran (RCW, 1971)” or popularly as the “Ramsar Convention”. Ramsar is the first of the modern global intergovernmental treaties on the conservation and sustainable use of natural resources of wetland areas. There are presently 165 Contracting Parties to the Convention, with 2,106 wetland sites, covering 205,134,098 hectares areas under Ramsar List of Wetlands for their International Importance.

The Convention classifies the wetlands in the following manner:

**Marine:** coastal wetlands including coastal lagoons, rocky shores, and coral reefs

**Estuarine:** including deltas, tidal marshes, and mangrove swamps

**Lacustrine:** wetlands associated with lakes

**Riverine:** wetlands along rivers and streams

**Palustrine:** meaning “marshy” - marshes, swamps and bogs

## 1.2. Definitions of Wetlands

Wetlands are such ecosystems or units of the landscape those are found on the interface between the water and terrestrial where the water is the main factor along with the contribution of characteristics of soil, vegetation and animal life. As for everything in this universe, wetlands also bearing its proper definition and its number are well over 50. A number of definitions were established by different persons, agencies and countries in different times. Among the several definitions few selected are given below:

Wetlands are defined differently by countries in their domestic legislations (MoEF, 2009). Most of the countries are given narrow interpretation to the definition in order to limit the ambit and scope of protection to wetlands. According to most widespread definition wetlands are defined as “lands transitional between terrestrial and aquatic eco-systems where the water table is usually at or near the surface or the land is covered by shallow water”. Even though there are 163 contracting parties to the Ramsar Convention, but there is no sufficient legislative protection available in many countries to protect wetlands. The nonprotection of wetlands is mainly attributed to its categorisation in legislations differently in different countries.

Under the Ramsar Convention on Wetlands, “wetlands” are defined in Articles 1.1 and 2.1 as shown below:

### 1.1.1. Article 1.1

“For the purpose of this Convention wetlands are areas of marsh, fen, peat-land 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 six meters.”

### 1.1.2. Article 2.1

“May incorporate riparian and coastal zones adjacent to the wetlands, and islands or bodies of marine water deeper than six meters at low tide lying within the wetlands.”

### 1.1.3. The Indian definition is as follows:

“‘wetland’ means an area or of marsh, fen, peatland or water; 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 six meters and includes all inland waters such as lakes, reservoir, tanks, backwaters, lagoon, creeks, estuaries and manmade wetland and zone of direct influence on wetlands that is to say the drainage area or catchment region of the wetlands as determined by the authority but does not include main river channels, paddy fields and the coastal wetland covered under the notification of the Government of India in the Ministry of environment and Forest, S.O number 114 (E) dated the 19th February, 1991.”

Wetlands are the areas those have acquired special characteristics from being wet on a regular or semi-regular basis. Indian definition is much wider than what the Ramsar Convention provides for. The Kerala Conservation of Paddy land and Wetland Act, 2008 defines wetland in Section 2(XVII) as: “wetland” means land lying between terrestrial and aquatic systems, where the water table is usually at or near the surface or which is covered by shallow water or characterized by the presence of sluggishly moving or standing water, saturating the soil with water and includes backwaters, estuary, fens, lagoons, mangroves, marshes, salt marshes and swamp forests but does not include paddy lands and rivers.

One of the earliest wetland definitions was given by Nathaniel (1980), who defined it in a report: “*General Account of the Freshwater Morasses of the United States*” as “*all areas... in which the natural declivity is insufficient, when the forest cover is removed, to reduce the soil to the measure of dryness necessary for agriculture. Wherever any unprofitable until the land is necessary to secure this desiccation, the area is classified as swamp*”.

“..... *areas of seasonally, intermittently, or permanently waterlogged soils or inundated land, whether natural or artificial, fresh or saline, e.g., waterlogged soils, ponds, billabongs, lakes, swamps, tidal flats, estuaries, rivers and their tributaries.*” (AWAC, 1977).

*Wetlands form the transitional zone between land and water, where saturation with water is the dominant factor determining the nature of soil development and the types of plant and animal communities living in and on it* (Cowardin *et al*, 1979).

Wetlands are “*land permanently or temporarily under water or waterlogged. Temporary wetlands must have surface water or water logging of sufficient frequency and/or duration to affect the biota. Thus the occurrence, at least sometimes, of hydrophytic vegetation or use by water birds is necessary attributes. This wide definition includes some areas, whose wetland nature is arguable, notably land subject to inundation but having little or no hydrophytic vegetation and bare ‘dry lakes’ in the arid interior*” (Paijmans *et al*, 1985).

“*A wetland is an ecosystem that depends on constant or recurrent, shallow inundation, or saturation at or near the surface of the substrate. The minimum essential characteristics*

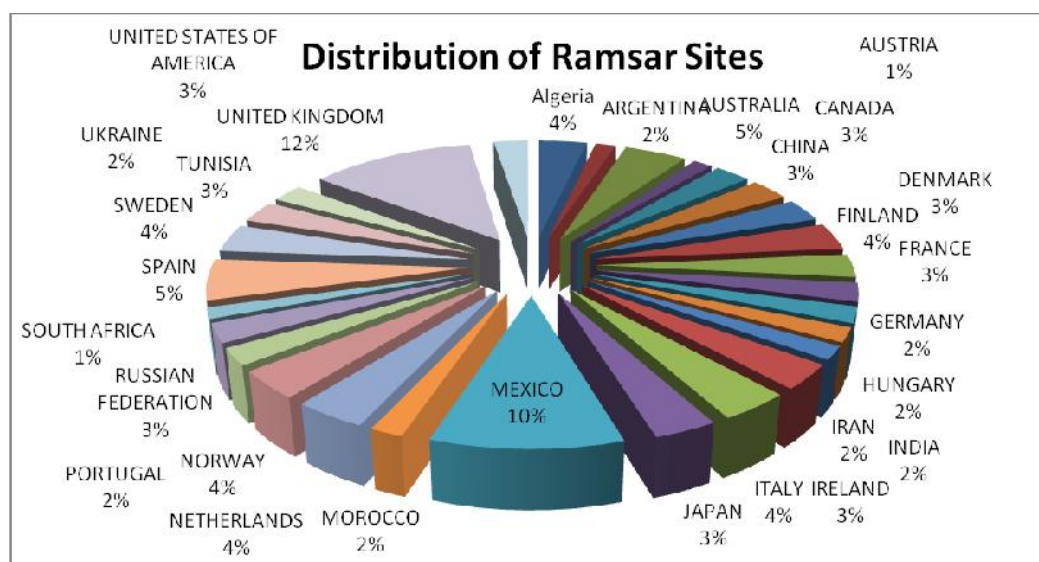
of a wetland are recurrent, sustained inundation, or saturation at or near the surface and the presence of physical, chemical, and biological features reflective or recurrent, sustained inundation or saturation. Common diagnostic features of wetlands are hydric soils and hydrophytic vegetation. These features will be present except where specific physiochemical, biotic or anthropogenic factors have removed them or prevented their development” (NRC, 1995).

### 1.3. Distribution and Classification of Wetlands

Wetlands are being an unseen storehouse of nature’s bounty and a gift of nature to mankind which act as regulators and reservoirs for rivers (Raju, 2012). But, the area of wetlands has been declining in every country due to invasion of the population and exploitation of natural resources which are non-environmental friendly (Smoktonowicz, 2005). People think that wetlands are unproductive areas free for filling and use of developmental needs (Kilborn 1991). Their ecological and economic functions are undermined for the last decades. The pollutant discharges, land filling, overpopulation and unrestricted exploitation of wetland resources are threatening the very existence of these environmentally fragile habitats (Squillace, 2007). World wide wetland distribution given by U.S. Agriculture department in 2007 (Fig. 1.4). The Ramsar Convention is a concerted effort of nations to protect these identified areas based on the principle of “wise use” of resources. Presently it covers 2189 protected sites all over the world which covers 208,802,675 hectares of land (<http://www.ramsar.org/>).

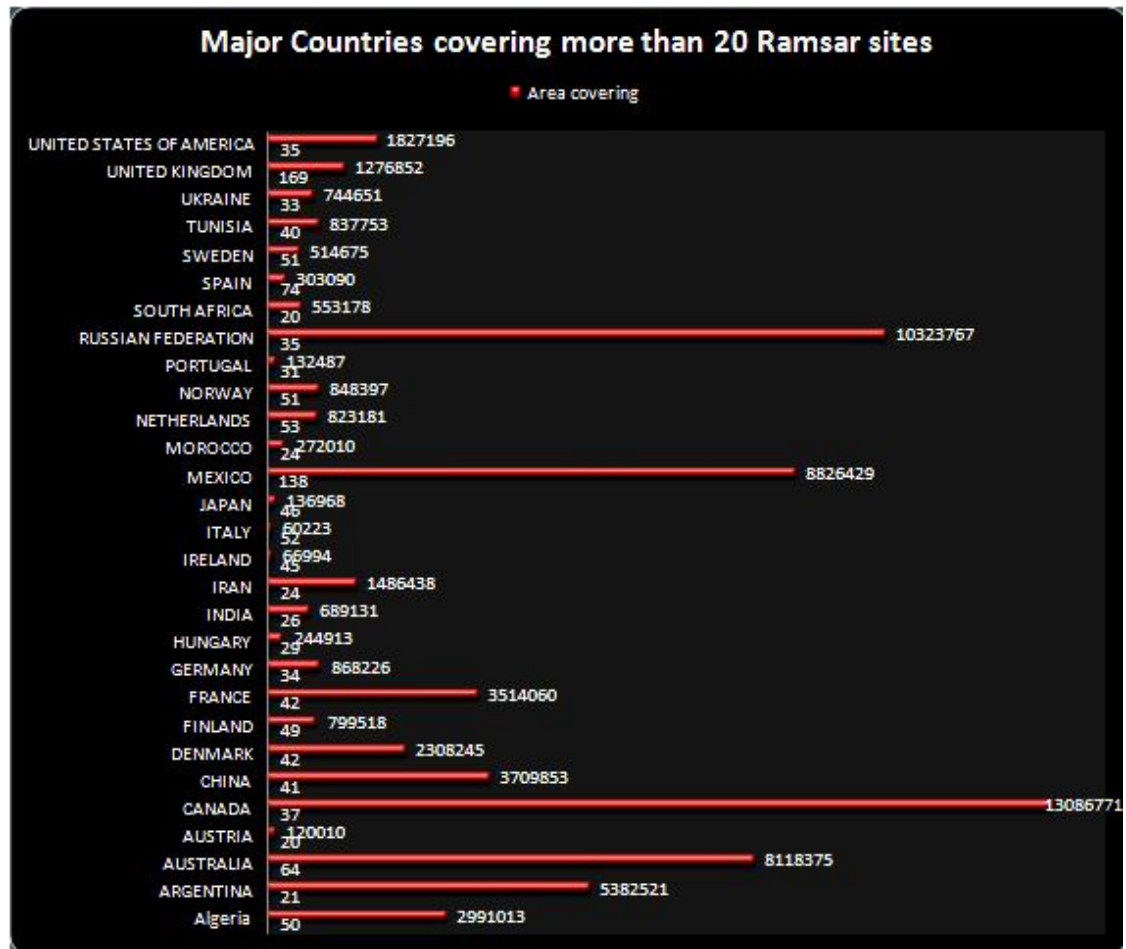
#### 1.3.1. Global scenario

Wetlands are distributed throughout the world from temperate to tropics, from glacial mountain to plains. Two-third areas of this blue planet are covered by water (UNEP, 1994). Total acquired percentage of land declared as Ramsar Site in the World is given in the Fig. 1.1. below. 97.5 % water of total hydrological system is deposited in the oceans those are 71.5 % of the total global

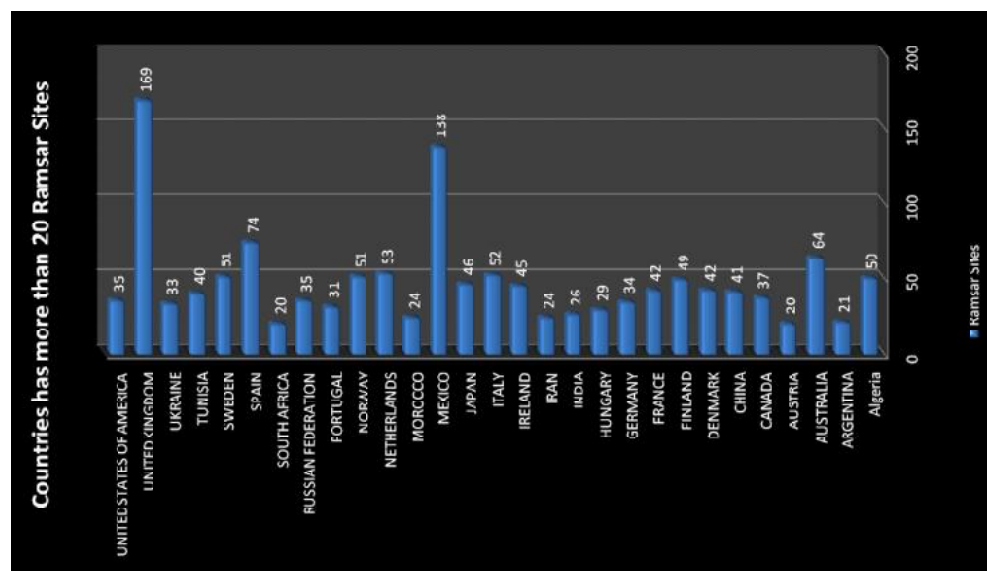


**Fig. 1.1.** Distribution of Ramsar sites worldwide

area. The World Conservation Monitoring Center has suggested an estimate of about 5.7 million square kilometers - roughly 6 % of the earth's land surface [WCMC, 1992] as wetlands. Out of this 6 % of total wetlands, only 2.53 % area covers fresh water wetlands and the rest vast areas are under seawater (WCMC, 1992; Chowdhury, 2009).

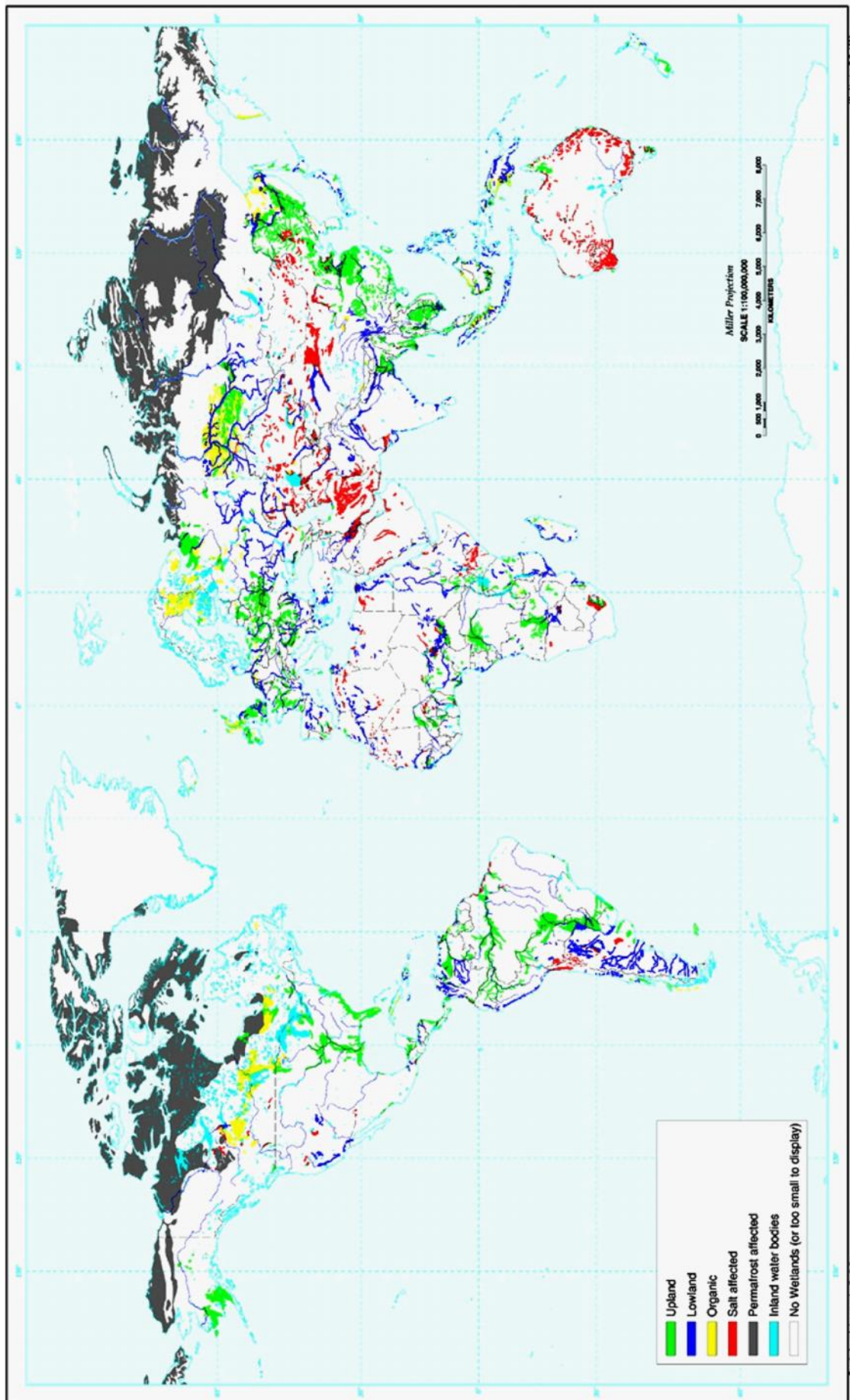


**Fig. 1.2.** Major countries covering Ramsar Wetlands in Hectors



**Fig. 1.3.** Major countries covering more than 20 Ramsar Wetlands

Fig. 1.4. Distribution of Wetlands Worldwide



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). Major countries has more than 20 Ramsar sites are given in the graph Fig.1.3 and their land cover is given in the graph Fig.1.2.

### 1.3.2. *Indian sub-continental scenario*

India, with its annual average rainfall of over 130 cm, varied topography and climatic regimes supports and sustain diverse and unique wetland habitats (Prasad *et al*, 2002). Natural wetlands in India consists of the high altitude Himalayan lakes, followed by wetlands situated in the flood plains of the major river systems, saline and temporary wetlands of the arid and semi-arid regions, coastal wetlands such as lagoons, backwaters and estuaries; mangrove swamps; coral reefs and marine wetlands, and so on (Prasad *et al*, 2002). In addition to the various types of natural wetlands, a large number of man-made wetlands also contribute to the faunal and floral diversity. The various reservoirs, shallow ponds and numerous tanks support wetland biodiversity and add to the country's wetland wealth. It is estimated that freshwater wetlands alone support 20 % of the known range of biodiversity in India (Deepa and Ramachandra, 1999). Wetlands in India occupy 58.2 million hectares, including areas under wet paddy cultivation (Directory of Indian Wetlands). Majority of the inland wetlands are directly or indirectly dependent on the major rivers like, Ganga, Bhramaputra, Narmada, Godavari, Krishna, Kaveri, Tapti (Prasad *et al*, 2002).

The Indian wetlands support 20 % of total Biodiversity of the country (Deepa and Ramachandra, 1999). Gopal (1995) prepared a list of over 1200 plant species and a partial list of animals those are found in Indian aquatic and wetland systems.

In India, assessment of country's wetland wealth has been conducted in different times. Primary inventory by the Department of Science and Technology, Government of India recorded a total of 1,193 wetlands, covering an area of about 3,904,543 ha, of which 572 were natural (Scott and Poole, 1989). The latest inventory records a total of 67,429 wetlands from India, 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). In India a variety of wetlands are found which cover inland and coastal areas even ponds than small ephemeral water bodies. Excluding rivers, wetland area of India is occupied by 18.4 % of total land-area of the country. Of this the major part of 70 % is concerned with paddy field (Chowdhury, 2009).

Indian Wetlands are distributed in different geographical regions ranging from Himalayas to Deccan plateau. For this wide diversity, which is chiefly responsible its variability in climatic conditions and changing topography. Anonymous (2007) classified these wetlands into different types based on their origin, vegetation, nutrient status, thermal characteristics, like:

1. **Glaciatic Wetlands** [e.g., *Tsomoriri* in Jammu & Kashmir; *Chandertal* in Himachal Pradesh]
2. **Tectonic Wetlands** [e.g., *Nilnag* in J&K; *Khajjiar* in HPradesh; *Nainital* and *Bhimtal* in Uttaranchal]
3. **Oxbow Wetlands** [e.g., Dal Lake, Wular Lake in J&K; Loktak Lake in Manipur and some wetlands in the river plains of Brahmaputra and Indo-Gangetic regions. Deepor Beel in Assam, Kabar in Bihar, Surahthal in Uttar Pradesh]
4. **Lagoons** [e.g., Chilika in Odisha]

5. **Crater Wetlands** [Lonar lake in Maharashtra]
6. **Salt Water Wetlands** [e.g., *Pangong Tso* in Jammu & Kashmir; *Sambhar* in Rajasthan]
7. **Urban Wetlands** [e.g., *Dal Lake* in J & K; *Nainital* in Uttaranchal; *Bhoj* in Madhya Pradesh]
8. **Ponds/Tanks, man-made Wetlands** [e.g., *Harike* in Punjab; *Pong Dam* in Himachal Pradesh]
9. **Reservoirs** [e.g., *Idukki*, *Hirakud dam*, *Bhakra-Nangal dam*)]
10. **Mangroves** [e.g., *Bhitarkanika* in Odisha]
11. **Coral reefs** [e.g., *Lakshadweep*]
12. **Creeks** [*Thane Creek* in Maharashtra), **sea grasses, estuaries, thermal springs** are some other kinds of wetlands in the country.

**Table 1.1.** State wise distribution of wetland areas in India

Sl. No.	State	Natural Wetland		Artificial Wetland	
		No.	Area (ha)	No.	Area (ha)
1	Andhra Pradesh	219	1,00,457	19,020	4,25,892
2	Arunachal Pradesh	2	20,200	NA	NA
3	Assam	1394	86,355	NA	NA
4	Bihar	62	2,24,788	33	48,607
5	Goa	3	12,360	NA	NA
6	Gujarat	22	3,94,627	57	1,29,660
7	Haryana	14	2,691	4	1,079
8	Himachal Pradesh	5	702	3	19,165
9	Jammu & Kashmir	18	7,227	NA	21,880
10	Karnataka	10	3,320	22,758	5,39,195
11	Kerala	32	24,329	2,121	2,10,579
12	Madhya Pradesh	8	324	53	1,87,818
13	Maharashtra	49	21,675	1,004	2,79,025
14	Manipur	5	26,600	NA	NA
15	Meghalaya	2	NA	NA	NA
16	Mizoram	3	36	1	1
17	Nagaland	2	210	NA	NA
18	Odisha	20	1,37,022	36	1,48,454
19	Punjab	33	17,085	6	5,391
20	Rajasthan	9	14,027	85	1,00,217
21	Sikkim	42	1,107	2	3
22	Tamilnadu	31	58,068	20,030	2,01,132
23	Tripura	3	575	1	4,833
24	Uttar Pradesh	125	12,832	28	2,12,470
25	West Bengal	54	2,91,963	9	52,564
<b>TOTAL</b>		<b>2167</b>	<b>14,58,580</b>	<b>65,251</b>	<b>25,87,965</b>

NA = Not available



The wetland systems of India are differentiating into 8 regions:

1. Reservoirs of the Daccan plateau of south and lagoons and other wetlands of south-western coast.
2. Saline expanses of Rajasthan, Gujarat and the gulf of Kachchh.
3. Fresh water lakes and reservoirs from Gujarat eastwards through Rajasthan (Kaeoladeo Ghana National Park) and Madhya Pradesh.
4. The delta wetlands and lagoons of East coast (Chilika Lake); the freshwater marshes of Gangetic plains.
5. The floodplain of the Brahmaputra.
6. The marshes and swamps in the hills of North-East India and Himalayan foothills.
7. The lakes and rivers of the mountain region of Kashmir and Ladakh.
8. The mangroves and other wetlands of the island areas of Andaman and Nicobar Islands.

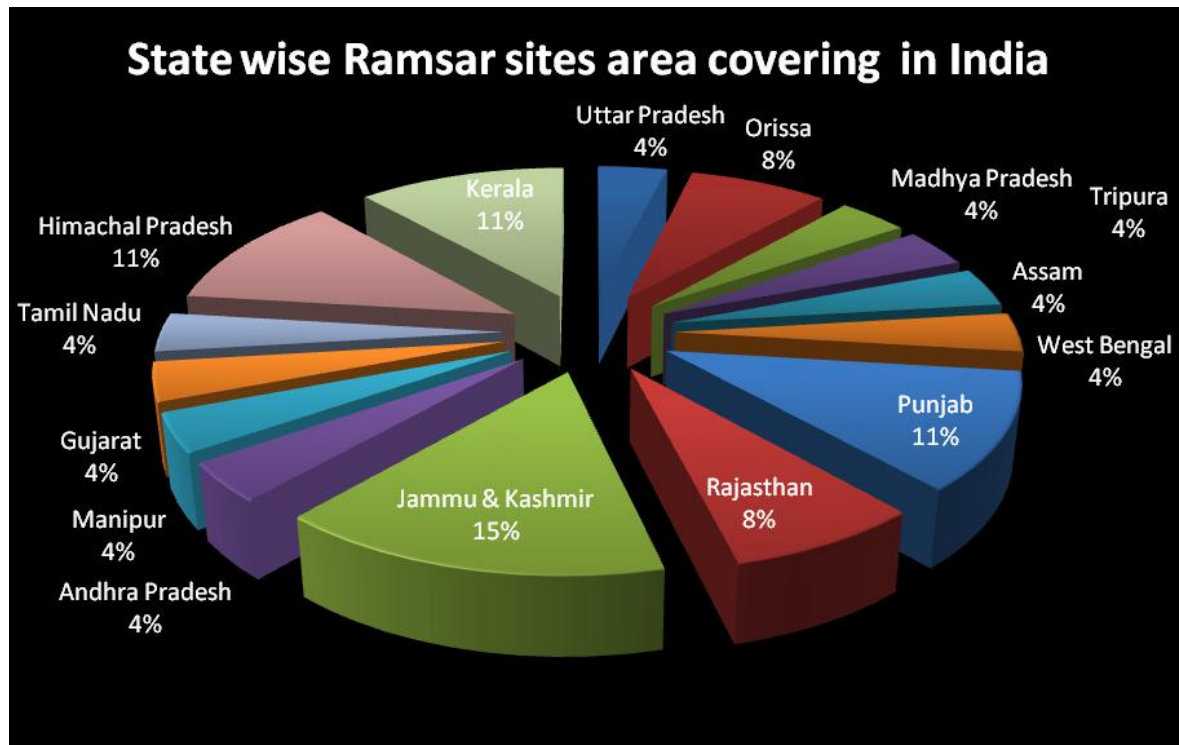
As per satellite data it was estimated that 75.8 million hector (ISRO, 1998) areas of total geographical land of India is wetlands which are widely distributed in different parts of the country (Fig.1.5). It is estimated that over 98 wetlands are matching with the criteria under the Ramsar Convention and 68 wetlands under protected areas (Chowdhury, 2009). However, so far, among all wetlands of the country, only 26 wetlands are declared as Ramsar Sites. State-wise distribution of wetlands in India (Chatrath, 1992; Chowdhury, 2009) is given in Table 1.1.

The details of the so far declared 26 Ramsar Sites in Indian Territory (ISRO, 2013) are shown in Table 1.2 below:

**Table 1.2.** Declared Ramsar Sites in India

Ramsar Site	Established on	State	Area in ha	Location
Ashtamudi Wetland	19/08/2002	Kerala	61,400	08°57'N 076°35'E
Bhitarkanika Mangroves	19/08/2002	Odisha	65,000	20°39'N 086°54'E
Bhoj Wetland	19/08/2002	Madhya Pradesh	3,201	23°14'N 077°20'E
Chandertal Wetland	08/11/2005	Himachal Pradesh	49	32°29'N 077°36'E
Chilika Lake	01/10/1981	Odisha	116,500	19°42'N 085°21'E
Deepor Beel	19/08/2002	Assam	4,000	26°08'N 091°39'E
East Calcutta Wetlands	19/08/2002	West Bengal	12,500	22°27'N 088°27'E
Harike Lake	23/03/1990	Punjab	4,100	31°13'N 075°12'E
Hokera Wetland	08/11/2005	Jammu & Kashmir	1,375	34°05'N 074°42'E
Kanjli	22/01/2002	Punjab	183	31°25'N 075°22'E
Keoladeo National Park	01/10/1981	Rajasthan	2,873	27°13'N 077°32'E
Kolleru Lake	19/08/2002	Andhra Pradesh	90,100	16°37'N 081°12'E
Loktak Lake	23/03/1990	Manipur	26,600	24°26'N 093°49'E
Nalsarovar Bird Sanctuary	24/09/2012	Gujarat	12,000	22°46'N 072°02'E
Point Calimere Wildlife & Bird Sanctuary	19/08/2002	Tamil Nadu	38,500	10°19'N 079°38'E
Pong Dam Lake	19/08/2002	Himachal Pradesh	15,662	32°01'N 076°05'E
Renuka Wetland	08/11/2005	Himachal Pradesh	20	31°37'N 077°27'E
Ropar	22/01/2002	Punjab	1,365	31°01'N 076°30'E

Rudrasagar Lake	08/11/2005	Tripura	240	23°29'N 090°01'E
Sambhar Lake	23/03/1990	Rajasthan	24,000	27°00'N 075°00'E
Sasthamkotta Lake	19/08/2002	Kerala	373	09°02'N 076°37'E
Surinsar-Mansar Lakes	08/11/2005	Jammu & Kashmir	350	32°45'N 075°12'E
Tsomoriri	19/08/2002	Jammu & Kashmir	12,000	32°54'N 078°18'E
Upper Ganga River (Brijghat to Narora Stretch)	08/11/2005	Uttar Pradesh	26,590	28°33'N 078°12'E
Vembanad-Kol Wetland	19/08/2002	Kerala	151,250	09°50'N 076°45'E
Wular Lake	23/03/1990	Jammu & Kashmir	18,900	34°16'N 074°33'E



**Fig. 1.5.** State wise distribution of Ramsar Site area covering in India

#### 1.4. Conservation of Inland Lakes

India is a big country and from the Table 1.2 it is clear that those are distributed in different corners of the country and are in different states. However, there are large number of man-made and natural Lakes in India and many of those are also conserved under the National Lake Conservation Programme (NLCP). Such state-wise numerical distribution of conserved lakes has been presented in Table 1.3.

#### 1.5. Wetlands of West Bengal

The Indian state of West Bengal is lies mostly in the Indo-Gangetic floodplain and is blessed with the presence of several wetlands. The northern part of the state is also extending into the sub-alpine hilly regions on the Singalila Range of the Eastern Himalaya. These wetlands are distributed from high altitude Darjeeling hills to the plains of Southern part of Bengal. The wetlands of West Bengal are mainly lakes, floodplains, marshes, bogs and estuaries of Sunderbans (Chowdhury, 2009). The Census report data placed by the Ministry of Environment and Forests, Government of India recorded 23 large fresh water wetlands for West Bengal.

**Table 1.3.** State-wise list of Lakes approved under National Lake Conservation Programme (NLCP)

State	No. of Lake
Andra Pradesh	1
Jammu and Kashmir	1
Karnataka	12
Kerala	1
Madhya Pradesh	1
Maharashtra	12
Odisha	1
Rajasthan	1
Tamil Nadu	2
Tripura	3
Uttaranchal	5
West Bengal	1
NLCP General	1
<b>TOTAL:</b>	<b>42</b>

Here in West Bengal 3,44,570 hectares area is under fresh water wetlands and 4200 sq km area is under Mangrove ecosystem. As per Chatrath (1992), there are 54 natural and 9 artificial wetlands are present in West Bengal which are covering the areas 2,919,63 hectares and 52,564 hectares respectively. The fresh water wetlands of the state include lakes, marshes, floodplains, rivers and lowland agricultural areas. The wetland system of West Bengal is divided into in three regions (IWMED, 1997) based on land topography:

**A. Sub-Himalayan region** that generally extended from Darjeeling to eastern bank of Ganga river i.e. upto Maldah district. These areas includes Hilly tracts of Darjeeling, Duars and Terai of Jalpaiguri and Koch Behar and low land floodplains, lakes, seasonal waterlogged areas of Uttar & Dakshin Dinajpur and Maldah districts.

**B. Gangetic region** that covers plains of entire Southern part of West Bengal except the active delta and coastal areas. This area covers all the district of Southern Bengal except North and South 24-parganas and costal part of the Purba Medinipur districts.

**C. Coastal region** that covers only North and South 24-parganas and Costal part of the Purba Medinipur districts. This region includes India's largest salt-water wetlands that are situated in *Sunderban* areas (forming a part of the Sundarban Biosphere Reserve).

Based on the total area, 24- Parganas (North and South together) holding first position for wetland but majority of the wetlands of this district are salt water or estuarine. Chowdhury 2009 arrange wetlands of West Bengal district-wise as shown in Table 1.4.

Out of 26 Ramsar sites of India only one, East Calcutta Wetland, is situated within the boundary of this state. This is one highly disturbed wetland, mostly used for pisciculture and a place for draining out of the sewage water of the Kolkata metropolis. Its biodiversity appears to be highly affected due to accumulation of sewage water and numerous other anthropological activities.

**Table 1.4.** District-wise distribution of wetlands in West Bengal

Sl. No.	District	Number	Type	Area (ha)
1.	24- Parganas (N & S)	1528	Fresh & Salt water	367900.74
2.	Maldah	562	Fresh water	29416.95
3.	Murshidabad	608	Fresh water	22076.89
4.	Medinipur ( <i>sensu lato</i> )	750	Fresh & Salt water	20807.00
5.	Puruliya	497	Fresh water	16804.89
6.	Birbhum	208	Fresh water	1741.56
7.	Nadia	446	Fresh water	12292.57
8.	West Dinajpur	493	Fresh water	10699.37
9.	Bankura	530	Fresh water	6913.6
10.	Bardhaman	630	Fresh water	6412.34
11.	Koch Behar	335	Fresh water	4930.51
12.	Howrah	112	Fresh water	1925.65
13.	Hoogly	184	Fresh water	1631.19
14.	Jalpaiguri	153	Fresh water	1089.99
15.	Darjeeling	44	Fresh water	271.79
16.	Kolkata	1	Fresh water	4.37
<b>Total:</b>				<b>504919.41</b>

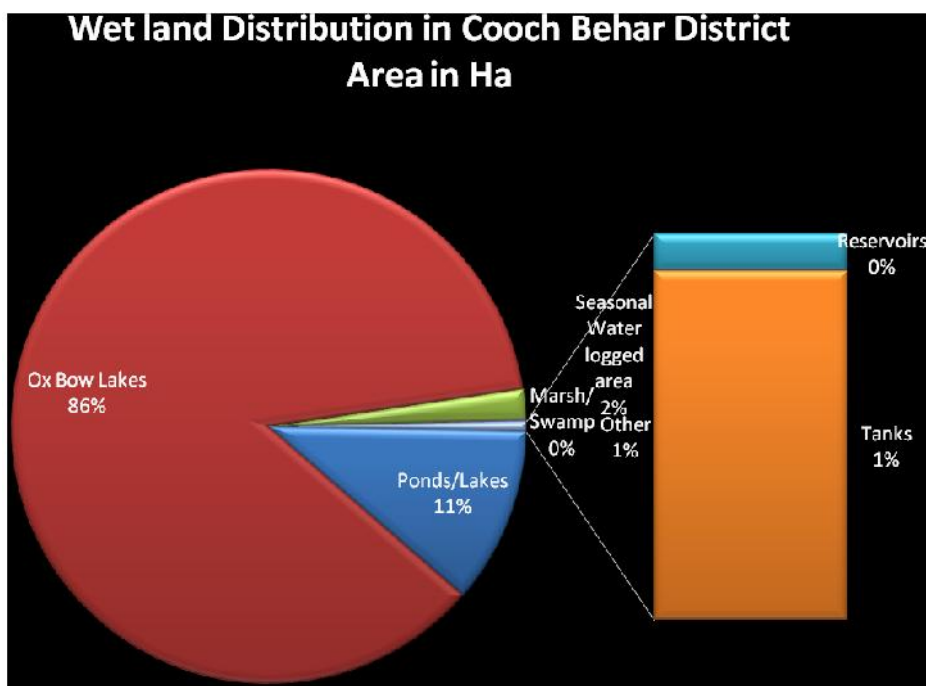
### 1.5.1. Wetland of Cooch Behar

Cooch Behar is essentially a flat district with a slight south-eastern slope along which the main rivers of the district are flowing. Some part of the district is comparatively lower and the rest portion of the district is slightly higher. The lower portion is inundated by the rivers during the monsoon period. So, the majority of wetlands of Cooch Behar district are *Palustrine* types (floodplains, seasonal water-logged, marsh), *Lacustrine* types (Lakes) and *Riverine* types. Maximum wetlands in the district has been originated by changing of riverine system. The district abounds in a large number of rivers and most of them have changed courses very frequently, as a result channels, meanders or ox-bow lakes are very common. Tista, Mansai, Jaldhaka, Torsa, Raidak, Shutunga and Gadadhar are the important rivers passing through this district. Rasik beel, Gossanimari Beel, Sitai Beel and Rasomati Beel came in focus of National Wetland Conservation programme. Wetlands having an area of more than 2.25 ha altogether covers 4930.51 ha which is almost 1.46 % of the total geographic area of the district. Ox Bow Lake is the dominant category of wetlands representing 86.30 % of the total wetland area (Bandyapadhyay *et al*, 2000). Majority of those show low turbidity and with their sizes below 10 ha. Inland lakes/ ponds are also available and those occupy 11.07 % of the total wetland area of the District (Fig. 1.6). All of these inland lakes are also with low turbidity of water. Waterlogged seasonal wetlands are forming the next category, so far as area coverage is concerned. It covers about 1.92 % of the total wetland area. The wetlands are locally referred as *Beel* or *Jhil*. The most of the wetlands are natural in origin and originated through the repeated sifting of different rivers of the area in the past. Except the Natural wetlands there are some artificial manmade water bodies located here and among those few are more than four hundred years old as maximum Dighis in the district were dug during the *Khen* and *Coach* Dynasty.

Bandyapadhyay *et al* (2000) enlisted the distribution of different Wetlands in Cooch Behar district are presented in Table 1.5.

**Table 1.5.** Wetlands of Coochbehar District

Wetland Type	No.	Area during		
		Total	Pre-monsoon	Post-monsoon
Ponds/Lakes	32	546	121.88	243.94
Ox Bow Lakes	280	4255.09	1537.47	3320.15
Seasonal Water logged area	15	94.84	22.01	94.84
Marsh/ Swamp	1	5.39	5.39	5.39
Reservoirs	1	2.87	00	2.87
Tanks	6	26.32	13.19	26.32
<b>TOTAL:</b>	<b>335</b>	<b>4930.51</b>	<b>1699.94</b>	<b>3693.51</b>

**Fig. 1.6.** Types of wetland cover areas in the Cooch Behar District

### 1.6. Importance of Wetlands

Few years ago, Wetlands were described as a WASTE LANDS (Chowdhury, 2009). In 21<sup>st</sup> Century, nature lovers established or realized the usefulness of wetlands and now these are referred as 'Wealth lands' (Chowdhury, 2009). Wetlands are fulfilling various needs of human being as well as greatly affects the environment which keeps our beloved habitat suitable for our survival or normal living. Wetlands are maintaining the world's ecosystem from the very beginning and are still continuing, it makes a global buffering system to make balance between high profile cities and under-developed villages and degraded forest areas. Now, wetlands are also termed as Kidney of the earth that can filter the ground water. The complete hydrological cycle of the earth is regulated or maintained by the wetland system (<http://www.ramsar.org/about/the-importance-of-wetlands>). Flood controlling is another good function of wetlands. During heavy rain in monsoon wetlands store the excess rainwater due to its low laying topography, to avoid flood and, thereby, saving human habitation, agricultural field with crops etc (<http://www.moef.nic.in/sites/default/files/Wetland%20Inventory.pdf>).

The availability of high level of nutrient in such water gradually forms a very good floral and faunal composition develops in wetlands with the lapse of time. It is true that first life, which may be

simple or complex, developed in water that gives us the role of water in life of any living organism. It is determined that wetlands are the very rich units, which supports largest concentration of biodiversity of the world just after tropical rainforests.

These are the habitats of various types of biological elements like algae, fungi, bryophytes, pteridophytes and most important group angiosperms (Warming and Raunkair, 1934).

The wetlands support very wide range of macro- and micro-animals like birds, fishes, reptiles, amphibians, zooplanktons, etc. Among them birds are very important. They choose wetlands mainly for their food (fishes, snakes, rhizome of different macrophytes, etc.), for breeding, over wintering and seasonal migration. These areas also forms the house of different migratory and domicile birds regarding including many species of threatened status. It is estimated (Cook, 1996) that about 20 % of the known species of life rely directly or indirectly on wetlands for their survival, as these are their primary and/or important seasonal habitats.

The excessive wild plant productions of wetland support the rural economy. The poor people living in nearby areas of wetland, i.e. surrounding villages collect many wild plants for their daily use as food, fodder, thatching, medicine etc. and also sold in local markets. Along with the plants, several species of fishes, mollusks are also used as food.

The marshy and floodplain areas are generally used for agricultural activities due to their high water potentiality. These areas are generally used for cultivation of wetland-crops. The seasonal rainfall and regular flooding increase the soil erosion causing filling-up of wetlands, thereby losing the depth of water. The shoreline erosion is controlled by the adventitious and densely anastomose root system of grasses and sedges.

Few species of wild submerged and marshland plants are also use as ornamentals for house hold aquariums along with different colorful fishes.

### **1.7. Wetlands in Danger**

Importance of wetlands is now well understood. It is also understood that 50 % wetlands have already disappeared from the global scenario. In USA the rate of wetland loss is maximum i.e. 85 %. People of last century, especially during the last 5 – 6 decades, treated the wetlands as *wastelands* and misused those in various ways including agricultural activities, recreation and filling-up for ‘development’ related works and these are causing great loss to these natural wet treasures (Chowdhury, 2009). Many research works exposed out several reasons and activities behind the wetland loss. Chowdhury (2009) recognized two main phases for wetland loss: the first one is anthropological which includes excessive agricultural activity, urbanization, pollution, artificially filling up, excessive tourism load etc. and other includes natural causes.

The rapid increase of human population are creating the heaviest 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. Due to overpopulation the expansion of industrial areas and related almost uncontrolled production of dangerous pollutants are dramatically increases those are creating extremely high negative pressure on wetlands and wetland-ecosystems as it is equally happening for the forest areas. But, forest areas are always treated as government property of every country and conservation strategies had been made from very early stage where as wetland conservation strategies had not been prepared by government of not a single county giving similar weightage as it is given for the forests. This particular negligence is the main cause of such drastic loss. Wetlands of each and 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 industries, various poisonous materials from different atomic power station etc. This process is still being continued in various countries of the world.

On the other hand, wetlands are also degraded by many 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 plant for decades are also the major pollutants. These situations induce growth of huge algal bloom creating eutrophication, which destroy the health of wetland ecosystems.

All these factors are responsible for converting the wetlands into non-wetland areas rapidly. According to Narayanan (1992) nearly one hectare area of wetland becomes degraded at the tick of every minute of the clock from this blue planet.

# **CHAPTER - II**

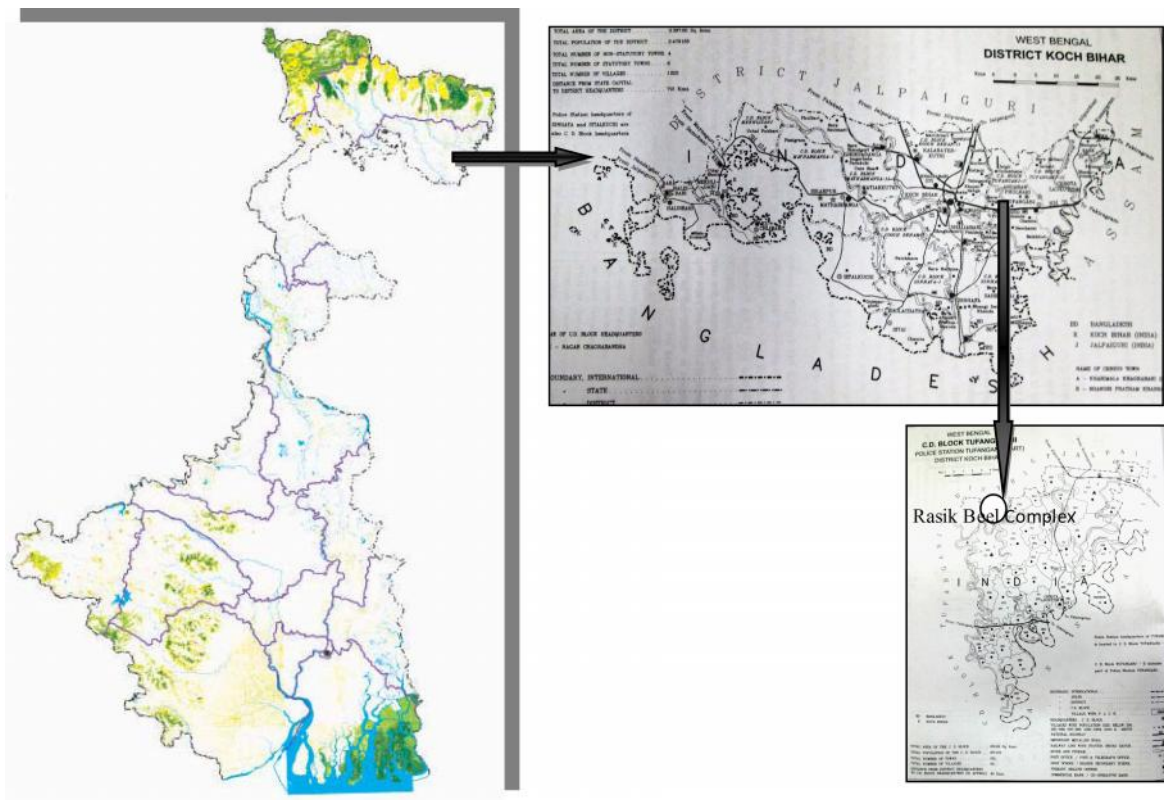


## Chapter - II

# STUDY AREA

Cooch Behar is a historically important district of West Bengal in India. The name 'Cooch Behar' has been derived from the *Koch Rajbongshi* tribe who were indigenous to this area since the time of Banasura, the great king of Asura. A Sanskrit word '*Bihar*' (to travel) is the key source of word '*Behar*', which means the land used to travel by 'Koch Rajbongshi' king. In the time of Maharaja Naranarayan, the greatest Koch Rajbanshi king, who ruled the area of the Kingdom extended from Uttar Dinajpur district including Kishanganj (Baikunthapur) to maximum part of Assam (Kamrup). The Koch Rajbanshi dynasty was originated from Mahishya community which is related to King Mahishasur (Banerjee, 1884). Koch Rajbanshi king has ruled the area since 16<sup>th</sup> century. In 1947, the state came to the dominion of India and merged with the Union of India shortly afterwards. On 19<sup>th</sup> January 1950, the state of Cooch Behar emerged as a new District for the Indian state of West Bengal (Banerjee, 1884; Ahamed, 1990).

Cooch Behar is located at the northeastern corner boundary of the State West Bengal. The Northern side is bounded by Jalpaiguri district, state of Assam in the eastern side and south and there is Bangladesh on the western border. The district is an important part of Himalayan Foothills and Duars of West Bengal [Fig. 2.1].



**Fig. 2.1.** Map showing the location of Rasik Beel complex in the Himalayan foothill region of West Bengal

Geopolitically the district is very much sensitive for its exclaves. 92 Bangladeshi exclaves, covering a total area of 47.7 km<sup>2</sup> are situated in the district but are not part of neither the district of Cooch Behar nor even of India. On the other hand, 106 Indian exclaves covering area 69.5 km<sup>2</sup> are located inside the political boundary of Bangladesh, which are very much parts of this district [Banerjee, 1884; Chowdhuri and Pal, 2010].

## 2.1. Location

The Rasik Beel complex is lies between *Burah Raidak* and *Ghoramara* Rivers in the Salbari Block under Tufanganj Sub-Division of the District of Cooch Behar, West Bengal. The geographical location at the central part of the lake is 89°44' 10" E Longitude and 26° 25'40" N Latitude (Chowdhuri and Pal, 2010). “Cooch-Behar” name is derived from the *Koch Rajbongshi* tribe name that is indigenous to this area. “Behar” is a *Sanskrit* word “*Bihar*” (to travel) which means the land which the “Koch Rajbongshi” Kings used to travel or roam about. In Geographical Census of India, the spelling of the name is use “*Koch Bihar*” ([http://www.shaba.co/wa?s=cooch\\_behar\\_district](http://www.shaba.co/wa?s=cooch_behar_district)) and local literature sometimes uses “*Coochbehar*” (<http://www.census2011.co.in/district.php>). State Government and the District Administration use the name “*Cooch Behar*” and this spelling is used to the current dissertation.

It is situated about 42 km of east from the district town Cooch Behar This Beel complex is well connected by two parallel metaled roads. The one on its western side extends from Harir-haat to Kamakshyaguri and the other is extending from Bakla to Kamakshyaguri. Again, the area is 34 km away from the Alipurduar town and 20 km from Tufanganj Sub-divisional town on road [Fig. 2.2]. The nearest railway station is Alipurduar (Chowdhuri and Pal, 2010).



**Fig. 2.2.** Brown lines are showing the main-road communication of the Rasik Beel area

The Rasik Beel is located very near to two IUCN recognized Hotspots for Conservation, namely ‘Himalaya’ and ‘Indo-Burma’ (Biswas, 2013). It is an Ox Bow Lake and is a left over detached part of the river Raidak. The area of the Beel is 178 hectors (Chowdhuri and Pal, 2010; Ahamed, 1990).

Two branches of this river are now flowing through two sides of Rasik Beel in north-south direction [Fig. 2.4]. The main River of Raidak- I in Western part of the Beel complex, and Raidak- II in the Eastern side of Beel Complex [Fig. 2.6]. Presently, both the rivers are passing through about one kilometer away from the Beel Complex, but their rejected two branches are now remaining as narrow streams (Banerjee, 1884).



**Fig. 2.3.** Present structure of Rasik Beel complex

The nearby areas of the Beel was covered with dense forest vegetation (Annonimus, 2005). The Western and North-Western sides are covered with Changmari Protected Forests [Fig. 2.4], North Eastern side is surrounded with Atiamocher Protected Forest and Takomari Protected Forest is spreading on the Eastern side of the Beel complex. But due to rapid increase of human settlements, acquiring land for cultivation and due to continuous legal and illegal timber extraction most of the forested area are now either missing or disappearing fast (Annonimus, 2011).



**Fig. 2.4.** Changmari forest within Rasik Beel complex



**Fig. 2.5.** Villages in the surrounding areas of Rasik Beel complex

There are many villages surrounding the Beel Complex in South-West to South-Eastern areas [Fig. 2.5]. The main villages of the study area are Rasik Beel, Changmari, Bochamari, Atiamochar and Salmari villages (Chowdhuri and Pal, 2010).

Shifting of the courses of rivers in this part of the country was a common phenomenon in recent-past (Kadir and Das, 2002; Pandit *et al.* 2004; Ghosh and Das 2005; Das *et al.* 2010; Chowdhuri and Pal, 2010). And, that has created a number of large and small Ox Bow lakes in this region like Rasik Beel, Nildoba Beel, Raichangmari Beel, Bochamari Beel, etc [Fig. 2.8; PLATE: 1; PLATE: 2]. Rasik Beel wetland complex is surrounded by Chengmari, Baro Salmari, Atiamochar and Takomari protected forests [Fig. 2.4].

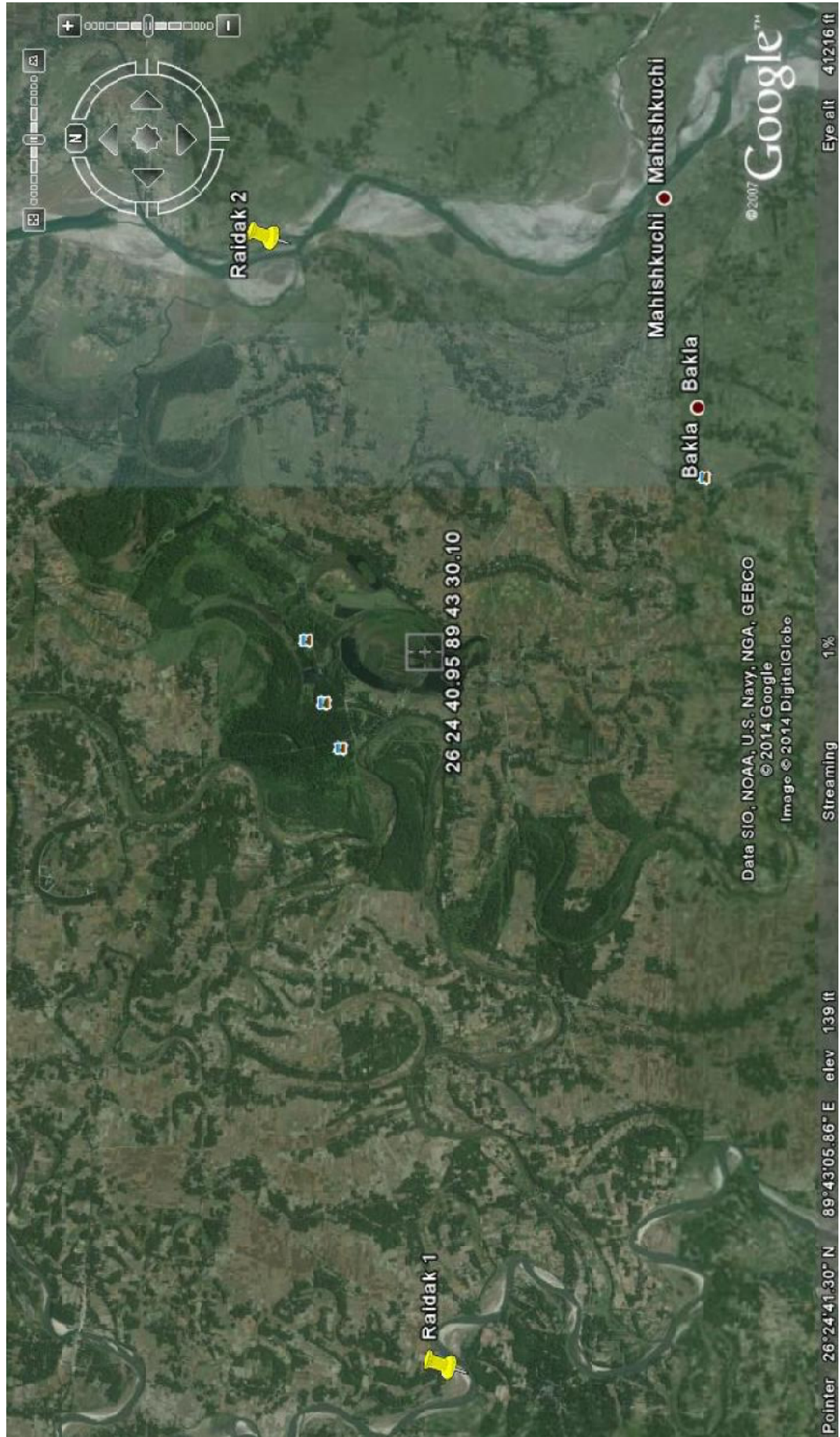


Fig. 2.6. Google Earth imagery showing Rasik Beel Rivercourses of Raidak-I and Raidak-II

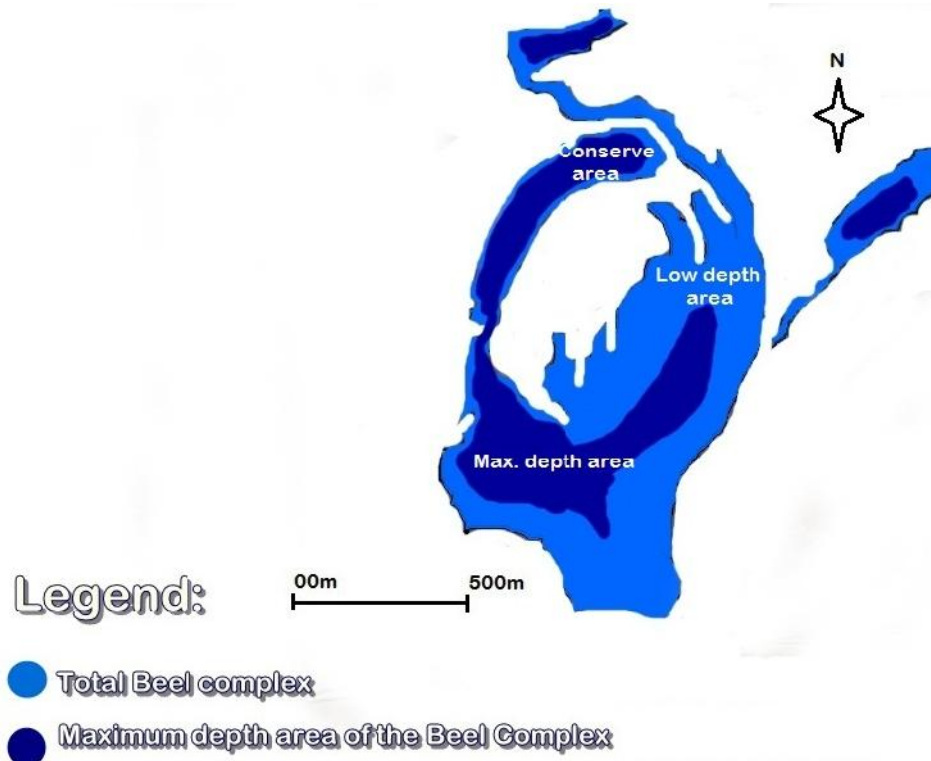


Fig. 2.7. Google Earth imagery showing seven Beels of Rasik Beel Complex

## 2.2. Topography and Drainage

Rasik Beel and its surrounding area is almost flat and low. The altitude against the mean sea level is only 15 m to 30 m amsl. Local rivers like Raidak- I and II, Burah Raidak and Ghoramara constitute the drainage system in this area. Rivers like Bala, Jainti, Sonkosh, Godadhor, Gholani etc. supply their excess water into the Beel during monsoon that result the flooding over huge areas almost every year. All the rivers are generally flowing in North to South direction. The result of shifting of Raidak-I and Raidak-II, the rejected courses are remaining as a Nala, which flooded during monsoon but remain water free in dry seasons (Banerjee, 1884) [Fig. 2.4].

In Bengali, the word ‘Beel’ means large water body. Rasik Beel is a complex of eight large wetlands and are known by different names: Noldoba Beel, Bochamari Beel, Rasik Beel, Batikata Beel, Ververi Beel, Borojan Beel, Chhotojan Beel and Raichangmari Beel [Fig. 2.7].



**Fig. 2.8.** Main water bodies of Rasik Beel complex

Raichangmari Beel is the deepest wetland and it is kept under protected areas. Fishing is prohibited from this part of the Beel complex, other seven Beels are open for fishing and as well as for the cultivation of fish.

### 2.3. Soil

The study area is located in a low altitudinal zone. The altitude of different location of this complex varies from 15 m to 30 m only. Being located near to the East Himalayan foothills, the area is quite flood prone. After rains in the catchments area of Raidak I and II, generally the water current become very strong and create flood in the adjacent areas. Rivers like Bala, Jainti, Godadhor, Gholani and also Sankosh influence to flood by supplying excess water and the deposited sand, silt and pebbles cause much problems in crop productivity as well as affects the hydrology of the area (Banerjee, 1884). So, soil is formed by alluvial deposits and is acidic in nature. It is mainly loam to sandy loam and from 0.15 to 1 m deep. The soil has a low level of organic matter, while potassium and phosphorus levels are medium. Deficiency of zinc, calcium, magnesium and sulphur are quite common features (Banerjee, 1884).

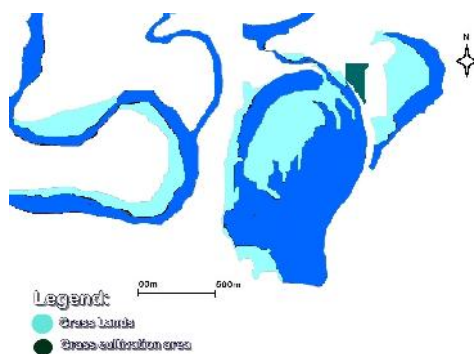
### 2.4. Vegetation Structure

The overall vegetation structure is much variable. In the permanent water cover region true hydrophytes are the only floristic elements. *Eichhornia crassipes*, *Azolla pinnata*, *Salvinia natans*, *Salvinia cucullata*, *Ceratopteris pteridoides* are the dominating plants in this part of Beel. But, the region, which remain submerged for some period of the year are hosting mainly amphibian plants (helophytic) in wet season and after receding of water a moisture loving terrestrial herbaceous flora occupy the habitat [Biswas *et al*, 2013; PLATE: 3; PLATE: 4].

In Champion & Seth's (1968) classification the area's vegetation matches partially with  $4D/SS_2$  and  $4D/SS_4$  *Tropical Seasonal Forest: Syzygium cumini swamp forest* and *Low Swamp Forest*. In the surrounding area, there are about eight villages mostly inhabited by tribal people.

The original vegetation in the surrounding area was basically *Syzygium cumini* dominated semi-evergreen type but most of the natural forests have been removed. Plantations of different exotic and native plants are developing in many areas including the contour of the central island. The Central island is now planted with mainly *Salix tetrasperma*, *Terminalia arjuna* and *Lagerstroemia reginae* [PLATE: 3; PLATE: 4].

Flood plains areas are good grasslands, dominated with *Saccharum spp.*, *Axonopus copressus* and *Commelina spp.* For Deer rehabilitation and entertainment conservation, the Forest Department has established a small plot of grassland in the Eastern part of Batikata Beel, near the Deer Conservation sector.



**Fig. 2.9.** Distribution of grasslands in the Rasik Beel complex



**Fig. 2.10.** Cultivation areas in and around the Rasik Beel complex

After the initiation of ecotourism center at Rasik Beel, a good number of garden plants also have been introduced for the beautification of the area. Some of these plants are also tending to be naturalized in the local vegetation. This is not desirable and has started affecting the native biodiversity of this area.

In addition to the garden plants Forest Department has also covered some areas with the plantation of some trees like *Albizia chinensis*, *Alstonia scholaris*, *Areca catechu*, *Artocarpus heterophyllus*, *Bamboosa tulda*, *Bauhinia purpurea*, *Bischofia javanica*, *Caryota urens*, *Dalbergia sissoo*, *Gmelina arborea*, *Lagerstroemia reginae*, *Litsea monopetala*, *Salix tetrasperma*, *Shorea robusta*, *Syzygium cumini*, *Tectona grandis*, *Terminalia arjuna*, and *Toona ciliata*.

Some portion of the Beel area has been occupied by local residents of Rasik Beel and Bochamari villages for paddy cultivation. They mainly cultivate Aush and Boro cultivars of paddy. In addition, jut (both, *Tita* and *Mitha*), potato, brinjal, chili, cabbage and other locally popular vegetables are also cultivated by them (Banerjee, 1884).

## 2.5. Fauna of Rasik Beel Complex

There are so many migratory bird species found in this wet land every year, and include Lesser Whistling, Dap chick, Bronze winged Jacana, Pheasant Tailed Jacana, Shoveler, Barheaded goose, White Eyed Poacherd etc. Except these, a lot of other local aquatic birds like small & large Cormorants, four species of Kingfisher, open bill stork etc. are the permanent residents of these beels. There are tortoise, gharial, leopard, spotted deer, peafowl and some other birds are kept in a small zoo established there, mainly as a part of tourism activities [Fig. 2. 3].

In the year 2009, Cooch Behar Forest Division in collaboration with the Zoological Survey of India conducted a bird census in the wetland complex, and has recorded the presence of 66 species of birds [[http://www.shaba.co/wa?s=cooch\\_behar\\_district](http://www.shaba.co/wa?s=cooch_behar_district)].

The entire study area comes under the protected forest and is managed by the Cooch Behar Forest Division. In recent past (January 2009) a beautiful 30m high watch tower was constructed by the Forest Department [Fig. 2.11]. There is a small zoo at Rasik Beel, which is recognized by the Central Zoo Authority, Govt. of India (Annonimus, 2013).



**Fig. 2.11.** The newly established watch tower in Rasik Beel





**PLATE - I: Landscape Figs. 1 - 8:** 1. Barajan Beel; 2. Chhotojan Beel Margin; 3. Raichangmari Beel Margin; 4. Barajan Beel Margin; 5. Raichangmari Beel; 6. Bochamari Beel; 7. Batikata Beel Margin; 8. Chhotojan Beel Margin



**PLATE - II: Landscape (continued) Figs. 9 - 16:** 9. Raichangmari Beel; 10. *Lagerstroemia spp* plantation; 11. Batikata Beel Margin; 12. Noldoba Beel; 13. Batikata Beel; 14. Park area; 15. Takomari Forest Area near Batikata Beel; 16. Bochamari Beel

# **CHAPTER - III**

### 3.1. Seasons of the year

The overall climate of the area is tropical and generally receives quite high downpour every year. This also controls the temperature and overall precipitation. Four distinct climatic seasons are observed in Rasik Beel complex area (Banerjee, 1884):

- i. Summer
- ii. Monsoon
- iii. Autumn, and
- iv. Winter.

### 3.2. Precipitation

South–Western monsoon is the primary source of rainfall. Monsoon is quite broad, extending from the middle of June to the later part of September (Chowdhuri and Pal, 2010). Rains during winter months are rare but common during summer. December is the driest month with minimum or no rainfall. However, most of the winter rain is received in March. April to May is the time of hails and thunder with some precipitation. Sometimes the dry spell becomes quite long, extending from October to March or April and that certainly adversely affects the local biodiversity. Maximum rainfall found in 2005 and 2008, but lowest precipitation found in 2006 in the data of Central Tobacco Research Institute (Table 3.1).

**Table 3.1.** Average yearly rainfall data for the period 2000 to 2009

Average Yearly Rainfall (mm): 2000 to 2009													
Year	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec	Total
2000	0	48	20	259.5	300	719	361	522	384	78	0	0	2691.5
2001	0	17	6	86	362.5	719	361	522	384	78	0	0	2535.5
2002	26.3	0	124.1	353.9	143	442.5	926	84.5	446.5	39.5	0	0	2586.3
2003	0	19	95	225	344.6	689	734	269	112	211.1	0	41	2739.7
2004	0	0	16	216	296	444	892	144	656.4	306	0	0	2970.4
2005	0.5	3	70	18.7	230.5	816.1	807.6	824	86	504.2	0	0	3360.6
2006	0	13	1.3	61.3	282.1	634.1	340.6	141.6	461.7	212	18.2	14	2179.9
2007	0	73	12.6	162.2	262.4	636.1	448.6	414.7	437.9	131.8	0	0	2579.3
2008	26	4.4	81.5	184.2	290.1	580.6	557.2	1044.8	423.6	239.6	0	3.2	3435.2
2009	0	0	25.8	91.1	246.7	770.2	244	519	249.6	250.1	0	0	2396.5
<b>Average</b>	<b>5.3</b>	<b>17.7</b>	<b>45.2</b>	<b>165.8</b>	<b>275.8</b>	<b>645.1</b>	<b>567.2</b>	<b>448.6</b>	<b>364.2</b>	<b>205</b>	<b>1.8</b>	<b>5.8</b>	<b>2747.5</b>

Source: Central Tobacco Research Institute, Dinhat, Coochbehar

### 3.3. Temperature

Temperature of the Rasik Beel area begins to raise from the end of April and reaches its maximum during June - August. Night temperature also rises and maintains at around 22° to 25° C during June

to August (Table 3.2). With the arrival of Monsoon in June the day temperature decreases by one to two degrees Celsius. Winter in the area is also quite severe, especially if it is mixed with rain.

**Table 3.2.** Average monthly maximum and minimum temperature since 2000 to 2009

Month		2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	Average
January	Max	22.7	22.8	23.2	22.1	22.6	23.8	22.4	22.1	24.5	23.6	<b>22.98</b>
	Min	10.0	8.7	10.7	8.4	9.3	8.5	10.9	8.9	10.6	11.6	<b>9.76</b>
February	Max	24.4	25.0	26.6	22.5	26.0	26.2	27.2	23.5	23.7	27.7	<b>25.28</b>
	Min	10.5	11.9	11.5	9.9	11.0	13.1	15.4	13.2	10.4	13.1	<b>12.0</b>
March	Max	28.2	30.6	29.3	27.7	30.8	29.3	30.8	28.3	28.4	31.0	<b>29.44</b>
	Min	15.8	15.1	15.6	13.6	17.2	15.2	16.0	15.2	16.8	15.5	<b>15.6</b>
April	Max	30.8	31.7	28.8	30.5	28.5	31.0	30.8	29.6	30.0	29.3	<b>30.1</b>
	Min	20.7	20.2	17.6	19.5	19.3	17.5	20.5	20.1	20.2	18.0	<b>19.36</b>
May	Max	31.0	31.2	30.1	32.1	31.9	30.6	27.2	32.5	31.2	31.6	<b>30.94</b>
	Min	22.5	22.4	21.7	21.1	21.3	18.7	22.7	23.2	22.2	18.9	<b>21.47</b>
June	Max	31.6	31.6	31.0	33.9	32.1	31.6	30.9	30.7	30.6	32.6	<b>31.66</b>
	Min	23.7	23.7	24.0	22.6	22.7	22.6	24.4	24.3	24.2	21.8	<b>23.4</b>
July	Max	31.7	31.7	30.4	32.7	31.3	29.5	32.1	30.5	30.9	32.7	<b>31.35</b>
	Min	25.2	25.2	24.2	24.2	23.0	25.2	25.6	24.8	25.1	24.1	<b>24.66</b>
August	Max	31.4	31.4	30.0	34.4	33.9	32.1	32.7	32.0	30.7	31.5	<b>32.01</b>
	Min	25.2	25.2	22.4	25.6	24.9	25.0	25.6	25.8	24.6	24.2	<b>24.85</b>
September	Max	31.1	31.1	32.0	34.5	32.1	33.2	31.0	30.9	31.6	33.1	<b>32.06</b>
	Min	24.0	24.0	23.6	24.5	23.6	24.8	24.2	24.5	24.3	23.6	<b>24.11</b>
October	Max	31.6	31.6	30.8	31.3	30.2	29.4	30.9	30.7	31.2	31.2	<b>30.89</b>
	Min	22.4	22.4	21.3	21.6	19.6	20.8	21.1	22.0	21.5	20.1	<b>21.28</b>
November	Max	27.5	27.5	28.0	28.9	29.0	27.9	26.8	28.7	28.0	27.8	<b>28.01</b>
	Min	17.1	17.1	16.4	17.2	14.6	15.4	16.5	16.9	15.1	14.8	<b>16.11</b>
December	Max	24.7	24.7	24.3	25.6	27.2	25.9	24.5	24.6	24.5	24.0	<b>25.0</b>
	Min	10.9	10.9	12.6	12.6	11.3	11.6	12.3	11.1	14.0	11.2	<b>11.85</b>

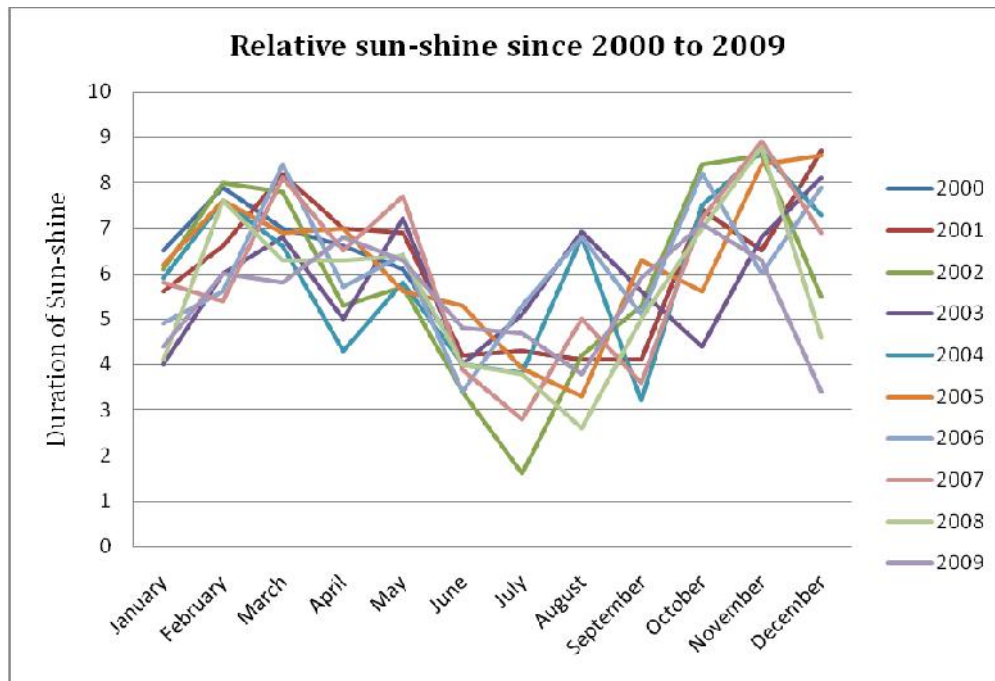
Source: Central Tobacco Research Institute, Dinahata, Coochbehar

### 3.4. Sun-shines

The Sun-shine period of the Rasik Beel area begins to raise from October and reaches its maximum in October and November (Fig. 3.1). Lowest sunshine has been recorded during June to August (Fig. 3.1). The monthly and annual averages of sun-shine in the Coochbehar District has been presented in Table 3.3.

**Table 3.3.** Relative sun-shine since 2000 to 2009 in the Rasik Beel area

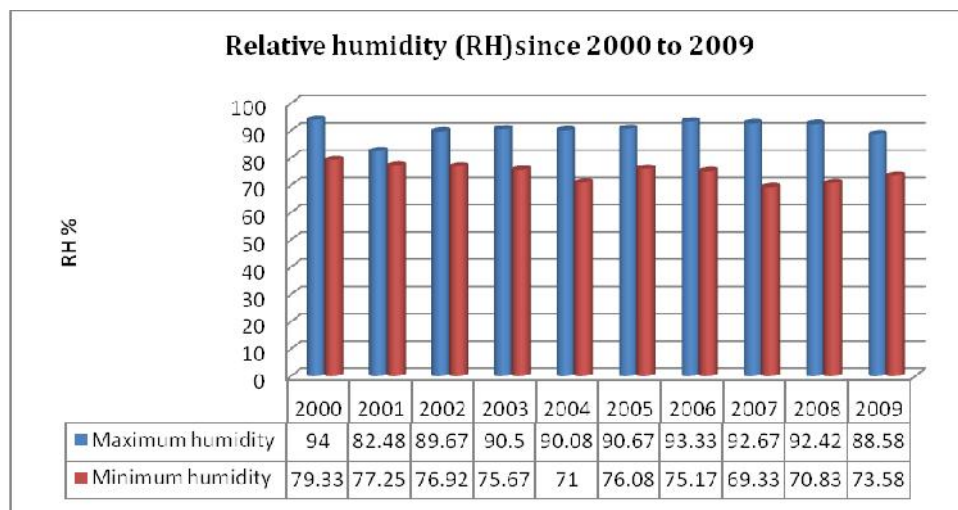
Month	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	Average
January	6.5	5.6	6.1	4.0	5.9	6.2	4.9	5.8	4.1	4.4	5.35
February	7.9	6.6	8.0	6.0	7.6	7.6	5.6	5.4	7.6	6.0	6.83
March	7.0	8.2	7.8	6.8	6.6	6.9	8.4	8.1	6.3	5.8	7.19
April	6.6	7.0	5.3	5.0	4.3	7.0	5.7	6.5	6.3	6.8	6.05
May	6.1	6.9	5.7	7.2	5.8	5.6	6.4	7.7	6.4	6.3	6.41
June	4.2	4.2	3.4	4.0	4.0	5.3	3.4	3.9	4.0	4.8	4.12
July	4.3	4.3	1.6	5.1	3.8	3.9	5.3	2.8	3.8	4.7	3.96
August	4.1	4.1	4.2	6.9	6.8	3.3	6.8	5.0	2.6	3.8	4.76
September	4.1	4.1	5.3	5.6	3.2	6.3	5.1	3.6	5.0	5.9	4.82
October	7.4	7.4	8.4	4.4	7.5	5.6	8.2	7.2	7.0	7.1	7.02
November	6.5	6.5	8.6	6.8	8.7	8.4	6.0	8.9	8.8	6.3	7.55
December	8.7	8.7	5.5	8.1	7.3	8.6	7.9	6.9	4.6	3.4	6.97



**Fig. 3.1.** Graph showing realtive sun-shine from 2000 to 2009 in Coochbehar District

### 3.5. Relative Humidity

Due to the presence of many permanent water bodies and good forest cover, the study area maintains high Relative Humidity around the year. The average maximum and minimum relative humidity in the area varies between 85 % and 95 % and never observed below 70 %. June to September are the most humid and December to February are the least humid months. Details of yearly RH % since 2000 to 2009 is given in Fig. 3.2.



**Fig. 3.2.** Graph showing Realtive Humidity changes from 2000 to 2009 in Coochbehar District

Floristically the Eastern Himalayan region is one of the richest regions in the World and literally considered as a *botanist's paradise* (Don 1821; Das 1995, 2005; Ghosh 2006). Main causes for these huge diversity are its Phytogeographic and Climatic variability. The Rainfall and Temperature fluctuation is very interesting and high humidity and moisture makes the land as a paradise for broad leaves and aquatic plants.

# **CHAPTER - IV**

## THE PRESENT WORK

Importance of the conservation of wetlands is now well-visualized. The Ramsar Convention and its follow-up to conserve innumerable wetlands round the world as '*Ramsar Sites*' has created a history in the field of conservation. In fact, the importance of wetlands in the ecosystem was wrongly interpreted previously, especially from the productive point of view. If one look directly into the marketable products from most of the wetland then that will look too much insignificant.

In India the wetlands are spreading almost in all corners of the country, from tropical to alpine belts, from high rainfall zones to the *Thar* deserts in Rajasthan and the biological elements living there are very much significant not only in number but also to their taxonomic nature, but also the ecosystem services they perform. So far only an insignificant number of 26 Ramsar Sites has been declared from the areas within the political boundary of India. This reflect our poor realization and/or least desire to conserve our biological resources.

Rasik Beel Complex has been developed due to the repeated shifting of the River Raidak in the Coochbehar district of the state of West Bengal. For long time it was left unattended by man and the entire surrounding area was covered with mostly mixed deciduous vegetation. Innumerable local and migratory birds were also known to live there since long. In every winter winged guests from far away countries and continents come in flocks in thousands and live in harmony for few months. From this observation it appears that the capacity for sustaining such large number of birds is present in the Beel.

On the other hand, the Rasik Beel is now being projected as a place of touristic interest, and that too is based mainly on these migratory birds. Any person who understand the method and need of conservation will realize how the tourism related activities are affecting the wetland habitat is being affected and endangering the life of all biological elements.

Considering all these points it is realized that to impose the strict conservation measures, at first, we need to have good basic knowledge on the elements of the biological diversity of Rasik Beel complex.

### 4.1. Previous Floristic Works

The green diversity of Terai and Duars has attracted a large number of researchers and plant collectors from different parts of the world at least for the last three centuries (Don, 1823, 1825; Das, 1995, 2004). Soon after, the famous naturalist Griffith also explored Terai green belt in 1847. The famous botanist Sir J.D. Hooker made his visit sometime during 1848 – '49 (Hooker, 1849, 1904). Immediately after J.D. Hooker, no other botanist taken up intense study of the Duars region. He explored the entire region and made a historic collection of approximately 2500 specimen of plants. His expedition and the account published by him include the *Flora of British India* (1854, 1872 –



1897, 1904) is still one of the most comprehensive descriptions of botanical splendors for this region.

Significantly, botanists from different other parts of the world has latter made significant contributions to the flora of Terai and Doors region of Jalpaiguri. They include Cowan and Cowan (1929), Ohashi (1975), Grierson and Long (1979, 1983 – 1991, 1999 – 2001, 1994 - 2000).

Champion and Seth (1968) also surveyed this region. Mukherjee (1965) prepared a sketch of the vegetation of Jalpaiguri District. Sikdar (1984) worked on Baikunthapur Forest division, Banerjee (1993), Pandit (1995) and Das *et al* (2003) worked on the Jaldapara Wildlife Sanctuary (now Jaldapara National Park), and Biswas *et al* (2012) published a detailed Dicotyledonous flora of Gossain Hat Beel. Wetlands of India was explored by Biswas and Calder (1937), Subramanyam (1962), Deb (1976), Cook (1996) and Fassett (2000). Pal *et al*. (2010) and Das (2013) worked on wetland of Assam. For Wetlands and their conservation, wetland macrophytes etc. of India are also reviewed by IUCN (1971), Gopal (1973), Wells (1992), WWF India (1993) and Williams (1997). Bandyopadhyay *et al* (2005) listed aquatic and wetland vascular plants of Cooch Behar district. But, a detail study on Rasik Beel area was not done previously. Saha *et al* (2013) worked on the medicinal plants of Gorumara National Park. Das *et al* (2010) prepare a detail sketch of three MPCAs of Terai and Dooars. These selected publications, on the other hand, showed the attractiveness of the plant diversity of this region. At the same time it is also clear that none of these works is complete and much more intensive explorations are essential for proper documentation from different aspects.

#### **4.2. Importance of the Present Work**

Broadleaf forests of West Bengal Duars are situated very near to the foothills of Eastern Himalaya and is a part of the IUCN recognized Himalaya Biodiversity Hotspot. The entire Landscape of the region is having significantly rich botanical diversity, occupied an important platform for huge inflow of tourists, researchers and also for botanists, mainly taxonomists. The flora is representing all the major groups of plant kingdom. The migration of plants from widely different localities since the upheaval of the Himalayas during Triassic from the bordering as well as from distant land masses is continuously enriching the flora. Important countries or places include China and Malaysian in the east and south of Oriental lands, Europe, America and Africa on the west and of Tibet and Siberia on the North have contributed to the floristic diversity of Terai-Duars region (Hooker, 1904).

Hydrophytes and helophytes of Apalchand Reserve in Jalpaiguri District have been surveyed during 1994 to 1999 (Dutta *et al*, 2002). In the near past, Chowdhury and Das (2007) surveyed in Rasik Beel and Bochamari Villages and recorded 33 species of angiosperms belonging to 22 families, which includes some common medicinal and some other useful plants.

Bala *et al* (2007) 42 species of angiosperms belonging to 26 families and 2 species of Pteridophytes from the wetlands of Nadia district of West Bengal, which are locally used for various purposes. Of these, 30 species are known to have good medicinal properties. As much as 172 species of vascular plants under 91 genera belonging to 42 families, of which 25 families with 43 genera and 79 species are Dicotyledonous and 13 families with 44 genera and 89 species belong to Monocotyledons

were, so far, recorded from the wetlands in Cooch Behar district (Bandyopadhyay *et al*, 2005). Mukhopadhyay (1987) enlisted 75 species under 47 genera of aquatic and semi-aquatic plants of Birbhum district. Of these, 15 species are belong to the dicotyledons and 57 species are monocotyledonous. Chowdhury (2009) recorded 357 species under 209 genera from 77 families that consists of 202 dicotyledonous species under 122 genera of 51 families, 147 species of monocotyledonous under 82 genera covering 19 families, 7 pteridophytes and 1 bryophytes from the Malda district located in the central part of the state of West Bengal. Gopal (1995) recorded over 1200 species of aquatic plants from India and also provided a list of animals from the wetland systems of India. However, no such study provided a reasonably complete wetland flora for different districts of West Bengal. The floristic estimate for the West Bengal wetlands is very poor and the required data for the Cooch Behar District is incomplete (Bandyopadhyay *et al*, 2005). So, the reliable data on wetland flora of Cooch Behar District is a basic requirement. Rasik Beel is a Complex of seven Beels and are intimately associated with Atiamochar and Takomari reserved forests in the Cooch Behar District. So, it was expected that the vegetation of the Beel Complex is much divers and is supposed to share a large number of aquatic and Wetland flora. Wetlands are also important as resting sites for migratory birds. Aquatic vegetation is the most valuable source of food, especially for the waterfowls. In the winter, migratory waterfowl search all the layers, sediment to above water plant parts for nutritious seeds, roots, tubers, small animals etc. for their sustenance. Resident waterfowls are feeding on different species of aquatic vegetation year-round (Gopal, 1995, 1994).

It is estimated that freshwater wetlands alone support 20 per cent of the known range of biodiversity in India (Deepa and Ramachandra, 1999). As many as 476 wetlands of different kinds each exceeding a total area of 10 ha have been identified within the Indian state of West Bengal. Of these, 12 wetlands are man-made. A few salt marshes have been explored for their macrophytic vegetation. A total of 123 species of angiosperms comprising 67 dicotyledonous and 56 monocotyledonous species were collected and their growth-forms were determined (Panda *et al*, 2009). The total numbers of aquatic plant species exceed 1200 is given by Gopal (1995). But, the actual State wise, District wise and Wetland wise estimation totally unknown.

#### **4.3. Objectives of the Present Work**

Rasik Beel is one important wetland located in the Coochbehar district of West Bengal and has been formed due to the shifting of the courses of the river Raidak. A group of Beels has been created and basically those are ox-bow lakes.

The present work is an attempt to know the vascular plants diversity in the Rasik Beel complex including its intervening and surrounding terrestrial vegetation.

So, the objectives of the present was basically:

- i. Detailed survey for the preparation of vascular plants flora of the Rasik Beel complex and of the adjoining regions. This is the prime objective of the present study.
- ii. Understanding the vegetation structure, including the phytosociological characters of the study area.
- iii. To understand the importance of the Beel and terrestrial vegetation in the life of the local villagers.

- iv. Understanding the occurrence and their present status of marketable NTFPs in the study area.
- v. Recognition of Endemic, Rare and Threatened species and to observe their population status in the area.
- vi. Recognition of alien elements in the flora and their local distribution pattern
- vii. Accumulation of sufficient voucher specimens to preserve in different Herbaria for future studies.
- viii. Recognition of disturbances in the process of *in situ* conservation in Rasik Beel complex and understanding the remedial measures.
- ix. Understanding the effects and *ex situ* conservation, including eco-development measures, on the local vegetation and the flora.
- x. Present status of conservation and thinking for the scope of improvement so that the total ecosystem, including local flora and fauna can be conserved effectively.
- xi. Assessing the possibility of forwarding a proposal to declare Rasik Beel Complex as one **Ramsar Site**.



**PLATE - III: Forest types, Figs. 17 - 24:** 17. Beel Margin Herbland; 18. Aquatic pre monsoon vegetation; 19. *Typha elephantina*; 20. Clerodendrum in forest group; 21. Ground cover under Lagerstroemia plantation; 22. Barajan Beel Margin shrubland; 23. Forest Shrubland; 24. Takomari Forest near Conservation sector



**PLATE VI: Forest types (contd.), Figs. 25 - 32:** 25. Atiamochar forest shrub land; 26. Takomari forest shrub land; 27. Gound cover of *Lagerstroemia* plantation; 28. *Diplazium* ground cover of Batikata Beel Margin; 29. Salmari forest shrubland; 30. Rasik Beel forest plantation; 31. *Terminalia* -*Salix* plantation; 32. Batikata Beel Margin cover

# CHAPTER - V

## MATERIALS AND METHODS

The entire methodology for the present dissertation is primarily based on the survey of plants and documentation of the flora of Rasik Beel complex in the Cooch Behar district of the Indian state of West Bengal. However, in the present survey only the vascular plants have been recorded. Considering from the floristic and vegetation survey the Rasik Beel complex is fully virgin and no literature on such aspects is available on this area and for the Cooch Behar District as well. So, the entire dissertation is based only on the freshly collected materials of vascular plants growing naturally or semi-naturally and cultured with one or more purpose in the study area. Therefore, the entire methodology followed during this dissertation work has been presented below in detail along with appropriate direct or indirect references.

### 5.1. Floristic Survey

The floristic survey of this part of Cooch Behar District includes all the vascular macrophytes those grow over the Rasik Beel wetland and its surrounding areas in different seasons of the year. To understand the proper and actual floristic structure of this part of the Cooch Behar district, mostly the conventional methods as described by Jain and Rao (1977) are followed.

*5.1.1. Mode of Sampling:* This study includes all the vascular macrophytes those grow in the water body of the study area. Plants are collected mostly by random sampling from different wetlands of the study area round the year covering at least three predominant seasons and for a period of 5 years, from 2007 to 2012. During summer, many plants grow in exposed land within wetland also were collected. This method has been followed for all the small and large wetlands, including ponds, rivers and ephemeral water bodies. Specimens were collected in triplicate in most of the cases and in their reproductive stages as far as possible.

*5.1.2. Collection of Specimens:* The voucher specimens were collected with or without flowering and fruiting condition and then processed according to the method as suggested by Jain & Rao (1977). Specimens of all the plants, wild as well as grown, were collected from the entire study area.

*5.1.3. Record of Field Data:* The collected specimens were tagged and necessary field data like flower colour, latex, aroma etc. were recorded in Field Note Book against the tag numbers. Local names, uses, parts used, habitat, distribution pattern, habit, flowering and fruiting, etc. were also recorded in the Field Note Book of the collected plants. The uses and local names of such plants were enquired with the local people and were also recorded in the Field Note Book.

*5.1.4. Drying of Specimens:* The collected specimens were dried in blotting papers and old news prints using a light plant-press in the field and then transferred to heavy wooden press after returning

to the laboratory. But, fleshy soft aquatic (submerged, free floating plant etc.) plants are treated with aqueous 10 % formaldehyde (HCHO) solution to check the fungal growth and to avoid fragmentation. The collected plant specimens were shocked in blotting paper first and then transferred to old newsprint or blotting papers within a short time. Specimens were given changes every 24 hours or even with a shorter interval for the first three days and then in regular intervals till the plants were properly dried.

*5.1.5. Poisoning of Specimens:* Then specimens were poisoned after drying by soaking in the saturated solution of Mercuric Chloride ( $\text{HgCl}_2$ ) in Rectified Spirit (i.e. around 6 % ethanolic solution of  $\text{HgCl}_2$ ) and then again dried under the blotters, sometimes using a Hot Air Oven.

*5.1.6. Mounting and Labeling:* After poisoning, specimens were mounted on herbarium boards using glue and then properly stitched with thread, whenever that was necessary. All the herbarium sheets were labeled properly, preferably on the lower right-hand corner of the sheet. The field number date and place of collection, scientific name, family, local name, phenophase (flowering and/or fruiting) were noted on the label. Also, the note recorded in the Field Note Book were also transferred on the label.

*5.1.7. Identification of Specimens:* Identification of collected specimens was done primarily with the help of different literature including *Flora of Bhutan* (Grierson and Long, 1983, 1987, 1991, 1994, 1999, 2001; Noltie, 1994, 2000), *Flora of India* (Sharma *et al*, 1993; Sharma and Balakrishnan, 1993; Sharma and Sanjappa, 1993; Hajra *et al*, 1995, 1997), *Flora of West Bengal* (Anonymus, 1997), *Flora of Eastern Himalaya* (Hara, 1966, 1971; Ohashi, 1975), *An Enumeration of Flowering Plants of Nepal* (Hara *et al*, 1978, 1979, 1982), *Ferns and Fern-Allies of Arunachal Pradesh* (Singh and Panigrahi, 2005), *The Orchids of Bhutan* (Pearce and Cribb, 2002), and *Diversity and Distribution of Bamboos in Assam* (Barooah and Borthakur, 2003). However, the identity was confirmed by matching specimens with the pre-identified and authenticated specimens available in NBU-Herbarium and at CAL.

*5.1.8. Storing of Voucher Specimens:* Completed herbarium sheets were stored temporarily in a steel cabinet in the Taxonomy & Environmental Biology Laboratory of the Department of Botany, North Bengal University. After finishing of the project work, the main set of voucher specimens will be deposited in the NBU-Herbarium and the duplicates will be deposited in CAL.

## **5.2. Methods of Enumeration**

The arrangement of different families in the enumeration of Rasik Beel flora is mainly based on APG III (Chase & Reveal, 2009), followed by the alphabetical presentation of genera and species. For the infraspecific categories the autonym is presented first and the remaining taxa alphabetically. To determine the correct name chiefly the 1.1 version of The Plant List [[www.theplantlist.org](http://www.theplantlist.org)] has been followed. The protologues for family and generic names were mostly taken from Cronquist (1981, Indian reprint in 2002, 1988) and IPNI [[www.ipni.org](http://www.ipni.org)]. The protologues for species and infraspecific categories were taken from different recently published literature, IPNI and The Plant List (version 1.1). A correct name is followed by the basionym and synonym(s), if any and all such names are also

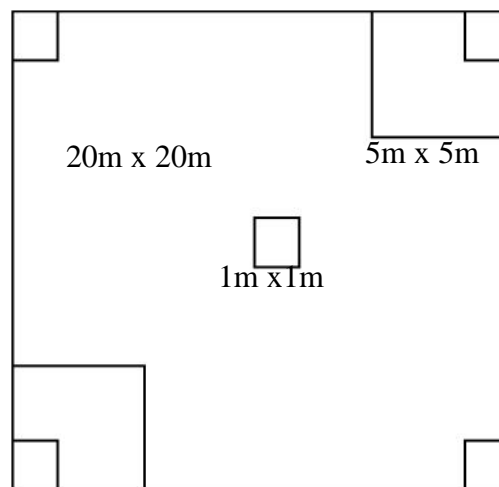


provided with protologue references. Reference to the records of different species in different floras covering this and the adjacent regions were also included. After the references, local or vernacular names, if available, in one or more local languages have been provided. Plants are then described in botanical terminologies following standard references. The phenology in the form of flowering and fruiting periods, exsiccata, general and local distribution and in some cases a 'Note' has been provided to enumerate each and every taxon of species and infraspecific categories.

Several quickly functional and useable numbered dichotomous identification keys to genera and for species and infraspecific categories have been created using mostly the easily observable characters and incorporated within the enumeration for the better utilization of the flora.

### 5.3. Phytosociology

*5.3.1. Sampling:* For the phytosociological understanding of the Rasik Beel vegetation, basic data was recorded through the application of quadrature sampling technique as suggested by Misra (1968), Shimwell (1971), Tripathi & Misra (1971), Phillip (1959), Das & Lahiri (1997), Kadir (2001), Rai (2006), Ghosh (2006) and Chowdhury (2009). During this survey 150 aquatic/ floating but fixed randomly distributed quadrates were taken from wetland surface and 25 random quadrates are taken from surrounding forest areas. As the wetland floras are mainly herbaceous, so 1m x 1m quadrates are adopted for such vegetation. Four pieces plastic of pipes, each 1 m in length, were used to form the frame that can float without any difficulty. Surveys were conducted in three different seasons and are designated as pre-monsoon [March - April], monsoon [May to July] and post-monsoon [September to November]. In deep water quadrates, free floating, submerged, immersed etc. plants are also recorded. During sampling all possible macrophytic plants including angiosperms, pteridophytes and bryophytes were recorded. In wetland algae is very common element, so it is present in almost all the quadrates but were not considered for the present work. In forests areas, Nested Quadrature technique has been used with 20m x 20m quadrates for trees and 5m x 5m quadrates for shrubs and 1m x 1m quadrates for herbaceous plants. The smaller quadrates were nested within the large [i.e. 20m x 20m] quadrates as shown in the figure 5.1. The List-Count data was recorded from each quadrature in three different seasons.



**Fig. 5.1.** Nested quadrature for study of Tree, Shrubs and Herbs

5.3.2. *Data processing*: Recorded data were transferred to MS Excel worksheet and different parameters like Frequency (F), Density (D), Abundance (A), Relative Frequency (RF), Relative Density (RD), Relative Abundance (RA) and Important Value Index (IVI) of each and every species were determined. The following formulas were used for the analysis of data as suggested by Misra (1968), Phillips (1959), Shimwell (1971), Tripathi and Misra (1971), Malhotra (1973), Das and Lahiri (1997), Kadir (2001), Rai (2006), Ghosh (2006), Chowdhury (2009) and Sarkar (2014):

**Frequency (F%)** = Number of quadrates in which the species occurred x 100/ Total number of quadrates examined

**Density (D)** = Total number of individuals of a species in all the quadrates/ Number of quadrates examined

**Abundance (A)** = Total number of plants of a species in all the quadrates/ Number of quadrates in which the species occurred

**Relative Frequency (RF)** = (Frequency of a species/ of the frequencies of all species) x 100

**Relative Density (RD)** = Total number of individuals of a species in all quadrates x 100/ Total number of individuals of all species in all quadrates

**Relative Abundance (RA)** = Abundance of a species x 100/ of abundance of all species

**Importance Value Index (IVI) or Species Importance Value Index (SIVI)**: This index is generally used to determine the overall importance of each individual species in a Particular community of ecosystem. The Importance Value Index is calculated by summing up the values of RF, RD and RA.

$$IVI = RF + RD + RA$$

## 5.4. Diversity Indices

### 5.4.1. Biological Diversity Indices

Biological diversity can be quantified in many different ways. For this, two main indices, Richness and Evenness of a particular species have been measured in a unit area. Richness is a measure of the number of different kinds of organisms present in a particular area whereas Evenness is a measure of the relative abundance of the different species making up the richness of an area.

### 5.4.2. Species Diversity Indices

Diversity indices are mathematical measures those show the proper information about composition in a particular community, species wise. Diversity indices provide important information about rarity and commonness of different species in a community. The ability to quantify diversity in this way is an important tool for biologists trying to understand community structure.

The actual scenario of plant species complexity in community structure of a particular wetland in season wise or in yearly, two different standard indices being used as follows:

**5.4.2.1. Shannon-Weiner Index (SDI)**: as suggested by Shannon – Weiner (1949) this Index is used to understand the proper plant diversity of a community and is calculated using the formula:

$$SDI = - \sum [(ni/N) \ln (ni/N)]$$

Where,  $H'$  is the index value

' $n_i$ ' is the number of individuals of a species

' $N$ ' is the total number of species in the habitat studied

**5.4.2.2. Simpson's Index (EH):** Simpson's index is another mathematical tool for understanding the concentration of dominance of particular species in the community or to identify the dominating species. Its value ranges between 0 – 1. Simpson index is a measure of diversity that takes into accounts both the richness and evenness. Simpson (1963) suggested the following formula for its calculation:

$$EH = \sum p_i^2$$

Where, ' $p_i$ ' is the proportional abundance of the ' $i^{\text{th}}$ ' species.

$$p_i = n_i/N$$

### 5.4.3. Species Richness Indices

Species richness means the measurement of number of species per sample. Species richness is the mode of determination of species diversity of an area based on the number of species occur in the habitat per unit area or sample plot. For determining the species richness standard and widely used indices adopted are:

**5.4.3.1. Menhinick Indices (D):** Menhinick (1964) provided the following formula for the calculation of Species Richness in a community -

$$D = S/\sqrt{N}$$

Where,  $S$  = Total number of species observed.

$N$  = Total number of individuals of all species.

**5.4.3.2. Margalef Indices (R1):** Margalef (1968) provided the following formula for to calculate the Species Richness in a community -

$$R1 = (s-1)/\ln(n)$$

Where,  $s$  = number of species.

$n$  = number of individuals of a species.

Apart from these, some other minor methodology might have adopted for the better and/or proper presentation or analysis of the result those are mostly self-explanatory and are generally supported with proper references.

# CHAPTER - VI

## ENUMERATION

The Angiospermic plant with the accepted name as per the Plant List, through proper taxonomic treatments of species, collected from the Rasik Beel complex has been arranged in compliance with the world wide accepted APG-III (Chase & Reveal, 2009) system of classification. As like as it, linear sequence of lycophytes and ferns (Christenhusz *et al*, 2011) has been adopted. The Pteridophyta family, genera and species with the accepted name as per the Plant List, through proper taxonomic treatments of species, collected from the Rasik Beel complex has been arranged in linear sequence of lycophytes and ferns (Christenhusz *et al*, 2011). The following sequence of enumeration is taken into consideration while enumerating each identified plants - (a) Accepted name (b) Basionyms (c) Synonyms if any (d) Homonym if any. (e) Vernacular name if any (f) Description (g) Flowering and fruiting periods/Fertile time (h) Specimen cited (i) Local distribution (j) General distribution.

Each individual taxon, is being furnished and protologue through the availability reference of the author citation. Most importantly, in the present study, an attempt has been made to include all the locally available taxonomic reference of the taxon. Mentioned below is the list of important books, selected scientific journals, papers, newsletters and periodicals that has been referred during the citation of the same.

### 6.1. Chronicles of literature of reference

#### 6.1.1. Names of the important books referred

Beng. Pl.	: Bengal Plants
En. Fl .Pl. Nepal	: An Enumeration of the Flowering Plants of Nepal
Fasc.Fl.India	: Fascicles, Flora of India
Fl.Brit.Ind.	: Flora of British India
Fl.Bhutan	: Flora of Bhutan
Fl.E.Himal.	: Flora of Eastern Himalaya
Fl.India	: Flora of India
Fl Indica	: Flora Indica
Fl. West Bengal.	: Flora of West Bengal
Prodr.Fl.Nepal	: Prodrumus florae Nepalensis
Pl.As.Rar.	: Plantae Asiaticae Rariores
Pl.Wilson	: Plantae Wilsonianae
Tr. Nor. Bengal.	: The Trees of Northern Bengal
FOC	: e-Flora of China
Nam. Change. Flr. Pl.	: Name changes in flowering plants by S. S. R. Bennett.

**6.1.2. Names of the journal referred:**

Bull.As.Soc.Beng.	: Bulletin of Asiatic Society of Bengal
Bull.Bot.Sur.Ind.	: Bulletin of Botanical Survey of India
J.Arn.Arb.	: Journal of Arnold Arboretum
J.Beng.Nat.Hist.Soc.	: Journal of Bengal Natural History Society
J.Bomb.Nat.Hist.Soc.	: Journal of Bombay Natural History Society
J.Econ.Tax.Bot.	: Journal of Economic and Taxonomic Botany
J.Jap.Bot	: Journal of Japanese Botany
J. R.A.S. Beng. Sci	: Journal of Royal Asiatic Society of Bengal
Kew.Bull.	: Kew Bulletin
J. Ind. For.	: Indian forester, Dehradun.
J. Plione	: Plieoine

**6.1.3. Abbreviation used in Enumeration:**

<i>agg.</i>	: aggregated species
<i>auct.</i>	: of various authors ( <i>auctorum</i> )
<i>Cf.</i>	: compare ( <i>Confer</i> )
<i>f.</i>	: form ( <i>forma</i> ) and <i>filial</i>
<i>nom.illeg.</i>	: Illegitimate name ( <i>Nomen illegitimum</i> )
<i>nom.nud.</i>	: <i>Nomen nudum</i>
<i>p.p.</i>	: In Part ( <i>pro parte</i> )
<i>Sensu.</i>	: In the sense of author indicated and not as originally intended
<i>ssp.</i>	: Sub-species
<i>Var.</i>	: Variety
<i>Var. nov.</i>	: New variety

**6.1.4. Other abbreviations commonly used in enumeration:**

Acad. : Academy	Ill. : Illustration
Bull. : Bulletin	J. : Journal
Cat. : Catalogue	no. : Number
Contr. : Contribution	Rep. : Report
Faun. : Fauna	Repert. : Repertorium
Fl. : Flora	Soc. : Society
Ic. : Icones	Contr. : Contribution

**6.1.5. Authorities of botanical names:**

Surnames of authors of Botanical names used in full form, no abbreviation has been used in the present work.

**6.1.6. Local (Common) names:**

Only Bengali common name of plants used as *vernacular names*.

**6.1.7. Description:**

Diam. : Diameter

Fig. : Figure

**6.1.8. Distributions:**

C. : Central

E. : Eastern

S. : Southern

W. : Western

N. : North

NE. : North-eastern

**6.1.9. Measurements:**

The measurement of the specimens during the study was made through metric unit system (m, cm and mm) for e.g. the dimensions of leaves are given as 2 – 3 x 1 – 1.5 cm, the first figure indicating the length and the second breadth.

## PTERIDOPHYTA

**For enumeration of this part A linear sequence of Lycophytes and Ferns after Christenhusz, M. J. M.; Zhang, X.C. & Schneider, H. (2011) has been followed**

**Subclass: Lycopodiidae** Beketov (1863).

**Order: Selaginellales** (1874).

**Selaginellaceae** Willkomm, Anleit. Stud. Bot. 2: 163. 1854; Prodr. Fl. Hisp. 1(1): 14. 1861.

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; Reed, C.F., Ind. Sellaginellarum 160 – 161. 1966; Panigrahi *et* Dixit, Proc. Nat. Inst. Sc. Ind. 34B (4): 201, f.6. 1968; Kunio Iwatsuki in Hara, Fl. East. Himal. 3: 168. 1972; 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; *Selaginella plumose* var. *monospora* (Spring) Bak, Jour. Bot. 21:145. 1883; *Selaginella semicordata sensu* Burkill, Rec. Bot. Surv. Ind. 10: 228. 1925, *non* Spring.

Plant up to 90 cm, main stem prostrate, rooting on all sides and at intervals, unequally tetragonal, main stem alternately branched 5 – 9 times, branching unequal, flexuous; leaves obscurely green, dimorphous, lateral leaves oblong to ovate-lanceolate, subacute, denticulate to serrulate at base. Spike short, quadrangular, sporophylls dimorphic, large sporophylls less than half as long as lateral leaves, oblong-lanceolate, obtuse, denticulate, small sporophylls dentate, ovate, acuminate.

*Fertile*: October to January.

*Specimen Cited*: Park, Rajib & AP Das 0521, dated 23. 07. 2007.

*Local Distribution*: Garden and conservation sectors.

*General Distribution*: India: West Bengal, Sikkim, Meghalaya, Arunachal Pradesh, Assam, Manipur; Myanmar, Bhutan, Indo-China, Nepal.

**Subclass: Polypodiidae** Cronquist (1966).

**Order: Gleicheniales** Schimper (1869).

**Gleicheniaceae** (R. Brown) Presl, ReI. Haenk 1(1): 70. 1825; Copeland, Gen. Fil. 26. 1947.

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

*Dicranopteris linearis* (Burman f.) Underwood, Bull. Torrey Bot. Cl., 34(5): 250. 1907; Holttum, Reinwardtia 4: 275. 1957; Holttum, Fl. Males. Ser. 2. 1: 33. 1959; Mehra *et* Bir, Pterid. Fl. Darjeeling & Sikkim Him. 122. 2008; Hiroshi Ito in Hara, Fl. East. Himal. 1: 456. 1966; Singh *et* Panigrahi, Fern Fern-allies of 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. *Gleichenia dichotoma* (Thunberg *ex* Murray) Hooker, Sp. Fil. 1: 6. 1844. *Gleichenia linearis* (Burman f.) Clarke, Trans. Linn. Soc. Lond. Ser. 2. Bot. 1: 428. 1880; Beddome, Handb. Ferns Brit. Ind. 4. 1883. *Diplopteridium lanigerum* (D. Don) Nakai, Bull. Nat. Sc. Mus. Tokyo 29: 53. 1950. *Gleichenia lanigera* D. Don, Prodr. Fl. Nep. 17. 1825.[PLATE: 6, Figure-50]



Rhizome wide creeping. Fronds large, forming thickets; stipes stout, brown, up to 12 cm, 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:* July to September.

*Specimen Cited:* Forest, *Rajib & AP Das 0556*, dated 24. 07. 2007.

*Local Distribution:* All over the conservation sectors.

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

**Order: Schizaeales** Schimper (1869).

**Lygodiaceae** M. Roemer, Handb. Allg. Bot. 3: 520. 1840.

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

**Key to the species:**

1a. Rhizome usually long creeping ..... *L. microphyllum*

1b. Rhizome short creeping or suberect ..... *L. flexuosum*

*Lygodium flexuosum* (Linnaeus) Swartz, Schard. In Jour. Bot. 1800 (2): 7. 106. 1810; Beddome, Handb. Ferns Brit. Ind. 457. f. 283. 1883; Alston *et* Holttum, Reinwardtia 5: 15. 1959; Holttum, Fl. Males. Ser. 2. 1(1): 53, f. 9e – f. 1959; Panigrahi *et* Dixit, Proc. Aut. Sch. Bot. 217. 1967; Hiroshi Ito in Hara, Fl. East. Himal. 1: 455. 1966; Baishya *et* Rao, Ferns Ferns allies Meghalaya 37. 1982; Chauhan *et al.*, Fl. Namdapha 79. 1996; Singh *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. *Ramondia flexuosa* (Linnaeus) Mirbel, Bull. Sci. Soc. Philom. Paris 2: 179. 1801. *Hydroglossum flexuosum* (Linnaeus) Willdenow, Schr. Akad. Erfurt 23, t. 1, f. 3. 23. 1802.

Rhizomes short, creeping. Fronds up to 35 cm, 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, dorsal surface puberulous, ovate to deltoid, tripinnate to quadripinnatifid, secondary rachis branches narrowly winged, hairy, basal ones largest and stalked, becoming sessile upwards. Sorophores 4 to 9 mm. Spores pale.

*Fertile:* March to December.

*Specimen Cited:* Forest, *Rajib & AP Das 0525*, dated 23. 07. 2007.

*Local Distribution:* Marginal areas of the conservation sector.

*General Distribution:* India: West Bengal, Assam, Arunachal Pradesh, Meghalaya, Bihar; Africa, Australia, China, Malaysia, Philippines, Sri Lanka.

*Lygodium microphyllum* (Cavanilles) R. Brown, Prodr. Fl. Nov. Holl. 1: 162. 1810; Beddome, Handb. 455, t. 282. 1883; Alston *et* Holttum, Reinwardtia 5: 12. 1959; 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* Cavanilles, Icon. Descr. Pl. 6(2): 76, t. 595, f. 2. 1801. *Lygodium scandens sensu* Swartz, Schrad. Jour. Bot. 1800 (2): 106. 1801; Beddome, Ferns of S. Ind. t. 61. 1863. *Ophioglossum filiforme* Roxburgh *ex* Griffith, Calc. Jour. Nat. Hist. 4: 476, t. 26, f. 3. 1844. *Hydroglossum scandens* (Linnaeus) Willdenow, Schr. Akad. Erfurt 20. 1802.

Climbers, up to 15 m, rhizome long creeping. Fronds up to 7 mm, 15 – 45 cm broad, tri pinnate, rachis surface glabrous, ovate-oblong, pinnate, primary rachis branches 3 – 5 mm, 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.

*Fertile*: March to December.

*Specimen Cited*: Forest, *Rajib & AP Das 0537*, dated 23. 07. 2007.

*Local Distribution*: Conservation sectors.

*General Distribution*: India: West Bengal, Sikkim, Assam, Meghalaya, Arunachal Pradesh, South india; China, Sri Lanka, Africa, Malaysia, Australia.

**Order: Salviniiales** Bartling in Mart., *Consp. Regn. Veg.*: 4. 1835.

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

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

*Marsilea minuta* Linnaeus, *Mant. Pl.* 308. 1771; Sledge, *Bot. Jour. Linn. Soc.* 84: 22. 1982; Fournier, *Bull. Soc. Bot. Fr.* 27: 329. 1880; Bak, *Handb. Fern Allies* 140. 1887; Kunio Iwatsuki in Hara, *Fl. East. Himal.* 1: 500. 1966; Prain, *Beng. Plants* 2: 957. 1903; Ghosh *et al.*, *Pter. Fl. East. Ind.* 1: 187. 2004. *Marsilea diffusa* var. *approximata* A. Braun, *Flora* 300. 1839. *Marsilea perrieriana* C. Christensen, *Dansk Bot. Ark.* 7: 179, t. 73, f. 15 – 16. 179. 1932. [PLATE: 10, Figure-120]

*Local name*: Susni Sasg

Aquatic with creeping rhizome, roots usually from nodes, stipes scattered, usually green, leaves four, sessile arranged at the tip of the stipe in cloud leaf model. Sporocarps borne at nodes in alternate clusters.

*Fertile*: January to April.

*Specimen Cited*: Chhotojan Beel, *Rajib & AP Das 0601*, dated 26. 07. 2007.

*Local Distribution*: All over the Beel areas.

*General Distribution*: allover India; Africa, Trinidad and Brazil.

**Salviniaceae** Martinov, *Tekhno-Bot. Slovar*: 559. 1820.

**Key to the genera:**

1a. Fronds two lobed, close together ..... *Azolla*

1b. Fronds unlobed ..... *Salvinia*

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

*Azolla pinnata* subsp. *africana* (Desvaux) R.M.K. Saunders *et* K. Fowler, *Bot. Jour. Linn. Soc.* 109: 351, f. 30A 351. 1992. *Azolla pinnata* R. Brown in *Prodr. In Fl. N. Holl.* 167, 1810; Holttum, *Fl. Malaya* 2: 621, 1968. Ghosh *et al.*, *Pterid. Fl. East. Ind.* 1: 184. 2004. [[PLATE: 10, Figure-111]

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

*Fertile*: May to August.

*Specimen Cited*: Chhotojan Beel, *Rajib & AP Das 0022*, dated 05. 02. 2007.

*Local Distribution*: Throughout the water body.

*General Distribution*: India: low lands throughout; Africa, Asia, Australia, Malaysia and Taiwan.

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

**Key to the species:**

- |   |                     |
|---|---------------------|
| 1a. Hairs on papillae on upper surface of floating leaves in regular rows ... | 2                   |
| 1b. Hairs on upper surface of floating leaves scattered .....                 | <i>S. cucullata</i> |
| 2a. Hairs on papillae jointed at the tips, ending in a deep brown cell .....  | <i>S. adnata</i>    |
| 2b. Hairs on papillae entirely free .....                                     | <i>S. natans</i>    |

*Salvinia adnata* Desvaux, Mém. Soc. Linn. Paris 6: 177. 1827. *Salvinia molesta* D.S. Mitchell, Brit. Fern Gaz. 10(5): 251 – 252. 1972; Ghosh *et al.*, Pter. Fl. East. Ind. 1: 179. 2004. [PLATE: 10, Figure-112]

Rhizomes horizontal, hairy, two leaves floating, third submerged into water and dissected, floating leaves petioled, clearly boat shaped, conduplicate, lower portion curved upwards, oblong elliptic to obovate, cordate, upper surface papillate, and are in regular rows, each papillae crowned with four uniseriate, colourless hairs. Macrosporocarp two, rarely three, globose, glabrous to subglabrous, stalked. Microsporocarp globose, densely hairy, sessile, containing mostly empty microsporangia.

*Fertile:* September to March.

*Specimen Cited:* Batikata Beel, Rajib & AP Das 0018, dated 05. 02. 2007.

*Local Distribution:* All over the Beel area.

*General Distribution:* India: West Bengal, South 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; Griffith, Calc. Jour. Nat. Hist. 4: 470. 1844 & Calc. Jour. Nat. Hist. 5: 255, t. 20, f. 21. 1845; Bak, Handb. Fern Allies 186, 1887; Prain, Beng. Plnats 2: 956. 1903. [PLATE: 10, Figure-113]

Free floating herbs, 3 - 6 cm, rhizomes hairy. Uppermost leaves or frond arranged in a row, sub-erect, with infolded edged, hairs on upper surface of floating leaves irregularly scattered; lamina entire, papillae not regular. Sporocarp form on submerged, root like leaves. Sporocarps are in cluster, globose. Microcarp elongated and hairy.

*Fertile:* September to March.

*Specimen Cited:* Batikata Beel, Rajib & AP Das 0039, dated 05. 02. 2007.

*Local Distribution:* All over the Beel area.

*General Distribution:* India: West Bengal, Assam, Meghalaya, Manipur, Tripura, Nagaland and Mizoram, Bihar, Orissa, Uttar Pradesh; Malaysia, Bangladesh, Myanmar.

*Salvinia natans* (Linnaeus) Allioni, Fl. Pedemont. 2: 289. 1785; Baker, Handb. Fern Allies, 135. 1887; Prain, Beng. Pl. 2: 96. 1903; Ghosh *et al.*, Pter. Fl. East. Ind. 1: 181. 2004. *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: 10, Figure-114]

Free floating herbs, 5 – 15 cm; rhizomes hairy. Uppermost leaves or frond flat, stalk hairy, hairs on papillae are entirely free, oval-oblong, upper surface with hooked papillae in regular row. Lamina entire, papillose. Sporocarps arise from nodes, globose with brown hairs. Sporocarp contains 25 microsporangia.

*Fertile:* November to March.

*Specimen Cited:* Varveri Beel, Rajib & AP Das 0031, dated 05. 02. 2007.

*Local Distribution:* All over the Beel area.

*General Distribution:* India: West Bengal, Bihar, Assam, Meghalaya, Manipur, Tripura, Uttar Pradesh and Kashmir; Europe, Asia, Africa and North America.

**Order: Polypodiales** Link, Hort. Berol. 2: 5. 1833.

**Pteridaceae** E.D.M.Kirchner, Schul-Bot.: 109. 1831.

**Key to the Genera:**

- |  |                            |
|--|----------------------------|
| 1a. Surface white powdery or waxy .....  | 2                          |
| 1b. Surface never white powdery or waxy .....  | 3                          |
| 2a. Lamina lanceolate to oblong-lanceolate, surface white powdery .....  | <b><i>Cheilanthes</i></b>  |
| 2b. Lamina triangular, ending in a small leaflet, pinnae largest towards base, surface without powder coated ..... | <b><i>Adiantum</i></b>     |
| 3a. Sporangia dorsal, indusium absent, paraphyses absent .....   | <b><i>Ceratopteris</i></b> |
| 3b. Sporangia ventral, indusium present, paraphyses present .....  | 4                          |
| 4a. Sori continuous of mostly all pinnae .....   | <b><i>Pteris</i></b>       |
| 4b. Sori not continuous of mostly along with vein .....  | <b><i>Onychium</i></b>     |

ADIANTUM Linnaeus, Sp. Pl. 1094, 1753.

***Adiantum caudatum*** Linnaeus, Mant. Pl. 308. 1771; Bedd., Handb. 83. 1883; Hope, Jour. Bomb. Nat. Hist. Soc. 13: 237. 1900; Hiroshi Ito in Hara, Fl. East. Himal. 1: 459. 1966. *Adiantum caudatum* var. *angustilobatum* Bonaparte, Notes Pteridol. 7: 173 – 174. 1918. *Adiantum lyratum* Blanco, Fl. Filip. 832. 1837.

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

*Fertile:* August to November.

*Specimen Cited:* Park, Rajib & AP Das 0629, dated 12. 02. 2008.

*Local Distribution:* Park sector.

*General Distribution:* India: West Bengal, Sikkim, Arunachal Pradesh, Manipur, Meghalaya, Western Himalaya; Nepal, Bhutan, China, Japan, Taiwan, Myanmar, Philippines, Malaysia.

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; Beddome, Handb. 123. 1883; Hope, Jour. Bombay Nat. Hist. Soc. 13: 458. 1901; Pal et Pal, Bot. Gaz. 124: 132 – 143. 1962; Lloyd, Brittonia 26(2): 148. 1974; Ghosh et al., Pter. Fl. East. Ind. 1: 190. 2004; Singh et Panigrahi, Fern Fern Allies Arun. Prad. 2: 430. 2005. *Acrosticum thalictroides* Linnaeus, Sp. Pl. 2: 1070. 1753. *Pteris thalictroides* (Linnaeus) Swartz, Schrad. Jour. Bot. 4: 651. 1801. *Acrostichum siliquosum* Linnaeus, Sp. Pl. 2: 1070. 1753. *Ceratopteris siliquosa* (Linnaeus) Copeland, Philip. Journ. Sci. 56: 107. 1935; Hiroshi Ito in Hara, Fl. East. Himal. 1: 468. 1966.

Rhizome short, erect, roots fibrous, annual. Fronds dimorphic, herbaceous; sterile fronds up to 40 cm, ovate-lanceolate, lobed. Stipes up to 20 cm, dirty green, wrinkled on drying; lamina 3-30 cm long, ovate, obtuse. Fertile fronds 3 – 100 x 3 – 40 cm, lanceolate, acute to acuminate. Stipes up to 25 cm, similar to sterile fronds; lamina 3 – 60 x 3 – 40 cm, acute to acuminate. Sporangia dorsal, solitary, indusium absent, paraphyses absent.

*Fertile*: September to December.

*Specimen Cited*: Forest, Rajib & AP Das 0016, dated 05. 02. 2007.

*Local Distribution*: Marginal and low depth water cover areas.

*General Distribution*: India: West Bengal, Assam, Manipur, Tripura, Arunachal Pradesh, Bihar, Uttar Pradesh, South India; throughout the tropics and sub-tropics.

ONYCHIUM Kaulfuss, Berlin Jahrb. d. Pharm. 21 : 45. 1820.

*Onychium siliculosum* (Desvaux) C. Christensen, Ind. Fil. 468, 1906; Hirosi Ito in Fl. E. Himal. 1: 464. 1966; Ind. Fil. 468. 1906; Lingnan, Sc. Journ. 13(3): 495. 1934. *Pteris siliculosa* Desvaux, Berlin. Mag. 5: 324. 1811. *Lomaria decomposita* D. Don, Prod. Fl. Nepal. 14. 1825. *Lomaria auria* Wallich, Cat.n. 38. 1828, *nom.nud.* *Lomaria caruifolia* Wallich, Cat. n. 39. 1828, *nom. nud.* *Pteris chrysocarpa* Hooker et Greville, Ie. Fil. t. 107. 1829. *Onychium siliculosum* (Desvaux) C. Christensen, Ind. Fil. 468. 1906; Ching, III Lingnan Sci. Journ. 13: 495. 1934. *Onychium auratum* Kaulfuss, Enum. Fil. 144. 1824; Beddome, Ferns Brit. Ind. t. 30. 1883; Hope, Jour. Bombay Nat. Hist. Soc. 13: 443. 1901.

Rhizome short, ascending; roots fibrous. Stipe tufted, up to 40 cm, naked except at base, sulcate, brown to pale brown. Fronds subdimorphous. Lamina as long as stipe, glabrous, ovate, lower pinnae subdeltoid, secondary and tertiary pinnae stalked, ultimate sterile pinnules very narrow, linear, entire, acute. Indusium membranaceous, entire, mass of sporangia yellow.

*Fertile*: August to December.

*Specimen Cited*: Forest, Rajib & AP Das 0058, dated 07. 02. 2007.

*Local Distribution*: All over the forest area.

*General Distribution*: India: West Bengal, Assam; Bhutan, Indo China, Myanmar, Malaysia, Philippines, Indonesia.

PTERIS Linnaeus, Sp. Pl. 1073. 1753.

#### Key to the species:

1a. Sori continuous in all pinnae of mature plants except basal ones ..... *P. vittata*

1b. Sori continuous round the sinus but not reaching apices of lobes ..... *P. biaurita*

*Pteris vittata* Linnaeus, Sp. Pl. 2: 1074. 1753; Heiron, Hedwigia 54: 290. 1914; Holttum, Rev. Fl. Males. 2: 396. 1955; 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; Hirosi Ito in Hara, Fl. East. Himal. 1: 467. 1966; Ghosh et. al., Pter. Fl. East. Ind. 1: 319. 2004. *Pteris longifolia* auct. Beddome, Ferns S. Ind.t. 33. 1863; Beddome, Handb. 106,t. 55. 1883; Hope, Jour. Bombay Nat. Hist. Soc. 13: 148. 1901; Clarke, Trans. Linn. Soc. Ser. 2. Bot. 1: 461. 1880. *Polypodium trapezoids* Burman f., Fl. Ind.t. 66, f. 2. 1768. *Pteris costata* Bory ex Willdenow, Sp. Pl., ed. 4, 5(1): 367. 1810. *Pteris longifolia* Wallich, Cat. no. 111. 1828. *Pteris amplexicaulis* Roxburgh, Calc. Jour. Nat. Hist.4: 505. 1844.

Rhizome short, erect to suberect, densely clothed, narrow, thin, entire scales, pale brownish when old. Stipes up to 40 cm, green, scaly almost throughout, pale brownish. Lamina 30 – 80 cm long, pinnae numerous, middle ones longest, all pinnae sessile and oblique, linear, base broadly cuneate to cordate, somewhat dilated, apex acuminate. Veins on both surfaces distinct. Sori continuous of mostly all pinnae in mature plants except the reduced basal ones.

*Fertile*: July to December.

*Specimen Cited*: Park, Rajib & AP Das 0627, dated 12. 02. 2008.

*Local Distribution:* Garden sector.

*General Distribution:* Throughout India; Tropical and Sub-tropical world.

***Pteris biaurita*** Linnaeus, Sp. Pl. ed. 1,2: 1076. 1753; Hope, Jour. Bombay Nat. Hist. Soc. 13: 455. 1901; Agardh, Rec. Sp. Gen. Pterid. 26. 1839; Hooker, Sp. Fil. 2: 203. 1858; Clarke, Trans. Linn. Soc. ser. 2. Bot. I: 469. 1880, pp.; C. Christensen, Contr. U.S. Nat. Herb. 26: 312. 1931; Holttum, Fl. Malaya 2: 407. 1954; Shieh, Bot. Mag. Tokyo 79: 291. 1966; Tagawa *et* Iwatsuki, Fl. Thailand 3(2): 237. 1985; Hiroshi Ito in Hara, Fl. East. Himal. 1: 465. 1966; Ghosh *et al.*, Pter. Fl. East. Ind. 1: 338. 2004. *Campteria biaurita* Hook. *et* Bauer, Gen. Fil. t. 65A. 1841; Beddome, Ferns South. Ind. t. 44. 1863; Beddome, Handb. 116. 1883. *Campteria rottleriana* Presl, Tent. Pterid. 147, t. 5. f. 26. 1836. *Pteris peetinata* D. Don, Prod. Fl. Nepal. 15. 1825; *non* Cavanilles 1802; Morton, Contr. U.S. Nat. Herb. 38(6): 267. 1973. *Pteris flavicaulis* Hayata, Jour. Coll. Sci. Imp. Univ. Tokyo 30(1): 443 – 444. 1911.

Rhizome short, erect, clothed 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, acuminate, base cuneate. Sori continuous round the sinus but not reaching the apices of lobes.

*Fertile:* July to January.

*Specimen Cited:* Forest, Rajib & AP Das 0069, dated 07. 02. 2007.

*Local Distribution:* Throughout the beel margin and forest area.

*General Distribution:* India: West Bengal, Assam, arunachal Pradesh, Maghalaya Kerala, Karnataka, Andaman & Nicobar, Islands, Orissa, Uttar Pradesh, Tamil Nadu, Bihar and other parts of India; Bhutan, China, West Indies, Malaysia, South Africa, Brazil.

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

***Cheilanthes anceps*** Blanford, Simla Nat. Hist. Soc. 25. 1886; Candollea 15: 203. 1956; Beddome, Handb. Supp. 21. 1892; Hope, Jour. Bomb. Nat. Hist. Soc. 13: 249. 1900; Alston *et* Bonner, Candollea 15: 203. 1956; Kunio Iwatsuki in Hara, Fl. East. Himal. 3: 173. 1972. *Cheilanthes farinose* (Forsk.) Kaulfuss, *Sensu* Hara, Fl. East. Himal. 3: 173. 1972; Kaulfuss, Candollea 27: 270. 1972. *Aleuritopteris anceps* (Blanford) Panigrahi, Bull. Bot. Surv. Ind. 2(3 & 4): 321. 1960; Wu, Acta Phytotax. Sin. 19(1): 70, t. 2. f. 1-3. 1981. *Cheilanthes farinosa* var. *anceps* Blanford, Jour. Asiat. Soc. 57, part 2 (4): 301. 1888. *Aleuritopteris farinosa* var. *anceps* (Blanford) Ching, Hong Kong. Nat. 10: 201. 1941. *Cheilanthes farinosa* Beddome, Handb. with suppl. 21. 1892.

Rhizome short, erect, clothed with linear-lanceolate, acuminate scales with apex and white margin. Stipe up to 30 cm long, dark chesnut to almost black. Lamina lanceolate to oblong-lanceolate, up to 25 cm, surface always coated with white powder, costa and rachis without scales, bipinnatifid, pinnae up to 15 pairs, apex of lamina pinnatifid. Sori along the margin of segments.

*Fertile:* August to May.

*Specimen Cited:* Park, Rajib & AP Das 0611. dated 11. 02. 2008.

*Local Distribution:* Garden sector.

*General Distribution:* India: West Bengal, Arunachal Pradesh, Assam, Meghalaya; Bhutan, Nepal, China.

**Aspleniaceae** Newman, Hist. Brit. Ferns: 6. 1840. Aspleniaceae (C. Presl) Mettenius *ex* A.B. Frank in Leunis, Syn. Pflanzenkd. ed. 2, 3: 1465. 1877; Copeland, Gen. Fil.: 163. 1947; Pichi-Sermolli in Webbia 31 (2): 337. 1977; Kramer *et* Viane in Kramer *et* Green, Fam. Gen. Vasc. Pl. 1: 52. 1990.

ASPLENIUM Linnaeus, Sp. Pl. 2: 1078. 1753.

*Asplenium ensiforme* Wallich ex Hooker et Greville, Ic. Fil. 1(4): t. 71. 1829; Beddome, Handb. Ferns Brit. Ind. 141. t. 71. 1883; Hope, Jour. Bombay Nat. Hist. Soc. 13: 460. 1901; Sledge, Bull. Brit. Mus. Bot. 3: 242. 1965; Kunio Iwatsuki in Hara, Fl. East. Himal. 1: 487. 1966; Singh et Panigrahi, Fern Fern-allies of Arun. Prad. I. 97. 2005. *Asplenium ensiforme* Wallich, Num. List. No. 200. 1829, *nom. nud.*

Rhizome erect, short. Fronds up to 40 cm, simple, repand. Lamina base decurrent, veins forked 1 – 2 times, free. Sori oblique, 8 – 12 mm long, blackish brown.

*Fertile:* August to November.

*Specimen Cited:* Forest, Rajib & AP Das 0547, dated 23. 07. 2007.

*Local Distribution:* Throughout the forest sectors.

*General Distribution:* India: West Bengal, Assam, Sikkim, Arunachal Pradesh, Bihar; Bhutan, Sri Lanka, Myanmar, S.W. China.

**Blechnaceae** Newman, Hist. Brit. Ferns, ed. 2 8. 1844.

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

*Blechnum orientale* Linnaeus, Sp. Pl. ed. 1, 2: 1077. 1753; Beddome, Handb. Ferns Brit. Ind. 132. t. 66. 1883; Singh et Panigrahi, Fern Fern-allies of Arun. Prad. I. 206 – 207. 2005.

Rhizome erect, up to 10 cm, apex densely paleaceous. Fronds up to 150 cm, tufted, pinnate, caudate acuminate. Stipes up to 40 cm long, paleaceous at base, thick, several pair of small auricles present, lamina 120 cm long, pinnae alternate, spreading, entire. Sori costal, elongated, indusium long, narrow, brown.

*Fertile:* September to January.

*Specimen Cited:* Forest, Rajib & AP Das 0557, dated 24. 07. 2007.

*Local Distribution:* Park sector.

*General Distribution:* India: West Bengal, Assam, Sikkim, Arunachal Pradesh, Bihar; Sri Lanka, Nepal, Bhutan, Bangladesh, China, Myanmar, Thailand, Indonesia, Malaysia, Australia.

**Athyriaceae** Alston, Taxon 5: 25. 1956.

**Key to the genera:**

- |                                    |                   |
|------------------------------------|-------------------|
| 1a. Sori basal .....               | <i>Allantodia</i> |
| 1b. Sori along with the vein ..... | <i>Diplazium</i>  |

ALLANTODIA Robert Brown, Prodr. Fl. Nov. Holland. 149. 1810.

**Key to the Species:**

- |   |                        |
|---|------------------------|
| 1a. Sori diplazioid type; indusium brown. ....          | <i>A. sikkimensis</i>  |
| 1b. Sori athyroid to asplenioid; indusium whitish ..... | <i>A. solenopteris</i> |

*Allantodia sikkimensis* (C.B. Clarke) Ching, Acta Phytotax. Sin. 9(1): 56. 1964. *Asplenium sikkimense* C.B. Clarke, Trans. Linn. Soc. London ser. II. Bot. 1(8): 500 – 501, pl. 65. f. 1. 1880. *Diplazium sikkimense* (C.B. Clarke) C. Christensen, Contrib. U.S. Nation. Herb. 26: 304. 1931; Singh et Panigrahi, Fern Fern-allies of Arun. Prad. I: 183 – 185. 2005.

Rhizome erect, up to 25 cm, roots thick. Paleae basifixed to pseudopeltate, ovate – lanceolate, entire. Fronds tufted, lanceolate, tripinnatisect, acuminate; stipes 75 – 120 cm, black at base, dirty brown, grooved dorsally. Lamina 100 – 150 cm, pinnae more than 8 pairs, alternate, lowest pinnae slightly short, pinnules opposite to sub opposite. Sori fewer, diplazioid, small, basal, indusium thin, brown.

*Fertile:* July to September

*Specimen Cited:* Forest, Rajib & AP Das 0607, dated 26. 07. 2007

*Local Distribution:* Common along the margin of Bochamari Beel.

*General Distribution:* India: West Bengal, Assam, Arunachal Pradesh; Bangladesh, Bhutan, China, Malaysia.

*Allantodia solenopteris* Kunze, Linnaea 24: 266. 1851. *Athyrium solenopteris* (Kuntze) T. Moore, Ind. Fil.: 43, 187. 1857; Beddome, Handb. Ferns Brit. Ind. 166, 1883, *p.p. excl. syn.*; Singh *et* Panigrahi, Fern Fern-allies of Arun. Prad. I: 132. 2005. *Athyrium pectinatum* Beddome, Ferns S. Ind.: t. 155. 1864.

Rhizome erect, fronds up to 60 cm, tufted. Lamina oblong, gradually acuminate; pinnae 14 – 20 pairs, 2<sup>nd</sup> or 3<sup>rd</sup> pair largest, basal slightly reduced. Pinnules ovate-oblong, oblique, acute, pinnule lobes up to 8 mm, oblong rectangular, crenate to serrate. Sori basal, athyrioid to asplenoid, indusium whitish pale, thin, persistent.

*Fertile:* June to September

*Specimen Cited:* Forest, Rajib & AP Das 0046, dated 05. 02. 2007

*Local Distribution:* Deer conservation area of the Beel

*General Distribution:* India: West Bengal, Assam, Arunachal Pradesh; Bangladesh, Bhutan, China, Malaysia.

DIPLAZIUM Swartz, Jour. Bot. (Schrader) 2: 4, 61. 1801.

*Diplazium esculentum* (Retzius) Swartz, Jour. Bot. (Schrader) 1801(2): 312. 1803; Beddome, Handb. Ferns Brit. Ind. 192. 1883; Sledge in Bull. Brit. Mus. Bot. 2: 310. 1962; Singh *et* Panigrahi, Ferns Fern-All. Arun. Prad. I: 161. 2005; Hiroshi Ito in Hara, Fl. East. Himal. 1: 474. 1966. *Hemionitis esculenta* Retzius, Obs. Bot. 4: 38. 1791; Beddome, Handb. Ferns Brit. Ind. 192. 1883. *Anisogonium esculentum* (Retzius) C. Presl, Tent. Pterid. 116. 1836. *Anisogonium serampurens* C. Presl, Tent. Pterid. 116. 1836.

*Vernacular Name:* Dhekia Saag.

Terrestrial fern; rhizome erect, dark brown. Fronds large; lamina 2 pinnate; pinnae petiolate; pinnules many; lobes acuminate, base broadly cuneate, shortly stalked. Sori linear, continuous along almost whole length on both sides of veins, brown; sporangia shortly stalked.

*Fertile:* July to September

*Specimen Cited:* Forest, Rajib & AP Das 0534, dated 23. 07. 2007

*Local Distribution:* Abundant along the Beel margins and Roadside forests.

*General Distribution:* India: West Bengal, Sikkim, Arunachal Pradesh, Assam, Meghalaya, Tripura, Western Ghats; Bangladesh, China and Malaysia.

**Dryopteridaceae** Herter, Revista Sudamer. Bot. 9: 15. 1949; *nom. cons.*

**Key to the Genera:**

- 1a. Pinnae widest at base, pinnules sessile, oblique deltoid ..... *Dryopteris*
- 1b. Basal pair pinnae strongly reflexed and slightly reduced or equal, sessile .... *Polystichum*



DRYOPTERIS Adans, Familles des Plantes 2. 1763.

*Dryopteris sparsa* (Hamilton ex D. Don) O. Kuntze., Rev. Gen. Pl. 2: 813. 1891; Hiroshi Ito in Hara, Fl. East. Himal. 1: 478. 1966; Singh et Panigrahi, Fern Fern-allies of Arun. Prad. I. 286. 2005. *Nephrodium sparsum* D. Don, Prod. Fl. Nepal. 6. 1825; C.B. Clarke, Trans. Linn. Soc. London ser. II. Bot. 1: 523. 1880, *p.p.*; Hope, Jour. Bombay Nat. Hist. Soc. 14: 743. 1903. *Aspidium catophoron* Kuntze, Bot. Zeitung (Berlin) 6: 262. 1848. *Polystichum sparsum* (D. Don) Keyserling, Polyp. Herb. Bunge 43. 1873. *Aspidium sparsum* (Hamilton ex D. Don) Sprengel, Syst. Veg. 4: 106. 1827. *Lastrea sparsa* (Hamilton ex D. Don) Moore, Ind. Fil. 87. 104. 1858; Beddome, Handb. Ferns Brit. Ind. 252. 1883.

Rhizome erect, paleaceous. Fronds up to 70 cm, tufted, oblong-lanceolate, caudate acuminate. Stipes 20 - 30 cm, groove continuous to costae, scars of fallen paleae black and rough, purple. Lamina 30 - 45 cm long, pinnae 7 - 11 pairs, widest at base, pinnules sessile, oblique deltoid, acute, pinnatifid, lobes entire. Sori globose, receptacles elevated, dorsal, indusium reniform.

*Fertile*: July to December.

*Specimen Cited*: Forest, Rajib & AP Das 0515; dated 23. 07. 2007.

*Local Distribution*: All over the forest area.

*General Distribution*: India: West Bengal, Assam, Sikkim, Arunachal Pradesh; Nepal, Sri Lanka, Myanmar, Tibet, China, Malaysia, Philippines, Japan, Taiwan.

POLYSTICHUM Roth, Tentamen Florae Germanicae 3. 1799.

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

Rhizome erect, short, paleaceous, curve, teeth dark brown. Stipes dense, ascending, margin irregularly toothed. 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*: August to December.

*Specimen Cited*: Forest, Rajib & AP Das 0049, dated 05. 02. 2007.

*Local Distribution*: All over the forest area.

*General Distribution*: India: West Bengal, Assam, Arunachal Pradesh; Nepal, Bhutan.

**Tectariaceae** Panigrahi, J. Orissa Bot. Soc. 8: 41. 1986.

TECTARIA Cavanilles, Anales Hist. Nat. 1: 115. 1799.

*Tectaria coadunata* (Wallich ex Hooker et Greville) C. Christensen, Contrib. U.S. Nation. Herb. 26(6): 331. 1931; Tagawa, Act. Phytotax. Geobot. 21: 180. 1965; Hiroshi Ito in Hara, Fl. East. Himal. 1: 481. 1966; Singh et Panigrahi, Fern Fern-allies of Arun. Prad. II. 633. 2005. *Aspidium coadunatum* Wallich ex J. Smith, Cat. no. 377. 1828; Hooker et Greville, Icon. Fil. 2: t. 202. 1831. *Sagenia coadunata* J. Smith, Bot. 4: 184. 1841; Beddome, Ferns S. India: 28. t. 81. 1863. *Tectaria macrodonta* C. Christensen, Ind. Fil. Suppl. III: 181. 1934. *Tectaria viridifrons* Ching, Acta Phytotax. Sin. 19(1): 130. 1981. *Aspidium cicutarium* subsp. *coadunatum* (Wallich ex Hooker et Greville) C. Christensen, Index Filic. 68. 1928.

Rhizome erect, short. pinnae ca 50 x 30 cm wide, tripinnatifid, oblong, caudate acute; costae grooved. Pinnules sub opposite, oblong, gradually acuminate. Secondary pinnules the largest on basal acroscopic side, sessile, deeply pinnatifid, not grooved; lobes broad ovate, obtuse. Sori round, terminal on included veinlets in 2 rows along midvein in areoles, slightly sunk; indusium large, thin, subentire.

*Fertile:* May to November.

*Specimen Cited:* Forest, Rajib & AP Das 0067, dated 06. 02. 2007.

*Local Distribution:* Throughout the study area.

*General Distribution:* India: West Bengal, Assam, Sikkim, Arunachal Pradesh, Bihar; Sri Lanka, Myanmar, S. W. China, North Malaysia, Taiwan, Thailand, Tropical Africa, Formosa.

**Davalliaceae** Mettenius *ex* Frank in Leunis, Syn. Pflanzenkd. ed. 2, 3: 1474. 1877; Pichi-Sermolli in Webbia 31(2): 343. 1977.

NEPHROLEPIS Schott, Gen. Fil. [Schott] t. 3. 1834.

*Nephrolepis auriculata* (Linnaeus) Trimen, Jour. Linn. Soc. London Bot. 24(160): 152. 1887; Beddome, Handb. Ferns Brit. India, 282, t. 144. 1883; Clarke, Trans. Linn. Soc. London, II, Bot., 1: 540. 1880; Mehra *et* Bir, Pter. Fl. Darj. Sikk. Him. 121. 2008. Sledge, Bot. Journ. Linn. Soc. 84: 7. 20. 1982; Singh *et* Panigrahi, Fern Fern-allies of Arun. Prad. I. 405. 2005. *Polypodium auriculatum* Linnaeus, Sp.Pl. 2: 1088. 1753. *Nephrolepis cordifolia sensu auct. pl., non* (Linnaeus) C. Presl, Tent. Pterid. 79. 1836; C.B. Clarke, Trans. Linn. Soc. London ser. II. Bot. 1: 541. 1880, *p.p.*; Beddome, Handb. Ferns Brit. Ind. 282. 1883, *p.p.*; Kunio Iwatsuki in Hara, Fl. East. Himal. 1: 469. 1966.

Rhizome short, erect, paleaceous at apex; roots thick, bearing fleshy tubers; paleae up to 6 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, sessile, alternate, drying pale green. Sori median, terminal, indusium reniform.

*Fertile:* August to November.

*Specimen Cited:* Park, Rajib & AP Das 0589, dated 25. 07. 2007.

*Local Distribution:* All over the forest area.

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

**Polyodiaceae** J. Presel *et* C. Presel, Delic. Prag. 159. 1822.

#### Key to the Genera:

- 1a. Terrestrial; with creeping rhizome ..... 2
- 1b. Epiphytic herbs; rhizome scandent ..... 3
- 2a. Sori very close, sunk ..... *Pyrrosia*
- 2b. Sori not so compact, superficial ..... *Thelypteris*
- 3a. Sori irregularly scattered throughout the surface of the lamina ..... *Neochheiropteris*
- 3b. Sori biseriate throughout the surface of lamina between lateral veins ... *Drynaria*

DRYNARIA (Bory) J. Smith, Hooker's Journal of Bot. 3. 1841.

*Drynaria quercifolia* (Linnaeus) J. Smith, Jour. Bot. 3: 398. 1841; Beddome, Handb. Ferns Brit. Ind. 341. t. 191. 1883; Kunio Iwatsuki in Hara, Fl. East. Himal. 1: 493. 1966; Baishya *et* Rao,

Fern Fern-allies Meghalaya 61. 1982; P.J. Bora *et al.*, Fl. Div. Ass. 436. 2003. *Polypodium quercifolium* Linnaeus, Sp. Pl. 2: 1087. 1753.

Epiphytic; rhizome scales linear, cordate, dark brown. Fronds dimorphic; sterile fronds overlapping the base of fertile fronds; fertile fronds ovate to oblanceolate, ca 30 – 70 cm long, pinnatisect, stipitate. Sori small, copious, biseriate throughout the surface of lamina in between lateral veins.

*Fertile:* May to July.

*Specimen Cited:* Forest, Rajib & AP Das 0063, dated 05. 02. 2007.

*Local Distribution:* An abundant epiphyte in forest sector.

*General Distribution:* throughout India; China, Sri Lanka, Fiji, Malaysia, Tropical Australia.

NEOCHEIROPTERIS C. Christensen, Bull. Soc. Bot. France 52(Mém. 1): 21. 1905.

*Neocheiropteris superficialis* (Blume) Bosman, Leiden Bot. Ser. 14: 121. 1991. *Polypodium superficiale* Blume, Jour. Fil. 130. t. 56 f. a.1828. & Enum. Pl. Jav. 123. 1828. *Microsorium superficiale* (Blume) Ching, Bull. Fan. Mem. Inst. Biol. Bot. 4: 299. 1933. Pp. 47. *Pleopeltis superficiale* (Blume) Beddome, Hand. Fer. Bri. Ind. 75. 1865.

Epiphytic herbs; rhizome scandent, scales denticulate, fronds linear to lanceolate, tapering at both ends, often sinuate, entire. Sori oval or rounded, superficially, irregularly scattered through the surface of the lamina.

*Fertile:* December.

*Specimen Cited:* Forest, Rajib & AP Das 0061, dated 07. 02. 2007.

*Local Distribution:* Epiphytic in forests.

*General Distribution:* India: West Bengal, Assam, Manipur, Tripura, Arunachal Pradesh, Bihar, Uttar Pradesh, South India; Bhutan, China, Malaysia.

PYRROSIA Mirbel, Hist. Nat. Pl. 4: 70. 1803; Hist. Nat. Veg. 3: 471; 5: 91. 1803.

*Pyrrrosia lanceolata* (Linnaeus) Farwell, Amer. Midland. Nat. 12: 245. 1931; Singh *et* Panigrahi, Fern Fern-allies of Arun. Prad. II. 537. 2005. *Acrostichum lanceolatum* Linnaeus, Sp. Pl. 2: 1067. 1753. *Candollea lanceolata* (Linnaeus) Lamarck *et* Mirbel, Hist. Nat. Veg. 5: 89. 1803. *Niphobolus lanceolatus* (Linnaeus) Trimen, Journ. Linn. Soc. 24: 125. 1886. *Cyclophorus lanceolatus* (Linnaeus) Alston, Jour. Bot.: 102. 1931.

Rhizomes wide-creeping, paleaceous. Paleae up to 6 x 0.5 mm, peltate, lanceolate, long toothed to hairy, acuminate, brown. Fronds up to 11 x 0.5 cm, sessile to stipes ca 1 cm long, elliptic to lanceolate, entire, acute. Sori globose, very close, sunk, covered with stellate-hairs with lanceolate arms.

*Fertile:* June to January.

*Specimen Cited:* Forest, Rajib & AP Das 0064, dated 05. 02. 2007.

*Local Distribution:* Epiphyte in forest sectors.

*General Distribution:* India: tropical and sub tropical areas; Sri Lanka, China, Polynesia.

THELYPTERIS Schnidel, Ic. Pl. (ed. Keller) 1: 45. t. 11 (Oct. ) 1762. sen. str., nom cons.

*Thelypteris nudata* (Roxburgh) C.V. Morton, Contr. U.S. Natl. Herb. 38(7): 352. 1974. *Polypodium nudatum* Roxburgh in Griffith, Calcutta Jour. Nat. Hist. 4: 491. 1844. *Pronephrium nudatum* (Roxburgh) Chandra, Bull. Bot. Surv. India 13: 274. 1971; Holttum, Blumea 20(1): 111. 1972; Singh *et* Panigrahi, Fern Fern-allies of Arun. Prad. II. 732. 2005. *Goniopteris lineata sensu*

Beddome, Ferns Brit. Ind: t. 3. 1865. *Nephrodium moulmeinense* Beddome, Ferns Brit. India: t. 18. 1876; Beddome, Handb. Ferns Brit. India: 275. t. 141. 1883. *Cyclosorus nudatus* (Roxburgh) B. Nayar *et* Kaur, Comp. Beddome, Handb. Ferns Brit. India: 66. 1974. *Pneumatopteris nudata* (Roxburgh) Punetha *et* Kholia, Jour. Bombay Nat. Hist. Soc. 86 (3): 476. 1989.

Rhizome creeping, paleaceous; paleae up to 6 mm, basifixed, lanceolate, entire, acuminate, pale brown. Fronds up to 150 cm, pinnate, caudate acuminate. Stipes 60 – 90 cm, paleaceous at base, grooved dorsally, hairy all over. Pinnae up to 30 cm, sub opposite to alternate, sessile, about 10 pairs; coastae grooved, densely hairy; veins simple. Sori round, median, indusium small.

*Fertile:* June to November.

*Specimen Cited:* Forest, *Rajib & AP Das 0516*, dated 23. 07. 2007.

*Local Distribution:* All over the forested areas.

*General Distribution:* India: West Bengal, Assam, Sikkim, Arunachal Pradesh, Meghalaya, Bihar, Orissa; Nepal, Bhutan, Bangladesh, Myanmar, Malaysia.

## GYMNOSPERMS

The Gymnospermic plants family, genera and species with the accepted name as per the Plant List, through proper taxonomic treatments of species, collected from the Rasik Beel complex has been arranged in alphabetic order. The following sequence of enumeration is taken into consideration while enumerating each identified plants- (a) Accepted name (b) Basionyms (c) Synonyms if any (d) Vernacular name (e) Description (f) Cone formation time (g) Specimen cited (h) Local distribution (i) General distribution.

**Araucariaceae** Henkel *et* W. Hochstetter, Syn. Nadelholz. xvii, 1. 1865; *nom. cons.*

ARAUCARIA Jussieu, Gen. Pl. 413. 1789.

*Araucaria columnaris* (G. Forster) Hooker, Bot. Mag. 78: t. 4635 1852. *Araucaria cookii* Robert Brown *ex* Endlicher, Syn. Conif. 188 1847.

*Vernacular name:* Jhau.

Large trees, up to 20 m; crown tower-shaped when young, becoming flat topped with age; lateral branchlets dense, drooping, pinnately arranged. Leaves dimorphic, loosely arranged in lateral branchlets, needlelike, slightly curved, acute or acuminate, wide at base; leaves on mature trees densely arranged, overlapping, glaucous. Pollen cones terminal, solitary, ovoid to ellipsoid.

*Cone formation:* June to December.

*Specimen Cited:* Park, Rajib & AP Das 0265, dated 10.02.2007.

*Local Distribution:* Planted in Park.

*General Distribution:* Pantropicals.

**Cupressaceae** Gray, Nat. Arr. Brit. Pl. 2: 222, 225. 1822; *nom. cons.*

PLATYCLADUS Spach, Hist. Nat. V g. Phan. 11: 333. 1841.

*Platycladus orientalis* (Linnaeus) Franco, Portugaliae Acta Biol., ser. B, Sist. Vol. "J lio Henriques": 33. 1949. *Thuja orientalis* Linnaeus, Sp. Pl. 2: 1002. 1753. *Thuja decora* Salisbury, Prodr. Stirp. Chap. Allerton 398. 1796.

*Vernacular name:* Jhau.

Small trees, up to 5 m; crown ovoid-pyramidal, broadly rounded. Leaves 1–2 mm; facial leaves rhomboid; lateral leaves overlapping facial ones, boat-shaped, ridged. Pollen cones yellowish green, ovoid. Seed cones bluish green, subglobose.

*Cone formation:* March to October.

*Specimen Cited:* Park, Rajib & AP Das 0436, dated 22. 07. 2007.

*Local Distribution:* Planted in Park.

*General Distribution:* Cultivate in Pantropics.

**Cycadaceae** Persoon, Syn. Pl. 2: 630. 1807; *nom. cons.*

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

*Cycas pectinata* Buchanan-Hamilton, Mem. Wern. Nat. Hist. Soc. 5: 322. 1826. *Cycas jenkinsiana* Griffith, Not. Pl. Asiat. 4: 9. 1854.

Vernacular name: *Cycas*.

Trees, trunk cylindric, often dichotomously branched, up to 6 m. Leaves 50–90, pinnate; petiole 10–30 cm, with few spines; lamina oblong-lanceolate; leaflets in 50–100 pairs, thickly, leathery, acute, slightly recurved, base decurrent. Cataphylls triangular, brown tomentose. Pollen cones fusiform; microsporophylls cuneate, densely pale brown tomentose. Megasporophylls more than 30, tightly grouped. Seeds 2 to 4, orange, becoming dark brown.

*Cone formation*: June to March.

*Specimen Cited*: Park, Rajib & AP Das 0474, dated 23.07.2007.

*Local Distribution*: Planted in Park.

*General Distribution*: India: cultivate throughout; Bhutan, Nepal, Bangladesh, Cambodia, Laos, Myanmar, Thailand, Vietnam.

# ANGIOSPERMS

For the enumeration of Angiospermic plants the APG III classification (Chase & Reveal, 2009) has been followed in this work

## Angiosperms

### Basal Angiosperms

**Order: Nymphaeales** Salisbury *ex* Berchtold *et* J. Presl (1820).

**Nymphaeaceae** Salisbury, Ann. Bot. 2: 70. 1805; *nom. cons.*

NYMPHAEA Linnaeus, Sp. Pl. 1: 510. 1753, *nom. cons.*

#### Key to the species:

- 1.a. Rhizomes producing slender stolons ..... *N. pubescens*
- 1.b. Rhizomes does not producing slender stolons ..... 2
- 2.a. Carpels only partially united, walls between locules  
of ovary double; fruit globose ..... *N. nouchali*
- 2.b. Carpels completely united, walls between locules of  
ovary single. Fruit ovoid to subglobose ..... *N. rubra*

*Nymphaea nouchali* Burman *f.*, Fl. Ind. 120. 1768; Van Royen in Nova Guinea 8: 110. f. 1962 *p*; Sharma *et al.*, Fl. Ind. 430. 1993. *Nymphaea stellata* Willdenow, Sp. Pl. 2: 1153. 1799; Hooker *f. et* Thomson in Hooker *f.*, Fl. Brit. Ind. 1: 114. 1872; Prain, Beng. Pl. 1: 213. 1903. *Nymphaea madagascariensis* de Candolle, Syst. Nat. 2: 50 50 1821. *Nymphaea emirnensis* Planchon, Rev. Hort. 2: 65. 1853.

*Vernacular name:* Shaluk.

Rhizomes erect, unbranched. Lamina elliptic-orbicular to orbicular, 8 – 20 cm, papery, abaxially glabrous, peltate a few mm from base of sinus, subentire to deeply crenate, base cordate, basal lobes parallel. Flowers slightly emergent, 3–10 cm in diam. Calyx inserted on receptacle; sepals lanceolate to oblong-lanceolate, slightly veined, persistent; petals 15 – 25, white. Carpels only partially united, walls between locules of ovary double. Fruits globose. Seeds ellipsoid-globose.

*Flowers & Fruits:* June to November.

*Specimen Cited:* Varveri Beel, Rajib & AP Das 0336, dated 21.07.2007.

*Local Distribution:* All over the beel water.

*General Distribution:* India, Bangladesh, Nepal, Afghanistan, Indonesia, Myanmar, Pakistan, Philippines, Sri Lanka, Thailand, Vietnam, Australia, New Guinea.

*Nymphaea pubescens* Willdenow, Sp. Pl. 2: 1154. 1799; Sharma *et al.*, Fl. Ind., 431. 1993. *Nymphaea lotus* var. *pubescens* (Willdenow) Hooker *f. et* Thomson, Fl. Indica. 1: 241. 1855. Hooker *f. et* Thomson in Hooker *f.*, Fl. Brit. Ind. 1: 114. 1872.

*Vernacular name:* Shaluk.

Rhizomes erect, producing slender stolons. Lamina ovate – elliptic to suborbicular, 15 – 20 cm, papery, abaxially densely pubescent, peltate more than 5 mm from base of sinus, base deeply cordate and basal lobes subparallel, margin dentate and teeth acute to subspinose. Flowers emergent, 5 – 8 cm in diam. Calyx inserted on receptacle; sepals oblong, conspicuously veined, caducous or decaying after anthesis. Petals 12 – 16, white, red, or pink, oblong. Filament of inner stamens only slightly wider than anther; connective apically unappendaged. Carpels completely united, walls between locules of ovary single. Fruits ovoid to subglobose. Seeds ellipsoid to globose.

*Flowers & Fruits:* July to November.

*Specimen Cited:* Khottamari Beel, *Rajib & AP Das 0402*, dated 22. 07. 2007.

*Local Distribution:* All over the Beel.

*General Distribution:* India: throughout the plains; Bangladesh, Malaysia, Africa, Java, Philippines and Hungary.

*Nymphaea rubra* Roxburgh *ex* Andrews, Bot. Rep. 8 (104): t. 503.1808; Prain, Beng. Pl. 1: 213. 1903; Sharma *et al*, Fl. Ind., 431. 1993. *Nymphaea lotus auct. non.* Linnaeus, Hooker *f. et* Thomson in Hooker *f.*, Fl. Brit. Ind.1: 114. 1872; Campbell in Grierson *et* Long, Fl. Bhut. 1(2): 341. 1984 ; Prain, Beng. Pl. 1: 213. 1903. [PLATE: 5, Figure-36]

*Vernacular name:* Rakta shaluk.

Rhizomes erect. Lamina ovate to suborbicular, 15 – 30 cm, papery, abaxially densely pubescent, peltate more than 5 mm from base of sinus, margin dentate and teeth acute, base deeply cordate. Flowers emergent, 5 – 9 cm in diameter. Calyx inserted on receptacle, circular; sepals oblong, conspicuously veined, caducous or decaying after anthesis; petals 12–18, red, oblong. Filaments of inner stamens only slightly wider than anther; connective apically unappendaged. Carpels completely united, walls between locules of ovary single. Fruits ovoid to subglobose. Seeds ellipsoid to globose.

*Flowers & Fruits:* July to December.

*Specimen Cited:* Khottamari Beel, *Rajib & AP Das 0251*, dated 10. 02. 2007.

*Local Distribution:* All over the Beel.

*General Distribution:* India: throughout the plains; Sri Lanka, Myanmar, Taiwan, Thailand, Laos, Cambodia, Vietnam, Malaysia, Indonesia and Philippines.

## Magnoliids (fr.: Magnoliidées)

**Order: Laurales** Perleb (1826).

**Lauraceae** A. Jussieu, Gen. Pl. 80. 1789; *nom. cons.*

### Key to the Genera:

- 1a. Flowers unisexual, rarely bisexual, in pseudoumbels or racemes; bracts large, forming an involucre ..... *Litsea*
- 1b. Flowers bisexual, rarely unisexual, in panicles or clusters, rarely in pseudoumbels; bracts small, not forming an involucre ..... *Cinnamomum*

CINNAMOMUM Schaeffer, Bot. Exped. 74. 1760, *nom. cons.*

### Key to the Species:

- 1a. Terminal branchlet of panicle bearing a 3–5-flowered cyme ..... *C. tamala*
- 1b. Terminal branchlet of panicle bearing a 1–3-flowered cyme ..... 2
- 2a. Leaf blade elliptic-oblong, Fl. Bhut. 1 2–30 × 4–9 cm, thickly leathery, base subrounded or attenuate ..... *C. bejolghota*
- 2b. Leaf blade ovate to oblong-ovate or ovate-lanceolate, smaller, leathery or subleathery to papery, base acute ..... *C. verum*

*Cinnamomum bejolghota* (Buchanan–Hamilton) Sweet, Hort. Brit. 344. 1826. Long in Grierson *et* Long, Fl. Bhut. 1(2): 258. 1984. *Laurus bejolghota* Buchanan – Hamilton, Trans. Linn. Soc. London 13(2): 559-560. 1822. *Laurus obtusifolia* Roxburgh, Fl. Ind., 2: 302-303. 1832.



Evergreen tree, up to 20m. Leaves coriaceous, opposite, elliptic, 25 – 40 x 6 – 12 cm, obtuse, base cuneate, glossy above, strongly 3 – veined from base; petioles 2 – 3cm. Flowers usually bisexual in axillary panicles. Panicles 12 – 20 cm, panicle bearing a 1–3-flower; perianth segments ovate, 2 – 3 mm, pubescent. Fruits ellipsoid.

*Flowers & Fruits:* March to May.

*Specimen Cited:* Forest, *Rajib & AP Das 0469*, dated 23. 07. 2007.

*Local Distribution:* Forest sector.

*General Distribution:* India: Tropical and subtropical forests in West Bengal, Assam, Sikkim, Bihar, Orissa, Uttar Pradesh; Nepal, Bhutan, Bangladesh, Laos, Myanmar, Thailand, Vietnam

***Cinnamomum tamala*** (Buchanan-Hamilton) T. Nees *et* Ebermaier, *Handb. Med.-Pharm. Bot.* 2: 426 1831; Yasuiti Momiyama in Hara, *Fl. E. Himal.* 1: 99. 1966; Long in Grierson *et* Long, *Fl. Bhut.* 1(2): 355. 1984; Prain, *Beng. Pl.* 2: 899. 1903. *Laurus tamala* Buchanan-Hamilton, *Trans. Linn. Soc. London* 13(2): 555 – 558. 1822. *Cinnamomum reinwardtii* Nees, *Syst. Laur.* 70. 1836.

*Vernacular name:* Tejpata.

Evergreen trees, up to 20 m. Leaves coriaceous, opposite, lanceolate, 10 – 12 x 3 – 5 cm, shortly acuminate, base cuneate, glossy above, strongly 3 – veined from base; petioles 2 – 3cm. Flowers usually bisexual in axillary panicles. Panicles shorter, 5 – 10 cm, bearing 3–5-flowered units; perianth segments ovate, pubescent. Fruits ellipsoid, 1 – 1.4 cm, borne on enlarged perianth cup with lower part of segments persisting as short lobes 1 – 2 mm.

*Flowers & Fruits:* April to May.

*Specimen Cited:* Rasik Beel, *Rajib & AP Das 0540*, dated 23.07.2007.

*Local Distribution:* Cultivated in village areas.

*General Distribution:* India: West Bengal, Assam, Sikkim, Bihar, Orissa; Bhutan, Nepal, Bangladesh.

***Cinnamomum verum*** J. Presl, *Prir. Rostlin* 2: 36. 1823. *Cinnamomum zeylanicum* Breyné, *Eph. Nat. Cur. Dec.* 4: 139. 1677; Prain, *Beng. Pl.* 2: 899. 1903. *Cinnamomum bengalense* Lukmanoff, *Nomencl. Icon. Cannel.* 5. 1889.

*Vernacular name:* Darchini.

Evergreen, up to 10 m. Young branchlets gray. Buds sericeous puberulent. Leaves usually opposite; petiole 1.5 – 2 cm, glabrous; leaf blade greenish white abaxially, green and shiny adaxially, ovate to ovate-lanceolate, 10 – 15 x 4 – 5 cm, leathery, glabrous on both surfaces, triplinerved, midrib and lateral veins elevated on both surfaces, base acute, margin entire, acuminate. Terminal branchlet of panicle bearing a 3–5 flowered cyme. Flowers yellow. Perianth tube obconical; perianth lobes 6, oblong. Fertile stamens 9. Ovary ovoid, glabrous; style short; stigma discoid. Fruit ovoid, black when mature

*Flowers & Fruits:* April to May.

*Specimen Cited:* Village sector, *Rajib & AP Das 1537*, dated 23. 05. 2009.

*Local Distribution:* Cultivated in village areas.

*General Distribution:* India: all over country; Bhutan, Nepal, Bangladesh, native to Sri Lanka; also cultivated in many Asian countries.

LITSEA Lamarck, *Encycl.* 3: 574. 1792, *nom. cons.*

**Key to the Species:**

- 1a. Leaf blade papery or membranous and deciduous ..... *L. cubeba*  
 1b. Leaf blade leathery or thinly leathery and evergreen ..... 2  
 2a. Perianth segments imperfect or lacking; leaf blade gray-yellow  
 tomentose or subglabrous abaxially ..... *L. glutinosa*  
 2b. Perianth segments 6–8. Branchlets and petioles ferruginous pubescent;  
 leaf blade abaxially ferruginous pubescent ..... *L. monopetala*

***Litsea glutinosa*** (Loureiro) C.B. Robinson, Philipp. Jour. Sci. 6(5): 321. 1911; Long in Grierson *et* Long, Fl. Bhut. 1(2): 277. 1984. *Sebifera glutinosa* Loureiro, Fl. Cochinch. 638. 1790. *Litsea sebifera* Persoon, Syn. Pl. 2: 4. 1807; Prain, Beng. Pl. 2: 902. 1903.

*Vernacular name:* Pipul.

Tree, up to 15 m, young shoots whitish pubescent. Leaves coriaceous, ovate – lanceolate, 10 – 16 x 4 – 8 cm, acute, base cuneate, glabrous or pale pubescent beneath; lateral veins 7 – 10 pairs; petioles slender, 2.5 – 3.5 cm. Umbels large, 7 – 10 mm in bud, whitish pubescent, pedicels 3 – 5 mm, white – pubescent. Fruits globose.

*Flowers & Fruits:* May to June.

*Specimen Cited:* Forest, Rajib & AP Das 0618, dated 11. 02. 2008.

*Local Distribution:* All over the forest areas.

*General Distribution:* Tropical and subtropical parts of India, Bhutan, Nepal, Myanmar, Philippines, Thailand, Vietnam.

***Litsea monopetala*** (Roxburgh) Persoon, Syn. Pl. 2: 4. 1807; Y. Momiyama in Hara, Fl. E. Him. 1: 102. 1966; Hara *et al.*, Enn. Fl. Pl. Nep. 3: 185. 1982; Long in Grierson *et* Long, Fl. Bhut. 1(2): 276. 1984. *Tetranthera monopetala* Roxburgh, Pl. Coromandel 2: 26.t. 1798. *Litsea polyantha* Jussieu, Ann. Mus. Natl. Hist. Nat. 6: 211. 1805; Prain, Beng. Pl. 2: 903. 1903.

*Vernacular name:* Bonkanthal.

Trees to 10 m, branchlets brownish tomentose. Leaves broadly elliptic, 8 – 20 x 4.5 – 10 cm, obtuse or apiculate, base rounded, greenish beneath when dry, softly tomentose and prominently reticulate beneath, lateral veins 7 – 11 pairs; petioles 1 – 2.2 cm. Umbels densely pubescent, bud 4 mm, on tomentose peduncles 2.5 – 9 mm, forming dense clusters, peduncles sessile or borne on a short stout stalk 2 – 3.5 mm. Fruit subglobose, 7 x 5 mm, apiculate, borne on perianth cup 4 – 4.5 mm across, on slender pedicels 8 – 10 mm.

*Flowers & Fruits:* November to July.

*Specimen Cited:* Forest, Rajib & AP Das 0685, dated 14. 02. 2008.

*Local Distribution:* Forest areas.

*General Distribution:* Tropical and subtropical parts of India, Himalayas, Bhutan, Cambodia, Laos, Malaysia, Myanmar, Nepal, Pakistan, Thailand, Vietnam.

***Litsea cubeba*** (Loureiro) Persoon, Syn. Pl. 2(1): 44. 1807; Y. Momiyama in Hara, Fl. E. Him. 1: 101. 1966; Hara *et al.* Enum. Fl. Pl. Nep. 3: 185. 1982; Long in Grierson *et* Long, Fl. Bhut. 1(2): 274. 1984. *Laurus cubeba* Loureiro, Fl. Cochinch. 1: 252. 1790; Hooker *f.* in Hooker *f.*, Fl. Brit. Ind. 5: 155. 1885.

Shrubs up to 5 m high. Stem usually glabrous, blackened when dry. Leaf blade papery or membranous and deciduous; lower leaves opposite, upper alternate; petioles to 0.13 cm, slender; lamina lanceolate, entire-half lanceolate, entire-half contortate 5.5 – 13 x 1.8 – 2.5 cm, acuminate, cuneate, upper surface green above, lower surface glaucous, glabrous both sides, nerves distinct, lateral veins obliquely

ascending, 10 - 17 pairs. Inflorescence usually umbels in clusters of 3 - 4, 4 - 10 flowered, in short peduncled; pedicels white, pubescent. Flowers hairy; perianth toothed, tube slightly reduced at base. Fruits subglobose.

*Flowers & Fruits:* December to June.

*Specimen Cited:* Forest, Rajib & AP Das 0118, dated 07. 02. 2007.

*Local Distribution:* Forest areas.

*General Distribution:* India, E. Himalaya, Nepal, Bhutan, Myanmar, Java, W. & C. China.

## Order: Magnoliales Bromhead (1838)

**Annonaceae** Jussieu, Gen. Pl. 283. 1789; *nom. cons.*

### Key to the Genera:

- 1a. Fruits with completely united carpels and seeds embedded in pulp ..... *Annona*
- 1b. Fruits with carpels forming free, often stipitate ..... 2
- 2a. Sepals or inner petals and sometimes also outer petals clearly imbricate ..... *Uvaria*
- 2b. Sepals and petal whorls all valvate or rarely very narrowly imbricate at tip .. 3
- 3a. Climbing shrubs. Peduncles and fruiting pedicels hooklike ..... *Artabotrys*
- 3b. Trees or erect shrubs. Peduncles and fruiting pedicels not hooked ..... *Polyalthia*

ANNONA Linnaeus, Sp. Pl. 1: 536. 1753.

### Key to the Species:

- 1a. Outer petals outside surface and carpels hairy; areoles flattened and separated by ridges; fruit pulp yellowish ..... *A. reticulata*
- 1b. Outer petals and carpels glabrous; areoles convex and separated by deep grooves; fruit pulp whitish ..... *A. squamosa*

*Annona reticulata* Linnaeus, Sp. Pl. 1: 573. 1753; Hooker *f. et* Thomson in Hooker *f.* Fl. Brit. Ind. 1: 78. 1872; Sharma *et al.*, Fl. Ind. 1: 207. 1993; Panda *et al.*, Fl. Samb. 35. 2004; Grierson in Grierson *et* Long, Fl. Bhut. 1(2): 355. 1984; Prain, Beng. Pl. 1: 206. 1903. *Annona excelsa* Kunth, Nov. Gen. Sp. 5: 59. 1821. *Annona lutescens* Safford, Contr. U. S. Natl. Herb. 18: 41. 1914.

*Vernacular name:* Nona.

Trees, 4 – 10 m; glabrous. Leaves oblong – lanceolate, 9 –20 x 3 – 5cm, entire, acuminate, base rounded; petiole 1 –1.5 cm long, glabrous. Flowers in axillary or terminal cymes, 2 – 3; pedicels 1 – 2 cm long. Sepals 3, broadly ovate, shortly acuminate, 2 –3 x 2 – 3mm, pubescent outside. Petals 6, 3 in inner whorl; outer ones narrowly oblong, triquetrous, acute apex, pubescent outside. Stamens numerous, 1mm long. Carpels many, ovoid to linear, 1mm, 1 ovuled; style oblong; stigma entire. Fruits ovoid, reticulate, many loculed. Seeds black, arillate.

*Flowers & Fruits:* May to November.

*Specimen Cited:* Village sector, Rajib & AP Das 0253, dated 10. 02. 2007.

*Local Distribution:* Foresters house.

*General Distribution:* India: West Bengal, Delhi, Uttar Pradesh, Bihar; West Himalayas, Myanmar, Indo–China.

*Annona squamosa* Linnaeus, Sp. Pl. 1: 537. 1753; Panda *et al.*, Fl. Samb. 35. 2004; Sharma *et al.*, Fl. Ind. 1: 207. 1993; Grierson in Grierson *et* Long, Fl. Bhut. 1(2): 244. 1984 ; Prain, Beng. Pl.

1: 206. 1903. *Annona asiatica* Linnaeus, Sp. Pl. 537. 1753. *Annona forskahlii* de Candolle, Syst. Nat. 1: 472. 1817. *Guanabanus squamosus* M. Gómez, Fl. Haban. 114. 1897.

*Vernacular name:* Aata.

Small tree, up to 6 m. Leaves elliptic, 6–10 x 2–5 cm, acute, base cuneate, pubescent at first, soon glabrous; petioles 6–10 mm; flowers solitary or few, leaf-opposed; outer petals yellow, oblong; fruits ovoid–globose, 8–9 cm diameter, surface covered with the rounded tips of incompletely fused carpels, glaucous.

*Flowers & Fruits:* May to October.

*Specimen Cited:* Village sector, Rajib & AP Das 0229, dated 09. 02. 2007.

*Local Distribution:* Village areas.

*General Distribution:* India: Widely cultivated; Nepal, Bhutan, Myanmar, Indo–China, S. China.

ARTABOTRYS R. Brown ex Ker Gawler, Bot. Reg. 5: t. 423. 1820.

*Artabotrys hexapetalus* (Linnaeus f.) Bhandari, Baileya 12: 147. 1964; Sharma *et al.*, Fl. Ind. 1: 251. 1993; Grierson in Grierson *et Long*, Fl. Bhut. 1(2): 243. 1984. *Annona hexapetala* Linnaeus f., Sp. Pl. suppl. 270. 1781; *Artabotrys odoratissimus* R. Brown, Bot. Reg. 5, t. 423. 1819; Prain, Beng. Pl. 1: 202. 1903. *Annona uncinata* Lamarck, Encycl. 2(1): 127. 1786. *Artabotrys uncinata* (Loureiro) Baillon, Hist. Pl. 1: 232. 1867. *Uvaria uncinata* Loureiro, Fl. Cochinch. 1: 349. 1790. *Uvaria odoratissima* Roxburgh, Fl. Ind. 2: 666. 1832.

*Vernacular name:* Kanthal champa.

Climbing shrubs, up to 10 m. Branchlets glabrous. Petiole 4–8 mm; leaf blade oblong to broadly lanceolate, 6–20 x 3–6 cm, papery, adaxially glabrous, base cuneate to acute, apex acuminate to acute, lateral veins 8–16 pairs and elevated on both surfaces. Inflorescences 1–2 flowered. Flowers fragrant. Sepals green, ovate, sparsely puberulous. Petals greenish to yellowish, oblong lanceolate, outside basally densely pubescent. Stamens oblong; connective apex 3 angular. Carpels oblong, glabrous. Fruiting carpels ovoid, glabrous, apex conspicuously apiculate. Seeds pale brown, smooth.

*Flowers & Fruits:* May to December.

*Specimen Cited:* Park, Rajib & AP Das 0533, dated 23. 07. 2007.

*Local Distribution:* Planted in the park.

*General Distribution:* India: West Bengal, Assam, Bihar, Uttar Pradesh; Himalayas, Myanmar, China.

POLYALTHIA Blume, Fl. Javae, Annonaceae 68. 1829.

*Polyalthia longifolia* (Sonnerat) Thwaites, Enum. Pl. Zeyl. 398. 1864; Hooker f. *et Thomson* in Hooker f., Fl. Brit. Ind. 1: 62. 1872; Sharma *et al.*, Fl. Ind. 1: 274. 1993; Grierson in Grierson *et Long*, Fl. Bhut. 1(2): 244. 1984; Prain, Beng. Pl. 1: 204. 1903. *Uvaria longifolia* Sonnerat, Voyage aux Indes 2: 233. t. 131. 1782. *Unona longifolia* (Sonnerat) Dunal, Monogr. Fam. Anonac. 109. 1817.

*Vernacular name:* Debdaru.

Trees, up to 30 m. Leaves pendulous, narrowly lanceolate, 10–18 x 2–3 cm, gradually acuminate, base rounded, margin undulate; petioles 5–8 mm. Flowers 5–10 in subumbellate clusters, pedicels 1.5–2.5 cm. Sepals and petal whorls all valvate or rarely very narrowly imbricate at tip. Fruit apocarpous, with carpels forming free, ellipsoid, often stipitate.

*Flowers & Fruits:* March to September.

*Specimen Cited:* Park, Rajib & AP Das 0440, dated 22. 07. 2007.

*Local Distribution:* Frontside of Garden.

*General Distribution:* India: grown as ornamental in all warmer parts of the country; Native of Sri Lanka; Bhutan, Bangladesh, Myanmar, China.

UVARIA Linnaeus, Sp. Pl. 1: 536. 1753.

*Uvaria hamiltonii* Hooker *f. et* Thomson, Fl. Brit. Ind. 1: 96. 1855; H. Ohashi in Hara, Fl. E. Himal. 1: 97. 1966; Hajra *et al.*, Fl. W. Beng. 1: 153. 1997; Prain, Beng. Pl. 1: 199. 1903; Grierson in Grierson *et* Long, Fl. Bhut. 1(2): 238. 1984. *Uvaria hamiltonii* var. *kurzii* King, Mat. Fl. Malay. Penins. 1(4): 263. 1892.

Scrambling shrubs, stems densely brownish pubescent. Leaves elliptic – obovate, 12 – 18 x 5 – 9 cm, shortly acuminate, baserounded, brownish pubescent specially beneath; petioles 5 mm. Flowers 6 cm across, pedicels 2 – 3.5cm. Sepals broadly ovate, brown tomentose. Petals red, obovate – spatulate, finely tomentose. Fruiting carpels obovoid – ellipsoid, reddish – brown, tomentose.

*Flowers & Fruits:* May to June.

*Specimen Cited:* Forest, Rajib & AP Das 0475, dated 23. 07. 2007.

*Local Distribution:* Forests near conservation area.

*General Distribution:* India: West Bengal, Assam, Bihar, Uttar Pradesh; Bhutan, Bangladesh, Myanmar, China.

## **Magnoliaceae** Jussieu, Gen. Pl. 280. 1789; *nom. cons.*

MAGNOLIA Linnaeus, Sp. Pl. 1: 535. 1753.

### **Key to the Species:**

- 1a. Fruits cylindrical or terete, flowers terminal on axillary branches ..... *M. champaca*
- 1b. Fruits globose to ovoid, flowers terminal in position ..... *M. grandiflora*

*Magnolia champaca* (Linnaeus) Baillon *ex* Pierre, Fl. Forest. Cochinch. t. 3. 1880. *Michelia champaca* Linnaeus, Sp. Pl. 1: 536. 1753; Hooker *f. et* Thomson in Hooker *f.*, Fl. Brit. Ind. 1: 42. 1872; H. Hara in H. Hara, Fl. East. Himal. 2: 36. 1971; Grierson in Grierson *et* Long, Fl. Bhut. 1(2): 236. 1984; Sharma *et al.*, Fl. Ind. 1: 175. 1993 ; Prain, Beng. Pl. 1: 197. 1903. *Michelia rufinervis* Blume, Bijdr. Fl. Ned. Ind. 1: 8. 1825.

*Vernacular name:* Swarna Champa.

Trees up to 50 m. Twigs ascending and forming a narrow umbelliform crown. Petiole 2 – 4 cm; leaf blade elliptic or elliptic–ovate, 12 – 25 x 4 – 8 cm, abaxially slightly puberulous, base broadly cuneate to rounded, apex long acuminate to subcaudate. Flowers fragrant, terminal on axillary brachyblasts. Tepals 15 – 20, yellow, oblanceolate. Staminal connective exerted and forming a long tip. Gynophore 2.5 – 3 mm; gynoecium with trichomes. Fruit 6 – 12 cm; mature carpels cylindrical or terete, tuberculate. Seeds 2 – 4 per carpel, rugose.

*Flowers & Fruits:* July to October.

*Specimen Cited:* Park, Rajib & AP Das 0187, dated 09. 02. 2007.

*Local Distribution:* Park.

*General Distribution:* India: Tropical and subtropical forest, West Bengal, Assam, Sikkim, Nagaland, Arunachal Pradesh, Bihar, Orissa, Delhi, Uttar Pradesh, West Himalayas; native to India, Indonesia, Malaysia, Myanmar, Nepal, Thailand, Vietnam.

*Magnolia grandiflora* Linnaeus, Syst. Nat., ed. 10, 2: 1802. 1759. *Magnolia longifolia* Sweet, Hort. Brit. 11. 1826. *Magnolia angustifolia* Millais, Magnolias 55, 83. 1927.

*Vernacular name:* Magnolia.

Trees, up to 30 m. Bark pale brown to gray. Petiole 2–4 cm, deeply furrowed; leaf blade elliptic to obovate-oblong, Fl. Bhut. 1 1–21 × 4–8 cm, thickly leathery, adaxially deep green and glossy, secondary veins 8–10 on each side of midvein, base cuneate, apex shortly mucronate. Flowers 12–18 cm in diam., fragrant, terminal in position. Tepals 9–12, white, obovate, thickly fleshy. Stamens 1.8–2 cm; filaments purple, flat; connective exerted and forming a mucro; anthers introrse. Gynoecium ellipsoid, densely long tomentose; carpels ovoid; styles reclinate. Fruit ovoid, densely brown to pale grayish yellow tomentose; mature carpels abaxially rounded, dehiscing along dorsal sutures, apex long beaked. Seeds ovoid; testa red.

*Flowers & Fruits:* June to October.

*Specimen Cited:* Park, Rajib & AP Das 0123, dated 07. 02. 2007.

*Local Distribution:* Park.

*General Distribution:* India: widely cultivated; Himalayas, Myanmar, China, native to North America.

## Order: Piperales Dumortier (1829)

**Aristolochiaceae** A. Jussieu, Gen. Pl. 72. 1789; *nom. cons.*

ARISTOLOCHIA Linnaeus, Sp. Pl. 2: 960. 1753.

### Key to the species:

- 1a. Leaves leathery; racemes 5–8 flowered; capsules dehiscing basipetally ..... *A. indica*
- 1b. Leaves papery; racemes 2–3 flowered; capsules dehiscing acropetally ..... *A. tagala*

*Aristolochia indica* Linnaeus, Sp. Pl. (1): 960. 1753; Prain, Beng. Pl. 2: 891. 1903. *Aristolochia lanceolata* Wight, Icon. Pl. Ind. Orient. 5: t. 1858 1852. *Aristolochia indica* var. *lanceolata* (Wight) Duchartre, Prodr. 15(1): 479. 1864.

*Vernacular name:* Ishwarmul.

Shrubby climber. Stem terete, with elongate internodes. Petiole 3 cm; lamina ovate, 5–10 × 4–8 cm, acute, base deeply cordate, leathery, glabrescent, veins palmate, 3–5 pairs from base. 5–8 flowered short racemes axillary. Pedicels pendulous, 3–6 cm; bracts ovate. Perianth tube geniculately curved, abaxially villous to glabrous; limb subcylindric, 3-lobed; lobes slightly unequal, subrounded. Anthers oblong. Gynostemium 3-lobed. Capsules oval, dehiscing basipetally.

*Flowers & Fruits:* April to July.

*Specimen Cited:* Forest, Rajib & AP Das 0086, dated 06. 02. 2007.

*Local Distribution:* Forest areas.

*General Distribution:* India: West Bengal, Assam, Sikkim, Bihar, Orissa; Nepal, Bhutan.

*Aristolochia tagala* Chamisso, Linnaea 7: 207. 1832; H. Hara in Hara, Fl. E. Himal. 3: 29. 1971; Grierson *et* Long in Grierson *et* Long, Fl. Bhut. 1(2): 354. 1984; Prain, Beng. Pl. 2: 891. 1903. *Aristolochia roxburghiana* Klotzsch, Monatsber. Königl. Preuss. Akad. Wiss. Berlin 596. 1859. *Aristolochia acuminata* Lamarck, Encycl. 1: 254. 1783.

Shrubby twinners. Stems terete, slightly furrowed, glabrous. Petiole glabrous; lamina ovate-cordate to oblong-ovate, 8–12 × 4–10 cm, acute to acuminate, base deeply cordate, lateral lobes subrounded, papery, both surfaces glabrous, veins palmate. Racemes in axils of leafy shoots, 2 to 3

flowered. Pedicels sparsely hairy, glabrescent; bractlets ovate-lanceolate. Perianth pale yellowish to greenish; tube slightly curved; utricle globose; limb ligulate, oblong, apex obtuse. Anthers ovoid. Capsules obovoid-globose to ovoid-cylindric, dehiscing acropetally. Seeds triangular.

*Flowers & Fruits:* May to August.

*Specimen Cited:* Forest, Rajib & AP Das 0298, dated 10. 02. 2007.

*Local Distribution:* Forest areas.

*General Distribution:* India: West Bengal, Sikkim, Assam, Arunachal Pradesh; Nepal, Bhutan, Bangladesh, Cambodia, Indonesia, Japan, Malaysia, Myanmar, Philippines, Thailand, Vietnam.

**Chloranthaceae** R. Brown *ex* Sims, Bot. Mag. 48: ad t. 2190. 1820; *nom. cons.*

CHLORANTHUS Swartz, Philos. Trans. 77: 359. 1787.

*Chloranthus erectus* Sweet, Hort. Suburb. London 28. 1818. *Chloranthus elatior* Link, Enum. Hort. Berol. Alt. 1: 140. 1821; H. Hara in Hara, Fl. E. Himal. 2: 14. 1971; Grierson *et* Long in Grierson *et* Long, Fl. Bhut. 1(2): 351. 1984. *Chloranthus erectus* (Buchanan-Hamilton) Verdcourt, Kew Bull. 40: 217. 1985. *Cryphaea erecta* Buchanan-Hamilton, Edinburgh Jour. Sci. 2: 11. 1825. *Chloranthus officinalis* Blume, Enum. Pl. Javae 79. 1827.

*Vernacular name:* Bon cha.

Subshrubs up to 2 m. Stems terete, glabrous. Leaves opposite; leaf blade broadly elliptic or obovate to oblanceolate, 10 – 18 × 4 – 7 cm, serrate, caudate, base cuneate, rigidly papery, glandular, glabrous; lateral veins 5 – 9 pairs. Spikes terminal, dichotomously or racemously branched; bracts triangular to ovate. Flowers white, small. Stamens 3; 2-loculed; lateral lobes smaller, with a 1-loculed anther each. Ovary ovoid. Young fruits green, white at maturity.

*Flowers & Fruits:* April to September.

*Specimen Cited:* Forest, Rajib & AP Das 0188, dated 09. 02. 2007.

*Local Distribution:* Forest areas.

*General Distribution:* India: West Bengal, Sikkim, Assam, Nagaland, Arunachal Pradesh; Bhutan, Nepal, Cambodia, Indonesia, Laos, Malaysia, Myanmar, Philippines, Thailand, Vietnam.

**Piperaceae** C. Agardh, Aphor. Bot. 201. 1824; *nom. cons.*

### Key to the Genera:

- 1a. Prophylls present, leaving conspicuous scars around stem nodes ..... *Piper*  
 1b. Prophylls absent, without or scars at nodes ..... *Peperomia*

PIPER Linnaeus, Sp. Pl. 1: 28. 1753.

### Key to the Species:

- 1a. Bracts oblong or obovate-oblong, adnate to rachis with  
 only sides and apex free ..... *P. nigrum*  
 1b. Bracts orbicular, peltate with free margin all round ..... 2  
 2a. Fruits apically tomentose, completely fused to each other  
 to form a nearly smooth, fleshy ..... *P. betle*  
 2b. Fruit glabrous, distinct, sometimes very soft when fully ripe  
 and then difficult to separate when pressed and dried ..... 3  
 3a. Leaves with veins all basal or nearly basal and all arising less than 3 mm  
 from base of blade. Leaves very finely powdery pubescent abaxially ..... *P. longum*

- 3b. Leaves with 2 or more lateral veins arising more than 1 cm from base of blade. Leaf blade and petiole glabrous or very finely powdery pubescent along veins ... 4
- 4a. Ovaries and fruit partly fused to rachis ..... *P. hamiltonii*
- 4b. Ovaries and fruit free from rachis ..... *P. sylvaticum*

***Piper betle*** Linnaeus, Sp. Pl. 1: 28. 1753; Hooker *f.* in Hooker *f.*, Fl. Brit. Ind. 5: 85. 1886; Long in Grierson *et* Long, Fl. Bhut. 1(2): 349. 1984, *sensu Piper betleoides* C. de Candolle; Prain, Bengal Pl. 2: 893. 1903. *Chavica betle* (Linnaeus) Miquel, Syst. Piperac. 228. 1843. *Chavica densa* Miquel, Syst. Piperac. 252. 1843.

*Vernacular name:* Paan.

Dioecious climbers. Stems rooted at nodes, slightly woody. Petiole very finely powdery pubescent; leaf-blade ovate to ovate-oblong, acuminate, cordate to rounded, symmetric, veins 7, usually opposite, others basal; reticulate veins conspicuous. Bracts orbicular, peltate with free margin all round. Spikes leaf-opposed. Fruits apically tomentose, completely fused to each other to form a nearly smooth. Drupes fused to form terete, fleshy, reddish infructescence.

*Flowers & Fruits:* May to July.

*Specimen Cited:* Forest, Rajib & AP Das 0175, dated 08. 02. 2007.

*Local Distribution:* Forest sectors.

*General Distribution:* India: Tropical and subtropical forests; S.E. to S.W. China, Indonesia, Malaysia, Philippines, Sri Lanka, Vietnam, Africa.

***Piper hamiltonii*** C. DC., Prodr. 16(1): 360. 1869; Hooker *f.* in Hooker *f.*, Fl. Brit. Ind. 5: 88. 1885; Long in Grierson *et* Long, Fl. Bhut. 1(2): 351. 1984; Prain, Beng. Pl. 2: 893. 1903.

Climber. Stem deeply striate, when dry. petiole to 2.4 cm; Lamina elliptic or elliptic obovate, 6 – 13 x 3.5 – 7 cm, obtuse, base rounded, 5 – veined, in lower most, 4.5 mm, without lateral veins, glabrous or very finely powdery pubescent along veins, coriaceous, pale in dry. Bracts orbicular, peltate with free margin all round. Fruiting spike interrupted, 10 – 16 cm, on peduncle 1- 2.5 cm. Ovaries and fruit partly fused to rachis. Drupes ovoid-subglobose, to 2.8 mm.

*Flowers & Fruits:* February to May.

*Specimen Cited:* Forest, Rajib & AP Das 0120, dated 07. 02. 2007.

*Local Distribution:* Forest areas

*General Distribution:* India: Tropical and subtropical forests; Nepal, Bhutan.

***Piper longum*** Linnaeus, Sp. Pl. 1: 29. 1753; Hooker *f.* in Hooker *f.*, Fl. Brit. Ind. 5: 83. 1886; H. Hara in Hara, Fl. E. Himal. 1: 43. 1966; Hara *et al.*, Enn. Fl. Pl. Nep. 3: 183. 1982; Long in Grierson *et* Long, Fl. Bhut. 1(2): 348. 1984; Prain, Beng. Pl. 2: 893. 1903.

*Vernacular name:* Pipul, Pipla.

Climbing shrub. Lamina symmetric, subacute or bluntly acuminate, base deeply cordate-auriculate, membranous, veins all basal or nearly basal and all arising less than 3 mm from base, very finely powdery pubescent abaxially. Bracts orbicular, peltate with free margin all round. Male spikes slender and female spikes cylindrical. Fruits glabrous, distinct, sometimes very soft when fully ripe and then difficult to separate when pressed and dried.

*Flowers & Fruits:* September to January.

*Specimen Cited:* Forest, Rajib & AP Das 0206, dated 09. 02. 2007.

*Local Distribution:* Forest areas.



*General Distribution:* India: tropical and subtropical forest, West Bengal, Assam, Sikkim, Arunachal Pradesh, Nagaland; Bangladesh, Bhutan, Nepal, Malaysia, Sri Lanka.

***Piper nigrum*** Linnaeus, Sp. Pl. 28. 1753; Hooker f. in Hooker f., Fl. Brit. Ind. 5: 90. 1887; Prain, Beng. Pl. 2: 893. 1903.

*Vernacular name:* Golmorich.

Slender climbers, rooting at nodes. Lamina broadly ovate oblong, oblique, base rounded, coriaceous. Bracts oblong or obovate-oblong, adnate to rachis with only sides and apex free. Spikes robust, Flowers dioecious. Fruits globose, sessile, black when ripe.

*Flowers & Fruits:* January to April.

*Specimen Cited:* Park, Rajib & AP Das 0262, dated 10. 02. 2007.

*Local Distribution:* Cultivated in Park sector.

*General Distribution:* India: widely cultivated in warmer regions; Nepal, Bhutan, Bangladesh, China.

***Piper sylvaticum*** Roxburgh, Fl. Ind. 1: 156. 1832; Hooker f. in Hooker f., Fl. Brit. Ind. 5: 84. 1886; Long in Grierson *et* Long, Fl. Bhut. 1(2): 348. 1984; Prain, Beng. Pl. 2: 893. 1903.

Climbers. Stoloniferous. Lamina usually ovate, acuminate, base cordate, with 2 or more lateral veins arising more than 1 cm from base, glabrous or very finely powdery pubescent along veins. Spikes leaf-opposed. Bracts orbicular, peltate with free margin all round. Male spikes slender. Female spikes erect, very finely powdery pubescent. Ovary globose, distinct. Ovaries and fruits free from rachis. Fruits glabrous, distinct, sometimes very soft when fully ripe and then difficult to separate when pressed and dried. Drupes globose.

*Flowers & Fruits:* August to September.

*Specimen Cited:* Forest, Rajib & AP Das 0314, dated 10. 02. 2007.

*Local Distribution:* Forest sectors.

*General Distribution:* Tropical and sub-tropical parts of the world.

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

***Peperomia pellucida*** (Linnaeus) Humboldt, Bonpland *et* Kunth, Nov. Gen. 1: 64. 1816 ; H. Hara in Hara, Fl. E. Himal. 1: 42. 1966; Long in Grierson *et* Long, Fl. Bhut. 1(2): 345. 1984; Prain, Beng. Pl. 2: 894. 1903. *Piper pellucidum* Linnaeus, Sp. Pl. 1. 30. 1753; *Micropiper pellucidum* (Linnaeus) Miquel, Comm. Phytogr. 54. 1840. *Peperomia ephemera* Ekman, Ark. Bot. 22 A(9): 20. 1929. *Peper exigua* (Blume) Miquel, Syst. Pip. 77. 1843; Hooker f. in Hooker f., Fl. Brit. Ind. 5: 97. 1886.

*Vernacular name:* Golpata.

Annual herbs, fleshy, up to 30 cm, glabrous. Stems ascending, much branched. Petiole 1–2 cm; lamina broadly ovate to ovate-triangular, acute, base cordate, length equal to width, membranous, both surfaces glabrous, translucent. Spikes terminal or leaf-opposed, slender, glabrous, flowers lax, slightly embedded in rachis; bracts shield-shaped, suborbicular, stalk short. Anthers subglobose. Ovary ellipsoid. Nuts globose.

*Flowers & Fruits:* April to July.

*Specimen Cited:* Park, Rajib & AP Das 0168, dated 08. 02. 2007.

*Local Distribution:* Abundant in park and conservation sectors.

*General Distribution:* Native of tropical America, Tropical and sub-tropical parts of the world.

## Monocots - Monocotyledon (Einkeimblättrige)

### Non Commelinids - Nicht-Commelinide

**Order: Alismatales** Dumortier (1829)

**Alismataceae** Ventenat, Tabl. Regn. Vég. 2: 157. 1799; *nom. cons.*

#### Key to the Genera:

- 1a. Plants with specialized tuber ..... *Butomopsis*
- 1b. Plants with simple tuber ..... *Sagittaria*

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

*Butomopsis latifolia* (D. Don) Kunth, Enum. Pl. 3: 165. 1841; Noltie, Fl. Bhutan 3(1): 163. 1994; Cook, Aqua. Wetl. Pl. Ind. 247. 1996. *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; Prain, Beng. Pl. 2: 1120. 1903.

Annual herbs with specialized tuber. Leaves radical, erect; petiole up to 18 cm; lamina 5 – 16 cm, 3 – 7 veined, acute, base attenuate. Scapes up to 30 cm; umbels 3 – 14 flowered. Sepals broadly elliptic, margin membranous, apex rounded to retuse.

*Flowers & Fruits:* May to September.

*Specimen Cited:* Bochamari Beel, *Rajib & AP Das 0007*, dated 05. 02. 2007.

*Local Distribution:* Throughout the Beel complex.

*General Distribution:* India, Nepal, throughout S.E. Asia, N. Africa, N. Australia.

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

#### Key to the species:

- 1a. Plants with floating leaf; lamina cordate, obtuse ..... *S. guayanensis*
- 1b. Plants erect; stoloniferous; lamina hastate, acute ..... *S. sagittifolia*

*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; Cook, Aqua. Wetl. Pl. Ind. 39, 1996; Rao & Verma in Bull. Bot. Surv. Ind. 18 (1-4): 39. 1976. *Sagittaria guayanensis* ssp. *lappula* (D. Don) Bogin, Mem. N. Y. Bot. Gard. 9: 192. t. 5. 1955. *Sagittaria guayanensis* Kunth, Syn. Pl. 1: 261. 1822. *Lophiocarpus guayanensis* (Kunth) Micheli, Monogr. Phan. 3: 62. 1881. *Echinodorus guayanensis* (Kunth) Grisebach, Fl. Brit. W. I. 505. 1862. [PLATE: 8, Figure-84]  
*Vernacular name:* Kut.

Fleshy, aquatic or marshy immersed herbs. Leaves radical; lamina floating, broadly ovate, obtuse or rounded, cordate at base; petiole long. Flowers white, in close whirls on stout pedicels; upper and lower few bisexual; petals ovate. Achenes several, surrounded by a toothed wing.

*Flowers & Fruits:* August to December.

*Specimen Cited:* Bochamari Beel, *Rajib & AP Das 0009*, dated 05. 02. 2007.

*Local Distribution:* Margins of water bodies through out the Beel.

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

*Sagittaria sagittifolia* Linnaeus, Sp. Pl. 2: 993. 1753; Hooker *f.*, Fl. Brit. Ind. 6: 561. 1893; Cook, Aqua. Wetl. Pl. Ind. 39, 1996; Rao & Verma in Bull. Bot. Surv. Ind. 18(1-4): 39. 1976; Rae *et* Noltie in Noltie, Fl. Bhut. 3(1): 164. 1994; Prain, Beng. Pl. 2: 1120. 1903; Bora & Kumar, Fl.

Div. Ass. 314. 2003. *Sagittaria sagittaria* Thunberg, Fl. Jap. 242. 1784. *Alisma sagittaria* Stokes, Bot. Mat. Med. 2: 335. 1812. *Sagittaria aquatica* Lamarck, Fl. Franç. 2:197. 1779. *Sagittaria heterophylla* Schreber, Fl. Erlang. 2:119. 1811. [PLATE: 9, Figure-92]

*Vernacular Name:* Chhoto kut.

Erect, fleshy aquatic or marshland stoloniferous herbs. Leaves radical; lamina hastate or sagittate, acute; petioles trigonous, spongy. 1-3 flowered whorls of panicles; flowers whitish purple. Achenes in a globose head, compressed, winged.

*Flowers & Fruits:* February to August.

*Specimen Cited:* Batikata Beel, *Rajib & AP Das 0033*, dated 05. 02. 2007.

*Local Distribution:* Margins of water bodies of Conservatory sectors and open fishing areas.

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

### **Aponogetonaceae** Planchon, Bot. Mag. 82: ad. t. 4894. 1856; *nom. cons.*

APONOGETON Linnaeus *f.*, Suppl. Pl. 32, 214. 1782, *nom. cons.*

#### **Key to the species:**

- 1a. Leaves floating ..... 2
- 1b. Leaves submerged ..... *A. crispum*
- 2a. Flowers pink or purple ..... *A. natans*
- 2b. Flowers white ..... *A. lakhonensis*

***Aponogeton crispum*** Thunberg, Nov. Gen. 4: 73. 1784; Hooker *f.*, Fl. Brit. Ind. 6: 564. 1893; Prain, Beng. Pl. 2: 1122. 1903; Cook, Aqua. Wetl. Pl. Ind. 48, 1996; Datta & Majumdar, Bull. Bot. Soc. Beng. 20 (2): 22. 1966. *Aponogeton echinatus* Roxburgh, Fl. Ind. 2: 210. 1832. *Spathium crispum* (Thunberg) Voigt, Hort. Suburb. Calcutt. 694. 1845. *Spathium echinatum* (Roxburgh) Voigt, Hort. Suburb. Calcutt. 694. 1845.

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 to February.

*Specimen Cited:* Varveri Beel, *Rajib & AP Das 0012*, dated 05. 02. 2007.

*Local Distribution:* Throughout Beel complex.

*General Distribution:* India: Andhra Pradesh, Kerala, Karnataka, Maharashtra, Punjab, West Bengal; Sri Lanka.

***Aponogeton natans*** (Linnaeus) Engler & Krause, Engler Pfreich. 24: 11. 1906; Majumdar, Bull. Bot. Soc. Beng. 19 (1): 15. 1955; Cook, Aqua. Wetl. Pl. Ind. 48, 1996. *Saururus natans* Linnaeus, Mantissa 2: 227. 1767. *Aponogeton monostachyus* Linnaeus *f.*, Suppl. 214. 1781 (ut *monostachon*); Hooker *f.*, Fl. Brit. Ind. 6: 564. 1893; Prain, Beng. Pl. 2: 1122. 1903. *Spathium monostachyum* (Linnaeus *f.*) Edgew, J. Asiat. Soc. Bengal 11: 148. 1842. *Aponogeton lucens* Hooker *f.*, Fl. Brit. India 6: 564. 1893.

Aquatic, perennial, stoloniferous herbs; scapigerous. Leaves floating with scapes sticking out. Flowers differently coloured, pink or purple, bisexual; perianth segments longer than mature carpels. Follicles smooth, 4 – 8 seeded.

*Flowers & Fruits:* October to March.

*Specimen Cited:* Varveri Beel, *Rajib & AP Das 0015*, dated 05. 02. 2007.

*Local Distribution:* Throughout Beel complex.

*General Distribution:* India: Andhra Pradesh, Jharkhand, Hariyana, Kerala, Karnataka, Madhya Pradesh, Orissa, Punjab, Rajasthan, Tripura, West Bengal; Sri Lanka, Tropical Asia and Africa.

*Aponogeton lakhonensis* A. Camus, Notul. Syst. 1: 273. 1910; Cook, Aqu. Wet. Pl. Ind. 48. 1996. *Aponogeton luteus* A. Camus, Notul. Syst. (Paris) 2: 204. 1912. *Aponogeton pygmaeus* K. Krause, Bot. Jahrb. Syst. 44(101): 8. 1910. *Aponogeton taiwanensis* Masamune, Kudoa 2(1): 1. 1941.

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, rounded, base rounded, herbaceous, with primary veins 7–9 at base. Inflorescence 4–5.5 cm, pedunculate. Flowers white, bisexual. Perianth segments 2, slightly obovate. Stamens 6. Carpels slightly united near base. Fruits ovoid.

*Flowers & Fruits:* September to February.

*Specimen Cited:* Khottamari Beel, Rajib & AP Das 0006, dated 05. 02. 2007.

*Local Distribution:* Throughout Beel complex.

*General Distribution:* India: West Bengal, Assam; Cambodia, Indonesia, Laos, Malaysia, Thailand, Vietnam.

**Araceae** A. Jussieu, Gen. Pl. 23. 1789. *nom. cons.*

**Key to the Genera:**

- 1a. Spadix with many flowers ..... 2
- 1b. Spadix with 1 – 2 male and 1 – 2 female flowers ..... 11
- 2a. Plants aquatic or semi-aquatic ..... 3
- 2b. Plants terrestrial ..... 6
- 3a. Plants free-floating ..... *Pistia*
- 3b. Plants rooted at the bottom ..... 4
- 4a. Plants much spiny; flowers bisexual ..... *Lasia*
- 4b. Plants without spines; flowers unisexual or sterile ..... 5
- 5a. Lamina peltate ..... *Colocasia*
- 5b. Lamina not peltate, ovate to linear-lanceolate ..... *Cryptocoryne*
- 6a. Plants erect ..... 7
- 6b. Plants climbing ..... 10
- 7a. Rhizome underground, short ..... 8
- 7b. Rhizome arial, large ..... *Alocasia*
- 8a. Plants stemless ..... *Xanthosoma*
- 8b. Plants with globose tuber ..... 9
- 9a. Leaves usually deeply 3-lobed ..... *Typhonium*
- 9b. Leaves much divided, twice or more ..... *Amorphophallus*
- 10a. Lamina oblong-elliptic or ovate-elliptic ..... *Scindapsus*
- 10b. Lamina lanceolate to linear-lanceolate with an articulation near base ..... *Pothos*
- 11a. Fronds rootless; inflorescences not enclosed in a membranous sheath ..... *Wolffia*
- 11b. Fronds bearing roots; inflorescences enclosed in a membranous sheath ..... 12
- 12a. Roots solitary on each frond segment ..... *Lemna*
- 12b. Roots several from each frond segment ..... *Spirodella*

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

***Lemna aequinoctialis*** Welwitsch, Apont. 578. 1859; Cook, Aqua. Wetl. Pl. Ind. 227, 1996. *Lemna minor* Hegelmaier, J. Bot. 3: 112. 1865; Noltie, Fl. Bhut. 3(1): 160. 1994; Cook, Aqua. Wetl. Pl. Ind. 228, 1996; *Lemna perpusilla* var. *trinervis* Austin, Manual 5: 479. 1867. *Lemna paucicostata* Hegelmaier, Lemnac. 139. t. 8. 141. 1868; Hooker f., Fl. Brit. Ind. 6: 556. 1893; Prain, Beng. Pl. 2: 1117. 1903. [PLATE: 10, Figure-116]

*Vernacular name:* Topa/ Khudi Paana

Small, free floating herbs. Fronds 1.5 – 2 mm long, ovate or ovate – oblong, asymmetric, nearly flat. Root solitary with winged root-sheath and acute root cap (called root pocket). Female flowers with solitary orthotropous ovule. Seeds ovoid, prominently ribbed.

*Flowers & Fruits:* August to October.

*Specimen Cited:* Bochamari Beel, *Rajib & AP Das 0028*, dated 05. 02. 2007.

*Local Distribution:* Throughout the Beel Complex.

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

SPIRODELA Schleiden, Linnaea 13: 391. 1839

***Spirodela polyrrhiza*** (Linnaeus) Schleiden, Linnaea 13: 392. 1829; Cook, Aqua. Wetl. Pl. Ind. 229, 1996. *Lemna polyrrhiza* Linnaeus, Sp. Pl. 2: 970. 1753; Hooker f., Fl. Brit. Ind. 6: 557. 1893; Prain, Beng. Pl. 2: 1117. 1903. *Lemna orbiculata* Roxburgh, Fl. Ind. 3: 565. 1832. *Lemna maxima* Blatter and Hallberg, J. India Bot. 2: 49. 1921. *Spirodela maxima* (Blatter & Hallberg) McCann, J. Bombay Nat. Hist. Soc. 43: 158. 1942. *Lemna major* Griffith, Not. Pl. Asiat. 3: 216. 1851. [PLATE: 10, Figure-115]

*Vernacular name:* Topa.

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

*Flowers & Fruits:* January to April.

*Specimen Cited:* Khottamari Beel, *Rajib & AP Das 0037*, dated 05. 02. 2007.

*Local Distribution:* Throughout the Beel Complex.

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

WOLFFIA Horkel ex Schleiden, Beitr. Bot. 233. 1844.

***Wolffia arrhiza*** (Linnaeus) Horkel ex Wimmer, Fl. Schiiles. 3: 140. 1857; Hooker f., Fl. Brit. Ind. 6: 557. 1893. Prain, Beng. Pl. 2: 1117. 1903; Cook, Aqua. Wetl. Pl. Ind. 230, 1996. *Lemna arrhiza* Linnaeus, Mantiss. 2: 294. 1771. *Wolffia michelii* M.J. Schleiden, Beitr. Bot. 233. 1844 (*nom. Illeg.*). *Wolffia delilii* Miquel, Ned. Kruidk. Arch. 3: 429. 1855.

*Vernacular name:* Topa.

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

*Flowers & Fruits:* July to October.

*Specimen Cited:* Varveri Beel, *Rajib & AP Das 0027*, dated 05. 02. 2007.

*Local Distribution:* Throughout the Beel Complex.

*General Distribution:* India, Bhutan, Bangladesh, Nepal, Cambodia, Indonesia, Japan, Laos, Malaysia, Myanmar, Pakistan, Philippines, Singapore, Sri Lanka, Thailand, Vietnam; introduced to America.

COLOCASIA Schott in Schott & Endlicher, Melet. Bot. 18. 1832, *nom. cons.*, not Link (1795).

**Key to the Species:**

- 1a. Leaf sheaths yellowish green ..... *C. esculenta*  
 1b. Leaf sheaths reddish brown ..... *C. fallax*

***Colocasia esculenta*** (Linnaeus) Schott in Schott & Endlicher, Melet. Bot. 18. 1832; Hara *et al.*, En. Flower. Pl. Nepal 1: 91. 1978; Noltie, Fl. Bhut. 3(1): 136. 1994; Cook, Aqua. Wetl. Pl. Ind. 51, 1996. Hajra *et al.*, Fl. Sikkim 1: 191. 1996. *Arum esculentum* Linnaeus, Sp. Pl. 2: 965. 1753. *Colocasia antiquorum* Schott in Schott & Endlicher, Melet. Bot. 18. 1832; Hooker *f.*, Fl. Brit. Ind. 6: 523. 1893. *Arum chinense* Linnaeus, Amoen. Acad. 4: 234. 1754. *Arum colocasia* Linnaeus, Sp. Pl. 985. 1753. *Caladium nymphaeifolium* Ventenat, Descr. Pl. Nov. t. 30. 1801. *Colocasia esculenta* var. *antiquorum* (Schott) F.T. Hubbard & Rehder, Bot. Mus. Leafl. 1(1): 5. 1932. *Colocasia nymphaefolia* Kunth, Enum. 3: 37. 1850; Hooker *f.*, Fl. Brit. Ind. 6: 523. 1893; Prain, Beng Pl. 2: 1112. 1903. *Arum nymphaeifolia* Roxburgh, Fl. Ind. 3: 495. 1832. [PLATE: 9, Figure-93]

*Vernacular Name:* Shola Kachu.

Erect, marshland herbs; rhizomes variable, leaves from the rhizome, dark-green above and glabrous, yellowish, convolute. Spadix long. Female flowers at the base, fertile ovaries intermixed with sterile ones; neuter above the female; male portion above the neuter synandrium lobed.

*Flowers & Fruits:* May to September.

*Specimen Cited:* Chhotojan Beel, *Rajib & AP Das 0036*, dated 05. 02. 2007; Forest, *Rajib & AP Das 0091*, dated 07. 02. 2007.

*Local Distribution:* Marshy low land areas.

*General Distribution:* India: West Bengal, Sikkim, Mizoram, Manipur, Maharashtra, Rajasthan, Delhi, Kerala, Karnatak, Goa; Himalaya, Tropical Asia, Bangladesh, Sri Lanka and South America.

***Colocasia fallax*** Schott, Bonplandia 7: 28. 1859 ; Noltie, Fl. Bhutan 3(1): 137. 1994; Hajra *et al.*, Fl. Sikkim 1: 192. 1996; *Colocasia kerrii* Gagnepain, Notul. Syst. (Paris) 9: 130. 1941.

*Vernacular Name:* Kachu.

Rhizome erect, globose, 2 cm in diameter; stolons creeping. Petioles 15 – 25 cm, sheathing for almost half of length; sheaths reddish brown; lamina narrowly oblong-ovate, 8 – 17 x 4 – 9 cm, apiculate, base shallowly cordate, slightly glaucous abaxially, intramarginal veins several. Peduncle slender. Spathe tube green; limb orange-yellow, narrowly lanceolate, finely acuminate. Female part of spadix 1 – 2 cm, with 4 – 5 rows of whitish sterile ovaries at base; male part scaly-rough, with several rows of sterile male flowers at base, apex acute. Ovaries green, speckled with white, subglobose; stigmas discoid at base.

*Flowers & Fruits:* August to September.

*Specimen Cited:* Village sector, *Rajib & AP Das 0025*, dated 05. 02. 2007.

*Local Distribution:* Marginal lowland of open fishing areas.

*General Distribution:* India: West Bengal, Sikkim, Manipur, Maharashtra; Himalayas, Tropical Asia, Bangladesh, Sri Lanka.

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

**Key to the species:**

- 1a. Limb of spathe ciliate along the margin ..... *C. ciliata*  
 1b. Limb of spathe smooth ..... *C. retrospiralis*

***Cryptocoryne ciliata*** (Roxburgh) Fischer *ex* Wydler, *Linnaea* 5: 428. 1830; Hooker *f.*, *Fl. Brit. Ind.* 6: 492. 1893; Blatter, *J. Bomb. Nat. Hist. Soc.* 17: 27. 1911; Prain, *Beng. Pl.* 2: 1106. 1903; 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.

Erect, unarmed aquatic herbs with stolons. Leaves linear-oblong or linear-lanceolate; limb of spathe ciliate along the margin. Spathe axillary, cuspidate with purple fimbriate margins. Carpels 5 – 7, fruit syncarpous, 5 – 7 loculed with 6 – 8 seeds in each, peduncle stout.

*Flowers & Fruits:* May to September.

*Specimen Cited:* Batikata Beel, *Rajib & AP Das 0043*, dated 05. 02. 2007; *Rajib & AP Das 0059*, dated 07. 02. 2007.

*Local Distribution:* Along the forest margins.

*General Distribution:* India and Malaysian Islands.

***Cryptocoryne retrospiralis*** Fischer *ex* Wydler, *Linnaea* 5: 428. 1830; Kunth, *Enum.* 3: 12. 1841; Engler in de Candolle, *Monog. Phan.* 2: 625. 1879; Hooker *f.*, *Fl. Brit. Ind.* 6: 493. 1893; Noltie, *Fl. Bhutan* 3(1): 155. 1994; Prain, *Beng. Pl.* 2: 1106. 1903; Cook, *Aqua. Wetl. Pl. Ind.* 57, 1996.

Aquatic, submerged herbs with fibrous root. Leaves numerous, radical, narrowly linear, lanceolate, acute. Spathes as long as the leaves, dull green, entire. Carpels 5 – 6, ovules 3 or more; stigma orbicular.

*Flowers & Fruits:* May to September.

*Specimen Cited:* Batikata Beel, *Rajib & AP Das 0045*, dated 05. 02. 2007.

*Local Distribution:* Along the forest margins.

*General Distribution:* India, S.E. Asia.

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

***Lasia spinosa*** (Linnaeus) Thwaites, *Enum.* 336. 1864; Hajra *et al.*, *Fl. Sikkim* 1: 192. 1996; 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: 7, Figure-74]

*Vernacular Name:* Knata Kachu.

Perennial, stout, prickly, aquatic herbs; rhizomes branched. Leaves coriaceous, glabrous, hastate or sagittate, pinnatifid; lobes narrow or broadly acuminate. Spathe greenish purple, axis spongy. Perianth pink, lobes hooked over the stamens. Stigma orange.

*Flowers & Fruits:* November to February.

*Specimen Cited:* Batikata Beel, *Rajib & AP Das 0038*, dated 05. 02. 2007.

*Local Distribution:* Margins of water body in the Conservatory sector.

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

TYPHONIUM Schott in Wiener Zeitschr. Kunst 1829: 732. 1829.

***Typhonium trilobatum*** (Linnaeus) Schott in Wiener Zeitschr. Kunst. 3: 72. 1829; Hooker *f.*, Fl. Brit. Ind. 6: 509. 1893; Hajra *et al.*, Fl. Sikkim 1: 195. 1996; Noltie, Fl. Bhut. 3(1): 139. 1994. *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:* Kharkon.

Rhizome short, tuberous, subglobose. Petiole green to purple; lamina cordate-ovate, usually deeply 3-lobed, 10 – 15 x 5 – 10 cm, acuminate to mucronate; lateral lobes 8 – 11 cm. Inflorescence appearing after the leaves. Spathe with dark purplish-red line, limb ovate-lanceolate, acuminate. Spadix shorter than spathe; female zone slightly conical; sterile zone densely covered with staminodes, upper half naked; male zone  $\pm$  2 cm. Stamens pink. Ovaries yellowish green; stigma sessile.

*Flowers & Fruits:* April to September.

*Specimen Cited:* Forest, Rajib & AP Das 0054, dated 07. 02. 2007.

*Local Distribution:* Park side forest area.

*General Distribution:* India: West Bengal, Sikkim, Bihar, Odisha; China, Myanmar, Sri Lanka, Nepal, Thailand, Malaysia.

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

***Pistia stratiotes*** Linnaeus, Sp. Pl. 2: 963. 1763; Hooker *f.*, Fl. Brit. Ind. 6: 497. 1893; Noltie, Fl. Bhut. 3(1): 156. 1994; Prain, Beng. Pl. 2: 1105. 1903; Cook, Aqua. Wetl. Pl. Ind. 65, 1996. *Zala asiatica* Loureiro, Fl. Cochinch. 405. 1790. *Pistia minor* Blume, Rumphia 1: 78. 1836. *Pistia africana* C. Presl, Epimel. Bot. 240. 1851. [PLATE: 10, Figure-117]

*Vernacular name:* Topa paana.

Small, free floating fleshy stoloniferous herbs. Leaves several in a rosette, densely pubescent. Lamina sessile, obovate-cuneate. Spathe much shorter than leaves, shortly peduncled, open above. Spadix adnate to the back of the tube of spathe, very small, free above. Fruits membranous, few seeded. Seeds oblong or obovoid albuminous.

*Flowers & Fruits:* May to October.

*Specimen Cited:* Varveri Beel, Rajib & AP Das 0024, dated 05. 02. 2007.

*Local Distribution:* Throughout the Beel complex.

*General Distribution:* Throughout India, Sri Lanka, tropical and subtropical regions worldwide.

ALOCASIA (Schott) G. Don in Sweet, Hort. Brit., ed. 3, 631. 1839, *nom. cons.*

***Alocasia macrorrhizos*** (Linnaeus) G. Don, Sweet, Hort. Brit. 3: 631. 1839; Hajra *et al.*, Fl. Sikkim 1: 186. 1996; Noltie, Fl. Bhut. 3(1): 139. 1994. *Arum macrorrhizon* Linnaeus, Sp. Pl. 965. 1753. *Alocasia indica* (Loureiro) Spach, Hist. Nat. Vég. 12: 47. 1846; Prain, Beng. Pl. 2: 1111. 1903. *Arum indicum* Loureiro, Fl. Cochinch. 536. 1790. *Colocasia indica* (Loureiro) Kunth, Enum. Pl. 3: 39. 1841.

*Vernacular Name:* Mann, Mankachu.

Rootstock stout, almost erect. Leaves large; lamina ovate, undulate, obtuse-rounded, bright green. Spathes yellowish green. Fertile male inflorescence white; females yellow.

*Flowers & Fruits:* April to September.

*Specimen Cited:* Forest, Rajib & AP Das 0044, dated 05. 02. 2007.



*Local Distribution:* Forests and road-side areas.

*General Distribution:* India, Bangladesh, Nepal, Sri Lanka, S.E. Asia to Pacific.

AMORPHOPHALLUS Blume *ex* Decaisne, Nouv. Ann. Mus. Hist. Nat. 3: 366. 1834, *nom. cons.*

***Amorphophallus bulbifer*** (Roxburgh) Blume in Rumphia 1: 148. 1837; Hooker *f.*, Fl. Brit. Ind. 6: 515. 1893; Hara, Fl. East. Himal. 1: 394. 1966; Hajra *et al.*, Fl. Sikkim 1: 186. 1996; Noltie, Fl. Bhut. 3(1): 133. 1994; Prain, Beng. Pl. 2: 1110. 1903. *Arum bulbiferum* Roxburgh, Fl. Ind. 3: 516. 1832. *Amorphophallus aculatum* Hooker *f.*, Fl. Brit. India 6: 515. 1893.

*Vernacular Name:* Buno Ol.

Tuber subglobose. Cataphylls brown, membranous. Leaf divided into numerous leaflets; bulbels developed at primary or secondary divisions; leaflets acuminate. Spathe ovate, subacute, margins overlapping basally. Spadix subacute, pink, sometimes whitish.

*Flowers & Fruits:* April to July.

*Specimen Cited:* Forest, Rajib & AP Das 0105, dated 07. 02. 2007.

*Local Distribution:* Forests and road-side areas.

*General Distribution:* South East Asia, Australia.

POTHOS Linnaeus, Sp. Pl. 2: 968. 1753.

***Pothos scandens*** Linnaeus, Sp. Pl. 2: 968. 1753; Noltie, Fl. Bhut. 3(1): 125. 1994; Prain, Beng. Pl. 2: 1115. 1903. *Pothos longifolius* C. Presl, Epimel. Bot. 242. 1851. *Pothos scandens f. angustior* Engler, Bot. Tidsskr. 24: 272. 1902. *Pothos fallax* Schott, Prodr. Syst. Aroid. 560. 1860. *Pothos angustifolius* (Rafinesque) C. Presl, Epimel. Bot. 243. 1851.

Shrubby root-climber. Stem more than 5 m; branches terete. Leaves petiolate; petiole cuneate, truncate at apex, many veined; lamina lanceolate to linear-lanceolate, 4–8 x 1–3 cm, acuminate, base obtuse. Inflorescence solitary, axillary, small; peduncle short; cataphylls imbricate, green, ovate, small. Spathe greenish to maroon, ovate, concave. Spadix stipitate; stipe erect, greenish; fertile zone yellow-green to off-white, globose or ovoid to subclavate. Fruit mid-green, ripening to deep scarlet, obclavate.

*Flowers & Fruits:* October to November.

*Specimen Cited:* Forest, Rajib & AP Das 0133, dated 07. 02. 2007.

*Local Distribution:* Forests and road side.

*General Distribution:* Bangladesh, Cambodia, India, Indonesia, Laos, Malaysia, Philippines, Singapore, Sri Lanka, Thailand, Vietnam, Madagascar.

SCINDAPSUS Schott in Schott & Endlicher, Melet. Bot. 21. 1832.

***Scindapsus officinalis*** (Roxburgh) Schott, Melet. Bot. 21. 1832; Noltie, Fl. Bhut. 3(1): 129. 1994; Prain, Beng. Pl. 2: 1114. 1903. *Pothos officinalis* Roxburgh, Fl. Ind. 1: 452. 1820. *Monstera officinalis* (Roxburgh) Schott, Wiener Z. Kunst 4: 1028. 1830. *Scindapsus annamicus* Gagnepain, Notul. Syst. (Paris) 9: 139. 1941.

*Vernacular Name:* Gajpipul.

Robust liana, root-climber. Petiole 26–32 cm, base imbricate, sheath reaching pulvinus; lamina pale green abaxially, green adaxially, oblong-elliptic or ovate-elliptic, 23–36 x 12–24 cm, entire,

acute to shortly acuminate, base subcordate, leathery; lateral veins numerous, diverging from midrib. Spathe yellow, involute-tubular, acuminate. Spadix sessile, cylindrical.

*Flowers & Fruits:* November to December

*Specimen Cited:* Forest, Rajib & AP Das 0124, dated 07. 02. 2007.

*Local Distribution:* Forests and road-side.

*General Distribution:* India, Bangladesh, Bhutan, China, Thailand, Vietnam.

XANTHOSOMA Schott, Melet. Bot. 19. 1832.

*Xanthosoma brasiliense* (Desfontaines) Engler, Engler Pflanzenr. Arac. Colocas. 58. 1920; Noltie, Fl. Bhut. 3(1): 139. 1994; *Caladium brasiliense* Desfontaines, Tabl. Ecole Bot., ed. 3: 386. 1829. *Xanthosoma hastatum* Eggers, Fl. St. Croix 99. 1879. *Xanthosoma hastifolium sensu* Duss, Fl. Phan. Antill. Franç. 481. 1897. *Philodendron fontanesii* Kunth, Enum. Pl. 3: 48. 1841. *Acontias hastifolius* Schott, Melet. Bot. 19. 1832. [PLATE: 7, Figure-67]

*Vernacular Name:* Dudh Kachu.

Stem small. Petiole 15 – 25 cm, sheathing for almost half of length; lamina large, ovate-hastate, undulate, obtuse-rounded, bright green, veins conspicuous; petiole to 40 cm.

*Flowers & Fruits:* September to December.

*Specimen Cited:* Forest, Rajib & AP Das 0697, dated 14. 02. 2008.

*Local Distribution:* Forest areas.

*General Distribution:* Native of tropical America; widely cultivated; often naturalized.

## **Hydrocharitaceae** A. Jussuie, Gen. Pl. 67. 1789; *nom. cons.*

### **Key to the genera:**

- 1a. Flowers enclosed in a bifid spathe or within 2 opposite spathal bracts ..... 2
- 1b. Flower solitary or few in leaf axil ..... *Najas*
- 2a. Perianth 3 in single whorls ..... *Vallisneria*
- 2b. Perianth 3+3 in two whorls ..... 3
- 3a. Leaves whorled sometime opposite ..... 4
- 3b. Leaves scattered ..... 5
- 4a. Leaves whorls arranged in regular and repeating patterns along elongated stems ... *Hydrilla*
- 4b. Leaves whorls in two rows even if sometimes spirally wound, arranged somewhat irregularly along the stem ..... *Nechamandra*
- 5a. Leaves sessile, linear ..... *Blyxa*
- 5b. Leaves petiolate, ovate-oblong ..... *Ottelia*

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

*Blyxa octandra* (Roxburgh) Planchon *ex* Thwaites, Enum. 332. 1864; Cook, Aqua. Wetl. Pl. Ind. 218, 1996. *Vallisneria octandra* Roxburgh, Pl. Corom. 2: 34. t. 165. 1802. *Blyxa roxburghii* Richard, Mem. Inst. Paris 12(2): 23. 1812 (*nomen illegitimate*); Hooker *f.*, Fl. Brit. Ind. 5: 660. 1888; Prain, Beng. Pl. 2: 996. 1903.

*Vernacular Name:* Pata Seola.

Tufted, annual, submerged, delicate, aquatic herbs. Leaves radical, linear, entire, acuminate, base broad, membranous. Spathe linear, cylindrical with white flowers; peduncle slender, terete. Fruits linear; seeds many, small oblong-elliptic.

*Flowers & Fruits:* November to February.

*Specimen Cited:* Noldoba Beel, *Rajib & AP Das 0052*, dated 05. 02. 2007.

*Local Distribution:* Throughout Beel Complex.

*General Distribution:* India: West Bengal, Andrapradesh, Maharastra, Madhyapradesh, Orrisa, Kerala; Bangladesh, Myanmar, New Guinea, Sri Lanka, Vietnam, Australia.

HYDRILLA Richard, Mém. Cl. Sci. Math. Inst. Natl. France 1811(2): 9, 61, 76. 1814.

*Hydrilla verticillata* (Linnaeus f.) Royle, Ill. Bot. Himal. t. 376. 1839; Hooker f., Fl. Brit. Ind. 5: 659. 1888; Noltie, Fl. Bhut. 3(1): 165. 1994; Prain, Beng. Pl. 2: 995. 1903; Cook, Aqua. Wetl. Pl. Ind. 218, 1996. *Serpicula verticillata* Linnaeus f., Suppl. 416. 1781; Roxburgh, Cor. Pl. 2: 33. t. 164. 1798; Fl. Ind. 3: 578. 1832. *Hydrilla polysperma* Blatter in J. Proc. Asiat. Soc. Beng. (N.s.) 26: 356. 1931. *Elodea verticillata* (Linnaeus f.) F. Mueller, Key Vict. Pl. 1: 423. 1888. *Hydrilla angustifolia* Hasskarl, Pl. Jav. Rar. 117. 1848. *Hydrilla najadifolia* Zollinger & Moritzi, Syst. Verz. 91. 1846.

*Vernacular Name:* Kureli.

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

*Flowers & Fruits:* November to January.

*Specimen Cited:* Batikata Beel, *Rajib & AP Das 0029*, dated 05. 02. 2007.

*Local Distribution:* Throughout Beel Complex.

*General Distribution:* India: throughout country; Japan, Malaysia, Philippines; S. & E. Europe, Africa, S. & E. Asia, Australia.

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; Cook, Aqua. Wetl. Pl. Ind. 219, 1996; Datta & Majumdar, Bull. Bot. Soc. Beng 20 (20): 23. 1966. *Vallisneria alternifolia* Roxburgh ex R. Wight, Bot. Misc. 2: 344. 1831; Naskar, Aqu. Semiaquat. Pl. Low. Ganget. plain, 229. 1990.

Submerged, fresh water herb. Leaves 1 to 2, opposite below and crowded, scattered at the branches, linear or linear lanceolate, serrulate, acuminate to acute; sessile, amplexicaul, usually 3-nerved. Male spathe sessile, axillary, ovoid, 2-fid. Female spathe sessile, narrow oblong. Flowers many, densely arranged.

*Flowers & Fruits:* December to June.

*Specimen Cited:* Batikata Beel, *Rajib & AP Das 0010*, dated 05. 02. 2007.

*Local Distribution:* Throughout Beel complex.

*General Distribution:* India: Assam, West Bengal, Bihar, Karnataka, Maharastra; Nepal, Bangladesh, Myanmar, Sri Lanka, Vietnam.

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

**Ottelia alismoides** (Linnaeus) Persoon, Sys. Pl. 1: 400. 1805; Hooker *f.*, Fl. Brit. Ind. 5: 662. 1888; Noltie, Fl. Bhut. 3(1): 166. 1994; Prain, Beng. Pl. 2: 997. 1903; Cook, Aqua. Wetl. Pl. Ind. 220, 1996. *Strtiotes alismoides* Linnaeus, Sp. Pl. 1: 535. 1753. *Ottelia lanceolata* (Gagnepain) Dandy, J. Bot. 72: 138. 1934. *Boottia lanceolata* Gagnepain, Bull. Soc. Bot. France 54: 540. 1907. [PLATE: 10, Figure-107]

*Local Name:* Pani Kolla

Submerged herbs. Leaves crowded, submerged; petioles long, variable in shape; lamina ovate-lanceolate, oblong or cordate, entire, acute. Spathe solitary, axillary, 1-flowered; flowers bisexual, sessile, yellowish white; ovary of 6 united carpels covered by spathe with 3 - 6 wavy-wings. Fruits oblong, ellipsoid, crowded with the sepals. Seeds numerous, oblong.

*Flowers & Fruits:* October to February.

*Specimen Cited:* Varveri Beel, *Rajib & AP Das 0001*, dated 05. 02. 2007.

*Local Distribution:* Throughout Beel complex.

*General Distribution:* India, Nepal, Indonesia, Japan, Korea, Laos, Malaysia, Myanmar, Cambodia, Philippines, Thailand, Sri Lanka, Vietnam, New Guinea, Africa, Australia; introduced in North America.

VALLISNERIA Linnaeus, Sp. Pl. 2: 1015. 1753.

**Vallisneria natans** (Loureiro) H. Hara, J. Jap. Bot. 49: 136. 1974; Cook, Aqua. Wetl. Pl. Ind. 221, 1996. *Physkium natants* Loureiro, Fl. Cochinch. 663. 1790. *Vallisneria asiatica* Miki, Bot. Mag. (Tokyo) 48: 329. 1934. *Vallisneria minor* Ito, Nippon Shokubutsumei 1: 23. ver. 1874. *Vallisneria spiralis* Linnaeus var. *denseserrulata* Mikino, Bot. Mag. Tokyo 28: 27. 1914; Lowden, Aquat. Bot. 13: 288. 1982. *Vallisneria physcium* Jussieu ex Sprengel, Syst. 3: 900. 1826. *Vallisneria spiralooides* Roxburgh, Fl. Ind. 3: 75. 1832; Naskar, Aqu. Semiaquat. Pl. Low. Ganget. plain, 231. 1990.

Submerged, stoloniferous, tufted herbs. Leaves linear, serrulate or entire, acute or obtuse, translucent green; male spathe 5 to 10 mm long; female spathe on long coiled peduncle which at maturity uncoils and helps fertilization after getting floating pollens from water surface. Fruits linear. Seeds numerous, oblong.

*Flowers & Fruits:* January to May.

*Specimen Cited:* Varveri Beel, *Rajib & AP Das 0005*, dated 05. 02. 2007.

*Local Distribution:* Throughout Beel Complex.

*General Distribution:* India, Nepal, China, Japan, Malaysia, Sri Lanka, Korea, Vietnam and Australia.

NAJAS Linnaeus, Sp. Pl. 2: 1015. 1753.

#### Key to the species:

- 1a. Male and female flowers alike without sheath; anthers 4 locular ..... *N. graminea*
- 1b. Male flowers only in a sheath; anthers 1 locular ..... *N. indica*

**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; Cook, Aqua. Wetl. Pl. Ind. 268, 1996. *Caulinia graminea* (Delile) Tzvelev, Novosti Sist. Vyssh. Rast. 13: 20. 1976.

*Vernacular Name:* Seola.

Stems up to 20 cm. Leaves narrowly linear to linear; sheath 1 – 3 mm, deeply auriculate; auricles lanceolate, serrulate with several teeth on each side, apex acute; lamina minutely and densely serrulate, acuminate. Monoecious; male flowers usually more toward upper axils with elliptic perianth; spathe absent; female flowers 1 – 2 mm; stigmas 2 – 4 lobed. Fruits oblong.

*Flower & Fruits:* October to July.

*Specimen Cited:* Raichangmari Beel, *Rajib & AP Das 0013*, dated 05. 02. 2007.

*Local Distribution:* Throughout Beel Complex.

*General Distribution:* India, Bhutan, Bangladesh, Nepal, Indonesia, Japan including Ryukyus, Korea, Malaysia, Myanmar, Phillipines, Sri Lanka, Thailand; throughout Old World, Africa, Australia, introduced into North America.

*Najas indica* (Willdenow) Chamisso, *Linnaea* 4: 501. 1829; Prain, *Beng. Pl.* 2: 1125. 1903; Cook, *Aqua. Wetl. Pl. Ind.* 269, 1996. *Cauline indica* Willdenow, *Mem. Ac. R. Sc. Berl.* 89, f. 3. 1801. *Najas falciculata* R. Brown, *J. Bot.* 2: 278, f. 4. 1864. *Najas minor sensu* Hooker f., *Fl. Brit. Ind.* 6: 569. 1893. *Najas lacerata* Rendle, *Trans. Linn. Soc.* 2, *Bot.* 5: 416, t. 41, f. 132-138. 1899. *Najas tenuis* A. Brown ex Magnus, *Beitr. Kenntn. Najas* 7. 1870 non *Zostera tenuis* Reuter, 1854.

*Vernacular Name:* Seola.

Submerged much branched, herbs. Leaves slightly recurved. Staminate flower solitary, enclosed in a spathe, perianth linear, anthers 4-celled; pistillate flower with no spathe or perianth. Seeds ellipsoid.

*Flower & Fruits:* November to February.

*Specimen Cited:* Bochamari Beel, *Rajib & AP Das 0003*, dated 05. 02. 2007.

*Local Distribution:* Throughout, in water bodies.

*General Distribution:* India, China, Japan and Taiwan.

**Potamogetonaceae** Dumortier, *Anal. Fam. Pl.* 59. 1829 ('Potamogetoneae'); *nom. cons.*

POTAMOGETON Linnaeus, *Sp. Pl.* 1: 126. 1753.

### Key to the species:

- 1a. Submerged lamina clasping the stem at base, sessile; floating leaves absent ..... *P. crispus*
- 1b. Submerged lamina never clasping the stem, petiolate; floating leaves present ..... 2
- 2a. Submerged lamina lanceolate; petiole longer than lamina in floating leaves ..... *P. nodosus*
- 2b. Submerged lamina linear; petiole shorter than lamina in floating leaves ..... *P. octandrus*

*Potamogeton octandrus* Poiret, *Lamarck, Encycl. M. Bot., Suppl.* 4: 534. 1816; Noltie, *Fl. Bhut.* 3(1): 170. 1994; Hajra *et al.*, *Fl. Sikkim* 1: 196, 1996; Cook, *Aqu. Wet. Pl. Ind.* 333. 1996. *Potamogeton octandrus* var. *minduhikimo* (Makino) Hara, *J. Jap. Bot.* 20(6-7): 331. 1944. *Hydrogeton heterophyllus* Loureiro, *Fl. Cochinch.* 244. 1790. *Potamogeton huillensis* Welwitsch ex Schinz, *Ber. Schweiz. Bot. Ges.* 1: 61. 1891.

Plants annual. Stems few to densely branched, filiform, terete; nodal glands absent; dormant buds axillary, narrowly fusiform. Leaves dimorphic; stipules axillary, convolute, membranous, free from leaf base, decaying early, green to greenish brown when dry. Submerged leaves sessile, alternate, linear to filiform, acuminate, 3 veined. Floating leaves petiolate, usually alternate; lamina opaque, elliptic to oblong ovate, entire, acute to obtuse, base rounded, leathery. Spikes densely flowered. Fruits obovoid.

*Flowers & Fruits:* August to January.

*Specimen Cited:* Bochamari Beel, *Rajib & AP Das 0008*, dated 05. 02. 2007.

*Local Distribution:* Bochamari Beel.

*General Distribution:* India: West Bengal, Sikkim, Madhya Pradesh, Jammu and Kashmir, Meghalay; Indonesia, Japan including Ryukyus, Korea, Malaysia, Nepal, Russia; Africa, Asia, Australia.

*Potamogeton crispus* Linnaeus, Sp. Pl. 1: 126. 1753; Hooker *f.*, Fl. Brit. Ind. 6: 566. 1893; Noltie, Fl. Bhut. 3(1): 171. 1994; Prain, Beng. Pl. 2: 1123. 1903; Cook, Aqua. Wetl. Pl. Ind. 268, 1996; Majumdar, Bull. Bot. Soc. Beng. 19(1): 15. 1965; Rao & Verma, Bull. Bot. Surv. Ind. 18 (1-4): 42. 1976. *Potamogeton tuberosus* Roxburgh, Fl. Ind. 1: 472. 1820. *Buccaferrea crispata* Bubani, Fl. Pyren. 4: 13. 1901. *Potamogeton crispus* var. *serrulatus* (Opiz) Roxburgh, Icon. Fl. Germ. Helv. 7: 18. 1845. *Potamogeton crispus* var. *najadoides* Graebner, Pflanzenr. IV, 11: 100. 1907. *Potamogeton lactucaceum* Montandon, Syn. Fl. Jura ed. 2: 305. 1868. *Potamogeton serrulatus* Opiz, Flora 5: 267. 1822.

Plants perennial, submerged in freshwater. Rhizome terete. Stems sparsely branched, terete to slightly flattened and angular, creeping at base. Leaves sessile; lamina broadly linear to narrowly oblong, undulate to crispate and serrate, obtuse, 3–7 veined. Spikes cylindrical. Fruits ovoid.

*Flowers & Fruits:* August to December.

*Specimen Cited:* Bochamari Beel, *Rajib & AP Das 0023*, dated 05. 02. 2007.

*Local distribution:* Bochamari Beel.

*General Distribution:* India: West Bengal, Sikkim, Madhya Pradesh, Uttar Pradesh, Karnataka, Goa, Maharashtra; Bhutan, Nepal, Japan, Kazakhstan, Korea, Pakistan, Russia, Tajikistan, Thailand, Uzbekistan; Cosmopolitan: Africa, Asia, Europe, Australia, introduced into New Zealand, North & South America.

*Potamogeton nodosus* Poiret, Encycl. Meth. Bot. Suppl. 4: 535. 1810; Majumdar, Bull. Bot. Soc. Beng. 20(2): 78. 1966; Noltie, Fl. Bhutan 3(1): 170. 1994; Cook, Aqua. Wetl. Pl. Ind. 333, 1996; Hajra *et al.*, Fl. Sikkim 1: 196, 1996; *Potamogeton indicus* Roxburgh, Fl. Ind. 1: 471. 1820 (*nomen illegitimate*); Hooker *f.*, Fl. Brit. Ind. 6: 565. 1893; Prain, Beng. Pl. 2: 845. 1903. *Potamogeton mexicanus* A. Bennett, J. Bot. 25: 289. 1887. *Potamogeton roxburghianus* Schultes & Schultes *f.*, Mant. 3: 367. 1827. *Potamogeton peruviana* C. Presl, J. Bot. 28: 298. 1890.

Aquatic herbs, stem terete, branched, length depends upon the depth of the water. Upper leaves floating, petiolate; lamina oblong or elliptic-lanceolate, entire, acuminate, base acuminate, coriaceous, glossy, many nerved. Spike 3–4 cm long, dense flowered, green. Flowers bisexual. Druplets long beaked, oblique.

*Flowers & Fruits:* September to March.

*Specimen Cited:* Bochamari Beel, *Rajib & AP Das 0035*, dated 05. 02. 2007.

*Local Distribution:* Bochamari Beel.

*General Distribution:* India, Sri Lanka, Malaya, Temperate and Tropical region.

## **Order: Asparagales Bromhead (1838)**

**Amaryllidaceae** S.C. Chen, Acta Phytotax. Sin. 19(3): 323. 1981.

CRINUM Linnaeus, Gen. ed. I. 97. 1737.

*Crinum amoenum* Roxburgh *ex* Ker Gawler, J. Sci. Arts (London) 3: 106. 1817; Hajra *et al.*, Fl. Sikkim 1: 137. 1996. *Crinum himalense* Royle, Ill. Bot. Himal. Mts. 374. 1839. *Crinum verecundum* Carey *ex* M. Roemer, Fam. Nat. Syn. Monogr. 4: 75. 1847. *Crinum amoenum*

Roxburgh, Fl. Ind. 2: 127. 1832; Hooker *f.*, Fl. Brit. Ind. 6: 282. 1892; Noltie, Fl. Bhutan 3(1): 83. 1994.

Bulbs subglobose. Leaves spreading, ensiform, margins narrow membranous, acute. Umbels on long solid, purplish scape with 3 – 10 white; flowers fragrant; perianth white; anthers versatile. Capsules subglobose.

*Flowers & Fruits:* June to August.

*Specimen Cited:* Forest, Rajib & AP Das 0170, dated 08. 02. 2007.

*Local Distribution:* In plantation forests.

*General Distribution:* India: West Bengal, Sikkim, Assam; Sri Lanka, Bhutan, Bangladesh, China, Myanmar.

**Hypoxidaceae** R. Brown in Flinders, Voy. Terra Austr. 2: 576. 1814 ('Hypoxidaeae'); *nom. cons.*

**Key to the genera:**

- 1a. Inflorescences from base of stem, 4 to 6 flowered raceme ..... *Curculigo*
- 1b. Inflorescences from node of stem, flowers more than 5 in raceme ..... *Molineria*

CURCULIGO Gaertner, Fruct. i. 63. t. 16. 1788.

*Curculigo orchioides* Gaertner, Fruct. Sem. Pl. 1: 63, t. 13. 1788; Hooker *f.*, Fl. Brit. India 6: 279. 1894; Prain, Beng. Pl. 2: 1059. 1903; Noltie, Fl. Bhut. 3(1): 69. 1994; Hajra *et al.*, Fl. Sikkim 1: 139. 1996. *Curculigo brevifolia* Dryander in Aiton, Hort. Kew. 2(2): 253. 1811. *C. malabarica* Wight, Ic. t. 2043. A, f. 1. 1853. *Curculigo orchioides* var. *minor* Bentham, Fl. Hongk. 366. 1861.

Rhizomes erect, subcylindric. Leaves in rosette, sessile to shortly petiolate; lamina lanceolate to linear, usually 10 – 55 × 1 – 2.5 cm, narrowly acuminate. Racemes umbellate, 4 to 6 flowered. Pedicel 2 mm. Perianth yellow; segments oblong-lanceolate, 8 – 10 × 2 – 3 mm. Stamens half as long as perianth segments. Ovary narrowly oblong. Stigma lobes longer than style. Berry subfusiform.

*Flowers & Fruits:* April to September.

*Specimen Cited:* Forest, Rajib & AP Das 0140, dated 07. 02. 2007.

*Local Distribution:* In plantation forests.

*General Distribution:* Pakistan, India, Myanmar, Thailand, Cambodia, Indonesia, Japan, Laos, Papua New Guinea, Philippines, Vietnam.

MOLINERIA Colla, Hort. Ripul. App. ii. 333. t. 18. 1826.

*Molineria capitulata* (Loureiro) Herbert, Amaryllidaceae 84. 1837; Fl. Jow. 2: 533. 1987; Noltie, Fl. Bhut. 3(1): 67. 1994. *Leucojum capitulatum* Loureiro, Fl. Cochinch. 199. 1790. *Curculigo capitulata* (Loureiro) Kuntze, Rev. Gen. Pl. 2: 703. 1891; Hajra *et al.*, Fl. Sikkim 1: 1139. 1996; *Leucojum capitulatum* Loureiro, Fl. Cochinch. 199. 1790. *Curculigo recurvata* Dryander in Aiton, Hort. Kew 2(2): 253. 1811; Hooker *f.*, Fl. Brit. India 6: 278. 1894; Prain, Beng. Pl. 2: 1059. 1903. *Molineria recurvata* (Dryander) Herbert, Amaryllidaceae 84. 1837.

Herbs up to 1 m. Rhizomes tuberous. Leaves 4 to 7 in rosette; petiole 30 – 70 cm; lamina oblong-lanceolate, 40 – 70 × 5 – 15 cm, acuminate. Flowering stems brown villous. Racemes nodding, capitate to subovoid, densely many flowered. Perianth yellow; segments ovate-oblong. Stamens 5 mm. Ovary subglobose to oblong. Style longer than stamens. Berry white. Seeds black.

*Flower & Fruit:* April to May

*Specimen Cited:* Forest, Rajib & AP Das 0196, dated 09. 02. 2007.

*Local Distribution:* Backside of conservatory areas.

*General Distribution:* Subtropical and temperate Himalayas, India, Sri Lanka, Bhutan, Myanmar, Malaysia, Indochina, China, Australia.

## **Orchidaceae** A. L. de Jussieu, Gen. Pl. 64. 1789 ('Orchideae').

### **Key to the genera:**

- |   |                             |
|---|-----------------------------|
| 1a. Roots through out leaf sheath .....                         | <b><i>Vanda</i></b>         |
| 1b. Roots from the base and nodes .....                         | 2                           |
| 2a. Roots fasciculate .....                                     | <b><i>Dendrobium</i></b>    |
| 2b. Roots not fasciculate .....                                 | 3                           |
| 3a. Stem covered by leaf sheath .....                           | 4                           |
| 3b. Partially upper parts of nodes covered by leaf sheath ..... | 5                           |
| 4a. Petals yellow, blotched with brown .....                    | <b><i>Acampe</i></b>        |
| 4b. Petals pinkish-purple .....                                 | <b><i>Aeridis</i></b>       |
| 5a. Stem stout; racemes dense flowered .....                    | <b><i>Rhynchostylis</i></b> |
| 5b. Stem slender; racemes with lax flowered .....               | <b><i>Papilionanthe</i></b> |

RHYNCHOSTYLIS Blume, Bijdr. 285 ["Rynchostylis"], 434. 1825.

***Rhynchostylis retusa*** (Linnaeus) Blume, Bijdr. 285.t. 49. 1825; Pearce *et* Cribb, Fl. Bhu. 3 (3): 552. 2002. *Epidendrum rentusum* Linnaeus, Sp. Pl. 953. 1753.

Epiphytic herb; stem stout, sheathed at base; pseudobulb absent, leaves oblong, curved, channeled, sessile. Flowers pink, mark with purple, in many flowered drooping racemes; bracts ovate, persistent, sepals ovate, obtuse, petals oblong, obtuse; fruits three angled capsule.

*Flowers & Fruits:* April to December.

*Specimen Cited:* Atiamochar, Rajib & AP Das 0474, dated 23.7.2007.

*Local Distribution:* Throughout Forests.

*General Distribution:* Throughout India; Bhutan, Nepal, Java, Malaysia, Myanmar, Thailand.

PAPILIONANTHE Schlechter, Orchis 9: 78. 1915.

***Papilionanthe teres*** (Roxburgh) Schlechter, Orchis 9: 78. 1915; Pearce *et* Cribb, Fl. Bhu. 3 (3): 536. 2002. *Dendrobium teres* Roxburgh, Fl. Ind. 3: 485. 1832. *Vanda teres* (Roxburgh) Lindl, Gen. & Sp. Orchis. 217. 1833; Hooker *f.* in Hooker *f.*, Fl. Brit. Ind. 6: 49. 1890.

Epiphytic herbs; stem slender, cylindrical, greenish. Leaves fleshy, teret. Flowers pink, 5 cm. Long, in simple lax axillary racemes. Sepals broadly oblong, petals sub orbicular, narrowed to the base; lip 3-lobed, marked with crimson spotted lines.

*Flowers & Fruits:* April to September.

*Specimen Cited:* Takomari, Rajib & AP Das 0500, dated 23.07.2007.

*Local Distribution:* Throughout Forests.

*General Distribution:* North Eastern India, Andaman and Nicobar Island; Bhutan, Bangladesh, Bhutan, Nepal, Myanmar, Thailand.



VANDA Jones *ex* R. Brown, Bot. Reg. 6: ad t. 506. 1820.

***Vanda griffithii*** Lindle in Paxton's Fl. Gard. 2: 22. 1851-52; Pearce *et* Cribb, Fl. Bhu. 3 (3): 575. 2002. *Luisia griffithii* (Lindle) Kranzlin, Xenia Orchid. 3: 119. 1893. *Trudelia griffithii* (Lindle) Garay, Orchid. Dig. 50 (2): 76. 1986.

Epiphytic; often forming large clumps, roots piercing through leaf sheaths, stem erect, sheathed, 7-13 cm long, leaves weakly curved, oblong, 3 lobed, 9 – 15 x 1 – 1.4 cm. Inflorescence many from leaf sheath, laxly 4 flowered. Flower bracts ovate to triangular; sepals and petals greenish- yellow, lip greenish with soft purple veins, column white, ovary slender, winged. Dorsal sepal lanceolate to obovate, obtuse, lateral sepal pendent, lanceolate, sub acute, lip 3- lobed, saccate at base.

*Flowers & Fruits:* March to June.

*Specimen Cited:* Atiamochar, Rajib & AP Das 0239, dated 09. 02. 2007.

*Local Distribution:* Throughout Forests.

*General Distribution:* India throughout; Bhutan, China, Sri Lanka, South East Asia, Philippines, Australia, New Guinea, Malaysia.

ACAMPE Lindley, Fol. Orchid. 4(Acampe): 1. 1853, *nom. cons.*

***Acampe papillosa*** (Lindle) Lindle, Fol. Orchid. Acompe 4: 2. No. 5. 1853; Pearce *et* Cribb, Fl. Bhu. 3(3): 491. 2002. *Saccolabium papillosum* Lindle, Bot. Reg. 18: t. 1552. 1833. *Saccolabium cariantum* Griffith, Not. Pl. Asiat. 3: 354. 1851. *Gastrochilus papillosum* (Lindle) Kuntze, Revis. Gen. Pl. 2: 661. 1891.

Plant epiphytic, roots arising from nodes. Stem elongate, branched, scandent, covered by leaf sheath. Leaves coriaceous, oblong, obliquely notched at apex, jointed, sessile. Inflorescence racemose, many flowered, peduncle sheathed at base, bracts semi circular to triangular, sepals oblong to elliptic, obtuse, yellow, linear to elliptic, obtuse; petals yellow, blotched with brown, linear to elliptic, obtuse; lip whitish, 3- lobed; pedicel and ovary 5 – 6 mm long. Column short, thick.

*Flowers & Fruits:* November to May.

*Specimen Cited:* Atiamochar, Rajib & AP Das 0527, dated 23.07.2007.

*Local Distribution:* Throughout Forests.

*General Distribution:* North Eastern to North western India; Bhutan, Nepal, Bangladesh, Myanmar, Thailand, Vietnam and Laos.

DENDROBIUM Swartz, Nova Acta Regiae Soc. Sci. Upsal., ser. 2, 6: 82. 1799, *nom. cons.*

***Dendrobium aphyllum*** (Roxburgh) C. E. C. Ficher in Gamble, Fl. Madras 3: 1416. 1928; Pearce *et* Cribb, Fl. Bhu. 3 (3): 406. 2002. *Limodorum aphyllum* Roxburgh, Pl. Coromandel 1: 34. t. 41. 1795. *Cymbidium aphyllum* (Roxburgh) Swartz, Ventensk. Acad. Nya. Handl. 6: 73. 1799. *Dendrobium cucullatum* Robert Brown, Bot. Reg. 7: t. 548. 1821.

Epiphytic; roots fasciculate. Stem pendant, slender, expanded at nodes; inter node sheathed. Leaves ovate to lanceolate, sub acuminate, sessile, distichous. Inflorescence lateral, arising from nodes of old stems, 1 flowered, bracteate, fragrant, scarious, sepals and petals pink to purple, lip pale yellow, shortly clawed, broadly sub orbicular, pubescent, convolute over the column; pedicel and ovary slender.

*Flowers & Fruits:* March to May.

*Specimen Cited:* Takomari, Rajib & AP Das 0233, dated 09. 02. 2007.

*Local Distribution:* Throughout Forests.

*General Distribution:* India, Bhutan, China, Nepal, Myanmar, Thailand, Vietnam to Malaysia.

*Aeridis multiflorum* Roxburgh, Pl. Coromandel 3: 67. t. 271. 1820; Pearce *et* Cribb, Fl. Bh. 3(3): 493. 2002. *Aeridis affine* Lindle, Gen. Sp. Orch. Pl.: 239. 1833. *Epidendrum geniculatum* Buchanan - Hamilton *ex* Hooker *f.*, Fl. Brit. Ind. 6: 1.45. 1890.

Epiphytes. Root flashy, fibrous, thick. Stem many leaved, covered by persistent leaf sheath. Lamina oblong, weakly curved, distichous. Inflorescence racemes, from leaf-sheath, densely many flowered; peduncle sheathed; bracts triangular-ovate, flowers fragrant, sepals and petals pinkish-purple. Apex often spotted with darker amethyst- purple, lip light amethyst purple, clawed geniculate, 3 –lobed, spur porrect, straight and compressed, column white.

*Flowers & Fruits:* May to July.

*Specimen Cited:* Atiamochar, Rajib & AP Das 0749, dated 22. 05. 2008.

*Local Distribution:* Throughout Forests.

*General Distribution:* North Eastern India; Bhutan, Nepal, Myanmar, China, Bangladesh, Thailand, Vietnam, Combodia.

### **Order: Dioscoreales** Hook.f. (1873)

#### **Burmanniaceae** Blume, Enum. Pi. Jav. 1: 27. 1830. *nom. cons.*

BURMANNIA Linnaeus, Sp. Pl. 1: 287. 1753.

*Burmattia coelestis* D. Don, Prodr. Fl. Nepal. 44. 1825; Prain, Beng. Pl. 2: 998. 1903; Noltie, Fl. Bhut. 3(1): 91. 1994; Hajra *et al.*, Fl. Sikkim 1: 23. 1996. *Burmattia triflora* Roxburgh, Fl. Ind. 2: 117. 1832. *Burmattia javanica* Blume, Enum. Pl. Javae 1: 28. 1827. *Burmattia bifurca* Hamilton *ex* Hooker *f.*, Fl. Brit. India 5: 665. 1888.

Small erect herbs. Stems green. Leaves few in basal rosette; cauline leaves linear, 1 – 3 x 0.2 – 0.5 cm. Racemes terminal, 2– 4 flowered. Flowers pedicellate to subsessile, bluish purple with yellow tepals. Perianth tube 4–12 mm; outer tepals ovate triangular, margin double. Stamens sessile. Capsule obovoid.

*Flowers & Fruits:* July to October.

*Specimen Cited:* Batikata Beel, Rajib & AP Das 0428, dated 22. 07. 2007.

*Local Distribution:* Marshy low land of conserved sector.

*General Distribution:* India, Bangladesh, Nepal, Myanmar, Thailand, Malaysia, Cambodia, Indonesia, Laos, New Guinea, Vietnam, Australia.

#### **Dioscoreaceae** R. Brown, Prodr. 1: 294. 1810 ('Dioscoreae'). *nom. cons.*

DIOSCOREA Linnaeus, Sp. Pl. 2: 1032. 1753.

#### **Key to the Species:**

- 1a. Leaves palmately 3 – 7 foliolate ..... *D. pentaphylla*
- 1b. Leaves simple ..... 2
- 2a. Stem twining to right ..... *D. pubera*
- 2b. Stem twining to left ..... 3
- 3a. Plant densely hairy ..... *D. bulbifera*
- 3b. Plants glabrous ..... *D. esculenta*

*Dioscorea bulbifera* Linnaeus, Sp. Pl. 1: 1033. 1753; Prain, Beng. Pl. 2: 1066. 1903; Hara, Fl. East. Himal. 1: 419. 1966; Noltie, Fl. Bhut. 3(1): 9. 1994. *Dioscorea sativa* Thunberg, Fl. Jap. 151. 1784; *non* Linnaeus, 1753; Hooker *f.*, Fl. Brit. Ind. 6: 295. 1892. *Dioscorea latifolia* Bentham, Niger Fl. 535. 1849. *Dioscorea pulchella* Roxburgh, Fl. Ind. 3: 801. 1832.

*Vernacular Name:* Metay aalu.

Tuber solitary, ovoid; roots fibrous. Stem twining to left. Bulblets purplish brown with orbicular spots. Leaves alternate, lamina broadly cordate, 9 – 17 × 4 – 14 cm, entire, caudate-acuminate. Male spikes usually clustered in leaf axils. In female flowers- staminodes 6. Capsule reflexed or drooping, oblong-globose. Seeds inserted near apex.

*Flowers & Fruits:* June to February.

*Specimen Cited:* Village sector, *Rajib & AP Das 0330*, dated 21. 07. 2007.

*Local Distribution:* Cultivated in village areas.

*General Distribution:* A native of Old World; India, Nepal, Sri Lanka.

***Dioscorea esculenta*** (Loureiro) Burkill, Gard. Bull. Straits Settlem. 1: 396. 1917; Noltie, Fl. Bhut. 3(1): 8. 1994; Hajra *et al.*, Fl. Sikkim 1: 141. 1996. *Onchus esculentus* Loureiro, Fl. Coch. 194. 1790. *Dioscorea spinosa* Roxburgh *ex* Wallich, Numer. List n. 5103. 1830. *Dioscorea fasciculata* Roxburgh, Fl. Ind. 3: 801. 1832; Prain, Beng. Pl. 2: 1066. 1903. [PLATE: 9, Figure-102]

*Vernacular Name:* Mete Alu.

Twining to left with large unequal tubers; densely hairy; stems prickly. Lamina simple, reniform or orbicular, acuminate or cuspidate, base cordate, 5 – 7 veined. Male spikes erect, sessile or shortly pedicellate; bracteoles very broad. Female racemes short. Capsules obcordate; seeds broadly winged.

*Flowers & Fruits:* September to January.

*Specimen Cited:* Village sector, *Rajib & AP Das 0341*, dated 21. 07. 2007.

*Local Distribution:* Cultivated in villages.

*General Distribution:* Cultivated in tropical Asia.

***Dioscorea pentaphylla*** Linnaeus, Sp. Pl. 1: 1032. 1753; Hooker *f.*, Fl. Brit. India 6: 289. 1892; Prain, Beng. Pl. 2: 1066. 1903; Hara, Fl. East. Himal. 1: 420. 1966; Noltie, Fl. Bhut. 3(1): 10. 1994. *Dioscorea jacquemontii* Hooker *f.*, Fl. Brit. India 6: 290. 1892. *Dioscorea digitata* Miller, Gard. Dict. 8: 6. 1768. *Dioscorea pentaphylla* var. *jacquemontii* (Hooker *f.*) Prain & Burkill, J. Proc. Asiat. Soc. Bengal 10(1): 23. 1914.

*Vernacular Name:* Panchpata.

Tubers irregular, long-ovoid; blaze white when fresh, becoming brown. Stem twining to left, prickly. Leaves alternate, palmately 3 – 7 foliolate; petiole 7 – 10 cm; leaflets ovate to lanceolate, 7 – 20 × 2 – 7 cm, pinnately veined, base attenuate, entire, acute. Male spikes in axillary panicles with long, lateral branches; axis brown pubescent. Female spikes simple or branched, brown puberulent. In female flowers bracts, perianth, and ovary hairy. Capsule long ellipsoid.

*Flowers & Fruits:* September to February.

*Specimen Cited:* Forest, *Rajib & AP Das 0337*, dated 21. 07. 2007.

*Local Distribution:* In plantation forests.

*General Distribution:* India, Bangladesh, Sri Lanka, Myanmar, tropical Africa.

***Dioscorea pubera*** Blume, Enum. Pl. Javae 1: 21. 1827; Noltie, Fl. Bhut. 3(1): 14. 1994. *Dioscorea anguinea* Roxburgh, Fl. Ind. 3: 803. 1832; Hooker *f.*, Fl. Brit. Ind. 6: 293. 1892; Prain, Beng. Pl. 2: 1066. 1903. *Dioscorea cornifolia* Kunth, Enum. Pl. 5: 385. 1850.

Tubers 1 or 2, narrowly cylindrical, rootlets few, flesh lemon yellow. Stem twining to right, lacking prickles, shortly pubescent; bulbelets sometimes produced. Leaves alternate-subopposite; lamina

ovate, cuspidate to shortly caudate, base shallowly cordate, margins cartilaginous, persistently pubescent beneath.

*Flowers & Fruits:* August to January.

*Specimen Cited:* Forest, Rajib & AP Das 0324, dated 21. 07. 2007.

*Local Distribution:* In forest areas.

*General Distribution:* Himalayas, India, Myanmar, Sumatra, Java.

## **Order: Liliales Perleb (1826)**

**Smilacaceae** Ventenat, Tabl. Regne V6g. 2: 146. 1799 ('Smilacae'); *nom. cons.*

SMILAX Linnaeus, Sp. Pl. 2: 1028. 1753.

### **Key to the Species:**

1a. Lamina ovate, peduncles slightly zigzagged, berries globose ..... *S. perfoliata*

1b. Lamina ovate - elliptic, peduncles stout, berries oblong .....;..... *S. zeylanica*

*Smilax perfoliata* Loureiro, Fl. Cochinch. 2: 622. 1790; Noltie, Fl. Bhutan 3(1): 28. 1994; Hajra *et al.*, Fl. Sikkim 1: 165. 1996. *Smilax prolifera* Roxburgh, Fl. Ind. 3: 795. 1832; Prain, Beng. Pl. 2: 1071. 1903.

Climbing shrubs. Stem branched, woody. Petiole 2–4 cm, broadly winged; wings 7–10 mm wide. Lamina usually ovate, 6–15 × 3–10 cm. umbels in panicles with slightly zigzagged rachis, 15–30 flowered. Male flowers: stamens 3–5 mm. Female flowers: tepals slightly smaller than male ones; staminodes 3. Berries globose.

*Flowers & Fruits:* Not recorded.

*Specimen Cited:* Forest, Rajib & AP Das 0242, dated 09. 02. 2007.

*Local Distribution:* In plantation forests.

*General Distribution:* India, Myanmar, Thailand, Laos, Vietnam.

*Smilax zeylanica* Linnaeus, Sp. Pl. 1: 1029. 1753; Hooker *f.* in Fl. Brit. India 6: 309. 1892; Hara *et al.*, Enum. Fl. Pl. Nepal 1: 79. 1978; Hajra *et al.*, Fl. Sikkim 1: 166. 1996. *Smilax collina* Kunth, Enum. Pl. 5: 261. 1850.

*Vernacular Name:* Kukur dainy.

Shrubby climbers. Branchlets striate, glabrous, prickly. Tendrils simple, glabrous. Lamina ovate–elliptic, entire, acute, base cuneate. In female umbels peduncles stout; receptacle globose. Receptacles in male umbels globose with brown bracteoles, flower buds oblong. Berries red when ripen.

*Flowers & Fruits:* March to December.

*Specimen Cited:* Forest, Rajib & AP Das 0335, dated 21. 07. 2007; Forest, Rajib & AP Das 0285, dated 10. 02. 2007.

*Local Distribution:* In plantation forests.

*General Distribution:* Tropical Himalayas, India: West Bengal, Assam, Bihar; Bhutan, Nepal, China, Bangladesh, Myanmar.

## **Commelinids**

### **Order: Arecales Bromhead (1840)**

**Areaceae** C. H. Schultz, Nat. Syst. Pflanz. 317. 1832 (nom. alt. vs. Palmae); *nom. cons.*

**Key to the genera:**

- 1a. Leaves twice pinnate; leaflets wedge shaped ..... ***Caryota***
- 1b. Leaves simply pinnate ..... 2
- 2a. Leaf rachis spiny; slender climber ..... ***Calamus***
- 2b. Leaf rachis not spiny; not climbing but with slender to stout trunk ... 3
- 3a. Inflorescence interfoliar ..... 4
- 3b. Inflorescence intrafoliar ..... ***Cocos***
- 4a. Stem 10 – 18 cm in diameter throughout; inflorescence branched to only 3 order ..... ***Areca***
- 4b. Stem swollen at base with 30 – 60 cm diameter, often irregularly swollen at the middle portion, upward gradually narrowed; inflorescence branched generally to 2 order ..... ***Roystonea***

**ARECA** Linnaeus, Sp. Pl. 2: 1189. 1753.

***Areca catechu*** Linnaeus, Sp. Pl. 1189. 1753; Hajra *et al.*, Fl. Sikkim 1: 180. 1996; Noltie, Fl. Bhut. 3(1): 430. 1994; Prain, Beng. Pl. 2: 1097. 1903. *Areca cathechu* Burman f., Fl. Indica 241. 1768. *Areca hortensis* Loureiro, Fl. Cochinch. 568. 1790.

*Vernacular Name:* Supari.

Trunk green when young, distant annual scars, 10 – 18 cm in diameter throughout. Leaves pinnate; leaflets narrow. Calyx minute in male flowers; corolla lobes lanceolate, ribbed. Calyx lobed to base in females, oblong – ovate, imbricate; corolla lobes small. Fruits orange when ripe, large, mesocarp fibrous; nuts ellipsoid.

*Flowers & Fruits:* March to July.

*Specimen Cited:* Village sector, Rajib & AP Das 0089, dated 06. 02. 2007.

*Local Distribution:* Throughout; parks and village areas; commonly planted.

*General Distribution:* Widely cultivated throughout tropical Asia; origin probably C. Malaysia.

**CALAMUS** Linnaeus, Sp. Pl. 325. 1753.

***Calamus tenuis*** Roxburgh, Fl. Ind. 3:780. 1832; Blatter, J. Bomb. Nat. Hist. Soc. 25(3): 392. 1918; Noltie, Fl. Bhut. 3(1): 421. 1994; Prain, Beng. Pl. 2: 1099. 1903. *Palmijuncus tenuis* (Roxburgh) Kuntze, Revis. Gen. Pl. 2: 734. 1891. *Calamus amarus* Loureiro, Fl. Cochinch. 210. 1790. *Calamus royleanus* Griffith, Calcutta J. Nat. Hist. 5: 40. 1845.

*Vernacular Name:* Bandari Bet.

Climbing shrubs, growing in clumps, stem large, slender. Leaves glabrous, pinnate, 40 – 70 cm long, leaflets 18 – 30 on each side, equidistant, alternate, linear lanceolate, acuminate, gradually becoming smaller upward, setose above. Petiole short; petiole and the nerves of the leaflets armed with straight spines. Leaf sheath armed with flat spines. Inflorescence very long, flexuose. Flowers minute. Fruit subglobose, mucronate.

*Flowers & Fruits:* April to October.

*Specimen Cited:* Forest, Rajib & AP Das 0055, dated 07. 02. 2007.

*Local Distribution:* Plantation forests.

*General Distribution:* India: West Bengal, Assam; Tropical Himalaya, Bangladesh, Bhutan, Myanmar.

**CARYOTA** Linnaeus, Sp. Pl. 1189. 1753.

*Caryota urens* Linnaeus, Sp. Pl. 1181. 1753; Noltie, Fl. Bhut. 3(1): 428. 1994; Hajra *et al.*, Fl. Sikkim 1: 182. 1996; Prain, Beng. Pl. 2: 1093. 1903.

*Vernacular Name:* Sagu Paam.

Tree, up to 25 m tall, stem blackish brown, 40–65 cm diameter throughout, surface not covered, leaf scars ringed. Leaves 3–5 m long; leaflets broadly cuneiform to narrowly oblique cuneiform, regularly toothed margins, tips irregularly cut with sharp angles. Cymba 1–2 m covering much branched numerous spikes. Fruits globose to oblate, red when ripe.

*Flowers & Fruits:* January to July.

*Specimen Cited:* Forest, Rajib & AP Das 0088, dated 06. 02. 2007.

*Local Distribution:* Planted near the entrance.

*General Distribution:* India, peninsula of Indo-china, Myanmar, Sri Lanka.

**COCOS** Linnaeus, Sp. Pl. 1188. 1753.

*Cocos nucifera* Linnaeus, Sp. Pl. 1188. 1753; Noltie, Fl. Bhut. 3(1): 430. 1994; Prain, Beng. Pl. 2: 1095. 1903. *Cocos indica* Royle, Ill. Bot. Himal. Mts. 395. 1840. *Cocos nana* Griffith, Not. Pl. Asiat. 3: 166. 1851. *Calappa nucifera* (Linnaeus) Kuntze, Revis. Gen. Pl. 2: 982. 1891.

*Vernacular Name:* Narkel.

Trees to 30 m tall, leaf scars ringed, enlarged towards the base. Leaves 3–4 m long; leaflets numerous, reduplicate, entire, linear lanceolate, 60–100 x 3–4 cm, acuminate. Inflorescence axially, branched multiple; cymba spindle shaped, thickly woody. Fruits ovoid to subglobose, slightly trigonous apical.

*Flowers & Fruits:* Round the year.

*Specimen Cited:* Village sector, Rajib & AP Das 0090, dated 07. 02. 2007.

*Local Distribution:* In the villages.

*General Distribution:* Cultivated throughout Asia.

**ROYSTONEA** O.F. Cook in Sci. Ser. 2. 12: 479. 1900.

*Roystonea regia* (Humboldt, Bonpland & Kunth) O.F. Cook, Sci. Ser. 2. 12: 479. 1900. *Oreodoxa regia* Humboldt, Bonpland & Kunth, Nov. Gen. & Sp. Pl. 1: 244. 1815. *Oenocarpus regius* (Humboldt, Bonpland & Kunth) Sprengel, Syst. Veg. 2: 140. 1825. *Roystonea elata* (W. Bartram) F. Harper, Proc. Biol. Soc. Wash. 59: 29. 1946. *Roystonea regia* var. *hondurensis* P.H. Allen, Ceiba 3: 17. 1952.

*Vernacular name:* Palm.

Trees to 20 m tall, swollen at base, often irregularly swollen at the middle portion, upward gradually narrowed. Leaves 4–5 m long; leaflets 150 to 250 on both side of rachis; leaflets 4-farious, linear lanceolate, acuminate; terminal leaflets shorter. Inflorescence interfolier, branched, 2 and 3 order. Female flowers only at base of rachillae.

*Flowers & Fruits:* December to April.

*Specimen Cited:* Park, Rajib & AP Das 0092, dated 07. 02. 2007.

*Local Distribution:* Often planted in parks and villages.

*General Distribution:* Usually planted in tropical areas as avenue tree.

**Order: Commelinales** Dumortier (1829)**Commelinaceae** R. Brown, Prodr. 1: 268. 1810 ('Commelineae'); *nom. cons.***Key to the genera:**

- 1a. Inflorescence within leaf sheath, sessile ..... *Amischotolype*
- 1b. Inflorescence outside of leaf sheath, stalked ..... 2
- 2a. Fruits indehiscent baccate ..... *Pollia*
- 2b. Fruits dehiscent capsular ..... 3
- 3a. Inflorescence broomlike, with innumerable small flowers; capsule  
2-valved ..... *Floscopa*
- 3b. Inflorescence not broomlike, with few flowers; capsule 3-valved .... 4
- 4a. Involucral bracts spathe-like ..... 5
- 4b. Involucral bracts absent or spreading or sheathlike ..... *Murdannia*
- 5a. Petals connate with 2 ends free; bracts imbricately arranged in  
2 rows ..... *Cyanotis*
- 5b. Petals wholly free; bracts not imbricately arranged in 2 rows ..... *Commelina*

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 herbs. Stems erect, distally branched. Leaf sheaths overlapping in distal part of stem; lamina elliptic, 25 – 30 × 5 – 10 cm, adaxially sparsely hispid or glabrous, abaxially yellow hirsute along veins, entire, caudate-acuminate, base cuneate. Heads with up to 10 flowers, within leaf sheath, sessile. Sepals ovate-oblong, 5 × 4 mm, sub-glabrous. Petals pale purple to reddish. Capsule ovoid, trigonous, rugose.

*Flowers & Fruits:* June to July.

*Specimen Cited:* Varveri Beel, Rajib & AP Das 0148, dated 08. 02. 2007.

*Local Distribution:* Marginal low land areas of open fishing part.

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

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

**Key to the species:**

- 1a. Lamina elliptic-ovate; capsule 5 seeded ..... *C. benghalensis*
- 1b. Lamina ovate-lanceolate or linear-lanceolate; capsules 2 – 3 seeded ..... 2
- 2a. Leaves scabridly pubescent; ovary 2 celled ..... *C. suffruticosa*
- 2b. Leaves glabrous with only a few hairs at mouth or hirsute throughout; ovary 3 celled ... 3
- 3a. Leaves acute; spathes 2 – 3 cm ..... 4
- 3a. Leaves acuminate; spathes 2 – 4 cm ..... *C. longifolia*
- 4a. Spathes conduplicate or free margins ..... *C. diffusa*
- 4b. Spathes funnel shaped or fused margins ..... *C. paludosa*

*Commelina benghalensis* Linnaeus, Sp. Pl. 1: 41. 1753; Hooker *f.*, Fl. Brit. Ind. 6: 370. 1892; Noltie, Fl. Bhut. 3(1): 238. 1994; Hajra *et al.*, Fl. Sikkim 1: 168. 1996; Prain, Beng. Pl. 2: 1082.

1903; Cook, Aqua. Wetl. Pl. Ind. 86, 1996; Guha Bakshi, Fl. Mur. Dist. 326. 1984.

*Vernacular Name:* Kanchera.

Perennial herbs. Stems mostly creeping. Leaf sheaths sparsely hirsute-ciliate; lamina ovate, 3 – 6 × 1.5 – 3 cm, subglabrous. Involucral bracts borne opposite to leaves, often several, aggregated at branch-tips, proximal margins connate, acute. Proximal branch of cincinni with elongate peduncle and 1 – 3 exserted, flowers sterile, distal branch longer with fertile flowers. Sepals 2 mm, membranous. Petals blue, free, 5 mm. Chasmogamous flowers underground. Capsule ellipsoid, dehiscent.

*Flowers & Fruits:* January- September

*Specimen Cited:* Forest, Rajib & AP Das 0156, dated 08. 02. 2007.

*Local Distribution:* Forests and road side.

*General Distribution:* India, Bangladesh, Myanmar, Java and 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. Bhutan 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.

*Vernacular Name:* Kanchera.

Annual herbs. Stems creeping, branched. Leaves subsessile; lamina lanceolate, 3 – 10 × 1 – 3 cm. Spathes conduplicate. Involucral bracts borne opposite to leaves, folded, ovate-lanceolate, acuminate. Cincinni dichotomously branched from base; 1 – 4 long exserted male flowers; other branches with much shorter peduncle and 3 – 5 bisexual flowers. Sepals 3 – 4 mm, membranous. Petals blue, free, 2 longer ones 5 mm. Capsule oblong, trigonous.

*Flowers & Fruits:* January to September

*Specimen Cited:* Forest, Rajib & AP Das 0182, dated 09. 02. 2007.

*Local Distribution:* Forests and road side.

*General Distribution:* Pantropical.

***Commelina longifolia*** Lamarck, 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.

*Vernacular Name:* Pani Kanchera.

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

*Flowers & Fruits:* July to January.

*Specimen Cited:* Barojan Beel, Rajib & AP Das 0216, dated 09. 02. 2007.

*Local Distribution:* Throughout the study area.

*General Distribution:* India, Java and 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. Plants 2: 1083. 1903. *Commelina rugulosa* C.B. Clarke, J. Linn. Soc., Bot. 11: 446. 1871. *Commelina simsonii* C.B. Clarke, J. Linn. Soc., Bot. 11: 446. 1871. *Spathodithyros suffruticosus* (Blume) Hasskârl, Commelin. Ind. 11. 1870.

*Vernacular Name:* Kanchera.



Perennial herbs. Stems erect or ascending, branched only distally, glabrous. Leaf sheaths sparsely hirsute ciliate; lamina lanceolate to ovate lanceolate, 8 – 10 × 3 – 5 cm, glabrous on both surfaces. Involucral bracts borne opposite to leaves, broadly cordate, obtuse. Cincinni 4 flowered; pedicels 3 mm, twisted in fruit. Petals white, free. Capsule sub globose, 2 valved. Seeds 1 per valve.

*Flowers & Fruits:* January to March.

*Specimen Cited:* Barojan Beel, *Rajib & AP Das 0201*, dated 09. 02. 2007.

*Local Distribution:* Throughout the study area.

*General Distribution:* India, Bangladesh, Nepal and Malaysia.

***Commelina paludosa*** Blume, Enum. Pl. Jav. 1: 2. 1827; Hooker *f.*, Fl. Brit. India 6: 372. 1894; Hara *et al.*, En. Fl. Pl. Nepal 1: 82. 1978; Noltie, Fl. Bhut. 3(1): 235. 1994; Cook, Aqua. Wetl. Pl. Ind. 85, 1996; Hajra *et al.*, Fl. Sikkim 1: 169. 1996. *Commelina obliqua* Buchanan–Hamilton *ex* D. Don, Prodr. Fl. Nepal. 45. 1825 (*nomen illegitimate*); Hooker *f.*, Fl. Brit. India 6: 372. 1894; Prain, Beng. Pl. 2: 1083. 1903. *Commelina donii* A. Dietrich, Sp. Pl. 2: 895. 1832. *Commelina paludosa f. pedunculata* Qaiser & Jafrin, Fl. W. Pakistan 84: 13. 1975.

*Vernacular Name:* Jota Kanchera.

Perennial herbs. Stems often semi-erect. Leaves sessile; sheath densely brown hispid at mouth; lamina lanceolate to ovate-lanceolate, 9 – 18 × 3 – 6 cm. Spathes funnel shaped. Involucral bracts often 5 – 8, forming terminal heads, sessile, glabrous, proximal margins connate, acute. Cincinnus 1; peduncle 1 cm; flowers 1 to several; pedicels twisted. Sepals 3 – 6 mm, membranous. Petals blue, 5 – 8 mm. Capsules ovoid – globose, trigonous.

*Flowers & Fruits:* August to April.

*Specimen Cited:* Noldoba Beel, *Rajib & AP Das 0282*, dated 10. 02. 2007.

*Local Distribution:* Throughout the study area.

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

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

### Key to the species:

- 1a. Cincinni reduced, 3 - 6 in axillary fascicles ..... *C. axillaris*
- 1b. Cincinni solitary, rarely terminal and also with flowers in axillary heads ..... 2
- 2a. Capsule obovoid, roots not fibrous ..... *C. vaga*
- 2b. Capsule columnar, roots fibrous ..... *C. cristata*

***Cyanotis axillaris*** (Linnaeus) D. Don *ex* Sweet, Hort. Brit. 430. 1826; Noltie, Fl. Bhut. 3(1): 222. 1994; Hajra *et al.*, Fl. Sikkim 1: 167. 1996; Prain, Beng. Pl. 2: 1085. 1903; 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 disruptens* Hasskarl, Commelin. Ind. 105. 1870.

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, connate with 2 ends free; bracts imbricately arranged in 2 rows. Filaments blue, lanate. Capsules oblong, trigonous.

*Flowers & Fruits:* June to September.

*Specimen Cited:* Forest, Rajib & AP Das 0721, dated 14. 02. 2008.

*Local Distribution:* Throughout the study area.

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

***Cyanotis vaga*** (Loureiro) J.A. Schultes & J.H. Schultes, Syst. Veg. 7: 1153. 1830; Hara *et al.*, Enum. Fl. Pl. Nepal 1: 82. 1978; Noltie, Fl. Bhut. 3(1): 220. 1994; Hajra *et al.*, Fl. Sikkim 1: 169. 1996. *Transescantic vaga* Loureiro, Fl. Cochinch. 193. 1790. *Cyanotis barbara* D. Don, Prodr. Fl. Nepal 46. 1825; Hooker *f.*, Fl. Brit. India 6: 385. 1894. *Commelina hirsuta* Hochstetter *ex* A. Richard, Tent. Fl. Abyss. 2: 344. 1850. *Tonningia vaga* (Loureiro) Kuntze, Revis. Gen. Pl. 2: 722. 1891. *Tradescantia vaga* Loureiro, Fl. Cochinch. 193. 1790.

Perennial herbs, bulbiferous. Bulbs globose. Stem branched, branching usually from base. Leaves all cauline; lamina linear to lanceolate, 4–12 cm × 0.3–1.5 cm. Cincinni solitary, rarely terminal and also with flowers in axillary heads. Sepals connate at base, oblong-lanceolate, abaxially white hirsute. Petals blue-purple, connate; bracts imbricately arranged in 2 rows. Filaments blue lanate. Capsule obovoid, trigonous. Seeds gray-brown, striate and finely reticulate.

*Flowers & Fruits:* July to October.

*Specimen Cited:* Forest, Rajib & AP Das 0729, dated 14. 02. 2008.

*Local Distribution:* Throughout the study area.

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

***Cyanotis cristata*** (Linnaeus) D. Don, Prodr. Fl. Nepal. 46. 1825; Noltie, Fl. Bhut. 3(1): 222. 1994; Hajra *et al.*, Fl. of Sikkim 1: 169. 1996; Prain, Beng. Pl. 2: 1085. 1903; 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. Cincinni often solitary, terminal or also axillary. Sepals connate at base, linear-lanceolate to oblanceolate, abaxially hirsute along mid-vein and margin. Petals blue or purple, connate with 2 ends free, 4 – 5 mm; bracts imbricately arranged in 2 rows. Filaments blue, lanate. Capsules columnar, trigonous, 2.5 mm. Seeds gray-brown, pitted.

*Flowers & Fruits:* July to October.

*Specimen Cited:* Forest, Rajib & AP Das 0654, dated 13. 02. 2008.

*Local Distribution:* Throughout the study area.

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

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

***Floscopa scandens*** Loureiro, Fl. Cochinch. 1: 193. 1790; Noltie, Fl. Bhut. 3(1): 225. 1994; Hajra *et al.*, Fl. Sikkim 1: 170. 1996; Prain, Beng. Pl. 2: 1086. 1903; Cook, Aqua. Wetl. Pl. Ind. 88, 1996. [PLATE: 6, Figure-55]

Perennial herbs. Stems 50 – 70 cm, simple, prostrate proximally. Leaves usually sessile or with short, winged petiole; lamina elliptic to lanceolate, 5 – 10 × 1–3 cm. Inflorescence broomlike, with extremely numerous small flowers; peduncle nearly absent; pedicels very short. Sepals shallowly

boat shaped. Petals blue - purple. Fertile stamens 6; filaments glabrous. Capsules ovoid, 2-valved, compressed. Seeds semi-ellipsoid.

*Flowers & Fruits*: July to November.

*Specimen Cited*: Bochamari Beel, *Rajib & AP Das 0671*, dated 13. 02. 2008.

*Local Distribution*: Margin of the Bochamari Beel.

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

MURDANNIA Royle, Ill. Bot. Himal. Mts. 1: 403. 1840, *nom. cons.*

### Key to the species:

1a. Lamina linear; inflorescence scorpioid cymose ..... *M. nudiflora*

1b. Lamina ovate-lanceolate; inflorescence terminal panicle ..... *M. spiralis*

***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. *Aneilema minutum* (Blume) Kunth, Enum. Pl. 4: 661. 1843.

Annual herbs. Roots fibrous. Rhizomes absent. Stems diffuse, creeping proximally. Leaves nearly all cauline; lamina linear to lanceolate, 3 – 10 × 0.5 – 1 cm, obtuse or acuminate. Involucral bracts absent or spreading or sheathlike. Cincinni several, in terminal panicles, several densely arranged flowers; peduncle slender; pedicels slender, straight. Sepals ovate-elliptic. Petals purple, obovate-orbicular. Fertile stamens 2. Capsules ovoid globose, trigonous.

*Flowers & Fruits*: October to April.

*Specimen Cited*: Batikata Beel, *Rajib & AP Das 0613*, dated 11. 02. 2008.

*Local Distribution*: Marshy low land of conserved areas.

*General Distribution*: Pantropical.

***Murdannia spirata*** (Linnaeus) G. Brueckner, Pfamilien. 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.

Perennial herbs. Roots fibrous. Rhizomes horizontal. Stems slender. Lamina narrowly ovate to lanceolate, 2 – 3.5 × 1 cm, margin undulate, obtuse to acute, base truncate, glabrous on both surfaces. Cincinni 1 – 4, forming terminal panicles; bracts very small; pedicels elongate. Sepals elliptic, persistent. Petals pale blue or nearly white, obovate-orbicular. Fertile stamens 3; staminodes 3. Capsules oblong, trigonous.

*Flowers & Fruits*: July to February.

*Specimen Cited*: Batikata Beel, *Rajib & AP Das 0591*, dated 25. 07. 2007.

*Local Distribution*: Marshy low land of conserved areas.

*General Distribution*: India and Indo-Malaysia.

POLLIA Thunberg, Nov. Gen. Pl. 1: 11. 1781 [24 Nov 1781].

***Pollia hasskarlii*** Rao Rolla, Notes Roy. Bot. Gard. Edinburgh 25: 188. 1964; Noltie, Fl. Bhut. 3(1): 232. 1994; Hajra *et al.*, Fl. Sikkim 1: 171. 1996.

Perennial herbs. Stems ascending. Leaves sessile; lamina elliptic to obovate-oblongate, 20–30 × 4–8 cm, glabrous on both surfaces. Inflorescence usually shorter than distal leaves; cincinni numerous; bracts membranous. Sepals subovate, shallowly boat shaped, abaxially puberulent glandular, caducous. Petals white or pale purple, obovate. Stamens 6, all fertile. Fruits indehiscent baccate, globose.

*Flowers & Fruits:* March to June.

*Specimen Cited:* Batikata Beel, *Rajib & AP Das 0568*, dated 24. 07. 2007.

*Local Distribution:* Marshy low land of conserved sector.

*General Distribution:* India, Bhutan, Bangladesh, Myanmar, China.

**Pontederiaceae** Kunth in Humboldt, Bonpland *et* Kunth, Nov. Gen. et Sp. 1: 265. 1816; *nom. cons.*

### Key to the genera

- 1a. Flowers sessile; perianth zygomorphic, segments basally united ..... ***Eichhornia***  
 1b. Flowers pedicellate; perianth actinomorphic, segments free nearly  
 to base ..... ***Monochoria***

EICHHORNIA Kunth, Enum. Pl. iv. 129. 1843.

***Eichhornia crassipes*** (Martius) Solms in de Candolle, Monogr. Phan.4: 527. 1883; Subramanym, Aquat. Angiosp. 70. 1962; Noltie, Fl. Bhut. 3(1): 175. 1994; Cook, Aqua. Wetl. Pl. Ind. 329, 1996; Hajra *et al*, Fl. Sikkim 1: 166. 1996; Bora *et* Kumar, Fl. Div. Ass. 358. 2003. *Pontederia crassipes* Martius, Nov. Gen. Pl. 9. t. 4. 1823. *Heteranthera formosa* Miquel, Linnaea 17: 60. 1843. *Piaropus crassipes* (Martius) Rafinesque, Fl. Tellur. 2: 81. 1837. [PLATE: 8, Figure-86]

*Local name:* Kachuri pana

Floating herbs. Roots many, long fibrous. Stems very short; stolons simple, apically producing new plants. Leaves radical; petiole green, 5–30 cm, spongy, usually very much swollen; lamina orbicular to broadly ovate, 5–18 × 5–16 cm, leathery, shallowly cordate to rounded. Spike spirally 7–15 flowered. Perianth 6 parted. Stamens 6; filaments curved. Pistil heterostylis; stigma glandular hairy.

*Flowers:* September to January.

*Specimen Cited:* Batikata Beel, *Rajib & AP Das 0179*, dated 09. 02. 2007.

*Local Distribution:* Throughout the water body.

*General Distribution:* India: all states of the country; Sri Lanka, Nepal, Bhutan, Bangladesh, Pakistan. Native to Brazil, now Pantropic.

MONOCHORIA Presl, Rel. Haenk. i. 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 de Candolle, Mon. Phan.4: 523. 1883; Prain, Beng. Pl. 2: 1079. 1903; Noltie, Fl. Bhut. 3(1): 175. 1994; Bora *et* Kumar, Fl. Div. Ass. 358. 2003. *Pontederia hastata* Linnaeus, Sp. Pl. 1: 288. 1753. *Monochoria hastaefolia* Presl, Rel. Haenk.1: 128. 1827; Hooker *f.*, Fl. Brit. Ind. 6: 362. 1882. *Carigola hastata* (Linnaeus) Rafinesque, Fl. Tellur. 2: 10. 1837. [PLATE: 5, Figure-45]

Perennial herbs, aquatic. Radical leaves with sheath broadened at base; petiole 10 – 60 cm; lamina triangular to triangular-ovate, 5 – 20 × 3 – 15 cm, sagittate to hastate, acuminate. Racemes short, erect, subumbellate; peduncle shorter than associated leaf petiole. Perianth segments bluish with green median vein and reddish blotch, ovate. Stamens filaments filiform. Style hairy at apex. Capsule oblong. Seeds oblong.

*Flowers & Fruits:* August to March.

*Specimen Cited:* Bochamari Beel, *Rajib & AP Das 0212*, dated 09. 02. 2007.

*Local Distribution:* Marginal areas of Bochamari Beel.

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

***Monochoria vaginalis*** (Burman f.) C. Presl, *Reliq. Haenk. 1: 128. 1827*; Prain, *Beng. Pl. 2: 1079. 1903*; Noltie, *Fl. Bhut. 3(1): 174. 1994*; Hajra *et al.*, *Fl. Sikkim 1: 166. 1996*. *Monochoria vaginalis* (Burman f.) C. Presl *ex* Kunth, *Enum. 4: 134. 1834*; Hooker f., *Fl. Brit. Ind. 6: 363. 1892*. *Pontederia vaginalis* Burman f., *Fl. Ind. 80. 1768*. *Monochoria vaginalis* var. *plantaginea* (Roxburgh) Solms, in A. de Candolle, *Monog. Phan. 4: 524. 1883*; Hooker f., *Fl. Brit. Ind. 6: 363. 1892*. *Gomphima vaginalis* (Burman f.) Rafinesque, *Fl. Tellur. 2: 10. 1837*. [PLATE: 10, Figure-106]

Aquatic herbs. Stems erect. Radical leaves with broad sheath; petiole 3 – 40 cm; lamina narrowly cordate, ovate to lanceolate, 2 – 20 × 1 – 8 cm, acute to acuminate. Flowering stems 12 – 35 cm. Inflorescences reflexed after anthesis; bract lanceolate. Flowers pedicellate. Perianth segments purplish. Filaments of smaller stamens filiform. Capsules ovoid. Seeds ellipsoid.

*Flowers & Fruits:* September to May.

*Specimen Cited:* Bochamari Beel, *Rajib & AP Das 0257*, dated 10. 02. 2007.

*Local Distribution:* Marginal areas of Bochamari Beel.

*General Distribution:* India, Bangladesh, Sri Lanka, Malayan Islands, China, Japan, Tropical Africa.

**Order: Poales** Small (1903)

**Sub order: Graminoid**

**Poaceae** Nash in Small, *Fl. Southeast U.S. 48. 1903* (nom. alt. cum Gramineae); *nom. cons.*

**Key to the genera**

- |   |                             |
|---|-----------------------------|
| 1a. Spikelets unisexual, male and female in same or different inflorescence ... | <b><i>Coix</i></b>          |
| 1b. Spikelets hermaphrodite, sterile and fertile in mixed inflorescence .....   | 2                           |
| 2a. Spikelets 2 flowered .....  | 3                           |
| 2b. Spikelets 3 to many flowered .....  | 16                          |
| 3a. Spikelets paired .....  | 4                           |
| 3b. Spikelets solitary .....  | 7                           |
| 4a. Spikelets in false compact spike.....                                       | <b><i>Hemarthria</i></b>    |
| 4b. Spikelet not in above manner .....  | 5                           |
| 5a. Spikelets awned; glumes coriaceous .....                                    | <b><i>Sclerostachya</i></b> |
| 5b. Spikelets awnless; glumes herbaceous .....                                  | 6                           |
| 6a. Panicle cylindric; all spikelets pedicellate .....                          | <b><i>Imperata</i></b>      |
| 6b. Panicle wide; only one spikelet pedicellate .....                           | <b><i>Saccharum</i></b>     |
| 7a. Some spikelets replaced by solitary bristle .....                           | <b><i>Setaria</i></b>       |
| 7b. Spikelets not replaced by any bristle .....                                 | 8                           |
| 8a. Spikelets in panicles .....   | 10                          |

8b. Spikelets in spike or raceme like inflorescence .....	9
9a. Lateral inflorescence erect... ..	<i>Sacciolepis</i>
9b. Lateral inflorescence densely congested and spike like .....	<i>Panicum</i>
10a. Upper lemma cartilaginous .....	<i>Digitaria</i>
10b. Upper lemma crustaceous or coriaceous .....	11
11a. Spikelets abaxial .....	<i>Bracharia</i>
11b. Spikelets adaxial .....	12
12a. Spikelets surrounded by one or more bristles .....	<i>Pennisetum</i>
12b. Spikelets not surrounded by bristles .....	13
13a. Glumes awned .....	14
13b. Glumes awnless .....	15
14a. Lamina ovate- lanceolate; spikelet solitary .....	<i>Oplismenus</i>
14b. Lamina linear; spikelets crowded .....	<i>Echinochloa</i>
15a. Lower glume absent or very small .....	<i>Paspalum</i>
15b. Lower glume usually half length of spikelets .....	<i>Paspalidium</i>
16a. Spikelets with only one fertile floret and others sterile .....	17
16b. Spikelets with 2 or more fertile florets .....	23
17a. Raceme deciduous or spikelets falling entire .....	<i>Perotis</i>
17b. Raceme persistent; spikelets breaking up at maturity .....	18
18a. Spikes arranged digitately .....	19
18b. Spikes usually in panicle .....	20
19a. Spikelets without reduced florets, awnless .....	<i>Cynodon</i>
19b. Spikelets with one or more reduced florets; awned .....	<i>Chloris</i>
20a. Glumes well developed; stamens 1-3 .....	<i>Sporobolus</i>
20b. Glumes minute or absent; stamens 6 .....	21
21a. Culms floating, lamina ovate-lanceolate .....	<i>Hygroryza</i>
21b. Culms not floating, lamina linear .....	22
22a. Spikelets consist of a single fertile florets .....	<i>Leersia</i>
22b. Spikelets with 2 glume like sterile lemmas below fertile florets .....	<i>Oryza</i>
23a. Lower glumes absent; upper one long .....	<i>Axonopus</i>
23b. Both glumes present .....	24
24a. Spikelets arranged in open, contractile or spike like panicle .....	<i>Eragrostis</i>
24b. Spikelets arranged in solitary digitate spike .....	25
25a. Inflorescence solitary terminal spike .....	<i>Desmostachya</i>
25b. Inflorescence not in solitary terminal spike .....	26
26a. Spikes racemosely arranged .....	<i>Leptochloa</i>
26b. spikes digitatly arranged .....	27
27a. Rachis ending in a sharp point .....	<i>Dactyloctenium</i>
27b. Rachis ending in a spikelet .....	<i>Eleusine</i>

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. Lamina oblong to linear-lanceolate; sheath keeled; ligules thin, fimbriate. Inflorescence racemose. Upper glumes elliptic – lanceolate, laterally hairy. Lemma ovate, acute.

*Flowers & Fruits:* August to December.

*Specimen Cited:* Forest, Rajib & AP Das 0605, dated 26. 07. 2007.

*Local Distribution:* Open forests and road side areas.

*General Distribution:* India: Arunachal Pradesh, Assam, North India, West Bengal, Andaman & Nicobar Islands; America, Brazil, Mexico, Myanmar.

BRACHIARIA (Trinius) Grisebach, Ledebour, Fl. Ross. 4: 469. 1853.

**Key to the species:**

- 1a. Lamina linear-lanceolate, hispid at margin ..... *B. distachya*  
 1b. Lamina ovate-lanceolate, amplexicaul, hairy ..... *B. reptans*

***Brachiaria distachya*** (Linnaeus) Stapf in Prain, Fl. Trop. Afr. 9: 565. 919. *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. Lamina linear-lanceolate, hispid at margin; ligule with ring of hairs. Spikelets in panicle, elliptic–obovate. Caryopsis oblong.

*Flowers & Fruits:* September to December.

*Specimen Cited:* Barojan Beel, Rajib & AP Das 0659, dated 13. 02. 2008.

*Local Distribution:* Marginal high land of central plantation area.

*General Distribution:* Plains of India, Myanmar, Malaysia, China and Australia.

***Brachiaria reptans*** (Linnaeus) Gardner & Hubbard in Hooker, Pl. sub. t. 3: 363. 1938; Hajra *et al.*, Fl. Sikkim 1: 246. 1996. Guha Bakshi, Fl. Mur. Dist. 378. 1984. *Panicum reptans* Linnaeus, Syst. Nat. 10: 870. 1759. *Panicum prostratum* Lamarck in Tab. Morais, Encycl. Meth. Bot. 1: 171. 1791; Hooker f., Fl. Brit. Ind. 7: 33. 1896; Prain, Beng. Pl. 2: 1177. 1903. *Urochloa reptans* Stapf; *sensu* Haines, Bot. Bihar & Orissa V: 1003. 1924.

Clumps long, creeping below, nodes glabrous; much branched, innovation shoots intravaginal. Lamina amplexicaul, hairy, ovate–lanceolate, sheaths ciliate not up to the next node. Racemes spreading, usually crowded, rachis hairy, trigonous pedicels with cilia longer than spikelets. Spikelets crowded, sub-sessile, ellipsoid glabrous.

*Flowers & Fruits:* March to December.

*Specimen Cited:* Forest, Rajib & AP Das 0362, dated 21. 07. 2007.

*Local Distribution:* Roadside areas.

*General Distribution:* Pantropical.

BAMBUSA Schreber, Gen. Pl. 236. 1789, *nom. cons.*

**Key to the Species:**

- 1a. Culms sheaths without auricles ..... *B. balcooa*  
 1b. Culms sheaths with auricles ..... 2  
 2a. Nodes with rings of gray-white silky hairs below and above sheath scar ... *B. tulda*  
 2b. Nodes without hairs and sheath scar but a deep yellow ring is present ..... *B. vulgaris*

***Bambusa balcooa*** Roxburgh, Hort. Beng. 25. 1814; Fl. Ind. 2: 196. 1832; Hooker f., Fl. Brit. Ind. 7: 39. 1896; Noltie, Fl. Bhut. 3(2): 488. 2000; Prain, Beng. Pl. 2: 1233. 1903.

*Vernacular Name:* Boro Bansh

Culms up to 25 m long, to 16 cm in diameter, green when young, pale grayish-green on maturity; wall thick at base, sheaths without auricles; nodes swollen with whitish ring above, hairy below; lower internodes 10 – 12 cm and upper internodes upto 45 cm long. Lamina oblong – lanceolate,

rounded or sub-cordate at the base, glabrous above; leaf-sheaths with dense, brown hairs. Mature spikelets flattened.

*Flowers & Fruits:* June to December.

*Specimen Cited:* Village sector, *Rajib & AP Das 0702*, dated 14. 02. 2008.

*Local Distribution:* Planted in Villages.

*General Distribution:* Bangladesh, India, Indonesia.

***Bambusa tulda*** Roxburgh, Fl. Ind., 2: 193. 1832; Noltie, Fl. Bhut. 3(2): 491. 2000; Prain, Beng. Pl. 2: 1232. 1903; Hajra *et al.*, Fl. Sikkim 1: 237. 1996.

*Vernacular Name:* Talda Bansh

Culms up to 14 m, internodes 30 – 35 cm, wall very thick, sheaths with auricles; nodes with rings of gray-white silky hairs below and above sheath scar, apex subtruncate; auricles unequal, shortly fimbriate; blade erect, slightly asymmetrical, broadly triangular, apex acutely acuminate. Lamina broadly linear or linear – lanceolate, densely villous, glabrous.

*Flowers & Fruits:* June to December.

*Specimen Cited:* Village sector, *Rajib & AP Das 0715*, dated 14. 02. 2008.

*Local Distribution:* Planted in Villages.

*General Distribution:* Bangladesh, Nepal, Bhutan, India, Thailand, Vietnam.

***Bambusa vulgaris*** Schrader *ex* J.C. Wendland, Coll. Pl. 2: 26. 1810; Prain, Beng. Pl. 2: 1233. 1903.

Culms up to 15 m, straight, sheaths with auricles; internodes deep yellow; nodes prominent; usually branching from lower nodes. Branches many, clustered. Culm sheaths deciduous. Lamina lanceolate, 10 – 25 x 1 – 3 cm. Pseudospikelets several, clustered at nodes, narrowly lanceolate to linear lanceolate, slightly flattened, apparently bifid.

*Flowers & Fruits:* June to January.

*Specimen Cited:* Village sector, *Rajib & AP Das 0678*, dated 14. 02. 2008.

*Local Distribution:* Commonly planted in local villages.

*General Distribution:* Pantropical.

CHLORIS Swartz, Prodr. 25. 1788.

***Chloris inflata*** Link, Enum. Pl. 1: 105. 1821. *Andropogon barbatum 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, sheath mouth ciliate, ligules a narrow membranous ring. Inflorescence a whorl of 4 – 22 spikes, sub-erect, rachis scabrid.

*Flowers & Fruits:* June – October.

*Specimen Cited:* Barojan Beel, *Rajib & AP Das 0628*, dated 12. 02. 2008.

*Local Distribution:* Marginal to highland areas of central plantation.

*General Distribution:* Pantropical.

COIX Linnaeus, Sp. Pl. 2: 972. 1753.

***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, grass; culms much branched, rooting at lower nodes, robust, spongy, glabrous, polish leafy. Lamina flat, firm, acuminate, cordate at base; inflorescence sub erect, false spikes, peduncles long.

*Flowers & Fruits:* October to March.

*Specimen Cited:* Noldoba Beel, *Rajib & AP Das 0657*, dated 13. 02. 2008.

*Local Distribution:* Marginal to lowland areas of open fishing sector.

*General Distribution:* India; Tropical Asia, Africa, America.

CYNODON Richard in Persoon, Syn. Pl. 1: 85. 1805, *nom. cons.*

*Cynodon dactylon* (Linnaeus) Persoon, Syn. Pl. 1: 85. 1805; Hooker *f.*, Fl. Brit. Ind. 7: 288. 1896; Noltie, Fl. Bhut. 3(2): 678. 2000; Prain, Beng. Pl. 2: 1227. 1903; Hajra *et al.*, Fl. Sikkim 1: 285. 1996; Bor, Grass. Bur. Cey. Ind. & Pak. 269, t. 52. 1960; Guha Bakshi, Fl. Mur. Dist. 381. 1984. *Panicum dactylon* Linnaeus, Sp. Pl. 58. 1753.

*Vernacular Name:* Durbaghas

Perennial prostrate or creeping; runners rooting at nodes. Lamina linear-lanceolate or ovate-lanceolate, sparsely hairy; sheath margin ciliate; ligule membranous. Panicle of radiating branches, peduncle erect; spikelets pedicelled, 2-flowered; lower florets sterile; upper bisexual, glumes 3 – 5 nerved.

*Flowers & Fruits:* Most part of the year.

*Specimen Cited:* Forest, *Rajib & AP Das 0689*, dated 14. 02. 2008.

*Local Distribution:* Forests and road side open areas.

*General Distribution:* India and S.E. 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* 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. Root stock very stout; stolons with shiny sheath. Stem tufted, sub-erect. Leaves many, basal, rigid; lamina with filiform apex, margin hispid; sheath with long hairs, ligule ciliate, ridged. Panicles strict and erect; rachis puberulous. Spikelets sessile, jointed. Caryopsis obliquely obovoid to ovate-oblong.

*Flowers & Fruits:* April to January.

*Specimen Cited:* Forest, *Rajib & AP Das 0707*, dated 14. 02. 2008.

*Local Distribution:* Forests and road side areas.

*General Distribution:* India, 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 distichous; lamina linear-lanceolate, flat, ciliate on margin; ligule membranous. Panicle of 2–6 digitate horizontal spikes; spikelets long, compressed, sessile, densely crowded; glumes unequal. Stamens 3. Caryopsis laterally flattened.

*Flowers & Fruits:* July to December.

*Specimen Cited:* Forest, Rajib & AP Das 0718, dated 14. 02. 2008.

*Local Distribution:* Forests and road side areas.

*General Distribution:* India, Tropical parts of the world.

DIGITARIA Haller, Hist. Stirp. Helv. 2: 244. 1768, *nom. cons.*, non Heister *ex* Fabricius (1759), *nom. rej.*

**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.

*Specimen Cited:* Forest, Rajib & AP Das 0725, dated 14. 02. 2008.

*Local Distribution:* Forests and road side areas.

*General Distribution:* India, Tropical and Sub-tropical Asia and Africa.

*Digitaria ciliaris* (Retzius) Koeler, Descr. Gram. 27. 1802; Noltie, Fl. Bhut. 3(2): 728. 2000; Hajra *et al.*, Fl. Sikkim 1: 251. 1996; Guha Bakshi, Fl. Mur. Dist. 385. 1984. *Panicum ciliare* Retzius, Obs. Bot 4: 16. 1786. *Paspalum sanguinale* Lamarck Var *ciliaris* (Retzius) Hooker f., Fl. Brit. Ind. 15. 1896. *Digitaria sanguinalis* Scopoli, fa. *commutata sensu* Haines, Bot. Bihar & Orissa V: 1007. 1924; Prain, Beng. Pl. 2: 1181. 1903. *Digitaria adscendens* (Humboldt, Bonpland & Kunth) Henrard, Blumea 1: 92. 1934.

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 to December.

*Specimen Cited:* Varveri Beel, Rajib & AP Das 0674, dated 13. 02. 2008.

*Local Distribution:* Marginal lowland of open fishing areas.

*General Distribution:* Pantropical.

ECHINOCHLOA P. Beauvois, Ess. Agrostogr. 53. 1812, *nom. cons.*

**Key to the species:**

1a. Stem slender, decumbent; lowest racemes usually under 2 cm ..... *E. colona*

1b. Stem stout, erect; lowest racemes usually over 3 cm ..... *E. crus-galli*

***Echinochloa crus-galli*** (Linnaeus) Beauverd, Ess. Agrost. 53: 161. 1812; Noltie, Fl. Bhut. 3(2): 703. 2000; Hajra *et al.*, Fl. Sikkim 1: 254. 1996; Guha Bakshi, Fl. Mur. Dist. 387. 1984. *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 or ascending, glabrous grass. Lamina linear, tapering to the acute point, subflaccid, margin finely cartilaginous. Inflorescence erect, much branched, pedicles binate or flascicled, very short; spikelets crowded, ovate elliptic, cuspidate or awned. Caryopsis broadly elliptic.

*Flowers & Fruits:* August to December.

*Specimen Cited:* Barojan Beel, *Rajib & AP Das 0730*, dated 14. 02. 2008.

*Local Distribution:* Marginal to highland areas of central plantation.

*General Distribution:* India, Myanmar, S. E. Asia, Sri Lanka, Africa.

***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. [PLATE: 9, Figure-91]

Annual, marshland, prostrate, slender grass; branched at lower parts, glabrous and smooth. Lamina narrow, linear, glabrous; sheath loose, smooth, compressed. Panicles branches 6 to many; spikelets ovate or elliptic, nearly sessile, glabrous, crowded, 4-ranked. Caryopsis elliptic.

*Flowers & Fruits:* July to December.

*Specimen Cited:* Barojan Beel, *Rajib & AP Das 0708*, dated 14. 02. 2008.

*Local Distribution:* Marginal to highland areas of central plantation.

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

ELEUSINE Gaertner, Fruct. Sem. Pl. 1: 7. 1788.

***Eleusine indica*** (Linnaeus) Gaertner, Fruct. 1: 8. 1788; Hooker *f.*, Fl. Brit. Ind. 7: 293. 1896; Noltie, Fl. Bhut. 3(2): 667. 2000; Hajra *et al.*, Fl. Sikkim 1: 288. 1996; Bor, Grass. Bur. Cey. Ind. & Pak. 493. 1960; Prain, Beng. Pl. 2: 1229. 1903. *Cynosurus indicus* Linnaeus, Sp. Pl. 1: 72. 1753.

Annual herbs. Culms tufted, rooted at nodes. Lamina flat or folded, 8 – 14 x 0.2 – 0.5 cm, glabrous to adaxial surface tuberculate-pilose. Inflorescence of digitate, 2 – 5 linear ascending racemes; spikelets elliptic, florets 3 – 9; glumes lanceolate, scabrid along keel; lower glume 1 veined; upper glume with thickened keel; lemmas ovate, acute; palea keels winged. Grain blackish, oblong to ovate.

*Flowers & Fruits:* June to October.

*Specimen Cited:* Forest, *Rajib & AP Das 0574*, dated 25. 07. 2007.

*Local Distribution:* open areas on forest margins and road side.

*General Distribution:* India, tropical and subtropical parts of world.

ERAGROSTIS Wolf, Gen. Pl. 23. 1776.

### Key to the species:

- 1a. Rachilla jointed ..... *E. tenella*  
 1b. Rachilla tough and smooth ..... 2  
 2a. Spikelets flate, elliptic-oblong..... *E. unioloides*  
 2b. Spikelets not flat, linear-oblong ..... *E. pilosa*

***Eragrostis pilosa*** (Linnaeus) P. Beauvois, Ess. Agrost. 71. 162. 175. 1812; Hooker *f.*, Fl. Brit. Ind. 7: 323. 1896; Noltie, Fl. Bhut. 3(2): 665. 2000; Prain, Beng. Pl. 2: 1223. 1903; Hajra *et al.*, Fl. Sikkim 1: 291. 1996; *Poa pilosa* Linnaeus, Sp. Pl. 1: 68. 1753.

Annual grass. Culms tufted. Lamina finely acuminate; sheath glabrous, ligule a ridge of hairs. Panicles long, pyramidal, spikelets linear, purplish; rachilla persistent; glumes unequal, ovate; stamens 3. Caryopsis ellipsoid.

*Flowers & Fruits:* June – August.

*Specimen Cited:* Barojan Beel, *Rajib & AP Das 0558*, dated 24. 07. 2007.

*Local Distribution:* Marginal to highland of central plantation.

*General Distribution:* Tropical and warmer regions of world.

***Eragrostis tenella*** (Linnaeus) Beauverd *ex* Roemer *et* Schultes, Syst. Veg. 2: 576. 1817; Noltie, Fl. Bhut. 3(2): 657. 2000; Prain, Beng. Pl. 2: 1221. 1903; Hajra *et al.*, Fl. Sikkim 1: 291. 1996; Guha Bakshi, Fl. Mur. Dist. 392. 1984. *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. Lamina narrowly linear; sheath ciliate at the mouth; ligule ciliate. Panicles loose, plumose; spikelets oblong. Glumes ovate-oblong. Caryopsis ovoid.

*Flowers & Fruits:* August – February.

*Specimen Cited:* Barojan Beel, *Rajib & AP Das 0514*, dated 23. 07. 2007.

*Local Distribution:* Marginal to highland areas of central plantation.

*General Distribution:* India, tropical parts of world.

***Eragrostis unioloides*** (Retzius) Nees *ex* Steudel, Syn. Pl. Glum. 1: 264. 1854; Hajra *et al.*, Fl. Sikkim 1: 292. 1996. *Poa unioloides* Retzius, Obs. Bot. 5: 19. 1789. *Eragrostis amaBeelis auct. non* Wight & Arnott in Hooker *f.*, Fl. Brit. Ind. 317. 1896; Prain, Beng. Pl. 2: 1220. 1903.

Annual, erect, tufted grass. Lamina flat; sheath striate; ligules membranous. Spikelets ovate – oblong, obtuse, pinkish-white. Caryopsis pointed.

*Flowers & Fruits:* August to March.

*Specimen Cited:* Batikata Beel, *Rajib & AP Das 0572*, dated 24. 07. 2007.

*Local Distribution:* Moist areas of backside to the conservatory sector.

*General Distribution:* India, Myanmar, Sri Lanka, S.E. Asia.

HEMARTHRIA R. Brown, Prodr. 207. 1810.

### Key to the species:

- 1a. Decumbent, pubescent grass ..... *H. compressa*  
 1b. Erect, glabrous grass ..... *H. longifolia*

***Hemarthria compressa*** (Linnaeus *f.*) R. Brown, Prodr. 207. 1810; Majumdar, Bull. Bot. Soc. Beng. 10(1&2): 102. 1956. Hajra *et al.*, Fl. Sikkim 1: 256. 1996. *Rottboellia compressa* Linnaeus *f.*, Suppl. 114. 1781; Hooker *f.*, Fl. Brit. Ind. 7: 153. 1896; Prain, Beng. Pl. 2: 898. 1903. *Rottboellia glabra* Roxburgh, Fl. Ind. 1: 253. 1820.

Annual, erect, tufted grass; usually branched; culms leafy throughout; lamina linear, acute; sheath loose and short; ligule small and round. Racemes, compressed, erect; spikelets linear, lanceolate.

*Flowers & Fruits:* March to January

*Specimen Cited:* Forest, Rajib & AP Das 0584, dated 25. 07. 2007.

*Local Distribution:* Forests and road side areas.

*General Distribution:* India and hotter part of world.

***Hemarthria longiflora*** (Hooker f.) A. Camus in Lecomte, Fl. Gen. Indo-Chine, 7: 380. 1922. Chowdhury & Das in Indian J. Appl. Res. 3(5): 48 – 49. 2013. *Rottboellia longiflora* Hooker f., Fl. Brit. Ind. 7: 154. 1896; Naskar, Aqu. Semiaquat. Pl. Low. Ganget. plain, 252. 1990.

Perennial. Stoloniferous, culms prostrate. Lamina conduplicate, acuminate; sheaths purple. Racemes subtended by an inflated leaf-sheath; spikelets in pairs with cuneate callus; base truncate; attached obliquely. Fertile lemma oblong; lemma apex obtuse. Palea absent or minute.

*Flowers & Fruits:* February to May.

*Specimen Cited:* Forest, Rajib & AP Das 0564, dated 24. 07. 2007.

*Local Distribution:* Forests and road side areas.

*General Distribution:* Eastern India: West Bengal; Bangladesh, Myanmar, Thailand, Vietnam, China, Malaysia.

HYGRORYZA Nees, Edinburgh New Philos. J. 15: 380. 1833.

***Hygroryza aristata*** (Retzius) Nees ex Wight et Arnott, Edinb. New Phil. Journal 15: 380. 1838; Hooker f., Fl. Brit. Ind. 7: 95. 1896; Prain, Beng. Pl. 2: 1185. 1903. [PLATE: 5, Figure-37]

Culms floating. Leaf sheaths open, strongly inflated, forming floats. Lamina 4 – 6 × 0.5 – 2 cm, obtuse, base rounded to cordate, adaxial surface papillate; ligule truncate. Inflorescence triangular; branches short, lowermost sub-verticillate; spikelets greenish; stipe 2 – 5 mm; lemma body 5 – 8 mm, spinulose on veins; palea keeled and spinulose along midvein, outer veins smooth, apex acute.

*Flowers & Fruits:* October to December.

*Specimen Cited:* Noldoba Beel, Rajib & AP Das 0623, dated 11. 02. 2008.

*Local Distribution:* Throughout the beel areas.

*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 rigid, creeping with deep-seated succurs. Lamina linear-lanceolate, margin scabrid; ligule membranous. Inflorescens compact panicle; spikelets lanceolate, densely white-silky. Stamens 2. Stigmas 2. Caryopsis oblong.

*Flowers & Fruits:* February to May.

*Specimen Cited:* Barojan Beel, Rajib & AP Das 0656, dated 13. 02. 2008.

*Local Distribution:* Marginal highland areas of central plantation sector.

*General Distribution:* India, Asia, Australia, S. E. Africa.

ISACHNE R. Brown, Prodr. 196. 1810.

*Isachne globosa* (Thunberg) Kuntze, Revis. Gen. Pl. 2: 778. 1891. *Milium globosum* Thunberg, Fl. Jap. 49 1784. *Isachne miliacea* Roth, Syst. Veg. 2: 476. 1817; Prain, Beng. Pl. 2: 1172. 1903.

Perennial herbs. Culms slender, erect to decumbent. Leaf sheaths shorter than internodes; lamina narrowly lanceolate, 3 – 11 × 0.4 – 0.8 cm, acute, base rounded, glabrous. Panicle open; branches and pedicels filiform, flexuose; spikelets elliptic-globose; lower floret male, upper female; glumes subequal, broadly elliptic; lower lemma oblong, shallowly convex.

*Flowers & Fruits:* October to March.

*Specimen Cited:* Chhotojan Beel, *Rajib & AP Das 0350*, dated 21. 07. 2007.

*Local Distribution:* Open areas of forests and road side vegetation.

*General Distribution:* India, Bangladesh, Sri Lanka, Bhutan, Nepal, Thailand, Malaysia, Indonesia, Japan, Korea, New Guinea, Philippines, 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: 1184. 1903; Bora & Kumar, Flor. Div. Ass. 412. 2003. *Leersia australis* R. Brown, Prodr. 210. 1810.

Annual, aquatic, erect grass. Branches slender, creeping, rooting at base. Lamina linear, acuminate, rigid, flat; 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 to December.

*Specimen Cited:* Chhotojan Beel, *Rajib & AP Das 0327*, dated 21. 07. 2007.

*Local Distribution:* Margins of Bochamari Beel.

*General Distribution:* India (Lower Himalaya); Tropical Africa, Australia, Myanmar.

LEPTOCHLOA P. Beauvois, Ess. Agro. 71. 1812.

*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: 924. 1903. *Aira filiformis* Koenig *ex* Roxburgh, Fl. Ind. 1: 328. 1820.

Annual, slender, aquatic grass. Lamina flat, finely tapering; sheath papillose-pilose, lacerate. Panicle diffuse, much branched; spikelets 2 – 4-fid, almost sessile, unilateral, alternate.

*Flowers & Fruits:* May to October

*Specimen Cited:* Chhotojan Beel, *Rajib & AP Das 0368*, dated 21. 07. 2007.

*Local Distribution:* Margins of Bochamari Beel.

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

OPLISMENUS P. Beauvois, Fl. Oware 2: 14. 1810 [“1807”], *nom. cons.*

### Key to the Species:

- 1a. Inflorescence with 4 – 7 racemes, glume awns antrorsely scabrid,  
very slender ..... *O. burmannii*
- 1b. Inflorescence with 5 – 10 racemes, glume awns smooth, stout ..... *O. compositus*

***Oplismenus burmannii*** (Retzius) P. Beauverd, Ess. Agrost. 54: 168 – 169. 1812; Hooker *f.*, Fl. Brit. Ind. 7: 68. 1896; Noltie, Fl. Bhut. 3(2): 684. 2000; Prain, Beng. Pl. 2: 1173. 1903; Hajra *et al.*, Fl. Sikkim 1: 261. 1996. *Panicum burmannii* Retzius, Obs. Bot. 3: 10. 1783. [PLATE: 7, Figure-69]

Annual herbs, prostrate; rooting at nodes. Lamina ovate-elliptic to lanceolate, pubescent; sheath compressed, ciliate. Panicle of 4 – 7 racemes; spikelets elliptic-lanceolate. Caryopsis convex.

*Flowers & Fruits:* August to December.

*Specimen Cited:* Forest, Rajib & AP Das 0396, dated 22. 07. 2007.

*Local Distribution:* Abundant in forests and road side areas.

*General Distribution:* India, Bangladesh, Sri Lanka, China, Japan.

***Oplismenus compositus*** (Linnaeus) P. Beauvois, Ess. Agrost. 54: 168. 1812; Noltie, Fl. Bhut. 3(2): 684. 2000; Prain, Beng. Pl. 2: 1173. 1903; Hajra *et al.*, Fl. Sikkim 1: 261. 1996. *Panicum compositum* Linnaeus, Sp. Pl. 1: 57. 1753.

Annual prostrate herb; rooting at nodes. Lamina lanceolate, acuminate, pubescent; sheath compressed, ciliate. Panicle 12 – 23 cm long with 5 – 10 racemes; spikelets 3 – 4 mm, elliptic – lanceolate. Caryopsis convex.

*Flowers & Fruits:* August to December.

*Specimen Cited:* Forest, Rajib & AP Das 0443, dated 22. 07. 2007.

*Local Distribution:* Abundant on forest margins and road side open vegetation.

*General Distribution:* Pantropical.

ORYZA Linnaeus, Sp. Pl. 1: 333. 1753.

***Oryza rufipogon*** Griffith, Notul. 3: 5. 1851; Hooker *f.*, Fl. Brit. Ind. 7: 92. 1896; Shukla, Grass. North East Ind. 301. 1996. *Oryza sativa* Linnaeus var. *fatua* Prain, Beng. Pl. 1184. 1903.

Annual grass; culms long, spongy bellow. Lamina linear, acuminate, margins scabrid; sheath loose; ligules splitting at tip. Spikelets long, long awaned. Caryopsis elliptic or oblong.

*Flowers & Fruits:* October to January.

*Specimen Cited:* Bochamari Beel, Rajib & AP Das 0401, dated 22. 07. 2007.

*Local Distribution:* Marginal areas of lowland of open fishing sector.

*General Distribution:* India: Assam, Meghalaya, Sikkim, West Bengal, Central India; Tropical Australia and Peru.

PANICUM Linnaeus, Sp. Pl. 1: 55. 1753.

***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 to December.

*Specimen Cited:* Varveri Beel, Rajib & AP Das 0445, dated 22. 07. 2007.

*Local Distribution:* Marginal marshy areas of open fishing sector.

*General Distribution:* India, S. Europe, Asia, Africa, America.

PASPALUM Linnaeus, Syst. Nat., ed. 10, 2: 855. 1759.

***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 with long stolons producing small tufts of culms, compressed. Leaf sheaths keeled, glabrous or pilose along upper margins and mouth, a line of hairs at junction with blade; lamina lanceolate-linear, acute, thin, glabrous or papillose along margins. Peduncled panicle of 2 racemes; spikelets single, in 2 rows, ovate to suborbicular; upper glume hyaline, long silky hairs along margins; lower lemma similar but not ciliate; upper lemma pallid at maturity, ovate, crustaceous.

*Flowers & Fruits:* May to September.

*Specimen Cited:* Khottamari Beel, Rajib & AP Das 0403, dated 22. 07. 2007.

*Local Distribution:* Lowland and moist areas of open fishing sector.

*General Distribution:* India; throughout tropics and subtropics of the world.

PASPALIDIUM Stapf in Prain, Fl. Trop. Africa 9: 582. 1920.

***Paspalidium punctatum*** (Burman) A. Camus in Lecomte, Fl. Gen. Del. Indo–China 7: 419. 1922; Hajra *et al.*, Fl. Sikkim 1: 264. 1996; Sukla, Grass. North East. Ind. 344. 1996; Bora & Kumar, Flor. Div. Ass. 421. 2003. *Panicum punctatum* Burman, Obs. Bot. 4: 15. 1786; Prain, Beng. Pl. 2: 1177. 1903.

Perennial grass. Culms long, floating, rooting at base, spongy. Lamina long, linear, acute, scabrid margined; sheaths glabrous; ligule hairy. Spikes longer than internodes; spikelets long, ovate-oblong, imbricate, sessile; glumes membranous. Caryopsis compressed.

*Flowers & Fruits:* August to December.

*Specimen Cited:* Khottamari Beel, Rajib & AP Das 0279, dated 10. 02. 2007.

*Local Distribution:* Lowland moist areas of open fishing sector.

*General Distribution:* India, tropical Asia, North Africa.

PENNISETUM Richard *ex* Persoon, Pers. Syn. i. 72. 1805.

***Pennisetum polystachion*** (Linnaeus) Schultes, Syst. Veg. Mant. 2: 146. 1824; Noltie, Fl. Bhut. 3(2): 741. 2000. *Panicum polystachion* Linnaeus, Syst. Nat. 10, 2: 870. 1759.

Annual grass, culms  $\pm 1$  m tall. 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 to November.

*Specimen Cited:* Bochamari Beel, Rajib & AP Das 0548, dated 24. 07. 2007.

*Local Distribution:* Margin of the Bochamari Beel.

*General Distribution:* Tropical Africa to India.

PEROTIS Aiton, Hort. Kew. 1: 85. 1789.

***Perotis indica*** (Linnaeus) O. Kuntze, Rev. Gen. Pl. 2: 787. 1891; Majumdar, Bull. Bot. 10(1 & 2): 44. 1956. *Anthoxanthum indicum* Linnaeus, Sp. Pl. 1: 28. 1753. *Saccharum spicatum* Linnaeus, Sp. Pl. 1: 54: 1753. *Perotis latifolia* Aiton, Hort. Kew 1: 85. 1789; Hooker *f.*, Fl. Brit. Ind. 7: 98. 1896; Prain, Beng. Pl. 2: 1186. 1903.



Aquatic, soft, wiry, spongy grass. Leaf-sheaths short, loose, striate; ligule short. Inflorescence terminal, rachis simple and scabrid; spikelets 1-flowered; pedicel small. Stamens 3. Caryopsis free in glume, terete.

*Flowers & Fruits:* July – August.

*Specimen Cited:* Bochamari Beel, *Rajib & AP Das 0308*, dated 10. 02. 2007.

*Local Distribution:* Marginal areas of the Bochamari Beel.

*General Distribution:* India, Sri Lanka, Mayanmer, tropical Africa.

SACCHARUM Linnaeus, Sp. Pl. 1: 54. 1753.

*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.

Tall perennial herbs; rhizomes long. Culms hollow, softly pilose below inflorescence. Leaf-sheaths pilose at mouth and margin; lamina 60 – 150 × 0.2 – 1 cm, glaucous, long attenuate; ligule brown. Panicle up to 40 cm; spikelets 3–4 mm; lower glume papery, acuminate; lower lemma ovate-lanceolate; upper lemma linear to linear-oblong. Lodicules ciliate.

*Flowers & Fruits:* September to December.

*Specimen Cited:* Raichangmari Beel, *Rajib & AP Das 0322*, dated 21. 07. 2007.

*Local Distribution:* Marginal lowland areas of Changmari Beel.

*General Distribution:* Afghanistan, Pakistan, India, Sri Lanka, Bhutan, Japan, Myanmar, Thailand, Malaysia, Indonesia, Cambodia, New Guinea, Philippines, Turkmenistan, Vietnam; SW Asia, Australia, Pacific Islands, Africa.

SACCIOLEPIS Nash, Man. Fl. N. States 89. 1901.

**Key to the species:**

1a. Plants annual; panicles under 4 cm long; caryopsis elliptic ...../..... *S. indica*

1b. Plants perennial; panicles more than 6 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. Panicle spike like, terete, upto 4 cm long; spikelets shortly pedicelled, ovoid. Stamens 3. Caryopsis elliptic.

*Flowers & Fruits:* August to January.

*Specimen Cited:* Varveri Beel, *Rajib & AP Das 0352*, dated 21. 07. 2007.

*Local Distribution:* Lowland moist areas of open fishing sector.

*General Distribution:* India, tropical and sub-tropical regioes of Asia and Australia.

*Sacciolepis interrupta* (Willdenow) Stapf in Prain, Fl. Trop. Afr. 9: 757. 1920; Blatter & Mac Cann, 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. Culms creeping, spongy, lower nodes rooting. Lamina soft, glabrous, base sub-cordate; ligule short. Panicles spike-like, terete; spikelets lanceolate, densely arranged, imperfect, ovoid, turgid spreading. Caryopsis obovoid.

*Flowers & Fruits:* August to January.

*Specimen Cited:* Bochamari Beel, *Rajib & AP Das 0437*, dated 22. 07. 2007.

*Local Distribution:* Marginal marshy areas of Bochamari Beel.

*General Distribution:* India, Sri Lanka, Myanmar and China.

SETARIA P. Beauvois, Ess. Agrostogr. 51. 1812, *nom. cons.*, non Acharius ex Michaux (1803).

### Key to the Species:

- 1a. Leaves linear, margins rough; panicles spike-like; bristles in clusters of 6 or more ..... *S. glauca*  
 1b. Leaves linear-lanceolate, margins ciliate; panicles partially distant; bristles borne singly ..... *S. palmifolia*

*Setaria palmifolia* (Koenig) Stapf, J. Lin. Soc. Bot. 42: 186. 1914; Hara *et al.*, Fl. East. Himal. 1: 376. 1966; Noltie, Fl. Bhut. 3(2): 723. 2000; Hajra *et al.*, Fl. Sikkim 1: 273. 1996. *Panicum palmaefolium* Koenig, Naturf. 22: 208. 1788.

Perennial, rhizomatous stem woody, knotted. Culms decumbent. Lamina linear-lanceolate, ciliate margins, acuminate, glabrous or sparsely hairy; sheath margin ciliate. Panicles partially distant, loose. Spikelets solitary, bristle single.

*Flowers & Fruits:* May to February.

*Exsiccatum:* Raichangmari Beel, *Rajib & AP Das 0450*, dated 22. 07. 2007.

*Local Distribution:* Marginal lowland moist areas of Changmari Beel.

*General Distribution:* Tropics of the Old World.

*Setaria glauca* (Linnaeus) P. Beauvois, Ess. Agro. 51: 178. 1812; Hooker *f.*, Fl. Brit. Ind. 7: 78. 1896; Bor, Grass. Bur. Cey. Ind. & Pak. 360. 1960. *Panicum glaucum* Linnaeus, Sp. Pl. 56. 1753; Prain, Beng. Pl. 2: 1170. 1903.

Small erect annual. Culms light. Lamina linear, rough on margins; sheaths keeled; ligules ciliate. Panicle spike like, dense, terete; spikelets long, elliptic; bristles in clusters of 6 or more; ciliate margins upper lemma coarsely rugose, boat-shaped. Caryopsis rounded-elliptic.

*Flowers & Fruits:* February to August.

*Specimen Cited:* Raichangmari Beel, *Rajib & AP Das 0489*, dated 23. 07. 2007.

*Local Distribution:* Marginal lowland areas of Changmari Beel.

*General Distribution:* India, throughout the warm and temperate countries.

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; Hajra *et al.*, Fl. Sikkim 1: 303. 1996; Prain, Beng. Pl. 2: 1213. 1903; Bora & Kumar, Flor. Div. Ass. 427. 2003. *Agrostis diandra* Retzius, Obs. Bot. 5: 19. 1789.

Perennial grass. Culms tufted, slender, branched. Lamina narrowly lanceolate, 1 – 7 × 0.1 – 0.4 cm. Panicle linear, spikelike, 1.5 – 7 × 0.3 – 0.6 cm; branches short, erect, mostly unbranched; spikelets narrowly lanceolate-oblong; lower glume lanceolate, upper glume oblong; lemma oblong, acute; palea broader, obtuse. Anthers 3. Grains red-brown, elliptic, apex rounded.

*Flowers & Fruits:* August to December.

*Specimen Cited:* Raichangmari Beel, *Rajib & AP Das 0619*, dated 11. 02. 2008.

*Local Distribution:* Marginal lowland areas of Changmari Beel.

*General Distribution:* India: Assam, Manipur, Nagaland, Bihar, Orissa, West Bengal; Sri Lanka, Australia.

## Sub order: Cyperoid

**Cyperaceae** A. L. de Jussieu, Gen. Pl. 26. 1789 ('Cyperoideae'); *nom. cons.*

### Key to the genera :

- |  |                              |
|--|------------------------------|
| 1a. Flowering glumes all distichous .....                            | 2                            |
| 1b. Flowering glumes spirally arranged .....                         | 4                            |
| 2a. Rachilla deciduous.....  | 3                            |
| 2b. Rachilla persistent .....  | <b><i>Kyllinga</i></b>       |
| 3a. Style base dilated, separate from achene by a constriction ..... | <b><i>Fimbristylis</i></b>   |
| 3b. Style base neither dilated nor constricted .....                 | <b><i>Cyperus</i></b>        |
| 4a. Style base dilated and constricted .....                         | 5                            |
| 4b. Style base neither dilated nor constricted .....                 | 6                            |
| 5a. Hypogynous bristles present .....                                | <b><i>Eleocharis</i></b>     |
| 5b. Hypogynous bristles absent .....                                 | <b><i>Bulbostylis</i></b>    |
| 6a. Glumes awned .....   | 7                            |
| 6b. Glumes not awned .....   | <b><i>Fuirena</i></b>        |
| 7a. Leaves reduced to sheath .....                                   | <b><i>Schoenoplectus</i></b> |
| 7b. Leaves well developed .....                                      | 8                            |
| 8a. Spikelets solitary in terminal .....                             | <b><i>Bolboschoenus</i></b>  |
| 8b. Spikelets in terminal cluster .....                              | <b><i>Scirpus</i></b>        |

**BOLBOSCHOENUS** (Ascherson) Palla in Hallier & Brand, Syn. Deut. Schweiz. Fl., ed. 3, 3: 2531. 1905.

***Bolboschoenus maritimus*** Palla var. ***affinis*** (Roth) P.J. Parmar, B.V. Shetty & V. Singh, Fl. Rajsthan 3: 888. 1993. *Scirpus affinis* Roth, Roemer & Schultes, Veg. 2: 140. 1817. *Bolboschoenus affinis* (Roth) Drobow, Trav. Mus. Bot. Acad. Sc. Imp. Petersburg 16: 139. 1916. *Scirpus maritimus* Linnaeus ssp. *affinis* (Roth) T. Norlindh Nils, Bot. Not. 125: 404. 1972; Clarke in Hooker f., Fl. Brit. Ind. 6: 659. 1893; Pain, Beng. Pl. 2: 1161. 1903.

Aquatic, erect, annual sedge. Stem triangular, glabrous. Leaves linear-lanceolate; sheath brown. Spikes terminal, compact, oval; glumes brown, oval, membranous. Achenes black-brown, cordate, hard, compressed.

*Flowers & Fruits:* October to January.

*Specimen Cited:* Batikata Beel, *Rajib & AP Das 0192*, dated 09. 02. 2007.

*Local Distribution:* Marshy lowland of conserved sector.

*General distribution:* India to Europe.

**BULBOSTYLIS** Kunth, Enum. Pl. 2: 205. 1837. *nom. cons.*

*Bulbostylis densa* (Wallich) Handle-Mazzetti *ex* Karsten & Schenck, Vegetations Beelder 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) Clarke in Hooker *f.*, Fl. Brit. Ind. 6: 652. 1893; Prain, Beng. Pl. 2: 1156. 1903.

Annual herbs, without rhizome. Clumps tufted, slender. Leaves basal, erect, half or more of stem length, entire, slightly evolute on margins, acuminate. Bracts 2 – 3. Inflorescence simple or subcompound anthela, bearing 4 – 7 spikelets. Spikelets solitary or clustered, 5 – 18 flowered. Glumes ovate to broadly ovate, ciliate. Stamens 2; style filiform, stigmas 3. Achenes obovate, trigonous.

*Flowers & Fruits:* April to December.

*Specimen Cited:* Forest, Rajib & AP Das 0160, dated 08. 02. 2007.

*Local Distribution:* Marshy lowland of conserved sector.

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

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

### Key to the species:

- 1a. Spikelets digitate or clustered ..... *C. haspan*
- 1b. Spikelets spicate or racemose ..... 2
- 2a. Rachilla of spikelet prominently winged ..... 3
- 2b. Rachilla of spikelet not winged or slightly winged ..... 5
- 3a. Spikelets 3 – 9 in short spike ..... *C. rotundus*
- 3b. Spikelets more than 8 in long spike ..... 4
- 4a. Wing of rachilla deciduous ..... *C. stoloniferus*
- 4b. Wing of rachilla persistent ..... *C. pangorie*
- 5a. Slender annual, tufted ..... 6
- 5b. Stout perennial ..... 7
- 6a. Bracts ovate, margin not curved ..... *C. iria*
- 6b. Bracts oblong, margin curved; spikelets winged ..... *C. compressus*
- 7a. Rachilla of spikes hairy ... *C. pilosus*
- 7b. Rachilla of spikes glabrous ..... 8
- 8a. Glumes obtuse; spikelets ovate ..... *C. distans*
- 8b. Glumes mucronate; spikelets linear ..... *C. cyperoides*

*Cyperus compressus* Linnaeus, Sp. Pl. 46. 1753; Clarke in 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; roots fibrous; stems tufted, erect or rarely prostrate, 3- gonous. Leaves shorter, sometimes longer than stem, acuminate. Bracts 3 – 7, leafy. Spikelets digitately clustered, much compressed; glumes ovate-lanceolate, closely imbricate; keel produced, laterally compressed. Nuts obovate, dark- brown or brown or brownish-black.

*Flowers & Fruits:* July – December.

*Specimen Cited:* Bochamari Beel, Rajib & AP Das 0211, dated 09. 02. 2007.

*Local Distribution:* Margin of the Bochamari Beel.

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

***Cyperus cyperoides*** (Linnaeus) 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.

Perennials herbs. Rhizome short. Culms laxly tufted, acutely triquetrous. Lamina 5 mm wide, conduplicate at basal part, gradually flatted upward, margin not scabrous. Bracts leaf-shaped, longer than inflorescence. Spikes cylindric to oblong, with densely arranged many spikelets. Spikelets linear-lanceolate; rachilla wings white. Stamens 3; anthers shortly linear. Style short; stigmas 3, slender. Achenes dark brown.

*Flowers & Fruits:* April to October.

*Specimen Cited:* Khottamari Beel, *Rajib & AP Das 0237*, dated 09. 02. 2007.

*Local Distribution:* Marginal lowland areas of open fishing sector.

*General Distribution:* Pakistan, India, Sri Lanka, Nepal, Bhutan, Myanmar, Malaysia, Indonesia, Japan, Korea, Laos, Philippines, Thailand, Vietnam; tropical Africa, America, and Oceanic Islands

***Cyperus haspan*** Linnaeus, Sp. Pl. 45. 1753; Clarke in 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, erect sedge. Stems solitary, compressed-trigonous. Lamina broad, spreading. Spikelets linear-lanceolate. Glumes ovate-oblong. Stamen-1; style bifid. Nuts shortly apiculate.

*Flowers & Fruits:* May to January.

*Specimen Cited:* Chhotojan Beel, *Rajib & AP Das 0131*, dated 07. 02. 2007.

*Local Distribution:* Marginal highland areas of central plantation.

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

***Cyperus iria*** Linnaeus, Sp. Pl. 45. 1753; Clarke in 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.

Annuals. Roots fibrous. Culms tufted, slender to slightly stout, compressed triquetrous. Leaves much shorter than culm; sheath reddish brown to brownish purple; lamina slightly folded. Bracts 3 to 5, leaf-like, basal 2 longer than inflorescence. Spikes ovoid; spikelets laxly arranged, lanceolate to oblong, compressed; rachilla almost wingless. Stamens 3; anthers ellipsoid. Style very short; stigmas short. Achenes dark brown.

*Flowers & Fruits:* August to February.

*Specimen Cited:* Bochamari Beel, *Rajib & AP Das 0343*, dated 21. 07. 2007.

*Local Distribution:* Margin of the Bochamari Beel.

*General Distribution:* India; Southern Hemisphere.

***Cyperus distans*** Linnaeus *f.*, Suppl. Pl. 103.1781; Clarke in 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 sedge, usually rhizomatous. Stem solitary, trigonous. Leaves shorter or as long as stem. Umbels compound, large. 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. Achenes oblong, trigonous, brown.

*Flowers & Fruits:* August to December.

*Specimen Cited:* Khottamari Beel, *Rajib & AP Das 0359*, dated 21. 07. 2007.

*Local Distribution:* Marginal lowland areas of open fishing sector.

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

***Cyperus rotundus*** Linnaeus, Sp. Pl. 45. 1753; Clarke in 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

Perennial sedges; rhizome elongated tuberous, ovoid, black, fragrant. Stems trigonous. Leaves acuminate. Umbel simple to compound; bracts usually 3, shorter or longer than inflorescence. Spikelets linear-lanceolate, many-flowered redish-brown; rachilla winged; glumes ovate to elliptic, imbricate. Achenes broadly obovoid, trigonous, dark-brown.

*Flowers & Fruits:* July to December.

*Specimen Cited:* Raichangmari Beel, *Rajib & AP Das 0370*, dated 21. 07. 2007.

*Local Distribution:* Marginal lowland of Changmari Beel.

*General distribution:* Throughout India; warm countries.

***Cyperus stoloniferus*** Retzius, Observ. Bot. 4: 10. 1786. *Cyperus arenarius* Hance ex C.B. Clarke, *J. Linn. Soc., Bot.* 21: 173 1884; Clarke in Hooker *f.*, Fl. Brit. Ind. 6: 616. 1893; Prain, Beng. Pl. 2: 1142. 1903.

Rhizome long, thick. Culms solitary, trigonous. Leaves usually shorter than culm; lamina folded, rarely flat. Bracts leafy. Spikelets oblong-lanceolate to lanceolate, 8 – 14 x 2 – 3 mm; rachilla narrowly winged; scales densely imbricate, broadly ovate, acute to subobtuse. Stamens 3; anthers linear. Style medium in length; stigmas 3. Achenes dark brown when mature, trigonous.

*Flowers & Fruits:* July.

*Specimen Cited:* Raichangmari Beel, *Rajib & AP Das 0042*, dated 05. 02. 2007.

*Local Distribution:* Marginal low land of Changmari Beel.

*General Distribution:* Pakistan, India, Sri Lanka, Myanmar, Malaysia, Indonesia, Cambodia, Laos, New Guinea, Philippines, Thailand, Vietnam; N Australia, Indian Ocean Islands, Madagascar

***Cyperus pangorei*** Rottboøll, Descr. Pl. Rar. 18. 1772; Noltie, Fl. Bhut. 3(1): 314. 1994; Hajra *et al.*, Fl. Sikkim 1: 216. 1996; Prain, Beng. Pl. 2: 1144. 1903.

Rhizome short. Culms trigonous. Leaves apically bladeless or with a short blade. Bracts longer than inflorescence. Anthela compound, unequal. Spikes broadly ovate, with 4 - 12 laxly arranged spikelets, slightly compressed, 6 – 30 flowered; scales reddish brown on both surfaces, obtuse. Stamens 3. Styles medium in length; stigmas 3. Achenes dark brown.

*Flowers & Fruits:* November to January.

*Specimen Cited:* Batikata Beel, *Rajib & AP Das 0084*, dated 06. 02. 2007.

*Local Distribution:* Marshy lowland areas of conserved sector.

*General Distribution:* Pakistan, India, Sri Lanka, Nepal, Bhutan, Myanmar, Vietnam.

***Cyperus pilosus*** Vahl, Enum. Pl. 2: 354. 1805; Noltie, Fl. Bhut. 3(1): 315. 1994; Hajra *et al.*, Fl. Sikkim 1: 216. 1996; Prain, Beng. Pl. 2: 1143. 1903.

Perennial herbs. Rhizome with slender stolons. Culms scattered, triquetrous. Leaves shorter than culm; sheath brownish; lamina flat. Bracts 5, basal 3 longer than inflorescence. Spikes ovate to

oblong; rachis densely yellow hispid. Spikelets distichous, laxly arranged; rachilla wings white; scales pale, mucronate. Stamens 3. Style short; stigmas 3. Achenes blackish, trigonous.

*Flowers & Fruits:* August to November.

*Specimen Cited:* Barojan Beel, *Rajib & AP Das 0099*, dated 07. 02. 2007.

*Local Distribution:* Marshy lowland of conserved sector.

*General Distribution:* India, Nepal, Bhutan, Malaysia, Indonesia, Philippines.

ELEOCHARIS R. Brown, Prodr. 224. 1810.

**Key to the species:**

- |   |                        |
|---|------------------------|
| 1a. Erect, over 1m high; spikes over 30 mm long .....           | <i>E. tetraquetra</i>  |
| 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 present, creeping .....                             | <i>E. palustris</i>    |
| 3b. Rhizome absent ... ..                                       | 4                      |
| 4a. Bristlets glistening, white .....                           | <i>E. atropurpurea</i> |
| 4b. Bristlets brown or rusty .....                              | <i>E. geniculata</i>   |
| 5a. Nuts smooth, spikelets dense .....                          | <i>E. conjesta</i>     |
| 5b. Nuts coarse, spikelets lax .....                            | <i>E. retroflexa</i>   |

*Eleocharis retroflexa* (Poiret) Urban ssp. *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.

Tufted annual, marshland sedge. Stems filiform, recurved. Leaves reduced to sheaths. Purple spikelets elliptical or ovoid, few flowered. Glumes 6 – 8, boat-shaped, obtuse or subacute, margin hyaline, membranous, purple-tinged, pale-brown, style base pyramidal, 3-lobed; style 3-fid. Achenes obovate, trigonous, trabeculate.

*Flowers & Fruits:* July to December.

*Specimen Cited:* Batikata Beel, *Rajib & AP Das 0220*, dated 09. 02. 2007.

*Local Distribution:* Marshy lowland areas of conserved sector.

*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.

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

*Flowers & Fruits:* October to November.

*Specimen Cited:* Batikata Beel, *Rajib & AP Das 0234*, dated 09. 02. 2007.

*Local Distribution:* Marshy lowland areas of conserved sector.

*General distribution:* India to Malaysia.

***Eleocharis congesta*** D. Don, Prodr, Fl. Nepal 41.1825; Clarke in Hooker *f.*, Fl. Brit. Ind. 6: 630. 1893; Noltie, Fl. Bhut. 3(1): 286. 1994; Prain, Beng. Pl. 2: 1149. 1903. *Eleocharis afflata* Steudel, Syn. Pl. glum. 2: 76. 1855.

Annual or perennial marshland sedge; stems triangular, ridged. Sheath apex truncate, apiculate. Spikelets oblong, terete, sub-acute, purplish; glumes loosely imbricate, oblong; stigmas 3. Nuts 0.15 cm long, yellow-green. Bristles 7, white or brown.

*Flowers & Fruits:* July to December.

*Specimen Cited:* Batikata Beel, *Rajib & AP Das 0219*, dated 09. 02. 2007.

*Local Distribution:* Marshy lowland areas of conserved sector.

*General distribution:* India, Sri Lanka, Malaysia.

***Eleocharis palustris*** R. Brown, Prodr. 224. 1810; Clarke in Hooker *f.*, Fl. Brit. Ind. 6: 628. 1893; Noltie, Fl. Bhut. 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. Lamina absent, sheath truncate. Spikelets ellipsoid or cylindrical. Glumes imbricate, ovate-lanceolate. Nuts broadly obovoid, biconvex.

*Flowers & Fruits:* November to March.

*Specimen Cited:* Batikata Beel, *Rajib & AP Das 0266*, dated 10. 02. 2007.

*Local Distribution:* Marshy lowland areas of conserved sector.

*General Distribution:* Cosmopolitan except Australia.

***Eleocharis atropurpurea*** (Retzius) Kunth, Enum. 2: 151. 1837; Clarke in Hooker *f.*, Fl. Brit. Ind. 6: 627. 1893; Noltie, Fl. Bhut. 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 head. Glumes imbricate. Nut black, obtuse, biconvex, tipped with the pale disciform style base, style 2-fid.

*Flowers & Fruits:* October to December.

*Specimen Cited:* Batikata Beel, *Rajib & AP Das 0293*, dated 10. 02. 2007.

*Local Distribution:* Marshy lowland areas of conserved sector.

*General Distribution:* Pantropical.

***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; Clarke in Hooker *f.*, Fl. Brit. Ind. 6: 627. 1893; Prain, Beng. Pl. 2: 1149. 1903.

Small, marshland sedge. 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:* July to December.

*Specimen Cited:* Raichangmari Beel, *Rajib & AP Das 0248*, dated 10. 02. 2007.

*Local Distribution:* Marginal lowland areas of Changmari Beel.

*General Distribution:* India and in other warmer countries.

FIMBRISTYLIS Vahl, Enum. Pl. 2: 285. 1805, *nom. cons.*



**Key to the species:**

- 1a. Stem with only one spikelet ..... *F. tetragona*  
 1b. Stem with more than one spikelet ..... 2  
 2a. Stems tufted, compressed, grooved; nuts whitish ..... *F. dichotoma*  
 2b. Stems filiform, slender, not grooved; nuts yellow ..... *F. aestivalis*

***Fimbristylis tetragona*** R. Brown, Prodr. 226. 1810; Clarke in Hooker *f.*, Fl. Brit. Ind. 6: 631. 1893; Prain, Beng. Pl. 2:1152. 1903.

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

*Flowers & Fruits:* October to December.

*Specimen Cited:* Batikata Beel, Rajib & AP Das 0290, dated 10. 02. 2007.

*Local Distribution:* Marshy lowland areas of conserved sector.

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

***Fimbristylis aestivalis*** (Retzius) Vahl, Enum. Pl. 2: 288. 1806; Clarke in Hooker *f.*, Fl. Brit. Ind. 6: 637. 1893; Noltie, Fl. Bhut. 3(1): 296. 1994; Hajra *et al.*, Fl. Sikkim 1: 219. 1996; Prain, Beng. Pl. 2: 1154. 1903. *Scirpus aestivalis* Retzius, Obs. Bot. 4: 12. 1786.

Culms densely tufted without rhizome, flatly trigonous, few leaves at base. Leaves shorter than culms, flat; sheaths short. Bracts filiform; anthelae compound, loose; spikelets solitary, ovate to oblong-lanceolate, many-flowered; glumes spiral, membranous, ovate to oblong, mucronate, reddish brown; stamen 1, anther lanceolate; style long and compressed. Achenes obovate, yellow.

*Flowers & Fruits:* May to August.

*Specimen Cited:* Batikata Beel, Rajib & AP Das 0616, dated 11. 02. 2008.

*Local Distribution:* Marshy lowland areas of conserved sector.

*General distribution:* India, China, Japan, Malaysia and 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; Clarke in Hooker *f.*, Fl. Brit. Ind. 6: 636. 1893; Prain, Beng. Pl. 2: 1153. 1903.

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

*Flowers & Fruits:* May to November.

*Specimen Cited:* Batikata Beel, Rajib & AP Das 0555, dated 24. 07. 2007.

*Local Distribution:* Marshy lowland areas of conserved sector.

*General Distribution:* Tropical to temperate zones across the world.

FUIRENA Rottbøll, Descr. Icon. Rar. Pl. 70. 1773.

***Fuirena ciliaris*** (Linnaeus) Roxburgh, Fl. Ind. 1: 184. 1820; Noltie, Fl. Bhut. 3 (1): 282. 1994. *Scirpus ciliaris* Linnaeus, Mant. Ail. 182. 1771. *Fuirena glomerata* Lamarck, Encyl. 1: 150. 1791; Clarke in Hooker f., Fl. Brit. Ind. 6: 666. 1893; Prain, Beng. Pl. 2: 1158. 1903.

Erect, annual, marshland sedge. Rhizome absent. Stems tufted. Leaves linear – lanceolate, acuminate; sheaths striate. Spikelets in clusters of 3 – 10, gray-green or brownish, ovoid or oblong. Glumes obovate or oblong; keel green. Achenes triquetrous, obovoid, surface smooth, pale.

*Flowers & Fruits:* October to January.

*Specimen Cited:* Bochamari Beel, Rajib & AP Das 0509, dated 23. 07. 2007.

*Local Distribution:* Marginal areas of Bochamari Beel.

*General distribution:* Cosmopolitan to tropical and sub-tropical regions.

KYLLINGA Rottboøll, Descr. Icon. Rar. Pl. 12. 1773, *nom. cons.*, not *Killinga* Adanson (1763).

### Key to the species:

- 1a. Keel of achene glume winged; heads greenish ..... *K. brevifolia*  
 1b. Keel of achene glume not winged; heads whitish ..... *K. nemoralis*

***Kyllinga brevifolia*** Rottboøll, Descr. 13. t. 4. f. 3. 1773; Clarke in 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.

Rhizome slender. Culms tufted, compressed, trigonous, 4 to 5 sheathed. Leaf-sheaths brown, acuminate; lamina 5 – 17 cm x 2 - 4 mm, flaccid. Bracts 3, leaf-like. Spike 1, ovoid-globose, with numerous densely arranged spikelets. Spikelets oblong-lanceolate, compressed, 1 to 2 flowered; scales ovate, keel spinulate. Stamens 1 – 3; anthers short, linear. Style long; stigmas 2. Achenes obovoid-oblong.

*Flowers & Fruits:* May to October.

*Specimen Cited:* Barojan Beel, Rajib & AP Das 0485, dated 23.07.2007.

*Local Distribution:* Forests and road side areas.

*General distribution:* Tropical and warm regions of South-East Asia.

***Kyllinga nemoralis*** (J.R. Forster & C. Forster) Dandy *ex* Hutchinson & Dalziel, Fl. W. Trop. Afr. 2: 487. 1936; Noltie, Fl. Bhut. 3(1): 325. 1994; Hajra *et al.*, Fl. Sikkim 1: 227. 1996. *Kyllinga monocephala* Rottboell, Descr. 13, t. 4, F. 4. 1773, *nom. Superfl.*; Prain, Beng. Pl. 2: 1141. 1903. *Thryocephalon nemorale* J.R. Forster & C. Forster, Char. Gen. Pl. 65. 1775. *Cyperus kyllinga* Endlicher, Cat. Hort. Ac. Vindob. 1: 94. 1842. [PLATE: 9, Figure-95]

*Vernacular Name:* Gothube.

Perennials herbs. Culms tufted, compressed triquetrous. Leaves usually shorter than culm; sheath brown; lamina flat. Bracts 3 to 4, much longer than inflorescence. Spikes ovoid to globose, with numerous spikelets. Spikelets sub-obovoid, compressed, 1-flowered; scales boat-shaped, apex slightly recurved mucronate. Stamens 3. Style long; stigmas 2. Achenes brown, oblong to obovoid-oblong.

*Flowers & Fruits:* May to August.

*Specimen Cited:* Chhotojan Beel, Rajib & AP Das 0550, dated 24. 07. 2007.

*Local Distribution:* Margin of the Bochamari Beel.

*General Distribution:* Pantropical.

RHYNCHOSPORA Vahl, Enum. Pl. 2: 229. 1805 [“Rynchospora”], *nom. cons.*

***Rhynchospora corymbosa*** (Linnaeus) Britton in Trans. New York Acad. Sci. 11: 84. 1892; Noltie, Fl. Bhut. 3(1): 329. 1994; Cook, Aqua. Wetl. Pl. Ind. 173, 1996; 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 to November.

*Specimen Cited:* Varveri Beel, Rajib & AP Das 0423, dated 22.07.2007.

*Local Distribution:* Marshy lowland areas of conserved sector.

*General Distribution:* Pantropical; India: West Bengal, Assam, Arunachalpradesh, Meghalaya, Tripura, Nagaland, Kerala, Karnataka; Sri Lanka, Bangladesh, Bhutan, Nepal.

SCHOENOPECTUS (Reichenbach) Palla, Verh. K. K. Zool.-Bot. Ges. Wien 38 (Sitzungsber.): 49. 1888, *nom. cons.*

### Key to the species:

- 1a. Nuts smooth, triangular ..... *S. grossus*
- 1b. Nuts transversely wavy ..... 2
- 2a. Glumes distinctly keeled, spikelets angular ..... *S. laterifolius*
- 2b. Glumes faintly keeled, spikelets terete ..... 3
- 3a. Spikelets 2–4; nuts plano-convex ..... *S. juncooides*
- 3b. Spikelets more than 10; nut triquetrous ..... *S. articulatus*

***Schoenoplectus articulatus*** (Linnaeus) Palla, Bot. Jahrb. 10: 229. 1888; Palla, Fl. Hassan dist. 697. 1976; Noltie, Fl. Bhut. 3(1): 284. 1994. *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. Bot. Ind. 108. 1834.

Glabrous, annual, tufted marshland robust sedge. Stems terete, spongy, transversely septate. Leaves reduced to sheaths. Inflorescence of many sessile spikelets, head like cluster. Spikelets ovoid to cylindrical-oblong. Glumes ovate, concave, acute; hypogynous bristles absent. Style linear. Achenes obovate, triquetrous, black, smooth.

*Flowers & Fruits:* October to January.

*Specimen Cited:* Khottamari Beel, Rajib & AP Das 0439, dated 22. 07. 2007; Varveri Beel, Rajib & AP Das 0617, dated 11. 02. 2008.

*Local Distribution:* Marginal lowland areas of open fishing sector.

*General distribution:* Tropical Asia, Africa and Australia.

***Schoenoplectus grossus*** (Linnaeus *f.*) Palla, Allg. Bot. Z. 17. Biebl. 3. 1911; Srivastava in Hajra *et al.*, Fl. Sikkim 1: 234. 1996. *Scirpus grossus* Linnaeus *f.*, Suppl. 104. 1781; Clarke in Hooker *f.*, Fl. Brit. Ind. 6: 659. 1896; Noltie, Fl. Bhut. 3(1): 280. 1994; Prain, Beng. Pl. 2: 1160. 1903.

Perennial, aquatic, glabrous sedges. Rootstock stout, stolons produces tubers; roots fibrous, triquetrous spongy. Leaves few, radical, concave, strongly keeled, spongy; sheaths long open. Inflorescence decomposed, terminal, open, ovoid, dark brown. Glumes broadly elliptic concave. Nuts elliptic-obovoid.

*Flowers & Fruits:* September to December.

*Specimen Cited:* Bochamari Beel, *Rajib & AP Das 0617*, dated 11. 02. 2008.

*Local Distribution:* Marginal lowland areas of open fishing sector.

*General distribution:* India, Bhutan, Bangladesh, Sri Lanka, China, Malaysia, Philippines.

***Schoenoplectus juncooides*** (Roxburgh) Palla, Bot. Jahrb. 10: 299. 1888; Noltie, Fl. Bhut. 3(1): 283. 1994; Srivastava in Hajra *et al.*, Fl. Sikkim 1: 235. 1996. *Scirpus juncooides* Roxburgh, Fl. Ind. 1: 218. 1820; *Scirpus erectus sensu* Clarke in Hooker *f.*, Fl. Brit. Ind. 6: 656. 1893; Prain, Beng. Pl. 2: 1160. 1903.

Tufted annual, marshland sedge. Stems flaccid or rigid. Leaves reduced to sheaths. Spikelets sessile, 2–5 in a lateral cluster; glumes suborbicular, concave, acute, pale–brown; hypogynous bristles 5–6, unequal, retrorsely scarbid, shorter or longer than achenes. Style linear, branches 2. Achenes globosely obovoid, brown to black.

*Flowers & Fruits:* July to February.

*Specimen Cited:* Bochamari Beel, *Rajib & AP Das 0631*, dated 12. 02. 2008.

*Local Distribution:* Marginal areas of Bochamari Beel.

*General distribution:* India, China, Japan, Malaysia, Australia.

***Schoenoplectus lateriflorus*** (J.F. Gmelin) K.A. Lye, Bot. Nat. 290. 1971; Bhat *et al.*, Sedg. & Gras. 82. 2001. *Scirpus lateriflorus* J.F. Gmelin, Syst. Nat. 2, 1: 127. 1791. *Scirpus supinus* Linnaeus var. *uninoides* Clarke in Hooker *f.*, Fl. Brit. Ind. 6: 656. 1893; Prain, Beng. Pl. 2: 1160. 1903. *Scirpus supinus* var. *lateriflorus* (Gmelin) Koyama, J. 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. 1753; Hara *et al.*, Enn. Flower. Pl. Nepal 1: 119. 1978.

Aquatic or marshland annual, erect, tufted. Stems glabrous, trigonous. Leaves short, sheath short. Spikelets in a axillary cluster, ovate, oblong, sessile, rachilla slender. Glumes ovate, membranous. Nuts transversely lineolate.

*Flowers & Fruits:* August to December.

*Specimen Cited:* Bochamari Beel, *Rajib & AP Das 0635*, dated 12. 02. 2008.

*Local Distribution:* Marginal areas of Bochamari Beel.

*General distribution:* India, Tropical Asia, N. America and Australia.

SCIRPUS Linnaeus, Sp. Pl. 1: 47. 1753, *nom. cons.*

***Scirpus michelianus*** Linnaeus, Sp. Pl. 1: 52. 1753; Clarke in Hooker *f.*, Fl. Brit. Ind. 6: 662. 1893; Noltie, Fl. Bhut. 3(1): 280. 1994; Prain, Beng. Pl. 2: 873. 1903; Datta & Majumdar, Bull. Bot. Soc. Beng. 20(2): 35. 1966. *Cyperus diffuses* Roxburgh, Fl. Ind. 1: 189. 1832.

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

*Flowers & Fruits:* July to January.

*Specimen Cited:* Chhotojan Beel, *Rajib & AP Das 0349*, dated 21. 07. 2007.

*Local Distribution:* Marginal areas of Bochamari Beel.

*General distribution:* Warmer parts of India, South Asia, South Europe to Japan.

**Juncaceae** A. L. de Jussieu, Gen. Pl. 43. 1789 ('Junci'); *nom. cons.*

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

*Juncus prismatocarpus* R. Brown, Prodr. Fl. Nov. Holl. 1: 259. 1810; Noltie, Fl. Bhut. 3(1): 254. 1994; Hajra *et al*, Fl. Sikkim 1: 176. 1996; Prain, Beng. Pl. 2: 1088. 1903.

Perennial tufted herbs. Stems erect. Basal leaves few; lamina linear, 8 – 22 cm × 2 – 4 mm, obtuse to acute. Inflorescence terminal, much branched; involucre bracts leafy, shorter than inflorescence; heads globose to hemispheric; bracts broadly ovate to ovate lanceolate. Perianth segments narrowly lanceolate to linear-lanceolate, acute. Stamens 3. Stigmas very long. Capsules narrow.

*Flowers & Fruits:* May to November.

*Specimen Cited:* Batikata Beel, Rajib & AP Das 0169, dated 08. 02. 2007.

*Local Distribution:* Marshy lowland of conserved sector.

*General Distribution:* Pakistan, India, Sri Lanka, Bhutan, Nepal, Indonesia, Japan, Korea, Laos, Cambodia, Malaysia, Papua New Guinea, Thailand, Vietnam, Australia, Pacific Islands.

### **Typhaceae** A. L. de Jussieu, Gen. Pl. 25. 1789 ('Typhae').

TYPHA Linnaeus, Sp. Pl. 2: 971. 1753.

*Typha elephantina* Roxburgh, Fl. Ind., 3: 566. 1832; Noltie, Fl. Bhut. 3(1): 177. 1994; Prain, Beng. Pl. 2: 1102. 1903. *Typha schimperi* P. Rohrbach, Verh. Bot. Vereins Prov. Brandenburg 11: 95. 1869. *Typha maresii* Battandier, Bull. Soc. Bot. France 34: 389. 1887. *Typha elephantina* var. *schimperi* (P. Rohrbach) Graebner, Pflanzenr. IV, 8: 11. 1900. *Typha latifolia* subsp. *maresii* (Battandier) Battandier, Fl. Algérie 1(2): 18. 1895.

Plants up to 2.5 m, stout. Leaves 1 – 1.5 m long, abaxially carinate, transverse section triangular. Staminate part of spikes with 1 bract, axis with dense brown hairs; pistillate part of spikes separated from staminate part. Female flowers with whitish bracteoles; bracteoles linear; ovary lanceolate, stalked; stigmas lanceolate.

*Flowers & Fruits:* unknown.

*Specimen Cited:* Chhotojan Beel, Rajib & AP Das 0566, dated 24. 07. 2007.

*Local Distribution:* Forests of central area.

*General Distribution:* Pakistan, India, Bangladesh, Bhutan, Nepal, Myanmar; Africa.

### **Eriocaulaceae** P. Beauvois *ex* Desvaux, Ann. Sc. Nat. 13: 45. 1828 ('Eriocauloneae').

ERIOCAULON Linnaeus, Sp. Pl. 1: 87. 1753.

#### **Key to the Species :**

- |   |                    |
|---|--------------------|
| 1a. Leaves upto 5 cm long; anthers white or pale yellow ..... | <i>E. cinereum</i> |
| 1b. Leaves 5 – 12 cm long; anthers black .....                | <i>E. alpestre</i> |

*Eriocaulon cinereum* R. Brown, Prodr. 254. 1810; Noltie, Fl. Bhut. 3(1): 244. 1994; Cook, Aqua. Wetl. Pl. Ind. 191. 1996. *Eriocaulon sieboldianum* Siebold & Zuccarini *ex* Steudel, Syn. Pl. Glum. 2: 272. 1855; Hooker *f.*, Fl. Brit. Ind. 6: 577. 1893; Prain, Beng. Pl. 2: 1127. 1903.

Small, stemless, tufted annual sedge. Leaves 2 – 5 cm long, narrowly linear glabrous, gradually attenuate to filiferous apex. Peduncle 10 – 15 cm, numerous, aggregated, glabrous, 5-ribbed. Heads small, whitish globose or ovoid; bracts glabrous.

*Flowers & Fruits:* October to March.

*Specimen Cited:* Batikata Beel, *Rajib & AP Das 0734*, dated 14. 02. 2008.

*Local Distribution:* Marshy low land of conserved sector.

*General Distribution:* India and Tropical parts of world.

***Eriocaulon alpestre*** Hooker *f.* & Thomson *ex* Körnicke, Miquel Ann. Mus. Bot. Lugduno-Batavi 3: 163. 1867; Noltie, Fl. Bhut. 3(1): 245. 1994; Hajra *et al.*, Fl. Sikkim 1: 197. 1996; Cook, Aqua. Wetl. Pl. Ind. 187. 1996. *Eriocaulon alpestre* var. *ampullaceum* P. Royen, Blumea 10: 126. 1960.

Leaves linear, 5 – 12 x 0.3 – 0.5 cm. Scapes 5 – 8 cm; sheath 3 – 8 cm; heads straw colored at base, black at apex; involucre bracts yellowish green, ovate, usually silky, glabrescent; floral bracts obovate to oblanceolate, glabrescent. Male flowers: petals 3, subequal, anthers black. Female flowers: petals 3, spatulate; ovary 3 loculed. Seeds narrowly ovoid.

*Flowers & Fruits:* June to August.

*Specimen Cited:* Varveri Beel, *Rajib & AP Das 0136*, dated 07. 02. 2007.

*Local Distribution:* Marshy lowland of conserved areas.

*General Distribution:* India, Bhutan, Nepal, Japan, Korea, Philippines, Thailand.

**Xyridaceae** C. A. Agardh, Aphor. Bot. 158. 1823 ('Xyrideae').

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; Noltie, Fl. Bhut. 3(1): 242. 1994; Hajra *et al.*, Fl. Sikkim 1: 167. 1996; Prain, Beng. Pl. 2: 1080. 1903; Cook, Aqua. Wetl. Pl. Ind. 369, 1996. *Xyris denticulata* R. Brown, Prodr. Fl. Nov. Holl. 256. 1810. *Xyris maritima* T. Koyama, Philipp. J. Sci. 84: 367. 1956. *Xyris dajacensis* P. Royen, Blumea 7: 208. 1953.

Tufted, aquatic, erect annual herbs. Lamina linear acuminate. Heads globose or ovoid. Flowers 4 – 6 in a head, bracts orbicular. Capsule broadly ovoid. Seeds minute, linear oblong, many.

*Flower & Fruits:* November to February.

*Specimen Cited:* Batikata Beel, *Rajib & AP Das 0143*, dated 08. 02. 2007.

*Local Distribution:* Marginal areas of water body of conservatory sector.

*General Distribution:* India; native to Tropical Australia.

**Order: Zingiberales** Grisebach (1854)

**Cannaceae** A. L. de Jussieu, Gen. Pl. 62. 1789 ('Cannae'); *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.

Rhizome much branched. Stems up to 2 m. Leaf sheath green; petiole short; lamina adaxially green, 25 – 55 x 8 – 16 cm. Racemes compact, branched; bracts ovate. Flowers 1 – 2 per cincinnus. Sepals pale. Corolla tube apricot yellow. Stamines 2 or 3; labellum red, lanceolate. Ovary green, globose. Capsule broadly ovoid.

*Flowers & Fruits:* Through out the year.

*Specimen Cited:* Park, *Rajib & AP Das 0167*, dated 08. 02. 2007.

*Local Distribution:* Grown in parks and gardens; often escapes.

*General Distribution:* Native to tropical America; cultivated throughout the tropics. Seminatualized in many areas.

**Costaceae** (Meisner) Nakai, Journ. 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* J. König, Retzius Obs. 3: 75. 1783. *Hellenia grandiflora* Retzius, Observ. Bot. 6: 18. 1791. *Costus speciosus* (J. König) J.E. Smith, Trans. L. Soc. 1: 249. 1791; G. Watt, Dict. Econ. Prod. 2: 579. 1889; Baker in 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, apex sharply pointed; bracteoles pale red. Calyx red, apex 3 lobed. Corolla tube 1 cm; lobes oblong-elliptic, apex white. Labellum white. Stamen petaloid, white with orange-yellow base. Capsule red, globose. Seeds black.

*Flowers & Fruits:* July to November.

*Specimen Cited:* Forest, Rajib & AP Das 0195, dated 09. 02. 2007.

*Local Distribution:* In plantation forests and bushes.

*General Distribution:* India, Bangladesh, Sri Lanka, Java.

**Marantaceae** Lindley, Nat. Syst. 267. 1830; *nom. cons.*

PHRYNIUM Willdenow, Sp. Pl., ed. 4, 1(1): 1, 17. 1797; *nom. cons.*

*Phrynium pubinerve* Blume, Enum. Pl. Javae 1: 38. 1827; Noltie, Fl. Bhut. 3(1): 214. 1994. *Phrynium densiflorum* Moritzi ex Körnig, Bull. Soc. Imp. Naturalistes Moscou 35(1): 101. 1862. *Phrynium malaccense* H.N. Ridley, J. Asiat. Soc. Straits 32: 180. 1899.

Plants up to 1 m. Rhizomes tuberous. Basal leaves several; cauline leaf 1; petiole to 60 cm, pulvinus 5 – 6 cm, glabrous; lamina ovate-oblong to oblong, 30 – 45 × 8 – 12 cm, glabrous, shortly acuminate, base acute. Inflorescence sessile, capitate; bracts purple-red, oblong-lanceolate, apex initially acute. Flower sessile. Sepals linear, sericeous. Corolla tube violet, shorter than calyx; lobes dark red, oblong-obovate. Outer staminodes light red, obovate, slightly corrugated. Ovary sericeous. Fruit dark red, shiny, pyriform; exocarp hard. Seeds shallowly grooved.

*Flowers & Fruits:* June to September.

*Specimen Cited:* Batikata Beel, Rajib & AP Das 0232, dated 09. 02. 2007.

*Local Distribution:* Margins of water body of conservatory sector.

*General Distribution:* Eastern Himalaya, including Terai and Duars; South East Asia.

**Musaceae** A. L. de Jussieu, Gen. Pl. 61. 1789 ('Musae'); *nom. cons.*

MUSA Linnaeus, Sp. Pl. 2: 1043. 1753.

#### Key to the Species:

- 1a. Bracts adaxially purple red, abaxially yellowish green ..... *M. balbisiana*
- 1b. Bracts adaxially deep red, abaxially purple ..... *M. paradisiaca*

*Musa balbisiana* Colla, Mem. Reale Accad. Sci. Torino 25: 384. 1820; Kew Bull. 1948: 14. 1948; Hara, Fl. East. Himal. 3: 136. 1975; Hara *et al.*, En. Flower. Pl. Nepal 1: 63. 1978; Noltie, Fl. Bhutan 3(1): 180. 1994; Hajra *et al.*, Fl. Sikkim 1: 135. 1996.

*Vernacular Name:* Bichikola

Pseudostems upto 5 m high, green with dark markings. Lamina oblong, entire, petiole spongy, base asymmetric. Compound spadix pendulous, 1 - 1.5 m; peduncle and rachis glabrous. Bracts of bisexual and male flowers adaxially purple red, abaxially yellowish green; bracts of female flowers deciduous. Flowers numerous. Berries yellow when ripe, obovoid, distinctly angled at maturity. Seeds numerous, brown, oblate, minutely warty.

*Flowers & Fruits:* Round the year.

*Specimen Cited:* Village sector, Rajib & AP Das 0567, dated 24. 07. 2007.

*Local Distribution:* In villages.

*General Distribution:* India, Sri Lanka, Nepal, Myanmar, Thailand, Malaysia, Indonesia (Java), New Guinea, Philippines.

*Musa* × *paradisiaca* Linnaeus, Sp. Pl. 2: 1043. 1753. Hajra *et al.*, Fl. Sikkim 1: 135. 1996. *Musa sapientum* Linnaeus, Syst. 10, 2: 1303. 1759; Hooker *f.*, Fl. Brit. Ind. 6: 262. 1892; Prain, Beng. Pl. 2: 1050. 1903.

Pseudostems clumped. Leaves erect; lamina adaxially deep green, abaxially light green, oblong, Fl. Bhut. 1.5 – 2.5 m × 30 – 55 cm, base subsymmetric, acute. Compound spadix pendulous; rachis glabrous. Bracts adaxially deep red, abaxially purple, deciduous. Flowers in 2 rows in each bract. Tepal suborbicular to oblong, acuminate. Infructescence with 6 – 8 clusters of erect to slightly curved berries. Seeds absent.

*Flowers & Fruits:* All round the year.

*Specimen Cited:* Bochamari village, Rajib & AP Das 0630, dated 12. 02. 2008.

*Local Distribution:* Commonly cultivated in villages.

*General Distribution:* Native to tropical Asia; widely cultivated in the tropics.

**Zingiberaceae** Lindley, Nat. Syst. ed. 2. 322. 1836 (nom. cons. prop. vs. Amomeae); *nom. cons.*

#### Key to the genera:

- |   |                 |
|---|-----------------|
| 1a. Inflorescence terminal or lateral on pseudostems .....                            | 2               |
| 1b. Inflorescence on separate shoots arising from rhizomes .....                      | 3               |
| 2a. Lateral staminodes reduced to small subulate point or swellings .....             | <i>Alpinia</i>  |
| 2b. Lateral staminodes attached to corolla tube and petal-like .....                  | <i>Globba</i>   |
| 3a. Style exerted well beyond anther-thecae and enfolded in a long anther-crest ..... | <i>Zingiber</i> |
| 3b. Style not exerted much beyond anther-thecae and not enfolding style.....          | <i>Curcuma</i>  |

ALPINIA Roxburgh, Asiat. Res. 11: 350. 1810, *nom. cons.*

#### Key to the species:

- |   |                     |
|---|---------------------|
| 1a. Bracteoles funnel-shaped, persistent .....              | <i>A. nigra</i>     |
| 1b. Bracteoles shell-shaped, deciduous after anthesis ..... | <i>A. calcarata</i> |



*Alpinia calcarata* (Haworth) Roscoe, Trans. Linn. Soc. London 8: 347. 1807; Prain, Beng. Pl. 2: 1047. 1903; Noltie, Fl. Bhut. 3(1): 206. 1994. *Renealmia calcarata* Haworth, Bot. Repos. 6: t. 421. 1805. *Alpinia calcarata* var. *compacta* Gagnepain, Bull. Soc. Bot. France 48: 85. 1902.

*Vernacular Name:* Purundi.

Pseudostems up to 1 m. Leaves sessile, lamina linear-lanceolate, 20 – 40 × 2 – 4 cm, glabrous, acuminate and caudate-mucronate, base attenuate. Panicles terminal, less than 10 cm; rachis slightly velvety. Calyx split on 1 side. Corolla tube white; lobes oblong. Lateral staminodes red. Labellum white with rose red and purple streaks. Filament 1.5 cm. Capsule red, globose.

*Flowers & Fruits:* May.

*Specimen Cited:* Bochamari Beel, *Rajib & AP Das 0716*, dated 14. 02. 2008; *Rajib & AP Das 0660*, dated 13. 02. 2008.

*Local Distribution:* Marginal areas of Bochamari Beel.

*General Distribution:* India, Sri Lanka, Myanmar.

*Alpinia nigra* (Gaertner) Burtt, Notes Roy. Bot. Gard. Edinburgh 35(2): 213. 1977; Noltie, Fl. Bhut. 3(1): 205. 1994; Hajra *et al.*, Fl. Sikkim 1: 121. 1996. *Zingiber nigrum* Gaertner, Fruct. Sem. Pl. 1: 35. 1788. *Alpinia allughas* (Retzius) Roscoe, Trans. Linn. Soc. London 8: 346. 1807; Prain, Beng. Pl. 2: 1047. 1903. *Amomum nigrum* (Gaertner) Räsusch, Nomencl. Bot. 3: 1. 1797. *Heritiera allughas* Retzius, Observ. Bot. 6: 17. 1791.

*Vernacular Name:* Purundi.

Pseudostems up to 2 m. Leaves sessile to subsessile; lamina elliptic-lanceolate, 25 – 50 × 6 – 8 cm, apex and base acute. Panicles terminal, erect; branches expanded; bracts ovate; bracteoles funnel shaped. Pedicel 5 mm. Calyx tubular. Corolla, cucullate. Lateral staminodes subulate. Labellum obovate. Stamen ca. 2 cm; anther curved. Ovary pubescent. Capsule black when dry.

*Flowers & Fruits:* July to October.

*Specimen Cited:* Noldoba Beel, *Rajib & AP Das 0155*, dated 08. 02. 2007.

*Local Distribution:* Marginal areas of Noldoba Beel.

*General Distribution:* India, Bhutan, Sri Lanka, Thailand.

CURCUMA Linnaeus, Sp. Pl. 1: 2. 1753, *nom. cons.*

*Curcuma aromatica* Salisbury, Parad. Lond. 2: t, 96. 1807; Hooker *f.*, Fl. Brit. Ind. 6: 210. 1890; Prain, Beng. Pl. 2: 1042; Noltie, Fl. Bhut. 3(1): 192. 1994. 1903; Hajra *et al.*, Fl. Sikkim 1: 125. 1996. *Curcuma wenyujin* Y.H. Chen & C. Ling, Acta Pharm. Sin. 16: 387. 1981.

*Vernacular Name:* Soti.

Plants up to 1 m. Rhizomes pale yellow inside, aromatic. Petiole equaling leaf blade; lamina oblong, Fl. Bhut. 25 – 50 × 10 – 20 cm, narrowly caudate, base attenuate. Inflorescences on separate shoots arising from rhizomes; spike cylindrical; fertile bracts pale green, ovate. Calyx sparsely hairy. Corolla tube funnel-shaped, villous at throat; lobes pinkish white. Lateral staminodes yellowish. Labellum yellow. Ovary villous.

*Flowers & Fruits:* May to September.

*Specimen Cited:* Forest, *Rajib & AP Das 0189*, dated 09. 02. 2007.

*Local Distribution:* Forest and road side areas.

*General Distribution:* India, Nepal, Bangladesh, Sri Lanka, Myanmar, Java.

GLOBBA Linnaeus, Mant. Pl. 2: 143, 170. 1771.

***Globba racemosa*** J.E. Smith, Exot. Bot. 2: 115. 1806; Noltie, Fl. Bhut. 3(1): 191. 1994; Hajra *et al.*, Fl. Sikkim 1: 127. 1996. *Globba orixensis* var. *racemosa* (J.E. Smith) Gagnepain, Bull. Soc. Bot. France 48: 201. 1901; Prain, Beng. Pl. 2: 1037. 1903.

Pseudostems up to 100 cm. Leaves sessile; lamina oblong to ovate-lanceolate, 12 – 20 × 4 – 5 cm, caudate, base acute, glabrous. Flowers in terminal thyrses, yellow, with orange, glandular spots. Calyx turbinate. Corolla lobes reflexed. Lateral staminodes lanceolate. Labellum reflexed, obcuneate. Filament 1 cm; anther without appendages. Capsule ellipsoid, smooth.

*Flowers & Fruits:* June to September.

*Specimen Cited:* Forest, Rajib & AP Das 0204, dated 09. 02. 2007.

*Local Distribution:* Common in plantation forests.

*General Distribution:* India, Nepal, Bhutan, Myanmar, Thailand.

ZINGIBER Miller, Gard. Dict. Abr., ed. 4, [1545]. 1754, *nom. cons.*

***Zingiber montanum*** (J. König) Link *ex* A. Dietrich, Sp. Pl. 1: 52. 1831. *Amomum montanum* J. König, Observ. Bot. 3: 51. 1783. *Zingiber purpureum* Roscoe, Trans. Linn. Soc. London 8: 348. 1807; Noltie, Fl. Bhut. 3(1): 188. 1994. *Zingiber cassumunar* Roxburgh, Asiat. Res. 11: 347. t. 5. 1810; Roxburgh, Fl. Ind. 1: 48. 1820; Hooker *f.*, Fl. Brit. Ind. 6: 248. 1892; Prain, Beng. Pl. 2: 1045. 1903.

*Vernacular Name:* Bon aada.

Rhizome perennial, fleshy, aromatic, yellow inside. Leaves sessile; ligule short, beelobed, pubescent; lamina linear-lanceolate, acute, base slightly rounded. Inflorescence basal, ovate; spike ovate, deep red. Calyx white, membranous. Style exerted well beyond anther-thecae and enfolded in a long anther-crest. Capsules ovoid; seeds purple.

*Flowers & Fruits:* June to August.

*Specimen Cited:* Forest, Rajib & AP Das 0246, dated 09. 02. 2007.

*Local Distribution:* Plantation forests.

*General Distribution:* Native of India; Sri Lanka and Malay Peninsula.

**Ceratophyllaceae** Gray, Nat. Arr. Brit. Pl. 2: 395, 554. 1822; *nom. cons.*

CERATOPHYLLUM Linnaeus, Sp. Pl. 2: 992. 1753.

***Ceratophyllum demersum*** Linnaeus, Sp. Pl. 2: 992. 1753; Hooker *f.* in Hooker *f.*, Fl. Brit. Ind. 5: 639. 1888; Prain, Beng. Pl. 2: 743. 1903. *Dichotophyllum demersum* (Linnaeus) Moench, Methodus 345. 1794. *Ceratophyllum cornutum* Richard *ex* S.F. Gray, Nat. Arr. Brit. Pl. 2: 555. 1821.

Stems up to 3 m long, suspended in water. Leaves bright green, coarse textured; whorls 1.5 – 6 cm in diameter; segments linear to filiform, not inflated. Flowers 1–3 mm in diameter. Achenes dark green to reddish brown, smooth or slightly tuberculate, margins wingless and spineless, facial spines absent; basal spines or tubercles 2, straight or curved; terminal spine 1.5 – 14 mm.

*Flowers & Fruits:* August to December.

*Specimen Cited:* Bochamari Beel, Rajib & AP Das 0076, dated 06. 02. 2007.

*Local Distribution:* Marginal areas of the Beel.

*General Distribution:* India: West Bengal, Assam, Sikkim, Bihar, Uttar Pradesh; Bhutan, Bangladesh.

**Eudicots - Eudicotyledon** (Zweikeimblättrige)**Peripheral Eudicots - Periphere Eudicotyledonen****Order: Ranunculales** Dumortier (1829)**Menispermaceae** A. Jussieu, Gen. Pl. 284. 1789; *nom. cons.***Key to the genera:**

- 1a. Main basal veins and their outer branches leading directly to margin .....2
- 1b. Main basal vein and their outer branches are not leading to margin ..... 3
- 2a. Sepals 6 in 2 whorls ..... *Tinospora*
- 2b. Sepals 8–12 in 3 or 4 whorls ..... *Pericampylus*
- 3a. Flowers and fruits in pedunculate umbel-like cymes or discoid heads, these often in compound umbels, sometimes forming a terminal thyrse ..... *Stephania*
- 3b. Flowers and fruits in a simple cymes, these flat-topped or in elongated thyrses, sometimes racemelike ..... *Cissampelos*

CISSAMPELOS Linnaeus, Sp. Pl. 2: 1031. 1753.

*Cissampelos pareira* Linnaeus, Sp. Pl. 1031. 1753; H. Kanai in Hara, Fl. E. Himal. 1: 94. 1966; Grierson in Grierson *et* Long, Fl. Bhut. 1(2): 336. 1984; Prain, Beng. Pl. 1: 208. 1903. *Cissampelos argentea* Kunth, Nov. Gen. Sp. 5: 67. 1821. *Cissampelos pareira* Linnaeus var. *hirsuta* (Buchanan–Hamilton *ex de* Candolle) Forman, Kew Bull. 22: 356. 1968.

Woody vines. Branches slender, striate, usually densely pubescent. Petioles shorter than lamina; leaf blade cordate-rotund to rotund, 2–7 cm long and wide, papery, abaxially densely pubescent, adaxially sparsely pubescent, base often cordate, sometimes subtruncate, rarely slightly rounded, apex often emarginate, with a mucronate acumen, palmately 5–7 veined. Male inflorescences axillary, solitary or few fascicled, corymbose cymes, pubescent. Female inflorescences thyrsoid, narrow, up to 18 cm, usually less than 10 cm; bracts foliaceous and suborbicular, overlapping along rachis, densely pubescent. Female flowers: sepals broadly obovate; petals minute. Drupes pubescent; endocarp broadly obovate.

*Flowers & Fruits:* August to January.

*Specimen Cited:* Forest, Rajib & AP Das 0032, dated 05. 02. 2007.

*Local Distribution:* Forested areas, on bushes.

*General Distribution:* Pantropical in Asia.

STEPHANIA Loureiro, Fl. Cochinch. 2: 598, 608. 1790.

**Key to the species:**

- 1a. Perianth in female flowers asymmetrical ..... *S. glabra*
- 1b. Perianth in female flowers symmetrical ..... *S. japonica*

*Stephania glabra* (Roxburgh) Miers, Ann. Mag. Nat. Hist., ser. 3 18: 14. 1866; Contrib. Bot. 3: 217. 1817; H. Hara in Hara, Fl. E. Himal. 2: 36. 1971; Grierson in Grierson *et* Long, Fl. Bhut. 1(2): 336. 1984; Sharma *et al.*, Fl. Ind. 1: 334. 1993. *Cissampelos glabra* Roxburgh, Fl. Ind. 3: 840. 1832. *Stephania rotunda* Loureiro, Fl. Cochinch. 608. 1790.

*Vernacular name:* Bhuin kumra.

Rootstock often tuberous. Lamina ovate or suborbicular, acute or subacute, base rounded, glabrous. Inflorescence usually axillary; pedunculate umbel-like cymes or discoid heads, these often in compound

umbels, sometimes forming a terminal thyrse peduncles umbels slender in male, generally stouter in female; Perianth in female flowers asymmetric. Fruits suborbicular, reddish on ripening.

*Flowers & Fruits:* April to July.

*Specimen Cited:* Forest, Rajib & AP Das 0098, dated 07. 02. 2007.

*Local Distribution:* Forested areas.

*General Distribution:* India: Arunachal Pradesh, Assam, Manipur, Nagaland, Tropical Himalayas, Western Peninsula; Nepal, Bhutan, Bangladesh, China.

***Stephania japonica*** (Thunberg ex J.A. Murray) Miers, Ann. Mag. Nat. Hist. ser. 3, 18: 14. 1866; H. Kanai in Hara, Fl. E. Himal. 1: 95. 1966; Hooker f. et Thomson in Hooker f., Fl. Brit. Ind. 1: 103. 1872; Grierson in Grierson et Long, Fl. Bhut. 1(2): 337. 1984; Sharma et al., Fl. Ind. 1: 335. 1993; *Menispermum japonicum* Thunberg ex J.A. Murray, Syst. Veg., ed. 14: 892. 1784.

Slender twiner. Lamina deltoid, acuminate, rounded, entire, sparsely pubescent beneath. Umbels axillary; male flowers sessile in dense capitate clusters; sepals oblanceolate, petals obovate; female inflorescence a pedunculate umbel-like cyme or discoid heads, these often in compound umbels, sometimes forming a terminal thyrse; female flowers similar to male; perianth in female flowers symmetric. Fruits suborbicular, red on ripening.

*Flowers & Fruits:* May to December.

*Specimen Cited:* Forest, Rajib & AP Das 0518, dated 23. 07. 2007.

*Local Distribution:* Forest areas.

*General Distribution:* Tropical to temperate regions of Asia and Africa.

TINOSPORA Miers, Ann. Mag. Nat. Hist., ser. 2, 7: 35, 38. 1851, *nom. cons.*

***Tinospora cordifolia*** (Willdenow) Miers, Ann. Mag. Nat. Hist., ser. 2 7: 35, 38. 1851. *Menispermum cordifolium* Willdenow, Sp. Pl. 4: 826. 1806. *Tinospora cordifolia* (Willdenow) Hooker f. et Thomson, Fl. Indica. 184. 1855; Hooker f. et Thomson in Hooker f., Fl. Brit. Ind. 1: 97. 1872; Grierson in Grierson et Long, Fl. Bhut. 1(2): 335. 1984; Sharma et al., Fl. Ind. 1: 347. 1993.

*Vernacular name:* Gulancha.

Large twiner with long slender (thread-like) arial roots. Lamina broadly ovate, abruptly acuminate, base cordate, glandular domatia in veins axils on lower surface, otherwise glabrous. Male flowers in few-flowered clusters, female flowers borne singly along axis. Outer sepals ovate in male, inner elliptic; petals obovate. Female flowers with sepals and petals similar to male; staminodes linear, carpels ellipsoid. Drupes red.

*Flowers & Fruits:* January to May.

*Specimen Cited:* Forest, Rajib & AP Das 0551, dated 24. 07. 2007.

*Local Distribution:* Forest areas.

*General Distribution:* India, Sri Lanka, Bangladesh and Myanmar.

PERICAMPYLUS Miers, Ann. Mag. Nat. Hist., ser. 2, 7: 36, 40. 1851, *nom. cons.*

***Pericampylus glaucus*** (Lamarck) Merrill, Interpr. Rumph. Herb. Amboin. 219. 1917; H. Kanai in Hara, Fl. E. Himal. 1: 95. 1966; Grierson in Grierson et Long, Fl. Bhut. 1(2): 336. 1984; Sharma et al., Fl. Ind. 1: 330. 1993. *Menispermum glaucum* Lamarck, Encycl. Meth. 4: 100. 1797. *Pericampylus formosanus* Diels, Pflanzenr. IV. 94: 221, f. 75, 221. 1910.

Base with a globose woody tuber. Lamina triangular-ovate to triangular-oblong, base subtruncate to cordate, rarely broadly cuneate, margin crenate or subentire, apex obtuse or rounded, rarely mucronate, apiculate. Inflorescences corymbose cymes. Drupes red or purple.

*Flowers & Fruits:* April to October.

*Specimen Cited:* Forest, Rajib & AP Das 0254, dated 10. 02. 2007.

*Local Distribution:* Forest areas.

*General Distribution:* India: Eastern Himalaya, West Bengal, Assam; Bhutan, Myanmar, China, Thailand, Taiwan, Japan, Malaysia.

## **Papaveraceae** A. Jussieu, Gen. Pl. 235. 1789; *nom. cons.*

### **Key to the Genera:**

- 1a. Spinescent stem with yellow latex, lamina prickly on lower surface ... *Argemone*  
 1b. Stem spineless with watery latex, lamina prickly less ..... *Fumaria*

ARGEMONE Linnaeus, Sp. Pl. 1: 508. 1753.

*Argemone mexicana* Linnaeus, Sp. Pl. 1: 508. 1753; H. Hara in Hara, Fl. E. Himal. 1: 103. 1966; Long in Grierson *et* Long, Fl. Bhut. 1(2): 402. 1984; Hooker *f. et* Thomson in Hooker *f.*, Fl. Brit. Ind. 1: 117. 1872; Prain, Beng. Pl. 1: 215. 1903; Sharma *et al.*, Fl. Ind. 2: 2. 1993; Hajra *et al.*, Fl. West Beng. 1: 405, 1997. *Argemone mexicana* var. *lutea* Kuntze, Revis. Gen. Pl. 1: 12. 1891. *Argemone vulgaris* Spach, Hist. Nat. Veg. 7: 26. 1839. *Argemone spinosa* Gaterau, Descr. Pl. Montauban 99. 1789. [PLATE: 8, Figure-76]

*Vernacular name:* Sheyalkanta.

Annuals, 40 – 90 cm high, much spinescent with yellow latex. Leaves sessile, elliptic – obovate, cordate, pinnatifid, 2 – 18 x 1.5 – 8 cm; segments dentate, spiny along margins, glaucous green, prickly on lower surface, smooth above. Flowers in terminal cluster, bright yellow, 3 – 6 cm in diameter, sessile. Sepals elliptic, 8 – 15 x 6 – 9 mm, prickly out side. Petals 4 – 6, imbricate, obovate. Stamens many, 9 – 10 mm long, filaments yellow, anthers 2 mm, yellow. Ovary ovoid, 10 – 12 x 3 – 5 mm. Capsules oblong; seeds many, deeply reticulate, blackish brown.

*Flowers & Fruits:* February to July.

*Specimen Cited:* Batikata Beel, Rajib & AP Das 0294, dated 10. 02. 2007.

*Local Distribution:* Marginal areas of Beels.

*General Distribution:* Throughout India. Native of tropical America.

FUMARIA Linnaeus, Sp. Pl. 2: 699. 1753; Gen. Pl. ed. 5, 314, 1754.

*Fumaria indica* (Hasskarl) Pugsley, Jour. L. Soc. Bot. 44: 313. 1919; Long in Grierson *et* Long, Fl. Bhut. 1(2): 384. 1984; *Fumaria vaillantii* Loisel var. *indica* Hasskarl., Fl. Ind. 56: 443. 1873; *Fumaria parviflora sensu* Wight *et* Arnott, Prodr. 1: 18. 1834; Prain, Beng. Pl. 1: 143. 1963; Sharma *et al.*, Fl. Ind. 2: 34. *Fumaria parviflora* var. *indica* (Haussk) Parsa, Fl. Iran 2: 490. 1986. *Fumaria vaillantii* Loiseleur in Desvaux, Jour. de Bot. 2: 358. 1809; H. Hara in Hara, Fl. E. Himal. 1: 104. 1966.

Small, erect much branched herbs. Stem glabrous, much branched, grooved. Leaves decomposed, multifid, glaucous, 3 x 2 cm; ultimate lobes flat, narrowly linear to linear – lanceolate, entire, acute, mucronate. Flowers pink in a 18 – 22 flowered racemes; bracts lanceolate, acuminate, equal, membranous. Sepal lanceolate, caduceous. Filament connate. Ovary glabrous; style slender.

*Flowers & Fruits*: December to March.

*Specimen Cited*: Children Park, *Rajib & AP Das 0331*, dated 21. 07. 2007.

*Local Distribution*: Behind the Panchayet Samiti Guest House.

*General Distribution*: India: West Bengal, Assam, Bihar, Orissa, Uttar Pradesh, Punjab, Haryana, Maharashtra, Karnataka, Tamilnadu; Bhutan, Nepal, Bangladesh, Pakistan to West Asia.

**Ranunculaceae** A. Jussieu, Gen. Pl. 231. 1789; *nom. Cons.*

**Key to the Genera:**

- 1a. Climbing shrubs. Leaflets reniform to broadly ovate ..... *Naravelia*  
 1b. Annual herbs leaflets ovate ..... *Ranunculus*

NARAVELIA Adanson, Fam. Pl. 2: 460, 581. 1763, *nom. et orth. cons.*

*Naravelia zeylanica* (Linnaeus) DC., Syst 1: 167, 1817; H. Hara in Hara, Fl. E. Himal. 1: 89. 1966; Hajra *et al.*, 1: 127, 1997; Prain, Beng. Pl. 1: 124, 1963; Grierson in Grierson *et Long*, Fl. Bhut. 1(2): 291. 1984. *Atragene zeylanica* Linnaeus, *Sp. Pl. 1: 542. 1753. Naravelia pilulifera* var. *yunnanensis* Y. Fei, Acta Bot. Yunnan. 19(4): 406. 1997.

Climbing shrubs. Leaves alternate, leaflets ovate, 8 – 10 x 5 – 7cm, acuminate, base cordate, glabrous above but densely pubescent beneath. Flowers on branched panicles, numerous. Sepals elliptic, densely appressed pubescent. Petals spatulate, greenish yellow. Achenes hairy, stalked.

*Flowers & Fruits*: November to January.

*Specimen Cited*: Forest, *Rajib & AP Das 0014*, dated 05. 02. 2007.

*Local Distribution*: Forested areas.

*General Distribution*: India: Tropical and sub tropical parts; Nepal, Bhutan, Bangladesh, Myanmar, China.

RANUNCULUS Linnaeus, Sp. Pl. 1: 548. 1753.

*Ranunculus sceleratus* Linnaeus, Sp. Pl. 1: 551. 1753; H. Hara in Hara, Fl. E. Himal. 2: 32. 1971; Hooker *f. et Thomson* in Hooker *f.*, Fl. Brit. Ind. 1: 19. 1872; Grierson in Grierson *et Long*, Fl. Bhut. 1(2): 303. 1984; Sharma *et al.*, Fl. Ind. 1: 128. 1993; Prain, Beng. Pl. 1: 193. 1903; Bora *et Kumar*, Flor. Div. Ass. 38. 2003. *Ranunculus holophyllus* Hance, Ann. Sci. Nat., Bot., sér. 4 5: 220. 1861. *Ranunculus oryzetorum* Bunge, Enum. Pl. China Bor. 2. 1833. [PLATE: 5, Figure-44]

Rosette annual herbs. Roots fibrous. Stems up to 60 cm, glabrous, much branched above. Basal leaves 5 – 13; petiole 2 – 10 cm; blade 3-partite, pentagonal, reniform to broadly ovate, base broadly cordate, central lobe cuneate to rhombic, 3-lobed; lateral lobes obliquely broadly obovate to obliquely cuneate. Compound monochasium terminal, corymbose; bracts leaflike. Receptacle glabrous. Sepals 5, ovate-elliptic. Petals 5, obovate, yellow, apex rounded. Stamens 10 – 19; anthers ellipsoid. Aggregate fruit cylindrical; carpels numerous.

*Flowers & Fruits*: May to November.

*Specimen Cited*: Khottamari Beel, *Rajib & AP Das 0026*, dated 05. 02. 2007.

*Local Distribution*: Marginal side of the beel.

*General Distribution*: India: tropical and subtropical part of the country; Bhutan, Nepal, Afghanistan, Japan, Kazakhstan, Korea, N Pakistan, Russia (Siberia), Thailand, SW Asia, Europe, North America.

**Core-Eudicots, non-Rosid, non-Asterid****unassigned to order - Keine Ordnungseinteilung****Dilleniaceae** Salisbury in W. Hooker, *Parad. Lond.* 2(1): t. 73. 1807.**Key to the genera**

- 1a. Woody climbers ..... *Tetracera*  
 1b. Large trees ..... *Dillenia*

DILLENIA Linnaeus, *Sp. Pl.* 1: 535. 1753.**Key to the species:**

- 1a. Flowers solitary; flower buds and fruits more than 5 cm in diameter;  
     carpels 14–20 ..... *D. indica*  
 1b. Flowers 2–7 in fascicles or racemes; flower buds and fruits less than 5  
     cm in diameter; carpels 5 ..... *D. pentagyna*

*Dillenia pentagyna* Roxburgh, *Pl. Corom.* 1: 21. t. 20. 1795; Clarke in Hooker *f.*, *Fl. Brit. Ind.* 1: 38. 1872; Hajra *et al.*, *Fl. Ind.* 1: 156. 1993; Grierson & Long, *Fl. Bhut.* 1(2): 355. 1984, Hajra *et al.*, *Fl. W. Beng.* 1: 153, 1997; Prain, *Beng. Pl.* 1: 195. 1903. *Colbertia augusta* Wallich *ex* G. Don, *Gen. Hist.* 1: 77. 1831. *Colbertia coromandelina* de Candolle, *Syst. Nat.* 1: 435. 1817. *Dillenia augusta* Roxburgh, *Fl. Ind.* 2: 652. 1832. *Dillenia hainanensis* Merrill, *Lingnan Sci. J.* 13: 64. 1934.

*Vernacular name:* Tartari.

Deciduous tree, up to 20m. Leaves simple, alternate, exstipulate; lamina obovate, 27–45 x 10–20 cm, serrate, obtuse, base cuneate. Flowers actinomorphic, bisexual, 2–7 in fascicles or racemes on older branches; buds less than 5 cm in diameter. Sepals 5, imbricate, persistent, ovate, reddish, acute. Petals free, imbricate, deciduous, obovate, yellow, rounded at apex. Stamens in 2 series, the outer numerous. Carpels 5, oblong. Fruits less than 5 cm in diameter; pseudocarp orange, 1–2 seeded, seeds ovoid, black, glabrous.

*Flowers & Fruits:* March to April.*Specimen Cited:* Atiamochar, *Rajib & AP Das 0695*, dated 14. 02. 2008.*Local Distribution:* Takomari Forest.*General Distribution:* India: tropical part throughout; Myanmar, China, Vietnam.

*Dillenia indica* Linnaeus, *Sp. Pl.* 1: 535. 1753; Hajra *et al.*, *Fl. W. Beng.* 1: 135, 1997. Grierson & Long, *Fl. Bhut.* 1(2): 355. 1984; Prain, *Beng. Pl.* 1: 195. 1903. *Dillenia elongata* Miquel, *Fl. Ned. Ind.* 1(2): 12. 1858. *Dillenia indica* f. *elongata* (Miquel) Miquel, *Ann. Mus. Bot. Lugduno-Batavi* 4: 79. 1868.

*Vernacular name:* Chalta.

Evergreen tree, up to 20m. Leaves simple, alternate, exstipulate; lamina elliptic to oblanceolate, 20–35 x 6–15 cm, serrate, acute, base attenuate. Flowers actinomorphic, bisexual, solitary, terminal; buds more than 5 cm in diameter. Sepals 5, imbricate, persistent, obovate. Petals free, imbricate, deciduous, obovate, white, rounded at apex. Stamens in 2 series, the outer numerous; anther opening by apical pores. Carpels 14–20, styles white, narrowly oblanceolate, flattened. Fruits more than 5 cm in diameter; pseudocarp yellowish green, each with 5 seeds embedded in pulp, seeds reniform, reddish.

*Flowers & Fruits*: February to July.

*Specimen Cited*: Atiamochar, Rajib & AP Das 0666, dated 13. 02. 2008.

*Local Distribution*: Forests.

*General Distribution*: India: tropical part throughout; Bhutan, Myanmar, China.

TETRACERA Linnaeus, Sp. Pl. 1: 533. 1753.

*Tetracera sarmentosa* (Linnaeus) Vahl, Symb. Bot. 3: 70. 1794. *Seguieria asiatica* Loureiro, Fl. Cochinch. 1: 341. 1790. *Tetracera asiatica* (Loureiro) Hoogland, Fl. Males. Bull. 1(4): 143. 1951. *Tetracera levinei* Merril, Philipp. J. Sci. 13(3): 147. 1918. *Delima sarmentosa* Linnaeus, Gen. Pl., ed. 5, App. 1754; Prain, Beng. Pl. 1: 195. 1903.

Evergreen woody climbers up to 20m. Leaves simple, alternate, lamina orbicular, 4–9 2–4 cm, finely serrate distally, apex acute, base broadly cuneate or approximately rounded, leathery. Panicles terminal, many flowered; peduncle pubescent, zigzag. Sepals 5, free, broadly ovate, unequal, persistent in fruit, apex obtuse, glabrous, ciliate. Petals 3, white, ovate, as long as sepals. Stamens numerous. Carpels 1, glabrous; style longer than stamens. Follicles orange, pericarp thinly leathery, with persistent style. Seed 1, black.

*Flowers & Fruits*: April to May.

*Specimen Cited*: Takomari, Rajib & AP Das 0696, dated 14. 02. 2008.

*Local Distribution*: Forests.

*General Distribution*: India: West Bengal, Assam, Bihar, Orissa; Bhutan, China, Indonesia, Malaysia, Myanmar, Sri Lanka, Thailand.

## Order: Caryophyllales Perleb (1826)

### clade of ‘core caryophyllids’:

**Amaranthaceae** A. Jussieu, Gen. Pl. 87. 1789 (*nom. cons.*).

#### Key to the Genera:

- |  |                      |
|--|----------------------|
| 1.a. Perianth scarious and dry; stamens often connate below .....                      | 2                    |
| 1.b. Perianth not scarious; stamens free .....   | 8                    |
| 2.a. Leaves alternate .....  | 3                    |
| 2.b. Leaves opposite .....   | 5                    |
| 3.a. Ovary with 2 to many ovules .....   | 4                    |
| 3.b. Ovary with 1 ovule .....  | <i>Amaranthus</i>    |
| 4.a. Fruit a red berry, indehiscent .....  | <i>Deeringia</i>     |
| 4.b. Fruit a utricle or capsule, dehiscent by a lid .....                              | <i>Celosia</i>       |
| 5.a. Inflorescences heads or complex thyrsoid; anthers 1 loculed .....                 | <i>Alternanthera</i> |
| 5.b. Inflorescences spikes; anthers 2 loculed .....                                    | 6                    |
| 6.a. Pseudostaminodes fringed or long fimbriate .....                                  | <i>Achyranthes</i>   |
| 6.b. Pseudostaminodes triangular ro rectangular .....                                  | 7                    |
| 7.a. Tepals of perfect flowers light green, glabrous; yellow, villous in imperfect ... | <i>Pupalia</i>       |
| 7.b. Tepals densely puberulous abaxially, pink .....                                   | <i>Aerva</i>         |
| 8.a. Plants covered with glandular hairs .....   | <i>Dysphania</i>     |
| 8.b. Plants covered with vesicular hairs, occasionally glabrous .....                  | <i>Chenopodium</i>   |



ACHYRANTHES Linnaeus, Sp. Pl. 1: 204. 1753.

**Key to the Species:**

- 1a. Flowers in long slender spike, bracts subulate, tepal ovate to lanceolate ... *A. aspera*  
 1b. Flowers dense, bracts broadly ovate, tepal lanceolate ..... *A. bidentata*

*Achyranthus aspera* Linnaeus, Sp. Plant. 204. 1753; H. Hara in Hara, Fl. E. Himal. 1:76. 1996; Hooker f. in Hooker f., Fl. Brit. Ind. 4: 4. 1885; Long in Grierson *et* Long, Fl. Bhut. 1(2): 227. 1984; Prain, Beng. Pl. 2: 875.1903. *Achyranthes australis* R. Brown, Prodr. Fl. Nov. Holl. 417. 1810. *Achyranthes canescens* R. Brown, Prodr. Fl. Nov. Holl. 417. 1810.

*Vernacular name:* Apang.

Perennial herbs, erect or spreading up to 80 cm. Leaves opposite, ovate–elliptic; petiole 10 to 13 mm; lamina 3 – 12 x 2 – 7 cm, acute, base cuneate, pubescent. Flowers in long slender spike, up to 30 cm; bracts subulate, occasionally spinous, concave. Perianth segments rigid, ovate to lanceolate; stamens 5; anthers 2 celled, filament connate at base; ovary oblong, style filiform; stigma capitate. Fruits 1 seeded.

*Flowers & Fruits:*

*Specimen Cited:* Forest, Rajib & AP Das 0102, dated 07. 02. 2007.

*Local Distribution:* Roadside forest.

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

*Achyranthes bidentata* Blume, Bijdr. 545. 1826; Hooker f. in Hooker f., Fl. Brit. Ind. 4:730. 1885; H. Hara in Hara, Fl. E. Himal. 1:76. 1966; Hara *et al.*, Enn. Fl. Pl. Nep.3:168. 1982; Long in Grierson *et* Long, Fl. Bhut. 1(2): 227.1984; Prain, Beng. Pl. 2: 875.1903. *Achyranthes chinensis* Osbeck, Dagb. Ostind. Resa 205. 1757. *Achyranthes fruticosa* Lamarck, Encycl. 1: 545. 1785.

*Vernacular name:* Apang.

Annual or biennial erect herbs. Stem green, quadrangular, appressed pubescent to nearly glabrous; branches opposite. Petioles hairy; leaf blade elliptic to elliptic – lanceolate, rarely oblanceolate, both surfaces spreading pubescent, base cuneate, caudate. Spikes terminal or axillary, up to 25 cm; rachis white hairy. Flowers dense. Bracts broadly ovate, apex acuminate; bracteoles spiny, base 2-parted, apex curved. Tepals lanceolate, apex acute. Utricles yellowish brown, shiny. Seeds brownish, oblong.

*Flowers & Fruits:* August to November.

*Specimen Cited:* Forest, Rajib & AP Das 0113, dated 07. 02. 2007.

*Local Distribution:* Road side forest area.

*General Distribution:* India, Bhutan, Nepal, Bangladesh, Myanmar, China.

ALTERNANTHERA Forsskål, Fl. Aegypt.-Arab. 28. 1775.

**Key to the Species:**

- 1a. Heads solitary, globose ..... *A. philoxeroides*  
 1b. Heads all sessile ..... 2  
 2.a. Tepals abaxially hairy ..... *A. paronychioides*  
 2.b. Tepals abaxially glabrous ..... *A. sessilis*

*Alternanthea philoxeroides* (Martius) Grisebach, Abh. Koen. Ges. Wiss. Goett. Phys. Cl. 24: 36.1983; Bora *et al.*, Flor. Div. Ass., 275. 2004. *Bucholzia philoxeroides* Martius, Beitr. Amarantac.

107. 1825; Nova Acta Leop. 13: 315. 1826. *Achyranthes paludosa* Bunbury, Proc. Linn. Soc. London 1: 109. 1841.

*Vernacular name:* Jalchhenchi.

Perennial herb. Stem ascending from a creeping base, branched; young stem and leaf axil white hairy; old ones glabrous. Petiole glabrous. Lamina oblong, oblong obovate to ovate – lanceolate, entire, acute with a mucro, base attenuate, glabrous. Heads solitary at leaf axil, globose. Bracts and bracteoles white, acuminate; bracts ovate; bracteoles lanceolate,. Tepals white, oblong, 5 mm, glabrous, acute. Filaments connate at base. Ovary obovoid, with short stalk.

*Flowers & Fruits* September to February.

*Specimen Cited:* Bochamari Beel, *Rajib & AP Das 0172*, dated 08. 02. 2007.

*Local Distribution:* Beel margin.

*General Distribution:* India; native of tropical Brazil.

***Alternanthera paronychioides*** St. Hill, Voy. Bres. 2 (2): 39. 1833; Panda *et al.*, Fl. Sambalp. 308. 2004. *Achyranthes chacoensis* (Morong) Standley, Jour. Wash. Acad. Sci. 5: 74. 1915. *Alternanthera ficoidea* (Linnaeus) R. Brown, Prodr. 417. 1810. *Gomphrena ficoidea* Linnaeus, Sp. Pl. 225. 1753. *Illecebrum ficoideum* Linnaeus, Sp. Pl. (ed. 2) 1: 300. 1762. [PLATE: 6, Figure-58]

Perennial herb. Stem hairy to glabrescent. Leaf blade oblanceolate to spatulate, abaxially hairy, apex obtuse to rounded. Heads sessile, ovoid to globose. Tepals white, ovate - oblong, scarious, hairy on the veins, outer 3 segments: 3-veined in proximal half, inner 2 somewhat laterally compressed, apex acute to mucronate. Stamens 5; anthers yellow, ellipsoid; staminodes 3- or 4-toothed; stigma capitate. Utricle brown, obcordate.

*Flowers & Fruits:* January to December.

*Specimen Cited:* Varveri Beel, *Rajib & AP Das 0068*, dated 06. 02. 2007; Raichangmari Beel, *Rajib & AP Das 0650*, dated 12. 02. 2008.

*Local Distribution:* Beel margin.

*General Distribution:* India; a native of tropical America; naturalized in tropics.

***Alternanthera sessilis*** (Linnaeus) R. Brown *ex de Candolle*, Cat. Pl. Hort. Mon sp. 4: 77. 1813; Hooker *f.* in Hooker *f.*, Fl. Brit. Ind. 4: 731. 1885; H. Hara in Hara, Fl. East. Himal. 1: 77. 1966; Long in Grierson *et Long*, Fl. Bhut. 1(2): 228. 1984. *Gomphrene sessilis* Linnaeus, Sp. Pl. 1: 225. 1753. *Achyranthes sessilis* (Linnaeus) Besser, Cat. Jard. Bot. Krzemieniec 12. 1810. *Alternanthera nodiflora* R. Brown, Prodr. 417. 1810. *Alternanthera triandra* Lamarck, Encycl. 1: 95. 1785. *Achyranthes triandra* Roxburgh, Fl. Ind. 1: 678. 1820; Prain, Beng. Pl. 2: 875. 1903. *Achyranthes villosa* Blanco, Fl. Filip. 189. 1837. *Allaganthera forskalli* Martius, Pl. Hort. Erlang. 69. 1814. *Alternanthera angustifolia* R. Brown, Prodr. Fl. Nov. Holl. 417. 1810. *Alternanthera denticulata* R. Brown, Prodr. Fl. Nov. Holl. 417. 1810.

*Vernacular name:* Chhenchi.

Prostrate herb, rooting at nodes, often perennial, stems with 2 lines of hairs. Lamina elliptic, 2 – 4.5 x 0.5 – 1.5 cm, acute, attenuate at base, sessile, glabrous. Flower clusters sessile, globose, white. Perianth segments all similar, 2 – 3mm, papery, unarmed. Stamens 5, 3 bearing anthers, basal cup very short, pseudostaminodes minute. Capsule rounded, 2 mm diameter, compressed, emerginate at apex; seed 1mm, surrounded by a thick wing.

*Flowers & Fruits:* March to August.

*Specimen Cited:* Bochamari Beel, *Rajib & AP Das 0082*, dated 06. 02. 2007; *Rajib & AP Das 0710*, dated 14. 02. 2008.

*Local Distribution:* Beel margin and cultivated land.

*General Distribution:* India, Sri Lanka, Myanmar, China, Pantropical.

AMARANTHUS Linnaeus, Sp. Pl. 2: 989. 1753.

**Key to the Species:**

- 1a. Tepals 3; stamens 3; utricles indehiscent ..... 2
- 1b. Tepals 5; stamens 5; utricles usually dehiscent by lid ..... *A. spinosus*
- 2a. Stem erect, somewhat branched; utricles very rugose ..... *A. viridis*
- 2b. Stem ascending, much branched; utricles smooth ..... *A. blitum*

*Amaranthus blitum* subsp. *oleraceus* (Linnaeus) Costea, Sida 19: 984 2001. *Amaranthus blitum* Linnaeus, Sp. Pl. 1: 990. 1753; Hooker *f.* in Hooker *f.*, Fl. Brit. Ind. 4: 721. 1885; Prain, Beng. Pl. 2: 871.1903. *Amaranthus lividus* Linnaeus, Sp. Pl. 1: 990. 1753; H. Hara in Hara, Fl. East. Himal. 1:77. 1966; Long in Grierson *et* Long, Fl. Bhut. 1(2): 224. 1984. *Amaranthus circinnatus* Poirat, Encycl. Suppl. 1: 311. 1810. *Blitum lividum* (Linnaeus) Moench, Methodus 359. 1794. *Amaranthus oleraceus* Linnaeus, Sp. Pl. 1403. 1753.

Prostrate or semi erect, annual herbs; branches in rosette. Leaves broadly ovate, 3 – 7 x 2 – 5cm, obtuse. Flowers in clusters densely aggregated in to slender spikes, up to 7 cm. Flowers unisexual, mostly female with a few males above; perianth segments 3, 1 mm long; tepal 3; stamens 3; stigma 3, minute; Capsules distinctly exceeding perianth, seeds strongly glossy, faintly striate without scurfy warts.

*Flowers & Fruits:* April to August.

*Specimen Cited:* Park, Rajib & AP Das 0424, dated 22.07.2007.

*Local Distribution:* Garden.

*General Distribution:* India, Bhutan, Bangladesh, Myanmar, China.

*Amaranthus spinosus* Linnaeus, Sp. Pl. 2: 991. 1753; Hooker *f.* in Hooker *f.*, Fl. Brit. Ind. 4: 718.1885; H. Hara in Hara, Fl. East. Himal. 1:77. 1966; Long in Grierson *et* Long, Fl. Bhut. 1(2): 225. 1984; Prain, Beng. Pl. 2: 879.1903. *Galliardia spitosa* (Linnaeus) Nieuwland, Amer. Midl. Naturalist 3(9): 278. 1914. *Amaranthus spinosus* var. *viridicaulis* Hasskarl, Flora 25: litt. 20 litt. 20. 1842.

*Vernacular name:* Kantanotey.

Perennial herb. Stem erect, green, terete, branched, glabrous. Petiole 1.8 cm, glabrous; leaf blade ovate-lanceolate, 3 – 1.5 cm, glabrous or slightly pubescent along veins when young, base cuneate, margin entire, apex obtuse. Terminal spike usually with all male flowers at or toward apex. Bracts becoming very sharply spiny in proximal part of spike. Tepals green, transparent at margin, apex acute; male flowers oblong; female flowers oblong-spatulate. Filaments slightly shorter than perianth. Stigmas 3. Utricles included in perianth, oblong. Seeds brownish black, subglobose.

*Flowers & Fruits:* May to September.

*Specimen Cited:* Park, Rajib & AP Das 0117, dated 07. 02. 2007.

*Local Distribution:* Garden and Park side.

*General Distribution:* India: West Bengal, Assam, Bihar, Madhyapradesh, Uttar Pradesh; Myanmar, China

*Amaranthus viridis* Linnaeus, Sp. Pl. ed. 2: 1405. 1753; Hooker *f.* in Hooker *f.*, Fl. Brit. Ind. 4: 720. 1885; Prain, Beng. Pl. 2: 651. 1903; Long in Grierson *et* Long, Fl. Bhut. 1(2): 224. 1984;

Prain, Beng. Pl. 2: 871.1903; Bora *et al.*, Flor. Div. Ass., 277. 2003. *Pyxidium viride* (Linnaeus) Moquin, Prodr. 13(2): 274. 1849. *Amaranthus polystachyus* Willdenow, Sp. Pl. 4: 385. 1805. *Galliardia adscendens* Bubani, Fl. Pyren. 1: 186. 1897. *Amaranthus fasciatus* Roxburgh, Fl. Ind. ed. 1832 3: 609. 1832. *Amaranthus gracilis* Desfontaines *ex* Poirat, Encycl., Suppl. 1(1): 312. 1810. *Amaranthus gracilis* Desfontaines, tabl. Ecole Bot. 43. 1804.

*Vernacular name:* Notey.

Erect annual herbs, up to 50 cm high. Leaves broadly ovate, 3 – 7 x 2 – 5 cm, obtuse. Flowers in clusters densely aggregated in to slender spikes, up to 7 cm. Flowers unisexual, mostly female with a few males above; perianth segments 3, 1 mm long; tepal 3; stamens 3; stigma 3, minute; Capsules 1 seeded, seeds somewhat glossy, minutely reticulate with scurfy warts.

*Flowers & Fruits:* April to June.

*Specimen Cited:* Park, Rajib & AP Das 0135, dated 07. 02. 2007.

*Local Distribution:* Garden.

*General Distribution:* India: West Bengal, Assam, Sikkim, Bihar, Orisa, Uttar Pradesh; Bhutan, Bangladesh, Myanmar, China.

CELOSIA Linnaeus, Sp. Pl. 1: 205. 1753.

*Celosia argentea* Linnaeus, Sp. Pl. 1: 205. 1753; Hooker *f.* in Hooker *f.*, Fl. Brit. Ind. 4: 714. 1885; H. Hara in Hara, Fl. East. Himal. 1:77. 1966; Prain, Beng. Pl. 2: 867. 1903; Long in Grierson *et* Long, Fl. Bhut. 1(2): 221. 1984. *Amaranthus purpureus* Nieuwland, Amer. Midl. Nat. 3: 279. 1914. *Celosia pallida* Salisbery, Prodr. Stirp. Chap. Allerton 145. 1796.

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, shining.

*Flowers & Fruits:* March to August.

*Specimen Cited:* Park, Rajib & AP Das 0019, dated 05. 02. 2007.

*Local Distribution:* Garden.

*General Distribution:* Tropical regions of Asia, Africa and America.

DEERINGIA R. Brown, Prodr. 413. 1810.

*Deeringia amaranthoides* (Lamarck) Merrill, Interpr. Rumph. Herb. Amboin. 211. 1917; H. Hara in Hara, Fl. East. Himal. 1:78. 1966; Hara *et al.*, Enn. Fl. Pl. Nep.3:169.1982; Long in Grierson *et* Long, Fl. Bhut. 1(2): 221. 1984. *Achyranthes amaranthoides* Lamarck, Encycl. Meth. B. 1: 548. 1785. *Celosia baccata* Retzius, Observ. Bot. 5: 23. 1788. *Cladostachys amaranthoides* (Lamarck) K.C.Kuan, Fl. Xizangica 1: 645. 1983. *Deeringia indica* Retzius *ex* Blume, Bijdr. 542. 1826.

Climbing shrub, up to 6 m. Stem with pendulous branches, hairy when young. Petiole 1.5 cm, glabrous; Leaves opposite; lamina ovate, 3 – 7 x 2 – 3.5 cm, acuminate, base rounded, puberulous beneath; petioles 5 – 15 mm. Spikes 10 – 20 cm; flowers bisexual, pedicels 1 – 2mm. Perianth segments 5, concave, 2.5 mm. Stamens 5, anthers 2 – celled. Ovary subglobose, stigmas 3, linear. Berry subglobose, red.

*Flowers & Fruits:* August to February.

*Specimen Cited:* Conservation sector, Rajib & AP Das 0056, dated 07. 02. 2007.

*Local Distribution:* Forest area near conservation sector.

*General Distribution:* Tropical parts of India; Bhutan, Nepal, Indonesia, Laos, Malaysia, Myanmar, Thailand, Vietnam; Australia.

PUPALIAA. Jussieu, Ann. Mus. Natl. Hist. Nat. 2: 132. 1803.

*Pupalia lappacea* (Linnaeus) A. Jussieu, Ann. Mus. Hist. Nat. Paris 2:132.1803; Hooker *f.* in Hooker *f.*, Fl. Brit. Ind. 4:724. 1885; Long in Grierson *et* Long, Fl. Bhut. 1(2): 207. 1984 ; Prain, Beng. Pl. 2: 872.1903. *Achyranthes lappacea* Linnaeus, Sp. Pl. 204.1753. *Pupalia atropurpurea* (Lamarck) Moquin in DC., Prodr. 13(2): 331.1849;

Annual to perennial herb. Stem ascending to semi-erect, tinged red, obtusely quadrangular, inflated at nodes. Lamina ovate to rhombic-oblong, entire, obtuse, base rounded, both surfaces densely hairy and ciliate. Racemes terminal, erect and straight, with 2 or 3 hermaphroditic and some unisexual flowers, unisexual flowers gradually decreasing upward; flower clusters shortly stalked. Bracts acuminate. Tepals of perfect flowers light green, ovate-oblong, glabrous, acuminate. Stamens 5; pseudostaminodes rectangular, truncate. Tepals of imperfect flowers and bracts yellow, villous, hooked. Utricles globose, glabrous. Seeds brown, very small, smooth.

*Flowers & Fruits:* June to November.

*Specimen Cited:* Park, Rajib & AP Das 0115, dated 07. 02. 2007.

*Local Distribution:* Road side, Garden and Park.

*General Distribution:* Tropical parts of India; Myanmar, Bhutan, Nepal, Bangladesh, China.

AERVA Forssk 1, Fl. Aegypt.-Arab. 170. 1775, nom. cons.

*Aerva sanguinolenta* (Linnaeus) Blume, Bijdr. 547.1826; H. Hara in Hara, Fl. East. Himal. 1:77. 1966; Long in Grierson *et* Long, Fl. Bhut. 1(2): 226. 1984. *Achyranthes sanguinolenta* Linnaeus, Sp. Pl. ed. 2: 294. 1762. *Achyranthes scandens* Roxburgh, Fl. Ind. 1: 676. 1820. *Aerva sanguinea* Miquel, Prodr. 13(2): 3. 1849. *Aerva scandens* (Roxburgh) Wallich, Icon. Pl. Orient. 2: t. 724. 1840; Prain, Beng. Pl. 2: 874.1903.

*Vernacular name:* Lopang.

Perennial herbs. Stem erect to slightly stoloniferous, less branched. Leaves ovate-elliptic to oblong-lanceolate, 2–8 x 1–5 cm. Inflorescences purple sericeous. Bracts, bracteoles, and tepals densely puberulous abaxially. Tepals pink. Pseudostaminodes triangular. Utricles ovate, glabrous. Seeds reniform.

*Flowers & Fruits:* January to June.

*Specimen Cited:* Park, Rajib & AP Das 0093, dated 07. 02. 2007.

*Local Distribution:* Garden.

*General Distribution:* India: widely grown in gardens; Bhutan, Nepal, Bangladesh, Cambodia, Laos, Malaysia, Myanmar, Philippines, Thailand, Vietnam.

CHENOPODIUM Linnaeus, Sp. Pl. 1: 218. 1753.

### Key to the Species:

- 1a. Plants up to 2 – 3 m; lower leaves to 20 cm; inflorescence pendulous ..... *C. giganteum*
- 1b. Plants usually smaller; lower leaves less than 8 cm; inflorescence panicles ..... *C. album*

*Chenopodium album* Linnaeus, Sp. Pl. 1: 219. 1753; Hooker *f.* in Hooker *f.*, Fl. Brit. Ind. 5: 3. 1886; H. Hara in Hara, Fl. E. Himal. 1: 76. 1966; Prain, Beng. Pl. 2: 657.1903; Long in Grierson *et* Long, Fl. Bhut. 1(2): 217. 1984. *Chenopodium candicans* Lamarck, Fl. Franç. 3: 248. 1779. *Chenopodium browneanum* Schultes, Syst. Veg. 6: 275. 1820. [PLATE: 9, Figure-104]

*Vernacular name:* Bothua.

Herbaceous, up to 80 cm. Leaves ovate – deltoid, 3 – 7 x 1 – 3.5 cm, acute, base cuneate, margin entire, sometimes weakly 3 – lobed, petioles 1 – 3 cm. Flower clusters dense, sessile, slender panicles. Flower bisexual, 0.7mm diameter. Perianth segments 5. Stamens 5. Seeds black.

*Flowers & Fruits:* November to May.

*Specimen Cited:* Village, Rajib & AP Das 0072, dated 06. 02. 2007.

*Local Distribution:* Village and area of Beel occupied for cultivation.

*General Distribution:* Tropical America and common in tropics.

***Chenopodium giganteum*** D. Don, Prodr. Fl. Nepal. 75 1825; H. Hara in Hara, Fl. E. Himal. 2: 24. 1971, sensu *Chenopodium album* Linnaeus; Long in Grierson *et* Long, Fl. Bhut. 1(2): 218. 1984; Prain, Beng. Pl. 2: 879.1903. *Chenopodium atriplicis* Linnaeus f., Suppl. Pl. 171. 1782. *Chenopodium punctulatum* Scopoli, Delic. Fl. Faun. Insubr. 1: 26. 1786.

*Vernacular name:* Bothua.

Herbaceous, reddish up to 3 m. Leaves rhombic - ovate, 6 – 20 x 4 – 7 cm, acute, base cuneate, margin coarsely irregular - dentate, sometimes weakly 3 – lobed, petioles 5 – 9 cm. Flower clusters dense, sessile, slender panicles. Flower bisexual, 0.7mm diameter. Perianth segments 5. Stamens 5. Seeds black.

*Flowers & Fruits:* September to February.

*Specimen Cited:* Village, Rajib & AP Das 0066, dated 06. 02. 2007.

*Local Distribution:* Village.

*General Distribution:* Cultivated widely in tropical Asia, America.

DYSPHANIA R. Brown, Prodr. 411. 1810.

***Dysphania ambrosioides*** (Linnaeus) Mosyakin *et* Clemants, Ukrayins'k. Bot. Zhurn. 59: 382. 2002. *Chenopodium ambrosioides* Linnaeus, Sp. Pl. 219. 1753; Hooker f. in Hooker f., in Fl. Brit. Ind. 5: 4. 1886, H. Hara in Hara, Fl. E. Himal. 76. 1966; Long in Grierson *et* Long, Fl. Bhut. 1(2): 218. 1984; Prain, Beng. Pl. 2: 879. 1903; Hara *et al.*, Enn. Fl. Pl. Nep. 3: 170. 1982; *Ambrina ambrosioides* Spach, Hist. Nat. Veg. 4: 297. 1836; *Chenopodium integrifolium* Voroschilov, Bot. Zhurn. 27: 42. 1942; *Chenopodium suffruticosum* Willdenow, Enum. Pl. Hort. Berol.: 290. 1809.

Aromatic herb, up to 100cm. Leaves lanceolate, 3 – 7 x 1 – 2cm, acuminate, base attenuate, serrate – dentate, yellowish gland –dotted beneath; petiole 0.5 – 1cm. Flower clusters subglabrous, elongate panicles. Flowers bisexual. Perianth segments 5. Stamens 5. Seeds smooth.

*Flowers & Fruits:* April to November.

*Specimen Cited:* Children Park, Rajib & AP Das 0145, dated 08. 02. 2007.

*Local Distribution:* Beel Margin throughout.

*General Distribution:* Tropical parts of India; native to Tropical America.

**Caryophyllaceae** A. Jussieu, Gen. Pl. 299. 1789; *nom. cons.*

### Key to the Genera :

- 1a. Stipules present, rarely obscure .....2
- 1b. Stipules absent ..... *Stellaria*
- 2a. Sepals green, leaflike; petals 2 – 6 parted ..... *Drymaria*
- 2b. Sepals white, scarious; petals entire ..... *Polycarpon*

DRYMARIA Willdenow *ex* Schultes in Roemer *et* Schultes, Syst. Veg. 5: 31. 1819.

***Drymaria cordata*** (Linnaeus) Willdenow *ex* Roemer *et* Schultes, Syst. Veg. 5: 406.1819; Hooker *f. et* Thomson in Hooker *f.*, Fl. Brit. Ind. 1: 244. 1874; Grierson in Grierson *et* Long, Fl. Bh. 1(2): 215.1984; Prain, Beng. Pl. 1: 238.1903. *Holosteum cordatum* Linnaeus, Sp. Pl. 1: 88. 1753. *Drymaria diandra* Blume, Bijdr. 62. 1825; Masami Mizushima in Hara, Fl. East. Himal. 1: 80. 1966; Sharma *et al.*, Fl. Ind. 2:533. 1993. *Holosteum diandrum* Swartz, Prodr. 27. 1788. *Stellaria adenophora* Le n, Fl. Cuba 2: 154. 1950. *Drymaria procumbens* Rose, Contr. U. S. Natl. Herb. 1: 304. 1895.

Stems elongate, rooting at nodes. Leaves broadly ovate or suborbicular, Leaves broadly ovate, 0.5 – 1.5 x 0.5 – 1.5 cm, acute or obtuse, mucronate, base rounded, glabrous, 5 veined, petiole 2 – 3mm; stipules lacerate into 1 – 2 mm filaments. Flowers broadest above middle. Sepals elliptic – ovate, green, leaflike, 3 veined, inflexed, glandular-papillose on veins. Petals white, 2 – 6 parted. Seeds finely tuberculate.

*Flowers & Fruits*: May to July.

*Specimen Cited*: Park, Rajib & AP Das 0030, dated 05. 02. 2007.

*Local Distribution*: Throughout study area.

*General Distribution*: India; Tropical and Subtropical Asia, Formosa, W. & S. China, Oceania, Hawaii.

STELLARIA Linnaeus, Sp. Pl. 1: 421. 1753.

### Key to the Species:

- 1a. Sepals connate at base into obconic calyx; stamens perigynous ... *S. uliginosa*
- 1b. Sepals distinct; stamens hypogynous ..... 2
- 2a. Sub erect herb, rooting at nodes ..... *S. media*
- 2b. Decumbent or prostrate, nodes rootless ..... *S. wallichiana*

***Stellaria media*** (Linnaeus) Villars, Hist. Pl. Dauphin 3: 615. 1789; M. Mizushima in Hara, Fl. East. Himal. 1: 82. 1966; Grierson in Grierson *et* Long, Fl. Bh. 1(2): 207. 1984; Prain, Beng. Pl. 1: 237.1903. *Alsine media* Linnaeus, Sp. Pl. 272. 1753. *Stellaria media* (Linnaeus) Cirillo, Essent. Pl. Char. Comment. 36. 1784. *Stellaria apetala* Ucria *ex* Roemer, Pl. Linn. Op. Arch. I (1): 68. 1796. *Stellaria vulgaris* Raunkiaer, Bot. Studier 13, 22. 1934.

Diffuse prostrate to sub-erect herb, 12 – 45 cm, rooting at nodes. Lamina ovate, 1 – 2 x 1 – 1.5cm, acute, base cordate, glabrous, petioles minute, veins indistinct. Few flowers in terminal leafy cymes, pedicels 1 – 1.5 cm. Sepals ovate, 3 – 4m, petals shorter than sepals, deeply bifid. Stamens 4 – 8. Capsule ovoid.

*Flowers & Fruits*: March to November.

*Specimen Cited*: Park, Rajib & AP Das 0053, dated 05. 02. 2007.

*Local Distribution*: Throughout study area.

*General Distribution*: India, Bhutan, Afghanistan, Japan, Korea, Pakistan, Russia, Europe.

***Stellaria uliginosa*** Murray, Prodr. Strip. Gotting. 55. 1770; Hara *et al.*, Enn. Fl. Pl. Nep. 1:58. 1979; Grierson in Grierson *et* Long, Fl. Bh. 1(2): 208. 1984. *Alsine uliginosa* (Murray) Britton, Mem. Torrey Bot. Club 5(10): 150. 1894. *Alsine uliginosa* (Murray) E.H.L. Krause, Deutschl. Fl. ed. 2, 5: 54. 1901. *Stellaria dilleniana* Leers, Fl. Herborn. 107. 1775.

Diffuse, sub-erect or decumbent herb, stems 4–30 cm, 4-angular, with a line of pubescence along one side, rooting at nodes. Lamina elliptic, 0.5–1.5 x 0.15 – 0.45 (-0.55) cm, acute or acuminate,

sessile, glabrous. Flowers few in terminal cymes; bracts ovate, acute c 1.5 mm, scarious; sepals 2.5 – 3.5 mm, glabrous; stamens 10 or sometimes 3 -5, hypogynous.

*Flowers & Fruits*: April to august.

*Specimen Cited*: Conservation sector, *Rajib & AP Das 0712*, dated 14. 02. 2008.

*Local Distribution*: Conservation sector.

*General Distribution*: India, Bhutan, Nepal, Japan, Korea, Pakistan, China, Vietnam.

*Stellaria wallichiana* Bentham *ex* Haines, Bull. Misc. Inf. Kew 1920: 66.1920; Sharma *et al.*, Fl. Ind 2: 591. 1993; Bora *et al.*, Flor. Div. Ass., 56. 2003. *Stellaria media* (Linnaeus) Villars, Hist. Pl. Dauph 3: 615. 1789, p.p.; Hooker *f. et* Thomson in Hooker *f.*, Fl. Brit. Ind. 1: 230. 1874.

Decumbent or prostrate, annual herbs. Lamina flat, entire, simple. Inflorescence cymose. Flower actinomorphic; corolla white, bisexual; sepals 5, petals 5, stamens hypogynous. Fruits capsule; seeds compressed, embryo annular.

*Flowers & Fruits*: January to May.

*Specimen Cited*: Park, *Rajib & AP Das 0363*, dated 21. 07. 2007.

*Local Distribution*: Garden near Beel side.

*General Distribution*: India, Nepal, Bhutan, Bangladesh, Myanmar, China.

POLYCARPON Linnaeus, Syst. Nat., ed. 10. 2: 881. 1759.

*Polycarpon prostratum* (Forssk 1) Ascherson *et* Schwein. F. Ost. Bot. Zoitschr. 39: 128. 1889. Sharma *et al.*, Fl. Ind. 2: 553. 1993; Grierson in Grierson *et* Long, Fl. Bhut. 1(2): 216. 1984. Guha Bakshi, Fl. Mur. Dist. 57. 1984. *Alsine protrata* Forsskal, Fl. Aegypt. – Arab. 207. 1775. *Hepalasia loeflingiae* Wught *et* Arnott, Prodr. 358. 1834. *Polycarpon loeflingiae* (Wight *et* Arnott) Bentham *et* Hooker *f.*, Gen. Pl. 1: 153. 1862; Hooker *f. et* Thomson in Hooker *f.*, Fl. Brit. Ind. 1: 245. 1874; Prain, Beng. Pl. 1: 238. 1903. *Polycarpon indicum* (Retzius) Merrill, Philipp. Jour. Sci. 10(5): 302-303. 1915. *Loeflingia indica* Retzius, Observ. Bot. 4: 8. 1786.

Plants annual. Stems prostrate to ascending, base rigid, 10 – 22 cm, glabrous. Lamina obovate to spatulate, 5 – 20 x 1.5 – 4 mm, glabrous, entire, acute, base attenuate. Cymes often axillary, sometimes rather lax, 2 – 4 cm; bracts stipule like. Pedicel short or absent, pilose. Sepals lanceolate, white, apex obtuse, hooded. Petals often fewer than 5, oblong, entire. Stamens 3, shorter than sepals. Capsules ovoid, shorter than sepals. Seeds light brown, cylindric, reticulate.

*Flowers & Fruits*: February to June.

*Specimen Cited*: Bochamari Beel, *Rajib & AP Das 0414*, dated 22. 07. 2007.

*Local Distribution*: Beel margin and cultivated areas.

*General Distribution*: Tropical India; tropical region of Asia and Africa.

### ‘succulent’ clade:

**Cactaceae** Jussieu, Gen. Pl. 310. 1789; *nom. cons.*

CEREUS Miller, Gard. Dict., ed. 4. 308. 1754.

*Cereus repandus* (Linnaeus) Miller, Gard. Dict. ed. 85. 1768. *Cactus repandus* Linnaeus, Sp. Pl. 467. 1753. *Cereus peruvianus* (Linnaeus) Miller, Gard. Dict. ed. 84. 1768; Long in Grierson *et* Long, Fl. Bhut. 1(2): 233. 1984. *Cactus peruvianus* Linnaeus, Sp. Pl. 467. 1753.



*Vernacular name:* Kata.

Columnar shrub or tree up to 10m. Branch segments elongate, 10 – 12 cm diameter, slightly glaucous – green. Ribs 6, when young almost flat, becoming broadly triangular when old. Areoles whitish, bearing 9 – 12 yellowish – brown spines. Flowers white, 15 mm long; stamens numerous, not exerted. Fruit orange yellow, subglobose.

*Flowers & Fruits:* March to June.

*Specimen Cited:* Park, Rajib & AP Das 0020, dated 05. 02. 2007.

*Local Distribution:* Garden.

*General Distribution:* India: cultivated throughout; Bhutan, Bangladesh, Myanmar, China.

## **Portulacaceae** Jussieu, Gen. Pl. 312. 1789; *nom. cons.*

PORTULACA Linnaeus, Sp. Pl. 1: 445. 1753.

*Portulaca oleracea* Linnaeus, Sp. Pl. 1: 445. 1753; Hooker *f. et* Thomson in Hooker *f.*, Fl. Brit. Ind. 1: 246. 1874; H. Hara in Hara, Fl. East. Himal. 1: 79. 1966; Grierson *et* Long in Grierson *et* Long, Fl. Bhut. 1(2): 196. 1984; Sharma *et al.*, Fl. Ind. 3: 4. 1993; Prain, Beng. Pl. 1: 240. 1903. *Portulaca intermedia* Link *ex* Schlechtendal, Bot. Zeitung (Berlin) 11(38): 667. 1853. *Portulaca consanguinea* Schlechtendal, Linnaea 24: 693. 1851. *Portulaca marginata* Kunth, Nov. Gen. Sp. 6: 72. 1823. *Portulaca latifolia* Hornemann, Hort. Bot. Hafn. 2: 491. 1815.

Annual herbs. Stems sometimes flushed red to purple, prostrate or decumbent, diffuse, much branched. Leaves alternate to subopposite; petiole short; lamina flat, obovate, 1 – 3 cm x 0.5 cm, obtuse-rounded, base cuneate. Flowers in clusters of 3 to 5. Sepals green, apex acute, keeled. Petals 5, yellow, obovate, slightly connate at base, apex retuse. Stamens 7 – 12; anthers yellow. Ovary glabrous. Stigmas 4. Capsule ovoid. Seeds glossy black when mature.

*Flowers & Fruits:* March to September.

*Specimen Cited:* Park, Rajib & AP Das 0057, dated 07. 02. 2007.

*Local Distribution:* Garden and Park at Beel side.

*General Distribution:* Tropical India; tropical and temperate regions worldwide.

## **‘third’ clade:**

**Molluginaceae** Bartling *et* H.L. Wendland, Beitr. Bot. 2: 158. 1825 ; *nom. cons.*

GLINUS Linnaeus, Sp. Pl. 1: 463. 1753.

### **Key to the Species:**

- 1a. Plant densely stellate tomentose; styles 5; capsule 5 valved ..... *G. lotoides*
- 1b. Plant subglabrous or pilose; styles 3 or 4; capsule 3 valved ..... *G. oppositifolius*

*Glinus lotoides* Linnaeus, Sp. Pl. 463. 1753; Bora *et al.*, Flor. Din. Ass. 169. 2003; Grierson *et* Long in Grierson *et* Long, Fl. Bhut. 1(2): 195. 1984. *Mollugo lotoides* (Linnaeus) Kuntze, Revis. Gen. Pl. 1: 264. 1891. *Molluga hirta* Thunberg, Prodr. Pl. Cap. 24. 1794; C.B. Clarke in Hooker *f.*, Fl. Brit. Ind. 2: 662. 1879; Kanjilal *et al.*, Fl. Ass. 2: 338. 1938 ; Prain, Beng. Pl. 1: 533. 1903. *Mollugo hirta* var. *lotoides* (Linnaeus) C.B. Clarke, Fl. Brit. India 2(6): 662. 1879. *Glinus dictamnoides* Burman *f.*, Fl. Indica 113. 1768. *Mollugo glinus* A. Richard, Tent. Fl. Abyss. 1: 48. 1847.

Herbs, densely stellate tomentose. Stems decumbent, 10 – 30 cm, much branched. Petiole very short; basal leaves in a rosette, drying soon; upper leaves verticillate to opposite, obovate to oblong-

spatulate, base attenuate, decurrent, margin entire, obtuse, rounded or acute. Flowers several, subsessile. Tepals elliptic to oblong. Stamens usually free. Ovary ovoid, 5 loculed; styles 5, free. Capsule ovoid, 5 valved. Seeds numerous, chestnut brown, reniform.

*Flowers & Fruits:* March to July.

*Specimen Cited:* Children Park, *Rajib & AP Das 0083*, dated 06. 02. 2007. Village, *Rajib & AP Das 0129*, dated 07. 02. 2007.

*Local Distribution:* Beel margin throughout.

*General Distribution:* India, Bhutan, Nepal, Bangladesh, Indonesia, Malaysia, Philippines, Sri Lanka; North and tropical Africa, S to S.E. Asia, S. Europe, tropical America, Oceania.

***Glinus oppositifolius*** (Linnaeus) A. DC., Bull. Herb. Boiss. 2, 1: 552. 1901; Guha Bakshi, Fl. Mur. Dist. 148. 1984. *Mollugo oppositifolia* Linnaeus, Sp. Pl. 89. 1753. *Molluga spergula* Linnaeus, Syst. ed. 10: 881. 1759; C. B. Clarke in Hooker f., Fl. Brit. Ind. 2: 662. 1879. *Glinus mollugo* Fenzl, Ann. Wiener Mus. Naturgesch. 1: 359. 1836. *Mollugo glinoides* A. Richard, Tent. Fl. Abyss. 1: 48. 1847.

*Vernacular name:* Gima.

Herbs 10 – 30 cm, much branched, pilose to subglabrous. Leaves in pseudowhorls of 3 – 6; leaf blade spatulate-oblongate to elliptic, 1 – 2.5 cm 3 – 6 mm, base attenuate, margin with sparse teeth, obtuse to acute. Pedicel slender. Flowers usually 2 – 7 in a cyme. Tepals greenish white, oblong, margin membranous, 3 veined. Stamens 3 to 5. Styles 3. Capsule ellipsoid, slightly shorter than persistent tepals. Seeds chestnut-brown, subreniform, granulose.

*Flowers & Fruits:* January to June.

*Specimen Cited:* Park, *Rajib & AP Das 0021*, dated 05. 02. 2007.

*Local Distribution:* Garden.

*General Distribution:* Tropical parts of India; Bhutan, Bangladesh, China, Pantropical Africa and Asia, N Australia.

**Nyctaginaceae** Jussieu, Gen. Pl. 90. 1789; *nom. cons.*

### Key to the Genera:

- 1a. Small tree ..... *Nyctanthes*
- 1b. Climbing shrubs or herbs ..... 2
- 2a. Climbing shrubs ..... *Bougainvillea*
- 2b. Prostrate or erect herbs ..... 3
- 3a. Flowers enclosed by a calyxlike involucre; fruit globose, obovoid, oblong, fusiform or terete, sometimes ribbed, without sticky glands ..... *Mirabilis*
- 3b. Flowers in cymose umbels; fruit clavate, obconic to obovoid, 5 or 10 ribbed, with sticky glands ..... *Boerhavia*

BOERHAVIA Linnaeus, Sp. Pl. 1: 3. 1753.

***Boerhavia coccinea*** Miller, Gard. Dict., ed. 8. n. 4. 1768; Grierson *et* Long in Grierson *et* Long, Fl. Bhut. 1(2): 194. 1984. *Boerhavia bracteata* T. Cooke, Bull. Misc. Inform. Kew 1909: 421. 1910. *Boerhavia viscosa* Lagasca *et* Rodrigues, Anales Ci. Nat. 4: 256. 1801. *Boerhavia coccinea* var. *viscosa* (Lagasca *et* Rodrigues) Moscoso, Cat. Fl. Doming. 1: 180. 1943.

*Vernacular name:* Punarnaba.

Perennial herb, stems up to 50 cm, diffuse. Leaves opposite, ovate elliptic to broadly ovate, 3 – 5 x 2 – 3 cm, subacute, base cordate, subglabrous, petiole 2 cm. Flowers in cymose, umbels, 3 – 5

flowered, bract minute. Perianth campanulate, purple, fruit 3mm., obconic to obovoid, 5 or 10 ribbed, with sticky glands.

*Flowers & Fruits*: April to August.

*Specimen Cited*: Park, Rajib & AP Das 0017, dated 05. 02. 2007.

*Local Distribution*: Park and Garden areas, road sides.

*General Distribution*: India: throughout; Native of tropical America.

BOUGAINVILLEA Commerson ex Jussieu, Gen. Pl. 91. 1789 [*“Buginvillea”*], *nom. et orth. cons.*

### Key to the Species:

- 1a. Leaves sparsely pubescent; bracts oblong to elliptic, as long as flowers; perianth tube distinctly angled ..... *B. glabra*
- 1b. Leaves densely pubescent; bracts elliptic-ovate, longer than flowers; perianth tube rounded ..... *B. spectabilis*

***Bougainvillea glabra*** Choisy, Prodr. 13(2): 437 1849; Grierson *et* Long in Grierson *et* Long, Fl. Bhut. 1(2): 194. 1984; Prain, Beng. Pl. 2: 863.1903. *Bougainvillea brachycarpa* Heimerl, Bot. Jahrb. Syst. 11: 88. 1889.

*Vernacular name*: Kagajful.

Large scrambling shrubs. Leaves alternate, ovate, 3 – 5 x 2 – 3cm, acute, base attenuated, sparsely pubescent, petiole ± 1cm. Flowers in terminal. Bracts papery, oblong to elliptic, subacute, base cordate, red, sessile, flowers on its midrib. Perianth 2 cm, minutely puberulous, distinctly angled.

*Flowers & Fruits*: February to May.

*Specimen Cited*: Park, Rajib & AP Das 0051, dated 05. 02. 2007.

*Local Distribution*: Park.

*General Distribution*: India: cultivated throughout; Native of tropical America.

***Bougainvillea spectabilis*** Willdenow, Sp. Pl. 2: 348. 1799; Grierson *et* Long in Grierson *et* Long, Fl. Bhut. 1(2): 194. 1984 ; Prain, Beng. Pl. 2: 863.1903. *Bougainvillea bracteata* Persoon, Syn. Pl. 1: 418. 1805. *Bougainvillea virescens* Choisy, Prodr. 13(2): 437. 1849.

*Vernacular name*: Kagajful.

Large climbing shrubs. Leaves alternate, ovate, 3 – 5 x 2 – 3cm, acute, base rounded, densely pubescent; petiole 1cm. Flowers in terminal. Bracts papery, elliptic – ovate, subacute, base cordate, red, sessile, longer than flowers; flowers on its midrib. Perianth 2 cm, pubescent, perianth tube rounded.

*Flowers & Fruits*: February to May.

*Specimen Cited*: Park, Rajib & AP Das 0048, dated 05. 02. 2007.

*Local Distribution*: Park.

*General Distribution*: India: cultivated throughout. Native of tropical America.

MIRABILIS Linnaeus, Sp. Pl. 1: 177. 1753.

***Mirabilis jalapa*** Linnaeus, Sp. Pl. 177. 1753; Hara *et al.*, Enn. Fl. Pl. Nep. 3: 167. 1982; Grierson *et* Long in Grierson *et* Long, Fl. Bhut. 1(2): 192. 1984; Prain, Beng. Pl. 2: 862.1903. *Nyctago jalapae* (Linnaeus) DC., Fl. Fran . ed. 3, 3: 426. 1805.

*Vernacular name*: Sandhyamalati.

Robust erect herb, up to 150cm. Leaves opposite, triangular ovate, 5 – 9 x 2 – 4 cm, acuminate, base truncate, glabrous, petioles 2 – 3cm. Flowers in terminal corymbose cymes. Involucre campanulate, 1cm. Perianth red, narrowly funnel – shaped, tube 5cm, limb 5 lobed. Stamens 5. Fruit globose, obovoid, oblong, fusiform or terete, sometimes ribbed, without sticky glands.

*Flowers & Fruits*: April to February.

*Specimen Cited*: Park, Rajib & AP Das 0034, dated 05. 02. 2007.

*Local Distribution*: In the Park and Garden.

*General Distribution*: India: cultivated throughout. Native of tropical America.

NYCTANTHES Linnaeus, Sp. Pl. 1: 6. 1753.

*Nyctanthes arbor-tristis* Linnaeus, Sp. Pl. 1: 6. 1753; C. B. Clarke in Hooker *f.*, Fl. Brit. Ind. 3: 603. 1882; Long in Grierson *et* Long, Fl. Bhut. 2(2): 937. 1999; Prain, Beng. Pl. 2: 660. 1903.

*Nyctanthes dentata* Blume, Mus. Bot. 1: 282 1851. *Nyctanthes tristis* Salisbery, Prodr. Stirp. Chap. Allerton 11 1796. *Scabrita triflora* Linnaeus, Mant. Pl. 1: 37 1767.

*Vernacular name*: Sheuli.

Shrubs; branches quadrangular. Leaves rigid, ovate, acuminate, base rounded or cuneate, margin entire or coarsely serrate, scabrid-hairy above, appressed pubescent on veins beneath. Flowers fragrant, sessile; corolla tube orange; lobes white. Capsule elliptic or suborbicular, 2 – lobed.

*Flowers & Fruits*: September to December.

*Specimen Cited*: Village sector, Rajib & AP Das 0047, dated 05. 02. 2007.

*Local Distribution*: Village.

*General Distribution*: India: cultivated throughout. Native of tropical America.

**Droseraceae** Salisbury in W. Hooker, Parad. Lond. t. 95. 1808 ('Drosereae').

DROSERA Linnaeus, Sp. Pl. 1: 281. 1753.

*Drosera burmannii* Vahl, Symb. Bot. 3: 50. 1794; Long in Grierson *et* Long, Fl. Bhut. 1(2): 379. 1984; Prain, Beng. Pl. 1: 472. 1903. *Drosera burmanni* var. *dietrichiana* (Reichenbach *f.*) Diels, Pflanzenr. IV, 112: 76. 1906. *Drosera dietrichiana* Reichenbach *f.*, Beitr. Syst. Pflanzenk. 73. 1871. [PLATE: 7, Figure-63]

Small herbs. Stem unbranched, extremely short. Leaves forming a flat rosette, subsessile, lamina yellowish green or red to reddish violet, 8 – 9 x 6 – 8 mm, obovate, obtuse, prostrate, densely covered with glandular hairs, greenish pink; petioles absent. Flowers few in erect racemes; scape 6–8 cm high; calyx glandular. Sepals 5, united at base, light green, red, or reddish violet, narrowly oblong. Petals white to light red to reddish violet, obovate; style 3, free.

*Flowering & Fruiting*: August to December.

*Specimen Cited*: Bochamri cultivation land, Rajib & AP Das 0111, dated 07. 02. 2007.

*Local Distribution*: Grass land.

*General Distribution*: India: tropical part throughout; Bhutan, S. E. Asia and Australia.

**Tamaricaceae** S. F. Gray, Arr. Brit. Pl. 2: 554. 1821 ('Tamaricinae'); *nom. cons.*

TAMARIX Linnaeus, Sp. Pl. 1: 270. 1753.

***Tamarix dioca*** Roxburgh *ex* Roth. Nov. Pl. Sp. 185. 1821; Dyer in 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; Grierson in Grierson *et Long*, Fl. Bhutan 2 (1): 232. 1991. [PLATE: 7, Figure-72]

*Local Name:* Jhaoa.

Shrubs or small tree. Branches gray-green, robust. Leaves of growing branches lanceolate; those of vegetative branches lanceolate to ovate-lanceolate, unequal in size, 1–4 mm, acuminate, base decurrent, amplexicaul, auriculate, imbricate. Racemes in branches of previous year and at apices of growing branches of current year forming a lax panicle. Flowers 4 merous. Sepals triangular-ovate, base slightly united, green, membranous, denticulate, apex obtuse. Petals obovate orbicular to elliptic, pink or purplish, deciduous after anthesis. Disk purple-red, thick. Stamens 4 or 5. Styles 3. Capsule large.

*Flowers & Fruits:* July to January.

*Specimen Cited:* Batikata Beel margin, *Rajib & AP Das 0186*, dated 09. 02. 2007.

*Local Distribution:* Riverine Grassland.

*General Distribution:* India: tropical part; Bangladesh, Nepal, Pakistan, Myanmar and Afghanistan.

**Plumbaginaceae** A. L. de Jussieu, Gen. Pl. 92. 1789 ('Plumbagines'); nom. cons.

PLUMBAGO Linnaeus, Sp. Pl. 1: 151. 1753.

***Plumbago zeylanica*** Linnaeus, Sp. Pl. 1: 151. 1753; Clarke in Hooker *f.*, Fl. Brit. Ind. 3: 480. 1882; H. Ohashi in Hara, Fl. E. Himal. 249. 1966; Hara *et al.*, Enn. Fl. Pl. Nep. 3: 61. 1982; Rae *et Aitken* in Grierson *et Long*, Fl. Bhut. 2(2): 570. 1999; Prain, Beng. Pl. 1: 639. 1903. *Plumbago scandens* Linnaeus, Sp. Pl. ed. 2, 215. 1762. *Findlaya alba* Bowdich, Exc. Madeira 258. 1825.

Scrambling bushy shrubs. Leaves ovate, entire, acute or acuminate, base cuneate or attenuate, glabrous. Petioles narrowly winged above, broadly auriculate at base. Racemes many-flowered, glandular. Corolla white. Capsules pale yellow-brown, ellipsoid.

*Flowers & Fruits:* September to February.

*Specimen Cited:* Cultivate in Bochamari village, *Rajib & AP Das 0727*, dated 14. 02. 2008.

*Local Distribution:* Panted in Villages.

*General Distribution:* Pantropical.

**Polygonaceae** A.L. de Jussieu, Gen. Pl. 82. 1789 ('Polygoneae'); nom. cons.

**Key to the genera:**

- 1a. Perianth 3 – 5 cleft; stigma capitate ..... 2
- 1b. Perianth 6 cleft; stigma fimbriate ..... ***Rumex***
- 2a. Petioles bearing reflexed prickles or bristles ..... ***Persicaria***
- 2b. Petioles articulate ..... ***Polygonum***

PERSICARIA (Linnaeus) Miller, Gard. Dict. Abr., ed. 4. vol. 3. 1754.

**Key to the species:**

- 1a. Flowers in axillary fascicles; ocrea 2-cleft ..... *P. plebeium*
- 1b. Inflorescence spicate, capitate, or paniculate; ocrea not 2-cleft ..... 2
- 2a. Stems and petioles with retrorse prickles ... .. *P. strigosum*
- 2b. Stems and petioles without retrorse prickles ..... 3

3a. Perennial herb .....	<i>P. barbatum</i>
3b. Annual herb .....	4
4a. Peduncles glandular hairy or glandular .....	<i>P. lapathifolium</i>
4b. Peduncles not glandular hairy and glandular .....	5
5a. Apex of ocrea usually with green leaflike wing .....	<i>P. orientale</i>
5b. Apex of ocrea without wing .....	6
6a. Perianth punctuate .....	<i>P. hydropiper</i>
6b. Perianth not punctuate .....	<i>P. chinense</i>

***Persicaria chinensis*** (Linnaeus) H. Gross, Engl. Bot. Jaharb. Syst. 49(2): 269. 277 & 315. 1913; Grierson *et* Long in Grierson *et* Long, Fl. Bhu. 1(1): 163. 1983. *Polygonum chinense* Linnaeus, Sp. Pl. ed. 1, 1: 363. 1753; Hooker *f.*, Fl. Br. Ind. 5: 44. 1886; Hara *et al.* Fl. E. Him. 3: 175. 1982; Prain, Beng. Pl. 2: 887. 1963. *Persicaria chinensis* var. *ovalifolia* (Meisner) Hara & Ohashi, Fl. E. Him. 71. 1966; 2: 22. 1971; Hara *et al.*, Enum. Fl. Pl. Nepal 3: 175. 1982. *Polygonum chinense* var. *ovalifolia* Meisner *sensu* Hooker *f.*, Fl. Br. Ind. 5: 45. 1885.

Scandent shrubs; stem glabrous. Stipules obliquely truncate tube and enclosed to entire internode, white. Lamina ovate, oblique, abruptly acuminate, cordate at base, glabrous except the midrib below; nerves many. Ochrea 2-3 cm long, membranous, ribbed, oblique at mouth, glabrous. Spike paniced, globose; peduncles glandularhairy; bracts ovate, obtuse, 1-flowered; flowers pedicelled; tepals 4, white, oblong, obtuse, glabrous; stamens 8, styles 3. Nut trigonous, glabrous, acute, brown.

*Flowers & Fruits:* Throughout the year.

*Specimen Cited:* Forest, Rajib & AP Das 0395, dated 22.07.2007.

*Local Distribution:* Throughout the Beel Margin.

*General Distribution:* India, Bhutan, Nepal, China, Japan, Malaysia.

***Persicaria strigosa*** (R. Brown) Nakai, Rigakkwai 24: 299. 1926; Grierson *et* Long in Grierson *et* Long, Fl. Bhu. 1(1): 160. 1983. *Polygonum strigosum* R. Brown, Prodr. Fl. Nov. Holl. 420. 1810; Prain, Beng. Pl. 2: 888. 1963. *Polygonum bodinieri* H. L v & Vaniot, Bull. Acad. Int. G ogr. Bot. 11: 343. 1902. *Truellum strigosum* (R. Brown) Soj k, Preslia 46: 149. 1974. *Tracaulon strigosum* (R. Brown) Greene, Leaf. Bot. Observ. Crit. 1: 22. 1904.

Annual herbs. Stems decumbent, branched, angulate, with retrorse prickles along angles. Petiole with recurved prickles; leaf blade elliptic or lanceolate, 6 – 2 – 3 cm, acuminate or acute, retrorse prickles along midvein, base weakly cordate or truncate, ciliate; ocrea tubular, membranous, with dense retrorse prickles at base, apex truncate, long ciliate. Inflorescence spicate; peduncle branched, each 2 or 3 flowered. Perianth pinkish, 5 parted; tepals elliptic. Styles 2 or 3; stigmas capitate. Achenes dark brown.

*Flowers & Fruits:* August to October.

*Specimen Cited:* Batikata Beel, Rajib & AP Das 0421, dated 22.07.2007.

*Local Distribution:* Throughout the Beel Margin.

*General Distribution:* India: Bangladesh, Nepal, Bhutan, Indonesia, Malaysia, Myanmar, New Guinea, Thailand, Vietnam, Australia.

***Persicaria barbata*** (Linnaeus) Hara, Fl. E. Him. 1: 70. 1966; Grierson *et* Long in Grierson *et* Long, Fl. Bhu. 1(1): 162. 1983. *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. *Polygonum kotoshoense* Ohki, Bot. Mag. (Tokyo) 39: 362. 1925. *Persicaria omerostroma* (Ohki) Sasaki, List Pl. Formos. 170. 1928. [PLATE: 10, Figure-119]

Erect stout herbs. Lamina subsessile, 6-12 x 2-3 cm, elliptic-lanceolate, acuminate at both ends, glabrate or pubescent; nerves many, slender; ochrea strigose, mouth oblique, shortly bristled, pubescent. Spike 2-4 cm long, shortly peduncled, stout, in 15-20 cm long panicles; bracts obovate, obtuse, long-ciliate; flowers white, 4-10 in each bracts, longpedicelled; pedicels persistent; tepals 5, free, oblong, obtuse, glandular; stamens 8; styles 3. Nut trigonous, acute, glabrous.

*Flowers & Fruits:* July to December.

*Specimen Cited:* Batikata Beel, *Rajib & AP Das 0415*, dated 22.07.2007.

*Local Distribution:* Throughout the Beel Margin.

*General Distribution:* India (Warmer part), Tropical part of Asia, Africa and America.

***Persicaria hydropiper*** (Linnaeus) Delarbre, Fl. Auvergne ed. 2: 518. 1800. *Persicaria hydropiper* (Linnaeus) Spach, Hist. Veg. 10: 536. 1841; Fl. Eastern. Himal. 2: 23. 1971; Grierson *et* Long in Grierson *et* Long, Fl. Bhut. 1(1): 162. 1983. *Polygonum hydropiper* Linnaeus, Sp. Pl. 1: 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. *Persicaria hydropiper* (Linnaeus) Opiz, Seznam 72. 1852. *Polygonum schinzii* J. Schuster, Bull. Herb. Boissier 2(8): 711. 1908. [PLATE: 6, Figure-57]

*Vernacular name:* Bish jhar.

Slender erect herbs. Lamina subsessile, 3-7 x 1.5-2.5 cm, elliptic, acuminate, base acute, scabrous along the nerves, nerves many, slender. Ochrea with immersed hairs, mouth ciliate. Racemes 3-10 cm long, paniced, slender, sometimes drooping; bracts obovate, ciliate; flowers solitary or paired in each bract; tepals oblong, obtuse, red-glandular; stamens 5; styles 3-fid. Nut trigonous, apiculate.

*Flowers & Fruits:* May to December.

*Specimen Cited:* Bochamari Beel, *Rajib & AP Das 0130*, dated 07. 02. 2007.

*Local Distribution:* Throughout the Beel Margin.

*General Distribution:* India (Plains and wet places), Pantropica Europe and N. Africa.

***Persicaria lapathifolia*** (Linnaeus) Delarbre, Fl. Auvergne ed. 2: 519. 1800. *Persicaria lapathifolia* (Linnaeus) S.F. Gray, Nat. Arr. Br. Pl. 2: 270. 1821; Grierson *et* Long in Grierson *et* Long, Fl. Bhut. (1): 161. 1983. *Polygonum lapathifolia* Linnaeus, Sp. Pl. 360. 1753; Hooker *f.*, Fl. Brit. Ind. 5: 35. 1886; Prain, Beng. Pl. 2: 886. 1963. *Polygonum nodosum* Persoon, Syn. Pl. 1: 440. 1805. *Polygonum incarnatum* Elliott, Sketch Bot. S. Carolina 1(5): 456. 1817.

Annual herbs. Stems erect, branched, swollen at nodes. Lamina lanceolate or broadly lanceolate, ciliate, acuminate or acute, base cuneate; ochrea brownish, tubular, membranous, glabrous, apex truncate. Inflorescence terminal or axillary, densely flowered, several spikes aggregated panicle like; bracts funnel-shaped, margin sparsely shortly ciliate. Perianth pink or white. Stamens usually 6. Styles 2, connate at base. Achenes black-brown, shiny, broadly ovoid, biconcave.

*Flowers & Fruits:* June to December.

*Specimen Cited:* Raichangmari Beel, *Rajib & AP Das 0074*, dated 06. 02. 2007.

*Local Distribution:* Near Tourist Bunlow.

*General Distribution:* India: Bhutan, Nepal, Bangladesh, Pakistan, Indonesia, Japan, Kazakhstan, Korea, Malaysia, Mongolia, Myanmar, New Guinea, Philippines, Russia, Tajikistan, Thailand, Turkmenistan, Uzbekistan, Vietnam; N Africa, Australia, Europe, North America.

***Persicaria orientalis*** (Linnaeus) Spach, Hist. Nat. V g. 10: 537 1841. *Persicaria orientalis* (Linnaeus) Assenov, Fl. Reip. Pop. Bulgar. 3: 250. 1966; Grierson *et* Long in Grierson *et* Long, Fl. Bhut. (1): 161. 1983. *Polygonum orientale* Linnaeus, Sp. Pl. 1: 362. 1753. Hooker *f.*, Fl. Brit. Ind. 5: 30. 1886; Prain, Beng. Pl. 2: 886. 1903. *Persicaria tibetica* Rendle, J. Bot. 428. 1900. *Polygonum orientale* var. *pilosum* (Roxburgh *ex* Meisner) Meisner, Prodr. 14(1): 123. 1856. *Polygonum pilosum* Roxburgh *ex* Meisner, Fl. Ind., ed. 1820 2: 286. 1824.

Annual herbs. Stems erect, much branched above, densely spreading villous. Lamina broadly ovate to ovate-lanceolate, 10 – 20 5 – 10 cm, both surfaces densely pubescent, densely ciliate, acuminate, base rounded or subcordate, slightly decurrent. Ocrea tubular, membranous, margin truncate, long ciliate, usually with green leaflike wing. Inflorescence terminal or axillary, slightly pendulous, several spikes aggregated and panicle-like; bracts green, broadly funnel shaped. Flowers dimorphic. Perianth white. Stamens 7, exserted. Styles 2, connate to below middle; stigmas capitate. Achenes, black-brown, shiny.

*Flowers & Fruits:* June to August.

*Specimen Cited:* Batikata Beel, Rajib & AP Das 0041, dated 05. 02. 2007.

*Local Distribution:* Throughout the Beel Margin.

*General Distribution:* India through out; Bhutan, Bangladesh, China, Indonesia, Japan, Korea, Myanmar, Philippines, Russia, Sri Lanka, Thailand, SW Asia, Australia and Europe.

POLYGONUM Linnaeus, Sp. Pl. 1: 359. 1753, nom. cons.

Key to the species

- 1a. Flowers in axillary fascicles, 2 cleft ..... *P. plebeium*  
 1b. Inflorescence spicate, pendulous; ocrea truncate to ciliate ..... *P. pubescens*

***Polygonum plebeium*** R. Brown, Prodr. Fl. Nov. Holl. 420. 1810 (“*Plebejum*”); Hooker *f.*, Fl. Brit. Ind. 5: 27. 1886; Grierson *et* Long in Grierson *et* Long, Fl. Bhu. 1(1): 170. 1983; Prain, Beng. Pl. 2: 885. 1903; Guha Bakshi, Fl. Mur. Dist. 274. 1984. *Avicularia indica* Didrichsen, Bot. Not. 1850: 187. 1850. *Polygonum herniarioides* Sprengel, Syst. Veg. 2: 256. 1825.

Prostrate woody herbs with radiate branches; stems glabrous. Lamina 0.8 – 1 x 0.3 – 0.5 cm, oblong, sessile, acute, glabrous. Ocrea chartaceous, white, ciliate. Flowers 3 – 7 together, sessile, axillary; tepals 5, ovate, acute, glabrous; stamens 5. Nut trigonous, acute, glabrous, brown.

*Flowers & Fruits:* October to March.

*Flowers & Fruits:* June to November.

*Specimen Cited:* Rasik Beel, Rajib & AP Das 0081, dated 06. 02. 2007.

*Local Distribution:* Throughout the study areas.

*General Distribution:* India: tropical part; Tropical and Sub Tropical Asia, Africa and Australia.

***Polygonum pubescens*** Blume, Bijdr. Fl. Ned. Ind. 2: 532. 1925; Steward Contr. Gray Herb. 88: 62. 1930. *Persicaria pubescens* (Blume) Hara in Jour. Jap. Bot. 17(6): 335. 1941; Hara, Fl. Eastern Himal. 73: 1966; Grierson *et* Long in Grierson *et* Long, Fl. Bhu. 1(1): 163. 1983. *Polygonum burbatum sensu* Willdenow, Roxburgh Fl. Ind. 2: 289. 1832 non L. *Polygonum flaccidum* Meisner, Prodr. 14(1): 107. 1856; Hooker *f.*, Fl. Brit. Ind. 5: 39. 1886; Prain, Beng. Pl. 2: 664. 1903. *Polygonum hispidum* Buchanan-Hamilton *ex* D. Don, Prodr. Fl. Nepal. 71. 1825. *Polygonum flaccidum* var. *hispidum* (Buchanan-Hamilton *ex* D. Don) Hooker *f.*, Fl. Brit. India 5: 40. 1886. [PLATE: 9, Figure-94]



Annual or perennial herbs. Stems erect, hispidulous. Lamina 3 – 8 1-4 cm ovate-lanceolate or broadly lanceolate, both surfaces hispidulous, ciliate, acuminate or acute, base cuneate. Ocrea tubular, hispid, apex truncate, ciliate. Inflorescence terminal or axillary, spicate, pendulous, lax; funnel-shaped, margin ciliate, each 3 or 4 flowered; pedicels longer than bracts. Perianth green, red above, 5 parted, densely purplish glandular punctate; tepals elliptic; stamens 8, included; styles 3, connate to below middle. Achenes black, ovoid.

*Flowers & Fruits:* March to October.

*Specimen Cited:* Rasik Beel, *Rajib & AP Das 0062*, dated 07. 02. 2007.

*Local Distribution:* Throughout the Beel Margin.

*General Distribution:* India, Malaya and Archipelago.

RUMEX Linnaeus, Sp. Pl. 1: 333. 1753.

### Key to the species:

- 1a. Inner fruiting sepals margin narrow, few toothed ..... *R. maritimus*
- 1b. Inner fruiting sepals margin wide, more toothed ..... *R. dentatus*

***Rumex dentatus*** Linnaeus, Mant. Pl. 2: 226. 1771; Hooker *f.*, Fl. Brit. Ind. 5: 59. 1886; Grierson *et Long* in Grierson *et Long*, Fl. Bhu. 1(1): 174. 1983; Prain, Beng. Pl. 2: 889. 1903. *Rumex klotzschianus* Meisner, Prodr. 14(1): 57. 1856. *Rumex dentatus* subsp. *klotzschianus* (Meisner) Rechard *f.*, Beib. Bot. Jahr. 49(2): 19. 1932. [PLATE: 6, Figure-51]

Annual herbs. Stems erect, branched from base, grooved; branches ascending to nearly divaricate, glabrous. Lower leaves: lamina oblong to narrowly elliptic, 4 – 12 2 – 3 cm, both surfaces glabrous, slightly undulate, obtuse or acute, base rounded, truncate or subcordate; cauline leaves smaller; ocrea fugacious, membranous. Inflorescence racemose, several racemes aggregated and panicle like. Flowers bisexual. Outer tepals elliptic; inner tepals enlarged in fruit; valves triangular ovate, base rounded, each margin with 2 to 4 teeth, apex acute to subacute. Achenes yellow-brown, shiny, ovoid, sharply trigonous.

*Flowers & Fruits:* May to August.

*Specimen Cited:* Bochamari Beel, *Rajib & AP Das 0040*, dated 05. 02. 2007.

*Local Distribution:* Throughout the Beel Margin.

*General Distribution:* India: tropical. Nepal, Afghanistan, India, Kazakhstan, Kyrgyzstan, Russia; N Africa, SE Europe.

***Rumex maritimus*** Linnaeus, Sp. Pl. 335. 1753; Hooker *f.*, Fl. Brit. Ind. 5: 59. 1886; Grierson *et Long* in Grierson *et Long*, Fl. Bhu. 1(1): 174. 1983; Prain, Beng. Pl. 2: 888. 1903. *Lapathum minus* Lamarck, Fl. Fran. 3: 4. 1778. *Rumex aureus* Miller, Gard. Dict. (ed. 8) no. 7 no. 7. 1768. *Rumex fueginus* Philip, Anales Univ. Chile 91: 493-494. 1895.

Annual herbs. Stems erect, branched below middle, grooved, glabrous. Lower leaves: lamina lanceolate to lanceolate-oblong, both surfaces glabrous, entire and smooth or occasionally slightly undulate, acute, base narrowly cuneate; cauline leaves shortly petiolate, smaller than basal ones; ocrea fugacious, membranous. Inflorescence paniculate. Flowers bisexual. Outer tepals elliptic; inner tepals enlarged in fruit; valves narrowly triangular ovate, base truncate. Achenes yellowbrown, shiny, ellipsoid, sharply trigonous.

*Flowers & Fruits:* May to July.

*Specimen Cited:* Bochamari Beel, *Rajib & AP Das 0050*, dated 05. 02. 2007.

*Local Distribution:* Throughout the Beel Margin.

*General Distribution:* India: throughout; Bhutan, Bangladesh, Kazakhstan, Mongolia, Myanmar, Russia, Europe, introduced in North America.

**Order: Saxifragales** Dumortier (1829)

**possible subclass 1:**

**Crassulaceae** De Candolle, Bull. Soc. Philom. no. 49: 1. 1801; *nom. cons.*

BRYOPHYLLUM Salisbury, Parad. Lond. t. 3. 1805.

*Bryophyllum pinnatum* (de Lamarck) Oken, Allg. Naturgesch. 3(3): 1966. 1841. *Bryophyllum pinnatum* (de Lamarck) Kurz, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 40(2): 52. 1871. *Kalanchoe pinnata* (Lamarck) Persoon, Syn. 446. 1805. Grierson in Grierson *et* Long, Fl. Bhut. 1 (3): 473. 1987. *Cotyledon pinnata* Lamarck, Dict. 2: 141. 1786.

*Vernacular Name:* Pathar kuchi.

Herbs, up to 140 cm, glabrous. Stems usually branched. Leaves pinnately compound with 3 – 5 leaflets; petiolules 3 cm; leaflet blades oblong to elliptic, 4 – 8 2 – 5 cm, margin crenate, apex obtuse. Inflorescences terminal, paniculate, up to 40 cm, many flowered. Flowers pendulous. Calyx tubular. Corolla reddish to purple, base sparsely ciliate; lobes ovate-lanceolate. Stamens inserted basally on corolla. Nectar scales oblong. Follicles included in calyx and corolla tube. Seeds striate.

*Flowers & Fruits:* January to March.

*Specimen Cited:* Cultivate in Bochamari village, *Rajib & AP Das 0223*, dated 09. 02. 2007.

*Local Distribution:* Cultivate in villages.

*General Distribution:* Native of Africa and naturalized throughout the tropics.

**Rosids:**

**Order: Vitales** Jussieu *ex* Berchtet *et* J. Presl (1820).

**Vitaceae** A. L. de Jussieu, Gen. Pl. 267. 1789 ('Vites').

**Key to the genera:**

- 1a. Plants climbers; tendrils present ..... 2
- 1b. Plants shrubs or trees; tendrils absent ..... *Leea*
- 2a. Inflorescence a loose thyrse or panicle, base subtended by a tendril ..... *Ampelocissus*
- 2b. Inflorescence a loose dichasium, corymbose cyme, or umbel, base without tendrils ..... 3
- 3a. Inflorescence leaf-opposed ..... *Cissus*
- 3b. Inflorescence usually axillary or pseudo-axillary ..... *Tetrastigma*

LEE A D. Royen *ex* Linnaeus, Syst. Nat., ed. 12, 2: 608, 627; Mant. Pl. 1: 17, 124. 1767, *nom. cons.*

**Key to the species:**

- 1a. Abaxial leaflet surface pubescent with dense peltate glands ..... *L. aequata*
- 1b. Abaxial leaflet surface pubescent without peltate glands ..... 2
- 2a. Leaves simple to 1–3-pinnate, blade large and broadly ovate ..... *L. macrophylla*
- 2b. Leaves pinnate, blade ovate-oblong ..... *L. asiatica*

***Leea aequata*** Linnaeus, Syst. Nat. (ed. 12) 2: 627. 1767; Mant. Pl. 1: 124. 1767; Long *et* Rae in Grierson *et* Long, Fl. Bhut. 2(1): 149. 1991; Prain, Beng. Pl. 1: 340. 1963. *Leea hirta* Roxburgh *ex* Hornemann, Hort. Bot. Hafn. 1: 231. 1813. *Leea hispida* Gagnepain, Notul. Syst. (Paris) 1: 229. 1910.

Small trees, up to 5m. Leaves 1 to 2 pinnate; stipules cuneate to lanceolate; lamilets elliptic-lanceolate to ovate-lanceolate, 6 – 25 3 – 7 cm, acuminate or caudate acuminate, irregular teeth, base cuneate to rounded. Inflorescence leaf-opposed; densely ferruginous pubescent. Calyx tube cupulate; sepals triangular and densely with glands. Petals elliptic, glabrous. Staminal tube 2 – 2.5 mm. Stamens 5; anthers elliptic. Ovary globose; stigma slightly capitate. Berry obovate, 4–6-seeded.

*Flowers & Fruits*: April to September.

*Specimen Cited*: Atiamochar forest, *Rajib & AP Das 0386*, dated 21.07.2007.

*Local Distribution*: Forests.

*General Distribution*: India: tropical part; Bhutan, Nepal, Bangladesh, Cambodia, Malaysia, Myanmar, Philippines, Thailand, Vietnam.

***Leea macrophylla*** Roxburgh *ex* Hornemann, Hort. Bot. Hafn. 1: 231. 1813; Long *et* Rae in Grierson *et* Long, Fl. Bhut. 2(1): 164. 1991; Prain, Beng. Pl. 1: 341. 1963. *Leea aspera* Wallich *ex* G. Don, Gen. Hist. 1: 713. 1831. *Leea robusta* Roxburgh, Fl. Ind., ed. 1820 2: 468. 1824. *Leea integrifolia* Roxburgh, Fl. Ind., ed. 1820. 2: 472. 1820.

Erect shrubs to small trees, up to 4m. Leaves variable in shape and size, simple, 3 foliolate, or 1 to 3 pinnate; stipules large and obovate; simple lamella broadly ovate, 35 – 60 30 – 50 cm, acuminate, dentate, base rounded. Inflorescences opposite to leaves, compound corymbose-ichasial. Calyx tube cupulate, with 5 triangular teeth. Petals elliptic. Stamens 5; anthers elliptic. Ovary nearly globose; stigma slightly capitate. Berry obovate, 6-seeded.

*Flowers & Fruits*: October to December.

*Specimen Cited*: Takomari forest, *Rajib & AP Das 0442*, dated 22.07.2007.

*Local Distribution*: Forests.

*General Distribution*: India: tropical parts; Bhutan, China, Nepal, Cambodia, Laos, Myanmar, Thailand.

***Leea asiatica*** (Linnaeus) Ridsdale, Bot. Hist. Hort. Malab. 189. 1980; Long *et* Rae in Grierson *et* Long, Fl. Bhut. 2(1): 163. 1991. *Leea aspera* Edgeworth, Trans. Linn. Soc. London 20(1): 36. 1846. *Leea crispa* Linnaeus, Mant. Pl. 1: 124. 1767. *Leea herbacea* Buchanan-Hamilton, Trans. Linn. Soc. London 14(1): 228-229. 1823; Prain, Beng. Pl. 1: 340. 1963. *Phytolacca asiatica* Linnaeus, Sp. Pl. 1: 441. 1753.

Erect shrubs. Branchlets terete with longitudinal ridges. Leaves pinnate; stipules large and obovate; simple lamella ovate-oblong, 40 – 60 30 – 50 cm, acuminate, dentate, base rounded. Inflorescences opposite to leaves, compound corymbose-dichasial; bracts triangular to narrow. Calyx tube cupulate, with 5 triangular teeth. Petals elliptic. Stamens 5; anthers elliptic. Ovary nearly globose. Berry obovate, 6 seeded.

*Flowers & Fruits*: June to November.

*Specimen Cited*: Takomari forest, *Rajib & AP Das 0375*, dated 21.07.2007.

*Local Distribution*: Forests.

*General Distribution*: India: through out India to Eastern India; Bhutan, China, Nepal, Cambodia, Laos, Myanmar, Thailand.

AMPELOCISSUS Planchon, Vigne Am r. Vitic. Eur. 8: 371. 1884, *nom. cons.*

*Ampelocissus sikkimensis* (M. Lawson) Planchon in J. Vigne Amer. Vitic. Eur. 8: 375. 1884; Fl. Ind. 5: 259. 2000; Long *et* Rae in Grierson *et* Long, Fl. Bhut. 2(1): 152. 1991. *Vitis sikkimensis* M. Lawson in Hooker *f.*, Fl. Brit. India 1(3): 650. 1875.

Woody lianas. Branchlets terete, with longitudinal ridges, glabrous. Leaves simple; petiole 6 cm, glabrous; leaflets cordate-oval, 20–15 cm, glabrous, basal veins 5, veinlets slightly prominent abaxially, inconspicuous adaxially, base cordate, margin finely toothed, apex mucronate. Compound dichasium leaf-opposed, base with a bifurcate tendril. Pedicel 2–5 mm, nearly glabrous. Berry red, globose, 2 seeded. Seeds oblong, base rostrate, apex subrounded.

*Flowers & Fruits*: November.

*Specimen Cited*: Atiamochar forest, Rajib & AP Das 0519, dated 23.07.2007.

*Local Distribution*: Forests.

*General Distribution*: Tropical Asia and America.

TETRASTIGMA (Miquel) Planchon in A. Candolle & C. Candolle, Monogr. Phan. 5: 320, 423. 1887.

### Key to the species:

1a. Leaves pedately 5 foliolate; tendrils biforked ..... *T. serrulatum*

1b. Leaves palmately 3 to 5 foliolate; tendrils unbranched ..... *T. campylocarpum*

*Tetragstigma campylocarpum* (Kurz) Planchon in A. Candolle & C. Candolle, Monogr. Phan. 5: 437. 1887; Long *et* Rae in Grierson *et* Long, Fl. Bhut. 2(1): 156. 1991. *Vitis campylocarpa* Kurz, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 41: 302. 1872.

Woody lianas. Branchlets terete, with longitudinal ridges; tendrils unbranched. Leaves palmately 3 to 5 foliolate; lamilets obovate–elliptic, 8–16–5–8 cm, base broadly cuneate; lateral leaflets rhombic-ovate, acute, base asymmetric and subrounded. Inflorescence a large compound dichasium, axillary. Flowers small. Calyx teeth inconspicuous, pubescent, margin undulate. Petals galeate, pubescent. Anthers yellow, ovoid. Disk well developed. Ovary cylindrical; style absent; stigma truncate. Berry purple-black when mature, elliptic. Seeds elliptic and flat.

*Flowers & Fruits*: October to April.

*Specimen Cited*: Atiamochar forest, Rajib & AP Das 0376, dated 21.07.2007.

*Local Distribution*: Forests.

*General Distribution*: India: tropical part; Bhutan, China, Myanmar, Thailand.

*Tetragstigma serrulatum* (Roxburgh) Planchon in A. Candolle & C. Candolle, Monogr. Phan. 5: 432. 1887; Long *et* Rae in Grierson *et* Long, Fl. Bhut. 2(1): 155. 1991. [PLATE: 10, Figure-122]

Slender lianas. Branchlets terete, with longitudinal ridges; tendrils biforked or sometimes unbranched. Leaves pedately 5 foliolate; petiole 3–5 cm; leaflets ovate-lanceolate, 3–6–1–4 cm, lateral veins 4 to 8 pairs, veinlets conspicuously raised, base rounded or cuneate, base of lateral leaflets asymmetric, margin undulate fine teeth on each side, apex caudate, acuminate. Inflorescence umbelliform, axillary; peduncle up to 5 cm. Buds ovoid-elliptic. Calyx minute; teeth inconspicuous. Petals ovate-elliptic, apex corniculate, glabrous. Filaments filiform; anthers yellow, oval. Disk developed. Lower part of ovary adnate to disk; style short; stigma expanded and irregularly divided. Berry purple-black at maturity, spheroid. Seeds obovoidelliptic, base attenuate to a short rostrum, apex subrounded.

*Flowers & Fruits*: March to November.

*Specimen Cited:* Atiamochar forest, *Rajib & AP Das 0391*, dated 21.07.2007.

*Local Distribution:* Forests.

*General Distribution:* India: West Bengal, Assam, Bihar; Bhutan, Nepal, Myanmar, Thailand.

CISSUS Linnaeus, Sp. Pl. 1: 117. 1753.

**Key to the species:**

- 1a. Ramblers; branches quadrangular with angles usually winged, succulent; tendrils simple  
..... *C. quadrangularis*
- 1b. Woody lianas; branchlets terete, not angled or winged; tendrils racemosely 5 branched  
..... *C. repens*

*Cissus quadrangularis* Linnaeus, Syst. Nat. ed. 12(2): 124. 1767. *Cissus quadrangula* Linnaeus, Mant. Pl. 1: 39. 1767; Fl. Ind. 5: 288. 2000; Prain, Beng. Pl. 1: 338. 1963 *Vitis quadrangularis* (Linnaeus) Wallich ex Wight, Cat. Indian Pl. 26 26 1833. *Cissus tetraptera* Hooker f., Niger Fl. 263. 1849.

*Vernacular Name:* Harjora.

Ramblers; branches quadrangular with angles usually winged, succulent; tendrils stout, simple. Leaves ovate to reniform, sometimes 3 – 7 – lobed, acute-obtuse at apex, truncate-cordate at base, subentire – denticulate at margins, glabrous; stipules broadly ovate, obtuse. Flowers glabrous; petals ovate-oblong. Berries obovoid or globose, apiculate, 1 – 2 – seeded. Seeds obovoid.

*Flowers & Fruits:* June to January.

*Specimen Cited:* Rasik Beel village, *Rajib & AP Das 0461*, dated 23.07.2007.

*Local Distribution:* Cultivated in village areas.

*General Distribution:* India: cultivated throughout; Bhutan, Bangladesh, China, Myanmar, Sri Lanka, Africa, Indonesia and Philippines.

*Cissus repens* Lamarck, Encycl. 1: 31. 1783; Long et Rae in Grierson et Long, Fl. Bhut. 2(1): 159. 1991. *Cissus cordata* Roxburgh, Fl. Ind. 1: 425. 1820. *Cissus glauca* Roxburgh, Fl. Ind. 1: 406. 1820. *Vitis repens* (de Lamarck) Wight & Arnott, Prodr. Fl. Ind. Orient. 1: 125-126. 1834; Prain, Beng. Pl. 1: 338. 1963.

Woody lianas. Branchlets terete, villous; tendrils racemosely 5 branched. Leaves simple, undivided to slightly 3-lobed; petiole 7 cm; stipules ovate-elliptic to oval, herbaceous, apex rounded; leaf blade ovateorbicular, 5 – 15 3 – 7 cm, adaxially with sparse versatile and villous, then glabrescent, basal veins 5 to 7, lateral veins 4 to 5 pairs, veinlets inconspicuously raised, base cordate, margin with irregular teeth or undulate, fine teeth in curves of wavy margin, apex acuminate to acute. Compound umbel terminal or leaf-opposed. Pedicel up to 6 mm. Buds oval, apex rounded. Calyx teeth inconspicuous. Petals oval. Anthers oval, abortive in female flowers. Disk undulately 4 lobed. Lower part of ovary adnate to disk; style conical, base slightly thick; stigma slightly expanded. Berry 1 seeded. Seed surface with slightly raised ridges.

*Flowers & Fruits:* July to May.

*Specimen Cited:* Forest, *Rajib & AP Das 0384*, dated 21.07.2007.

*Local Distribution:* Forests.

*General Distribution:* India: West Bengal; Assam, Bihar, Orissa, Maharastra; Bhutan, Nepal, Cambodia, Laos, Malaysia, Philippines, Thailand, Vietnam, Australia, Tropical and sub-tropical parts of the world.

**Core-Eudicots: Rosids: Eurosids (I) (fr.: Fabid es ou Eurosids I)****Order: Celastrales Link (1829)**

**Celastraceae** R. Brown in Flinders, Voy. Terra Austr. 2: 554. 1814 ('Celastrineae'); *nom. cons.*

CELASTRUS Linnaeus, Sp. Pl. 1: 196. 1753, *nom. cons.*

*Celastrus paniculatus* Carl L. Willdenow, Sp. Pl. 1: 1125. 1798; Long, in Grierson *et* Long, Fl. Bhut. 2(1): 111. 1991. Prain, Beng. Pl. 1: 329. 1963. *Ceanothus paniculatus* Roth, Nov. Pl. Sp. 154. 1821. *Celastrus alnifolius* D. Don, Prodr. Fl. Nepal. 190. 1825. *Diosma serrata* Blanco, Fl. Filip. 168. 1837. *Celastrus paniculatus* Willdenow, Sp. Pl. 1: 1125. 1797.

Large deciduous twining shrubs; bark pale brown, rough and cracked, exfoliating in small scales. Lamina elliptic – oblong to ovate, 5 – 10 × 2 – 5 cm, glabrous, serrate, mucronate to acuminate, base cuneate. Thyrses terminal, 5–10 cm. Flowers greenish, 5 merous, dioecious; sepals free; petals oblong to obovate-rectangular. Disk membranous, cupulate, slightly 5 lobed. Stamens inserted on margin of disk. Ovary globose. Capsule globose, 3 valved.

*Flowers & Fruits:* April to August.

*Specimen Cited:* Rasik Beel, *Rajib & AP Das 0539*, dated 23.07.2007.

*Local Distribution:* Through out Forest.

*General Distribution:* India: through out; Bhutan, Nepal, Sri Lanka, Cambodia, Indonesia, Laos, Malaysia, Myanmar, Thailand, Vietnam; Australia, Pacific islands.

**Order: Oxalidales Bercht. & J. Presl (1820)**

**Elaeocarpaceae** A. L. de Jussieu *ex* De Candolle, Prodr. 1: 519. 1824 ('Elaeocarpeae'); *nom. cons.*

ELAEOCARPUS Linnaeus, Sp. Pl. 1: 515. 1753.

*Elaeocarpus floribundus* Blume, Bijdr. 120. 1825; Dyer in Fl. Brit. Ind. 1: 401. 1874; Miller in Grierson *et* Long, Fl. Bhut. 2(1): 170. 1991; Prain, Beng. Pl. 1: 287. 1963. *Elaeocarpus rigidus* Ridley in J. Asiat. Soc. Str. Settl. 54:28, 1910. *Elaeocarpus ramsoii* Kunth in Feddes Repert. 44: 131. 1938. *Elaeocarpus floribundus* var. *tahanensis* (Hend.) Ng, Tree Fl. Malaya 4: 88. 1989. *Elaeocarpus lobbianus* Turcz., Bull. Soc. Imp. Naturalistes Moscou 31(1): 235. 1858.

*Vernacular Name:* Jalpai.

Trees upto 20 m high. Lamina ovate to elliptic-ovate, acute to acuminate, base cuneate or rounded, glabrous, glandular-punctate beneath. Racemes 20 – 25-flowered. Sepals lanceolate, glabrescent or thinly appressed hairy. Petals white, obtriangular, hairy on margins only. Ovaries 3-celled. Fruits ellipsoid- obovoid.

*Flowers & Fruits:* March to December.

*Specimen Cited:* Bochamari village, *Rajib & AP Das 0085*, dated 06. 02. 2007.

*Local Distribution:* Panted in Villages.

*General Distribution:* India: cultivated throughout; Bangladesh, Bhutan, Myanmar, Malaysia and Indonesia.

**Oxalidaceae** R. Brown in Tuckey, Narr. Exped. Congo 433. 1818 ('Oxalideae'); *nom. cons.*

**Key to the genera:**

- 1a. Leaves fascicled at top of stem, even-pinnate ..... ***Biophytum***  
 1b. Leaves basal or cauline along stem, 3-foliolate ..... ***Oxalis***

**OXALIS** Linnaeus, Sp. Pl. 1: 433. 1753.

**Key to the species:**

- 1a. Subterranean bulb 1 – 3 cm; leaves basal ..... 2  
 1b. Rootstock a slender taproot, leaves from creeping branch ..... *O. corniculata*  
 2a. Lamina triangular, apex flat, strait ..... *O. latifolia*  
 2b. Lamina obcordate, apex deeply emarginated ..... *O. debilis* var. *corymbosa*

***Oxalis corniculata*** Linnaeus, Sp. Pl. 435. 1753; Hooker *f.*, Fl. Brit. Ind. 1: 436. 1874; H. Ohashi in Hara, Fl. E. Himal. 1:168. 1966; Hara *et al.*, Enn. Fl. Pl. Nep. 2: 77. 1979; Fl. Ind. 4: 242. 1997; Hajra *et al.*, Fl. W. Beng. 1:373. 1997; Long in Grierson *et Long*, Fl. Bhut. 1(3): 742. 1987; Prain, Beng. Pl. 1: 291. 1963.

*Vernacular name:* Ambali.

Annuals herbs, up to 50 cm, creeping, ascending to semierect. Rootstock a slender taproot, sometimes woody; stolons absent. Stipules small. Leaves petiole 3 – 8 cm; lamina obcordate, 0.3 – 2 0.4 – 2 cm, green, variably adaxially and abaxially pubescent, deeply emarginate. Inflorescences umbellate, 1–5- flowered; peduncle usually slightly longer than petioles; bracts linear-lanceolate. Sepals oblonglanceolate, margin ciliate especially at apex. Petals bright yellow, oblong-ovate. Capsule long cylindric, 5 angled, a few septate hairs on dehiscence sutures. Seeds brown to brownish red, ovoid-oblong, transversely ridged.

*Flowers & Fruits:* February to October.

*Specimen Cited:* Park, Rajib & AP Das 0706, dated 14. 02. 2008.

*Local Distribution:* Throughout the study area.

*General Distribution:* India: throughout; Bhutan, China, Nepal, Pakistan, Japan, Korea, Malaysia, Myanmar, Russia, Thailand.

***Oxalis latifolia*** Humboldt, Bonpland & Kunth, Nov. Gen. Sp. 5:184, t. 467. 1821; H. Ohashi in Hara, Fl. E. Himal. 1: 168. 1966; Hara *et al.*, Enn. Fl. Pl. Nep. 2:77. 1979; Long in Grierson *et Long*, Fl. Bhut. 1(3): 743. 1987.

Perennials herbs, up to 25 cm, stemless, pubescent. Subterranean bulb 1 – 3 cm; scales loose, papery, 3-veined. Leaves basal; petiole 5 – 15 cm, with moderately dense spreading white trichomes; lamina triangular, 2–4 1 – 3 cm, flat, strait. Inflorescences corymbose cymes, irregularly branched; peduncle 10 – 15 cm or longer; bracts lanceolate, membranous. Pedicels, bracts, and sepals pubescent. Sepals lanceolate, apex with 2 reddish brown calli. Petals purplish pink with darker veins, obcordate. Ovary pubescent.

*Flowers & Fruits:* March to December.

*Specimen Cited:* Rasik Beel, Rajib & AP Das 0675, dated 13. 02. 2008.

*Local Distribution:* Garden.

*General Distribution:* Tropical India; SE Asia, Africa.

***Oxalis debilis* var. *corymbosa*** (de Candolle) Lourteig, Ann. Missouri Bot. Gard. 67: 840 1980 publ. 1981. *Oxalis corymbosa* de Candolle, Prodr. 1:696. 1824; H. Ohashi in Hara, Fl. E. Himal. 1: 168. 1966; Hara *et al.*, Enn. Fl. Pl. Nep. 2:77. 1979; Long in Grierson *et Long*, Fl. Bhut. 1(3): 743. 1987. [PLATE: 6, Figure-49]

Perennials herbs, up to 25 cm, stemless, pubescent. Subterranean bulb 1 – 3 cm; scales loose, papery, 3-veined. Leaves basal; petiole 5 – 15 cm, with moderately dense spreading white trichomes; leaflet blades obcordate, 2 – 4 1 – 3 cm, both surfaces covered with trichomes, apex deeply emarginate. Inflorescences corymbose cymes, irregularly branched; peduncle 10 – 15 cm or longer; bracts lanceolate, membranous. Pedicels, bracts, and sepals pubescent. Sepals lanceolate, apex with 2 reddish brown calli. Petals purplish pink with darker veins, obcordate. Ovary pubescent.

*Flowers & Fruits*: March to December.

*Specimen Cited*: Garden, Rajib & AP Das 0680, dated 14. 02. 2008.

*Local Distribution*: Garden.

*General Distribution*: Tropical India; Native of tropical America naturalized in Asia.

BIOPHYTUM Candolle, Prodr. 1: 689. 1824.

***Biophytum sensitivum*** (Linnaeus) de Candolle, Prodr. 1: 690. 1824; Hooker *f.*, Fl. Brit. Ind. 1: 436. 1874; Hajra *et al.*, Fl. Ind. 4: 238. 1997; Prain, Beng. Pl. 1: 295. 1963. *Oxalis sensitiva* Linnaeus, Sp. Pl. 434. 1753.

Annuals herbs, up to 25 cm, base woody. Stem simple, slender to robust. Leaves fascicled at top of stem, even-pinnate, 3 – 10 cm; rachis slender, moderately hispid; leaflets 6 – 14 pairs; leaflet blades oblong to obovate-oblong, 3 – 12 2 – 6 mm, usually glabrous, sparsely covered with trichomes, base almost symmetric. Umbels several flowered; peduncle subequal to leaf length; bracts several, lanceolate, densely crowded at apex of peduncle. Pedicel 1 mm at anthesis but to 3 mm in fruit. Sepals with glandular septate trichomes. Petals yellow, longer than sepals. Capsule ellipsoid-obovoid, pubescent.

*Flowers & Fruits*: July to December.

*Specimen Cited*: Conservation Sector, Rajib & AP Das 0579, dated 25.07.2007.

*Local Distribution*: Forest near Conservation sector.

*General Distribution*: India: tropical; Bhutan, China, Nepal, Sri Lanka, Indonesia, Malaysia, Philippines, Thailand, Vietnam; tropical Africa.

**Order: Malpighiales** Jussieu *ex* Berchtold & J. Presl (1820)

**Clusiaceae** Lindley, Nat. Syst. ed. 2. 74. 1836 (*nom. alt. prop.* Lindley vs. Gutti-ferae); *nom. cons.*

MESUA Linnaeus, Sp. Pl. 1: 515. 1753.

***Mesua ferrea*** Linnaeus, Sp. Pl. (ed. 2) 1: 734. 1762; Grierson *et* Long in Grierson *et* Long, Fl. Bhut. 1(2): 371. 1984; Prain, Beng. Pl. 1: 246. 1963. *Mesua nagassarium* (Burman *f.*) Kosterman, Ceylon J. Sci., Biol. Sci. 12: 71. 1976. *Calophyllum nagassarium* Burman *f.*, Fl. Indica 121. 1768.

Tree, up to 20m. Leaves elliptic lanceolate, 8 – 14 x 3 – 4cm, acuminate, base rounded, glossy above, whitish waxy beneath, young leaves pinkish. Flowers large, fragrant, terminal or axial. Pedicels 5 mm. Sepals thickened, puberulous. Petals white, obovate. Anthers large, conspicuous, yellow. Style curve, peltate stigma. Fruits ovoid, dehiscent, woody and nut like, pointed apex, 1 – 4 seeded.

*Flowers & Fruits*: February to April.

*Specimen Cited*: Garden, Rajib & AP Das 0065, dated 07. 02. 2007.

*Local Distribution*: Garden.



*General Distribution:* India: cultivated; Bhutan, China, Myanmar.

**Elatinaceae** Cambesshdes, Mem. Mus. Hist. Nat. Paris 18: 225. 1829 ('Elatineae').

BERGIA Linnaeus, Mant. Pl. 2: 152, 241. 1771.

***Bergia ammannioides*** Roxburgh *ex* Roth, Nov. pl. Sp. 219. 1821; Roxburgh, Fl. Ind. 2: 457. 1832, "*ammanoides*"; Dyer in Hooker *f.*, Fl. Brit. Ind. 1: 251. 1874; Prain, Beng. Pl. 1: 243. 1963. *Elatine ammannioides* (Roxburgh *ex* Roth) Wight & Arnott, prodr. 41.1834. *Bergia ammannioides* Roxburgh *ex* Roth var. *pentandra* Wight, Ill. India. Bot. 54, t. 25a.1840. Sharma *et al.*, Fl. Ind. 3: 33.1993. *Elatine ammannioides* Wight & Arnott, Prodr. Fl. Ind. Orient. 41. 1834. *Bergia pentandra* Cambess. *ex* Guillemain & Berger Perrot, Fl. Seneg. Tent. 42. 1831.

Annual herbs. Stem branched at base; branches erect or obliquely ascending, densely glandular hairy. Stipules 2-fid, lobes lanceolate, margin laciniate-denticulate; lamina oblanceolate, to obovate-lanceolate or narrowly elliptic, 0.6–2 cm 2–6 mm, serrate, acute, base oblique or attenuate. Flowers numerous and clustered in leaf axils, small. Sepals narrowly ovate, margin membranous, apex acuminate. Petals reddish, narrowly ovate or elliptic, apex mucronate. Stamens 5; filaments filiform, base slightly widened. Ovary ovoid; styles 5; stigmas capitate. Capsule subglobose. Seeds brown, narrowly ovoid.

*Flowers & Fruits:* September to January.

*Specimen Cited:* Raichangmari Beel margin, *Rajib & AP Das 0144*, dated 08. 02. 2007.

*Local Distribution:* Throughout the Beel Margin.

*General Distribution:* Tropical India; Tropical Asia from Iran to China, Philippines, Australia and Tropical Africa.

**Euphorbiaceae** A.L. de Jussieu, Gen. Pl. 384. 1789 ('Euphorbiae'); *nom. cons.*

### Key to the genera

- |   |                            |
|---|----------------------------|
| 1a. Plants usually dioecious; stamens 15–250 .....                | <b><i>Mallotus</i></b>     |
| 1b. Plants evergreen; stamens 3–15 .....                          | 2                          |
| 2a. Lamina palmately lobed .....                                  | 3                          |
| 2b. Lamina not palmately lobed .....                              | 4                          |
| 3a. Filament branched; Perianth monochlamydous .....              | <b><i>Ricinus</i></b>      |
| 3b. Filament simple; perianth into distinct calyx & corolla ..... | <b><i>Jatropha</i></b>     |
| 4a. Inflorescence cyathia .....                                   | <b><i>Euphorbia</i></b>    |
| 4b. Inflorescence racemose .....                                  | 5                          |
| 5a. Raceme terminal; lamina lanceolate .....                      | <b><i>Croton</i></b>       |
| 5b. Raceme axillary; leaves ovate to ovate – elliptic .....       | 6                          |
| 6a. Fruiting calyx accrescent .....                               | <b><i>Baliospermum</i></b> |
| 6b. Fruiting calyx not accrescent .....                           | 7                          |
| 7a. Stipules caducous .....                                       | <b><i>Balakata</i></b>     |
| 7b. Stipules triangular .....                                     | <b><i>Acalypha</i></b>     |

ACALYPHA Linnaeus, Sp. Pl. 2: 1003. 1753.

### Key to the species:

1a. Inflorescences usually bisexual; plants herbs ..... *A. indica*

1b. Inflorescences unisexual; plants shrubs ..... *A. hispida*

***Acalypha hispida*** Burman *f.*, Fl. Ind.: 303, t. 61, fig. 1. 1768; Hooker *f.*, Fl. Brit. Ind. 5: 417. 1887; Long in Grierson *et* Long, Fl. Bhutan 1(3): 797. 1987; Keng, Concise Fl. Sing.: 105. 1990; Ngerns. & Chayamarit in Chayamarit & Welzen, Fl. Thailand 8, 1: 26. 2005. *Ricinocarpus hispidus* (Burman *f.*) Kuntze, Revis. Gen. Pl. 2: 618. 1891.

*Vernacular name:* Moragjhuti.

Shrubs, up to 3 m. Stipules triangular. Leaves petioles 2–11 cm, longitudinally grooved above; lamina ovate to broadly ovate, 7–10 x 1–4 cm, coriaceous, acute or acuminate, crenulate-serrate, base retuse or obtuse. Inflorescences unisexual, solitary, with only pistillate flowers, axillary, pendulous. Staminate flowers unknown. Pistillate flowers 3–8 per node; bracts minute, ovate, sepals 3, ovate; ovary subglobular, tomentose, stigmas dark red.

*Flowers & Fruits:* April to August.

*Specimen Cited:* Park, Rajib & AP Das 0585, dated 25.07.2007.

*Local Distribution:* Park.

*General Distribution:* India: cultivated throughout; Bhutan, China, Bangladesh, Malay Peninsula, New guinea.

***Acalypha indica*** Linnaeus, Sp. Pl.: 1003. 1753; Drury, Useful Pl. Ind.: 10. 1873; Hooker *f.*, Fl. Brit. Ind. 5: 416. 1887; Prain, Beng. Pl. 2: 948. 1963. *Ricinocarpus indicus* (Linnaeus) Kuntze, Revis. Gen. Pl. 2: 618. 1891. *Acalypha chinensis* Benthams, Fl. Hongk.: 303. 1861.

Erect, annual herbs, up to 90 cm; stem longitudinally grooved. Stipules narrowly triangular. Petioles longitudinally grooved above, pubescent; blades rhomboid, 3–7 x 2–6 cm, acute or obtuse, crenulate-serrate, base cuneate. Inflorescences 1 to 2 together, bisexual, axillary, pistillate flowers at base. Staminate flowers 6–10 per node; bracts ovate-oblong to ovate–lanceolate; sepals 4, ovate. Pistillate flowers 1–4 per node; bracts cup-shaped; sepals 3, ovate; ovary subglobular. Fruits 3-lobed, oblate or subglobular. Seeds ovoid.

*Flowers & Fruits:* April to September.

*Specimen Cited:* Garden, Rajib & AP Das 0544, dated 23.07.2007.

*Local Distribution:* Frontside of Garden.

*General Distribution:* India: tropical part; Bhutan, China, Sri Lanka, Japan, Taiwan, Malaysia, Singapore, Philippines, Sumatra, Java, Tropical Africa.

BALIOSPERMUM Blume, Bijdr. 603. 1826.

***Baliospermum solanifolium*** (Burman) Suresh, Regnum Veg. 119: 106. 1988 & Interpret. Rheede's Hort. Malab. 106. 1988; *Croton solanifolius* Burman, Fl. Malab. 6. 1769. *Baliospermum montanum* (Willdenow) M. Iler Argoviensis in de Candolle, Prodr. 15(2): 1125. 1866; Long in Grierson *et* Long, Fl. Bhut. 1(3): 811. 1987; Prain, Beng. Pl. 2: 946. 1963. *Jatropha montana* Willdenow, Sp. Pl. 4: 563. 1805. *Baliospermum axillare* Blume, Bijdr.: 604. 1826. *Croton polyandrus* Roxburgh, Fl. Ind. ed. 2. 3: 682. 1832. *Baliospermum polyandrum* (Roxburgh) Wight, Icon. Pl. Ind. Or. 5. 2: 23, t. 1885.

Shrubs, up to 2 m, monoecious; young branches green. Petiole pubescent; lamina elliptic, oblong to broadly ovate, 5–15 x 1–5 cm, papery, acute to acuminate, undulate-crenulate, base rounded to broadly cuneate. Panicles axillary, male flower narrow, pubescent; sepals 5, ovate; disk urceolate. Female flowers 1–3, axillary; sepals 5, ovate to triangular; disk annular; ovary densely pubescent; style apex bifid. Fruiting calyx accrescent; capsule pendulous, subglobose. Seeds elliptic-ovoid.

*Flowers & Fruits:* March to September.

*Specimen Cited:* Takomari forest, *Rajib & AP Das 0661*, dated 13.02.2008.

*Local Distribution:* Takomari Forests.

*General Distribution:* India: tropical; Bangladesh, Bhutan, Nepal, Pakistan, Sri Lanka, Myanmar, Cambodia, Laos, Vietnam, Malay Peninsular, Borneo, Sumatra, Java, Celebes, Moluccas, Lesser Sunda Islands.

CROTON Linnaeus, Sp. Pl. 2: 1004. 1753.

***Croton bonplandianus*** Baillon in Adansonia 4: 339. 1864; Long in Grierson *et* Long, Fl. Bhut. 1(3): 354. 1987; Guha Bakshi, Fl. Mur. Dist. 283. 1984; Panda *et* Das, Fl. Sambalp. 328. 2004. *Croton sparsiflorus* Morung in Ann. New York Acad. Sci. 7: 221. 1893; Haines, Bot. Bihar & Orissa Pt. II: 105. 1921. *Oxydectes bonplandiana* (Baillon) Kuntze, Revis. Gen. Pl. 2: 610. 1891. [PLATE: 6, Figure-52]

*Vernacular name:* Bontulsi.

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, carpel-3. Fruits schizocarpic with three one seeds cocci.

*Flowers & Fruits:* January to December.

*Specimen Cited:* Road side near gate, *Rajib & AP Das 0504*, dated 23.07.2007.

*Local Distribution:* Throughout the study areas.

*General Distribution:* India: throughout; Native to S. America and Pantropical.

JATROPHA Linnaeus, Sp. Pl. 2: 1006. 1753, nom. cons.

***Jatropha curcas*** Linnaeus, Sp. Pl. ed. 1: 1006. 1753; Hooker *f.*, Fl. Brit. Ind. 5: 383. 1887; Long in Grierson *et* Long, Fl. Bhut. 1 (3): 790. 1987; Prain, Beng. Pl. 2: 941. 1963. *Curcas indica* A. Richard, Hist. Fis. Cuba, Bot. 11: 208. 1850. *Jatropha acerifolia* Salisbury, Prodr. Stirp. Chap. Allerton 389. 1796.

*Vernacular Name:* Varena.

Erect, bushy, raddish, undershrubs. Leaves alternate, palmately lobed, cordate at base; petiole, stipules glandular hairy. Flower in cyme; bracts lanceolate. Sepals with glandular hairs, persistent; corolla purplish red; stamens basally connete. Capsules oblong, 3 – lobed.

*Flowers & Fruits:* June to December.

*Specimen Cited:* Bochamari village, *Rajib & AP Das 0319*, dated 21.07.2007.

*Local Distribution:* Cultivated in village areas.

*General Distribution:* Tropical and sub-tropical parts of the world.

RICINUS Linnaeus, Sp. Pl. 2: 1007. 1753.

***Ricinus communis*** Linnaeus, Sp. Pl. 2: 1007. 1753; Hooker *f.* in Hooker *f.*, Fl. Brit. Ind. 5: 457. 1887; Long in Grierson *et* Long, Fl. Bhut. 1(3): 808. 1987; Prain, Beng. Pl. 2: 952. 1963; Haines, Bot. Bihar & Orissa Pt. II: 112. 1921; Panda *et* Das, Fl. Sambalp., 340. 2004. *Cataputia minor* Ludwig, Def. Gen. Pl. ed. 3: 81. 1760. *Croton spinosus* Linnaeus, Sp. Pl. 2: 1005. 1753. *Ricinus africanus* Miller, Gard. Dict. ed. 8: 5. 1768. *Ricinus communis* Linnaeus, Sp. Pl. 2: 1007. 1753.

*Vernacular name:* Vanna.

Tall perennial, erect, fleshy, glabrous herbs. Lamina simple, palmately 7–9 lobed. Inflorescence terminal raceme with lower female and upper male flower. Male flower with bract, actinomorphic, parienth-5; stamens-5; female flower with 5-perianth, carpel-3. Fruits schizocarpic with 3 one seeded cocci.

*Flowers & Fruits:* January to December.

*Specimen Cited:* Bochamari village, *Rajib & AP Das 0371*, dated 21.07.2007.

*Local Distribution:* Cultivated in village areas.

*General Distribution:* Tropical India and Africa.

BALAKATA Esser, *Blumea* 44: 154. 1999.

***Balakata baccata*** (Roxburgh) Esser, *Blumea* 44: 155, map 1. 1998; *Sapium baccatum* Roxburgh, *Fl. Ind. ed. 2, 3:* 694. 1832; Hooker *f.*, *Fl. Br. India* 5: 470. 1888; Long in Grierson et Long, *Fl. Bhut. 1(3):* 354. 1987; Prain, *Beng. Pl. 2:* 954. 1963. *Sapium populifolium* Wight, *Icon. Pl. Ind. Orient. 5, 2:* tab. 1950, fig. 2. 1853.

Trees, up to 26 m. Leaves ovate to elliptic, 8–20 x 4–11 cm, leathery, acuminate, margin flat, base obtuse to acute. Staminate flowers pedicel 0.5–1.5 mm long; calyx 0.5–1 mm; filaments 0.4–0.6 mm. Pistillate flowers white, pedicel 0.6–1 mm long; calyx 1 mm; style 0.1–0.5 mm; stigmata 0.75–2 mm. Fruits flattened globular; sulcate, 2 seeded.

*Flowers & Fruits:* March to October.

*Specimen Cited:* Atiamochar, *Rajib & AP Das 0231*, dated 09. 02. 2007.

*Local Distribution:* Forests near conservation area.

*General Distribution:* India: West Bengal, Bihar, Orissa, Maharastra; Bangladesh, China, Thailand, W. Malaysia, Sumatra, Borneo.

EUPHORBIA Linnaeus, *Sp. Pl. 1:* 450. 1753.

### Key to the species:

- 1a. Stem prostrate; cyathia solitary ..... *E. heyneana*
- 1b. Stem ascending to suberect; cyathia in pedunculate cymes..... 2
- 2a. Capsule pubescent ..... *E. hirta*
- 2b. Capsule glabrous ..... *E. hypericifolia*

***Euphorbia heyneana*** Sprengel in Linnaeus, *Syst. Veg* (ed. 16) 3: 791. 1826; Panda et Das, *Fl. Sambalp.*, 330. 2004. *Euphorbia microphylla* Heyne ex Roth, *Nov. Pl. Sp.* 229. 1821, *non* Lamarck, 1788 (*nomen illegitimate*); Hooker *f.*, *Fl. Brit. Ind.* 5: 252. 1887; Prain, *Beng. Pl. 2:* 925. 1963; Haines, *Bot. Bihar & Orissa pt. II:* 148. 1921; Mooney, *Suppl. Bot. Bihar & Orissa* 35. 1950. *Chamaesyce heyneana* (Sprengel) Soj k, *Cas. N r. Mus., Odd. Pr r.* 140: 169. 1972.

Annual, prostrate, spreading herbs; stem glabrous, internodes ribbed, stipules laciniate. Leaves opposite, lamina ovate to oblanceolate, serrulate, base rounded, oblique. Cyathia radish, axillary, involucre bracts tubular, glands 4. male flowers in 4-groups, staked. Female flower laterally pendulous, ovary glabrous. Capsules glabrous, seeds 3.

*Flowers & Fruits:* January to December.

*Specimen Cited:* Park, *Rajib & AP Das 0717*, dated 14. 02. 2008.

*Local Distribution:* Forests near conservation area.

*General Distribution:* India: tropical; Bhutan, China, Bangladesh, Malaysia, Myanmar, Pakistan.

***Euphorbia hirta*** Linnaeus, Sp. Pl. 454. 1753; Haines, Bot. Bihar & Orissa pt. II: 147. 1921; Guha Bakshi, Fl. Mur. Dist. 286. 1984; Long in Grierson *et* Long, Fl. Bhut. 1 (3): 766. 1987. *Euphorbia pilulifera auct. non* L. 1753; Hooker *f.*, Fl. Brit. Ind. 5: 250. 1887; Prain, Beng. Pl. 2: 925. 1963. *Euphorbia capitata* de Lamarck, Encycl. 2: 422. 1788. *Euphorbia nodiflora* Steudel, Nomencl. Bot. ed. 2, 1: 613. 1840.

Annual, erect herbs. Stem jointed, hairy, purplish. Leaves opposite, simple, base oblique, lanceolate, serrulate, acute, pubescent, stipules subulate. Flowers in terminal and axillary clustered cyathia; perianth green; stamens – 1. Fruits depressed, globose, hairy; cocci trigonous.

*Flowers & Fruits:* January to December.

*Specimen Cited:* Park, Rajib & AP Das 0382, dated 21.07.2007.

*Local Distribution:* Throughout the study areas.

*General Distribution:* tropical and subtropical regions in both hemispheres.

***Euphorbia hypericifolia*** Linnaeus, Sp. Pl. 454. 1753; Hooker *f.*, Fl. Brit. Ind. 5: 249. 1887; Long in Grierson *et* Long, Fl. Bhut. 1(3): 354. 1987; Pain, Beng. Pl., 2: 924. 1903; Guha Bakshi, Fl. Mur. Dist. 286. 1984. *Euphorbia parviflora* Linnaeus, Syst. ed. 10, 2: 1047. 1759. *Chamaesyce hypericifolia* (Linnaeus) Millspaugh, Publ. Field Columb. Mus., Bot. Ser. 2: 302. 1909. *Ditritea obliqua* Rafinesque-Schmaltz, Sylva Tellur. 115. 1838. *Euphorbia indica* Lamarck, Encycl. 2: 423. 1788.

Annual herbs, up to 50 cm. Root fibrous. Stems many from base, spreading to erect, often purplish tinged. Leaves opposite; stipules triangular; lamina ovate, 3–5 1.5–2.5 cm, rounded, obscurely toothed, base obliquely rounded. Cyathia in axillary or terminal pedunculate capitates cymes; involucre cuplike, marginal lobes triangular; glands 4, green, rounded. Male flowers slightly exerted. Female flower exerted from involucre; ovary pubescent; styles free; stigma deeply 2 lobed. Capsule 3 angular-ovoid. Seeds ovoid-tetragonal.

*Flowers & Fruits:* January to May.

*Specimen Cited:* Conservation sector, Rajib & AP Das 0713, dated 14. 02. 2008.

*Local Distribution:* Forests near conservation area.

*General Distribution:* Tropical weed in Africa and Asia.

MALLOTUS Loureiro, Fl. Cochinch. 2: 635. 1790.

***Mallotus philippensis*** (de Lamarck) M. Iler Argoviensis, Linnaea 34: 196. 1865; Hooker *f.*, Fl. Brit. Ind. 5: 442. 1887; Long in Grierson *et* Long, Fl. Bhut. 1(3): 801. 1987; Prain, Beng. Pl. 2: 950. 1963. *Croton philippense* de Lamarck, Enc. 2: 206. 1786. *Croton punctatus* Retzius ('*punctatum*'), Obs. Bot. 5: 30. 1789. *Croton coccineus* Vahl, Symb. Bot. 2: 97. 1791. *Rottlera tinctoria* Roxburgh, Pl. Corom. 2: 36, t. 168. 1802. *Croton montanum* Willdenow, Sp. Pl. 4: 547. 1805. *Rottlera philippensis* (de Lamarck) A. Jussieu *ex* Sprengel, Syst. Veg. (ed. 16) 3: 877. 1826. *Rottlera tinctoria* Roxburgh var. *monstruosa* Hamilton *ex* Dillwyn, Rev. Hortus Malab.: 22. 1839. *Rottlera aurantiaca* Hooker *et* Arnott, Bot. Beech. Voy.: 270. 1841.

Small trees, up to 15 m. Stipules triangular. Leaves alternate; lamina ovate to elliptic, 4–22 x 2–10 cm, acuminate to cuspidate, entire, base usually rounded. Inflorescences axillary and terminal, single to 2 branches. Staminate inflorescences up to 18 cm long; flowers in small groups of 3 to 4; bracts triangular. Staminate flowers green; sepals 2–4, elliptic to obovate; stamens 15–20, whitish to light green, anthers light yellow. Pistillate inflorescences up to 21 cm long; bracts triangular. Pistillate flowers, yellow to red, scented; sepals 3–6, ovate, yellow-green; ovary 2–3 locular. Fruits capsules. Seeds subellipsoid.

*Flowers & Fruits:* March to August.

*Specimen Cited:* Atiamochar, *Rajib & AP Das 0735*, dated 14. 02. 2008.

*Local Distribution:* Forests near conservation area.

*General Distribution:* India: throughout; Bhutan, Nepal, Bangladesh, China, Sri Lanka to Taiwan, throughout Malesia to Australia and W. Pacific.

### **Hypericaceae** A.L. de Jussieu, Gen. Pl. 254. 1789 ('Hyperica').

HYPERICUM Linnaeus, Sp. Pl. 2: 783. 1753.

*Hypericum japonicum* Thunburgh, Syst. Veg. ed. 14: 702. 1784; Prain, Beng. Pl. 1: 244. 1963. *Hypericum nervatum* Hance, Ann. Bot. Syst. 2: 188. 1851. *Hypericum chinense* Osbeck, Dagb. Ostind. Resa 244. 1757. *Brathys orysetum* Blume, Mus. Bot. 2: 20. 1856. *Hypericum japonicum* Murray, Syst. Veg. ed. 14: 702. 1784; Dyer in Fl. Brit. Ind. 1: 256. 1874; Hara *et al.*, Enn. Fl. Pl. Nep. 2: 62. 1979; Fl. Ind. 3: 69. 1993; Grierson *et Long* in Grierson *et Long*, Fl. Bhut. 1(2): 376. 1984. [PLATE: 5, Figure-45]

Annular herbs, 5–25 cm. Suberect or diffuse, sometimes prostrate, stems quadrangular, branches dichotomous, rooting at basal nodes. Leaves sessile, 3–8 x 1–5 mm, lamina elliptic-ovate to oblanceolate, obtuse or rounded, cordate. Flowers in terminal dichotomous often broad cymes; bracts linear, sepals elliptic-obovate, acute to sub obtuse; petals yellow. Capsules ovoid.

*Flowers & Fruits:* throughout the year.

*Specimen Cited:* Rasik Beel, *Rajib & AP Das 0095*, dated 07. 02. 2007.

*Local Distribution:* Throughout the study areas.

*General Distribution:* India: tropical states; Nepal, Bhutan, Bangladesh, Sri Lanka, Myanmar, China, Taiwan, Vietnam.

### **Putranjivaceae** J.G. Agardh, Theoria Syst. Pl. Fam. Phan. 301. 1858 ('Putranjiveae').

PUTRANJIVA Wallich, Tent. Fl. Nepal. 61. 1826.

*Putranjiva roxburghii* Wallich, Tent. Fl. Nepal. 61. 1826; Hooker *f.*, Fl. Brit. Ind. 5: 336. 1887; Prain, Beng. Pl. 2: 936. 1963. *Nageia putranjiva* Roxburgh, Fl. Ind. ed. 1832 3: 766. 1832. *Drypetes roxburghii* (Wallich) Hurusawa, J. Fac. Sci. Univ. Tokyo, Sect. 3, Bot. 6: 335. 1954.

Dioecious tree, up to 15 m, with drooping leaves. Leaves distichous; lamina oblong to elliptic, 4–14 x 2–5 cm, subcoriaceous, glabrous, acuminate to obtuse, crenate or serrate, slightly undulate, base obliquely cuneate. Flowers yellowish green. Staminate flowers axillary in dense clusters; pedicel short; sepals 4 to 5, unequal, margin ciliate; stamens 3 to 4; disc absent. Pistillate flowers 1–4 together; pedicel short; sepals 5, lobes erect, very unequal; ovary densely hairy; stigmas 2 to 3. Fruits ovoid to globose, 1 seeded.

*Flowers & Fruits:* May to October.

*Specimen Cited:* Conservation sector, *Rajib & AP Das 0466*, dated 23.07.2007.

*Local Distribution:* Planted near Pond for Ghorial.

*General Distribution:* India: cultivated throughout; China, W. Himalaya to Burma, Indo-China, Java, Papua New Guinea.

### **Passifloraceae** A.L. de Jussieu, Ann. Mus. Hist. Nat. Paris 6: 102. t. 37-41. 1805 ('Passifloreae'); *nom. cons.*

PASSIFLORA Linnaeus, Sp. Pl. 2: 955. 1753, *nom. cons.*

*Passiflora foetida* Linnaeus, Sp. Pl. 959. 1753; Prain, Beng. Pl. 1: 512. 1963. *Dysosmia hircina* Sweet ex M. Roemer, Fam. Nat. Syn. Monogr. 2: 150. 1846. *Passiflora balansae* Chodat, Bull. Herb. Boissier 2: 744. 1902. *Passiflora hirsuta* Loddiges, Bot. Cab. 2(4): t. 138. 1818. *Passiflora variegata* Miller, Gard. Dict. (ed. 8) no. 8 no. 8. 1768.

*Vernacular name:* Jhumkolata.

Herbaceous vines, foul smelling. Stem slender, spreading pubescent. Stipules partly clasping, deeply parted. Leaves simple, opposite; lamina broadly ovate to oblong-ovate, 5–12 × 3–8 cm, irregularly undulate, acute, base cordate, membranous. Inflorescence reduced to a single flower, opposite tendril. Flowers white. Sepals awned. Petals 1–1.5 cm. Corona 3–5 seriate, membranous. Stamens coherent at base, flat; anthers oblong. Ovary shortly stipitate, ellipsoid. Berry orange-red, ovoid-globose.

*Flowers & Fruits:* August to February.

*Specimen Cited:* Rasik Beel, Rajib & AP Das 0112, dated 07.02.2007.

*Local Distribution:* Forest floor.

*General Distribution:* India: native to the West Indies and N South America.

**Phyllanthaceae** J.G. Agardh, Theoria Syst. Pl. Fam. Phan. 249. 1858 ('Phyllantheae').

**Key to the genera:**

- |  |                           |
|--|---------------------------|
| 1a. Flowers with petals and disk .....                 | <b><i>Bridelia</i></b>    |
| 1b. Flowers without petals .....                       | 2                         |
| 2a. Flowers without disk .....                         | <b><i>Sauropus</i></b>    |
| 2b. Flowers with a prominent, usually fleshy disk..... | 3                         |
| 3a. Male flowers with prominent pistillode .....       | <b><i>Flueggea</i></b>    |
| 3b. Male flowers without pistillode .....              | <b><i>Phyllanthus</i></b> |

BRIDELIA Willd., Sp. Pl. 4: 978. 1806;

***Bridelia retusa*** (Linnaeus) A. Jussieu, Euphorb. Gen.: 109, t. 7, f. 22. 1824; Long in Grierson *et* Long, Fl. Bhut. 1(3): 769. 1987; Prain, Beng. Pl. 2: 927. 1963. *Clutia retusa* Linnaeus, Sp. Pl.:1042. 1753. *Clutia spinosa* Roxburgh, Pl. Corom. 2: 38, t. 172. 1802. *Bridelia spinosa* (Roxburgh) Willdenow, Sp. Pl. 4: 979. 1806. *Bridelia retusa* (Linnaeus) Sprengel, Syst. Veg. 3: 48. 1826, *pro comb. nov.*; *Bridelia squamosa* (de Lamarck) Gehrmann, Bot. Jahrb. Syst. 41, Beibl. 95: 30. 1908. *Bridelia cambodiana* Gagnepain, Bull. Soc. Bot. France 70: 432. 1923. *Bridelia pierrei* Gagnepain, Bull. Soc. Bot. France 70: 434. 1923;

Small tree, up to 15 m. Stipules ovate triangular, whitish woolly, early caducous. Petiole glabrous; lamina obovate, 6–22 × 3–11 cm, emarginate to obtuse or acute, entire to shallowly crenate, base rounded to obtuse. Inflorescences on leafless branches and spike-like. Staminate flowers pale yellowish green to brown; pistillate flowers reddish to brown. Sepals ovate-triangular. Petals variable in shape, base spatulate. Stamens white; anthers ovoid, reddish to purplish. Ovary globose; styles 2, only basally united, stigmas shortly bifid. Fruits depressed-globose. Seeds semigloboid.

*Flowers & Fruits:* May to December.

*Specimen Cited:* Atiamochar forest, Rajib & AP Das 0575, dated 25.07.2007.

*Local Distribution:* Forests near conservation area.

*General Distribution:* India, Bhutan, S. China, Sri Lanka, Myanmar, Indochina, Thailand, Malay Peninsula, Sumatra.

FLUEGGEEA Willdenow, Sp. Pl. 4: 637, 757. 1805.

*Flueggea virosa* (Roxburgh ex Willdenow) Voigt, Hort. Suburb. Calc.: 152. 1845; Long in Grierson et Long, Fl. Bhut. 1(3): 775. 1987. *Phyllanthus virosus* Roxburgh ex Willdenow, Sp. Pl. 4: 578. 1805. *Xylophylla obovata* Willdenow, Enum. Hort. Berol.: 329. 1809. *Flueggea microcarpa* Blume, Bijdr.: 580. 1825; Prain, Beng. Pl. 2: 931. 1963. *Securinega virosa* (Roxburgh ex Willdenow) Baillon, Adansonia 6: 334. 1866; *Securinega microcarpa* (Blume) M ller Argoviensis in de Candolle, Prod. 15, 2: 434. 1866. *Securinega obovata* (Willdenow) M ller Argoviensis in de Candolle, Prod. 15, 2: 449. 1866. *Flueggea obovata* (Willdenow) Wallich ex Villars, Novis. App.: 189. 1880.

Tall shrubs, up to 4 m, dioecious. Leaves distichous; lamina elliptic to obovate, 1 — 8 x 0.6 — 5 cm, papery; rounded to slightly acuminate, margin flat, base usually attenuate. Inflorescences fascicles. Flowers white; sepals outer two smaller than inner 3. Staminate greenish to yellowish, pendulous, sweet scented; filaments white; disc glands fleshy, yellow; pistillode deeply divided into 3 branches. Pistillate flowers green; sepals 0.7 — 1 mm diameter, disc annular; ovary 1 x 0.8 mm wide. Fruits globular.

*Flowers & Fruits:* April to October.

*Specimen Cited:* Atiamochar forest, *Rajib & AP Das 0704*, dated 14. 02. 2008.

*Local Distribution:* Forests near conservation area.

*General Distribution:* India, Bhutan, China, Tropical Africa and Asia to Japan, Australia and Polynesia.

SAUROPLUS Blume, Bijdr. 595. 1826.

*Sauropus quadrangularis* (Willdenow) M ller Argoviensis, Linnaea 32: 73 1863; Hooker f., Fl. Br. India 5: 335. 1887; Long in Grierson et Long, Fl. Bhut. 1(3): 783. 1987; Prain, Beng. Pl. 2: 932. 1963. *Phyllanthus quadrangularis* Willdenow, Sp. Pl. 4: 585. 1805. *Ceratogynum rhamnoides* Roxburgh ex Wight, Icon. Pl. Ind. Orient. 5: t. 1900. 1852. *Sauropus compressus* M ller Argoviensis in de Candolle, Prodr. 15, 2: 243. 1866. *Sauropus pubescens* Hooker f., Fl. Brit. Ind. 5: 335. 1887. *Sauropus compressus* M ller Argoviensis var. *compressus*: Chakraborty & M.G. Gangopau, J. Econ. Tax. Bot. 20: 526, fig. 4. 1996.

Woody herbs to small shrubs, up to 2 m. Stipules triangular to sometimes strongly falcate. Lamina elliptic to obovate, 0.6 – 4 x 0.5 – 2 cm, slightly emarginated to rounded, often mucronulate, revolute, base often slightly oblique and asymmetric, rounded to cuneate. Flowers in small axillary fascicles with both sexes, yellow to deep red. Staminate flowers glabrous; calyx flat, lobes heart-shaped. Pistillate flowers glabrous; ovary 1 x 1.7 mm; stigmas erect. Fruits ovoid.

*Flowers & Fruits:* March to October.

*Specimen Cited:* Atiamochar forest, *Rajib & AP Das 0366*, dated 21.07.2007.

*Local Distribution:* Throughout the study areas.

*General Distribution:* India throughout; Bhutan, Nepal, China, Myanmar, Thailand, Laos, Cambodia, Vietnam.

PHYLLANTHUS Linnaeus, Sp. Pl. 2: 981. 1753.

#### Key t the genera:

- 1a. Large or small trees ..... 2
- 1b. Herbs or small shrubs ..... 3
- 2a. Stipules triangular-ovate, ciliate; fruit greenish yellow ..... *P. emblica*
- 2b. Stipules lanceolate to linear oblong; fruits blackish or purplish .... *P. reticulatus*
- 3a. Axillari fascicle usually bisexual ..... *P. urinaria*



- 3b. Axillari fascicle usually unisexual ..... 4  
 4a. Filament free ..... *P. virgatus*  
 4b. Filament connate in column ..... 5  
 5a. Capsules triangular globose ..... *P. amarus*  
 5b. Capsules depressed globose ..... *P. fraterous*

***Phyllanthus amarus*** Schumacher *et* Thonning, Naturvidensk. Math. Afd. 4: 195. 1829; Hara *et al.*, Enn. Fl. Pl. Nep. 3: 198. 1982. *Phyllanthus niruri* auct. non Linnaeus, Hooker *f.*, Fl. Brit. Ind. 5: 298. 1887; H. Ohashi in Hara, Fl. E. Himal. 181. 1966; Prain, Beng. Pl. 2: 936. 1963. *Phyllanthus nanus* Hooker *f.*, Fl. Brit. India 5: 298. 1887. *Diasperus nanus* (Hooker *f.*) Kuntze, Revis. Gen. Pl. 2: 601. 1891.

Annual or biennial, erect or prostrate, herbs, up to 150 cm. Leaves distichous; stipules linear to linear-lanceolate, green; lamina oblong to elliptic-oblong, 3–8 × 2–4 mm, thinly papery, obtuse, base rounded. Plants monoecious. Flower fascicles along lower part of leafy shoots usually male, middle usually bisexual with 1 female and 1 male flower. Male flowers: sepals 5, elliptic to ovate, abruptly acute; disk glands 5; stamens 3; filaments completely connate into a column; anthers sessile. Female flowers: sepals 5, obovate-oblong to ovate; disk flat to subulate, deeply 5 lobed; ovary globose-triangular; styles free. Capsules triangular globose, smooth. Seed sharply 3 angled.

*Flowers & Fruits:* Through out the year.

*Specimen Cited:* Garden, Rajib & AP Das 0431, dated 22.07.2007.

*Local Distribution:* Throughout the study areas.

*General Distribution:* pantropical weed possibly originating in the Americas

***Phyllanthus urinaria*** Linnaeus, Sp. Pl. 2: 982. 1753; Hooker *f.*, Fl. Brit. Ind. 5: 293. 1887; Haines, Bot. Bihar & Orissa pt. II: 125. 1921; Long in Grierson *et* Long, Fl. Bhut. 1(3): 772. 1987; Prain, Beng. Pl. 2: 935. 1963. *Diasperus urinaria* (Linnaeus) Kuntze, Revis. Gen. Pl. 2: 601. 1891. *Phyllanthus cantoniensis* Schweigg, Enum. Pl. Hort. Regiom. 54. 1812.

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:* April to December.

*Specimen Cited:* Garden, Rajib & AP Das 0464, dated 23.07.2007.

*Local Distribution:* Throughout the study areas.

*General Distribution:* Tropical India; Bhutan, Chian, Nepal, Sri Lanka, Indonesia, Japan, Laos, Malaysia, Thailand, Vietnam; Pantropical, Native to South America.

***Phyllanthus fraternus*** G.L.Webster in Contr. Gray. Herb. 176: 53. 1955 and in J. Arnold Arbor. 38: 308. 1957. *Phyllanthus niruri* auct. pl. non l. 1753, Hooker *f.*, Fl. Brit. Ind. 5: 298. 1887; Prain, Beng. Pl. 2: 936. 1963. *Phyllanthus fraternus* subsp. *togoensis* Jean F.Brunel & J.P. Roux, Bull. Soc. Bot. France 122: 161. 1975.

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. to February.

*Specimen Cited:* Garden, Rajib & AP Das 0508, dated 23.07.2007.

*Local Distribution:* Throughout the study areas.

*General Distribution:* Pantropical, Native to South America.

***Phyllanthus virgatus*** G.Froster *f.*, Fl. Ins. Austrl. Prodr. 65. 1786. (*ut virgata*) Airy Shaw, Kew. Bull. 26: 325. 1972; Long in Grierson *et* Long, Fl. Bhut. 1(3): 772. 1987; Guha Bakshi, fl. Mus. Dist. 294.1984. *Phyllanthus simplex* Retzius, Obs. Bot. 5: 29. 1789; (Var. *genurinus*); Hooker *f.*, Fl. Brit. Ind. 5: 295. 1887; Prain, Beng. Pl. 2: 936. 1903. *Phyllanthus simplex* var. *virgatus* (Froster *f.*) M Iler Argoviensis, Linnaea 32: 32. 1863 and in de Candolle, prodr. 15(2): 391. 1866. *Diasperus virgatus* (G.Forster) Kuntze, Revis. Gen. Pl. 2: 597. 1891.

Small annual herbs, up to 80 cm, monoecious; stem slightly woody at base. Stipules membranous; petiole short; lamina thinly leathery, linear-lanceolate to narrowly elliptic, 5–25 × 2–6 mm, obtuse to acute, base slightly obliquely rounded. Inflorescences bisexual, axillary fascicles with 2–4 male and 1 female flower. Male flowers: sepals 6, broadly ovate to rotund; disk glands 6, oblong; stamens 3; filaments free; anthers subglobose. Female flowers: sepals 6, ovate-oblong, reflexed, purple with whitish membranous margins, persistent in fruit; ovary globose, 3 celled; styles 3. Capsules oblate. Seeds trigonous.

*Flowers & Fruits:* June to February.

*Specimen Cited:* Garden, Rajib & AP Das 0419, dated 22.07.2007.

*Local Distribution:* Throughout the study areas.

*General Distribution:* Tropical India; Bhutan, Nepal, Sri Lanka, Indonesia, Laos, Malaysia, Cambodia, Thailand, Vietnam; Pacific islands.

***Phyllanthus emblica*** Linnaeus, Sp. Pl. 2: 982. 1753; Hooker *f.*, Fl. Brit. Ind. 5: 289. 1887; Long in Grierson *et* Long, Fl. Bhut. 1(3): 772. 1987; Prain, Beng. Pl. 2: 935. 1963. *Embllica officinalis* Gaertner, Fruct. 122-123, Pl. 108, f. 2. 1790. *Embllica officinalis* Gaertner, Fruct. Sem. Pl. 2: 122. 1790. *Embllica arborea* Rafinesque-Schmaltz, Sylva Tellur. 91. 1838.

*Vernacular Name:* Amlaki.

Small trees, up to 12 m, monoecious, deciduous; leafy shoots angular. Leaves distichous; stipules triangular-ovate, ciliate; lamina oblong to linear-oblong, 8–22 × 1.5–6 mm, papery to leathery, truncate, mucronate to retuse at tip, narrowly revolute, base shallowly cordate, oblique. Fascicles with many male flowers and sometimes 1 or 2 larger female flowers. Male flowers: sepals 6, yellow; stamens 3; anthers erect, oblong. Female flowers: sepals 6, oblong or spatulate; ovary ovoid; styles 3, connate at base, deeply bifid. Fruit a drupe, globose, greenish yellow, exocarp fleshy. Seeds reddish.

*Flowers & Fruits:* April to September.

*Specimen Cited:* Rasik Beel village, Rajib & AP Das 0490, dated 23.07.2007.

*Local Distribution:* Cultivated in village areas.

*General Distribution:* India: tropical part; Bhutan, Nepal, Sri Lanka, Cambodia, Indonesia, Laos, Malaysia, Myanmar, Philippines, Thailand; South America.

***Phyllanthus reticulatus*** Poiret in de Lamarck, Encycl. M th. 5: 298. 1804; Hooker *f.*, Fl. Brit. Ind. 5: 288. 1887; Long in Grierson *et* Long, Fl. Bhut. 1(3): 773. 1987; Prain, Beng. Pl. 2: 935. 1963. *Kirganelia reticulata* (Poiret) Baillon, tude G n. Euphorb.: 613. 1858. *Cicca reticulata* (Poiret) Kurz, Forest Fl. Burma 2: 354. 1877. *Anisonema reticulatum* (Poiret) A. Jussieu, Euphorb. Gen. 4. 1824. *Diasperus reticulatus* (Poiret) Kuntze, Revis. Gen. Pl. 2: 600. 1891.

Small trees, up to 4 m. Stipules lanceolate to linear oblong. Lamina elliptic, 3–4 × 0.6–1 cm, obtuse or orbicular, entire, base cuneate. Flowers in bisexual cymes, each with several staminate flowers and 1 to 2 pistillate flowers. Staminate flowers: sepals 5 to 6, oblong to obovate or suborbicular; stamens 5. Pistillate flowers: sepals 5 or 6, oblong to elliptic; ovary glabrous. Fruits depressed globose, blackish or purplish. Seeds plano-convex.

*Flowers & Fruits:* Through out the year.

*Specimen Cited:* Atiamochar forest, *Rajib & AP Das 0444*, dated 22.07.2007.

*Local Distribution:* Throughout the study areas.

*General Distribution:* Tropical India; Bhutan, China, Sri Lanka, Burma, Vietnam, Laos, Peninsular Malaysia.

**Salicaceae** Mirbel, *Elem. Phys.* V6g. 2: 905. 1815 ('Salicineae'); *nom. cons.*

SALIX Linnaeus, *Sp. Pl.* 2: 1015. 1753.

*Salix tetrasperma* Roxburgh, *Pl. Coromandel* 1: 66, pl. 97: 66. 1795; Grierson *et* Long in Grierson *et* Long, *Fl. Bhut.* 1(1): 66. 1983; Prain, *Beng. Pl.* 2: 989. 1963. *Pleiarina tetrasperma* (Roxburgh) N. Chao & G.T. Gong, *J. Sichuan For. Sci. Techn.* 17(2): 6. 1996.

Trees up to 10m tall. Buds narrowly ovoid, glabrous, apex acute. Stipules obliquely ovate, glandular, serrate. Leaves simple, alternate; lamina ovate to linear lanceolate, 6 – 14 x 2 – 4 cm, serrate, acuminate, base cuneate or suborbicular, abaxially pale, adaxially green, glabrous, shiny. Male catkin 10cm; peduncle with 2 or 3 pilose leaflets; rachis densely pubescent or woolly; bracts elliptic. Stamens usually 8; anthers yellow, ovoid. Female catkin nearly as long as male catkin. Ovary ovoid; style short; stigma 2 lobed. Capsule ovoid, glabrous.

*Flowers & Fruits:* November to April.

*Specimen Cited:* Central Island of Beel complex, *Rajib & AP Das 0270*, dated 10. 02. 2007.

*Local Distribution:* Planted at Beel complex.

*General Distribution:* India: tropical parts; Indonesia, Malaysia, Myanmar, Pakistan, Philippines, Thai-land, Vietnam.

**Violaceae** Lamarck *et* De Candolle, *Fl. Franc.* ed. 3. 5: 801. 1805.

VIOLA Linnaeus, *Sp. Pl.* 2: 933. 1753.

*Viola tricolor* Linnaeus, *Sp. Pl.* 935. 1753. *Viola tricolor* var. *hortensis* de Candolle, *Prodr.* 1: 303. 1824.

Annual or biennial herbs. Stems erect, angled, branched. Basal leaf blade narrowly ovate to lanceolate, long petiolate; stipules large, leaflike; cauline leaf blade ovate to oblong lanceolate, remotely crenate, rounded or obtuse, base rounded. Flowers solitary in leaf axils, usually 3 colored (purple, white and yellow), with 3 – 10 flowers per stem. Sepals green, oblong-lanceolate, apex acute. Corolla flat; upper petals deep purpleviolet, lateral petals and anterior one 3 colored. Ovary glabrous; styles short; stigmas enlarged, globose. Capsule ellipsoid.

*Flowers & Fruits:* April to September.

*Specimen Cited:* Garden, *Rajib & AP Das 0186*, dated 09. 02. 2007.

*Local Distribution:* Garden.

*General Distribution:* India: native to Europe.

**Order: Fabales** Bromhead (1838)

**Fabaceae** H.G.L. Reichenbach, *Consp. Regni Veg.* 149. 1828 (*nom. cons. prop.*; *nom. alt.* vs. *Leguminosae et Papilionaceae*).

**Key to the genera:**

1a. Leaves simple or with 2 to many leaflets .....	3
1b. Leaves pinnate .....	2
2a. Leaves evenly pinnate or bipinnate; flowers large, zygomorphic .....	17
2b. Leaves usually bipinnate; flowers small, regular .....	23
3a. Anthers dimorphic .....	4
3b. Anthers uniform in size and shape .....	32
4a. Legumes transversely septate and breaking up into 1-seeded joints ....	5
4b. Legumes not transversely septate .....	6
5a. Inflorescences racemose, lax; bracts membranous, usually persistent .....	<i>Aeschynomene</i>
5b. Inflorescences usually scorpioid-cymose, congested; bracts scarious, caducous .....	<i>Smithia</i>
6a. Climbing or weak plants or trees or tall shrub .....	7
6b. Erect subshrubs .....	<i>Crotalaria</i>
7a. Style flattened .....	8
7b. Style generally terete .....	12
8a. Flowers generally resupinate .....	<i>Clitoria</i>
8b. Flowers not resupinate .....	9
9a. Flowers mostly adapted to birds or bats for pollination .....	10
9b. Flowers mostly adapted to bees for pollination .....	<i>Pueraria</i>
10a. Trees; stems with prickles .....	<i>Erythrina</i>
10b. Climbers or trees; if trees, then stems without prickles .....	11
11a. Legume with many seeds, 2-valved .....	<i>Mucuna</i>
11b. Legume samaroid with 1 apical seed .....	<i>Butea</i>
12a. Legumes breaking up into 1-seeded segments when ripe .....	13
12b. Legumes not breaking up into separate segments when mature .....	14
13a. Joints of legume plicate-retrofracted .....	<i>Uraria</i>
13b. Joints of legume not plicate-retrofracted .....	<i>Desmodium</i>
14a. Stamens monadelphous and filaments partly connate .....	<i>Tephrosia</i>
14b. Stamens diadelphous, mostly vexillary filament free .....	15
15a. Legumes indehiscent .....	<i>Dalbergia</i>
15b. Legumes dehiscent .....	16
16a. Rachis of leaves ending in a tendril .....	<i>Abrus</i>
16b. Rachis of leaves not ending in a tendril .....	<i>Sesbania</i>
17a. Leaves simple, entire or 2-lobed or divided and 2-foliolate .....	<i>Bauhinia</i>
17b. Leaves once pinnate or bipinnate .....	18
18a. Leaves usually bipinnate .....	20
18b. Leaves once pinnate .....	19
19a. Anthers dorsifixed, opening by lateral slits .....	21
19b. Anthers basifixed, opening by apical pores .....	22
20a. Plants unarmed; trees .....	<i>Delonix</i>
20b. Plants usually armed with prickles; climbers .....	<i>Caesalpinia</i>
21a. Bracteoles sepaloid or petaloid .....	<i>Tamarindus</i>
21b. Bracteoles not sepaloid or petaloid .....	<i>Saraca</i>
22a. Petioles and rachis of leaves without glands; stamens sigmoidally curved ...	<i>Cassia</i>
22b. Petioles and rachis of leaves with; filaments straight .....	<i>Senna</i>

23a. Stamens 10 or fewer .....	25
23b. Stamens numerous, usually more than 10 .....	24
24a. Filaments free or only connate at base .....	<i>Acacia</i>
24b. Filaments connate into a tube .....	27
25a. Tall trees, more than 6m tall .....	<i>Adenanthera</i>
25b. Small trees or shrubs, less than 6m tall .....	26
269a. Armed plant; leaflets sensitive .....	<i>Mimosa</i>
26b. Unarmed plant; leaflets not sensitive .....	<i>Leucaena</i>
27a. Legume septate between seeds, thick, fleshy .....	<i>Samanea</i>
27b. Legume not septate between seeds, flat, thin .....	<i>Albizia</i>

ABRUS Adanson, Fam. Pl. 2: 327, 511. 1763.

### Key to the species:

- 1a. Seeds conspicuously glossy black and red, subglobose ..... *A. precatorius*
- 1b. Seeds uniformly dark brown to almost black, compressed ..... *A. pulchellus*

*Abrus pulchellus* Wallich ex Thwaites, Enum. Pl. Zeyl. 91. 1859; Grierson *et* Long in Grierson *et* Long, Fl. Bhut. 1(3): 655. 1987; Prain, Beng. Pl. 1: 369. 1963.

*Vernacular name:* Kuch.

Large, slender, climbing, lianas. Leaves paripinnate, alternate; leaflets 6–10 paired, opposite; blades suboblong to obovateoblong, 0.5–3.5 x 0.3–1 cm, base rounded or subcordate, truncate and with mucro. Racemes axillary. Flowers dense. Calyx campanulate, 4 toothed. Corolla white or purple red. Stamens 9. Legumes oblong, dehiscent, with 4–8 seeds. Seeds black-brown, elliptic to ovoid.

*Flowers & Fruits:* April to August.

*Specimen Cited:* Near conservation sector, *Rajib & AP Das 0114*, dated 07. 02. 2007.

*Local Distribution:* Atiamochar forest.

*General Distribution:* India: through out; Bhutan, China, Bangladesh, Nepal, Sri Lanka, Myanmar, Indonesia, Malaysia, Cambodia, Philippines, Thailand, Vietnam.

*Abrus precatorius* Linnaeus, Syst. Nat., ed. 12, 2: 472. 1767; Grierson *et* Long in Grierson *et* Long, Fl. Bhut. 1(3): 655. 1987; Prain, Beng. Pl. 1: 369. 1963. *Abrus tunguensis* P. Lima, Broteria, Ser. Bot. 19: 127. 1921. *Glycine abrus* Linnaeus, Sp. Pl. 2: 753. 1753.

*Vernacular name:* Lalkuch.

Large, slender, much branched, climbing, lianas. Leaves paripinnate; leaflets 8–12 paired, opposite; blades suboblong, Fl. Bhut. 1 – 2 x 0.3 – 0.8 cm, base rounded, truncate and with mucro. Racemes axillary. Flowers small, dense. Calyx campanulate, 4 toothed. Corolla purple; wings and keels narrower. Stamens 9. Ovary hairy. Legumes oblong, dehiscent, with 2–5 seeds. Seeds lustrous, black in lower part, red in upper part, subglobose.

*Flowers & Fruits:* March to August.

*Specimen Cited:* Atiamochar forest, *Rajib & AP Das 0255*, dated 10. 02. 2007.

*Local Distribution:* Atiamochar forest.

*General Distribution:* Widespread in the tropical India; tropical Asia.

ACACIA Miller, Gard. Dict. Abr., ed. 4, [25]. 1754, nom. cons.

**Key to the species:**

- 1a. Flowers in racemes or spikes ..... *A. catechu*  
 1b. Flowers in heads, then rearranged in panicles ..... *A. pennata*

***Acacia catechu*** (Linnaeus f.) Willdenow, Sp. Pl. 4: 1079. 1806; Grierson *et* Long in Grierson *et* Long, Fl. Bhut. 1(3): 642. 1987; Prain, Beng. Pl. 1: 458. 1963. *Mimosa catechu* Linnaeus f., Suppl. Pl. 439. 1782.

*Vernacular name:* Khayer.

Deciduous, small trees, up to 10 m. Branchlets with a pair of flat, hooked spines below stipules. Leaf glands near petiolar base and between several upper leaflets of rachis; pinnae 15 – 30 pairs; leaflets 30 – 50 pairs, linear, 2 – 6 x 1 – 1.5 mm. Spikes 1–4, axillary. Flowers white. Calyx campanulate. Petals lanceolate to oblanceolate. Stamens numerous. Ovary glabrous. Legume brown, dehiscent, apex rostrate. Seeds 3 – 10.

*Flowers & Fruits:* April to September.

*Specimen Cited:* Plantation forest, *Rajib & AP Das 0320*, dated 21.07.2007.

*Local Distribution:* Plantation forest.

*General Distribution:* India: through out; Bhutan, Bangladesh, Nepal, Pakistan, Sri Lanka, Myanmar, Thailand; introduced elsewhere.

***Acacia pennata*** (Linnaeus) Willdenow, Sp. Pl. 4: 1090. 1806; Grierson *et* Long in Grierson *et* Long, Fl. Bhut. 1(3): 641. 1987; Prain, Beng. Pl. 1: 459. 1963. *Mimosa pennata* Linnaeus, Sp. Pl. 1: 522. 1753.

Large climbers, with copious, scattered prickles. Stipules lanceolate, cuspidate; petiolar glands subpeltate; pinnae 10 – 20 pairs; leaflets 40 – 50 pairs, densely crowded, linear, 5 – 10 x 0.5 – 1 mm, base truncate, ciliate, sharply acute, asymmetric. Heads solitary or 2 to 3 fasciculate, globose, arranged in axillary or terminal panicles. Calyx subcampanulate, 5 toothed. Ovary puberulent. Legume strap shaped, 12 – 18 x 2 – 4 cm. Seeds black, 8 – 12, narrowly elliptic.

*Flowers & Fruits:* March to October.

*Specimen Cited:* Forest, *Rajib & AP Das 0289*, dated 10. 02. 2007.

*Local Distribution:* Atiamochar forest.

*General Distribution:* India: through out; Bhutan, Nepal, Sri Lanka, Cambodia, Malaysia, Myanmar, Thailand, Vietnam.

ADENANTHERA Linnaeus, Sp. Pl. 1: 384. 1753.

***Adenantha pavonina*** Linnaeus, Sp. Pl. 1: 556. 1753; Grierson *et* Long in Grierson *et* Long, Fl. Bhut. 1(3): 636. 1987; Prain, Beng. Pl. 1: 452. 1963.

*Vernacular name:* Lalchandan bichi.

Small trees, up to 16 m. Petiole and rachis puberulent; pinnae 3 – 5 pairs; leaflets 4 – 8 pairs, alternate, oblong to ovate, 2.5 – 3 x 1.5 – 2 cm, both ends rounded-obtuse. Racemes simple, axillary or arranged in panicles at apices. Flowers yellow, small, fragrant. Calyx golden yellow puberulent. Petals oblong, slightly connate at base. Stamens 3 – 4 mm. Ovary nearly sessile; stigma small. Legume narrowly oblong, Fl. Bhut. 1 2 – 18 x 1 – 1.5 cm, valves contorted after dehiscence.

Seeds scarlet, suborbicular to ellipsoidal.

*Flowers & Fruits:* April to October.

*Specimen Cited:* Park, Rajib & AP Das 0315, dated 10. 02. 2007.

*Local Distribution:* Cultivated in Park.

*General Distribution:* Cultivated pantropical.

ALBIZIA Durazzini, Mag. Tosc. 3(4): 13. 1772.

### Key to the species:

- |   |                        |
|---|------------------------|
| 1a. Midvein of leaflets medial or eccentrically close to lower margin ..... | <i>A. procera</i>      |
| 1b. Midvein of leaflets eccentrically close to upper margin .....           | 2                      |
| 2a. Leaflets more than 2 cm large .....                                     | 3                      |
| 2b. Leaflets less than 1 cm large .....                                     | <i>A. chinensis</i>    |
| 3a. Inflorescens 30 – 40 flowered corymbs.....                              | <i>A. lebeck</i>       |
| 3b. Inflorescens 10 – 15 flowered panicles .....                            | <i>A. odoratissima</i> |

*Albizia chinensis* (Osbeck) Merrill, Amer. J. Bot. 3: 575. 1916; Grierson *et* Long in Grierson *et* Long, Fl. Bhut. 1(3): 646. 1987. *Mimosa chinensis* Osbeck, Dagb. Ostind. Resa, 233. 1757.

*Vernacular name:* Shirish.

Large deciduous, trees, up to 30 m. Stipules deciduous, cordate, large; glands just below junctions of pinnae; pinnae 6 – 12 pairs; leaflets 25 – 35 pairs, sessile, oblong-linear, base subtruncate, ciliate, apex acuminate. Heads 12 – 20 flowered, arranged in a terminal panicle. Flowers dimorphic, green-white. Calyx funnelshaped, shortly 5 toothed. Corolla just double of calyx; lobes ovate-deltoid. Stamens slightly longer than corolla tube. Ovary yellow-brown. Legume indehiscent. Seeds elliptic, flat.

*Flowers & Fruits:* March to December.

*Specimen Cited:* Near conservation sector, Rajib & AP Das 0394, dated 22.07.2007.

*Local Distribution:* Atiamochar forest.

*General Distribution:* Throughout India; most areas with a seasonal climate in S and SE Asia.

*Albizia lebeck* (Linnaeus) Bentham, London J. Bot. 3: 87. 1844 [“lebbek”]; Grierson *et* Long in Grierson *et* Long, Fl. Bhut. 1(3): 644. 1987; Prain, Beng. Pl. 1: 461. 1963. *Mimosa lebeck* Linnaeus, Sp. Pl. 1: 516. 1753.

*Vernacular name:* Sada shirish.

Small, deciduous, trees, up to 12 m. Stipules caducous, small; leaf rachis with disklike glands near base and at base of pinnae; pinnae 2 – 4 pairs; leaflets 4 – 8 pairs, narrowly elliptic to slightly obliquely oblong, Fl. Bhut. 2 – 5 x 1 – 2 cm, base oblique, obtuse to retuse. Corymbs 30 – 40 flowered. Flowers dimorphic, fragrant. Calyx funnel shaped, with short teeth. Corolla green yellow; lobes deltoid-ovate. Stamens white; tube shorter than corolla tube. Ovary glabrous, sessile. Legume straw-colored, strap-shaped, flat. Seeds brown.

*Flowers & Fruits:* May to September.

*Specimen Cited:* Atiamochar forest, Rajib & AP Das 0649, dated 12. 02. 2008.

*Local Distribution:* Atiamochar forest.

*General Distribution:* Throughout India; native to tropical Africa; introduced or naturalized in Bangladesh, Bhutan, Myanmar, Nepal, Pakistan, Sri Lanka.

*Albizia odoratissima* (Linnaeus *f.*) Bentham, London J. Bot. 3: 88. 1844; Grierson *et* Long in Grierson *et* Long, Fl. Bhut. 1(3): 644. 1987; Prain, Beng. Pl. 1: 461. 1963. *Mimosa odoratissima* Linnaeus *f.*, Suppl. Pl. 437. 1782.

*Vernacular name:* Kalo shirish.

Small evergreen, trees, up to 15 m. Stipules filiform; leaf glands 2 cm above base of petiole and rachis between first and second pinnae, elliptic; pinnae 2–4 pairs; leaflets sessile, 6–14 pairs, oblong, base obliquely truncate, obtuse, sometimes mucronate. Heads arranged in panicles. Flowers dimorphic, 10–15, sessile, yellowish. Calyx cupshaped. Corolla funnel-shaped; lobes lanceolate. Staminal tube as long as corolla tube. Ovary ferruginous tomentose. Legume oblong, compressed. Seeds 6–12, ovate in outline.

*Flowers & Fruits:* June to October.

*Specimen Cited:* Atiamochar forest, *Rajib & AP Das 0545*, dated 23.07.2007.

*Local Distribution:* Atiamochar forest.

*General Distribution:* Throughout India; Bangladesh, Bhutan, Nepal, Pakistan, Sri Lanka, Thailand, Laos, Myanmar, Vietnam.

*Albizia procera* (Roxburgh) Bentham, London J. Bot. 3: 89. 1844; Grierson *et* Long in Grierson *et* Long, Fl. Bhut. 1(3): 645. 1987; Prain, Beng. Pl. 1: 461. 1963. *Mimosa procera* Roxburgh, Pl. Coromandel 2: 12. 1799.

*Vernacular name:* Kalo shirish.

Small deciduous, trees, up to 15 m. Leaf petiole with an oblong gland 1 cm above base; pinnae 3–5 pairs; leaflets 6–12 pairs, ovate to subrhombic, 3–5 x 1–2 cm, base oblique, obtuse to emarginate. Heads 20 flowered, arranged in axillary or terminal panicles. Flowers uniform, sessile. Calyx 2–3 mm. Corolla yellow-white; lobes lanceolate. Staminal tube longer than corolla tube. Ovary glabrous, subsessile. Legume ligulate. Seeds 8–12, obovoid-elliptic.

*Flowers & Fruits:* May to August.

*Specimen Cited:* Atiamochar forest, *Rajib & AP Das 0693*, dated 14. 02. 2008.

*Local Distribution:* Atiamochar forest.

*General Distribution:* Throughout India; Bangladesh, Bhutan, Nepal, Pakistan, Sri Lanka, Thailand, Laos, Myanmar, Vietnam.

TEPHROSIA Persoon, Syn. Pl. 2: 328. 1807, *nom. cons.*

*Tephrosia candida* de Candolle, Prodr. 2: 249. 1825; Grierson *et* Long in Grierson *et* Long, Fl. Bhut. 1 (3): 659. 1987; Prain, Beng. Pl. 1: 405. 1963.

Perennial. Leaflets blades oblong. Pseudoracemes terminal or lateral. Calyx teeth equal. Corolla white. Ovary tomentose, with numerous ovules. Legume linear, straight, brown tomentose.

*Flowers & Fruits:* October to December

*Specimen Cited:* Bochamari, *Rajib & AP Das 0208*, dated 09. 02. 2007.

*Local Distribution:* Cultivated in villages.

*General Distribution:* Tropical and sub-tropical parts of the world.

TAMARINDUS Linnaeus, Sp. Pl. 1: 34. 1753.

*Tamarindus indica* Linnaeus, Sp. Pl. 1: 34. 1753; Hooker *f.* in Hooker *f.*, Fl. Brit. India 2: 273. 1878; Grierson *et* Long in Grierson *et* Long, Fl. Bhut. 1 (3): 636. 1987; Prain, Beng. Pl. 1: 444. 1963.

*Vernacular Name:* Tetul.

Trees. Leaflets oblong, small, glabrous, base obliquely rounded, apex rounded. Flowers few, yellowish tinged with purplish red stripes. Petals obovate, subequal to calyx lobes, margin repand, curled. Ovaries slightly incurved, terete. Pods brownish, straight or arcuate.



*Flowers & Fruits*: May to December.

*Exsicattus*: Salmari, *Rajib & AP Das 0244*, dated 09. 02. 2007.

*Local Distribution*: Cultivated in villages.

*General Distribution*: Tropical and sub-tropical parts of the world.

BAUHINIA Linnaeus, Sp. Pl. 1: 374. 1753.

**Key to the species:**

- |  |                     |
|--|---------------------|
| 1a. Lamina ovate-cordate to cordate .....      | <i>B. acuminata</i> |
| 1b. Lamina suborbicular to broadly ovate ..... | 2                   |
| 2a. Fertile stamens 5 .....                    | <i>B. variegata</i> |
| 2b. Fertile stamens 3 .....                    | <i>B. purpurea</i>  |

***Bauhinia acuminata*** Linnaeus, Sp. Pl. 1: 376. 1753; Prain, Beng. Pl. 1: 441. 1963.

Large shrubs up to 3 m. Young branches zigzag. Lamina ovate-cordate to cordate, 8 – 12 x 6 – 12 cm, subleathery, primary veins 9 – 11, base cordate, bifid, lobes acuminate or slightly acute. Inflorescence a raceme, with 3 – 9 flowers, axillary; bracts and bracteoles linear. Hypanthium tubular. Calyx spathe open on one side, shortly 5 toothed. Petals white, obovate-elliptic. Fertile stamens 10 in 2 whorls. Ovary prominently stalked. Legume straight to slightly curved. Seeds 6 – 10, compressed.

*Flowers & Fruits*: April to August.

*Specimen Cited*: Near Park, *Rajib & AP Das 0677*, dated 14. 02. 2008.

*Local Distribution*: Planted in Parks and villages.

*General Distribution*: India: through out; Bhutan, China, Bangladesh, Sri Lanka, Indonesia, Laos, Malaysia, Philippines, Thailand, Vietnam.

***Bauhinia purpurea*** Linnaeus, Sp. Pl. 1: 375. 1753; Grierson *et* Long in Grierson *et* Long, Fl. Bhut. 1(3): 633. 1987; Prain, Beng. Pl. 1: 442. 1963.

*Vernacular name*: Kanchan.

Small trees, up to 10 m. Petiole 3 – 4 cm; lamina suborbicular, 10 – 16 x 8 – 14 cm, stiffly papery, base shallowly cordate, apex bifid, lobes slightly acute. Inflorescence a raceme with few flowers, axillary and terminal. Calyx open as a spathe into 2 lobes. Petals pink. Fertile stamens 3; filaments as long as petals. Staminodes 5 or 6. Ovary stalked; style curved. Legume linear, flat; valves woody. Seeds compressed, suborbicular.

*Flowers & Fruits*: September to March.

*Specimen Cited*: Park, *Rajib & AP Das 0325*, dated 21.07.2007.

*Local Distribution*: Cultivated in Parks.

*General Distribution*: India: through out; probably only native from Nepal through continental monsoon Asia, now introduce to Cambodia, Laos, Myanmar, Thailand, Vietnam.

***Bauhinia variegata*** Linnaeus, Sp. Pl. 1: 375. 1753; Grierson *et* Long in Grierson *et* Long, Fl. Bhut. 1(3): 634. 1987; Prain, Beng. Pl. 1: 442. 1963.

*Vernacular name*: Kanchan.

Small, deciduous, trees, up to 15 m. Lamina suborbicular to broadly ovate, 6 – 10 x 7 – 10 cm, subleathery, base shallowly to deeply cordate, apex bifid, lobes rounded. Inflorescence a raceme, few flowered, axillary and terminal. Calyx open as a spathe into 2 lobes. Petals white, or purplish spots, oblanceolate. Fertile stamens 5; filaments as long as petals, slender. Ovary stalked; style curved; stigma small. Legume linear, flat; valves woody. Seeds 10–15, compressed.

*Flowers & Fruits*: February to July.

*Specimen Cited*: Bochamari, *Rajib & AP Das 0311*, dated 10. 02. 2007.

*Local Distribution*: Cultivate in villages.

*General Distribution*: India: through out; Bhutan, China, Cambodia, Laos, Myanmar, Thailand, Vietnam; widely cultivated in the tropics and subtropics.

CAESALPINIA Linnaeus, Sp. Pl. 1: 380. 1753.

*Caesalpinia cucullata* Roxburgh, Fl. Ind., ed. 1832, 2: 358. 1832; Grierson *et* Long in Grierson *et* Long, Fl. Bhut. 1(3): 623. 1987; Prain, Beng. Pl. 1: 447. 1963.

Medium climbers, up to 5 m, with recurved prickles on old stems. Pinnae 2 – 5 pairs, stalked; stipules absent; leaflets 3 – 6 pairs, broadly ovate to oblong, 4 – 10 x 2.5 – 4 cm, leathery, base broadly cuneate to obtuse-rounded, acuminate. Panicles terminal racemes. Receptacle deeply discoid or shallowly campanulate. Sepals 5, unequal. Petals yellow, oblong, glabrous. Stamens 10, exserted. Ovary compressed; style slender; stigma truncate. Legume reddish brown, elliptic-oblong, indehiscent, winged along ventral suture.

*Flowers & Fruits*: Round the year.

*Specimen Cited*: Forest, *Rajib & AP Das 0286*, dated 10. 02. 2007.

*Local Distribution*: Forest margin.

*General Distribution*: India: through out; Bhutan, Indonesia, Laos, Malaysia, Myanmar, Nepal, Thailand, Vietnam.

CASSIA Linnaeus, Sp. Pl. 1: 376. 1753, *nom. cons.*

#### Key to the species:

- 1a. Leaflets 5 – 10 pairs, base slightly asymmetric ..... *C. javanica* subsp. *nodosa*
- 1b. Leaflets 3 - 4 pairs, base broadly cuneate ..... *C. fistula*

*Cassia javanica* subsp. *nodosa* (Buchanan-Hamilton *ex* Roxburgh) K. Larsen & S. S. Larsen, Nat. Hist. Bull. Siam Soc. 25(3–4): 205. 1975; Grierson *et* Long in Grierson *et* Long, Fl. Bhut. 1(3): 629. 1987. *Cassia nodosa* Buchanan-Hamilton *ex* Roxburgh, Fl. Ind. 2: 336. 1824; Prain, Beng. Pl. 1: 437. 1963.

Small, deciduous, trees. Leaves 20 – 25 cm; leaflets 5 – 10 pairs, 2 – 5 x 1 – 2 cm, subleathery, base slightly asymmetric, acute to obtuse. Racemes lateral on short side branches; inflorescence axis slender. Sepals ovate. Petals deep yellow, ovate. Stamens 10. Ovary linear, whitish pubescent. Legume blackish brown, terete.

*Flowers & Fruits*: April to September.

*Specimen Cited*: Rasik Bil village, *Rajib & AP Das 0122*, dated 07. 02. 2007.

*Local Distribution*: Villages.

*General Distribution*: India: through out; Bhutan, China, Indonesia, Malaysia, Thailand; cultivated in the neotropics.

*Cassia fistula* Linnaeus, Sp. Pl. 1: 377. 1753; Grierson *et* Long in Grierson *et* Long, Fl. Bhut. 1(3): 625. 1987; Prain, Beng. Pl. 1: 437. 1963.

*Vernacular name*: Bandarlathi.

Small deciduous trees, up to 15 m. Leaves 30 – 40 cm, with 3 to 4 pairs of leaflets; leaflets broadly ovate to ovate-oblong, 8 – 12 x 4 – 8 cm, leathery, base broadly cuneate, acute. Racemes axillary,

lax, pendent. Pedicels slender. Sepals narrowly ovate. Petals golden yellow, broadly ovate. Stamens 10, exceeding petals. Ovary stalked; stigma small. Legume pendulous, indehiscent. Seeds numerous, elliptic, flattened.

*Flowers & Fruits:* April to September.

*Specimen Cited:* Park, Rajib & AP Das 0142, dated 07. 02. 2007.

*Local Distribution:* Cultivated in Parks.

*General Distribution:* Native to India; cultivated throughout the tropics.

SENNA Miller, Gard. Dict. Abr., ed. 4. 1754.

### Key to the species:

- |  |                        |
|--|------------------------|
| 1a. Small shrubs, up to 3 m .....                      | 2                      |
| 2a. Trees .....  | <i>S. siamea</i>       |
| 2a. Stipules caducous, lanceolate .....                | 3                      |
| 2a. Stipules persistent, triangular .....              | <i>S. alata</i>        |
| 3a. Leaflets obovate to obovate-oblong .....           | <i>S. tora</i>         |
| 3b. Leaflets ovate to ovate-oblong or lanceolate ..... | 4                      |
| 4a. Lamina 3-5 pairs .....                             | <i>S. occidentalis</i> |
| 4b. Lamina 6 – 10 pairs .....                          | <i>S. sophera</i>      |

*Senna alata* (Linnaeus) Roxburgh, Fl. Ind., ed. 1832, 2: 349. 1832. *Cassia alata* Linnaeus, Sp. Pl. 1: 378. 1753; Grierson *et* Long in Grierson *et* Long, Fl. Bhut. 1(3): 629. 1987; Prain, Beng. Pl. 1: 438. 1963.

Small shrubs, up to 3 m. Leaves 35 – 50 cm; stipules persistent, triangular; petiolar glands absent; lamina 6 – 15 pairs, oblong to obovate-oblong, 6 – 15 x 3 – 7 cm, base obliquely truncate, obtusely rounded. Racemes axillary, dense, many flowered or several racemes forming a terminal panicle. Sepals orange-yellow, oblong. Petals bright yellow, ovate-orbicular. Stamens 10, fertile stamens 7. Ovary puberulent, sessile; ovules many. Legume winged. Seeds 50 – 60, compressed, deltoid.

*Flowers & Fruits:* August to December.

*Specimen Cited:* Batikata Beel margin, Rajib & AP Das 0213, dated 09. 02. 2007.

*Local Distribution:* Throughout Beel Margin.

*General Distribution:* India: through out; native to tropical America; widely introduced in the tropics elsewhere.

*Senna occidentalis* (Linnaeus) Link, Handb. 2: 140. 1831. *Cassia occidentalis* Linnaeus, Sp. Pl. 1: 377. 1753; Grierson *et* Long in Grierson *et* Long, Fl. Bhut. 1(3): 631. 1987; Prain, Beng. Pl. 1: 437. 1963.

*Vernacular name:* Atasi.

Small shrubs, erect, up to 1.5 m. Leaves 15 – 20 cm; stipules caducous, lanceolate; lamina 3 – 5 pairs, ovate to ovate-oblong, 4 – 10 x 2 – 3 cm, base rounded, acuminate. Corymbose racemes, axillary or terminal; bracts caducous. Sepals unequal. Petals yellow, purplish veined. Fertile stamens 7, reduced stamens 3. Ovary tomentose; style glabrous. Legume brown, falcate, flattened. Seeds 30 – 40, flat, orbicular.

*Flowers & Fruits:* Round the year.

*Specimen Cited:* Rasik Bil road side, Rajib & AP Das 0162, dated 08. 02. 2007.

*Local Distribution:* Forest throughout.

*General Distribution:* India: through out; native to tropical America; widely introduced in the tropics and subtropics elsewhere.

***Senna siamea*** (Lamarck) H. S. Irwin & Barneby, Mem. New York Bot. Gard. 35: 98. 1982. *Cassia siamea* Lamarck, Encycl. 1: 648. 1785; Prain, Beng. Pl. 1: 438. 1963.

Small trees, up to 15 m. Leaves 20 – 30 cm; leaflets 6 – 12 pairs, oblong to ovate-oblong, 3 – 7 x 2 – 3 cm, leathery, base rounded, obtusely rounded, mucronate. Racemes in axils of apical leaves or a large terminal panicle on a robust peduncle; bracts linear. Sepals suborbicular. Petals yellow, broadly obovate. Stamens 10, among them 7 fertile. Ovary sessile. Legume flattened, purplish brown when mature. Seeds 10 – 30, light brown, ovoid.

*Flowers & Fruits:* May to October.

*Specimen Cited:* Rajib & AP Das 0127, dated 07. 02. 2007.

*Local Distribution:* Cultivated to Road side.

*General Distribution:* Tropical India; native to Myanmar and Thailand, and probably also to Cambodia, Laos, and Vietnam; widely cultivated in the tropics.

***Senna sophera*** (Linnaeus) Roxburgh, Fl. Ind., ed. 1832, 2: 347. 1832. *Cassia sophera* Linnaeus, Sp. Pl. 1: 379. 1753; Grierson *et* Long in Grierson *et* Long, Fl. Bhut. 1(3): 631. 1987; Prain, Beng. Pl. 1: 438. 1963.

*Vernacular name:* Atasi.

Under shrubs, up to 2 m. Leaves 7 – 18 cm; petiole 3–5 cm, with a narrow clavate gland above petiole joint; lamina 4 – 10 pairs, lanceolate to elliptic-lanceolate, 2 – 4 x 1 – 2 cm, base rounded, acute to shortly acuminate. Corymbs axillary, few flowered; bracts ovate. Sepals ovate-orbicular. Petals yellow, obovate. Stamens 10, 6 or 7 fertile. Ovary finely pubescent. Legume straight. Seeds 30 – 40, ovoid, compressed.

*Flowers & Fruits:* May to October.

*Specimen Cited:* Road side, Rajib & AP Das 0193, dated 09. 02. 2007.

*Local Distribution:* Road side.

*General Distribution:* native to tropical Asia; widely introduced in the tropics and subtropics elsewhere.

***Senna tora*** (Linnaeus) Roxburgh, Fl. Ind., ed. 1832, 2: 340. 1832. *Cassia tora* Linnaeus, Sp. Pl. 1: 376. 1753; Grierson *et* Long in Grierson *et* Long, Fl. Bhut. 1(3): 632. 1987; Prain, Beng. Pl. 1: 438. 1963.

*Vernacular name:* Jhunjhuni.

Annual, erect, suffrutescent herbs, up to 2 m. Leaves 5 – 10 cm; stipules linear; rachis with a club-shaped gland between leaflets; leaflets 3 pairs, obovate to obovate-oblong, Fl. Bhut. 2 – 5 x 2 – 3 cm, base cuneate to rounded and oblique, rounded. Racemes axillary, short, 2 to 3 flowered; bracts linear, acute. Sepals ovate to ovate-oblong. Petals yellow, unequal, obovate. Fertile stamens 7, staminodes absent. Ovary sessile; style glabrous. Legume terete, slender. Seeds 20 – 30, rhomboid.

*Flowers & Fruits:* June to November.

*Specimen Cited:* Road side, Rajib & AP Das 0178, dated 09. 02. 2007.

*Local Distribution:* Road side

*General Distribution:* India: through out; native to tropical America; widely cultivated in the tropics and subtropics.

CROTALARIA Linnaeus, Sp. Pl. 2: 714. 1753, *nom. cons.*

***Crotalaria alata*** Buchanan-Hamilton ex D. Don, Prodr. Fl. Nepal. 241. 1825; Grierson *et* Long in Grierson *et* Long, Fl. Bhut. 1(3): 735. 1987; Prain, Beng. Pl. 1: 373. 1963.

Small, erect, up to 100 cm. Stipules decurrent on stem as a broad wing. Leaves simple, nearly sessile; lamina elliptic to obovate-elliptic, 3 – 10 x 1.5 – 5 cm, base attenuate to cuneate, obtuse and mucronate. Racemes terminal or leaf-opposed, 2 to 3 flowered; bracts ovate-lanceolate. Calyx 2 lipped; lobes lanceolate. Corolla yellow; obovate-orbicular; wings oblong; keel ovate. Ovary glabrous. Legume oblong, 3 – 4 cm, 30 – 35 seeded. Seeds obliquely cordate, smooth.

*Flowers & Fruits:* June to December.

*Specimen Cited:* Road side, *Rajib & AP Das 0709*, dated 14. 02. 2008.

*Local Distribution:* Road side.

*General Distribution:* Throughout India; Bhutan, Bangladesh, Nepal, Sri Lanka, Cambodia, Indonesia, Malaysia, Myanmar, Thailand, Vietnam; cultivated and naturalized in Africa and Madagascar.

DALBERGIA Linnaeus *f.*, Suppl. Pl. 52, 316. 1782, *nom. cons.*

***Dalbergia sissoo*** Roxburgh ex Candolle, Prodr. 2: 416. 1825; Grierson *et* Long in Grierson *et* Long, Fl. Bhut. 1(3): 652. 1987; Prain, Beng. Pl. 1: 411. 1963.

*Vernacular name:* Sisu.

Trees, up to 20 m. Leaves 12 – 15 cm; leaflets 3 – 5; lamina rhombic obovate, rounded, shortly caudate. Panicles axillary. Flowers nearly sessile, fragrant; bracts caducous, lanceolate. Calyx campanulate, broadly ovate, 5 toothed. Corolla yellowish white; broadly obovate, emarginate; wings and keel oblanceolate. Stamens 9, monadelphous. Ovary oblong, 4 – 6 ovuled; style very short; stigma capitate. Legume linear-oblong. Seeds reniform, compressed.

*Flowers & Fruits:* March to November.

*Specimen Cited:* Road side, *Rajib & AP Das 0151*, dated 08. 02. 2007.

*Local Distribution:* planted throughout road side/

*General Distribution:* native to India; widely cultivated in the tropics.

DELONIX Rafinesque, Fl. Tellur. 2: 92. 1837.

***Delonix regia*** (Bojer) Rafinesque, Fl. Tellur. 2: 92. 1837; Grierson *et* Long in Grierson *et* Long, Fl. Bhut. 1(3): 622. 1987. *Poinciana regia* Bojer, Bot. Mag. 56: t. 2884. 1829; Prain, Beng. Pl. 1: 446. 1963.

*Vernacular name:* Krishnachurha.

Large, deciduous, trees, up to 20 m. Leaves 20 – 60 cm; petiole 7 – 12 cm; petiolules short; pinnae opposite, 15 – 20 pairs, 5 – 10 cm; leaflets 25 pairs, opposite, oblong, 5 – 9 x 3 – 4 mm, base oblique, entire, obtuse. Corymbose racemes terminal or axillary. Flowers bright red. Receptacle discoid. Sepals reddish inside, margin greenish yellow. Petals reflexed after anthesis, red, tinged with yellow and white spotted, spatulate. Stamens curved upward. Stigma small. Legume dark reddish brown. Seeds 20 – 40.

*Flowers & Fruits:* June to October.

*Specimen Cited:* Park, *Rajib & AP Das 0139*, dated 07. 02. 2007.

*Local Distribution:* planted in Park.

*General Distribution:* Native to Madagascar; often cultivated in the tropics.

DESMODIUM Desvaux, J. Bot. Agric. 1: 122. 1813, *nom. cons.*

**Key to the species:**

- |  |                      |
|--|----------------------|
| 1a. Leaves 3 foliolate .....                             | 2                    |
| 1b. Leaves 1 foliolate .....                             | <i>D. gangeticum</i> |
| 2a. Terminal leaflet blade obcordate to obovate .....    | <i>D. triflorum</i>  |
| 2b. Terminal leaflet blade ovate to ovate–elliptic ..... | <i>D. laxiflorum</i> |

*Desmodium laxiflorum* Candolle, Ann. Sci. Nat. (Paris) 4: 100. 1825; Grierson *et* Long in Grierson *et* Long, Fl. Bhut. 1(3): 678. 1987; Prain, Beng. Pl. 1: 425. 1963.

Erect, shrubs, up to 100 cm. Leaves 3 foliolate; terminal leaflet ovate to ovate–elliptic, 10–17 x 3–7 cm, shortly acuminate. Racemes terminal and axillary, 2–7 flowered, fascicled. Calyx densely villous; upper lobes entire. Corolla white to violet; broadly obovate to orbicular; wings auriculate. Legume linear.

*Flowers & Fruits:* August to December.

*Specimen Cited:* Forest, Rajib & AP Das 0261, dated 10. 02. 2007.

*Local Distribution:* Throughout forest.

*General Distribution:* India: through out; Bhutan, Indonesia, Laos, Malaysia, Myanmar, Nepal, New Guinea, Philippines, Thailand, Vietnam.

*Desmodium gangeticum* (Linnaeus) D. Candolle, Prodr. 2: 327. 1825; Grierson *et* Long in Grierson *et* Long, Fl. Bhut. 1(3): 672. 1987; Prain, Beng. Pl. 1: 425. 1963. *Hedysarum gangeticum* Linnaeus, Sp. Pl. 2: 746. 1753.

Erect, much branched, shrubs, up to 1 m. Leaves 1 foliolate; lamina narrowly elliptic-ovate, 5–12 x 3–7 cm, base rounded, acute. Racemes terminal and axillary, 10–30 cm, 2–6 flowered at each node. Calyx 4 lobed. Corolla green-white; standard obovate; wings oblong; keel narrowly obovate. Ovary hairy. Legume linear, slightly curved.

*Flowers & Fruits:* April to October.

*Specimen Cited:* Forest, Rajib & AP Das 0218, dated 09. 02. 2007.

*Local Distribution:* Throughout forest.

*General Distribution:* India: through out; Bhutan, Nepal, Sri Lanka, Cambodia, Kashmir, Laos, Malaysia, Myanmar, Thailand, Vietnam; tropical Africa, Australia, Pacific islands; naturalized in the West Indies.

*Desmodium triflorum* (Linnaeus) D. Candolle, Prodr. 2: 334. 1825; Grierson *et* Long in Grierson *et* Long, Fl. Bhut. 1(3): 673. 1987; Prain, Beng. Pl. 1: 424. 1963. *Hedysarum triflorum* Linnaeus, Sp. Pl. 2: 749. 1753;

Perennial, prostrate, herbs, up to 50 cm. Leaves 3 foliolate; terminal leaflet blade obcordate to obovate, 3–10 x 2.5–9 mm, base cuneate, truncate, round or slightly emarginate. Flowers solitary or 2 in leaf axils. Calyx 5 parted; lobes narrowly lanceolate. Corolla purple-red, nearly as long as calyx; standard obcordate; wings elliptic; keel longer than wings, curved. Stamens diadelphous. Legume narrowly oblong, flat.

*Flowers & Fruits:* June to November.

*Specimen Cited:* Forest, Rajib & AP Das 0154, dated 08. 02. 2007.

*Local Distribution:* Throughout forest.

*General Distribution:* Throughout India; Nepal, Sri Lanka, Malaysia, Myanmar, Thailand, Vietnam; tropics of Africa, Americas, SW Asia, Australia, Pacific islands.

LEUCAENA Bentham, J. Bot. (Hooker) 4: 416. 1842, nom. cons.

*Leucaena leucocephala* (Lamarck) de Wit, Taxon 10: 54. 1961; Grierson *et* Long in Grierson *et* Long, Fl. Bhut. 1(3): 640. 1987. *Mimosa leucocephala* Lamarck, Encycl. 1: 12. 1783.

Small trees, up to 8 m. Stipules caducous, deltoid; leaflets 5 – 12 pairs, linear-oblong, 8 – 12 x 1.5 – 3 mm, base cuneate, ciliate, acute. Heads usually 1 or 2, axillary. Flowers white. Calyx 5 toothed. Petals narrowly oblanceolate. Stamens 10. Ovary shortly stipitate; stigma cupular. Legume straight, narrowly ovoid, flat.

*Flowers & Fruits*: June to September.

*Specimen Cited*: Forest, Rajib & AP Das 0448, dated 22.07.2007.

*Local Distribution*: Plantation forest.

*General Distribution*: Tropical India; native to tropical America, widely distributed in tropical and subtropical regions.

URARIA Desvaux, J. Bot. Agric. 1: 122. 1813.

*Uraria picta* (Jacquin) Desvaux *ex* Candolle, Prodr. 2: 324. 1825; Grierson *et* Long in Grierson *et* Long, Fl. Bhut. 1(3): 678. 1987. *Hedysarum pictum* Jacquin, Collectanea 2: 262. 1788.

Erect, slender shrubs, up to 2 m. Leaves imparipinnate, 5 or 7 foliolate; leaflet blades linear-oblong to narrowly lanceolate, terminal one 6 – 12 x 1 – 2 cm, base rounded, apex narrowly acute. Racemes terminal, 15 – 30 cm. Calyx 5 parted, ciliate. Corolla pink or pale blue; standard obovate; keel as long as wings. Ovary glabrous, 3 to 5 ovuled. Legume lead-colored.

*Flowers & Fruits*: April to October.

*Specimen Cited*: Forest, Rajib & AP Das 0608, dated 26.07.2007

*Local Distribution*: Takomari forest.

*General Distribution*: Throughout India; Bhutan, Bangladesh, Nepal, Pakistan, Sri Lanka, Cambodia, Japan, Malaysia, Myanmar, Philippines, Thailand, Vietnam; tropical Africa, Australia

MIMOSA Linnaeus, Sp. Pl. 1: 516. 1753.

#### Key to the species:

- 1a. Pinnae and leaflets strongly sensitive; digitate ..... *M. pudica*
- 1b. Pinnae and leaflets not sensitive; pinnate ..... *M. invisa*

*Mimosa invisa* Colla, Flora oder Allgemeine Botanische Zeitung 20. 1837 *Mimosa diplotricha* C. Wright *ex* Sauvalle, Anales Acad. Ci. Med. Habana 5: 405. 1868.

*Vernacular name*: Sada lajjabati.

Scandent or prostrate subshrubs; stems 4-angulate, hirsute, with or without prickles along angles. Leaves 10 – 15 cm; petiole and rachis with 4 rows of recurved prickles; pinnae 5 to 10 pairs; leaflets 20 – 30 pairs per pinna, linear-oblong, 3 – 4 x 1 – 2 mm. Heads 1 or 2, axillary. Flowers bisexual. Calyx minute. Corolla narrowly funnelshaped, 4 lobed. Stamens 8; filaments pale purple-pink. Legumes in clusters, slightly curved, oblong. Seeds yellow-brown.

*Flowers & Fruits*: March to October.

*Specimen Cited*: Forest, Rajib & AP Das 0271, dated 10. 02. 2007.

*Local Distribution*: Road side forest.

*General Distribution*: Native to tropical America; introduced throughout the tropics.

***Mimosa pudica*** Linnaeus, Sp. Pl. 1: 518. 1753; Grierson *et* Long in Grierson *et* Long, Fl. Bhut. 1(3): 639. 1987; Prain, Beng. Pl. 1: 456. 1963.

*Vernacular name:* Lajjabati.

Diffuse, branched, herbs with reflexed bristles and scattered, curved prickles. Stipules lanceolate; pinnae and leaflets sensitive; pinnae usually 2 pairs, digitate; leaflets 10 – 20 pairs, linear-lanceolate, margin ciliate, acute. Heads solitary or 2, axillary, globose; peduncle long; bracts linear. Flowers numerous, pink. Calyx minute. Corolla campanulate. Stamens 4, exserted. Ovary shortly stipitate; ovules 3 to 4; style filiform. Legumes arranged in a star, slightly recurved, flat, oblong. Seeds light brown, ovoid.

*Flowers & Fruits:* March to November.

*Specimen Cited:* Rasik Bil, *Rajib & AP Das 0110*, dated 07. 02. 2007.

*Local Distribution:* Throughout forest.

*General Distribution:* Throughout India; native to tropical America; naturalized in tropical regions of the world.

ERYTHRINA Linnaeus, Sp. Pl. 2: 706. 1753.

### Key to the species:

- 1a. Flowers paired; wings and keels subequal ..... *E. variegata*
- 1b. Flowers clusters of 3 to 4; keels much longer than wings ..... *E. stricta*

***Erythrina variegata*** Linnaeus, Herb. Amboin. 10. 1754; Grierson *et* Long in Grierson *et* Long, Fl. Bhut. 1(3): 684. 1987.

*Vernacular name:* Mandar.

Trees, up to 20 m. Branches with straight and minute prickles. Leaves pinnately 3 foliolate, usually clustered at branch tip; stipules lanceolate, deciduous; leaflets broadly ovate to rhomboid-ovate, 15 – 28 x 15 – 26 cm, membranous, both surfaces glabrous, basal veins 3, lateral veins 5 pairs, base broadly cuneate, entire, acuminate to obtuse; base of leaflet with a pair of glands similar to stipules. Raceme terminal; peduncle robust; flowers paired. Calyx spathe-like. Corolla red; standard elliptic, obtuse, shortly clawed; wings and keels subequal; keel petals separate. Ovary micro-villous; style glabrous. Legume black.

*Flowers & Fruits:* March to August.

*Specimen Cited:* Rasik Bil village, *Rajib & AP Das 0407*, dated 22.07.2007.

*Local Distribution:* Cultivated in villages.

*General Distribution:* Throughout India; Bhutan, China, Bangladesh, Sri Lanka, Cambodia, Indonesia, Japan, Laos, Malaysia, Myanmar, Philippines, Thailand, Vietnam; Australia, Pacific islands; introduced to Africa and Central and South America.

***Erythrina stricta*** Roxburgh, Fl. Ind., ed. 1832, 3: 251. 1832; Grierson *et* Long in Grierson *et* Long, Fl. Bhut. 1(3): 683. 1987; Prain, Beng. Pl. 1: 398. 1963. [PLATE: 9, Figure-96]

*Vernacular name:* Mandar.

Small trees, up to 12 m. Branches with short whitish prickles. Leaves pinnately 3-foliolate; stipules deciduous; terminal leaflet broadly triangular, almost rhomboid, 9 – 20 x 8 – 25 cm, both surfaces glabrous, lateral veins 5– 8 pairs, base nearly cordate to broadly cuneate, entire, acute to caudate with mucro. Raceme with clusters of 3 to 4 flowers. Calyx spathe-like, undivided or apex slightly 2-lobed. Corolla red; standard elliptic-lanceolate to ovate-triangular; wings subobovate, shorter than



calyx; keels much longer than wings. Ovary hairy; style narrow. Legume glabrous. Seeds 1 – 4, dark brown.

*Flowers & Fruits*: March to September.

*Specimen Cited*: Rasik Bil village, *Rajib & AP Das 0491*, dated 23.07.2007.

*Local Distribution*: Cultivated in villages.

*General Distribution*: Tropical India; Bhutan, Nepal, Thailand, Cambodia, Laos, Myanmar, Vietnam.

MUCUNA Adanson, Fam. Pl. 2: 325, 579. 1763, *nom. cons.*

***Mucuna pruriens*** (Linnaeus) de Candolle, Prodr. 2: 405. 1825; Grierson *et* Long in Grierson *et* Long, Fl. Bhut. 1(3): 671. 1987; Prain, Beng. Pl. 1: 400. 1963.

Semiwoody twining vines. Leaves up to 46 cm; stipels robust; leaflets papery, lateral veins 5 – 8 on each side, running into margin; terminal leaflet elliptic to ovate-rhombic, 8 – 16 x 7 – 10 cm, base broadly cuneate to rounded, acute to shortly acuminate; lateral leaflets 7 – 19 cm. Inflorescence axillary, long and pendulous; bracts and bracteoles linear-lanceolate. Calyx tube lobed; lateral 2 lobes broadly triangular. Corolla deep purple; standard 2/3 of keel length; wings shorter than keel; keel 3 – 4 cm. Legume linear-oblong. Seeds 3 – 6.

*Flowers & Fruits*: September to April.

*Specimen Cited*: Forest, *Rajib & AP Das 0714*, dated 14. 02. 2008.

*Local Distribution*: Throughout forest.

*General Distribution*: Widely distributed in the tropics.

PUERARIA Candolle, Ann. Sci. Nat. (Paris) 4: 97. 1825.

***Pueraria phaseoloides*** (Roxburgh) Benth, J. Linn. Soc., Bot. 9: 125. 1865; Grierson *et* Long in Grierson *et* Long, Fl. Bhut. 1(3): 693. 1987; Prain, Beng. Pl. 1: 396. 1963. *Dolichos phaseoloides* Roxburgh, Fl. Ind., ed. 1832, 3: 316. 1832.

Herbaceous vines. Stipules basifixed, ovate-lanceolate; stipels linear; leaflets broadly ovate to ovate-rhomboid, terminal one broader, 6 – 10 x 5 – 9 cm, lateral ones smaller, oblique, entire or 3-lobed. Racemes solitary. Bracts and bracteoles linear-lanceolate. Flowers with short pedicels, clustered at slightly distant nodes. Calyx pilose; lower tooth as long as tube, others deltoid, shorter than tube. Corolla bluish; standard suborbicular; wings obovate-oblong, slightly longer than keel. Ovary linear. Legumes subcylindric. Seeds 15–20, oblong-elliptic.

*Flowers & Fruits*: August to November.

*Specimen Cited*: Salmari, *Rajib & AP Das 0583*, dated 25.07.2007

*Local Distribution*: Villages.

*General Distribution*: India; Bhutan, Nepal, Cambodia, Laos, Malaysia, Myanmar, Thailand, Vietnam; widely cultivated elsewhere in the tropics.

AESCHYNOMENE Linnaeus, Sp. Pl. 2: 713. 1753.

***Aeschynomene indica*** Linnaeus, Sp. Pl. 713. 1753; Baker in Hooker *f.*, Fl. Brit. Ind. 2: 151. 1876; Grierson *et* Long in Grierson *et* Long, Fl. Bhut. 1(3): 710. 1987; Prain, Beng. Pl. 1: 418. 1903; Majumdar, Bull. Bot. Soc. Bengal 20 (2): 64. 1966.

*Vernacular name*: Shola.

Shrub like, annual herbs; stem nodules present. Leaflets numerous small, sessile, alternate, linear, obtuse, the upper one smallest; stipules linear lanceolate, acuminate, with acute auricled base. Flowers yellow, in axillary racemes; calyx glabrous. Pods 6-10 jointed, dotted with black.

*Flowers & Fruits:* September to December.

*Specimen Cited:* Barajan Beel, *Rajib & AP Das 0121*, dated 07. 02. 2007.

*Local Distribution:* Throughout the wetlands.

*General Distribution:* India: Bengal, Assam and South India; Bangladesh, Myanmar, Malaya and Tropical Africa.

SAMANEA (Bentham) Merrill, J. Wash. Acad. Sci. 6: 46. 1916.

*Samanea saman* (Jacquin) Merrill, J. Wash. Acad. Sci. 6: 47. 1916; Grierson *et* Long in Grierson *et* Long, Fl. Bhut. 1(3): 647. 1987. *Mimosa saman* Jacquin, Fragm. Bot. 15. 1800;

Trees, up to 25 m. Pinnae 3–5 pairs, to 15 cm; glands at junctions of pinnae and leaflets; leaflets 3–8 pairs per pinna, asymmetrically oblong, Fl. Bhut. 2–4 x 1–2 cm, base half rounded, rounded to obtuse, often emarginate and mucronulate. Heads 1–5, axillary. Marginal flowers pedicellate; calyx funnel-shaped; corolla red or yellowish red; stamens white at base. Central flowers sessile. Legume black, oblong, compressed.

*Flowers & Fruits:* August to December.

*Specimen Cited:* Bochamari, *Rajib & AP Das 0215*, dated 09. 02. 2007.

*Local Distribution:* Villages.

*General Distribution:* Throughout India; native to N part of tropical South America; planted throughout the tropics.

**Polygalaceae** A. L. de Jussieu, Ann. Mus. Hist. Nat. Paris 14: 389. 1809 ('Poly-galeae').

POLYGALA Linnaeus, Sp. Pl. 2: 701. 1753.

*Polygala glomerata* Loureiro, Fl. Cochinch. 426. 1790; Kit Tan in Grierson *et* Long, Fl. Bhut. 2 (1): 50. 1991. *Polygala chinensis* Linnaeus, Sp. Pl. 2: 704. 1753; Clarke in Hooker *f.*, Fl. Brit. Ind. 1: 204. 1872.

Small, erect annual herbs, upto to 30 cm tall, densely pubescent. Lamina sessile, linear–lanceolate, glabrous; racemes slightly extra-axillary, 2-3 flowered; flowers nodding, outer sepals acuminate, ciliate; wings acuminate, awned.

*Flowers & Fruits:* July to October.

*Specimen Cited:* Riverine grassland near park, *Rajib & AP Das 0323*, dated 21.07.2007.

*Local Distribution:* Riverine Grassland.

*General Distribution:* Pantropical.

**Order: Rosales Bercht. & J.Presl (1820)**

**Cannabaceae** Martinov, Tekhno-Bot. Slovar 99. 1820; *nom. cons.*

CANNABIS Linnaeus, Sp. Pl. 2: 1027. 1753.

*Cannabis sativa* Linnaeus, Sp. Pl. ed. 1. 1027. 1753; Hooker *f.* in Hooker *f.*, Fl. Brit. Ind. 5: 487. 1888; H. Ohashi in Hara, Fl. E. Himal. 1: 53. 1966; Grierson *et* Long in Grierson *et* Long, Fl. Bhut. 1(1): 134. 1983; Prain, Beng. Pl. 2: 960.1903. *Cannabis erratica* Sievers, Neueste Nord. Beytr. Phys. Geogr. Erd- V lkerbeschreib. 7: 174. 1793.

*Vernacular name:* Bhang.

Annual herbs, up to 1.5 m. Branchlets densely white pubescent. Stipules linear. Leaves alternate; petiole 2 cm; lamina abaxially whitish green, strigose; segments usually lanceolate to linear, 3–6 x 1–2 cm with longest in middle, margin coarsely serrate, apex acuminate. Male inflorescences 25 cm. Male flowers yellowish green, nodal; pedicel 2 mm, thin; sepals ovate to lanceolate, membranous; petals absent; anthers oblong. Female inflorescences crowded in apical leaf axils among leaflike bracts and bracteoles. Female flowers green, sessile; calyx sparsely pubescent; ovary globose, enclosed by appressed calyx, surrounded closely by bract and bracteoles. Persistent bracts yellow. Achene flattened ovoid; pericarp crustaceous, finely reticulate.

*Flowers & Fruits:* May to July.

*Specimen Cited:* Road side forest, *Rajib & AP Das 0374*, dated 21. 07. 2007.

*Local Distribution:* Road side along the Beel margin.

*General Distribution:* Native to Central Asia and naturalized in temperate and tropical world.

## **Moraceae** Gaudichaud, Gen. Pl. 13. 1835 ; *nom. cons.*

### **Key to the Genera:**

- 1a. Inflorescences a fig with many minute flowers completely enclosed within a hollow receptacle opening by an apical pore closed by scale-like bracts ..... ***Ficus***
- 1b. Inflorescences a capitulum, spike, or raceme, rarely a cyme, or with flowers inserted on a discoid receptacle ..... 2
- 2a. Stamens straight in flower buds, rarely inflexed ..... ***Artocarpus***
- 2b. Stamens inflexed in flower buds ..... 3
- 3a. Plant sometimes spiny, particularly on juvenile growth ..... ***Streblus***
- 3b. Plant unarmed ..... ***Morus***

**ARTOCARPUS** J. R. Forster *et* G. Forster, Char. Gen. Pl. 51. 1775, *nom. cons.*

- 1a. Lamina obovate; fruits subglobose, 1.5 – 3 cm in diameter, irregularly lobed, smooth ..... *A. lakoocha*
- 1b. Lamina ovate to elliptic; fruits large, globose to oblong, Fl. Bhut. 1.5 – 30 cm diameter, unlobed ..... *A. heterophyllus*

***Artocarpus heterophyllus*** Lamarck, Encyl. Meth. B. 3: 209. 1789; Hara *et al.*, Enn. Fl. Pl. Nep. 3: 208. 1982; Grierson *et* Long in Grierson *et* Long, Fl. Bhut. 1(1): 100. 1983. *Artocarpus maximus* Blanco, Fl. Filip. 669. 1837. *Artocarpus philippensis* Lamarck, Encycl. 3: 210. 1789.

*Vernacular name:* Kanthal.

Trees; up to 35 m. Leaves ovate to elliptic, 8 – 14 x 4 – 9 cm, apiculate, base cuneate, glabrous; petiole 1.5 – 2 cm, stipules broadly ovate, 2 – 6 cm; leaves of young plants with 1 – 2 pairs of lateral lobes. Male heads club-shaped, 2 – 6 x 1 – 2 cm, peduncles 2 – 4 cm. Syncarps oblong, Fl. Bhut. 1.5 – 40 x 15 – 30 cm, surface rough with sharp perianth points formed from the tips of elongated sterile female flowers which surround the achenes, latter enclosed by sweet fleshy perianths. Compound fruits large, globose to oblong.

*Flowers & Fruits:* February to July.

*Specimen Cited:* Village sector, *Rajib & AP Das 0732*, dated 14. 02. 2008.

*Local Distribution:* Village area.

*General Distribution:* India: cultivated in all northern States; Bhutan, Bangladesh, China.

***Artocarpus lakoocha*** Roxburgh, Fl. Ind. 3: 524. 1832; Prain, Beng. Pl. 2: 971. 1903. *Artocarpus lacucha* Buchanan–Hamilton, Mem. Wern. Soc. 5: 333, 1826; Hara *et al.*, Enn. Fl. Pl. Nep. 3: 209. 1979; Grierson *et* Long in Grierson *et* Long, Fl. Bhut. 1(1): 100. 1983. *Artocarpus lacucha* Buchanan–Hamilton *ex* D. Don, Prodr. Fl. Nepal. 333. 1825.

*Vernacular name:* Daoa.

Tree, up to 40 m, shoots brownish hispid. Leaves obovate, 30–35 x 20–22 cm, glabrous and rather glossy above; petioles 1.5–4 cm; stipules lateral. Leaves of young plants are shallowly pinnatifid. Fruits subglobose, 3–5 cm, brownish yellow with irregular lobed and smooth.

*Flowers & Fruits:* February to June.

*Specimen Cited:* Village sector, *Rajib & AP Das 0719*, dated 14. 02. 2008.

*Local Distribution:* Village area.

*General Distribution:* Pantropical.

FICUS Linnaeus, Sp. Pl. 2: 1059. 1753.

### Key to the species:

- 1a. Male and female flowers on same plants .....2
- 1b. Male and fertile female flowers on different plants .....5
- 2a. Plants with long aerial roots which can form new trunks or  
strangle host plant ..... 3
- 2b. Trees with well-defined main trunk ..... *F. hispida*
- 3a. Leaf blade with wax gland abaxially at base of midvein ..... *F. elastica*
- 3b. Leaf blade with out wax gland abaxially at base of midvein ..... 4
- 4a. Lamina apex obtuse ..... *F. benghalensis*
- 4b. Lamina apex caudate with cauda ..... *F. religiosa*
- 5a. Root-climbers, usually with 2 types of leaves on creeping  
vegetative stems and on fertile stems ..... *F. hederacea*
- 5b. Trees or shrubs without aerial roots and all leaves similar ..... 6
- 6a. Stipules red; lamina base very asymmetric; figs on  
pendulous, leafless branchlets ..... *F. semicordata*
- 6b. Stipules yellow and white; lamina base not as above; figs  
axillary on normal leafy shoots ..... *F. semicordata*

*Ficus benghalensis* Linnaeus, Sp. Pl. 1059. 1753; Hooker *f.* in Hooker *f.*, Fl. Brit. Ind. 5: 499. 1888; Hara *et al.*, Enn. Fl. Pl. Nep. 3: 209. 1982; Grierson *et Long* in Grierson *et Long*, Fl. Bhut. 1(1): 97. 1983; Prain, Beng. Pl. 2: 979. 1903. *Ficus banyana* Oken, Allg. Naturgesch. 3(3): 1561. 1841. *Urostigma benghalense* (Linnaeus) Gasparrini, Nov. Gen. Fic. 7. 1844.

*Vernacular name:* Bot.

Wide branching tree, up to 30m, branches forming additional proproots. Leaves ovate, 8.5–20 x 7–15 cm, obtuse, base rounded, finely puberulous beneath at first, glabrous and shiny above, lateral veins 5 pairs, 5 veined at base, petioles 2–5 cm; stipules ovate–lanceolate, 2 cm. Figs globose, 2 cm, solitary or in axillary pairs, sessile, pubescent, basal bracts 3, rounded.

*Flowers & Fruits:* October to May.

*Specimen Cited:* Village sector, *Rajib & AP Das 0596*, dated 25. 07. 2007.

*Local Distribution:* Bochamari Village.

*General Distribution:* Pantropical in Asia.

*Ficus semicordata* Buchanan–Hamilton *ex* Smith in Rees, Cycl. 14: *Ficus* no. 71. 1810; H. Ohashi in Hara, Fl. E. Himal. 1: 54. 1966; Grierson *et Long* in Grierson *et Long*, Fl. Bhut. 1(1): 90. 1983. *Covellia cunia* (Buchanan–Hamilton *ex* Roxburgh) Miquel, London Jour. Bot. 7: 459. 1848.

*Ficus cunia* Buchanan-Hamilton ex Roxburgh. Fl. Ind. 3: 561. 1832; Prain, Beng. Pl. 2: 982.1903.  
*Ficus semicordata* var. *conglomerata* (Roxburgh) Corner, Gard. Bull. Singapore 17: 449. 1960.

Trees, up to 9 m, crown flat. Bark gray, smooth. Stipules red, lanceolate. Leaves distichous; petiole thick, densely covered with stiff hairs; leaf blade oblong-lanceolate, strongly asymmetric, 16–25 x 9–11 cm, papery, abaxially densely covered with stiff short hairs and small yellowish brown convex spots, margin with small teeth or entire, apex acuminate. Figs on pendulous, eventually prostrate, leafless branchlets, sometimes underground at maturity, solitary, reddish purple when mature, globose. Male flowers: near apical pore. Female flowers calyx lobes 4 to 5; ovary ovoid-ellipsoid; style lateral, long; stigma cylindrical, shallowly 2-lobed. Achenes broadly ovoid.

*Flowers & Fruits:* May to October.

*Specimen Cited:* Forest, Rajib & AP Das 0641, dated 12. 02. 2008.

*Local Distribution:* Forest Sectors.

*General Distribution:* India: West Bengal, Sikkim, Assam, Arunachal Pradesh, Bihar, Uttar Pradesh, Andhra Pradesh; Nepal, Bhutan, Malaysia, Myanmar, Thailand, Vietnam, China.

*Ficus elastica* Roxburgh ex Horneman, Hort. Bot. Hafn. Suppl.: 7. 1819; Grierson *et* Long in Grierson *et* Long, Fl. Bhut. 1(1): 94. 1983. *Visiania elastica* (Roxburgh ex Horneman) Gasparrini, Nov. Gen. Fic. 9. 1844. *Ficus elastica* var. *benghalensis* Blume, Bijdr. 446. 1825.

*Vernacular name:* Rabar.

Tree, up to 20m. Aerial roots few; epiphytic when young. Bark pale gray, smooth. Branchlets strong. Stipules dark red, membranous; scar conspicuous. Petiole robust. Leaves ovate elliptic, 15–35 x 8–15 cm, acute, base rounded, glabrous, glossy, veins numerous, petioles 3–6cm; stipules conspicuous, 14–20 cm. Figs oblong–ellipsoid, 9–12 x 5–7 mm, sessile, basal bracts ellipsoid, deciduous.

*Flowers & Fruits:* June to November.

*Specimen Cited:* Park, Rajib & AP Das 0597, dated 25. 07. 2007.

*Local Distribution:* Park area.

*General Distribution:* Introduced and widely cultivated.

*Ficus heterophylla* Linnaeus *f.*, Suppl. Pl. 442.1782; Hooker *f.* in Hooker *f.*, Fl. Brit. Ind. 5: 518. 1888; Haines, Bot. Bihar & Orissa pt. V: 835. 1924; Panda *et* Das, Fl. Sambalpur, 346. 2004. Grierson *et* Long in Grierson *et* Long, Fl. Bhut. 1(1): 92. 1983; Prain, Beng. Pl. 2: 981.1903. *Ficus denticulata* Vahl, Symb. Bot. 1: 83. 1790. *Ficus elongata* Miquel, London Jour. Bot. 7: 231. 1848. *Ficus cannabina* Loureiro, Fl. Cochinch. 668. 1790. [PLATE: 5, Figure-43]

Creeping shrub, procumbent; young stem pubescent. Branchlets becoming reddish brown, slender, shortly pubescent. Stipules caducous, short, membranous. Leaves distichous; leaves broadly ovate, 3–9 x 2–6.5 cm, acute, base obliquely cordate, 1–4 lobed, denticulate, pubescent beneath; petioles 0.5–3.5cm. Figs solitary, axillary, obovoid 2.6–1.8 cm, pubescent, peduncles 1–1.5cm.

*Flowers & Fruits:* Throughout the year.

*Specimen Cited:* Park, Rajib & AP Das 0731, dated 14. 02. 2008.

*Local Distribution:* Park at Beel Margin.

*General Distribution:* India, Sri Lanka, China and Malay Island.

*Ficus hispida* Linnaeus *f.*, Suppl. 442.1782; Hooker *f.* in Hooker *f.*, Fl. Brit. Ind. 5: 522.1888; Hara *et al.*, Enn. Fl. Pl. Nep. 3: 210. 1982; H. Ohashi in Hara, Fl. E. Himal. 1: 54. 1966; Grierson *et* Long in Grierson *et* Long, Fl. Bhut. 1(1): 89. 1983; Prain, Beng. Pl. 2: 981.1903. *Covellia hispida* (Linnaeus *f.*) Miquel, London Jour. Bot. 7: 462. 1848. *Covellia assamica* Miquel, London Jour. Bot. 7: 464. 1848.

*Vernacular name:* Dumur.

Tree up to 10m; coarsely hairy; dioecious. Stipules usually 4 and decussate on leafless fruiting branchlets, ovate-lanceolate. Leaves opposite, coriaceous, elliptic, 9 – 32 x 5 – 17cm, acute, base truncate, hirsute beneath, margins serrulate, veins 7 pairs, petioles 2 – 8cm. Figs many, short racemes in axillary position, globose, subsessile, 1 – 2cm, hirsute; apical scales rounded, prominent.

*Flowers & Fruits:* Throughout the year.

*Specimen Cited:* Forest, Rajib & AP Das 0593, dated 25.07.2007.

*Local Distribution:* All over the Forest area and village side.

*General Distribution:* Pantropical in Asia.

***Ficus religiosa*** Linnaeus, Sp. Pl. 1059. 1753; Hooker *f.* in Hooker *f.*, Fl. Brit. Ind. 5: 513. 1888; H. Ohashi in Hara, Fl. E. Himal. 1: 54. 1966; Hara *et al.*, Enn. Fl. Pl. Nep. 3: 211. 1982; Grierson *et Long* in Grierson *et Long*, Fl. Bhut. 1(1): 94. 1983; Prain, Beng. Pl. 2: 980.1903. *Urostigma religiosum* (Linnaeus) Gasparriani, Ficus 82, pl. 7 82. 1844. *Ficus peepul* Griffith, Not. Pl. Asiat. 4: 393. 1854. *Ficus religiosa* var. *cordata* Miquel, Ann. Mus. Bot. Lugduno-Batavi 3: 287. 1867.

*Vernacular name:* Pakur.

Trees, up to 18 m tall, epiphytic when young, crown wide when mature. Branchlets grayish brown, sparsely pubescent when young. Stipules ovate, small, apex acute. Petiole slender, sometimes longer than leaf blade, articulate; leaf blade triangular-ovate, 8 – 16 x 8 – 10 cm, leathery, abaxially green, adaxially dark green and shiny, caudate with cauda, margin entire, base broadly cuneate to cordate. Figs axillary on leafy branchlets, paired or solitary, red when mature, globose to depressed globose. Male, gall, and female flowers within same fig.

*Flowers & Fruits:* February to July.

*Specimen Cited:* Village, Rajib & AP Das 0333, dated 21. 07. 2007; 0141, dated 07. 02. 2007.

*Local Distribution:* Village area.

*General Distribution:* Throughout India; native to N. India, Nepal, Pakistan; cultivated throughout the tropics.

***Ficus hederacea*** Roxburgh, Fl. Ind., ed. 1832, 3: 538. 1832; H. Ohashi in Hara, Fl. E. Himal. 1: 53. 1966; Grierson *et Long* in Grierson *et Long*, Fl. Bhut. 1(1): 98. 1983; Prain, Beng. Pl. 2: 982.1903. *Ficus cantoniensis* Bodinier *ex H. L. v.*, Mem. Real Acad. Ci. Barcelona 6: 148. 1907. *Ficus anabatos* Voigt, Hort. Suburb. Calcutt. 286. 1845. *Ficus longipes* Griffith, Not. Pl. Asiat. 4: 397. 1854.

Scandent shrubs. Stems and branchlets with aerial roots at nodes; branchlets pubescent when young. Stipules caducous, ovate. Leaves distichous; petiole thick; leaf blade elliptic to ovate-elliptic, 6 – 10 x 3 – 5 cm, thickly leathery, with hairs when young, base broadly cuneate to obtuse, margin entire, apex obtuse to occasionally rounded. Figs axillary on leafy or on leafless branchlets, solitary or paired, yellowish green to red when mature, globose, apical pore navel-like, slightly convex.

*Flowers & Fruits:* April to August.

*Specimen Cited:* Park, Rajib & AP Das 0301, dated 10. 02. 2007.

*Local Distribution:* Foresters Quarters.

*General Distribution:* India, Bhutan, Nepal, Laos, Myanmar, Thailand.

MORUS Linnaeus, Sp. Pl. 2: 986. 1753.

***Morus indica*** Linnaeus, Sp. Pl. 986. 1753. *Morus longistylus* Diels, Notes Roy. Bot. Gard. Edinburgh 5(25): 293. 1912. *Morus australis* Poirat in Lamarck, Ency. 4: 380. 1796; H. Ohashi in Hara, Fl. E. Himal. 1: 55. 1966; Grierson *et Long* in Grierson *et Long*, Fl. Bhut. 1(1): 101. 1983.

*M. indica auct. non* Linnaeus, Hooker *f.* in Hooker *f.*, Fl. Brit. India 5: 492. 1888; Prain, Beng. Pl. 2: 968. 1903.

*Vernacular name:* Tunt.

Small trees, up to 10 m, unarmed. Leaves ovate, 3.5–10 x 3–6 cm, caudate–acuminate, base cordate, margin serrate, some leaves deeply 3–lobed minutely strigose above and pubescent beneath, petioles 2 cm, stipules 1 cm. Flowers appearing with young leaves. Male spikes 2 cm, peduncles 1 cm, perianth segments 2 mm, stamens 4. Female spikes 7–10 mm, peduncles 3 mm, perianth segments ovate, style 4 mm, bifid. Fruiting spikes 2 x 1 cm, succulent perianth red at first, becoming blackish–purple.

*Flowers & Fruits:* February to May.

*Specimen Cited:* Park, Rajib & AP Das 0128, dated 07. 02. 2007.

*Local Distribution:* Park and Village areas.

*General Distribution:* Cultivated throughout India; widely cultivated throughout the World.

STREBLUS Loureiro, Fl. Cochinch. 2: 754. 1790.

*Streblus asper* Loureiro, Fl. Cochinch. 1: 615. 1790; Hooker *f.* in Hooker *f.*, Fl. Brit. Ind. 5: 489. 1888; H. Ohashi in Hara, Fl. E. Himal. 1: 55. 1966; 1967; Hara *et al.*, Enn. Fl. Pl. Nep. 3: 212. 1982; Grierson *et* Long in Grierson *et* Long, Fl. Bhut. 1(1): 102. 1983; Prain, Beng. Pl. 2: 969. 1903.

*Vernacular name:* Sheora.

Small tree, up to 12 m, young shoots pubescent, sometimes spiny. Leaves elliptic obovate, 3–7 x 2–3.5 cm, acute, base cuneate, margin serrate, petioles 2 mm. Male clusters 5 mm, perianth pale yellow, tepal ovate, 2mm, pubescent. Female flowers ovoid, 2mm, style filiform, terminal. Achenes 3 mm.

*Flowers & Fruits:* March to May.

*Specimen Cited:* Conservation sector, Rajib & AP Das 0071, dated 06. 02. 2007.

*Local Distribution:* Near Deer conservation area.

*General Distribution:* Throughout India; Bhutan, Nepal, Bangladesh, Cambodia, Indonesia, Laos, Malaysia, Philippines, Sri Lanka, Thailand, Vietnam.

**Rhamnaceae** A.L. de Jussieu, Gen. Pl. 376. 1789 ('Rhamni'); *nom. cons.*

**Key to the genera:**

- |  |                         |
|--|-------------------------|
| 1a. Fruit with longitudinal wings .....                          | <b><i>Gouania</i></b>   |
| 1b. Fruit without longitudinal wings .....                       | 2                       |
| 2a. Leaves distinctly triplinerved, stipules often spinose ..... | <b><i>Zizyphus</i></b>  |
| 2b. Leaves pinnately veined, stipules never spinose .....        | <b><i>Berchemia</i></b> |

ZIZIPHUS Miller, Gard. Dict. Abr., ed. 4. 1754.

**Key to the species:**

- |                                    |                      |
|------------------------------------|----------------------|
| 1a. Scandent or erect shrubs ..... | <i>Z. oenopolia</i>  |
| 1b. Trees .....                    | <i>Z. mauritiana</i> |

*Zizyphus mauritiana* Lamarck, Encycl. 3: 319. 1789; Fl. Ind. 5: 233. 2000; Long *et* Rae in Grierson *et* Long, Fl. Bhut. 2 (1): 138. 1991. *Zizyphus jujuba* (Linnaeus) Gaertner, Fruct. 1: 203. 1788 (*non* Miller, 1768); Hooker *f.*, Fl. Brit. Ind. 1: 632. 1875. *Rhamnus jujuba* Linnaeus, Sp. Pl. 194. 1753.

*Vernacular Name:* Kul.

Evergreen trees, up to 15 m. Stipular spines 2, one oblique and hooklike recurved; lamina ovate to oblong-elliptic, 3 – 6 1.5 – 5 cm, papery to thickly papery, 3-veined from base, rounded or acute, serrulate, base subrounded, slightly oblique. Flowers green-yellow, axillary dichotomous cymes. Sepals ovate-triangular. Petals oblong-spatulate. Stamens subequalling petals. Disk thick, fleshy, 10-lobed. Ovary globose, glabrous. Drupe turning black at maturity; mesocarp corky; endocarp thick.

*Flowers & Fruits:* August to March.

*Specimen Cited:* Bochamari Village, *Rajib & AP Das 0705*, dated 14. 02. 2008.

*Local Distribution:* Cultivated in village areas.

*General Distribution:* India, Bhutan, Nepal, Sri Lanka, Afghanistan, Indonesia, Malaysia, Myanmar, Thailand, Vietnam; Africa, Australia.

***Ziziphus oenopolia*** (Linnaeus) Miller, Gard. Dict. (ed. 8) no. 3. 1768[“oenoplia”]. *Rhamnus oenopolia* Linnaeus, Sp. Pl. 1: 194. 1753.

*Vernacular name:* Bonkul.

Erect or scandent shrubs, spinose. Stipular spines 1, sometimes 2, one recurved and one erect; lamina ovate-oblong to ovate-lanceolate, 3 – 9 x 2 – 4 cm, papery, 3 veined at base, acute to acuminate, inconspicuously crenate, base ± asymmetric, subrounded. Flowers greenish yellow, few to 10 in axillary cymes. Sepals ovate-triangular, acute. Petals spatulate, clawed, enfolding stamens. Stamens slightly shorter than petals. Disk pentagonous, thick, fleshy, often 5 lobed. Ovary globose; style 2 branched. Drupe black, globose; stone 1 to 2 seeded. Seeds globose.

*Flowers & Fruits:* August to February.

*Specimen Cited:* Batikata Beel, *Rajib & AP Das 0687*, dated 14. 02. 2008.

*Local Distribution:* Riverine Forest.

*General Distribution:* India, Bhutan, China, Sri Lanka, Indonesia, Malaysia, Myanmar, Philippines, Thailand, Australia.

BERCHEMIA Necker ex Candolle, Prodr. 2: 22. 1825, *nom. cons.*

***Berchemia floribunda*** (Wallich) Brongniart, Ann. Sci. Nat. (Paris) 10: 357. 1827 & M m. Fam. Rhamn es, 50. 1826; Long *et* Rae in Grierson *et* Long, Fl. Bhut. 2 (1): 142. 1991. *Berchemia floribunda* var. *oblongifolia* Y.L. Chen & P.K.Chou, Bull. Bot. Lab. N. E. Forest. Inst., Harbin 5: 19. 1979. *Berchemia laxa* Wallich, Numer. List 4257. 1831.

Scandent Shrubs. Stipules narrowly lanceolate, persistent; lamina abaxially dark brown when dry, adaxially green, ovate or ovate-elliptic to elliptic, 4 – 10 x 2 – 5 cm, papery, acute to acuminate, entire, base rounded to cordate. Inflorescences in terminal cymose panicles or axillary cymose racemes. Flowers numerous, glabrous, few in fascicles. Calyx tube shallowly patelliform; lobes narrowly triangular. Petals spatulate. Disk thick, fleshy. Ovary nearly completely immersed in disk; style cylindrical, undivided; stigma 2 to 3 lobed. Drupe red, cylindrical-elliptic to ovoid-oblong; stone 2-loculed.

*Flowers & Fruits:* May to October.

*Specimen Cited:* Atiamochar, *Rajib & AP Das 0476*, dated 23.07.2007.

*Local Distribution:* Forests.

*General Distribution:* India, Bhutan, Japan, Nepal, Thailand, Vietnam.

GOUANIA Jacquin, Select. Stirp. Amer. Hist. 263. 1763.

***Gouania tiliifolia*** de Lamarck, Encycl. 3: 4. 1789. *Gouania scandens* (Gaertner) R.B. Drum, in Fl. Zambes. 2: 435. 1966. *Gouania sieberiana* Schldtle *ex* C. Presl, Abh. K nigl. B hm. Ges.



Wiss. V, 3: 469. 1845. *Gouania leptostachya* Candolle, Prodr. 2: 40. 1825; Long *et* Rae in Grierson *et* Long, Fl. Bhut. 2 (1): 146. 1991.

Climbing shrubs. Leaves alternate; stipules lanceolate and caducous; lamina abaxially pale green, adaxially dark green, ovate to ovate-oblong, 5 – 12 x 2.5 – 5 cm, papery, acuminate, crenate-serrate, base cordate. Flowers polygamous, 5 merous, solitary to few in fascicles, axillary cymose racemes, and terminal cymose panicles to 30 cm. Sepals ovate-triangular. Petals white, obovate. Disk distinctly pentagonous. Ovary completely immersed in but not fused with disk; styles short, 3 fid. Capsule 3 winged. Seeds brownish, obovoid.

*Flowers & Fruits*: August to December.

*Specimen Cited*: Atiamochar, Rajib & AP Das 0420, dated 22.07.2007.

*Local Distribution*: Forests.

*General Distribution*: India, Bhutan, Nepal, Laos, Malaysia, Myanmar, Philippines, Singapore, Thailand, Vietnam.

**Rosaceae** A.L. de Jussieu, Gen. Pl. 334. 1789; *nom. cons.*

**Key to the genera:**

- 1a. Erect shrub, with abundant prickles ..... *Rosa*  
 1b. Small diffuse herb ..... *Duchesnea*

DUCHESNEA Smith, Trans. Linn. Soc. London 10: 372. 1811.

*Duchesnea indica* (W. Jackson) Focke, Nat. Pflanzenfam. 24[III,3]: 33. 1888; Grierson *et* Long in Grierson *et* Long, Fl. Bhut. 1 (3): 579. 1987. *Fragaria indica* W. Jackson, The botanist's repository; 1797 t.479 1807; *sensu* Hooker *f.* in Hooker *f.*, Fl. Brit. India 2: 343. 1878. *Potentilla indica* var. *major* Makino, Bot. Mag. (Tokyo) 28: 184. 1914. [PLATE: 6, Figure-48]

Herbs perennial. Stipules narrowly ovate; leaflets petiolulate, obovate to rhombic-oblong, margin obtusely serrate, apex rounded. Flowers 1 – 2.5 cm in diam. Carpels numerous, free. Aggregate fruit ripening red. Achenes shining when fresh, ovoid.

*Flowers & Fruits*: June to October.

*Specimen Cited*: Park side grass land, Rajib & AP Das 0137, dated 07. 02. 2007.

*Local Distribution*: Throughout forest ground cover.

*General Distribution*: Tropical and sub-tropical parts of the world.

ROSA Linnaeus, Sp. Pl. 1: 491. 1753.

*Rosa chinensis* Jacquin, Observ. Bot. 3: 7. 1768.

*Vernacular name*: Golap.

Shrubs erect, up to 1 m. Branchlets purple-brown; prickles abundant, curved, flat. Leaves including petiole 5 cm; stipules adnate to petiole, free parts auriculate, acuminate, entire; rachis and petiole sparsely prickly; lamina broadly ovate or ovate-oblong, 3 – 8 x 2 – 5 cm, long acuminate or acuminate, finely serrate, base subrounded or broadly cuneate. Flowers 4 to 5, rarely solitary; bracts linear, acute. Hypanthium ovoid-globose to pyriform. Sepals 5, deciduous, ovate, entire to lobed. Petals 5, double, red, obovate, emarginated, base cuneate. Styles free, exserted.

*Flowers & Fruits*: April to October.

*Specimen Cited*: Park, Rajib & AP Das 1223, dated 21. 07. 2012.

*Local Distribution*: Cultivated in Parks and Garden.

*General Distribution:* Widely cultivated elsewhere.

**Ulmaceae** Mirbel, *El m. Physiol. V g. Bot.* 2: 905. 1815; *nom. cons.*

TREMA Loureiro, *Fl. Cochinch.* 2: 539, 562. 1790.

*Trema orientalis* (Linnaeus) Blume, *Mus. Bot. Lugd. Bot.* 2: 62. 1856; Hooker *f.* in Hooker *f.*, *Fl. Brit. Ind.* 5: 484. 1888; H. Hara in Hara, *Fl. E. Himal.* 1: 52. 1966; Hara *et al.*, *Enn. Fl. Pl. Nep.* 3: 207. 1982; Grierson *et Long* in Grierson *et Long*, *Fl. Bhut.* 1(1): 86. 1983; Prain, *Beng. Pl.* 2: 960. 1903. *Celtis orientalis* Linnaeus, *Sp. Pl.* 2: 1044. 1753. *Trema africana* Blume, *Mus. Bot.* 58. 1856.

*Vernacular name:* Khorigachh.

Small trees or shrubs, up to 20 m. Stipules linear-lanceolate. Petiole pubescent; lamina 11 – 17 x 5 – 10 cm, leathery and fragile, abaxially grayish white to grayish green when dry, acuminate to acute, denticulate, base cordate and oblique; basally 3 veined. Male inflorescences pubescent. Tepals 5. Ovary rudimentary, compressed. Female flowers pedicellate; tepals 4, triangular-ovate. Drupes globose to ovoid-globose; perianth persistent. Seed broadly ovoid.

*Flowers & Fruits:* March to October.

*Specimen Cited:* Village sector, *Rajib & AP Das 0417*, dated 22. 07. 2007.

*Local Distribution:* Forests around villages.

*General Distribution:* India: tropical; Sri Lanka, Tropical Africa, W. and S. China and Australia.

**Urticaceae** Jussieu, *Gen. Pl.* 400. 1789 ; *nom. cons.*

#### Key to the Genera:

- 1a. Plants with stinging hairs; female flowers without staminodes ..... 2
- 1b. Plants without stinging hairs; female flowers with or without staminodes ...3
- 2a. Stipules simple; shrubs; fruit globose ..... *Dendrocnide*
- 2b. Stipules 2-fid at apex; herbs or subshrubs; fruit winged ..... *Laportea*
- 3a. Perianth lobes of female flowers free or connate at base, staminodes present ..... 4
- 3b. Perianth lobes of female flowers usually connate into a tube, staminodes absent . ..... 5
- 4a. Leaves opposite, rarely spirally alternate; leaf blade usually symmetric ... *Pilea*
- 4b. Leaves alternate, usually distichous; leaf blade usually asymmetric ..... *Elatostema*
- 5a. Lamina 3-veined from base ..... *Gonostegia*
- 5b. Lamina with at least 2 major lateral veins arising clearly above base ..... *Pouzolzia*

BOEHMERIA Jacquin, *Enum. Syst. Pl.* 9: 31. 1760.

#### Key to the species:

- 1a. Leaves alternate; stipules lanceolate; leaf blade ovate to sub-elliptic, margin denticulate ..... *B. glomerulifera*
- 1b. Leaves opposite; stipules subulate-lanceolate; leaf blade obliquely ovate to oblong, margin crenulate ..... *B. hamiltoniana*

***Boehmeria glomerulifera*** Miquel in Zollinger, Syst. Verz. 2: 101, 104. 1854; Grierson *et* Long in Grierson *et* Long, Fl. Bhut. 1(1): 124. 1983. *Boehmeria depauperata* Weddell, Ann. Sci. Nat., Bot. IV, 1: 202. 1854. *Boehmeria travancarica* Beddome, Fl. Sylv. S. India 225. 1872.

Shrubs, up to 70 cm. Leaves alternate; stipules lanceolate; petiole pubescent to glabrous; leaf blade ovate to sub-elliptic, 7 – 20 x 3 – 7 cm, papery, slightly rough, base broadly cuneate, margin denticulate, apex acuminate to caudate-acuminate. Glomerules usually unisexual; male ones on proximal part of flower-bearing branches; female ones on distal part. Male flowers 4-merous, very shortly pedicellate, pubescent; rudimentary ovule ellipsoid. Female flowers broadly obovoid, pubescent, with short neck. Fruiting perianth brown, obovoid, sessile.

*Flowers & Fruits*: November to April.

*Specimen Cited*: Rasik Beel, Rajib & AP Das 0094, dated 07. 02. 2007.

*Local Distribution*: Forest sectors.

*General Distribution*: India: West Bengal, Assam, Sikkim; Bhutan, Indonesia, Laos, Myanmar, Sri Lanka, Thailand, Vietnam

***Boehmeria hamiltoniana*** Weddell, Ann. Sci. nat. ser. 4, 1: 199. 1854; Hooker *f.* in Hooker *f.*, Fl. Brit. Ind. 5: 579. 1885; T. Tuyama in Hara, Fl. E. Himal. 1: 56. 1966; Grierson *et* Long in Grierson *et* Long, Fl. Bhut. 1(1): 127. 1983. *Boehmeria platyphylla* var. *hamiltoniana* (Weddell) Weddell, Prodr. 16(1): 213. 1869.

Shrubs, up to 1m; branches glabrous. Leaves opposite; stipules subulate-lanceolate; strigose, glabrous; leaf blade obliquely ovate to oblong, 5 – 15 x 3 – 7 cm, herbaceous, base broadly cuneate, margin crenulate, apex acuminate. Glomerules unisexual, on long inflorescences, usually with a few long basal branches, widely separated; female spikes very slender. Male subsessile; perianth lobes elliptic, connate at base; rudimentary ovule ellipsoid. Fruiting perianth ellipsoid, compressed.

*Flowers & Fruits*: May to December.

*Specimen Cited*: Forest, Rajib & AP Das 0198, dated 09. 02. 2007.

*Local Distribution*: Forested areas.

*General Distribution*: Tropical parts of India, Nepal, Bhutan, Bangladesh, China.

DENDROCNIDE Miquel, Pl. Jungh. 1: 29. 1851.

***Dendrocnide sinuata*** (Blume) Chew, Gard. Bull. Sing. 121; 206. 1965; H. Hara in Hara, Fl. E. Himal. 3: 19. 1975; Grierson *et* Long in Grierson *et* Long, Fl. Bhut. 1(1): 111. 1983. *Urtica sinuata* Blume, Bijdr. Fl. Ned. Ind. 505. 1825. *Urtica crenulata* Roxburgh, Fl. Ind., ed. 1832 3: 591. 1832. *Laportea sinuata* (Blume) Miquel, Ann. Mus. Bot. Lugduno-Batavum 4: 301. 1869. *Laportea crenulata* Gaudichaud, Voy. Bonite, Bot. 498. 1826. [PLATE: 6, Figure-47]

*Vernacular name*: Daman.

Large shrubs, up to 3 m; branchlets spreading; bark gray-green; upper stem and branchlets sparsely armed with stinging hairs. Stipules brownish, ovate-lanceolate, subleathery, puberulent abaxially; petiole sparsely pubescent; leaf blade elliptic-oblong to obovate-lanceolate, 10 – 38 x 5 – 16 cm, leathery, sparsely armed with stinging hairs on veins, base cuneate, rounded to deeply cordate, margin entire, apex shortly acuminate. Inflorescences in distal axils of branchlets, long paniculate; armed with stinging hairs. Male flowers subsessile, perianth lobes 4, ovate, pubescent and stinging hairy; stamens 4. Female flowers pedicels fleshy; perianth lobes 4, unequal. Stigma ligulate. Achene asymmetrically.

*Flowers & Fruits*: September to November.

*Specimen Cited:* Forest, Rajib & AP Das 0228, dated 09. 02. 2007.

*Local Distribution:* Behind the Foresters Quarter.

*General Distribution:* India: West Bengal, Assam, Bihar; Nepal, Bhutan, Myanmar, Sri Lanka, Thailand, Malaysia.

LAPORTEA Gaudichaud-Beaupr , Voy. Uranie, Bot. 498. 1830, *nom. cons.*

***Laportea interrupta*** (Linnaeus) Chew, Gard. Bull. Singapore 21(2): 200–201. 1965; T. Tuyama in Hara, Fl. E. Himal. 1: 60. 1966. *Urtica interrupta* Linnaeus, *Sp. Pl.* 2: 985. 1753. *Fleurya interrupta* (Linnaeus) Wight, Icon. Pl. Ind. Or. 6: 10, t. 1975, 10. 1853; Prain, Beng. Pl. 2: 961.1903. *Schychowskia interrupta* (Linnaeus) Wight, Contri. U.S. Nation. Herb. 9: 371. 1905.

Annual herbs, monoecious. Stems straight, branched, up to 80 cm; upper stems and petioles sparsely armed with short stinging and pubescent hairs. Stipules ovate-oblong; petiole 3–10 cm; leaf blade ovate to cordate, 5–8 × 4–5 cm, herbaceous, 3-veined, lateral basal pair reaching middle margin, lateral veins 5 or 6 each side of midvein, reaching teeth, base abruptly cuneate to shallowly cordate, margin serrate, apex acuminate. Inflorescences axillary, 25 cm, sparsely armed with minutely stinging hairs. Male flowers pedicellate; perianth lobes 3 to 4, obovate; stamens 3 to 4. Female flowers: pedicel not winged; perianth lobes 4, free, unequal, dorsal lobe ovate, concave, enclosing the ovary, broadly ovate. Ovary asymmetrically triangular; stigma reflexed. Achene obliquely triangular, compressed.

*Flowers & Fruits:* June to September.

*Specimen Cited:* Forest, Rajib & AP Das 0276, dated 10. 02. 2007.

*Local Distribution:* Behind the Foresters Quarter.

*General Distribution:* Tropical parts of India; Bhutan, Indonesia, Japan, Malaysia, Myanmar, Philippines, Sri Lanka, Thailand, Vietnam; Africa.

GONOSTEGIA Turczaninow, Bull. Soc. Imp. Naturalistes Moscou 19(2): 509. 1846.

***Gonostegia hirta*** (Blume ex Hasskarl) Miquel, Ann. Mus. Bot. Lugduno – Batavi 4: 303. 1869; T. Tuyama in Hara, Fl. E. Himal. 1: 59. 1966. *Pouzolzia hirta* Blume ex Hasskal, Cat. Hort. Borger. 80. 1844; Hooher f. in Hooker f., Fl. Brit. Ind. 5: 586. 1888; Grierson *et* Long in Grierson *et* Long, Fl. Bhut. 1(1): 129. 1983; Prain, Beng. Pl. 2: 965.1903. *Urtica hirta* Blume, Brijdr. 495. 1825. *Gonostegia hirta* Miquel, Ann. Mus. Bot. Lud. Bat. 4: 303. 1869. *Memorialis hirta* (Blume ex Hasskarl) Weddell, Prodr. 16(2): 2356. 1869.

Herbs, often prostrate, up to 90 cm, monoecious or dioecious. Stems 4 angled distally, pubescent. Leaves opposite, stipules broadly ovate; leaf blade narrowly lanceolate to ovate-elliptic, 3–8 × 1–3 cm, herbaceous or thinly papery, 3 veined, subglabrous, base subcordate to rounded, apex acuminate to acute. Glomerules bisexual or unisexual. Male flowers perianth lobes 5, oblanceolate, apex acute. Female flowers sessile; perianth tube ovoid, apex 2 toothed. Achene white to black, ovoid.

*Flowers & Fruits:* January to September.

*Specimen Cited:* Park, Rajib & AP Das 0348, dated 21. 07. 2007.

*Local Distribution:* Beel Margin near Conservatory sector and Park side.

*General Distribution:* India: Tropical Himalayas; Malaysia, China and Australia.

POUZOLZIA Gaudichaud-Beaupr , Voy. Uranie, Bot. 503. 1830.

***Pouzolzia zeylanica*** (Linnaeus) Bennett *et* R. Brown, Pl. Jav. Rar. 66–67. 1838; T. Tuyama in Hara, Fl. E. Himal. 1: 62. 1966; Grierson *et* Long in Grierson *et* Long, Fl. Bhut. 1(1): 130. 1983. *Parietaria indica* Linnaeus, Mant. Pl. 128. 1767. *Pouzolzia indica* (Linnaeus) G. Bennett, Pl. Jav. Rar. 67. 1838; Prain, Beng. Pl. 2: 965.1903. *Urtica glomerata* Klein ex Willdenow, Sp. Pl. 4(1):

361. 1805. *Parietaria zeylanica* Linnaeus, Sp. Pl. 2: 1052. 1753. *Pouzolzia indica* (Linnaeus) Gaudichaud, Freyc., Voy. Bot. 503. 1826; Hooker f. in Hooker f., Fl. Brit. Ind. 5: 581. 1888. [PLATE: 5, Figure-39]

Perennial herbs, erect, rarely prostrate, simple to few branched at base, up to 15 cm; rootstock often tuberous; strigillose. Leaves often opposite, sometimes alternate on lower stems; stipules triangular; leaf blade ovate to narrowly lanceolate, 2 – 5 1 - 3 cm, smallest ones on short branchlets, herbaceous, abaxial surface sparsely to densely strigillose, adaxial surface glabrous; base cuneate to rounded, rarely subcordate, margin entire, apex subobtuse, acuminate. Glomerules often bisexual, bisexual ones in nodes of proximal leaves, female in distal axils; bracts triangular, ciliate. Male perianth lobes 4, narrowly oblong to oblong-oblancheolate, puberulent, apex acute. Female perianth tube ellipsoid to rhombic, puberulent. Achenes white, light to dark yellow, ovoid.

*Flowers & Fruits:* September to April.

*Specimen Cited:* Conservation sector, *Rajib & AP Das 0159*, dated 08. 02. 2007.

*Local Distribution:* Beel Margin near Conservatory and Park sectors.

*General Distribution:* Tropical sub tropical india, Bhutan, Sri lanka, Bangladesh, Myanmar and China.

PILEA Lindley, Collect. Bot. t. 4. 1821, *nom. cons.*

### Key to the species:

- 1a. Leaves 3-veined from base of blade ..... *P. cordifolia*
- 1b. Leaves pinnately veined ..... *P. microphylla*

***Pilea cordifolia*** Hooker f., Fl. Brit. Ind. 5: 558. 1888; T. Tuyama in Hara, Fl. E. Himal. 1: 61. 1966; Grierson *et* Long in Grierson *et* Long, Fl. Bhut. 1(1): 114. 1983.

Perennial herbs, monoecious. Stems simple to branched, up to 40 cm, succulent, with galls on mid portion of internodes. Stipules persistent, ovate-oblong; lamina abaxially pale green, obliquely ovate to elliptic, unequal, 7 – 12 x 4 – 6 cm, membranous, 3-veined, lateral veins many, acuminate, acumen serrulate, coarsely crenate-serrate, base cordate to rounded. Inflorescences solitary, male distal, a paniculate cyme; female inflorescence proximal, shorter. Male flowers reddish, pedicellate, stamens 4. Female flowers subsessile, perianth lobes connate at base, unequal, abaxial lobe cymbiform, longer; staminodes 3, scale-like, oblong. Achene brownish, obliquely ovoid, compressed, smooth.

*Flowers & Fruits:* June to September.

*Specimen Cited:* Park, *Rajib & AP Das 0181*, dated 09. 02. 2007.

*Local Distribution:* Beel Margin near Conservatory sector and Park side.

*General Distribution:* Tropical India; Nepal, Bhutan, Bangladesh, China.

***Pilea microphylla*** (Linnaeus) Liebm., Kongel. Danske Vidensk. Selsk. Skr., Naturvidensk. Math. Afd., ser. 5, 5(2): 302. 1851. *Parietaria microphylla* Linnaeus, Syst. Nat., ed. 10, 2: 1308. 1759.

Annual, monoecious herbs. Stems ascending, succulent. Stipules persistent, triangular; lamina abaxially pale green, adaxially green, unequal in size, 2 – 4 1 – 3 mm, obtuse, entire, somewhat recurved, base cuneate or attenuate. Inflorescences often androgynous, compactly cymosecapitate; glomerules few flowered. Male flowers pedicellate; rudimentary ovary minute. Female perianth lobes subequal, oblong. Achene ovoid.

*Flowers & Fruits:* January to October.

*Specimen Cited:* Park, Rajib & AP Das 0138, dated 07. 02. 2007.

*Local Distribution:* Through out construction areas.

*General Distribution:* Tropical India; S.E. Asia; native to tropical South America.

ELATOSTEMA J. R. Forster *et* G. Forster, Char. Gen. Pl. 53. 1775, *nom. cons.*

*Elatostema monandrum* (Buchanon-Hamilton *ex* D. Don) H. Hara in Hara, Fl. E. Himal. 3: 21. 1975; Hara *et al.*, Enn. Fl. Pl. Nep. 3: 203. 1982; Grierson *et* Long in Grierson *et* Long, Fl. Bhut. 1(1): 122. 1983. *Procris monandra* Buchanan-Hamilton *ex* D. Don, Prodr. 61. 1825. *Elastotema surculosum* Wight, Icon. t. 2091, f. 4. 1853; Hooker *f.* in Hooker *f.*, Fl. Brit. Ind. 5: 572. 1888. *Elatostema diversifolium* Weddell, Prodr. 16(2): 189. 1868. *Elatostema laetum* Weddell, Ann. Sci. Nat., Bot. IV, 1: 190. 1854.

Herbs very small, erect 5 - 15 cm. Stems either glabrous or puberulous. Leaves sessile, alternate, a small rudimentary leaf placed oppositely; lamina ovate - lanceolate, 2 - 4 x 0.3 - 1.2 cm, lower leaves smaller, sub-entire, margin deeply serrate from middle or often below middle, acute or acuminate, base obliquely cuneate-rounded ; rudimentary leaves to 0.8 cm long, oblong, entire. Flowers heads of male flowers usually sessile, rarely pedunculate, subtended by free broad bracts. Female receptacles sessile and enclosed by connate bracts. Achenes fusiform.

*Flowers & Fruits:* June to September.

*Specimen Cited:* Park, Rajib & AP Das 0070, dated 06. 02. 2007.

*Local Distribution:* Throughout the Conservatory sectors and Park side.

*General Distribution:* India: West Bengal, Assam, Meghalaya, Arunachal Pradesh, Sikkim, Bihar; Bhutan, Nepal, Sri Lanka, Myanmar, China.

**Order: Cucurbitales** Jusseu *ex* Berchtold & J. Presl (1820)

**Cucurbitaceae** A.L. de Jussieu, Gen. Pl. 393. 1789; *nom. cons.*

**Key to the genera:**

- |   |                      |
|---|----------------------|
| 1a. Marginal segments of corolla fimbriate .....              | <i>Trichosanthes</i> |
| 1b. Marginal segments of corolla not fimbriate .....          | 2                    |
| 2a. Stamens 5 .....   | <i>Zanonia</i>       |
| 2b. Stamens 3 or 1 .....                                      | 3                    |
| 3a. Stamens united; leaf blade pedatipartite .....            | <i>Cyclanthera</i>   |
| 3b. Stamens free; leaves not pedately compound .....          | 4                    |
| 4a. Flowers small less than 1cm in diam .....                 | 5                    |
| 4b. Flowers comparatively large, more than 2 cm in diam ..... | 6                    |
| 5a. Male flowers without pistillode .....                     | <i>Diplocyclos</i>   |
| 5b. Male flowers with pistillode .....                        | <i>Mukia</i>         |
| 6a. Corolla campanulate .....                                 | <i>Coccinia</i>      |
| 6b. Corolla rotate .....                                      | 7                    |
| 7a. Flowers with leaflike bract on pedicel .....              | <i>Momordica</i>     |
| 7b. Flowers without bract on pedicel .....                    | 8                    |
| 8a. Male flowers in racem to subumbell .....                  | <i>Luffa</i>         |
| 8b. Flowers solitary .....                                    | <i>Citrullus</i>     |

COCCINIA Wight & Arnott, Prodr. Fl. Ind. Orient. 1: 347. 1834.

*Coccinia grandis* (Linnaeus) Voigt, Hort. Suburb. Calcutt. 59. 1845; Hara *et al.*, Enn. Fl. Pl. Nep. 2: 177. 1979. *Bryonia grandis* Linnaeus, Mant. Pl. 126. 1767. *Coccinia cordifolia* Cogn., Monogr. Phan. 3: 529. 1881. *Cephalandra grandis* Kurz, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 46(2): 103. 1877.

*Vernacular Name:* Telakucha.

Climbing herbs. Stem slender, slightly woody, branched. Tendrils simple, filiform, glabrous. Petioles slender; lamina broadly cordate, 5 – 12 x 4 – 10cm, usually 5 lobed, obtuse, base with several glands. Flowers dioecious, solitary. Male pedicel slender; calyx-tube broadly campanulate, segments linear-lanceolate; corolla white or slightly yellow, segments ovate, glabrous outside, pubescent inside; stamens 3, filaments and anthers connate, anthers subglobose. Female pedicel slender; staminodes 3, nearly subulate, villous at base; ovary fusiform, stigmas 3. Fruits fusiform. Seeds yellow, oblong.

*Flowers & Fruits:* January to December.

*Specimen Cited:* Takomari forest, Rajib & AP Das 0157, dated 08. 02. 2007.

*Local Distribution:* Forest floor.

*General Distribution:* Tropical and sub-tropical parts of the world.

DIPLOCYCLOS (Endlicher) T. Post & Kuntze, Lex. Gen. Phan. 178. 1903 [“*Diplocyclus*”].

*Diplocyclos palmatus* (Linnaeus) C. Jeffrey in Kew Bull. 15: 352. 1962 ; Grierson in Grierson *et Long*, Fl. Bhutan 2(1): 255. 1991. *Bryonia palmata* Linnaeus, Sp. Pl. 1012. 1753, excl. syn. *Bryonia laciniosa* Linnaeus, Sp. Pl. 1013. 1753. *Ilocania pedata* Merril, Philipp. J. Sci. 13(1): 65-66. 1918.

Tuberous monoecious climbing herbs; stems slender, tendrils 2 – fid. Lamina deeply palmately 5 – lobed, denticulate or undulate, upper surface scabrous, lower smooth. In male flowers corolla campanulate, greenish-yellow, shortly papillose. Female flowers fasciculate, ovary globose. Fruits spherical, green; seeds grey.

*Flowers & Fruits:* April to December.

*Specimen Cited:* Atiamochar forest, Rajib & AP Das 0200, dated 09. 02. 2007.

*Local Distribution:* Forest floor.

*General Distribution:* Tropical and sub-tropical parts of India, Sri Lanka, Myanmar, Bangladesh, Pakistan, Malaysia, China, Africa, Australia.

LUFFA Miller, Gard. Dict. Abr., ed. 4, [806]. 1754.

### Key to the species:

- 1a. Stamens 5; fruit smooth ..... *L. cylindrica*
- 1b. Stamens 3; fruit with 8–10 acute ribs ..... *L. acutangula*

*Luffa acutangula* (Linnaeus) Roxburgh, Fl. Ind. ed. 1832 3: 713. 1832; Grierson in Grierson *et Long*, Fl. Bhut. 2 (1): 256. 1991. *Cucumis longus* var. *indicus* Grew, Mus. Reg. Soc. 229. 1681. *Luffa foetida* Cavanilles, Icon. 1: 7. 1791. *Momordica tubiflora* Wallich, List 6749. 1832. *Luffa acutangula* (Linnaeus) Roxburgh, Hort. Beng. 70. 1814. *Cucumis acutangulus* Linnaeus, Sp. Pl. ed. 1: 1001. 1753.

*Vernacular name:* Jhinga.

Annual scandent herbs; stem sulcate-angular, pubescent. Tendrils robust, 3 fid. Lamina suborbicular, membranous, 15 – 20 x 15 – 20cm, 5 to 7 lobed, median lobe broadly triangular, lateral lobes

smaller, dentate, acute. Male flowers in raceme at apex of peduncle. Calyx tube campanulate, segments lanceolate, acuminate, slightly reflexed. Corolla yellow, rotate, segments obcordate, both surfaces subglabrous; stamens 3, free, anthers puberulent. Female flowers: solitary; ovary terete, style short, stigmas 3, expanded. Fruits cylindrical, with 8–10 acute ribs. Seeds ovate, black.

*Flowers & Fruits:* June to December.

*Specimen Cited:* Park side forest, *Rajib & AP Das 0284*, dated 10. 02. 2007.

*Local Distribution:* Forests.

*General Distribution:* India, S and SW Asia; also cultivated in tropical regions.

***Luffa cylindrica*** (Linnaeus) M. Roemer, *Fam. Nat. Syn. Monogr.* 2: 63. 1846. *Momordica cylindrica* Linnaeus, *Sp. Pl.* 1009. 1753. *Momordica luffa* Linnaeus, *Sp. Pl.* 1009. 1753. *Luffa pentandra* Roxburgh, *Fl. Ind. ed.* 1832 3: 712. 1832. *Luffa aegyptiaca* Miller, *Gard. Dict. ed.* 8, 4: 500. 1785; Dyer in *Fl. Brit. Ind.* 2: 614. 1879; Grierson in Grierson *et Long*, *Fl. Bhutan* 2(1): 256. 1991.

*Vernacular Name:* Dhundol.

Annual scandent herbs; stem and branches scabrous, sulcate-angular, puberulent. Tendrils rather robust, usually 2 to 4 fid. Lamina triangular or suborbicular, 10 – 18 x 10 – 16cm, often palmately 5 to 7 lobed, lobes triangular, dentate, acute or acuminate, base deeply cordate. Male flowers usually in a raceme, calyx broadly campanulate, segments ovate lanceolate, acuminate, 3 nerved; corolla yellow, rotate, segments oblong. Stamens usually 5, connate at first, later free. Female flowers solitary; ovary long cylindrical, stigmas 3. Fruit cylindrical. Seeds ovate, smooth, black.

*Flowers & Fruits:* June to December.

*Specimen Cited:* Park side forest, *Rajib & AP Das 0227*, dated 09. 02. 2007.

*Local Distribution:* Forest.

*General Distribution:* Tropics of the Old World; cultivated in warm countries.

MOMORDICA Linnaeus, *Sp. Pl.* 2: 1009. 1753.

***Momordica charantia*** Linnaeus, *Sp. Pl. ed.* 1: 1009. 1753; Dyer in *Fl. Brit. Ind.* 2: 616. 1879; Grierson in Grierson *et Long*, *Fl. Bhutan* 2(1): 252. 1991. *Momordica indica* Linnaeus, *Herb. Amb.* 24. 1754. [PLATE: 10, Figure-121]

*Vernacular Name:* Uchhe.

Annual scandent herbs, branched. Tendrils up to 20 cm, simple. Petiole slender. Lamina ovate-reniform or suborbicular, membranous, 4 – 10 x 4 – 9cm, lobes ovate-oblong, margin crenate or irregularly lobed, acute, sinus semicircular, nerves palmate. Male flowers solitary in axils of leaves, pedicel slender. Calyx segments ovate-lanceolate, acute. Corolla yellow, segments obovate; stamens 3, free. Female flowers solitary; ovary fusiform, stigmas expanded, 2 lobed. Fruits fusiform to cylindrical, orange when mature. Seeds numerous, oblong.

*Flowers & Fruits:* May to October.

*Specimen Cited:* Near conservation sector, *Rajib & AP Das 0226*, dated 09.02. 2007.

*Local Distribution:* Forests.

*General Distribution:* Tropical and sub-tropical parts of the world.

MUKIA Arnott, *Madras J. Lit. Sci.* 12: 50. 1840.

***Mukia maderaspatana*** (Linnaeus) M.J. Roemer, *Fam. Nat. Syn. Monogr.* 2: 47. 1846; Grierson in Grierson *et Long*, *Fl. Bhutan* 2(1): 258. 1991. *Cucumis maderaspatana* Linnaeus, *Sp. Pl.*



1012. 1753. *Bryonia scabrella* Linnaeus f., Suppl. Pl. 424. 1781. *Mukia scabrella* (Linnaeus f.) Arnot, J. Bot. (Hooker) 3: 276. 1841.

Annual scandent herbs, all parts densely yellow-brown hispid. Stems branched. Tendrils simple. Lamina rigid, ovate to ovate cordate, usually 3 – 5 lobed, 5 – 10 x 5 – 8cm, irregularly denticulate, slightly obtuse, base cordate. Male flowers fascicled, pedicels short; calyx-tube campanulate, segments subulate, reflexed; corolla yellow, segments ovate-oblong, apex obtuse; stamens 3, filaments short, slightly pilose, anthers oblong, ciliate, connective distinct; rudimentary ovary globose. Female flowers solitary. Fruiting pedicels extremely short; fruit dark red, globose. Seeds ovate.

*Flowers & Fruits:* April to December.

*Specimen Cited:* Park side forest, *Rajib & AP Das 0712*, dated 14. 02. 2008.

*Local Distribution:* Forest floor.

*General Distribution:* Tropical and sub-tropical parts of the world.

TRICHOSANTHES Linnaeus, Sp. Pl. 2: 1008. 1753.

### Key to the species:

1a. Lamina broadly ovate cordate; bracts entire ..... *T. cordata*

1b. Lamina suborbicular; bract dentate ..... *T. lepiniana*

***Trichosanthes cordata*** Roxburgh, Fl. Ind. 3: 703. 1832; Grierson in Grierson *et* Long, Fl. Bhut. 2 (1): 265. 1991. *Involucraria cordata* (Roxburgh) M. Roemer, Fam. Nat. Syn. Monogr. 2: 97. 1846. *Trichosanthes microsiphon* Kurz, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 308. 1872.

Stem robust, angular. Lamina broadly ovate cordate, 8 – 20 x 7 – 18cm, minutely denticulate, acute to shortly acuminate, base cordate, papery. Male raceme 4 to 7 flowered; peduncle stout, striate, sparsely puberulent; pedicels thick; bracts oblong, entire, shortly hirsute; calyx tube attenuate from apex towards base; sepals linear-lanceolate. Female flower solitary; ovary oblong, slightly puberulent. Fruit globose, smooth, red.

*Flowers & Fruits:* July to August.

*Specimen Cited:* Near conservation sector, *Rajib & AP Das 0278*, dated 10. 02. 2007.

*Local Distribution:* Forest.

*General Distribution:* India, Laos, Malaysia, Myanmar, Singapore

***Trichosanthes lepiniana*** (Naudin) Cogniaux in DC., Monogr. Phan. 3:377. 1881; H. Ohashi in Hara, Fl. E. Himal. 1:325. 1966; Grierson in Grierson *et* Long, Fl. Bhutan 2(1): 266. 1991. *Involucraria lepiniana* Naudin, Cat. 2. 1868. *Trichosanthes tricuspida* Loureiro, Fl. Cochinch. 589. 1790; Hara *et al.*, Enn. Fl. Pl. Nep. 2: 180. 1979. *Trichosanthes palmata* Roxburgh, Fl. Ind. 3: 704. 1832; Dyer in Fl. Brit. Ind. 1: 606. 1879.

*Vernacular name:* Makal.

Stem robust, branched, glabrous. Lamina suborbicular, 9 – 17 cm, shortly 3 to 5 lobed up to middle, adaxially deep green, rough, denticulate, acute to shortly acuminate, base cordate. Male raceme 15 cm; peduncle robust, striate; bracts suborbicular, margin lacerate; calyx tube puberulent; sepals narrowly ovate, margin lacinate. Female flowers solitary; pedicel glabrous; bracts ovate, entire; ovary ovate, glabrous. Fruit ovoid, smooth, red. Seeds broadly ovate.

*Flowers & Fruits:* May to Nov.

*Specimen Cited:* Near conservation sector, *Rajib & AP Das 0230*, dated 09. 02. 2007.

*Local Distribution:* Rosd side forests.

*General Distribution:* India, Bhutan. Endemic to Eastern Himalaya

ZANONIA Linnaeus, Sp. Pl. 2: 1028. 1753.

**Zanonia indica** Linnaeus, Sp. Pl., ed. 2, 2: 1457. 1763; Grierson in Grierson *et* Long, Fl. Bhut. 2 (1): 268. 1991.

Stem robust, branched. Leaves glabrous, lamina ovate oblong, 8 – 15 x 5 – 10cm, entire, acute, base rounded, leathery, adaxially smooth, abaxially with distinctly reticulate nerves, lateral nerves 3 - 4 pairs. Male peduncle slender, rachis much-branched. Calyx-segments ovate-triangular, acute. Corolla pale yellow-brown, segments oblong, obtuse. Female peduncle 5 - 10-flowered; pedicels thick; calyx-segments obtuse; ovary cylindrical. Fruit brownish, finely granulate, apex truncate, base obtuse. Seeds oblong.

*Flowers & Fruits:* May to October.

*Specimen Cited:* Near conservation sector, *Rajib & AP Das 0305*, dated 10. 02. 2007.

*Local Distribution:* Atiamochar forest.

*General Distribution:* Tropical India; Cambodia, Indonesia, Laos, Malaysia, Myanmar, Philippines, Sri Lanka, Thailand, Vietnam.

CYCLANTHERA Schrader, Index Sem. Hort. Acad. Goett. 1831: 2. 1831.

**Cyclanthera pedata** (Linnaeus) Schrader, Index Sem. Hort. Goett. (GOET) 1831: 2. 1831; Grierson in Grierson *et* Long, Fl. Bhut. 2 (1): 262. 1991. *Momordica pedata* Linnaeus, Sp. Pl. 1009. 1753. *Momordica pedisecta* Linnaeus ex Ser., Prodr. 3: 319. 1828. *Anguria pedisecta* Ser., Prodr. 3: 319. 1828. *Momordica pedata* L., Sp. Pl. 2: 1009. 1753.

Annual scandent herbs. Stem robust. Tendrils 2 fid. Petiole 5 – 12 cm; leaflets elliptic to elliptic lanceolate, median 7 – 15 x 2 – 5 cm, dentate, acuminate, base cuneate. Male flowers in a panicle; pedicels filiform. Calyx tube cupular, segments linear. Corolla yellow, segments ovate-triangular, puberulent; filaments connate, anther circular. Female calyx and corolla as in male, ovary ovate. Fruit narrowly oblong to long elliptic, apex acuminate. Seeds black.

*Flowers & Fruits:* May to October.

*Specimen Cited:* Near conservation sector, *Rajib & AP Das 0264*, dated 10. 02. 2007.

*Local Distribution:* Atiamochar forest.

*General Distribution:* India: tropical parts; Bhutan, China, Bangladesh.

CITRULLUS Schrader ex Ecklon & Zeyher, Enum. Pl. Afric. Austral. 2: 279. 1836, *nom. cons.*

**Citrullus lanatus** (Thunb.) Matsum. & Nakai, Index Seminum (TI) 1916: 30. 1916. *Momordica lanata* Thunburg, Prodr. Pl. Cap. 13. 1794. *Cucumis citrullus* (Linnaeus) Ser., Prodr. 3: 301. 1828. *Citrullus vulgaris* Schr. ex Eckl & Zeyh., Enum. Pl. Afr. Austr. 279. 1836; Hooker *f.* in Hooker *f.*, Fl. Brit. India 2: 621. 1879.

Annual herbs. Stem and branches robust, villous. Tendrils puberulent, 2 fid. Petiole densely pubescent; lamina triangulate-ovate, 8 – 15 x 5 – 10cm, both surfaces hispid, 3 partite, segments lobulate, acute to acuminate, base cordate. Flowers monoecious, solitary. Male pedicel villous; calyx-tube densely villous, segments narrowly lanceolate. Corolla pale yellow segments ovate-oblong; stamens 3, nearly free. Female calyx and corolla as in male, ovary densely villous, stigmas 3, reniform. Fruits globose, smooth. Seeds numerous, ovate.

*Flowers & Fruits*: April to October.

*Specimen Cited*: Near conservation sector, *Rajib & AP Das 0214*, dated 09. 02. 2007.

*Local Distribution*: Atiamochar forest.

*General Distribution*: India: native to S Africa; cultivated in all warmer areas of the world.

## Core-Eudicots: Rosids: Eurosids (II)

**Order: Myrtales** Jussieu *ex* Berchtold & J. Presl (1820)

**Combretaceae** R. Brown, Prodr. 1: 351. 1810; *nom. cons.*

### Key to the genera:

- 1a. Trees ..... *Terminalia*  
 1b. Woody lianas ..... *Combretum*

COMBRETUM Loefling, Iter Hispan. 308. 1758, *nom. cons.*

### Key to the species:

- 1a. Stamens not exerted from calyx tube; style partly adnate to calyx tube .... *C. indicum*  
 1b. Stamens usually exerted from calyx tube; style not adnate to calyx tube .... *C. decandrum*

*Combretum decandrum* Jacquin, Enum. Syst. Pl. 19. 1760; Clement in Grierson *et* Long, Fl. Bhutan 2(1): 306. 1991; Prain, Beng. Pl. 1: 482. 1903. *Poivreia alternifolia* (C.H. Persoon) de Candolle, Prodr. 3: 17. 1828. *Gonocarpus jacquini* William Hamilton, Prodr. Pl. Ind. Occid. 39. 1825. *Combretum palmeri* Rose, Contr. U. S. Natl. Herb. 5: 136. 1898. *Combretum roxburghii* Sprengel, Syst. Veg. 2: 331. 1825.

*Combretum decandrum* Roxburgh, Pl. Coromandel 1: 43. 1796, not Jacquin (1760); Pentaptera Woody lianas. Branchlets reddish villosulous when young. Leaves opposite; lamina oblong-elliptic to obovate-oblong, 5 – 15 x 3 – 6 cm, lateral veins in 6 or 7 pair, obtuse, base obtuse to obtuse-rounded. Inflorescences terminal and axillary, laxly compound spikes 5–15 cm, leafy panicle; bracts persistent at anthesis, tomentose. Calyx tube distally; lobes 5, broadly triangular. Petals 5, obovate-oblong. Stamens 10, only slightly exerted, not exceeding petals. Fruit glossy, cylindrical, 5-winged.

*Flowers & Fruits*: August to November.

*Specimen Cited*: Atiamochar forest near Batikata Beel, *Rajib & AP Das 0492*, dated 23.07.2007.

*Local Distribution*: Atiamochar Forest.

*General Distribution*: India: tropical; Bhutan, China, Bangladesh, Nepal, Laos, Myanmar, Sri Lanka, Thailand, Vietnam.

*Combretum indicum* (Linnaeus) De Philipps, *Useful Pl. Dominica* 277. 1998. *Quisqualis indica* Linnaeus, Sp. Pl. ed. 2: 556. 1762; Clement in Grierson *et* Long, Fl. Bhutan 2(1): 309. 1991. *Quisqualis glabra* Burmanf., Fl. Indica 104. 1768. *Quisqualis grandiflora* Miquel, J. Bot. N. erl. 1: 119. 1861. *Quisqualis indica* Linnaeus, Sp. Pl., ed. 2, 1: 556. 1762.

*Vernacular name*: Madhabilata.

Lianas up to to 8 m. Lamina mostly oblong-elliptic to elliptic, 5 – 16 x 2 – 7 cm, lateral veins in 7 to 8 pairs, acuminate to shortly caudate base obtuse. Inflorescences lax; bracts deciduous, filiform-linear to ovate. Flowers fragrant. Calyx tube yellow pilose; lobes deltoid, acute to shortly acuminate. Petals opening white, later turning yellowish abaxially and reddish adaxially, obovate to oblanceolate. Fruit red when young, greenish black or brown when ripe, sharply 5 ridged, apex mucronate.

*Flowers & Fruits:* March to November.

*Specimen Cited:* Bochamari Village, *Rajib & AP Das 0569*, dated 24.07.2007.

*Local Distribution:* Cultivate in villages.

*General Distribution:* India (through out), Bhutan, China, Bangladesh, Nepal, Sri Lanka, Pakistan, Indonesia, Laos, Malaysia, Myanmar, Philippines, Singapore, Thailand, Vietnam; coastal E Africa, Indian Ocean islands, Pacific islands; introduced to other parts of tropical Africa and Central and South America.

TERMINALIA Linnaeus, Mant. Pl. 1: 21, 128. 1767, *nom. cons.*

### Key to the species:

- 1a. Fruit 3 to 5 winged ..... 2
- 1b. Fruit 2 to 5 ridged ..... 3
- 2a. Fruit 2 winged with a rudimentary wing between two ..... *T. myriocarpa*
- 2b. Fruit 4 to 5 winged without rudimentary wing ..... *T. arjuna*
- 3a. Lamina elliptic ..... *T. chebula*
- 3b. Lamina obovate ..... *T. bellirica*

***Terminalia arjuna*** (Roxburgh *ex de Candolle*) Wight & Arnott, Prodr. Fl. Ind. Orient. 314. 1834. Prain, Beng. Pl.?? *Pentaptera arjuna* Roxburgh (Hort. Beng. 34.1814, *nom. nud.*) *ex de Candolle*, Prodr. 3: 15. 1828.

*Vernacular Name:* Arjun.

Trees, trunk buttressed. Bark greenish-white. Leaves sub-opposite or alternate; lamina elliptic – oblong, Fl. Bhut. 15 – 30 x 6 – 15 cm, obtuse or mucronate, base obtuse-rounded to attenuate. Flowers in pendulous axillary or terminal panicles of spikes. Calyx lobes 5, pale-yellow. Stamens 10, exserted. Drupes ovoid or obovoid – oblong, woody, strongly 5 ridged.

*Flowers & Fruits:* May to April.

*Specimen Cited:* Rasik Beel, *Rajib & AP Das 0541*, dated 23.07.2007.

*Local Distribution:* Through out Forest.

*General Distribution:* India, Bhutan, China, Bangladesh, Sri Lanka.

***Terminalia bellirica*** (Joseph Gaertner) Roxburgh, Pl. Coromandel 2: 54. 1805; Clarke in Hooker *f*, Fl. Brit. Ind. 2: 445. 1879; Clement in Grierson *et Long*, Fl. Bhutan 2(1): 304. 1991. *Myrobalanus bellirica* Gaertner, Fruct. Sem. Pl. 2: 90. 1791. *Myrobalanus bellirica* Joseph Gaertner, Fruct. Sem. Pl. 2: 90. 1791. *Terminalia punctata* Roth, Nov. Pl. Sp. 381. 1821.

*Vernacular Name:* Baherha.

Large, deciduous trees, up to 35 m. Leaves spiraled, crowded into pseudowhorls at apices of branchlets; petiole 3–9 cm, glabrous but ferruginous tomentose when young, especially at base, with 2 glands above middle; lamina glossy, obovate, 15 – 30 x 6 – 15 cm, obtuse or mucronate, base obtuse-rounded to attenuate. Inflorescences axillary, simple spikes. Calyx lobes 5. Stamens 10, exserted. Fruit shortly stipitate, subglobose to broadly ellipsoid, weakly to strongly 5 ridged.

*Flowers & Fruits:* March to August.

*Specimen Cited:* Rasik Beel, *Rajib & AP Das 0602*, dated 26.07.2007.

*Local Distribution:* Through out Forest.

*General Distribution:* India, Bhutan, Bangladesh, Nepal, Sri Lanka, Cambodia, Indonesia, Laos, Malaysia, Myanmar, Thailand, Vietnam; N. Australia; introduced in E. Africa.

***Terminalia chebula*** Retzius, *Observ. Bot.* 5: 31. 1789; Clarke in Hooker *f.*, *Fl. Brit. Ind.* 2: 446. 1879; H. Ohashi in Hara, *Fl. E. Himal.* 1: 220. 1966; Clement in Grierson *et Long*, *Fl. Bhutan* 2(1): 304. 1991.

*Vernacular Name:* Haritaki.

Large trees, up to 30 m. Leaves alternate to subopposite; petiole moderately stout; lamina elliptic, 7 – 16 x 4 – 10 cm, both surfaces glabrous, mucronate, base obtuse-rounded to cuneate, oblique. Inflorescences axillary or terminal, simple spikes, 5–10 cm, numerous flowered. Flowers bisexual. Calyx tube distally cupular; lobes 5. Stamens 10, exserted. Fruit not stipitate, blackish brown when ripe, ovoid, obtusely 5-ridged.

*Flowers & Fruits:* May to December.

*Specimen Cited:* Rasik Beel, *Rajib & AP Das 0639*, dated 12. 02. 2008.

*Local Distribution:* Takomari Forest.

*General Distribution:* India, Bhutan, China, Bangladesh, Nepal, Sri Lanka, Cambodia, Laos, Malaysia (introduced), Myanmar, Thailand, Vietnam.

***Terminalia myriocarpa*** Van Heurck & Mueller Argoviensis, *Observ. Bot.* 215. 1871; Clement in Grierson *et Long*, *Fl. Bhutan* 2(1): 305. 1991.

*Vernacular name:* Pukkasaj.

Large evergreen trees, up to 35 m. Leaves opposite; petiole stout, with 2 stalked glands at apex; lamina oblong-elliptic to oblong-lanceolate, 10 – 28 x 4 – 12 cm, thickly papery, short, oblique tip, entire to slightly undulate, rarely conspicuously toothed, base obtuse. Inflorescences terminal or axillary, simple or compound, long. Calyx tube distally cupular; lobes 5. Stamens 10, exserted. Fruit not stipitate, 2 winged with a rudimentary wing, yellowish when dry.

*Flowers & Fruits:* August to February.

*Specimen Cited:* Rasik Beel, *Rajib & AP Das 0586*, dated 25.07.2007.

*Local Distribution:* Atiamochar Forest.

*General Distribution:* India, Bhutan, Bangladesh, Nepal, China, Indonesia, Laos, Malaysia, N Myanmar, Thailand, N Vietnam.

**Lythraceae** Jaume St. Hilaire, *Expos. Fam.* 2: 175. 1805 ('Lythraeae'; *nom. cons. prop.* vs. Salicariaceae).

#### Key to the genera:

- |  |                             |
|--|-----------------------------|
| 1a. Tree or shrubs .....                       | 2                           |
| 1b. Herbs .....                                | 4                           |
| 2a. Fruits capsules .....                      | 3                           |
| 2b. Fruits berries .....                       | <b><i>Punica</i></b>        |
| 3a. Leaves leathery; stamens 10 – 12 .....     | <b><i>Woodfordia</i></b>    |
| 3b. Leaves papery; stamens 30 to 120 .....     | <b><i>Lagerstroemia</i></b> |
| 4a. Aquatic floating herbs .....               | <b><i>Trapa</i></b>         |
| 4b. Marshy land or wet terrestrial herbs ..... | 5                           |
| 5a. Flowers usually 3 or more per axil .....   | <b><i>Ammannia</i></b>      |
| 5b. Flowers usually solitary.....              | <b><i>Rotala</i></b>        |

AMMANNIA Linnaeus, *Sp. Pl.* 1: 119. 1753.

#### Key to the species:

- 1a. Petals absent ..... *A. baccifera*  
 1b. Petals present ..... *A. multiflora*

***Ammannia baccifera*** Linnaeus, Sp. Pl. 120. 1753; Clarke in Hooker *f.*, Fl. Brit. Ind. 2: 569. 1879; Long *et* Rae in Grierson *et* Long, Fl. Bhut. 2 (1): 271. 1991; Prain, Beng. Pl. 2: 500. 1903; Cook, Aqua. Wetl. Pl. Ind. 249. 1996; Guha Bakshi, Fl. Mur. Dist. 131. 1984. *Ammannia indica* de Lamarck, Tabl. Encycl. 1: 311. 1792. *Ammannia glauca* Wallich *ex* Wight & Arnott, Prodr. Fl. Ind. Orient. 1: 305. 1834. *Ammannia baccifera f. glauca* (Wallich *ex* Wight & Arnott) Koehne, Bot. Jahrb. Syst. 1: 261. 1880.

Annual, herbs. Stem with numerous ascending branches. Leaves opposite on basal, opposite or alternate toward apices, narrowly elliptic or oblanceolate, 8–40 × 3–9 mm, base attenuate to subcordate. Flowers 3 to many in dense axillary cymes; pedicels subsessile; bracteoles minute. Floral tube campanulate, tapering at base; sepals 4; epicalyx absent. Petals absent. Stamens 4. Style absent or much shorter than ovary. Capsules exserted.

*Flowers & Fruits:* July to Dec.

*Specimen Cited:* Batikata Beel, Rajib & AP Das 0146, dated 08. 02. 2007.

*Local Distribution:* Margins of water bodies through out the Beel.

*General Distribution:* India, Bhutan, Nepal, Bangladesh, China, Malaysia, Philippines, Thailand, Vietnam, Afghanistan, Cambodia, Laos; tropical Africa, Australia, Caribbean islands.

***Ammannia multiflora*** Roxburgh, Fl. Ind. 1: 447. 1820; Clarke in Hooker *f.*, Fl. Brit. Ind. 570. 1879; Prain, Beng. Pl. 1: 500. 1903; Bot. Bihar & Orissa pt. II: 380. 1922; Panda *et* Das, Fl. Sambalp. 340. 2004; Cook, Aqua. Wetl. Pl. Ind. 250. 1996. *Cryptotheca dichotoma* Blume, Bijdr. 1129. 1827. *Ammannia parviflora* de Candolle, Prodr. 2: 77. 1825.

Annual, herbs. Stems with numerous short branches. Leaves opposite, narrowly elliptic or broadly linear to lanceolate-oblong, Fl. Bhut. 2–3 cm x 3–10 mm, base attenuate to cordate. Flowers 3–7 in dense axillary cymes; pedicels 1–2 mm; bracteoles linear. Floral tube campanulate, 4 ribbed; sepals 4. Petals 4, pink to whitish, obovate, minute. Stamens 4. Style 1/3–1/2 as long as ovary. Capsules redbrown, exserted.

*Flowers & Fruits:* November to September.

*Specimen Cited:* Bochamari Beel, Rajib & AP Das 0161, dated 08. 02. 2007.

*Local Distribution:* Bochamari Beel.

*General Distribution:* India, Bhutan, China, Japan, Malaysia and Australia. tropics and subtropics of Africa and Australia.

LAGERSTROEMIA Linnaeus, Syst. Nat., ed. 10, 2: 1068, 1076, 1372. 1759.

#### Key to the species:

- 1a. Shrubs; stamens dimorphic ..... *L. indica*  
 1b. Trees; stamens monomorphic ..... 2  
 2a. Stamens 40 to 60 ..... *L. parviflora*  
 2b. Stamens 75 to 120 ..... *L. speciosa*

***Lagerstroemia indica*** Linnaeus, Syst. Nat. ed. 10(2): 1076. 1759. Long *et* Rae in Grierson *et* Long, Fl. Bhut. 2 (1): 276. 1991; Prain, Beng. Pl.?? *Lagerstroemia indica* var. *alba* Ram. Goyena, Fl. Nicarag. 410. 1909. *Lagerstroemia minor* Retzius, Observ. Bot. 1: 20. 1779.

Shrubs up to 7 m. Branchlets slender, 4 angled. Leaves semi sessile; lamina elliptic to oblong-obovate, mucronate, 3–7 x 1.5–3.5 cm, papery, lateral veins 3–7 pairs, acute with small mucro,

base broadly cuneate to rounded. Panicles subpyramidal, densely flowered. Floral tube 6-merous; annulus present; epicalyx absent. Petals purple or white. Stamens 36–40, dimorphic. Ovary glabrous. Capsules ellipsoidal, 4–6-valved.

*Flowers & Fruits*: November to July.

*Specimen Cited*: Park, Rajib & AP Das 0505, dated 23.07.2007.

*Local Distribution*: Often planted in parks and villages.

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

***Lagerstroemia parviflora*** Roxburgh, Pl. Coromandel 1: 48. 1796. Long *et* Rae in Grierson *et* Long, Fl. Bhut. 2 (1): 276. 1991; Prain, Beng. Pl. 1:503. 1903. *Murtughas parviflora* Kuntze, Revis. Gen. Pl. 1: 249. 1891. *Fatioa napaulensis* de Candolle, Prodr. 3: 89. 1828.

*Vernacular name*: Sidha.

Trees, up to 15 m. Petiole 1.2–1.5 cm; lamina ovate to oblong-elliptic, 5–12 x 3–6 cm, papery, round to mucronate, base acute to attenuate. Panicles 5–7 cm. Floral tube 6-merous; sepals narrowly deltate, ½ as long as floral tube; annulus absent; epicalyx segments absent or minute. Petals purple to bluish purple when dry, ovate. Stamens 40 to 60, monomorphic. Ovary glabrous. Capsules oblong, 6 valved.

*Flowers & Fruits*: March to December.

*Specimen Cited*: Tacomari forest, Rajib & AP Das 0511, dated 23.07.2007.

*Local Distribution*: Tacomari Forest.

*General Distribution*: Pantropical.

***Lagerstroemia speciosa*** (Linnaeus) Persoon, Syn. Pl. 2: 72. 1806. *Lagerstroemia hirsuta* (Lamarck) Willdenow, Sp. Pl. 2: 1178. 1799; Long *et* Rae in Grierson *et* Long, Fl. Bhut. 2 (1): 276. 1991. *Adambe hirsuta* Lamarck, Encycl. 1: 39. 1783. *Lagerstroemia flos-reginae* Retzius, Observ. Bot. 5: 25 1788.

*Vernacular Name*: Jarul.

Trees, up to 15 m. Petiole 1.2–1.5 cm; lamina elliptic to oblong-elliptic, 8–22 x 5–10 cm, papery, lateral veins 10 to 11 pairs, shortly acuminate, base acute to attenuate. Panicles 10–15 cm. Floral tube 6-merous; sepals narrowly deltate, ½ as long as floral tube; annulus absent; epicalyx segments absent or minute. Petals purple to bluish purple when dry, ovate. Stamens 75 to 120, monomorphic. Ovary glabrous. Capsules oblong, 6 valved.

*Flowers & Fruits*: March to December.

*Flowers & Fruits*: May to September.

*Specimen Cited*: Tacomari forest, Rajib & AP Das 0512, dated 23.07.2007.

*Local Distribution*: Plantation forests.

*General Distribution*: India, Nepal, Bhutan, Myanmar, Thailand.

PUNICA Linnaeus, Sp. Pl. 1: 472. 1753.

***Punica granatum*** Linnaeus, Sp. Pl. 1: 472. 1753. Long *et* Rae in Grierson *et* Long, Fl. Bhut. 2 (1): 288. 1991; Prain, Beng. Pl.?? . *Punica grandiflora* Hortulanorum *ex* Ernst G. Steudel, Nom. ed. I. 669. 669 . *Punica nana* Linnaeus, Sp. Pl. ed. II. 676. 1753.

*Vernacular name*: Dalim.

Shrubs, up to 2m. Branches and branchlets 4-angled. Petiole 3–8 mm; lamina adaxially shiny, lanceolate to elliptic-oblong, 2–7 x 1–1.5 cm, obtuse or mucronate, base attenuate. Floral tube red-orange, campanulate; sepals 5–9, erect. Petals 5–9, bright red-orange, obovate. Stamens numerous, included to exserted. Ovary 8–12 loculed. Fruit globose, leathery berries. Seeds obpyramidal within juicy sarcotestal layer, ruby-red.

*Flowers & Fruits:* March to July.

*Specimen Cited:* Rasik Beel, *Rajib & AP Das 0221*, dated 09. 02. 2007.

*Local Distribution:* In the villages.

*General Distribution:* widespread in cultivation.

ROTALALinnaeus, Mant. Pl. 2: 143, 175. 1771.

### Key to the species

- |  |                        |
|--|------------------------|
| 1a. Flowers in terminal spikes .....                                 | <i>R. rotundifolia</i> |
| 1b. Flowers in axillary spikes .....                                 | 2                      |
| 2a. Leaf margin translucent to opaque white; capsules 2 valved ..... | <i>R. indica</i>       |
| 2b. Leaf margin green; capsules 3 to 4 valved .....                  | <i>R. densiflora</i>   |

***Rotala densiflora*** (Roth) Koehne, Bot. Jahrd. Syst. 1(2): 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; Clark in Hooker f., Fl. Brit. Ind. 2: 568. 1879; Prain, Beng. Pl. 1: 500. 1903. *Rotala densiflora* subsp. *uliginosa* (Roth) Koehne, Bot. Jahrb. Syst. 1(2): 165. 1880.

Annual, amphibious, herbs, up to 25 cm. Stem usually creeping, sparsely to densely branched, 4 winged, wings not running into leaves. Leaves decussate, often alternate toward stem apex, narrowly elliptic to oblong – ovate, 10 – 25 x 2 – 5 mm, acute, base cordate to obtuse. Bracts of stem and lower branches like foliage leaves. Flowers solitary; bracteoles pink, lanceolate. Floral tube 5 merous, campanulate; epicalyx segments present between sepals. Petals 5, bright pink. Stamens 5. Ovary globose; style shorter than ovary. Capsules subglobose, 3-valved.

*Flowers & Fruits:* August to February.

*Specimen Cited:* Rasik Beel, *Rajib & AP Das 0087*, dated 06. 02. 2007.

*Local Distribution:* Margins of water bodies through out the Beel.

*General Distribution:* India (Throughout), Nepal, Pakistan, Indonesia, Sri Lanka, China, Malaya, Australia and tropical Africa.

***Rotala indica*** (Willdenow) Koehne, Bot. Jahrb. Syst. 1(2): 172. 1880. Long *et* Rae in Grierson *et* Long, Fl. Bhut. 2 (1): 272. 1991; Cook, Aqua. Wetl. Pl. Ind. 257. 1996. *Peplis indica* Willdenow, Sp. Pl. 2(1): 244. 1799.

Annual, amphibious, herbs, up to 40 cm. Stem creeping and branched at base. Leaves decussate, obovate-elliptic to obovate – oblong, 5 – 20 x 3 – 8 mm, obtuse, translucent, base cuneate. Bracts foliage. Flowers in axillary spikes or sessile in bracts on main stem; bracteoles linear. Floral tube 4 merous, pink-red at anthesis, narrowly to broadly campanulate; sepals 4, lanceolate-deltate; epicalyx absent. Petals 4, pink, minute to 1/2 as long as sepals. Stamens 4. Ovary ellipsoidal. Capsule ellipsoidal, 2-valved.

*Flowers & Fruits:* August to April.

*Specimen Cited:* Bochamari Beel, *Rajib & AP Das 0191*, dated 09. 02. 2007.

*Local Distribution:* Margins of water bodies of Conservatory sectors and open fishing areas.



*General Distribution:* India, Bhutan, Nepal, Sri Lanka, Thailand, Vietnam, Laos, Cambodia, Indonesia, Japan, Korea, Malaysia, Myanmar, Philippines; introduced in rice fields in Africa, Europe and North America.

***Rotala rotundifolia*** (Buchanan - Hamilton *ex* Roxburgh) Koehne, Bot. Jahrb. Syst. 1(2): 175. 1881; Bora & Kumar, Flor. Div. Ass. 158. 2003; Long *et* Rae in Grierson *et* Long, Fl. Bhut. 2 (1): 272. 1991; Cook, Aqua. Wetl. Pl. Ind. 260. 1996. *Ammannia rotundifolia* Buchanan-Hamilton in Don Prodr. 220. 1825; Clarke in Hooker *f.*, Fl. Brit. Ind. 2: 566. 1828; Prain, Beng. Pl. 1: 500. 1903. [PLATE: 6, Figure-54]

Annual, amphibious, herbs, up to 25 cm. Stem extensively creeping and rooting herbs with red stem. Lamina sessile, orbicular or broadly elliptic – rounded. Flowers pinkish sessile, closely packed in terminal simple or panicle spikes; calyx tube campanulate, petals 4, pink coloured. Capsules 4-valved ellipsoid; seeds elliptic peltate.

*Flowers & Fruits:* November to April.

*Specimen Cited:* Batikata Beel, *Rajib & AP Das 0158*, dated 08. 02. 2007.

*Local Distribution:* Margins of water bodies of Conservatory sectors and open fishing areas.

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

WOODFORDIA Salisbury, Parad. Lond. 1(2): t. 42. 1806.

***Woodfordia fruticosa*** (Linnaeus) Kurz, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 40: 56. 1871. Long *et* Rae in Grierson *et* Long, Fl. Bhut. 2 (1): 275. 1991. *Lythrum fruticosum* Linnaeus, Syst. Nat., ed. 10, 2: 1045. 1759. [PLATE: 7, Figure-66]

Tall shrubs, up to 5 m. Leaves lanceolate to ovate-lanceolate, 3 – 12 × 1 – 4 cm, leathery, Acuminate, base rounded to subcordate. Inflorescences axillary, 3 – 15 flowers. Floral tube light red to red-orange, greenish basally; sepals oblong-ovate to deltate; epicalyx segments scarcely present. Petals 6, thin, linear-lanceolate. Stamens 12, inserted above ovary base, long-exserted. Ovary 2-loculed. Capsules elongate, elliptic. Seeds reddish brown.

*Flowers & Fruits:* January to May.

*Specimen Cited:* Deer conservation sector, *Rajib & AP Das 0198*, dated 09. 02. 2007.

*Local Distribution:* Shrubland near fodder plantstion.

*General Distribution:* India, Bhutan, Nepal, Pakistan, Indonesia, Laos, Myanmar, Thailand.

TRAPA Linnaeus, Sp. Pl. 1: 120. 1753.

### Key to the species:

- 1a. Fruit shortly rhombic, 2 – 4 stony horned, crest bulge to a thin rib ..... *T. natans*
- 1b. Fruit narrowly rhombic, 4 leathery horned, crest absent ..... *T. natans* var. *bispinosa*

***Trapa natans*** Linnaeus, Sp. Pl. 120. 1753; Cook, Aqua. Wetl. Pl. Ind. 363. 1996. *Trapa bicornis* Osbeck, Dagb. Ostind. Resa 191. 1757 *Trapa chinensis* Loureiro, Fl. Cochinch. 1: 86. 1790. *Trapa natans* var. *incisa* Makino, Bot. Mag. (Tokyo) 1: 105. 1887-1892. *Trapa bispinosa* Roxburgh var. *incisa* (Siebold & Zuccarini) Franchet & Savatier, Nakai, Fl. Kor. 2: 490. 1911. Clarke in Fl. Brit. Ind. 2: 590. 1879; Prain, Beng. Pl. 1: 508. 1903. *Trapa incise* Siebold & Zuccarini, Fl. Jap. 134. 1843. [PLATE: 7, Figure-65]

*Vernacular name:* Jalsingara.

Aquatic floating herbs. Petiole swollen distally. Floating lamina in rosettes, rhomboid, lamina glossy and dark green, rhombic – triangular, adaxially glabrous, coarsely and sharply incised-dentate distally.

Petals white, 7–10 mm. Fruit shortly rhombic, 2 – 4 stony horned, surface variously ribbed to smooth, crest a prominent bulge to a thin rib, crown tetragonal to rounded, or dome-shaped. Horns horizontal, ascending, or recurved, flat-triangular or broadly conic.

*Flowers & Fruits:* May to November.

*Specimen Cited:* Raichangmari Beel, *Rajib & AP Das 0197*, dated 09. 02. 2007.

*Local Distribution:* Throughout, wild in water bodies.

*General Distribution:* India, Bangladesh, China, Pakistan, Indonesia, Japan, Korea, Laos, Malaysia, Thailand, Philippines, Russia and Vietnam. Africa, Europe; naturalized in Australia and North America.

*Trapa natans* var. *bispinosa* (Roxburgh) Makino, Bot. Mag. (Tokyo) 11: 283. 1897 & Inuma, Sumoku-Dzusetu" ed. 3", 1: 137. 1907; Prain, Beng. Pl. 1: 508. 1903; Cook, Aqua. Wetl. Pl. Ind. 363. 1996. *Trapa bicornis* var. *bispinosa* (Roxburgh) Z.T. Xiong, J. Wuhan Bot. Res. 3(2): 160. 1985. *Trapa bispinosa* Roxburgh, Pl. Cor. 3: t. 234. 1815; Clarke in Hooker f., Fl. Brit. Ind. 2: 590. 1879. [PLATE: 5, Figure-46]

*Vernacular name:* Jalsingara.

Aquatic floating herbs. Floating lamina in rosettes, rhomboid, lamina glossy and dark green, rhombic – triangular, glabrous or sparsely pubescent on veins, adaxially glabrous, margin coarsely and sharply incised-dentate distally. Petals pink to pale purplish or white, Fruit narrowly rhombic, 4 soft, leathery horned, surface variously ribbed to smooth, crest absent; horns conic, lower horns descending, upper horns horizontal to ascending.

*Flowers & Fruits:* May to November.

*Specimen Cited:* Bochamari Beel, *Rajib & AP Das 0194*, dated 09. 02. 2007.

*Local Distribution:* Bochamari Beel; often cultivated.

*General Distribution:* Throughout India: Nepal, China, Indonesia, Japan, Korea, Laos, Malaysia, Thailand and Vietnam.

**Melastomataceae** A.L. de Jussieu, Gen. Pl. 328. 1789 ('Melastomae'); *nom. cons.*

**Key to the genera:**

- 1a. Stamens equal in length and shape; fruit a dry capsule ..... *Osbeckia*
- 1b. Stamens unequal in length and shape; fruit a fleshy capsule ..... *Melastoma*

MELASTOMA Linnaeus, Sp. Pl. 1: 389. 1753.

*Melastoma malabathricum* Linnaeus, Sp. Pl. 1: 390. 1753 ('malabathrica'); Clarke in Hooker f., Fl. Brit. Ind. 2: 523. 1879; H. Ohashi in Hara, Fl. E. Himal. 1: 221. 1966; Hara *et al.*, Enn. Fl. Pl. Nep. 2: 170. 1979; Clement in Grierson *et Long*, Fl. Bhutan 2(1): 296. 1991. *Melastoma affine* D. Don, Mem. Wern. Nat. Hist. Soc. 4: 288. 1823 *Melastoma malabathricum* var. *normale* (D. Don) R.C. Srivastava, Novon 8(2): 203. 1998 *Melastoma normale* D. Don, Prodr. Fl. Nepal. 220. 1825. *Melastoma polyanthum* Blume, Flora 2: 481. 1831. [PLATE: 5, Figure-33]

Bushy shrubs. Stems densely appressed hairy. Leaves elliptic to lanceolate-elliptic, acute or shortly acuminate, base rounded, cuneate, veins 5; upper surface with rows of white cells at base of very short hairs. Calyx tube densely covered with appressed, fimbriate-margined, scale like hairs; lobes triangular – oblong. Petals mauve to rose – purple.

*Flowers & Fruits:* January to December.

*Specimen Cited:* Near Conservation section, *Rajib & AP Das 0224*, dated 09. 02. 2007.

*Local Distribution:* Throughout the open places in Forest area.

*General Distribution:* Tropical Himalayas, India, China, Sri Lanka, Myanmar, Malaysia and Australia.

OSBECKIA Linnaeus, Sp. Pl. 1: 345. 1753.

*Osbeckia nepalensis* Hooker f., Exot. Fl. 1: , pl. 31. 1823; Clement in Grierson *et* Long, Fl. Bhutan 2(1): 295. 1991; Prain, Beng. Pl.1: 495. 1903. [PLATE: 8, Figure-88]

Erect shrubs, up to 1m. Stems 4 sided, densely strigose. Lamina oblong-lanceolate to ovate-lanceolate, 5 – 13 2 – 4 cm, stiffly papery, both surfaces densely strigose, secondary veins 2 on each side of midvein, acuminate, entire and ciliate, base cordate to obtuse. Inflorescences terminal, a panicle of cymes; bracts leaflike. Bracteoles 2, broadly ovate. Calyx lobes 5, long ovate, ciliate, acuminate. Petals 5, white. Stamens 10, inclined to one side; filaments as long as anthers; anthers beaked. Ovary ovoid-globose, 5-celled. Capsule ovoid-globose, densely strigose.

*Flowers & Fruits:* June to February.

*Specimen Cited:* Near Conservation section, *Rajib & AP Das 0517*, dated 23.07.2007.

*Local Distribution:* Through out Forest.

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

**Myrtaceae** A.L. de Jussieu, Gen. Pl. 322. 1789 ('Myrti'); *nom. cons.*

**Key to the genera:**

- |   |                   |
|---|-------------------|
| 1a. Fruit a capsule .....                                       | <i>Eucalyptus</i> |
| 1b. Fruit not capsule .....                                     | 2                 |
| 2a. Flowers solitary; Fruit a berry .....                       | <i>Psidium</i>    |
| 2b. Flowers in axillary or terminal cymes; fruits a drupe ..... | <i>Syzygium</i>   |

EUCALYPTUS L'H ritier, Sert. Angl. 18. 1789.

*Eucalyptus tereticornis* James E. Smith, Spec. Bot. New Holland 4: 41 1795. Long *et* Rae in Grierson *et* Long, Fl. Bhutan 2 (1): 286. 1991. *Eucalyptus insignis* Naudin, Descr. Emploi Eucalypt. 30. 1891. *Eucalyptus populifolia* Desfontaines, Tabl. cole Bot. ed. 3: 408. 1829. *Leptospermum umbellatum* Joseph Gaertner, Fruct. Sem. Pl. 1: 174. 1788.

Large trees, up to 25 m. Bark grayish white, smooth. Branchlets terete, slender, pendulous. Lamina of young leaves ovate to broadly lanceolate, mature leaves narrowly lanceolate, 12 – 20 x 1.2 – 2 cm, slightly twisted. Inflorescences axillary, simple, umbels 5–8 flowered. Flowers buds long ovate, apex acuminate. Stamens with long obovate anthers, dehiscing longitudinally. Capsule subglobose to ovoid; disk broad; valves 4 to 5.

*Flowers & Fruits:* January to August.

*Specimen Cited:* Park, *Rajib & AP Das 0263*, dated 10. 02. 2007.

*Local Distribution:* Often planted in parks and villages.

*General Distribution:* India, Bhutan, China; native to E and SE Australia.

PSIDIUM Linnaeus, Sp. Pl. 1: 470. 1753.

*Psidium guajava* Linnaeus, Sp. Pl. 470. 1753; Clarke in Hook.f, Fl. Brit. Ind. 2: 468. 1879; Long *et* Rae in Grierson *et* Long, Fl. Bhutan 2(1): 287. 1991. Prain, Beng. Pl.?? *Guajava pumila* (Vahl) Kuntze, Revis. Gen. Pl. 1: 240. 1891. *Psidium pumilum* Vahl, Symb. Bot. 2: 56. 1791. *Myrtus guajava* (Linnaeus) Kuntze, Revis. Gen. Pl. 3(2): 91. 1898. *Psidium cujavus* Linnaeus, Herb. Amb. 7. 1754.

*Vernacular Name:* Peyara.

Small tree, up to 5 m; branchlets finely pubescent. Leaves oblong-elliptic, 8 – 12 x 3 – 5 cm, acute, base rounded, pubescent beneath, lateral veins parallel, prominent beneath; stipules minute, often caducous. Flowers mostly solitary on pubescent peduncle; bracteoles subulate, caducous. Calyx tube obovoid, constricted at apex, pubescent; lobes leathery, ovate, unequal. Petals white, obovate. Berry pear-shaped.

*Flowers & Fruits*: Throughout the year.

*Specimen Cited*: Rasik Beel village, *Rajib & AP Das 0258*, dated 10. 02. 2007.

*Local Distribution*: In the villages.

*General Distribution*: Native of tropical America, naturalized and cultivated in India.

SYZYGIUM P. Browne *ex* Gaertner, *Fruct. Sem. Pl.* 1: 166. 1788, *nom. cons.*

### Key to the species:

- 1a. Cymes borne in axils of older ..... *S. cumini*
- 1b. Cymes borne in terminal position of branches ..... *S. jambos*

*Syzygium cumini* (Linnaeus) Skeels, *Bull. Bur. Pl. Industr. U.S.D.A.* 248: 25 1912 & U.S. Dept. Agric. *Bur. Pl. Ind. Bull.* 248. 25. 1912; Long *et* Rae in Grierson *et* Long, *Fl. Bhutan* 2(1): 284. 1991. *Myrtus cumini* Linnaeus, *Sp. Pl.* 471. 1753. Prain, *Beng. Pl.?? Eugenia jambolana* de Lamarck, *Encycl.* 3: 198. 1789. *Eugenia obovata* Poirlet, *Encycl. Suppl.* 3: 124. 1813.

*Vernacular Name*: Jam.

Tree, up to 20 m. Leaves coriaceous, elliptic to obovate, 5 – 10 x 3 – 5 cm, base cuneate, veins numerous, intra-marginal vein conspicuous. Cymes borne in axils of older and fallen leaves, many-flowered. Flowers sessile. Calyx funnel-shaped, tube tapering into stalk-like base, lobes shallow, persistent. Petals creamy. Stamens 2 – 5 mm. Fruit obovoid, crimson, becoming black when ripe.

*Flowers & Fruits*: June to December.

*Specimen Cited*: Forest, *Rajib & AP Das 0174*, dated 08. 02. 2007.

*Local Distribution*: Natural Forest patch.

*General Distribution*: India (tropical and subtropical regions), Sri Lanka, Malaya and Australia.

*Syzygium jambos* (Linnaeus) Alston, *Handb. Fl. Ceylon* 6(Suppl.): 115 1931. Long *et* Rae in Grierson *et* Long, *Fl. Bhutan* 2 (1): 280. 1991. Prain, *Beng. Pl.?? Eugenia jambos* Linnaeus, *Sp. Pl.* 470. 1753. *Eugenia vulgaris* Baillon, *Hist. Pl.* 6: 345. 1876. *Eugenia jambosa* Crantz, *Inst. Rei Herb.* 2: 201. 1766.

*Vernacular name*: Golabjam.

Trees, up to 10 m. Stems broadly branched. Branchlets terete. Lamina lanceolate to ovate-lanceolate, 8 – 25 x 2 – 5 cm, leathery, acuminate to long acuminate, entire, base narrow to broadly cuneate. Inflorescences usually terminal cymes with several flowers. Flowers white. Hypanthium obconic. Calyx lobes 4. Petals broadly ovate. Stamens 1.5 – 3 cm. Style 2–3.5 cm. Drupe pale yellow when ripe, globose to ellipsoid, 1 to 2 seeded, pericarp fleshy. Embryos numerous.

*Flowers & Fruits*: February to November.

*Specimen Cited*: Bochamari, *Rajib & AP Das 0252*, dated 10. 02. 2007.

*Local Distribution*: In the villages.

*General Distribution*: India, Philippines; Malesia and SE Asia.

**Onagraceae** A.L. de Jussieu, *Gen. Pl.* 317. 1789 ('Onagrae'); *nom. cons.*

LUDWIGIA Linnaeus, *Sp. Pl.* 1: 118 ["Ludvigia"]; 2: [1204]. 1753.

**Key to the species:**

- 1a. Floating; pneumatophores in at nodes of floating stems ..... *L. adscendens*  
 1b. Not floating; pneumatophores absent ..... 2  
 2a. Stamens 8; stigma subglobose, 4 lobed ..... *L. octovalvis*  
 2b. Stamens many; stigma globose, not 4 lobed ..... 3  
 3a. Capsule subcylindric, slightly 4 angled, seeds visible through walls ..... *L. prostrata*  
 3b. Capsule oblanceoloid, often nodding, seeds not visible through wall .... *L. perennis*

***Ludwigia adscendens*** (Linnaeus) Hara in J. Jap. Bot. 28(10): 291. 1953; Cook, Aqua. Wetl. Pl. Ind. 276. 1996; Guha Bakshi, Fl. Mur. Dist. 135. 1984; Bora *et* Kumar, Flor. Div. Ass. 159. 2003. *Jussiaea adscendens* Linnaeus, Syst. Nat. (ed. 12) 2: 297. 1754. *Jussiaea repans* Linnaeus, Sp. Pl. 1: 388. 1753; Clarke in Hooker *f.*, Fl. Brit. Ind. 2: 587. 1879; Prain, Beng. Pl. 1: 368. 1903. [PLATE: 6, Figure-53]

Perennial herbs, with creeping and floating stems, rooting at nodes, with white, erect, spindle shaped pneumatophores in clusters at nodes of floating stems. Lamina oblong to spatulate – oblong, 0.5 – 6 × 0.5 – 3 cm, glabrous, lateral veins 6–12 per side, obtuse to subacute, margin entire. Sepals 5, deltoid-acuminate. Petals creamy-white with yellow base, obovate. Stamens 10. Style white; stigma discoid. Capsule with brown ribs, cylindric.

*Flowers & Fruits:* June to November .

*Specimen Cited:* Bochamari Beel, *Rajib & AP Das 0304*, dated 10. 02. 2007.

*Local Distribution:* Throughout, in water bodies.

*General Distribution:* India: throughout; Nepal, Bhutan, Pakistan, China, Indonesia, Japan, Malaysia, Philippines, Sri Lanka, Thailand; widespread in Africa, S and SE Asia, Australia.

***Ludwigia octovalvis*** (Jacquin) P.H. Raven, Kew Bull. 15: 476. (1961, publ.) 1962; Hoch in Grierson *et* Long, Fl. Bhutan 2(1): 312. 1991; Cook, Aqua. Wetl. Pl. Ind. 277. 1996. *Ludwigia octovalvis* subsp. *sessiliflora* (Micheli) P.H. Raven, Kew Bull. 15: 476. 1962. *Jussiaea pubescens* Linnaeus, Sp. Pl. (ed. 2) 1: 555. 1762. *Ludwigia octovalvis* (Jacquin) Raven ssp. *sessiliflora* (Roti Michelozzi) Raven in Reinw. 6: 362. 1963; Chowdhery *et al.* in Hajra *et al.*, Materials for the Fl. Arunachal Prad. 1: 504. 1996. *Oenothera octovalvis* Jacquin, Enum. 19. 1760. *Jussiaea suffruticosa* Linnaeus, Sp. Pl. 388. 1753; Clarke in Hooker *f.*, Fl. Brit. Ind. 2: 587. 1879. Prain, Beng. Pl. 1: 368. 1903. [PLATE: 9, Figure-98]

Perennial, erect herbs. Stems up to 90 cm, well branched. Lamina linear to subovate, 4 – 13 × 1 – 4 cm, submarginal vein prominent, attenuate, base narrowly cuneate. Sepals 4, ovate to lanceolate. Petals yellow, broadly obovate. Stamens 8. Stigma subglobose, shallowly 4 lobed. Capsule pale brown, cylindric, terete. Seeds in 2 to more rows per locule, free.

*Flowers & Fruits:* June to February.

*Specimen Cited:* Batikata Beel, *Rajib & AP Das 0307*, dated 10. 02. 2007.

*Local Distribution:* Margins of water bodies of Conservatory sectors and open fishing areas.

*General Distribution:* India: throughout; Bhutan, China, S.E. Asia, tropical Africa.

***Ludwigia perennis*** Linnaeus, Sp. Pl. 1: 119. 1753; Raven in Reinw. 6: 367. 1964; Hoch in Grierson *et* Long, Fl. Bhutan 2(1): 312. 1991; Cook, Aqua. Wetl. Pl. Ind. 278. 1996; 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. *Jussiaea perennis* (Linnaeus) Brenan, Kew Bull. 1953: 163. 1953. *Jussiaea caryophyllea* de Lamarck, Encycl. 3(1): 331-332. 1789.

Annual erect herbs, with taproot. Stems up to 80 cm, branched, subglabrous. Petiole winged; leaf Annual erect herbs. Stems up to 80 cm, branched. Petiole winged; lamina narrowly elliptic to lanceolate, 3–10 x 1–3 cm, subacute, base narrowly cuneate. Sepals 4, rarely 5, deltate. Petals yellow, elliptic. Stamens many. Stigma globose. Capsule often nodding, pale brown, oblanceoloid, terete. Seeds in 2 to more rows per locule, free.

*Flowers & Fruits:* Juli to April.

*Specimen Cited:* Batikata Beel, *Rajib & AP Das 0346*, dated 21.07.2007.

*Local Distribution:* Batikata Beel margin.

*General Distribution:* India: throughout; Bhutan, China, Sri Lanka, Madagascar, S. E. Asia, Malaysia to tropical Africa, Australia and New Caledonia.

*Ludwigia prostrata* Roxburgh, Fl. Ind., ed. 1820 1: 441. 1820; Hoch in Grierson *et* Long, Fl. Bhutan 2(1): 312. 1991; Cook, Aqua. Wetl. Pl. Ind. 279. 1996. *Jussiaea prostrata* (Roxburgh) L v., Feddes Repert. Spec. Nov. Regni Veg. 8: 138. 1910. *Nematopyxis prostrata* Miquel, Fl. Ned. Ind. 37. 1855.

Annual or short-lived perennial herbs, erect. Stems often red tinged, up to 50 cm. Lamina elliptic to narrowly elliptic, 2–12 0.3–2.5 cm, lateral veins 8–12 per side, acute, base narrowly cuneate. Sepals 4, deltate. Petals yellow, narrowly spatulate. Stamens as many as sepals. Stigma globose. Capsule pale brown, subcylindric, slightly 4 angled, seeds clearly visible in outline through walls. Seeds in one row per locule, free.

*Flowers & Fruits:* June to December.

*Specimen Cited:* Batikata Beel, *Rajib & AP Das 0287*, dated 10. 02. 2007.

*Local Distribution:* Marshy low land areas.

*General Distribution:* India: tropicals; Bhutan, Nepal, China, Indonesia, Philippines, Sri Lanka.

## **Order: Brassicales** Bromhead (1838)

**Brassicaceae** Lindley, Nat. Syst. ed. 2. 58. 1836 (*nom. alt.* vs. Cruciferae); *nom. cons.*

### **Key to the genera:**

- 1a. Basal leaves rosulate; fruit indehiscent ..... *Cardaria*
- 1b. Basal leaves cauline; fruit dehiscent ..... 2
- 2a. Cauline leaves entire ..... *Brassica*
- 2b. Some cauline leaves coarsely dentate to pinnately divided ..... *Rorippa*

BRASSICA Linnaeus, Sp. Pl. 2: 666. 1753.

*Brassica rapa* Linnaeus, Sp. Pl. 666. 1753; Grierson in Grierson *et* Long, Fl. Bhut. 1(2): 420. 1984. *Brassica chinensis* Linnaeus, Cent. Pl. I: 19. 1755. *Brassica pekinensis* (Loureiro) Rupr., Fl. Ingr. 96. 1860. *Brassica arvensis* Hablitz, Descr. Phys. Taur. 146. 1788.

*Vernacular name:* Sorshe.

Annual or biennial herbs. Stems erect, simple or branched above. Basal and lowermost cauline leaves petiolate; petiole slender or thickened and fleshy, sometimes strongly winged; lamina ovate to oblong lanceolate, 10–30 3–10cm, entire, repand or dentate, sometimes pinnatifid or pinnatisect and with a large terminal lobe and smaller, 1–6, oblong or ovate lateral lobes on each side of midvein. Upper cauline leaves sessile, ovate, oblong, or lanceolate, base amplexicaul, deeply cordate, or auriculate, margin entire or repand. Flowers in racemes. Sepals oblong. Petals bright yellow, obovate, apex rounded. Fruit linear terete, sessile. Seeds dark brown, globose.

*Flowers & Fruits*: March to June.

*Specimen Cited*: Bochamari village, *Rajib & AP Das 0173*, dated 08. 02. 2007.

*Local Distribution*: Villages and crop fields.

*General Distribution*: India: widely cultivated.

CARDAMINE Linnaeus, Sp. Pl. 2: 654. 1753.

*Cardamine hirsuta* Linnaeus, Sp. Pl. 655. 1753; Grierson in Grierson *et* Long, Fl. Bhut. 1(2): 431. 1984. *Cardamine multicaulis* Hoppe ex Schur, Enum. Pl. Transsilv. 47. 1866. *Cardamine tenella* E.D. Clarke, Trav. Var. Eur. 2: 117. 1812.

Annual herbs. Stems erect, ascending or decumbent. Basal leaves rosulate; petiole ciliate; lamina 2.5 – 8 cm, lyrate pinnatisect; terminal lobe reniform or orbicular, entire, repand or 3 – 5 lobed. Fruiting pedicels erect or ascending, slender. Sepals oblong. Petals white, spatulate. Stamens 4. Ovules 14 – 40 per ovary. Fruit linear; valves glabrous. Seeds light brown.

*Flowers & Fruits*: March to August.

*Specimen Cited*: Park, *Rajib & AP Das 0119*, dated 07. 02. 2007.

*Local Distribution*: Park and Garden areas.

*General Distribution*: India: pantropical areas; Bhutan, China, Sri Lanka, Pakistan, Indonesia, Malaysia, Japan, Laos, New Guinea, Philippines, Thailand, Turkmenistan, Vietnam; S.W. Asia, Europe; naturalized in S. Africa, Australia, North and South America.

RORIPPA Scopoli, Fl. Carniol. 520. 1760.

*Rorippa benghalensis* (DC.) Hara, J. Jap. Bot. 49: 132. 1974; Grierson in Grierson *et* Long, Fl. Bhut. 1(2): 437. 1984. *Nasturtium benghalense* de Candolle, Syst. Nat. 2: 198. 1821. *Sinapis benghalensis* Roxburgh *ex* de Candolle, Syst. Nat. 2: 198. 1821 (prosyn.). *Nasturtium indicum* Linnaeus var. *benghalensis* (de Candolle) Hooker *f.* & T. Anderson in Hooker *f.*, Fl. Brit. Ind. 1: 134. 1872.

Annual herbs. Stems simple at base, few to many branched above. Basal leaves soon withered. Lowermost cauline leaves auriculate; lamina oblong to oblong obovate, lyrate-pinnatifid; terminal lobe broadly ovate or oblong; lateral lobes 1 – 4, oblong or ovate, margin serrate or dentate. Racemes bracteate throughout; bracts lanceolate linear to oblong-linear, subentire or denticulate. Sepals elliptic or oblong. Petals pale yellow, spatulate or oblanceolate. Ovules 100 – 170 per ovary. Fruit linear, straight or curved. Seeds reddish brown.

*Flowers & Fruits*: March to May.

*Specimen Cited*: Garden, *Rajib & AP Das 0107*, dated 07. 02. 2007.

*Local Distribution*: Park and Garden areas.

*General Distribution*: India: tropical parts; Nepal, Bhutan, Bangladesh, Indo-china and Java, Thailand, Vietnam.

**Capparidaceae** A.L. de Jussieu, Gen. Pl. 242. 1789 ('Capparides'); *nom. cons.*

#### Key to the genera:

- |  |                 |
|--|-----------------|
| 1a. Leaves compound, with 3 leaflets ..... | <i>Crateva</i>  |
| 1b. Leaves simple .....                    | <i>Capparis</i> |

*Capparis zeylanica* Linnaeus, Sp. Pl. ed. 2: 720. 1762. *Capparis acuminata* Roxburgh, Fl. Ind. 2: 566. 1824. *Capparis aeylanica* Roxburgh, Fl. Ind. 2: 567. 1824. *Capparis polymorpha* Kurz, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 42(2): 227. 1873.

Scandent shrubs or trailing. Stipular spines strong, sharp, recurved. Leaves simple; lamina elliptic-lanceolate to obovate-lanceolate, 3 – 8 x 2 – 4cm, acute, base cuneate to rounded, subleathery. Inflorescences superaxillary racemes, 2 or 3 flowered, near apex of young branches. Sepals slightly unequal; sepals of outer whorl nearly orbicular acute to obtuse; sepals of inner whorl elliptic. Petals white to yellowish white, oblong. Stamens 30–45. Gynophore base gray tomentose; ovary ellipsoid; ovules many. Fruit red to purplish red when mature, globose to ellipsoid.

*Flowers & Fruits*: February to July.

*Specimen Cited*: Rasik Beel, *Rajib & AP Das 0241*, dated 09. 02. 2007.

*Local Distribution*: Takomari forest.

*General Distribution*: Tropical India; Bhutan, China, Nepal, Indonesia, Myanmar, Philippines, Sri Lanka, Thailand, Vietnam.

CRATEVA Linnaeus, Sp. Pl. 1: 444. 1753.

***Crateva religiosa*** G. Forster, Diss. Pl. Esc. 45. 1786; Grierson in Grierson *et* Long, Fl. Bhut. 1(2): 412. 1984. [PLATE: 7, Figure-75]

*Vernacular name*: Barna.

Large trees; up to 25m. Petiole with minute triangular glands near rachis; lamina 5 – 9 x 3 – 4 cm, thin and leathery, abaxially gray, acuminate to abruptly acuminate. 10 – 25-flowered in corymbs; bracts leaflike, caducous. Flowers open as leaves emerge. Sepals ovate, acuminate. Petal white to yellow. Stamens 16–22. Fruit ovoid to obovoid. Seeds 22 – 28 per fruit, dark brown.

*Flowers & Fruits*: April to August.

*Specimen Cited*: Atiamochar forest, *Rajib & AP Das 0207*, dated 09. 02. 2007.

*Local Distribution*: Atiamochar Forests area.

*General Distribution*: India: tropical; Bhutan, Nepal, Sri Lanka, Cambodia, Indonesia, Myanmar, Thailand, Vietnam.

**Caricaceae** Dumortier, Anal. Fam. Pl. 36. 1829 (*nom. cons. prop.* vs. Papayaceae).

CARICA Linnaeus, Sp. Pl. 2: 1036. 1753.

***Carica papaya*** Linnaeus, Sp. Pl. 1036. 1753; Clarke in Hooker *f.*, Fl. Brit. Ind. 2: 599. 1879; Grierson in Grierson *et* Long, Fl. Bhut. 2(1): 236. 1991. *Carica citrifolia* Jacquin, Ecl. Pl. Rar. 1: 101, t. 68-69, 1816. *Papaya carica* Gaertner, Fruct. Sem. Pl. 2: 191, pl. 122, f. 2. 191. 1790. *Papaya edulis* Bojer, Hortus Maurit. 277. 1837. *Vasconcellea peltata* (Hooker *et* Arnot) A. de Candolle, Prodr. 15(1): 416. 1864. *Papaya peltata* (Hooker *et* Arnot) Kuntze, Revis. Gen. Pl. 1: 253. 1891. *Carica peltata* Hooker *et* Arnot, Bot. Beechey Voy. 425. 1840.

*Vernacular Name*: Pepe.

Shrubs. Leaves ovate or orbicular in outline, deeply palmately divided into 7 – 9 sharp tooth, pinnatifid lobes. Flowers fragrant; panicles 30 – 40 cm, lobes spreading. Female flowers on peduncles; petals lanceolate. Fruit yellow when ripe, ellipsoid or narrowly obovoid, flesh thick, orange. Seeds ellipsoid, black, wrinkled.

*Flowers & Fruits*: January to December.

*Specimen Cited*: Rasik Beel village, *Rajib & AP Das 0096*, dated 07. 02. 2007.

*Local Distribution*: Panted in Villages.

*General Distribution*: A native of West Indies; widely cultivated in warmer areas.



**Moringaceae** R. Brown in Denham *et* Clapperton, Trav. N. and Central Afr. 238. 1826 ('Moringeae'); *nom. cons.*

MORINGA Adanson, Fam. Pl. 2: 318. 1763.

*Moringa oleifera* Lamarck, Encycl. 1: 398. 1785; Grierson *et* Long in Grierson *et* Long, Fl. Bhut. 1(2): 445. 1984. *Guilandina moringa* Linnaeus, Sp. Pl. 1: 381. 1753. *Moringa zeylanica* Burmann, Thes. Zeylan. 162, t. 75: 162. 1736. *Moringa moringa* (Linnaeus) Millspaugh, Field Mus. Nat. Hist., Bot. Ser. 1(7): 490. 1902. *Moringa pterygosperma* Gaertner, Fruct. Sem. Pl. 2: 314-315, pl. 147, f. 2: 314. 1791.

*Vernacular Name*: Sajna.

Trees. Leaves petiolate, 3 – pinnate; lamina 4–6 pairs, ovate to elliptic oblong, rounded to emarginate, base rounded to cuneate. Inflorescence a widely spreading panicle, bracteate. Flowers white to cream, fragrant. Sepals lanceolate to linear-lanceolate. Petals spatulate. Ovary hairy. Capsule 3 – valved, dehiscent. Seeds subglobose, 3 – angled.

*Flowers & Fruits*: June to December.

*Specimen Cited*: Bochamari, Rajib & AP Das 0171, dated 08. 02. 2007.

*Local Distribution*: Cultivated at villages.

*General Distribution*: native to India; Tropical and sub-tropical parts of the world.

**Order: Malvales** Jussieu *ex* Berchttert *et* J. Presl (1820)

**Bixaceae** Kunth, Diss. Malv. etc. 17. 1822 ('Bixineae').

BIXA Linnaeus, Sp. Pl. 1: 512. 1753.

*Bixa orellana* Linnaeus, Sp. Pl. 512. 1753; Long *et* Rae in Grierson *et* Long, Fl. Bhutan 2 (1): 231. 1991. *Bixa purpurea* Sweet, Hort. Brit. 33. 1826. *Orellana americana* (Poir.) Kuntze, Revis. Gen. Pl. 1: 44. 1891. *Orellana orellana* (Linnaeus) Kuntze, Revis. Gen. Pl. 3(2): 9. 1898.

Shrubs or small trees, evergreen. Leaves simple, alternate; lamina abaxially pale green, adaxially deep green, cordate ovate to triangular ovate, 10 – 25 4 – 12 cm, palmately 5-veined, glabrous, entire, acuminate, base rounded or subtruncate, sometimes slightly cordate. Panicles robust, often flat-topped. Sepals obovate. Petals bright pink, obovate. Stamens many; anthers yellow, apically dehiscent. Capsule subglobose or ovoid, slightly laterally compressed. Seeds numerous, red-brown.

*Flowers & Fruits*: Throughout the year.

*Specimen Cited*: Bochamari, Rajib & AP Das 0106, dated 07. 02. 2007.

*Local Distribution*: Cultivate in Village.

*General Distribution*: India: native to tropical America; cultivated pantropically.

**Dipterocarpaceae** Blume, Bijdr. 1: 222. 1825 ('Dipterocarpeae').

SHOREA Roxburgh *ex* C. F. Gaertner, Suppl. Carp. 47. 1805.

*Shorea robusta* Roxburgh *ex* Gaertner f., Suppl. Carp. 3: 48.t. 186. 1805; Clarke in Hooker *f.*, Fl. Brit. Ind. 1: 306. 1874; Grierson *et* Long in Grierson *et* Long, Fl. Bhut. 1(2): 361. 1984.

*Vernacular Name*: Sal.

Trees, up to 40 m, deciduous; crown spreading. Stipules lanceolate, small. Leaves simple, alternate; lamina 8 – 20 3 – 12 cm, ovate to oblong, entire, acuminate, base obtuse to cordate, thinly leathery, midvein prominent abaxially and conspicuous adaxially, glabrous. Flowers sessile;

branches racemose, secund; bracts caducous, minute. Petals strongly contorted, linear. Sepals ovate, subequal. Stamens many. Ovary ovoid. Fruit sepals unequal, spatulate, sparsely pubescent; nut ovoid.

*Flowers & Fruits:* February to July.

*Specimen Cited:* Rasik Beel forest, *Rajib & AP Das 0648*, dated 12. 02. 2008.

*Local Distribution:* Atiamochar, Takomari, Solmari forests.

*General Distribution:* Tropical and sub-tropical parts of the world.

## **Malvaceae** A.L. de Jussieu, Gen. P11. 271. 1789.

### **Key to the genera:**

- |  |                     |
|--|---------------------|
| 1a. Leaves simple .....  | 2                   |
| 1b. Leaves digitately compound .....   | 10                  |
| 2a. Stamens in 2 or more bundle.....   | 3                   |
| 2b. Stamens in single bundle.....  | 4                   |
| 3a. Androgynophore absent; fruit a smooth capsule .....                            | <i>Corchorus</i>    |
| 3b. Androgynophore present; fruit a spiny or bristly capsule .....                 | <i>Triumfetta</i>   |
| 4a. Fruit a loculicidal capsule; ovary with 3–5 fused carpels .....                | 5                   |
| 4b. Fruits schizocarp, sometimes berrylike, carpels separating into mericarps .... | 6                   |
| 5a. Calyx caducous; capsule long and sharp-angled .....                            | <i>Abelmoschus</i>  |
| 5b. Calyx persistent; capsule usually cylindrical to globose .....                 | <i>Hibiscus</i>     |
| 6a. Filament tube with anthers inserted along sides .....                          | 7                   |
| 6b. Filament tube with anthers inserted at apex .....                              | 8                   |
| 7a. Epicalyx 5-lobed .....   | <i>Urena</i>        |
| 7b. Epicalyx 7–12-lobed .....  | <i>Malvaviscus</i>  |
| 8a. Epicalyx absent .....  | <i>Sida</i>         |
| 8b. Epicalyx present .....   | 9                   |
| 9a. Epicalyx lobes 6 .....   | <i>Alcea</i>        |
| 9b. Epicalyx lobes 3 .....   | <i>Malva</i>        |
| 10a. Seeds with cotton .....   | <i>Bombax</i>       |
| 10b. Seeds without cotton .....  | 11                  |
| 11a. Flowers without petals; fruit apocarpous with separate follicles .....        | <i>Sterculia</i>    |
| 11b. Flowers with petals; fruit syncarpous .....                                   | 12                  |
| 12a. Flowers without staminodes .....  | <i>Melochia</i>     |
| 12b. Flowers with staminodes .....   | 13                  |
| 13a. Seeds with long membranous wing .....   | <i>Pterospermum</i> |
| 13b. Seeds wingless .....  | <i>Ambroma</i>      |

ABELMOSCHUS Medikus, Malvenfam. 45. 1787.

*Abelmoschus moschatus* Medikus, Malv. 1: 46. 1787; Blumea 14: 90. 1966; Hara *et al.*, Enn. Fl. Pl. Nep. 2: 66. 1979; Fl. Ind. 3: 308. 1993. *Hibiscus abelmoschus* Linnaeus, Sp. Pl. 696. 1753; Roxburgh, Fl. Ind. ed. 2, 3: 202. 1832; Dyer in Fl. Brit. Ind. 1: 347. 1874; J. B. Nat. Hist. S. 51: 781. 1953; *Bamia abelmoschus* (Linnaeus) Robert Brown *ex* Wallich, Cat. 52. 1829. *Abelmoschus betulifolia* Wallich, Numer. List 87. 1829. *Abelmoschus ciliaris* Walper, Repert.

Bot. Syst. 2: 308. 1843. *Hibiscus moschatus* (Medikus) Salisbery, Prodr. Stirp. Chap. Allerton 387. 1796. *Hibiscus chinensis* Roxburgh, Hort. Bengal. 51. 1814.

*Vernacular name:* Muskdana.

Annual or perennial shrub. Stems glandular hairy. Lamina broadly ovate or orbicular, 4–17 x 3–18 cm; lamina angular, 3–7 lobed, upper leaves narrower, lobes linear, lanceolate, ovate to obovate–oblong, serrate or dentate, acute or acuminate, base broadly cordate. Flowers solitary, axillary. Epicalyx segments linear, persistent. Calyx stellate–tomentose outside, sericeous inside. Corolla yellow with dark purple centre, petals obovate, rounded at apex, fleshy and ciliate at base. Capsules ovoid to globose, acuminate. Seeds musk scented.

*Flowers & Fruits:* October to December.

*Specimen Cited:* Atiamochar forest, *Rajib & AP Das 0379*, dated 21.07.2007.

*Local Distribution:* Plantation Sector.

*General Distribution:* India: tropical region; Bangladesh, China, Indo–China, Thailand, Malaysia and Fiji Islands.

HIBISCUS Linnaeus, Sp. Pl. 2: 693. 1753, *nom. cons.*

### Key to the species:

- 1a. Plants herbaceous ..... *H. sabdariffa*
- 1b. Plants large shrubs or trees ..... 2
- 2a. Staminal column longer than corolla; lamina not lobed ..... *H. rosa-sinensis*
- 2b. Staminal column shorter than corolla; lamina lobed ..... *H. mutabilis*

*Hibiscus mutabilis* Linnaeus, Sp. Pl. 694. 1753; Roxburgh, Fl. Indica ed. 2, 3: 201. 1832; Dyer in Hooker f., Fl. Brit. Ind. 1: 344. 1874; H. Ohashi in Hara, Fl. E. Himal. 1: 204. 1966; Blumea 14: 66. 1966; Bull. B. Surv. Ind. 12: 167. 1972; Hara *et al.*, Enn. Fl. Pl. Nep. 2: 67. 1979; Fasc. Fl. Ind. 19: 147. 1988; Fl. Ind. 3: 390. 1993; Hajra *et al.*, Fl. W. Beng. 1: 298, 1997.

*Vernacular name:* Sthal Padma.

Perennial, shrubs, 6 m tall. Lamina suborbicular, 12–25 cm across, palmately 3–7 lobed. Flowers solitary, axillary or sub corymbose at the top. Epicalyx segments 8–12, linear–lanceolate. Calyx lobes 3–4 x 1 cm, ovate–lanceolate. Petals obovate, 6–8 cm, white to pink, changing colour to more or less red in late evening. Staminal column shorter than corolla. Capsules subglobose. Seeds reniform.

*Flowers & Fruits:* September to December.

*Specimen Cited:* Rasik Beel Village, *Rajib & AP Das 0487*, dated 23.07.2007.

*Local Distribution:* Village area.

*General Distribution:* India: tropical regions; South China, Taiwan, South Japan. Widely cultivated and occasionally naturalised in the tropics.

*Hibiscus rosa-sinensis* Linnaeus, Sp. Pl. 694. 1753; Roxburgh, Fl. Ind. ed. 2, 3: 194. 1832; Dyer in Fl. Brit. Ind. 1: 334. 1874; H. Ohashi in Hara, Fl. E. Himal. 1: 204. 1966; Hara *et al.*, Enn. Fl. Pl. Nep. 2: 67. 1979; Fl. Ind. 3: 391. 1993; Hajra *et al.*, Fl. W. Beng. 1: 299, 1997; Miller *et Long* in Grierson *et Long*, Fl. Bhut. 2 (1): 182. 1991.

*Vernacular name:* Jaba.

Perennial, erect, glabrous shrubs, 2–3 m tall. Lamina ovate to ovate–lanceolate, 4–10 x 3–5 cm; regularly serrate, acute, base rounded. Flowers solitary, axillary. Epicalyx segments 5–10,

lanceolate, free half as long as calyx. Calyx campanulate, lanceolate. Petals obovate, red. Staminal column 5 – 9 cm long, exserted, pollen bearing in upper half only. Fruit not found.

*Flowers & Fruits:* Throughout the year.

*Specimen Cited:* Rasik Beel Village, *Rajib & AP Das 0326*, dated 21.07.2007.

*Local Distribution:* Village area.

*General Distribution:* Tropical India; possibly Eastern African origin. Widely cultivated throughout the tropics and subtropics.

***Hibiscus sabdariffa*** Linnaeus, Sp. Pl. 695. 1753; Dyer in Fl. Brit. Ind. 1: 340. 1874; H. Ohashi in Hara, Fl. E. Himal. 1: 204. 1966; Hara *et al.*, Enn. Fl. Pl. Nep. 2: 67. 1979; Fl. Ind. 3: 391. 1993; Prain, Beng. Pl. 1: 182. 1963; Hajra *et al.*, Fl. W. Beng. 1: 299, 1997; Miller *et Long* in Grierson *et Long*, Fl. Bhut. 2 (1): 182. 1991.

*Vernacular name:* Chukar, Tok Dhenros.

Annual herbs, 1 – 2m tall. Lamina polymorphic, 5 – 10 x 1 – 2 cm, palmately 3 – 5 lobed, lobes lanceolate, ovate or oblong. Flowers solitary, axillary or in raceme by reduction of the upper leaves. Epicalyx segments 8 – 11, lanceolate to oblong elliptic. Calyx cup – shaped, fleshy after flowering. Petals obovate, 4 – 5 cm long, yellow with purple base. Staminal column shorter than petals. Capsules ovoid. Seeds reniform.

*Flowers & Fruits:* October to January.

*Specimen Cited:* Bochamari Village, *Rajib & AP Das 0317*, dated 21.07.2007.

*Local Distribution:* Village area.

*General Distribution:* India: tropical India; unknown origin, cultivated in the tropics.

MALVAVISCUS Fabricius, Enum. 155. 1759.

***Malvaviscus penduliflorus*** de Candolle, Prodr. 1: 445. 1824. *Malvaviscus arboreus* subsp. *penduliflorus* (de Candolle) Hada, Folia Geobot. Phytotax. 5: 432. 1970. *Malvaviscus arboreus* var. *penduliflorus* (de Candolle) Schery in Ann. Miss. Bot. Gard. 29: 223. 1942; Hara *et al.*, Enn. Fl. Pl. Nep. 2: 68. 1979; Miller *et Long* in Grierson *et Long*, Fl. Bhut. 2 (1): 194. 1991. *Malvaviscus penduliflorus* Mocino & Sesse *ex de Candolle*, Prodr. 1: 445. 1824; Fl. Ind. 3: 393. 1993; Hajra *et al.*, Fl. W. Beng. 1: 306, 1997; *Malvaviscus arboreus* Cavanilles, Diss. 3: 13, t. 48. f. 1. 1787; H. Ohashi in Hara, Fl. E. Himal. 1: 205. 1966; Blumea 14: 132. 1966; Hara *et al.*, Enn. Fl. Pl. Nep. 2: 68. 1979; Fl. Ind. 3: 393. 1993; *Hibiscus malvaviscus* Linnaeus, Sp. Pl. 694. 1753.

*Vernacular name:* Lankajaba.

Erect, perennial shrubs; shoots stellate – pubescent and with simple hairs. Lamina ovate to broadly ovate, entire or 3 – 5 lobed, 3 – 10 x 1.5 – 8 cm, acute, base rounded or cordate, margin serrate, thinly pubescent; petiole 1 – 4 cm; stipules filiform 2 – 5 mm. Pedicels 1 cm. Epicalyx segments 5 – 10, linear – oblong, Fl. Bhut. 1 cm. Calyx 1 – 2 cm. Petals scarlet.

*Flowers & Fruits:* Throughout the year.

*Specimen Cited:* Rasik Beel Village, *Rajib & AP Das 0329*, dated 21.07.2007.

*Local Distribution:* Village area.

*General Distribution:* India: Cultivated throughout in India; Native in tropical America; South America, Widely cultivated in the tropics.

URENA Linnaeus, Sp. Pl. 2: 692. 1753.

*Urena lobata* Linnaeus, Sp. Pl. 692. 1753, s.l.; Masters in Fl. Brit. India 1: 329. 1872; Roxburgh, Fl. Ind. ed. 2, 3: 182. 1832; H. Ohashi in Hara, Fl. E. Himal. 1: 206. 1966; Hara *et al.*, Enn. Fl. Pl. Nep. 2: 69. 1979; Fl. Ind. 3: 380. 1993; Hajra *et al.*, Fl. W. Beng. 1: 312, 1997; Miller *et Long* in Grierson *et Long*, Fl. Bhutan 2(1): 194. 1991. *Urena trilobata* Velloso, Fl. Flumin. 7: t. 44t. 44. 1825. *Urena grandiflora* de Candolle, Prodr. 1: 442. 1824.

Perennial undershrubs. Stems pubescent. Leaves extremely variable in size and shape, lamina 2–9 x 1–7 cm, ovate to orbicular, shallowly lobed, lobes 3–5, serrate to crenate, obtuse to acute, base shallowly cordate to rounded, hairy on both surfaces; stipules linear to lanceolate, acute. Flowers axillary, solitary or 2–3 in clusters. Epicalyx segments linear to lanceolate, acute, simple and stellate hairs towards apex inside. Calyx tubular to campanulate, lobes ovate to deltoid, shortly acuminate, hairs similar to epicalyx. Corolla pink with a purple centre; obovate, rounded at apex. Schizocarps globose, spines with 4–5 retrores, short, sharp hooks at the top. Seeds reniform.

*Flowers & Fruits:* August to December.

*Specimen Cited:* Atiamochar forest, *Rajib & AP Das 0277*, dated 10. 02. 2007.

*Local Distribution:* Plantation sector & conservation area.

*General Distribution:* Throughout in India; pantropical weed.

SIDA Linnaeus, Sp. Pl. 2: 683. 1753.

### Key to the species:

- 1a. Calyx adaxially with long simple hairs along veins; mericarps smooth ..... *S. cordata*
- 1b. Calyx adaxially stellate pubescent or glabrous; mericarps smooth ..... 2
- 2a. Mericarp awns conspicuous ..... *S. cordifolia*
- 2b. Mericarp awns absent ..... 3
- 3a. Leaves distichous; stipules unequal ..... *S. acuta*
- 3b. Leaves spiral; stipules equal ..... *S. rhombifolia*

*Sida acuta* Burman *f.*, Fl. Ind. 147. 1768; J. B. Nat. Hist. S. 51: 780. 1953; H. Ohashi in Hara, Fl. E. Himal. 1: 205. 1966; Blumea 14: 186. 1966; Hara *et al.*, Enn. Fl. Pl. Nep. 2: 68. 1979; Roxbrgh, Fl. Indica 3: 171. 1832; Fl. Ind. 3: 281. 1993; Hajra *et al.*, Fl. W. Beng. 1: 308, 1997; Miller *et Long* in Grierson *et Long*, Fl. Bhutan 2(1): 192. 1991. *Sida lanceolata* Retzius, Obs. Bot. 4: 119. 1786. *Sida carpinifolia* auct. *non* Linnaeus *f.* 1785; Dyer in Fl. Brit. Ind. 1: 323. 1874. *Malvinda carpinifolia* (Linnaeus *f.*) Medik., Malvenfam. 24. 1787. *Sida carpinifolia* Linnaeus *f.*, Suppl. Pl. 307. 1782.

*Vernacular name:* Set Berala.

Erect under shrubs, branched throughout, shoots thinly stellate-pubescent becoming glabrous. Lamina narrowly lanceolate to lanceolate, serrate, acute, base cuneate, rarely rounded, glabrescent, stipules of each pair unequal, filiform to linear-lanceolate. Flowers axillary, solitary or 2–5 flowered. Petals yellow, obovate.

*Flowers & Fruits:* September to May.

*Specimen Cited:* Road near Gate, *Rajib & AP Das 0079*, dated 06. 02. 2007.

*Local Distribution:* All Terrestrial Sectors.

*General Distribution:* India: Along roadsides up to 1200m, open places throughout; Pantropical.

***Sida cordifolia*** Linnaeus, Sp. Pl. 684. 1753; Dyer in Fl. Brit. Ind. 1: 324. 1874; H. Ohashi in Hara, Fl. E. Himal. 1: 205. 1966; Hara *et al.*, Enn. Fl. Pl. Nep. 2: 68. 1979; Fl. Ind. 3: 285. 1993; Hajra *et al.*, Fl. W. Beng. 1: 309, 1997; Miller *et Long* in Grierson *et Long*, Fl. Bhutan 2 (1): 192. 1991. *Sida pellita* Kunth, Nov. Gen. Sp. 5: 263 1822. *Sida holosericea* Willdenow *ex Sprengel*, Syst. Veg. 3: 112. 1826. *Sida rotundifolia* de Lamarck *ex Cavanilles*, Diss. 1: 19, pl. 3, f. 6: 19. 1785.

*Vernacular name:* Berala.

Erect, under shrubs. Lamina ovate to oblong or orbicular; crenate serrate; obtuse or acute; shallowly cordate at base. Flowers axillary, solitary or 2 – 5 in clusters. Corolla yellow or cream yellow, petals obliquely obovate, truncate at apex; ciliate at base. Staminal column simple hairy or glabrous.

*Flowers & Fruits:* Throughout the year.

*Specimen Cited:* Road near Gate, *Rajib & AP Das 0100*, dated 07. 02. 2007.

*Local Distribution:* All terrestrial sector.

*General Distribution:* India: Throughout the dry waste places; Pantropical.

***Sida rhombifolia*** Linnaeus, Sp. Pl. 684. 1753; Miller *et Long* in Grierson *et Long*, Fl. Bhutan 2 (1): 193. 1991. *Malva rhombifolia* (Linnaeus) E.H.L. Krause, Deutschl. Fl. (ed. 2) 6: 238. 1901. *Napaea rhombifolia* (Linnaeus) Moench, Methodus 621. 1794.

*Sida alba* Cavanilles, Diss. 1: 22. 1785.

Erect or prostrate subshrubs, much branched. Stipules linear; leaf simple, lamina rhombic to oblong lanceolate or obovate, 1–5 1 – 2 cm, dentate, obtuse to acute, base broadly cuneate. Flowers solitary, axillary. Pedicel 1 – 2 cm. Calyx cup-shaped, lobes triangular, apices acute. Petals yellow, obovate, base attenuate, apex rounded. Filament tube 4 – 5 mm, glabrous. Style branches 8 – 10. Fruit semiglobose to broadly turbinate, shallowly grooved to near base. Seeds reniform, blackish.

*Flowers & Fruits:* September to March.

*Specimen Cited:* Road near Gate, *Rajib & AP Das 0132*, dated 07. 02. 2007.

*Local Distribution:* Road side.

*General Distribution:* India: Bhutan, Cambodia, Laos, Nepal, Thailand, Vietnam; pantropical.

***Sida cordata*** (Burman *f.*) Borss. Waalk., Blumea 14: 182. 1966; Miller *et Long* in Grierson *et Long*, Fl. Bhutan 2 (1): 192. 1991. *Melochia cordata* Burman *f.*, Fl. Indica 143. 1768. *Sida multicaulis* Cavanilles, Diss. 1: 10, pl. 1, f. 6: 10. 1785.

Procumbent shrubs. Stems slender. Stipule filiform; leaf simple, alternate, lamina broadly ovate, 2 – 5 1.8 – 5 cm, crenate or dentate, acuminate, base cordate. Flowers usually solitary, axillary. Pedicel slender. Calyx cup shaped, lobes acute. Corolla yellow. Filament tube glabrous or sparsely pilose. Schizocarp nearly globose.

*Flowers & Fruits:* July to February.

*Specimen Cited:* Road near Gate, *Rajib & AP Das 0126*, dated 07. 02. 2007.

*Local Distribution:* Road side.

*General Distribution:* India: Philippines, Sri Lanka, Thailand; pantropical species of unknown origin.

ALCEA Linnaeus, Sp. Pl. 2: 687. 1753.

***Alcea rosea*** Linnaeus, Sp. Pl. 687. 1753; Fl. Ind. 3: 386. 1993; Hajra *et al.*, Fl. W. Beng. 1: 293, 1997; Miller *et Long* in Grierson *et Long*, Fl. Bhutan 2 (1): 190. 1991. *Althaea rosea* (Linnaeus) Cavanilles, Diss. 2. 91. t. 28. f. 1. 1786; Dyer in Fl. Brit. Ind. 1: 319. 1874; Blumea 14: 151. 1966. *Althaea rosea* var. *sinensis* (Cavanilles) S.Y. Hu, Fl. China Family 153: 10. 1955. *Althaea sinensis* Blanco, Fl. Filip. 552. 1837.

Erect herbs, up to 2 m tall. Leaves simple; lamina 3 – 10 x 3 – 8 cm, ovate to suborbicular, deeply 3 – 7 lobed, crenate, acute, base cordate or rounded; glabrous or sparsely stellate above. Flowers solitary, axillary or in terminal raceme by replacing the upper leaves. Epicalyx segments 6–7, ovate to lanceolate. Petals red. Staminal column 5 angled. Schizocarps depressed globose, longitudinally sulcate.

*Flowers & Fruits:* March to September.

*Specimen Cited:* Park, *Rajib & AP Das 0165*, dated 08. 02. 2007.

*Local Distribution:* Park.

*General Distribution:* Extensively cultivated.

MALVA Linnaeus, Sp. Pl. 2: 687. 1753.

***Malva verticillata*** Linnaeus, Sp. Pl. 689. 1753; Masters in Fl. Brit. Ind. 1: 320. 1874; Miller *et* Long in Grierson *et* Long, Fl. Bhutan 2 (1): 189. 1991; 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 sak.

Biennial herbs; stem sparsely stellate velutinous. Stipules ovate-lanceolate. Leaves simple; lamina reniform to round, 5 – 11 5 – 10 cm, 5 – 7 lobed, lobes rounded or acute, margin crenateserrate. Flowers 3 to many-fascicled, axillary. Epicalyx lobes filiform-lanceolate. Calyx cup-shaped. Corolla whitish to reddish, slightly longer than sepals. Filament tube 3 – 4 mm, glabrous. Style branches 10. Schizocarp flat globose. Seeds purple-brown, reniform.

*Flowers & Fruits:* December to March.

*Specimen Cited:* Rasik Beel Village, *Rajib & AP Das 0205*, dated 09. 02. 2007.

*Local Distribution:* Cultivate at villages.

*General Distribution:* India: cultivated throughout; Bhutan, Korea, Mongolia, Myanmar, Pakistan; Asia, Europe, Egypt and South Africa.

CORCHORUS Linnaeus, Sp. Pl. 1: 529. 1753.

***Corchorus aestuens*** Linnaeus, syst. Nat. ed. 10. 2: 1079. 1759; Sharma *et al.*, Fl. Ind. 3: 485. 1993; Long *et* Rae in Grierson *et* Long, Fl. Bhutan 2 (1): 172. 1991. *Corchorus acutangulus* de Lamarck, Encycl. 2: 104. 1786; Mast. in Hooker *f.*, Fl. Brit. Ind. 1: 398. 1874.; Haines, Bot. Bihar & Orissa 2: 87. 1921. *Corchorus fuscus* Roxburgh, Fl. Ind. 2: 582. 1824.

*Vernacular name:* Jangli pat.

Annual herbs, up to 1 m tall. Stem brownish; branches slender. Leaves simple, alternate. Lamina ovate or broadly ovate, 4 – 6 3 – 4 cm, serrate, shortly acuminate or acute, base rounded, basal pair of teeth usually elongating into filiform or caudate appendages. Flowers solitary or several together in cymes, axillary or leaf-opposed. Sepals 5, narrowly oblong. Petals 5, yellow, nearly as long as sepals, obovate. Stamens many, yellow. Ovary 3 – 5 loculed, long cylindrical. Capsule cylindrical, angled, 3 – 5 valved. Seeds separated by transverse septum.

*Flowers & Fruits:* August to December.

*Specimen Cited:* Rasik Bil, *Rajib & AP Das 0164*, dated 08. 02. 2007.

*Local Distribution:* Bochamari Beel.

*General Distribution:* India, Bangladesh, Bhutan, Indonesia, Malaysia, Myanmar, Nepal, Pakistan, Philippines, Sri Lanka, Thailand, Vietnam; tropical Africa, Australia, Central America, West Indies.

TRIUMFETTA Linnaeus, Sp. Pl. 1: 444. 1753.

***Triumfetta rhomboidea*** Jacquin, Enum. Syst. Pl. 22. 1760; Long *et* Rae in Grierson *et* Long, Fl. Bhutan 2 (1): 173. 1991. *Bartramia indica* Linnaeus, Sp. Pl. 389. 1753. *Triumfetta angulata* Lam., Encycl. 3(2): 421. 1791. *Triumfetta bartramii* Linnaeus, Syst. Nat. (ed. 10) 2: 1044. 1759. *Triumfetta indica* Lam., Encycl. 3: 420. 1791. *Bartramia rhombifolia* Stokes, Bot. Mat. Med. 3: 15. 1812.

Subshrubs. Branchlets gray-brown tomentose. Leaves simple, alternate; lamina of lower leaf broadly ovate orbicular to rhomboid, 3 lobed, 3 – 8 2 – 7 cm, irregularly bluntly serrate, acute, base broadly cuneate or rounded; upper leaf blades oblong-lanceolate, not lobed. Cymes 3 – 5 per axil. Sepals narrowly oblong, villous. Petals yellow, slightly shorter than sepals, hairy along margins. Stamens 10. Ovary spiny. Capsule globose, spiny, indehiscent, tip hooked.

*Flowers & Fruits*: August to May.

*Specimen Cited*: Road near Gate, Rajib & AP Das 0078, dated 06. 02. 2007.

*Local Distribution*: Road side.

*General Distribution*: India; throughout tropics; type from West Indies.

BOMBAX Linnaeus, Sp. Pl. 1: 511. 1753, *nom. cons.*

***Bombax ceiba*** Linnaeus, Sp. Pl. 1: 511. 1753; Hajra *et al*, Fl. Ind. 3: 398. 1993; Long *et* Rae in Grierson *et* Long, Fl. Bhut. 2(1): 195. 1991. *Bombax ceiba* Burman *f.*, Fl. Indica 145. 1768. *Bombax malabaricum* de Candolle, Prodr. 1: 479. 1824. *Gossampinus malabarica* Merrill, Lingnan Sci. J. 5: 126. 1927 publ. 1928. *Gossampinus rubra* Buchanan-Hamilton, Trans. Linn. Soc. London 15: 128. 1826. *Melaleuca grandiflora* Blanco, Fl. Filip. 615. 1837.

*Vernacular Name*: Simul.

Large tree, up to 25m; branches whorled, spreading horizontally; trunk buttressed at base. Leaves clustered towards branch ends, with 5 – 7 leaflets; leaflets elliptic, 9 – 16 x 4 – 5 cm, entire, caudate. Flowers appearing before leaves, solitary, axillary, borne towards branch ends. Calyx green. Petals crimson, thick, narrowly oblong – obovate. Stamens shortly united at base. Style 4 – 6 mm. Capsule ellipsoid, thickly white woolly within; seeds numerous.

*Flowers & Fruits*: March to April.

*Specimen Cited*: Atiamochar forest, Rajib & AP Das 0435, dated 22.07.2007.

*Local Distribution*: Forest and Road side near Leopard cage.

*General Distribution*: Tropical and sub-tropical parts of the world.

ABROMA Linnaeus *f.*, Suppl. Pl. 54. 1782.

***Abroma augusta*** Linnaeus *f.*, Suppl. Pl. 341. 1782; Long *et* Rae in Grierson *et* Long, Fl. Bhut. 2(1): 206. 1991.

*Vernacular Name*: Ulat Khambal

Shrubs, upto 4 m. Branchlets densely stellate velutinous. Stipules linear, caducous; Leaves simple; lamina cordate or ovate-cordate, 3 – 5 lobed, 10 – 20 8 – 17cm, basal veins 3 – 7, prominently raised on both surfaces, acute or acuminate, base cordate. Inflorescence cymose, 1 – 5 flowered. Flowers pendulous. Sepals lanceolate, both surfaces densely puberulent. Petals dark bluish purple, basal part as broad as long and hairy, upper part ellipticspatulate, apex acute or obtuse. Staminodes nearly spatulate, both surfaces hairy. Ovary oblong, slightly hairy; style triangular-tongue-shaped. Capsule erect, stellate hairy, 5 winged. Seeds oblong, black.

*Flowers & Fruits*: June to January.



*Specimen Cited:* Bochamari Village, *Rajib & AP Das 0073*, dated 06. 02. 2007.

*Local Distribution:* Panted in Villages.

*General Distribution:* India, Nepal, Bhutan, China, Malaysia.

MELOCHIA Linnaeus, Sp. Pl. 2: 674 [“774”]. 1753, *nom. cons.*

***Melochia corchorifolia*** Linnaeus, Sp. Pl. 675. 1753; Mast. in Hooker *f.*, Fl. Brit. Ind. 1: 374. 1874; Sharma *et al.*, Fl. Ind. 3: 441. 1993; Guha Bakshi, Fl. Mur. Dist. 71. 1984. *Riedleia corchorifolia* (Linnaeus) de Candolle, Prodr. 1: 491. 1824. *Geruma subtriloba* Blanco, Fl. Filip. 182. 1837. *Melochia supina* Linnaeus, Sp. Pl. 675. 1753. *Melochia erecta* Burman *f.*, Fl. Indica 143. 1768. *Riedleia corchorifolia* (Linnaeus) de Candolle, Prodr. 1: 491. 1824.

Subshrubs, less than 1 m, erect or decumbent. Branches yellow-brown, sparsely stellate puberulent. Stipules linear. Leaves simple; lamina ovate to ovate lanceolate, 2 – 6 x 1 – 2 cm, dentate, acute, base rounded or cordate, thinly papery, basal veins 5. Inflorescence a dense terminal or axillary cyme. Epicalyx lobes 4, linear, hairy. Calyx campanulate, 5 lobed, lobes triangular. Petals 5, white, drying reddish, oblong, narrowed at base. Stamens 5, connate at base, opposite petals. Ovary sessile; styles 5, filiform. Capsule globose, 5 angular. Seeds brown-black, ovoid, slightly triangular.

*Flowers & Fruits:* June to December.

*Specimen Cited:* Rasik Beel, *Rajib & AP Das 0383*, dated 21.07.2007.

*Local Distribution:* Throughout the Beel Margin.

*General Distribution:* India: Paleotropical.

PTEROSPERMUM Schreber, Gen. Pl. 2: 461. 1791, *nom. cons.*

***Pterospermum acerifolium*** Willdenow, Sp. Pl. 3: 729. 1800; Long *et* Rae in Grierson *et* Long, Fl. Bhutan 2 (1): 204. 1991. *Pentapetes acerifolia* Linnaeus, Sp. Pl. 698. 1753. *Pterospermadendron acerifolium* (Linnaeus) Kuntze, Revis. Gen. Pl. 1: 80. 1891. *Dombeya acerifolia* (Linnaeus) Gaertner, Fruct. Sem. Pl. 2: 260. 1791.

Big trees. Branchlets densely velutinous. Stipules linear; petiole robust, striate; lamina nearly orbicular to oblong, Fl. Bhut. 2 0 – 35 x 12 – 27 cm, entire or crenate, truncate, nearly pointed, base cordate, leathery; juvenile leaves palmately lobed, peltate. Flowers solitary, fragrant; epicalyx lobes fimbriate or palmately divided. Sepals linear oblong. Petals white, linearoblong, slightly cuneate, glabrous. Staminodes hairy. Ovary oblong, 5 angular; ovules many per locule. Capsule woody, cylindrical, 5 grooved, apex rounded. Seeds many per locule, obliquely ovate, flat, brown, smooth.

*Flowers & Fruits:* August to December.

*Specimen Cited:* Atiamochar forest, *Rajib & AP Das 0473*, dated 23.07.2007.

*Local Distribution:* Pantation forests.

*General Distribution:* India, Bhutan, Bangladesh, Nepal, Laos, Malaysia, Myanmar, Thailand.

STERCULIA Linnaeus, Sp. Pl. 2: 1007. 1753.

***Sterculia villosa*** Roxburgh, Fl. Ind., ed. 1832, 3: 153. 1832; Dyer in Fl. Brit. Ind. 1: 355. 1874; Long *et* Rae in Grierson *et* Long, Fl. Bhut. 2(1): 199. 1991. *Sterculia armata* Masters, Fl. Brit. India 1: 357. 1874. *Sterculia lantsangensis* Hu, Bull. Fan Mem. Inst. Biol., Bot. 8(1): 42. 1937.

*Vernacular name:* Odal.

Trees. Branchlets robust, with leaf scars, brown stellate pubescent when young. Leaves simple; stipules lanceolate; lamina palmately 3 – 7 lobed, 17 – 22 cm, caudate, base broadly cordate, central lobe broadly ovate. Inflorescence subterminal on branchlets, paniculate. Calyx campanulate,

apex acuminate. Male flowers: androgynophore curved, glabrous. Stamens 10. Female flowers: ovary globose. Style curved downward, hairy. Follicles narrowly ellipsoid, apex shortly beaked. Seeds black, oblong.

*Flowers & Fruits:* February to October.

*Specimen Cited:* Atiamochar forest, *Rajib & AP Das 0468*, dated 23.07.2007.

*Local Distribution:* Forests.

*General Distribution:* India, Bhutan, Cambodia, Myanmar, Nepal, Thailand. Tropical and subtropical parts of the world.

**Order: Sapindales** Jussieu *ex* Berchtold & J. Presl (1820)

**Anacardiaceae** R. Brown in Tuckey, Narr. Exped. Congo 431. 1818 ('Anacardieae'); *nom. cons.*

**Key to the genera:**

- 1a. Leaves pinnately compound ..... *Lannea*
- 1b. Leaves simple ..... *Mangifera*

LANNEAA. Richard in Guillemin et al., Fl. Seneg. Tent. 153. 1831, *nom. cons.*

*Lannea coromandelica* (Houttuyn) Merrill in J. Arnold Arb. 19: 353. 1939; Grierson in Grierson *et* Long, Fl. Bhut. 2 (1): 61. 1991. *Dialium coromandelicum* Houttuyn, Nat. Hist. Ser. 2(2): 39. t.5. f.2. 1774. *Odina wodier* Roxburgh, Fl. Ind. 2: 293. 1832; Hooker *f.* in Hooker *f.*, Fl. Brit. India 2: 29. 1876.

*Vernacular Name:* Jika.

Deciduous trees, up to 10 m. Leaves imparipinnately compound; lamilets usually 7 pairs, ovate to oblong-ovate, 5 – 9 2.5 – 4 cm, entire, acuminate, base cuneate; membranous or papery. Inflorescences paniculate or racemose, appearing before leaves. Flowers unisexual, tetramerous. Calyx lobes ovate to broadly ovate. Petals yellow, ovate-oblong. Ovary glabrous, ovoid, 4-locular, usually only 1 ovule fertile. Drupes ovaoid – obovoid, red in maturity.

*Flowers & Fruits:* January to May.

*Specimen Cited:* Rasik Beel village, *Rajib & AP Das 0364*, dated 21.07.2007.

*Local Distribution:* Village areas.

*General Distribution:* India, Bhutan, India, Myanmar, Nepal, Sri Lanka; cultivated elsewhere in continental SE Asia, such as in Cambodia, Laos, Malaysia, Thailand, Vietnam, where it is probably naturalized.

MANGIFERA Linnaeus, Sp. Pl. 1: 200. 1753.

*Mangifera indica* Linnaeus, Sp. Pl. 1: 200. 1753; Hooker *f.* in Hooker *f.*, Fl. Brit. India 2: 13. 1876; Grierson in Grierson *et* Long, Fl. Bhut. 2 (1): 59. 1991; Fl. Ind. 5: 466. 2000.

*Vernacular Name:* Aam.

Trees, up to 20 m. Petiole grooved apically, inflated basally; lamina oblong to oblong-lanceolate, 12 – 20 x 3 – 5 cm, leathery, acute to long acuminate, entire, undulate, base cuneate to obtuse. Inflorescence paniculate, terminal, glabrous to tomentose-pilose; bracts lanceolate, pubescent. Pedicels articulate. Sepals ovate-lanceolate, glabrous to pubescent, acuminate. Petals light yellow, oblong to oblong-lanceolate, glabrous. Fertile stamen 1, with ovate anther; staminodes

4. Disk inflated, fleshy, 5 lobed. Ovary oblique, ovate. Drupe oblong to subreniform, greenish yellow to red.

*Flowers & Fruits*: March to July.

*Specimen Cited*: Rasik Beel village, *Rajib & AP Das 0334*, dated 21.07.2007.

*Local Distribution*: Village areas.

*General Distribution*: India, Nepal, Bangladesh, Myanmar and Malaysia.

**Meliaceae** A.L. de Jussieu, Gen. Pl. 263. 1789 ('Meliae'); *nom. cons.*

**Key to the genera:**

- |  |                    |
|--|--------------------|
| 1a. Fruit a capsule; seeds winged .....                      | 2                  |
| 1b. Fruit a drupe or berry; seeds not winged .....           | 4                  |
| 2a. Filaments free .....                                     | <i>Toona</i>       |
| 2b. Filaments connate into a staminal tube .....             | 3                  |
| 3a. Anthers inserted on apical margin of staminal tube ..... | <i>Chukrasia</i>   |
| 3b. Anthers inserted inside staminal tube .....              | <i>Swietenia</i>   |
| 4a. Fruits a capsule .....                                   | <i>Aphanamixis</i> |
| 4b. Fruits a drupe .....                                     | 5                  |
| 5a. Leaves bipinnate .....                                   | <i>Melia</i>       |
| 5b. Leaves pinnate.....                                      | <i>Azadirachta</i> |

AZADIRACHTA Jussieu, Bull. Sci. Nat. Geol. 23: 236. 1830.

*Azadirachta indica* A. Jussieu in Mem. Mus. Hist. Nat. 19: 221.t.13.f. 5. 1830; Fl. Ind. 4: 478. 1997; Grierson in Grierson *et* Long, Fl. Bhut. 2 (1): 32. 1991. *Melia azadirachta* Linnaeus, Sp. Pl. 385. 1753; Hooker *f.*, Fl. Brit. Ind. 1: 544. 1875.

*Vernacular name*: Nim.

Trees, up to 10 m, deciduous. Leaves odd-pinnate, pinnate; leaflets opposite; lamilets ovate – elliptic to lanceolate, 3 – 7 x 2 – 3 cm, shortly acuminate, crenate to entire, base ± oblique and cuneate to broadly cuneate. Flowers fragrant. Calyx 5 parted; sepals ovate to oblongovate, acute. Petals lilac-colored, obovate spatulate. Staminal tube purple; anthers 10. Ovary spherical, glabrous, 5 – 8 locular, with 2 ovules per locule; style acerose; stigma capitate. Drupe globose to ellipsoid. Seed ellipsoid.

*Flowers & Fruits*: March to December.

*Specimen Cited*: Rasik Beel village, *Rajib & AP Das 0452*, dated 22.07.2007.

*Local Distribution*: Cultivated in village areas.

*General Distribution*: Pantropical.

CHUKRASIA A. Jussieu, Bull. Sci. Nat. G ol. 23: 239. 1830.

*Chukrasia tabularis* A. Jussieu in Mem. Mus. Hist. Nat. 19: 251. t. 22. 1830; Hooker *f.* in Hooker *f.*, Fl. Brit. India 1: 568. 1875; Hajra *et al.*, Fl. Ind. 4: 481. 1997; Grierson in Grierson *et* Long, Fl. Bhut. 2 (1): 39. 1991.

*Vernacular name*: Chikrasi.

Trees, up to 25 m. Leaves usually 30 – 50 cm; lamilets 10 – 15; lamilet ovate to oblong-lanceolate, 6 – 12 x 3 – 5 cm, papery, acute to acuminate, entire, base oblique. Thyrses lax; bracts linear. Flowers fragrant. Calyx puberulent. Petals cream-colored to ± lavender, linear-oblong to spatulate,

12 – 15 x 5 – 6 mm. Staminal tube cylindrical; anthers 10, oblong. Ovary on a short disk, elongate. Capsule yellowish gray to brown, subglobose to oblong, usually 3-valved, woody. Seeds flat, oblong.

*Flowers & Fruits:* April to January.

*Specimen Cited:* Atiamochar, *Rajib & AP Das 0454*, dated 22.07.2007.

*Local Distribution:* Forests.

*General Distribution:* India, Bhutan, Nepal, Sri Lanka, Indonesia, Laos, Malaysia, Thailand, Vietnam.

MELIA Linnaeus, Sp. Pl. 1: 384. 1753.

***Melia azedarach*** Linnaeus, Sp. Pl. 384. 1753; Hooker *f.*, Fl. Brit. Ind. 1: 544. 1875; Hajra *et al.*, Fl. Ind. 4: 494. 1997; Grierson in Grierson *et Long*, Fl. Bhut. 2 (1): 30. 1991.

*Vernacular name:* Ghoranim.

Trees, up to 10 m, deciduous. Leaves odd-pinnate, 2 to 3-pinnate; leaflets opposite; lamilets ovate – elliptic to lanceolate, 3 – 7 x 2 – 3 cm, shortly acuminate, crenate to entire, base ± oblique and cuneate to broadly cuneate. Flowers fragrant. Calyx 5 parted; sepals ovate to oblongovate, acute. Petals lilac-colored, obovate spatulate. Staminal tube purple; anthers 10. Ovary spherical, glabrous, 5 – 8 locular, with 2 ovules per locule; style acerose; stigma capitate. Drupe globose to ellipsoid. Seed ellipsoid.

*Flowers & Fruits:* March to December.

*Specimen Cited:* Rasik Beel village, *Rajib & AP Das 0243*, dated 09. 02. 2007.

*Local Distribution:* Cultivated in village areas.

*General Distribution:* India, Bhutan, Nepal, Sri Lanka, Indonesia, Laos, Papua New Guinea, Philippines, Thailand, Vietnam; tropical Australia, Pacific islands.

SWIETENIA Jacquin, Enum. Syst. Pl. 4. 1760.

***Swietenia mahagoni*** (Linnaeus) Jacquin, Enum. Syst. Pl. 20. 1760; Hajra *et al.*, Fl. Ind. 4: 525. 1997. *Cedrela mahagoni* Linnaeus, Syst. Nat., ed. 10, 2: 940. 1759.

*Vernacular name:* Mehagoni.

Large trees, up to 25 m. Leaves alternate, base slightly swelling; leaflets 8 – 12; leaflet blades ovate to lanceolate, 10 – 18 x 4 – 6 cm, leathery, long acuminate, entire or with 1 to 2 serrations, base oblique. Thyrses axillary. Flowers small. Calyx cup-shaped, 5 lobed; lobes short and truncate, apex rounded. Petals greenish white, obovate. Staminal tube subcylindric, glabrous; anthers 10. Disk annular. Ovary conic to ovoid. Capsule brown, ovoid. Seeds apically winged.

*Flowers & Fruits:* May to October.

*Specimen Cited:* Bochamari, *Rajib & AP Das 0390*, dated 21.07.2007.

*Local Distribution:* Cultivated in village areas.

*General Distribution:* India, tropical Asia. Native to tropical America.

TOONA (Endlicher) M. Roemer, Fam. Nat. Syn. Monogr. 1: 131. 1846.

***Toona ciliata*** M. Roemer, Fam. Nat. Syn. Monogr. 1: 139. 1846; Grierson in Grierson *et Long*, Fl. Bhut. 2 (1): 38. 1991. *Cedrela toona* Roxburgh *ex* Rottler, Ges. Naturf. Freunde Berlin Neue Schriften 4: 198. 1803; Hooker *f.*, Fl. Brit. Ind. 1: 568. 1875.

*Vernacular Name:* Tun.

Trees, up to 25m. Leaves pilose; leaflets usually 7 – 15 pairs, glabrescent; leaflet blades lanceolate to ovate-lanceolate, 9 – 11 x 3 – 5 cm, acute to acuminate, entire, base usually asymmetric. Inflorescences pendent. Flowers sweetly scented. Sepals spatulate, margins shortly ciliate. Petals white to creamy white. Disk reddish orange. Seeds winged at both ends; wings unequal, apex narrowly obtuse.

*Flowers & Fruits:* January to November.

*Specimen Cited:* Park, *Rajib & AP Das 0267*, dated 10.02. 2007.

*Local Distribution:* Cultivated in village areas and Park sector.

*General Distribution:* Tropical and sub-tropical parts of the world. India, Bangladesh, Bhutan, Nepal, Sri Lanka, Pakistan, Cambodia, Indonesia, Laos, Malaysia, Myanmar, Papua New Guinea, Philippines, Thailand, Vietnam; E Australia, W Pacific islands.

APHANAMIXIS Blume, Bijdr. 165. 1825.

*Aphanamixis polystachya* (Wallich) R. Parker, Indian Forester 57: 486. 1931; Grierson in Grierson et Long, Fl. Bhut. 2 (1): 35. 1991. *Amoora rohituka* (Roxburgh) Wight & Arnott in Wight, Cat. Ind. Pl. 24. 1833; Hooker f., Fl. Brit. Ind. 1: 559. 1875. *Andersonia rohituka* Roxburgh, Fl. Ind. 2: 213. 1832. *Aglaia polystachya* Wallich in Roxburgh, Fl. Ind. 2: 429. 1824.

Medium trees, up to 30 m. Leaves odd- or evenpinnate, 30 – 60 cm; leaflets 7 – 21, opposite; leaflet blades oblong-elliptic to ovate, 12 – 23 x 4 – 10 cm with basal pair smallest, subleathery to leathery when mature, caudate-acuminate to obtuse, entire, base oblique and cuneate to broadly cuneate or sometimes one side rounded. Inflorescences axillary. Sepals 5, suborbicular. Petals concave. Staminal tube globose, glabrous. Ovary 3 locular. Capsule spherical-pyriform to nearly ovoid. Seeds grayish brown, oblate.

*Flowers & Fruits:* May to October.

*Specimen Cited:* Takomari forest, *Rajib & AP Das 0532*, dated 23.07.2007.

*Local Distribution:* Forests near conservation area.

*General Distribution:* India, Bhutan, Indonesia, Sri Lanka, Laos, Malaysia, Papua New Guinea, Philippines, Thailand, Vietnam; Pacific islands.

**Rutaceae** A.L. de Jussieu, Gen. Pl. 296. 1789; *nom. cons.*

### Key to the genera:

- 1a. Fruit follicular or drupaceous; endocarp cartilaginous; seeds with endosperm ..... *Toddalia*
- 1b. Fruit baccate; endocarp membranous or fleshy; seeds without endosperm ..... 2
- 2a. Leaves digitately 3-foliolate ..... 3
- 2b. Leaves odd-pinnately with 5 to 7 leaflets ..... 4
- 3a. Plants evergreen; fruit with leathery exocarp and spongy mesocarp ..... *Citrus*
- 3b. Plants deciduous; fruit with thin, parenchymatous exocarp and woody mesocarp ... *Aegle*
- 4a. Style persistent in fruit ..... *Glycosmis*
- 4b. Style deciduous in fruit ..... 5
- 5a. Flower buds globose ..... *Clausena*
- 5b. Flower buds ellipsoid to obovoid ..... *Murraya*

AEGLE Corr a, Trans. Linn. Soc. London 5: 222. 1800, *nom. cons.*

*Aegle marmelos* (Linnaeus) Correa in Trans. Linn. Soc. London 5:223.1800; Hooker *f.*, Fl. Brit. Ind. 1:516.1875; Grierson in Grierson *et* Long, Fl. Bhut. 2 (1): 10. 1991. *Crateva marmelos* Linnaeus, Sp. Pl. 444.1753. Fl. Ind. 4: 264. 1997.

*Vernacular name:* Bel.

Trees; shoots dimorphic, some spineless others bearing straight spines. Lamina ovate – elliptic, crenate, bluntly acuminate, base cuneate, glabrous or sparsely pubescent; petioles unwinged. Calyx cup-shaped. Petals elliptic oblong, white. Fruits ellipsoid or broadly ovoid.

Flowers & Fruits: March to December.

*Specimen Cited:* Bochamari village, *Rajib & AP Das 0598*, dated 26.07.2007.

*Local Distribution:* Village areas.

*General Distribution:* India, Myanmar and Sri Lanka.

CITRUS Linnaeus, Sp. Pl. 2: 782. 1753.

### Key to the species:

- 1a. Shrubs ..... *C. limon*
- 1b. Trees ..... *C. maxima*

*Citrus limon* (Linnaeus) Osbeck, Reis Ostindien China, 250. 1765; Grierson in Grierson *et* Long, Fl. Bhut. 2 (1): 22. 1991. *Citrus medica* Linnaeus var. *limon* Linnaeus, Sp. Pl. 2: 782. 1753. [PLATE: 7, Figure-73]

*Vernacular Name:* Lebu.

Shrubs. Branches spiny. Leaf blade ovate to elliptic, margin conspicuously crenulate, apex usually mucronate. Flowers solitary. Calyx cup-shaped. Petals purplish, inside white. Ovary subcylindric or barrel-shaped. Fruit yellow, ellipsoid to ovoid.

*Flowers & Fruits:* April to May.

*Specimen Cited:* Near conservation sector, *Rajib & AP Das 0594*, dated 25.07.2007.

*Local Distribution:* Forests.

*General Distribution:* Tropical and sub-tropical parts of the world.

*Citrus maxima* (Burman) Merrill, Interpr. Herb. Amboin. 296.1917; Grierson in Grierson *et* Long, Fl. Bhut. 2 (1): 21. 1991. *Aurantium maximum* Burman in Rumphius & Burman, Herb. Amboin. Auctuar. 7: Index [16]. 1755.

*Vernacular Name:* Jambura.

Trees; twigs spiny. Leaves obtuse, base rounded, margin obscurely crenate, pubescent along midrib beneath; petiole broadly winged. Flowers solitary or in axillary clusters. Petals white, oblong. Ovary subglobose, sharply delimited from deciduous style. Fruit globose or subpyriform; peel yellow, thick.

*Flowers & Fruits:* April to December.

*Specimen Cited:* Bochamari village, *Rajib & AP Das 0600*, dated 26.07.2007.

*Local Distribution:* Cultivated in village areas.

*General Distribution:* Pantropical.

CLAUSENA N.L. Burman, Fl. Indica, 87, 243. 1768.

*Clausena excavata* Burman *f.*, Fl. Ind. 87, t. 29, 2. 1768; Hooker *f.*, Fl. Brit. Ind. 1: 504. 1875; Grierson in Grierson *et* Long, Fl. Bhut. 2 (1): 16. 1991; Fl. Ind. 4: 325. 1997.

*Vernacular name:* Bonkari.

Shrubs, up to 2 m. Leaves 21 – 27 foliolate but on young plants to 41 foliolate; lamina ovate - lanceolate to rhomboid, asymmetric, 2 – 9 x 1 – 3 cm, both surfaces pubescent, Obtuse to shortly acuminate, repand, base oblique. Inflorescences terminal; bracts opposite. Flowers globose in bud. Petals pale yellowish white, ovate to obovate. Stamens 8; filaments basally dilated, geniculate at middle, apically linear. Style stout. Fruit ellipsoid; 1 to 2 seeded.

*Flowers & Fruits:* April to October.

*Specimen Cited:* Road side near gate, *Rajib & AP Das 0528*, dated 23.07.2007.

*Local Distribution:* Forests.

*General Distribution:* India: tropical; Bhutan, Bangladesh, Nepal, Cambodia, Indonesia, Laos, Malaysia, Myanmar, Philippines, Thailand, Vietnam.

GLYCOSMIS Corr a, Ann. Mus. Natl. Hist. Nat. 6: 384. 1805, *nom. cons.*

***Glycosmis pentaphylla*** (Retzius) de Candolle, Prodr. 1: 538. 1924 ; Grierson in Grierson *et Long*, Fl. Bhut. 2 (1) : 15. 1991. *Limonia pentaphylla* Retzius, Observ. Bot. 5: 24. 1789.

Trees, up to 5m. Leaves 3 to 5 foliolate; leaflet blades oblong, 10 – 25 x 3 – 7 cm, papery, mucronate, serrate, base cuneate. Inflorescences axillary or terminal paniculate. Flowers globose in bud. Sepals broadly ovate. Petals white or pale yellow. Stamens 10. Ovary globose to broadly ovoid; style extremely short; stigma slightly expanded. Fruit reddish, subglobose.

*Flowers & Fruits:* July to March.

*Specimen Cited:* Rasik Beel forest, *Rajib & AP Das 0561*, dated 24.07.2007.

*Local Distribution:* Forests.

*General Distribution:* Tropical and sub-tropical parts of the world. India, Bhutan, Sri Lanka, Indonesia, Cambodia, Laos, Malaysia, Myanmar, Nepal, Pakistan, Philippines, Thailand, N.W. Vietnam.

MURRAYAJ. Koenig ex Linnaeus, Mant. Pl. 2: 554, 563. 1771 [“*Murraea*”], *nom. cons.*

### Key to the species:

- 1a. Fruits bluish black, ovoid to oblong ..... *M. koenigii*
- 1b. Fruit orange, narrowly ellipsoid ..... *M. paniculata*

***Murraya koenigii*** (Linnaeus) Sprengel, Syst. Veg. 2: 315. 1817; Hooker *f.*, Fl. Brit. Ind. 1: 503. 1875; H. Ohashi in Hara, Fl. E. Himal. 3: 75. 1975; Hara *et al.*, Enn. Fl. Pl. Nep. 2: 82. 1979; Grierson in Grierson *et Long*, Fl. Bhut. 2 (1): 17. 1991. *Bergera koenigii* Linnaeus, Mant. Pl. 2: 555, 563. 1771.

*Vernacular Name:* Karipata.

Shrubs, up to 5 m. Leaves 17 – 31-foliolate; lamina ovate, 2–5 x 0.5–2 cm, entire, base obtuse to rounded and oblique. Inflorescences terminal, many flowered. Flowers 5 – merous, ellipsoid in bud. Sepals ovate. Petals white, oblanceolate to oblong. Stamens 10. Stigma capitate. Fruits bluish black, ovoid to oblong.

*Flowers & Fruits:* March to August.

*Specimen Cited:* Rasik Beel, *Rajib & AP Das 0679*, dated 14. 02. 2008.

*Local Distribution:* Forests.

*General Distribution:* Tropical and sub-tropical parts of the world. India, Bhutan, Nepal, Pakistan, Sri Lanka, Thailand, Laos, Vietnam.

***Murraya paniculata*** (Linnaeus) Jack, Malayan Misc. 1: 31. 1820; Grierson in Grierson *et* Long, Fl. Bhut. 2 (1): 17. 1991. *Chalcas paniculata* Linnaeus, Mant. Pl. 1: 68. 1767.

*Vernacular name:* Kamini.

Shrubs, up to 6 m. Leaves 2–5 foliolate; petiolules less than 1 cm; lamina mostly suborbicular-ovate to elliptic, 2–6 1.5–3 cm, rounded to acuminate, entire to crenulate. Inflorescences terminal or axillary. Flowers 5 merous, fragrant. Sepals ovate to lanceolate, persistent in fruit. Petals white, narrowly elliptic to oblanceolate. Stamens 10. Fruit orange, narrowly ellipsoid or rarely ovoid. Seeds villous.

*Flowers & Fruits:* May to February.

*Specimen Cited:* Rasik Beel, *Rajib & AP Das 0642*, dated 12. 02. 2008.

*Local Distribution:* Forests.

*General Distribution:* India, Bhutan, Nepal, Sri Lanka, Pakistan, Cambodia, Indonesia, Japan, Laos, Malaysia, Myanmar, New Guinea, Philippines, Thailand, Vietnam; Australia, S.W. Pacific islands.

TODDALIA Jussieu, Gen. Pl. 371. 1789, nom. cons.

***Toddalia asiatica*** (Linnaeus) Lamarck, Tabl. Encycl. 2: 116. 1797; Grierson in Grierson *et* Long, Fl. Bhut. 2 (1): 9. 1991. *Paullinia asiatica* Linnaeus, Sp. Pl. 1: 365. 1753, *typ. cons.*

*Vernacular name:* Belkanta.

Woody climbers, usually armed. Petiole 1–4 cm; leaflet blades usually sessile to subsessile, elliptic to obovate or oblanceolate, 3–12 1–4 cm, acuminate or rarely acute to obtuse, base narrowly cuneate to attenuate. Inflorescences up to 17 cm. Sepals 0.3–0.5 mm. Petals cream-white, ovate to elliptic. Stamens in male flowers 3–4 mm, in female flowers ligulate. Gynoecium in female flowers ovoid to ellipsoid. Fruit 5–10 mm in diam.

*Flowers & Fruits:* August to January.

*Specimen Cited:* Salmari forest, *Rajib & AP Das 0724*, dated 14.02. 2008.

*Local Distribution:* Forests.

*General Distribution:* India: tropical; Bhutan, Nepal, Bangladesh, Indonesia, Japan, Laos, Malaysia, Myanmar, Philippines, Sri Lanka, Thailand, Vietnam; Africa, Madagascar.

**Sapindaceae** A.L. de Jussieu, Gen. Pl. 246. 1789 ('Sapindi'); *nom. cons.*

LITCHI Sonnerat, Voy. Indes Orient. 3: 255. 1782.

***Litchi chinensis*** Sonnerat, Voy. Indes Orient. 3: 255-258. 1782; Long in Grierson *et* Long, Fl. Bhut. 2 (1): 72. 1991. *Nephelium litchi* Cambess, M m. Mus. Hist. Nat. 18: 30. 1829.

*Vernacular Name:* Lichu.

Evergreen tree, up to 30 m. Leaflets coriaceous, elliptic – lanceolate, 6–15 2–4 cm, sharply acuminate, base obliquely cuneate, lateral veins inconspicuous. Inflorescences terminal panicles. Calyx greenish-white. Stamens 6 to 7; filaments ca. 4 mm. Ovary densely tuberculous and hispid. Fruit globose; pericarp dry and brittle when ripe, warted; aril whitish, fleshy.

*Flowers & Fruits:* February to July.

*Specimen Cited:* Rasik Beel village, *Rajib & AP Das 0313*, dated 10. 02. 2007.

*Local Distribution:* Cultivated in study area.

*General Distribution:* S.E. Asia; widely cultivated in subtropical regions. Laos, Malaysia, Myanmar, Philippines, Thailand, Vietnam, New Guinea; widely cultivated in subtropical regions.



**Core-Eudicots: Asterids (fr.: Ast rid es)****Order 47: Cornales** Link (1829)

**Cornaceae** Dumortier, Anal. Fam. Pl. 33. 1829 ('Corneae'); Link, Handb. 2: 2. 1831.

*ALANGIUM* Lamarck, Encycl. 1: 174. 1783, *nom. cons.*

*Alangium chinense* (Loureiro) Harms in Ber. Deutsch. Bot. Ges. 15: 24. 1897; Clement in Grierson *et Long*, Fl. Bhutan 2(1): 332. 1991. *Stylidium chinense* Loureiro, Fl. Cochinch. 1: 221. 1790. *Marlea begoniaefolia* Roxburgh, Cor. Pl. 3: 80t. 203. 1819; Clarke in Hook.f, Fl. Brit. Ind. 2: 743. 1879; Prain, Beng. Pl.?? *Stylidium chinense* Loureiro, Fl. Cochinch. 221. 1790. *Guettarda jasminiflora* Blanco, Fl. Filip. 722. 1837.

Small trees. Leaves alternate; pubescent, ovate – suborbicular or broadly subquadrate, margin entire to angular lobed, tip long acuminate, base oblique, truncate or deeply cordate, glabrous above. Flowers white, inflorescence axillary. Fruits ovoid, dark purple when ripe, glabrous.

*Flowers & Fruits*: March to October.

*Specimen Cited*: Road side near conservation sector, *Rajib & AP Das 0640*, dated 12. 02. 2008.

*Local Distribution*: Forest.

*General Distribution*: India: tropical; Bhutan, Nepal, Myanmar, Malaysia, Tropical Africa.

**Order: Ericales** Berchtold & J. Presl (1820)

**Balsaminaceae** De Candolle, Prodr. 1: 685. 1824 ('Balsamineae'); *nom. cons.*

*IMPATIENS* Linnaeus, Sp. Pl. 2: 937. 1753.

**Key to the species:**

- 1a. Upper petal cucullate; ovary glabrous ..... *I. trilobata*
- 1b. Upper petal orbicular, mucronulate; ovary densely pubescent ..... *I. balsamina*

*Impatiens balsamina* Linnaeus, Sp. Pl. 2: 938. 1753; C. Grey-Wilson in Grierson *et Long*, Fl. Bhut. 2 (1): 103. 1991.

*Vernacular name*: Dopati.

Annual herbs, up to 80 cm. Stem succulent. Leaves alternate, sometimes lowest ones opposite; lamina narrowly elliptic to oblanceolate, 4 – 12 x 1.5 – 3 cm, lateral veins 4 – 7 pairs, acuminate, deeply serrate, base cuneate. Inflorescences 1 to 3 flowered axillary fascicle without peduncles. Flowers pink, simple or double petalous. Lateral sepals 2. Lower sepal deeply navicular. Upper petal orbicular, mucronulate; lateral united petals shortly clawed, 2 lobed; basal lobes obovate-oblong, small; distal lobes suborbicular. Stamens 5; filaments linear; anthers ovoid, apex obtuse. Ovary densely pubescent. Capsule broadly fusiform. Seeds many, black-brown, globose.

*Flowers & Fruits*: July to October.

*Specimen Cited*: Garden, *Rajib & AP Das 0620*, dated 11. 2. 2008.

*Local Distribution*: Garden.

*General Distribution*: Native to SE Asia; cultivated worldwide.

*Impatiens trilobata* Colebrooke, Exot. Fl. 2: t. 141. 1825; C. Grey-Wilson in Grierson *et Long*, Fl. Bhut. 2 (1): 90. 1991. *Impatiens flavida* Hooker f. & Thomson, J. Proc. Linn. Soc., Bot. 4: 127. 1860.

*Vernacular name:* Dopati.

Annual herbs, up to 70 cm. Stem succulent. Leaves alternate, sometimes lowest ones opposite; lamina narrowly elliptic – lanceolate to oblanceolate, 3 – 10 x 1.5 – 2.5 cm, lateral veins 5 – 7 pairs, acuminate, serrate, base cuneate. Inflorescences 2 to 3 flowered axillary fascicle. Flowers pink, simple or double petalous. Lateral sepals 2. Lower sepal deeply saccate. Upper petal cucullate; lateral united petals shortly clawed, 2 lobed; basal lobes obovate-oblong, small; distal lobes suborbicular. Stamens 5; filaments linear; anthers ovoid. Ovary fusiform, glabrous. Capsule fusiform. Seeds many, black, globose.

*Flowers & Fruits:* July to October.

*Specimen Cited:* Atiamochar forest margin, *Rajib & AP Das 0554*, dated 24.07.2007.

*Local Distribution:* Forest margin.

*General Distribution:* Tropical Asia.

### **Ebenaceae** Ventenat, Tabl. Regne V6g. 2: 443. 1799; *nom. cons.*

DIOSPYROS Linnaeus, Sp. Pl. 2: 1057. 1753.

*Diospyros malabarica* (Desrousseaux) Kosteletsky, Allg. Med. Pharm. Fl. 3: 1099. 1834; Long et Rae in Grierson et Long, Fl. Bhut. 2(2): 576. 1999. *Garcinia malabarica* Desrousseaux in Lam., Ency. 3: 701. 1792. *Diospyros embryopteris* Persoon, Syn. 2: 624. 1807(*illegitimate*); C.B. Clarke in Hooker f., Fl. Brit. India 3: 556. 1882. *Embryopteris glutinifera* Roxburgh, Pl. Coromandel 1: 49. 1796. *Diospyros glutinifera* (Roxburgh) Wallich, Numer. List. 4123. B. 1831.

*Vernacular Name:* Gab.

Trees; branchlets glabrous. Leaves coriaceous, oblong, acute-obtuse, base rounded, reticulate above; petiole stout. Flowers unisexual, fragrant, white; males in umbellate cymes, females solitary; calyx accrescent. Fruits globose, reddish, yellow when ripe.

*Flowers & Fruits:* May to July.

*Specimen Cited:* Rasik Bil village, *Rajib & AP Das 0222*, dated 09. 02. 2007.

*Local Distribution:* Planted in Villages.

*General Distribution:* India, Sri Lanka, Thailand.

### **Lecythidaceae** Poiteau, Mem. Mus. Hist. Nat. Paris 13: 141. t. 2-8. 1825; *nom. cons.*

#### **Key to the genera:**

- 1a. Leaves clustered at apex of branchlets; fruits globose, many-seeded ..... *Careya*
- 1b. Leaves not clustered at apex; fruits 4 angled, 1 seeded ..... *Barringtonia*

BARRINGTONIA J. R. Forster & G. Forster, Char. Gen. Pl. 38. 1775, *nom. cons.*

*Barringtonia acutangula* (Linnaeus) Gaertner, Fruct. 2: 97. 1791; Clarke in Hooker f., Fl. Brit. Ind. 2: 508. 1879. *Eugenia acutangula* Linnaeus, Sp. Pl. 471. 1753. *Butonica acutangula* (Linnaeus) Lamarck, Tabl. Encycl. t. 591. 1794. *Caryophyllus acutangulus* (Linnaeus) Stokes, Bot. Mat. Med. 3: 75. 1812. *Michelia acutangula* (Linnaeus) Kuntze, Revis. Gen. Pl. 1: 240. 1891.

*Vernacular Name:* Hijol.

Trees. Leaves alternate; lamina obovate or oblanceolate, obscurely denticulate, rounded, obtuse or acute, base cuneate. Racemes long, drooping, many-flowered. Sepals 4, oblong, connate below; petals 4, elliptic, obtuse, pink. Fruits 4 – angled, 1 – seeded.

*Flowers & Fruits:* May to December.

*Specimen Cited:* Rasik Beel village, *Rajib & AP Das 0109*, dated 07. 02. 2007.

*Local Distribution:* Road side.

*General Distribution:* India, Bangladesh, Sri Lanka, Myanmar, Bangladesh, Australia.

CAREYA Roxburgh, Pl. Coromandel 3: 13. 1811; *nom. cons.*

*Careya arborea* Roxburgh, Pl. Corom. 3: 14, t.218. 1819; Clarke in Hooker f., Fl. Brit. Ind. 2:511. 1879; Long *et* Rae in Grierson *et* Long, Fl. Bhutan 2(1): 290. 1991. *Barringtonia arborea* (Roxburgh) F. Mueller, Fragm. 5: 184. 1866. *Careya orbiculata* Miers, Trans. Linn. Soc. London, Bot. 1: 98. 1875. *Cumbia coneanae* Buchanan-Hamilton, Trans. Linn. Soc. London 15: 97. 1827. *Careya sphaerica* Roxburgh, Fl. Ind. 2: 636. 1824.

*Vernacular Name:* Kumbhi.

Deciduous trees; fibrous bark. Leaves clustered towards apex of branchlets; lamina obovate, crenate-denticulate to entire, shortly acuminate, base cuneate. Flowers sessile, in terminal cymes; calyx campanulate, lobes 4; petals 4, white. Berries globose, green, many-seeded.

*Flowers & Fruits:* April to July.

*Specimen Cited:* Forest, *Rajib & AP Das 0153*, dated 08. 02. 2007.

*Local Distribution:* Forests.

*General Distribution:* India, Bhutan, China, Sri Lanka, Bangladesh, Pakistan.

**Primulaceae** Ventenat, Tabl. Regne V6g. 2: 285. 1799; *nom. cons.*

**Key to the genera:**

1a. Lamina elliptic to oblanceolate; petals nearly free ..... *Ardisia*

1b. Lamina broadly ovate to oblong; petals campanulate ..... *Maesa*

ARDISIA Swartz, Prodr. Veg. Ind. Occ. 3: 48. 1788.

*Ardisia solanacea* Roxburgh, Pl. Coromandel 1: 27. 1795; Long *et* Rae in Grierson *et* Long, Fl. Bhut. 2(2): 514. 1999.

Shrubs, glabrous. Lamina elliptic to oblanceolate, papery, base cuneate, margin subrevolute, entire, apex acute. Inflorescences at bases of new shoots, paniculate with racemose. Flowers leathery, pink. Sepals broadly ovate to reniform, ciliate, apex rounded. Petals nearly free; lobes broadly ovate, margin entire, hyaline, apex obtuse or acute. Fruits purplish red or blackish, densely black punctate.

*Flowers & Fruits:* February to November.

*Specimen Cited:* Atiamochar forest, *Rajib & AP Das 0249*, dated 10. 02. 2007.

*Local Distribution:* Through out forests.

*General Distribution:* India, Nepal, Singapore, Sri Lanka, cultivated in Hawaii.

MAESA Forssk 1, Fl. Aegypt. Arab. 66. 1775.

*Maesa indica* (Roxburgh) A. de Candolle, Trans. Linn. Soc. London 17(1): 134. 1834; Long *et* Rae in Grierson *et* Long, Fl. Bhut. 2(2): 507. 1999. *Baeobotrys indica* Roxburgh, Fl. Ind. 2: 230. 1824.

Shrubs, up to 2m tall, scandent. Leaves simple, alternate; lamina broadly ovate to oblong, 8 – 18 x 5 – 9cm, serrate-dentate or -denticulate, teeth not callose, acute or acuminate, base obtuse or

subrounded, papery. Inflorescences axillary or subterminal, racemose or paniculate; bracteoles broadly ovate. Flowers white or light yellow-green. Calyx lobes broadly ovate, pellucid punctate, margin entire, sparsely ciliate. Corolla campanulate, orange punctate-lineate; lobes broadly ovate. Stamens inserted at middle of corolla tube. Style short; stigma lobed. Fruit globose or subglobose.

*Flowers & Fruits*: April to September.

*Specimen Cited*: Atiamochar, Rajib & AP Das 0177, dated 08. 02. 2007.

*Local Distribution*: Throughout forests.

*General Distribution*: India: throughout; Bhutan, China, Vietnam.

**Sapotaceae** A.L. de Jussieu, Gen. Pl. 151. 1789 ('Sapotae'); *nom. cons.*

MANILKARA Adanson, Fam. Pl. 2: 166. 1763, *nom. cons.*

*Manilkara zapota* (Linnaeus) P.Royen, Blumea 7: 410. 1953. *Achras sapota* Linnaeus, Sp. Pl. ed. 2: 470. 1762. *Achras zapota* Linnaeus, Sp. Pl. App.: 1190. 1753. *Pouteria mammosa* (Linnaeus) Cronquist, Lloydia 9: 287. 1946. *Sapota achras* Miller, Gard. Dict. ed. 8: 1. 1768.

*Vernacular name*: Sabeda.

Shrubs or small trees. Branchlets glabrous. Leaves alternate, often closely clustered at end of branchlets; lamina obovate to obovate elliptic, 5 – 10 x 3 – 7 cm, glabrous, apex retuse, base broadly cuneate to obtuse. Flowers axillary, fascicled. Pedicel thick. Sepals ovate triangular. Corolla white or light yellow; lobes oblong. Stamens 4 – 5 mm; staminodes 2 parted, lobes linear. Ovary ovoid. Berry obovoid-oblong to ellipsoid, 1 or 2 seeded.

*Flowers & Fruits*: August to December.

*Specimen Cited*: Bochamari, Rajib & AP Das 0104, dated 07. 02. 2007.

*Local Distribution*: Cultivate in villages.

*General Distribution*: India: cultivate throughout; Sri Lanka, Thailand, Vietnam, Cambodia.

**Theaceae** Mirbel, Bull. Soc. Philom. 3: 381. 1813 (*nom. lect.* vs. Ternstroemiaceae, vide D. Don, 1825); *nom. cons.*

CAMELLIA Linnaeus, Sp. Pl. 2: 698. 1753.

*Camellia japonica* Linnaeus, Sp. Pl. 698. 1753. *Camellia florida* Salisbery, Prodr. Stirp. Chap. Allerton 370. 1796. *Camellia bonnardii* Berlese ex Lemaire, Hort. Universel 3: 161. 1842.

*Vernacular name*: Camelia.

Shrubs. Petiole glabrous or adaxially pubescent; leaf blade broadly elliptic to oblong-elliptic, 5 – 10 x 3 – 6 cm, serrulate, shortly acuminate and with an obtuse tip, base cuneate to broadly cuneate, leathery, secondary veins 6 – 9 on each side of midvein, slender, and visible on both surfaces. Flowers axillary or subterminal, solitary or paired, subsessile. Stamens glabrous; outer filament whorl basally connate. Gynoecium glabrous. Ovary ovoid, 3 loculed. Capsule globose. Seeds brown.

*Flowers & Fruits*: February to September.

*Specimen Cited*: Garden, Rajib & AP Das 0060, dated 07. 02. 2007.

*Local Distribution*: Garden.

*General Distribution*: India: cultivated throughout; China. Cultivated world wide.

**Core-Eudicots: Asterids: Euasterids (I)**

**unassigned to order - Keine Ordnungseinteilung**

**Boraginaceae** A.L. de Jussieu, Gen. Pl. 143. 1789 ('Borragineae'); *nom. cons.*

**Key to the genera:**

- 1a. Inflorescences terminal and axillary, branched; flowers pedicilate ..... *Cynoglossum*  
 1b. Inflorescences terminal, solitary; flowers sessile ..... *Heliotropium*

CYNOGLOSSUM Linnaeus, Sp. Pl. 1: 134. 1753.

*Cynoglossum lanceolatum* Forsskal, Fl. Aegypt. – Arab. 41.1775; Clarke in Hooker f., Fl. Brit. Ind. 4: 156.1883; Mill in Grierson *et* Long, Fl. Bhut. 2(2): 907.1999. *Cynoglossum micranthum* Desfontaines, Tab. Ecol. ed. 1: 220.1804; Hooker f., Fl. Brit. Ind. 4: 156.1883. *Cynoglossum racemosum* Roxburgh, Fl. Ind. 2: 6. 1824. *Cynoglossum hirsutum* Thunberg, Prodr. Pl. Cap. 34. 1794.

Perennial herbs, up to 90 cm. Stems erect, branched, densely hispid, hairs discoid at base; branches spreading. Basal and lower stem leaves petiolate, oblong-lanceolate, 7 – 10 x 1 - 3 cm, densely pubescent, hairs discoid at base, base attenuate, apex acute; upper stem leaves sessile or short petiolate, lanceolate, smaller. Inflorescences terminal and axillary; branches spreading at an obtuse angle, ebracteate. Pedicel 1 mm. Calyx lobes ovate, pubescent outside, glabrous inside, slightly enlarged in fruit, apex obtuse. Corolla light blue, campanulate. Anthers ovoid. Style tetragonous. Nutlets ovoid-globose, 2–2.5 mm, abaxially concave, with dense glochids, marginal glochids not confluent at base.

*Flowers & Fruits:* April to December.

*Specimen Cited:* Near gate, Rajib & AP Das 0332, dated 21.07.2007.

*Local Distribution:* Road side shrubland.

*General Distribution:* India, Bhutan, China, Indo-Malayan.

HELIOTROPIUM Linnaeus, Sp. Pl. 1: 130. 1753.

*Heliotropium indicum* Linnaeus, Sp. Pl. 1: 139.1753; Clarke in Hooker f., Fl. Brit. Ind. 4:152.1883; Mill in Grierson *et* Long, Fl. Bhut. 2(2): 878. 1999; Bora *et* Kumar, Flor. Div. Ass., 222. 2003. *Tiaridium indicum* Lehmann, Pl. Asperif. Nacif. 14. 1818. *Heliotropium foetidum* Salisbury, Prodr. Stirp. Chap. Allerton 112. 1796. *Tiaridium indicum* (Linnaeus) Lehman, Pl. Asperif. Nucif. 1: 14. 1818. *Heliophytum indicum* (Linnaeus) de Candolle, Prodr. 9: 556. 1845. *Local Name:* Hatisura.

Annual herbs, up to 50 cm. Stems erect, stout, much branched, strigose. Leaves alternate to subopposite; petiole 3 cm; leaf blade 5 – 10 x 3 – 4 cm, pubescent to strigose, base rounded to truncate, decurrent to petiole, margin undulate, apex acute. Cymes solitary, scorpioid, ebracteate. Flowers sessile, crowded. Calyx lobes lanceolate, strigose. Corolla light blue to bluepurple, salverform; lobes rotund, margin crispate. Anthers narrowly ovate. Ovary glabrous. Style 0.5 mm; stigma conical, pubescent. Fruit ribbed, glabrous; mericarps longitudinally ribbed.

*Flowers & Fruits:* September to August.

*Specimen Cited:* Near gate, Rajib & AP Das 0411, dated 22.07.2007.

*Local Distribution:* Road side shrubland.

*General Distribution:* India, Bhutan, Bangladesh, China, America, Tropical Africa and Malaysia.

**Icacinaceae** (Bentham) Miers, Ann. Mag. Nat. Hist. ser. 2. 9: 221. 1852; *nom. cons.*

NATSIATUM Buchanan-Hamilton ex Arnott, Edinburgh New Philos. J. 16: 314. 1834.

*Natsiatum herpeticum* Buchanan-Hamilton *ex* Arnott, Edinburgh New Philos. J. 16: 314. 1834; Hooker *f.* in Hooker *f.*, Fl. Brit. India 1: 595. 1875; H. Ohashi in Hara, Fl. E. Himal. 1: 191. 1966; Hara *et al.*, Enn. Fl. Pl. Nep. 2: 87. 1979; Long in Grierson *et* Long, Fl. Bhut. 2(1): 135. 1991. *Natsiatum tonkinense* Gagnepau, Notul. Syst. (Paris) 1: 205. 1910.

Young branches yellow – brown strigose; old branches conspicuously lenticellate. Petiole slender; leaf blade cordate – ovate, apex acute. Flowers yellow – green. Sepals lanceolate, petals narrowly lanceolate. Drupes yellow – green, becoming black with age.

*Flowers & Fruits*: June to September.

*Specimen Cited*: Atiamochar forest, *Rajib & AP Das 0610*, dated 26.07.2007.

*Local Distribution*: Through out Forest.

*General Distribution*: Throughout India; Bhutan, China, Bangladesh, Nepal, Sri Lanka, NE Thailand, N Vietnam, NE Laos, S Myanmar.

**Order: Gentianales** Lindle (1846).

**Apocynaceae** A.L. de Jussieu, Gen. Pl. 143. 1789 ('Apocineae'); *nom. cons.*

**Key to the genera:**

- |   |                        |
|---|------------------------|
| 1a. Carpels united only at stigmatic disc .....             | 2                      |
| 1b. Carpels usually united by styles .....                  | 4                      |
| 2a. Erect shrubs .....                                      | <i>Calotropis</i>      |
| 2b. Climbing or prostrate herbs .....                       | 3                      |
| 3a. Corolla tube cylindrical, campanulate .....             | <i>Marsdenia</i>       |
| 3b. Corolla rotate to shallowly bowl-shaped .....           | <i>Dregea</i>          |
| 4a. Subshrubs or perennial herbs .....                      | 5                      |
| 4b. Climbers or Shrubs or trees .....                       | 6                      |
| 5a. Fruits a follicle .....                                 | <i>Catharanthus</i>    |
| 5b. Fruits a subglobose drupe .....                         | <i>Rauvolfia</i>       |
| 6a. Leaves whorled, at least toward tips of branches .....  | <i>Alstonia</i>        |
| 6b. All leaves opposite .....                               | 7                      |
| 7a. Corolla lobes overlapping to left .....                 | 8                      |
| 7b. Corolla lobes overlapping to right .....                | 9                      |
| 8a. Stamens well exerted; corona usually present .....      | <i>Wrightia</i>        |
| 8b. Stamens included or barely exerted; corona absent ..... | <i>Tabernaemontana</i> |
| 9a. Trees; corolla lobes not caudate .....                  | <i>Holarrhena</i>      |
| 9b. Climbers, corolla lobes caudate .....                   | 10                     |
| 10a. Corolla funnellform to subcampanulate .....            | <i>Vallisneria</i>     |
| 10b. Corolla cylindric .....                                | <i>Ichnocarpus</i>     |

ALSTONIAR. Brown, Mem. Wern. Nat. Hist. Soc. 1: 75. 1811, *nom. cons.*

*Alstonia scholaris* (Linnaeus) Robert Brown, Mem. Wern. Nat. Hist. Soc. 1:76. 1811; Hooker *f.*, Fl. Brit. Ind. 3: 642. 1882; Watson in Grierson *et* Long, Fl. Bhut. 2(2): 672. 1999. *Echites scholaris* Linnaeus, Mant. Pl. 1:53.1767. *Pala scholaris* (Linnaeus) Roberty, Bull. Inst. Fran . Afrique Noire 15: 1426. 1953.

*Vernacular name*: Chhatim.

Trees up to 40 m, glabrous. Bark gray; branchlets copiously lenticellate. Leaves in whorls of 3–10; petiole 2–3 cm; leaf blade narrowly obovate to very narrowly spatulate, 7–28 x 2–11 cm, leathery, base cuneate, apex usually rounded; lateral veins 25–50 pairs. Cymes dense, pubescent; peduncle 5–8 cm. Pedicel usually as long as or shorter than calyx. Corolla white; lobes broadly ovate or broadly obovate, overlapping to left. Ovaries distinct, pubescent. Follicles distinct, linear. Seeds oblong, margin ciliate.

*Flowers & Fruits*: June to December.

*Specimen Cited*: Takomari Forest, *Rajib & AP Das 0372*, dated 21.07.2007.

*Local Distribution*: Throughout the study area.

*General Distribution*: India, Bhutan, Bangladesh, Sri Lanka, Singapore, Malay Archipelago, tropical Australia and Africa.

CATHARANTHUS G. Don, Gen. Hist. 4: 95. 1837.

*Catharanthus roseus* (Linnaeus) G. Don, Gen. Hist. 4: 95. 1837; Watson in Grierson *et* Long, Fl. Bhut. 2(2): 670. 1999. *Vinca rosea* Linnaeus, Syst. Ed. 10: 944. 1759; Hooker *f.*, Fl. Brit. Ind. 3: 640. 1882. *Ammocallis rosea* (Linnaeus) Small, Fl. S.E. U.S. 936. 1903. *Pervinca rosea* (Linnaeus) Moench, Methodus 463. 1794.

*Vernacular name*: Nayantara.

Subshrubs or perennial herbs to 1 m tall, erect or decumbent. Young stems puberulent. Leaves obovate or elliptic, 6 x 3 cm, herbaceous, apex minutely apiculate; lateral veins 8–11 pairs. Corolla red to pink or white and then mostly with a pink; tube 2.5–3 cm, pilose inside, throat villous; lobes broadly obovate. Follicles 4 x 0.5 cm.

*Flowers & Fruits*: April to December.

*Specimen Cited*: Park, *Rajib & AP Das 0388*, dated 21.07.2007.

*Local Distribution*: Parks.

*General Distribution*: Tropical Asia, Africa.

HOLARRHENA R. Brown, Mem. Wern. Nat. Hist. Soc. 1: 62. 1811.

*Holarrhena pubescens* Wallich *ex* G. Don, Gen. Hist. 4: 78. 1837; Watson in Grierson *et* Long, Fl. Bhut. 2(2): 671. 1999. *Chonemorpha antidysenterica* G. Don, Gen. Hist. 4: 76. 1837.

*Vernacular name*: Kurchi.

Shrubs or trees, up to 10 m tall. Branchlets with whitish, dotlike lenticels. Petiole 1–5 mm, grooved, glandular inside groove; leaf blade ovate or elliptic, 10–24 x 4–11.5 cm, membranous, pubescent, sometimes densely so abaxially, base rounded, apex acute or obtuse; lateral veins 10–15 pairs. Cymes 4–9 cm; peduncle 2 cm. Pedicel 1–3 cm. Sepals elliptic to linear. Corolla white, pubescent; lobes oblong. Anthers included, narrowly ovate, base rounded. Follicles linear, with whitish, dotlike lenticels. Seeds 1–1.6 cm.

*Flowers & Fruits*: April to December.

*Specimen Cited*: Takomari Forest, *Rajib & AP Das 0459*, dated 23.07.2007.

*Local Distribution*: Forest.

*General Distribution*: , India, Bhutan, Nepal, Bangladesh, Cambodia Laos, Myanmar, Thailand,

ICHNOCARPUS R. Brown, Mem. Wern. Nat. Hist. Soc. 1: 61. 1811, *nom. cons.*

*Ichnocarpus frutescens* (Linnaeus) W.T. Aiton in Aiton *f.*, Hort. Kew. ed. 2, 2: 69. 1811; Hooker *f.*, Fl. Brit. Ind. 3: 669. 1882; Watson in Grierson *et* Long, Fl. Bhut. 2(2): 686. 1999. *Apocynum frutescens* Linnaeus, Sp. Pl. 213. 1753. *Echites frutescens* (Linnaeus) Roxburgh, Hort. Bengal.

20. 1814. *Gardenia voluBeelis* Loureiro, Fl. Cochinch. 148. 1790. *Ichnocarpus frutescens* (Linnaeus) R. Brown, Mem. Wern. Nat. Hist. Soc. 1: 62. 1809.

*Vernacular name:* Dudheli lata.

Extensively woody climber. Leaves lanceolate to elliptic – oblong 5.2 x 1.4 cm, acute – acuminate, base cuneate to obtuse, sub – coriaceous, to coriaceous, glabrous above, sparsely pubescent on main veins below; petiole 2 – 13 mm. Flowers small and fragrant, white. Calyx lobes ovate, obtuse to sub acute. Corolla tube cylindrical; lobes lanceolate, tips curved, particularly around mouth. Follicles very slender, curved and divergent, 2.5 – 6 x 0.2 cm. Seeds narrow, with scanty white coma 1.2 – 1.8 cm long.

*Flowers & Fruits:* April to September.

*Specimen Cited:* Takomari Forest, *Rajib & AP Das 0506*, dated 23.07.2007.

*Local Distribution:* Throughout the study area.

*General Distribution:* India, Bhutan, China, Bangladesh, Nepal, Sri Lanka, Myanmar, Java and Australia.

RAUVOLFIA Linnaeus, Sp. Pl. 1: 208. 1753.

*Rauvolfia tetraphylla* Linnaeus, Sp. Pl. 208. 1753. *Rauvolfia heterophylla* Willdenow ex Roemer & Schultes, Syst. Veg. 4: 805. 1819. *Rauvolfia hirsuta* Jacquin, Enum. Syst. Pl. 14. 1760. *Rauvolfia tomentosa* Jacquin, Enum. Syst. Pl. 14. 1760.

*Vernacular name:* Chando.

Small shrubs, up to to 1 m. Leaves in whorls of 3–5; petiole 2–5 mm; lamina ovate to oblong, 2 – 12 x 0.8 – 3 cm, membranous, acute or obtuse, base broadly cuneate to rounded; lateral veins 5 – 12 pairs. Peduncle 1–4 cm. Corolla white, tube urceolate, long hairy inside distal half; lobes ovate to suborbicular. Stamens inserted at corolla throat. Ovaries connate. Drupes subglobose, glabrous, connate. Seeds 2.

*Flowers & Fruits:* May to September.

*Specimen Cited:* Atiamochar forest, *Rajib & AP Das 0425*, dated 22.07.2007.

*Local Distribution:* Forest near Leopard Cage.

*General Distribution:* Native to tropical America.

TABERNAEMONTANA Linnaeus, Sp. Pl. 1: 210. 1753.

*Tabernamontana divaricata* (Linnaeus) R. Brown in Roemer et Schultes, Syst. Veg. 4: 427. 1819; H. Ohashi in Hara, Fl. E. Himal. 1: 259. 1966; Watson in Grierson et Long, Fl. Bhut. 2(2): 675. 1999. *Nerium divaricatum* Linnaeus, Sp.Pl. 209. 1753. *Tabernaemontana coronaria* (Jacquin) Willdenow, Enum. Hort. Bertol 275. 1809; Hooker f., Fl. Brit. Ind. 3: 646. 1882. *Tabernaemontana recurva* Roxburgh, Hort. Bengal. 20. 1814. *Nyctanthes acuminata* Burman f., Fl. Indica 5. 1768. *Kopsia cochinchinensis* Kuntze, Revis. Gen. Pl. 2: 415. 1891.

*Vernacular name:* Sadaful.

Shrubs or small trees 0.5–5 m tall, glabrous. Petiole 3–10 mm; leaf blade elliptic, 3–18 x 1–6 cm, apex acuminate; lateral veins 5 – 17 pairs. Cymes dichotomous, 1–8-flowered; bracts scale like. Flower buds with an ovoid head, apex acute or obtuse. Calyx lobes often ciliate. Corolla white, tube 1.5–2.7 cm; lobes simple or double, obovate or broadly so, 1.5–2.7 x 0.8–2 cm. Stamens inserted at basal third of corolla tube. Follicles obliquely and narrowly ellipsoid.

*Flowers & Fruits:* April to Nov

*Specimen Cited:* Atiamochar forest, *Rajib & AP Das 0306*, dated 10. 02. 2007.



*Local Distribution:* Through out Forest.

*General Distribution:* Native of Tropical Asia, widely naturalised.

WRIGHTIA R. Brown, Mem. Wern. Nat. Hist. Soc. 1: 73. 1811.

***Wrightia arborea*** (Dennstaedt) Mabberley in Taxon 26(5/6): 533.1977. Watson in Grierson *et* Long, Fl. Bhut. 2(2): 676.1999. *Periploca arborea* Dennstaedt in Schluessel Hort. Malab. 13, 23 & 25.1818. *Wrightia tomentosa* Roemer *et* Schultes in Linnaeus, Syst. Veg. 4/414. 1819; C.B. Clarke in Hooker *f.*, Fl. Brit. India 3:653.1882. *Nerium tomentosum* (Roemer *et* Schultes) Roxburgh, Fl. Indica ed. 1832. 2: 6. 1832.

*Vernacular name:* Khira.

Trees upto 20 m tall. Branches gray or brown, pubescent, lenticellate. Petiole 2 – 8mm; lamina elliptic to broadly elliptic - obovate, 5 – 18 x 3 – 8 cm, pubescent to glabrescent adaxially, tomentose abaxially; lateral veins 10–14 pairs. Cymes pubescent. Sepals ovate or broadly ovate. Corolla yellowish, rotate or subrotate; tube 3–8 mm, glabrous; lobes narrowly elliptic to ovate; corona scales 10, shorter than anthers, glabrous inside, apex dentate. Ovaries connate. Follicles connate, cylindrical, lenticellate. Seeds linear-fusiform, coma 3 cm.

*Flowers & Fruits:* May to December.

*Specimen Cited:* Atiamochar forest, Rajib & AP Das 0273, dated 10. 02. 2007.

*Local Distribution:* Atiamochar and Takomari Forest.

*General Distribution:* India, Bhutan, China, Bangladesh, Pakistan, Sri Lanka, Myanmar, Thailand.

VALLARIS N. Burman, Fl. Indica 51. 1768.

***Vallaris solanacea*** (Roth) Kuntze, Revis. Gen. Pl. 2: 417. 1891; Watson in Grierson *et* Long, Fl. Bhut. 2(2): 678. 1999. *Peltanthera solanacea* Roth, Nov. Sp. 132. 1821. *Vallaris assamensis* Griffith, Not. Pl. Asiat. 4: 77. 1854. *Vallaris solanacea* (Roth) K. Schuman, Nat. Pflanzenfam. 4(2): 186. 1895.

Climbing shrubs, often twining. Bark dirty whitish gray; flowering branchlets, slender, grayish pubescent. Petiole 0.2–1.5 cm; lamina elliptic to narrowly elliptic, 2–16 x 0.8–5 cm, densely pubescent on both surfaces, base cuneate or rounded; lateral veins 7–12 pairs. Flowers fragrant; pedicel 0.5 – 3 cm. Sepals ovate or narrowly elliptic. Corolla white or pale yellow, tube 5–10 mm, lobes rounded at apex. Staminal glands yellow, globose; disc shorter than ovary, apex pilose. Follicles oblong, 8 – 12 x 1.5 - 3 cm. Seeds ellipsoid, coma 3–4 cm.

*Flowers & Fruits:* March to July.

*Specimen Cited:* Atiamochar forest, Rajib & AP Das 0393, dated 22.07.2007.

*Local Distribution:* Through out Forest.

*General Distribution:* Cambodia, India, Indonesia, Laos, Myanmar, Pakistan, Sri Lanka, Thailand, Vietnam.

CALOTROPIS R. Brown, Mem. Wern. Nat. Hist. Soc. 1: 39. 1810 (preprint).

***Calotropis gigantea*** (Linnaeus) Dryander in Aiton, Hortus Kew. ed. 2, 2: 78. 1811; Hooker *f.*, Fl. Brit. Ind. 4: 17. 1883; H. Ohashi in Hara, Fl. E. Himal. 1: 260. 1966; Watson in Grierson *et* Long, Fl. Bhut. 2(2): 700. 1999. *Asclepias gigantea* Linnaeus, Sp. Pl. 214. 1753. *Calotropis gigantiea* (Linnaeus) R. Brown *ex* Schultes, Syst. Veg. 6: 91. 1820. *Periploca cochinchinensis* Loureiro, Fl. Cochinch. 1: 167. 1790. [PLATE: 7, Figure-71]

*Vernacular name:* Akanda.

Shrubs, 1–3 m tall. Leaf blade obovate-oblong or oblong, 7–25 x 3–12 cm, base cordate, apex obtuse, cottony tomentose when young, frequently glabrescent and glaucous green; lateral veins 6–9 pairs. Cymes umbel-like, with fine woolly hairs; peduncle robust. Pedicel thick. Calyx almost flat. Flower buds cylindrical. Corolla usually purplish or lilac with paler greenish base, fleshy, glabrous; lobes ovate, 1.5 x 1 cm, spreading or reflexed, margin revolute. Corona shorter than gynostegium. Follicles obliquely elliptic to oblong-lanceolate in outline, both ends incurved. Seeds broadly ovate; coma 3–4 cm.

*Flowers & Fruits:* Throughout the year

*Specimen Cited:* Rasik Beel village, *Rajib & AP Das 0410*, dated 22.07.2007.

*Local Distribution:* Villages.

*General Distribution:* India, Bhutan, Bangladesh, Nepal, Pakistan, Sri Lanka, Indonesia, Laos, Malaysia, Myanmar, Thailand, Vietnam; tropical Africa.

MARSDENIA R. Brown, Prodr. 460. 1810.

*Marsdenia tinctoria* R. Brown in Mem. Wern. Nat. Hist. Soc. 1: 28-30. 1810; Hooker *f.*, Fl. Brit. Ind. 4: 34. 1883; H. Ohashi in Hara, Fl. E. Himal. 1: 262. 1966; Watson in Grierson *et* Long, Fl. Bhut. 2(2): 709. 1999. *Pergularia tinctoria* (Robert Brown) Sprengel, Syst. Veg. 1: 844. 1824. *Marsdenia tinctoria* var. *tomentosa* Masamune *ex* Tsiang & P.T. Liis, Acta Phytotax. Sin. 12(1): 117. 1974. *Marsdenia globifera* Tsiang, Sunyatsenia 3(2-3): 199-202, pl. 22, f. 13, 199. 1936. *Asclepias tinctoria* Roxburgh, [H. Beng. 20. 1814. nom. nud.] Fl. Ind. ed. 2, 2: 43. 1832.

Climbing undershrub. Plant nearly glabrous, young parts often softly pubescent-tomentose. Leaves ovate to elliptic 7–17 x 3–9 cm, apex acuminate or caudate, base rounded to truncate, somewhat shallowly cordate, membranous, sparsely hairy, particularly on veins. Flowers white, very small, subsessile, in distinctive crowded spike-like cymose inflorescence; flowering axis 4 cm long; peduncle short; pedicels slender. Calyx lobes rounded-ovate, ciliate, sparsely puberulent. Corolla tube cylindrical, slightly swollen at base, glabrous outside; lobes very short, oblong-rounded, glabrous. Gynostegium 1.2 mm high; staminal coronal scales with caudate tips extending above; stigmatic head hidden by anthers. Follicles densely covered in fine pubescence.

*Flowers & Fruits:* Mar to Dec.

*Specimen Cited:* Atiamochar, *Rajib & AP Das 0422*, dated 22.07.2007.

*Local Distribution:* Atiamochar and Takomari Forest.

*General Distribution:* India, Bhutan, Nepal, Sri Lanka, Indonesia, Japan, Laos, Malaysia, Myanmar, Philippines, Thailand, Vietnam.

DREGEA E. Meyer, Comm. Pl. Afr. Austr. 199. 1838, *nom. cons.*

*Dregea volubilis* (Linnaeus *f.*) Bentham *ex* Hooker *f.*, Fl. Brit. India 4: 46. 1883. *Wattakaka volubilis* (Linnaeus *f.*) Stapf, Bot. Mag. 148: , sub pl. 8976. 1923; Watson in Grierson *et* Long, Fl. Bhut. 2(2): 723. 1999. *Asclepias volubilis* Linnaeus *f.*, Suppl. Pl. 170. 1782. *Marsdenia volubilis* (Linnaeus *f.*) Cooke, Fl. Bombay 2: 166. 1904. *Tylophora macrantha* Hance, J. Bot. 20(231): 79. 1882.

Lianas, up to 12 m. Lamina broadly ovate to suborbicular, 7–16 x 3–12 cm, acute to short acuminate, base shallowly cordate. Inflorescences pendent, many flowered. Sepals ovate-oblong. Corolla glabrous; lobes broadly ovate, ciliate. Corona yellowish green. Anther appendages white; pollinia oblong. Ovaries pilose. Follicles narrowly ovoid. Seeds ovate, flattened, marginate.

*Flowers & Fruits:* May to December.

*Specimen Cited:* Near conservation sector, *Rajib & AP Das 0465*, dated 23.07.2007.

*Local Distribution:* Through out Forest.

*General Distribution:* India, Bhutan, Bangladesh, Nepal, Sri Lanka, Cambodia, Indonesia, Kashmir, Laos, Malaysia, Philippines, Thailand, Vietnam.

**Rubiaceae** A.L. de Jussieu, Gen. Pl. 196. 1789; *nom. cons.*

**Key to the genera:**

- |  |                     |
|--|---------------------|
| 1a. Herbs, soft subshrubs, or herbaceous vines .....                 | 2                   |
| 1b. Low to tall woody shrubs or trees .....                          | 6                   |
| 2a. Ovary and fruit densely covered by well-developed .....          | <i>Dentella</i>     |
| 2b. Ovary and fruit smooth and glabrous .....                        | 3                   |
| 3a. Plants extensively twininer or climber .....                     | 4                   |
| 3b. Plants erect or creepier but not climber .....                   | 5                   |
| 4a. Fruit capsular with several to numerous small angled seeds ..... | <i>Oldenledia</i>   |
| 4b. Fruit schizocarpous, with 2 flattened winged pyrenes .....       | <i>Paederia</i>     |
| 5a. Calyx and corolla lobes each 6 .....                             | <i>Richardia</i>    |
| 5b. Calyx and corolla lobes 3–5 .....                                | <i>Spermacoce</i>   |
| 6a. Flowers fused together by their ovaries; fruit multiple .....    | <i>Morinda</i>      |
| 6b. Flowers free; fruit free .....                                   | 7                   |
| 7a. Flowers in globose heads, terminal.....                          | <i>Neolamarckia</i> |
| 7b. Flowers variously arranged in cymes, axillary .....              | <i>Coffea</i>       |

NEOLAMARCKIA Bosser, Bull. Mus. Natl. Hist. Nat., B, Adansonia 6: 247. 1985.

*Neolamarckia cadamba* (Roxburgh) J. Bosser in Bull. Mus. Nation. Hist. Nat. 4e ser., B. Adansonia 6: 247. 1984; Springate, Mill, Wood, Wright *et* Long in Grierson *et* Long, Fl. Bhut. 2(2): 739. 1999. *Nanilea cadamba* Roxburgh, Fl. Ind. ed. Carey, 2: 121. 1824. *Sarcocephalus cadamba* (Roxburgh) Kurz, Prelim. Rep. Forest Pegu App. A: lxxviii. 1875. *Samama cadamba* (Roxburgh) Kuntze, Revis. Gen. Pl. 1: 296. 1891. *Anthocephalus cadamba* (Roxburgh) Miquel, Fl. Ned. Ind. 2: 135. 1856.

*Vernacular name:* Kadam.

Large deciduous trees, up to 30 m; branches horizontally spreading. Lamina elliptic to oblong - elliptic, 12 – 20 x 5 - 11 cm, thinly leathery, acute, entire, base rounded; stipules lanceolate. Flowering heads solitary, terminal; peduncles stout. Calyx tube glabrous; lobes oblong, hairy. Corolla yellowish white, funnelform; lobes lanceolate. Fruiting head yellowish green at maturity. Seeds nearly 3 angled.

*Flowers & Fruits:* June to November.

*Specimen Cited:* Bochamari, Rajib & AP Das 0587, dated 25.07.2007.

*Local Distribution:* Cultivated in villages.

*General Distribution:* Tropical and sub-tropical parts of the world.

SPERMACOCE Linnaeus, Sp. Pl. 1: 102. 1753.

**Key to the species:**

- |   |                     |
|---|---------------------|
| 1a. Angles of stems narrowly winged ..... | <i>S. alata</i>     |
| 1b. Angles of stems not winged .....      | <i>S. ocymoides</i> |

***Spermacoe alata*** Aublet, Hist. Pl. Guiane 60. 1775. *Borreria alata* (Aublet) de Candolle, Prodr. 4: 544. 1830.

*Vernacular name:* Aalughas.

Diffuse herbs, stem distinctly 4 angled, angles narrowly winged. Lamina ovate – elliptic to oblong, 4 – 8 x 2 – 4 cm, obtuse, entire, base broadly cuneate; stipules triangular. Flowers in axillary clusters, sessile; tube cylindrical, limb 4 lobed. Corolla funnelform, white. Style 4 – 6 mm long; stigma 2, lobes linear. Capsule ovoid. Seeds ovoid to globose.

*Flowers & Fruits:* May to December.

*Specimen Cited:* Garden, *Rajib & AP Das 0529*, dated 23.07.2007.

*Local Distribution:* Throughout study areas.

*General Distribution:* Pantropical.

***Spermacoe ocymoides*** Burman f., Fl. Indica 34. 1768; Springate, Mill, Wood, Wright *et* Long in Grierson *et* Long, Fl. Bhut. 2(2): 819. 1999. *Bigelovia parviflora* Sprengel, Syst. Veg. 1: 405. 1824. *Borreria ocymoides* (Burman f.) de Candolle, Prodr. 4: 544. 1830.

Diffuse herbs, stem distinctly 4 angled. Lamina lanceolate to elliptic – oblong, Fl. Bhut. 2 – 4 x 1 – 2 cm, acute, base cuneate; stipules membranous. Flowers in axillary clusters, sessile; tube cylindrical, limb 4 lobed. Corolla funnelform, white. Style 4 – 6 mm long; stigma 2, lobes linear. Capsule ellipsoid. Seeds ellipsoid.

*Flowers & Fruits:* June to August.

*Specimen Cited:* Road side, *Rajib & AP Das 0632*, dated 12. 02. 2008

*Local Distribution:* Road side forest ground throughout.

*General Distribution:* Pantropical.

COFFEA Linnaeus, Sp. Pl. 1: 172. 1753.

***Coffea bengalensis*** Roxburgh *ex* Schultes, Syst. Veg. 5: 200. 1819 *et*. Fl. Ind. 1: 540. 1820; C.B. Clarke in Hooker f., Fl. Brit. India 3: 153. 1880; H. Ohashi in Hara, Fl. E. Himal. 1: 308. 1966. *Psilanthus bengalensis* (Roxburgh *ex* Schultes) J.F. Leroy, Bull. Mus. Natl. Hist. Nat., B, Adansonia 3: 252. 1981; Springate, Mill, Wood, Wright *et* Long in Grierson *et* Long, Fl. Bhut. 2(2): 803. 1999. *Coffea floreifolia* A. Chevalier, Rev. Bot. Appl. Agric. Trop. 18: 836. 1938. *Coffea semiexserta* Colebrooke *ex* Roxburgh, Fl. Ind. 2: 195. 1824. *Psilanthus bababudanii* Sivarajan, Biju *et* P. Mathew, Bot. Bull. Acad. Sin. n.s., 33: 212. 1992. [PLATE: 7, Figure-70]

*Vernacular Name:* Chaiti Phul.

Deciduous shrubs, up to 50 cm; branches spreading. Lamina elliptic to ovate-lanceolate, 4 – 10 x 2 – 5 cm, caudate-acuminate, entire, base rounded to acute, nerves hairy beneath. 2 – 5 flowered cymes in the axil, white. Calyx glabrous. Corolla white, funnelform, outside glabrous. Ovary ellipsoid. Drupes ovoid or subglobose, black when ripe. Seeds grooved.

*Flowers & Fruits:* February to November.

*Specimen Cited:* Forest, *Rajib & AP Das 0462*, dated 23.07.2007.

*Local Distribution:* Throughout the study area.

*General Distribution:* Subtropical Himalaya, Bangladesh, Myanmar.

DENTELLA J. R. Forster & G. Forster, Char. Gen. Pl. 13. 1775.

**Key to the species:**

- 1a. Fruit densely multicellular transparent villose ..... *D. repens*  
 1b. Fruit glabrous ..... *D. repens* var. *serpyllifolia*

***Dentella repens*** (Linnaeus) J.R. Froster & G. Froster, *Charact. Gen. Pl.* 26, t. 13. 1775; Hooker *f.*, in Hooker *f.*, *Fl. Brit. Ind.* 3: 42. 1880; Prain *Beng. Pl.* 1: 555. 1903; Springate, Mill, Wood, Wright *et Long* in Grierson *et Long*, *Fl. Bhut.* 2(2): 755. 1999. Haines, *Bot. Bihar & Orissa Pt. IV*: 443. 1922; Mooney, *Suppl. Bot. Bihar & Orissa* 71. 1950; Panda *et Das*, *Fl. Sambalp.*, 168. 2004. *Oldenlandia repens* Linnaeus, *Mantius Pl.* 1: 40. 1767. *Hedyotis repens* (Linnaeus) de Lamarck, *Tabl. Encycl.* 1: 271. 1792. [PLATE: 8, Figure-79]

Creeping, small herbs, much branched; adventitious roots at nodes. Leaves with short petiole; blade small, oblong-lanceolate to obovate – spatulate, 2 - 8 x 2 – 4 mm, apex acute, entire, base cuneate; stipules triangular. Flowers usually solitary in forks of branchlets, rarely axillary. Hypanthium covered in pellucid trichomes. Calyx tube 1 mm in diameter. Corolla white. Stamens included. Style 2 – 6mm. Fruit compressed globose, densely multicellular transparent villose.

*Flowers & Fruits*: August to February.

*Specimen Cited*: Garden, Rajib & AP Das 0472, dated 23.07.2007.

*Local Distribution*: Throughout study areas.

*General Distribution*: Tropical India; Bhutan, Sri Lanka, Myanmar, Singapore, Malayan Island to N. Australia and Polynesia.

***Dentella repens* var. *serpyllifolia*** (Wallich *ex* Craib) Verdcourt, *Kew Bull.* 37: 545 1983; Springate, Mill, Wood, Wright *et Long* in Grierson *et Long*, *Fl. Bhut.* 2(2): 755. 1999. *Dentella serpyllifolia* Wallich *ex* Craib, *Fl. Siam.* 2: 27 1932.

Creeping, small herbs, much branched; adventitious roots at nodes. Leaves with short petiole; blade small, oblong-lanceolate to obovate – spatulate, 2 - 8 x 2 – 4 mm, apex acute, entire, base cuneate; stipules triangular. Flowers usually solitary in forks of branchlets, rarely axillary. Hypanthium glabrous. Calyx tube 1 mm in diameter. Corolla white. Stamens included. Style 2 – 6mm. Fruit compressed globose, glabrous.

*Flowers & Fruits*: August to February.

*Specimen Cited*: Garden, Rajib & AP Das 0644, dated 12. 02. 2008.

*Local Distribution*: Throughout study areas.

*General Distribution*: Pantropical.

OLDENLANDIA Linnaeus, *Sp. Pl.* 1: 119. 1753.

### Key to the species:

- 1a. Leaves linear; capsule globose ..... 2  
 1b. Leaves elliptic to lanceolate; capsule ovate ..... *O. verticillata*  
 2a. Flowers in axillary corymbose Calyx lobes narrowly triangular ..... *O. corymbosa*  
 2b. Flowers solitary; calyx lobes ciliate ..... *O. diffusa*

***Oldenlandia corymbosa*** Linnaeus, *Sp. Pl.* 1: 119. 1753; Hooker *f.*, *Fl. Brit. Ind.* 3: 64. 1880; H. Ohashi in Hara, *Fl. E. Himal.* 1: 309. 1966; Springate, Mill, Wood, Wright *et Long* in Grierson *et Long*, *Fl. Bhut.* 2(2): 766. 1999. Prain *Beng. Pl.* 1: 559. 1903 (Rep. ed. 1999). Guha Bakshi, *Fl. Mur. Dist.* 154. 1984. *Hedyotis corymbosa* (Linnaeus) Lamark, *Tab. Encl.* 1: 272. 1791; Panda *et Das*, *Fl. Sambalp.*, 172. 2004. *Gerontogea corymbosa* (Linnaeus) Chamisso & Schlechtendal, *Linnaea* 4: 154. 1829. *Hedyotis biflora* var. *corymbosa* (Linnaeus) Kurz, *J. Asiat. Soc. Bengal* 46(2): 133. 1877.

Diffuse, annual herbs, up to 40 cm. Leaves opposite, subsessile; lamina membranous, linear to narrowly lanceolate, 1 - 2 x 0.2 – 0.4 cm, acute, entire, base cuneate; stipules membranous, sheath-like. Inflorescence axillary, arranged in corymbose, 2 to 4 flowered; bracts minute. Flowers 4 merous. Calyx tube globose; lobes narrowly triangular. Corolla white, tubulate. Stamens inserted at corolla tube. Stigma 2 lobed. Capsule membranous, globose.

*Flowers & Fruits:* January to December.

*Specimen Cited:* Road side, *Rajib & AP Das 0599*, dated 26.07.2007.

*Local Distribution:* Road side forest ground throughout.

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

***Oldenlandia diffusa*** (Willdenow) Roxburgh, Hort. Beng. 11. 1814; Fl. Ind. 1: 444.1820; Prain Beng. Pl. 1: 559.1903; Hooker *f.* in Hooker *f.*, Fl. Brit. Ind. 3: 65.1880; Springate, Mill, Wood, Wright *et* Long in Grierson *et* Long, Fl. Bhut. 2(2): 765. 1999. Haines, Bot. Bihar & Orissa Pt. 447. 1922; Guha Bakshi, Fl. Mur. Dist. 157. 1984. *Hedyotis diffusa* Willdenow, Sp. Pl. 1: 566. 1798; Panda *et* Das, Fl. Sambalp., 172. 2004. *Hedyotis diffusa* var. *extensa* (Hooker *f.*) R. Dutta, Taxon. Revis. Hedyotis Indian Subcont. 146. 2004. *Oldenlandia pauciflora* Roxburgh *ex* Wight & Arnott, Prodr. Fl. Ind. Orient. 415. 1834. *Oldenlandia diffusa* var. *extensa* Hooker *f.*, Fl. Brit. India 3: 65. 1880. *Oldenlandia diffusa* var. *polygonoides* Hooker *f.*, Fl. Brit. India 3: 65. 1880.

Diffuse, annual herbs, up to 50 cm; stems slightly flattened. Leaves opposite, sessile; lamina membranous, linear, 1 - 5 x 0.3 mm, acute; stipules connate at base, apex aristate. Flowers 4 merous, solitary; pedicels slightly stout. Calyx tube globose, ciliate. Corolla white, tabulate; lobes ovate- oblong. Stamens inserted at corolla tube throat; anthers exerted, oblong. Stigma 2 lobed, lobes spreading. Capsule compressed globose. Seeds angled.

*Flowers & Fruits:* January to December.

*Specimen Cited:* Forest, *Rajib & AP Das 0526*, dated 23.07.2007.

*Local Distribution:* Throughout study areas.

*General Distribution:* Tropical and sub-tropical India; S. China, Japan, Malaysia, Borneo and Philippines.

***Oldenlandia verticillata*** Linnaeus, Mant. Pl. 1: 40. 1767. *Hedyotis verticillata* (Linnaeus) Lamarck, Tabl. Encycl. 1: 271. 1792; Springate, Mill, Wood, Wright *et* Long in Grierson *et* Long, Fl. Bhut. 2(2): 763. 1999. *Hedyotis wallichii* Walpers, Repert. Bot. Syst. 2: 498. 1843. *Oldenlandia hispida* (Retzius) de Lamarck, Encycl. 4: 536. 1798. *Scleromitron crassifolium* Miquel, Fl. Ned. Ind. 2: 185. 1857. *Hedyotis verticillata* (Linnaeus) de Lamarck, Tabl. Encycl. 1: 271. 1792. [PLATE: 9, Figure-101]

Annual, diffuse, prostrate herbs, up to 25 cm. Leaves opposite, sessile; lamina thinly leathery, elliptic to lanceolate, 2 – 5 x 1 – 2 cm, acuminate, base cuneate; stipules slightly hairy, connate at base. Flowers sessile. Calyx tube obconical; lobes 4, lanceolate. Corolla white, lobes lanceolate. Stamens inserted at corolla tube throat; anthers exerted. Style apex inflated. Capsule ovate. Seeds many in each cell.

*Flowers & Fruits:* March to November.

*Specimen Cited:* Forest, *Rajib & AP Das 0653*, dated 13. 02. 2008.

*Local Distribution:* Road side forest ground throughout.

*General Distribution:* India, Nepal, Vietnam, Malaysia, Indonesia

PAEDERIA Linnaeus, Syst. Nat., ed. 12, 2: 135, 189; Mant. Pl. 1: 7, 52. 1767, *nom. cons.*

***Paederia foetida*** Linnaeus, Mant. Pl. 1: 52. 1767; Fl. Ind. 2:517. 1824; C.B. Clarke in Hooker f., Fl. Brit. India 3:195. 1881; H. Ohashi in Hara, Fl. E. Himal. 1:314. 1966; Hara *et al.*, Enn. Fl. Pl. Nep. 2:206. 1979; Springate, Mill, Wood, Wright *et Long* in Grierson *et Long*, Fl. Bhut. 2 (2): 812. 1991. *Psychotria volubilis* Roxburgh *ex* Wight & Arnott, Prodr. Fl. Ind. Orient. 424. 1834. *Paederia tomentosa* Blume, Bijdr. 968. 1826. *Paederia scandens* var. *mairi* (H.L. Veill.) H. Hara, Enum. Sperm. Jap. 2: 24. 1952. *Paederia scandens* f. *microphylla* (Honda) H. Hara, Enum. Sperm. Jap. 2: 25. 1952. *Paederia scandens* (Loureiro) Merrill, Contr. Arnold Arbor. 8: 163. 1934. *Paederia prainii* Gandoger, Bull. Soc. Bot. France 65: 35. 1918. *Paederia foetida* var. *Sessiliflora* (Poir.) Baker, Fl. Mauritius 158. 1877. [PLATE: 9, Figure-103]

*Vernacular Name:* Gondhopata.

Large climbers. Leaves opposite; lamina membranous, ovate to lanceolate, 5 – 11 x 2 – 4 cm, acute, base rounded to cordate; stipules ovate-lanceolate, bifid. Panicles axillary to terminal, spreading; bracteoles minute. Flowers subsessile. Calyx lobes triangular. Corolla outside purplish beneath whitish pubescence; lobes ovate with broad undulate margin. Fruits globose.

*Flowers & Fruits:* July to January.

*Specimen Cited:* Forest, Rajib & AP Das 0412, dated 22.07.2007.

*Local Distribution:* Throughout study areas.

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

MORINDA Linnaeus, Sp. Pl. 1: 176. 1753.

***Morinda angustifolia*** Roxburgh, Pl. Coromandel 3: 32. 1815 *et*. Pl. Coromandel tab. 287. 1819; C.B. Clarke in Hooker f., Fl. Brit. India 3: 156. 1880; Springate, Mill, Wood, Wright *et Long* in Grierson *et Long*, Fl. Bhut. 2(2): 804. 1999. *Morinda angustifolia* var. *scabridula* Craib, Fl. Siam. 2: 174. 1934. *Morinda squarrosa* Buchanan-Hamilton, Trans. Linn. Soc. London 13: 535. 1822.

*Vernacular Name:* Haldikath.

Erect, tall shrubs, up to 6 m. Leaves opposite, lamina oblong-elliptic to oblong-lanceolate, 15 - 35 x 7 - 12 cm, acuminate, entire, attenuate at base; stipules interpetiolar, acuminate. Capitulum many-flowered. Flowers sessile. Calyx tube appressed mutually at anthesis, truncate. Corolla white, incurved; limb 5 lobed; lobes ovate-lanceolate. Stamens 5; anthers linear. Style bifid at apex. Ovary 4 celled. Drupecetum white, mulberry-shaped; drupes obovate, 4 seeded.

*Flowers & Fruits:* March to June.

*Specimen Cited:* Forest, Rajib & AP Das 0662, dated 13. 02. 2008.

*Local Distribution:* Throughout Forest.

*General Distribution:* Tropical and sub-tropical parts of the world.

RICHARDIA Linnaeus, Sp. Pl. 1: 330. 1753.

***Richardia scabra*** Linnaeus, Sp. Pl. 330. 1753. *Spermacoce hirsuta* Willdenow *ex* Roemer & Schultes, Syst. Veg. 3: 531. 1818. *Plethyrasis glauca* Rafinesque, Autik. Bot. 13. 1840. *Richardia pilosa* Ruiz & Pavon, Fl. Peruv. 3: 50. 1802. *Richardsonia cubensis* A. Richard, Hist. Fis. Cuba, Bot. 11: 31. 1850.

Decumbent, annual herbs, up to 80cm; lamina ovate to elliptic lanceolate, 1 – 5 x 1 – 3cm, thickly papery, bluntly acute, ciliate, base attenuate; stipules fused with petioles into a sheath. Inflorescence a terminal, subsessile capitulum of many flowers, bracts broadly ovate. Flowers 5 merous. Calyx tube constricted at apex; lobes usually 6, lanceolate to narrowly lanceolate. Corolla white; lobes 6. Stamens 6. Ovary usually 3 celled. Stigma capitate, 3 lobed. Mericarp obovoid.

*Flowers & Fruits:* February to July.

*Specimen Cited:* Road side, *Rajib & AP Das 0494*, dated 23.07.2007.

*Local Distribution:* Road side forest ground throughout.

*General Distribution:* India, Native to tropical America.

**Order: Lamiales** Bromhead (1838)

**Acanthaceae** A.L. de Jussieu, Gen. Pl. 102. 1789 ('Acanthi'); *nom. cons.*

**Key to the genera:**

- |   |                      |
|---|----------------------|
| 1a. Large vines .....   | <i>Thunbergia</i>    |
| 1b. Prostrate or erect herbs, shrubs .....                                  | 2                    |
| 2a. Hooklike retinacula present in fruits .....                             | 3                    |
| 2b. Retinacula absent in fruits .....                                       | <i>Nelsonia</i>      |
| 3a. Calyx lobes heteromorphic .....   | 4                    |
| 3b. Calyx lobes homomorphic .....   | 5                    |
| 4a. Upper lip of corolla 4-lobed and lower lip 1-lobed .....                | <i>Barleria</i>      |
| 4b. Upper lip of corolla 2-lobed and lower lip 3-lobed .....                | <i>Lepidagathis</i>  |
| 5a. Corolla lobes contorted in bud; stamens 4 .....                         | 6                    |
| 5b. Corolla lobes not contorted in bud; stamens and staminodes 0 or 2 ..... | 7                    |
| 6a. Inflorescence secund with orbicular to reniform bracts .....            | <i>Phaulopsis</i>    |
| 6b. Inflorescence not second, bracts linear to oblong .....                 | <i>Hygrophila</i>    |
| 7a. Ovules 3 to many per locule; seeds 6 to many per capsule .....          | <i>Phlogacanthus</i> |
| 7b. Ovules 2 per locule; seeds 4 per capsule .....                          | 8                    |
| 8a. Stamens 4 .....   | <i>Asystasia</i>     |
| 8b. Stamens 2 .....   | 9                    |
| 9a. Flowers subtended by 2 involucre .....                                  | <i>Dicliptera</i>    |
| 9b. Flowers subtended by a single pair of bracteoles .....                  | 10                   |
| 10a. Inflorescence often dense with imbricate bracts 2 to 4-ranked .....    | <i>Rungia</i>        |
| 10b. Inflorescence a spike .....  | <i>Justicia</i>      |

ASYSTASIA Blume, Bijdr. 796. 1826.

*Asystasia macrocarpa* Nees in Wallich, Pl. As. Rar. 3: 89. 1832; Clarke in Hooker *f.*, Fl. Brit. Ind. 4: 495. 1885; H. Ohashi in Hara, Fl. E. Himal. 1: 300. 1966; Wood in Grierson *et* Long, Fl. Bhut. 2(3): 1282. 2001. *Mackaya macrocarpa* (Nees) Das, Fl. Assam 3: 447. 1939.

Ascending herbs. Stems branched, 4 angled. Lamina ovate to elliptic, 4–10 2–5 cm, glabrous, acuminate, entire, base truncate to rounded. Racemes axillary and terminal; bracts triangular; bracteoles linear-lanceolate. Calyx lobes linear-lanceolate, margin ciliate. Corolla white; tube basally cylindrical; lobes obovate; middle lobe of lower lip with violet or maroon markings. Stamens included. Ovary ellipsoid; stigma slightly capitate, 2-lobed. Capsule pubescent. Seeds irregularly obovate.

*Flowers & Fruits:* June to September.

*Specimen Cited:* Forest, *Rajib & AP Das 0571*, dated 24.07.2007

*Local Distribution:* Throughout Forest.

*General Distribution:* India, Thailand, Indo-China peninsula to Malaysia.

BARLERIA Linnaeus, Sp. Pl. 2: 636. 1753.



**Key to the species:**

- 1a. Flowers in axillary and terminal dense spikes ..... *B. strigosa*  
 1b. Flowers in axillary cymes ..... *B. cristata*

***Barleria cristata*** Linnaeus, Sp. Pl. 636.1753; C.B. Clarke in Hooker *f.*, Fl. Brit. India 4:488. 1884; Wood in Grierson *et* Long, Fl. Bhut. 2(3): 1281. 2001. *Barleria alba* Loddiges, Bot. Cab. 4: t. 360. 1820. *Barleria ciliata* Roxburgh, Fl. Ind. 3: 38. 1832. *Barleria dichotoma* Roxburgh, Fl. Ind. ed. 1832 3: 39. 1832. *Barleria laciniata* Wallich, Pl. Asiat. Rar. 3: 91. 1832. *Barleria indica* Linnaeus *ex* T. Anderson, J. Linn. Soc., Bot. 7: 115. 1864.

*Vernacular name:* Jaati.

Branched, subshrubs. Leaves caducous; lamina elliptic to ovate, 2 – 10 x 1 – 4 cm, papery, acute to shortly acuminate, entire, base cuneate and decurrent. Flowers usually 2 in leaf axil or clustered on branched shoots. Bracts foliose. Two outer calyx segments ovate to lanceolate; adaxial 2 segments linear to lanceolate, margin ciliate. Corolla purple, 2 lipped; limb 5 lobed. Fertile stamens 4, didynamous. Staminode 1. Ovary compressed, long elliptic.

*Flowers & Fruits:* November to December.

*Specimen Cited:* Forest, Rajib & AP Das 0669, dated 13. 02. 2008.

*Local Distribution:* Throughout Forest.

*General Distribution:* Indo-China, India; Islands of Indian Ocean.

***Barleria strigosa*** Willdenow, Sp. Pl. 3: 379. 1800; Wood in Grierson *et* Long, Fl. Bhut. 2(3): 1281. 2001. *Barleria caerulea* Roxburgh, *Fl. Ind.* 3: 39. 1832. *Barleria polystachya* Hooker *ex* Nees, Prodr. 11: 226. 1847. *Barleria strigosa* var. *polystachya* (Nees) C.B. Clarke, Fl. Brit. India 4: 490. 1884. *Barleria strigosa* var. *terminalis* (Nees) C.B. Clarke, Fl. Brit. India 4: 490. 1884. [PLATE: 6, Figure-60]

Much branched subshrubs. Stems subterete, coarsely fulvous strigose. Lamina elliptic to ovate, 6–15 x 2–5cm, both surfaces fulvous strigose especially along veins, acute, sub-entire, base cuneate. Flowers in axillary and terminal dense spikes; bracts oblong to elliptic-oblong; bracteoles elliptic, ciliate. Outer calyx lobes purple, ovate; inner calyx lobes yellowish brown, lanceolate. Corolla purplish red; tube basally cylindrical; lobes obovate-oblong. Stamens 4; staminode 1. Ovary ovoid. Capsule ellipsoid, 4 seeded.

*Flowers & Fruits:* November to February.

*Specimen Cited:* Forest, Rajib & AP Das 0536, dated 23.07.2007

*Local Distribution:* Throughout Forest.

*General Distribution:* India, Bhutan, China, Nepal, Sri Lanka, Indonesia, Malaysia, Myanmar, Thailand, Cambodia and Vietnam.

DICLIPTERA Jussieu, Ann. Mus. Natl. Hist. Nat. 9: 267. 1807, *nom. cons.*

***Dicliptera bupleuroides*** Nees in Wallich, Pl. As. Rar. 3: 111. 1832; H. Ohashi in Hara, Fl. E. Himal. 1: 301. 1966; Wood in Grierson *et* Long, Fl. Bhut. 2(3): 1292. 2001. *Dicliptera roxburghii* T. Anderson, J. Linn. Soc., Bot. 9: 519. 1867. *Justicia canescens* Wallich, Numer. List 72: n. 2423. 1830. *Dicliptera cardiocarpa* Nees, Pl. Asiat. Rar. 3: 111. 1832. *Dicliptera roxburghiana* var. *bupleuroides* (Nees) C.B. Clarke in Fl. Brit. India 4: 554. 1885.

Ascending herbs. Stems sulcate, pubescent. Lamina ovate, base cuneate, sub-entire, acuminate. Inflorescences axillary and subsessile, cymes, many flowered; bracts lanceolate. Calyx lobes subulate,

pubescent. Corolla lip orbicular to oblong, 3 lobed, lobes ovate. Staminal filaments 2 – 2.3 mm; anther thecae spherical. Ovary pilose. Capsule pilose. Seeds ovate.

*Flowers & Fruits:* September to May.

*Specimen Cited:* Road side, *Rajib & AP Das 0546*, dated 23.07.2007.

*Local Distribution:* Road side forest ground throughout.

*General Distribution:* Tropical India; Bhutan, Bangladesh, Himalayas, Afghanistan, Thailand, Indo-Chinese Peninsula.

HYGROPHILAR. Brown, Prodr. 479. 1810.

### Key to the species:

- 1a. Flowers axillary, in whorls upward ..... *H. phlomoides*  
 1b. Inflorescences terminal, spikes ..... *H. polysperma*

*Hygrophila polysperma* (Roxburgh) Anderson, J. Linn. Soc. (Bot.) 9: 456. 1867; Clarke in Hooker f., Fl. Brit. Ind. 4: 406. 1884; Prain, Beng. Pl. 2: 597. 1903; Wood in Grierson *et* Long, Fl. Bhut. 2(3): 1252. 2001; Majumdar, Bull. Bot. Soc. Bengal 20(2): 112. 1966. *Justicia polysperma* Roxburgh, Fl. Ind. 1: 119. 1832. *Hemidelphis polyspermus* (Roxburgh) Nees in Wallich, Pl. As. Rar. 3: 80. 1832; Guha Bakshi, Fl. Mur. Dist. 238. 1984. *Ruellia uliginosa* Wallich, Numer. List 2378. 1830.

Perennials, prostrate herbs, up to 1m. Stems 4 angled, slightly swollen above nodes. Lamina oblong-lanceolate to ovate, 2 – 4 x 1 – 1.5 cm, glabrous, subobtuse, entire, base attenuate. Inflorescences terminal, spikes; bracts ovate-elliptic to obovate. Calyx lobes lanceolate, unequal. Corolla white; lower lip 3-lobed; upper lip 2-lobed. Stamens 2, slightly exserted; staminodes 2, bristlelike. Capsule linear-oblong.

*Flowers & Fruits:* March to August.

*Specimen Cited:* Batikata Beel, *Rajib & AP Das 0562*, dated 24.07.2007.

*Local Distribution:* Beel margins through out.

*General Distribution:* Tropical regions of Asia, Africa and America.

*Hygrophila phlomoides* Nees, in Wallich, *Pl. Asiat. Rar. 3: 80. 1832*; Wood in Grierson *et* Long, Fl. Bhut. 2(3): 1252. 2001. *Cardanthera longifolia* Buchanan-Hamilton *ex* Nees, Prodr. 11: 90. 1847. *Ruellia phlomoides* Wallich, Numer. List 2376. 1830. [PLATE: 8, Figure-80]

Perennial, erect herbs. Stems 4-angled, brown strigose. Petiole hirsute; lamina elliptic to obovate – oblong, Fl. Bhut. 2 – 10 x 1 – 4cm, papery, base usually attenuate, entire to slightly undulate, acute or obtuse. Flowers axillary, in whorls upward; bracteoles linear-oblong, hirsute. Calyx white hirsute, 5-lobed; lobes linear. Corolla pinkish, pubescent; lower lip oblong, 3-lobed; upper lip triangular, 2-lobed. Stamens 4. Ovary glabrous; style pubescent. Capsule pilose.

*Flowers & Fruits:* October to December.

*Specimen Cited:* Batikata Beel, *Rajib & AP Das 0426*, dated 22.07.2007.

*Local Distribution:* Beel margins through out.

*General Distribution:* India, Bhutan, Indonesia, Philippines, Indo-Chine peninsula, Pakistan, Thailand, Vietnam.

JUSTICIA Linnaeus, Sp. Pl. 1: 15. 1753.

### Key to the species:

- 1a. Calyx unequally 5-lobed ..... 2  
 1b. Calyx equally 5-lobed ..... 3  
 2a. Spikes dense ..... *J. japonica*  
 2b. Spikes slender ..... *J. diffusa*  
 3a. Lamina narrowly lanceolate ..... *J. gendarussa*  
 3b. Lamina ovate to elliptic-ovate ..... *J. adhatoda*

***Justicia adhatoda*** Linnaeus, Sp. Pl. 1: 15. 1753, Wood in Grierson *et* Long, Fl. Bhut. 2(3): 1287. 2001. *Adhatoda vasica* Nees in Pl. As. Rar., 3: 103. 1832; C.B. Clarke in Hooker *f.*, Fl. Brit. India 4: 540. 1885. *Adhatoda zeylanica* Medik., Hist. & Commentat. Acad. Elect. Sci. Theod.-Palat. 6: 393. 1790. *Dianthera latifolia* Salisb., Prodr. Stirp. Chap. Allerton 103. 1796.

*Vernacular name:* Basak.

Shrubs up to 3m. Petiole puberulent; lamina ovate to elliptic-ovate, 5–16 2–6 cm, acuminate, entire, base broadly cuneate. Spikes terminal; bracts ovate-oblong; bracteoles linear-lanceolate. Calyx 5 lobed; lobes linear-oblong. Corolla white, broadly tubular; upper lip ovate-oblong, shallowly 2 lobed; lower lip oblong-circular, 3-lobed, middle lobe subcircular. Stamens exserted; anther thecae ellipsoid. Ovary pubescent; style recurved. Capsule obovoid.

*Flowers & Fruits:* January to June.

*Specimen Cited:* Rasik Bil village, Rajib & AP Das 0542, dated 23.07.2007.

*Local Distribution:* Cultivated in villages.

*General Distribution:* Probably native to India, Tropical and sub-tropical parts of the world.

***Justicia gendarussa*** Burman *f.*, Fl. Indica 10. 1768; C.B. Clarke in Hooker *f.*, Fl. Brit. India 4: 532. 1885; Wood in Grierson *et* Long, Fl. Bhut. 2(3): 1287. 2001. *Gendarussa vulgaris* Nees in Wallich, Pl. As. Rar. 3: 104. 1832. *Justicia gandarussa* Linnaeus *f.*, *Suppl. Pl.* 85. 1782. *Ecbolium gendarussa* (Burman *f.*) Kuntze, *Revis. Gen. Pl.* 2: 487. 1891.

*Vernacular name:* Kalakasunda.

Subshrubs up to 1.5 cm tall, much branched. Stems swollen at nodes. Lamina narrowly lanceolate, 5–9 x 1–1.5 cm, glabrous, acute to shortly acuminate, subsinuate, base cuneate. Spikes terminal and axillary, usually in a leafy panicle; bracts triangular. Calyx 5 lobed. Corolla creamy white; tube basally cylindric; lower lip violet dotted basally, cuneate-obovate, 3 lobed; upper lip violet blotched, triangular. Stamens exserted. Ovary glabrous; style glabrous; stigma capitate. Capsule clavate.

*Flowers & Fruits:* February to April.

*Specimen Cited:* Bochamari, Rajib & AP Das 0651, dated 12. 02. 200

*Local Distribution:* Cultivated in villages.

*General Distribution:* India, Nepal, Bhutan, Sri Lanka, Thailand, Cambodia, Myanmar; widely cultivated.

***Justicia diffusa*** Willdenow, Sp. Pl. 1: 87. 1797; Clarke in Hooker *f.*, Fl. Brit. Ind. 4: 538. 1885; Wood in Grierson *et* Long, Fl. Bhut. 2(3): 1288. 2001. *Justicia procumbens* Linnaeus, Sp. Pl. 1: 15. 1753, *Rostellaria diffusa* (Willdenow) Nees, Pl. Asiat. Rar. 3: 100. 1832.

Woody herbs. Stems procumbent, diffuse. Petioles 2 mm; lamina lanceolate – elliptic to suborbicular – linear, 3 – 5cm, minutely pubescent. Spikes composed of cymes, slender; bracts oblong-lanceolate, less broad than calyx, base ovate. Calyx 5 parted, splitting to base; 4 segments lanceolate, lower 2 longer, 1 segment small. Calyx segments and bracts ciliate. Corolla flesh colored, small. Capsule oblong, glabrous.

*Flowers & Fruits:* July to November.

*Specimen Cited:* Forest, *Rajib & AP Das 0477*, dated 23.07.2007.

*Local Distribution:* Atiamochar.

*General Distribution:* India, Nepal, Bhutan, Sri Lanka, Myanmar and Thailand.

*Justicia japonica* Thunb., *Fl. Jap.* 20. 1784. *Justicia simplex* D. Don, *Prodr. Fl. Nepal.* 118. 1825; Clarke in Hooker *f.*, *Fl. Brit. Ind.* 4: 539. 1885; Wood in Grierson *et Long*, *Fl. Bhut.* 2(3): 1288. 2001. *Justicia japonica* Thunberg, *Fl. Jap.* 20.1784.

*Rostellaria mollissima* Nees, *Pl. Asiat. Rar.* 3: 101. 1832.

Annual herbs. Stems repens. Leaves orbicular, scariously hirsute, blade 1cm, orbicular, apex rounded, with long petioles. Spike small, dense. Bracts minutely shorter calyx segments, base ovate to caudate, margin ciliate. Calyx 5-parted, segments slender. Capsule pure white, barbarte pubescent.

*Flowers & Fruits:* August to November.

*Specimen Cited:* Garden, *Rajib & AP Das 0531*, dated 23.07.2007.

*Local Distribution:* Garden.

*General Distribution:* India, Nepal, Bhutan, Sri Lanka, Myanmar, Thailand and Malaya.

LEPIDAGATHIS Willdenow, *Sp. Pl.* 3: 400. 1800.

*Lepidagathis incurva* Buchanan-Hamilton *ex* D. Don, *Prodr. Fl. Nepal.* 119. 1825; H. Ohashi in Hara, *Fl. E. Himal.* 1: 303. 1966; *Fl. Nep.* 3:142.1982; Wood in Grierson *et Long*, *Fl. Bhut.* 2(3): 1286. 1991. *Lepidagathis hyalina* Nees in Wall., *Pl. As. Rar.* 3: 95. 1832; C.B.Clarke in Hooker *f.*, *Fl. Brit. India* 4: 521. 1885.

Ascending herbs, up to 90 cm, anisophyllous. Stems 4-angled, sulcate. Lamina ovate to elliptic, 3–10 x 1–5cm, base cuneate, entire and slightly sinuate, acute to shortly acuminate. Spikes elongate, secund; bracts oblong-lanceolate, 1-veined, long acuminate. Calyx glabrescent; posterior lobe oblong-lanceolate, 3-veined; lateral lobes lanceolate; anterior lobes connate at base. Corolla white streaked with purple. Stamens slightly exerted. Ovary pubescent. Capsule 5mm, distally pubescent. Seeds subcircular.

*Flowers & Fruits:* November to April.

*Specimen Cited:* Chhotojan Beel, *Rajib & AP Das 0634*, dated 12. 02. 2008.

*Local Distribution:* Beel margins through out.

*General Distribution:* India, China, Mayanmer, Malaysia, Phillipins.

NELSONIA R. Brown, *Prodr.* 480. 1810.

*Nelsonia canescens* (de Lamarck) Sprengel in Linnaeus, *Syst. Veg. ed.* 16. 1: 42. 1824; Wood in Grierson *et Long*, *Fl. Bhut.* 2(3): 1250. 2001. *Justicia canescens* de Lamarck, *Tab. Encycl. Method Bot.* 1: 41. 1791. *Nelsonia campestris* R. Brown, *Prodr. Fl. Nov. Hall.* 1: 481. 1810; Clarke in Hooker *f.*, *Fl. Brit. Ind.* 4: 394. 1884; Prain, *Beng. Pl.* 2: 594.1903. *Justicia lamiifolia* Roxburgh, *Fl. Ind.*, ed. 1820 1: 135. 1820. *Dianthera tomentosa* Roxburgh *ex* C.B.Clarke in Hooker *f.*, *Fl. Brit. India* 4: 395. 1884. *Nelsonia lamiifolia* (Roxburgh) Sprengel, *Syst. Veg.* 1: 42. 1824. *Nelsonia rotundifolia* Robert Brown, *Prodr.* 481. 1810.

Annual herbs, creeping, prostrate to decumbent. Stems subterete, villous. Petiole villous; lamina elliptic to ovate, 1–3 x 1–1.5cm, lamina of basal leaves 6–10 x 3–5 cm, both surfaces villous, base cuneate, entire, acute. Spikes 3 – 4cm; bracts elliptic. Calyx 2-lobed. Corolla bluish purple or

white; tube cylindric. Stamens inserted at base of throat; filaments glabrous. Ovary glabrous; ovules 4–8 per locule. Capsule 6–14 seeded. Seeds broadly ellipsoid.

*Flowers & Fruits*: February to April.

*Specimen Cited*: Road side, *Rajib & AP Das 0681*, dated 14. 02. 2008.

*Local Distribution*: Road side forest ground throughout.

*General Distribution*: India, Bhutan, China, Nepal, Indonesia, Laos, Malaysia, Myanmar, Cambodia, Philippines, Thailand, Vietnam; Africa, Madagascar.

PHAULOPSIS Willdenow, Sp. Pl. 3: 4, 342. 1800 [“Phayloopsis”], *nom. cons.*

***Phaulopsis imbricata*** (Forsskal) Sweet, Hort. Brit. Ed. 1. 327. 1826; Wood in Grierson *et* Long, Fl. Bhut. 2(3): 1275. 2001. *Ruellia imbricata* Forsskal, Fl. Aegypt – Arab. 113. 1775. *Aetheilema mucronatum* Griffith, Not. Pl. Asiat. 4: 137. 1854. *Aetheilema reniforme* Nees, Pl. Asiat. Rar. 3: 94. 1832. *Phaulopsis parviflora* Willdenow, Sp. Pl. 3: 342. 1800. *Aetheilema reniforme* Nees, Pl. Asiat. Rar. 3: 94. 1832. [PLATE: 9, Figure-100]

Ascending herbs, up to 50 cm, slightly anisophyllous. Stems ascending, 4-angled. Petiole 4–5 cm; lamina ovate to elliptic, 7–10 x 3–5 cm, papery, acuminate, entire, base cuneate to attenuate and slightly oblique. Spikes terminal; bracts orbicular to reniform. Posterior calyx lobes ovate-elliptic, other lobes linear to subulate. Corolla white; lower lip 3-lobed, lobes ovate-oblong; upper lip narrow, 2-lobed. Staminal filaments glabrous. Style pilose. Capsule ellipsoid.

*Flowers & Fruits*: October to February.

*Specimen Cited*: Forest, *Rajib & AP Das 0570*, dated 24.07.2007.

*Local Distribution*: Throughout Forest.

*General Distribution*: India, Bhutan, Bangladesh, Indo-China, Vietnam, Himalaya, tropic Africa.

PHLOGACANTHUS Nees in Wallich, Pl. Asiat. Rar. 3: 76, 99. 1832.

***Phlogacanthus thyrsoformis*** (Roxburgh *ex* Hardwicke) Mabberley, Bot. Hist. Hortus Malabaricus 189. 1980. *Justicia thyrsoformis* Hardwicke, Asiat. Res. 6: 349. 1799. *Phlogacanthus thyrsoflorus* Nees, Pl. Asiat. Rar. 3: 99. 1832. C.B. Clarke in Hooker *f.*, Fl. Brit. India 4: 512. 1884; H. Ohashi in Hara, Fl. E. Himal. 1: 303. 1966; Hara *et al.*, Enn. Fl. Pl. Nep. 3: 143. 1982; Wood in Grierson *et* Long, Fl. Bhut. 2(3): 1284. 1991. *Justicia thyrsooides* Roxburgh *ex* Nees, Prodr. 11: 321. 1847. *Phlogacanthus thyrsoflorus* (Hardwicke) Mabberley in Bot. Hist. Hortus Malabaricus 83. 1980.

*Vernacular name*: Jaglibasak.

Large shrubs, up to 4m. Lamina elliptic-oblong to oblong, 8–16 x 4–5 cm, acuminate to long acuminate, base attenuate, undulate. Inflorescences in terminal thyrses; bracts small. Calyx lobes linear-lanceolate, unequal. Corolla orange; tube slightly curved; lower lip deeply 3 lobed, lobes ovate; upper lip 2 cleft. Stamens much exerted; filaments glabrous; staminodes 2. Ovary glabrous. Capsule glabrous, 8-seeded.

*Flowers & Fruits*: January to March.

*Specimen Cited*: Forest, *Rajib & AP Das 0467*, dated 23.07.2007.

*Local Distribution*: Throughout Forest.

*General Distribution*: India, Bhutan, Myanmar, Nepal.

RUNGIA Nees in Wallich, Pl. Asiat. Rar. 3: 77, 109. 1832.

***Rungia pectinata*** (Linnaeus) Nees in de Candolle, Prodr. 11: 470. 1847; Wood in Grierson *et* Long, Fl. Bhut. 2(3): 1291. 2001. Guha Bakshi, Fl. Mur. Dist. 244. 1984. *Justicia pectinata* Linnaeus, Torner, Cent. II: Pl. 3. 1756; Amoen. Acad. 4: 299. 1760. *Dicliptera pectinata* (Linnaeus) Jussieu, Ann. Mus. Hist. Nat. 9: 169. 1807. *Dianthera parviflora* Roxburgh *ex* Nees, Prodr. 11: 471. 1847. *Rungia parviflora* Nees, Pl. Asiat. Rar. 3: 110. 1832. *Rungia parviflora* (Retzius) Nees var. *pectinata* (Linnaeus) Clarke in Hooker *f.*, Fl. Brit. Ind. 4: 550. 1985. Prain, Beng. Plants 2: 613. 1903.

Annual, prostrate herbs, rooting at nodes, up to 50 cm. Lamina oblong-elliptic, 1–4 x 0.5–1.5 cm, glabrous, acute, entire, base cuneate. Spikes axillary and terminal, 1 sided, solitary to compound; bracts dimorphic; sterile bracts green, elliptic; fertile bracts circular to obovate, pubescent, broadly hyaline. Calyx colorless, pubescent; lobes linear-lanceolate, narrowly hyaline, mucronulate. Corolla blue; lower lip 3-lobed, lobes triangular; upper lip ovate. Staminal filaments glabrous. Ovary glabrous. Capsule ellipsoid. Seeds orbicular.

*Flowers & Fruits:* September to May

*Specimen Cited:* Park, Rajib & AP Das 0344, dated 21.07.2007.

*Local Distribution:* Throughout study areas.

*General Distribution:* India, Bhutan, Sri Lanka, Bangladesh, Myanmar, Nepal, Thailand, Vietnam and Malaysia.

THUNBERGIA Retzius, Physiogr. S lsk. Handl. 1(3): 163. 1780, *nom. cons.*

### Key to the species:

- 1a. Petiole hirsute; lamina oblong-ovate ..... *T. fragrans*
- 1b. Petiole grooved; lamina triangular-ovate ..... *T. grandiflora*

***Thunbergia fragrans*** Roxburgh, *Pl. Coromandel 1*: 47. 1795; Wood in Grierson *et* Long, Fl. Bhut. 2(3): 1247. 2001. *Roxburghia rostrata* Russell *ex* Nees, Prodr. 11: 57. 1847. *Thunbergia volubilis* Persoon, Syn. Pl. 2: 179. 1806.

Large vines, herbaceous. Stems 4-angled, sulcate. Petiole hirsute; lamina oblong-ovate, broadly ovate to oblong-lanceolate, 5–15 x 2–6 cm, subglabrous, palmately 3–5-veined, acute to acuminate, irregularly sinuate to shallowly coarsely dentate, base rounded to cuneate or cordate. Flowers axillary, solitary; bracteoles ovate. Calyx dentate. Corolla red; tube basally cylindrical; lobes obovate. Stamens included; filaments glabrous; anther thecae divergent. Ovary glabrous; style exerted; stigma funnel-shaped. Capsule glabrous.

*Flowers & Fruits:* September to April.

*Specimen Cited:* Forest, Rajib & AP Das 0381, dated 21.07.2007.

*Local Distribution:* Takomari forest.

*General Distribution:* India, Bhutan, China, Sri Lanka, Indonesia, Laos, Philippines, Cambodia, Thailand, Vietnam.

***Thunbergia grandiflora*** (Roxburgh *ex* Rottler) Roxburgh, Bot. Reg. 6: 495. 1820; Wood in Grierson *et* Long, Fl. Bhut. 2(3): 1248. 2001. *Flemingia grandiflora* Roxburgh *ex* Rottler, Neue Schriften Ges. Naturf. Freunde Berlin 4: 202. 1803. *Thunbergia chinensis* Merrill, Philipp. J. Sci. 21(5): 510. 1922. *Thunbergia cordifolia* Nees, Prodr. 11: 35. 1847.

Large, woody vines up to 15 m. Stems 4-angled. Petiole grooved; lamina ovate to triangular-ovate, 5–15 3–9 cm, papery, palmately 3–7-veined, acuminate to acute, undulate, base subcordate to truncate. Flowers solitary, paired in leaf axils or arranged in terminal racemes with 2–4 flowers;

bracts subulate. Calyx unlobed. Corolla bluish; limb subactinomorphic; lobes ovate. Staminal filaments 6–8 mm; anther thecae pubescent. Style glabrous; stigma with 2 subequal lobes. Seeds ovate.

*Flowers & Fruits:* September to April.

*Specimen Cited:* Forest, Rajib & AP Das 0460, dated 23.07.2007.

*Local Distribution:* Atiamochar forest.

*General Distribution:* India, Bhutan, China, Myanmar, Thailand, Vietnam.

## **Bignoniaceae** A.L. de Jussieu, Gen. P11. 137. 1789 ('Bignoniae'); *nom. cons.*

### **Key to the genera:**

- 1a. Leaflets 2 to 4; lamina triangular-ovate ..... ***Oroxylum***  
 1b. Leaflets 9 to 19; lamina elliptic-oblong to obovate-oblong ..... ***Spathodea***

OROXYLUM Ventenat, Decas Gen. Nov. 8. 1808.

***Oroxylum indicum*** (Linnaeus) Bentham ex Kurz, Forest Fl. Burma 2: 237. 1877; Aitken in Grierson et Long, Fl. Bhut. 2(3): 1241. 2001. *Bignonia indica* Linnaeus, Sp. Pl. 2: 625. 1753. *Bignonia tuberculata* Roxburgh ex de Candolle, Prodr. 9: 177. 1845. *Bignonia pentandra* Loureiro, Fl. Cochinch. 379. 1790. *Spathodea indica* (Linnaeus) C.H. Persoon, Syn. Pl. 2: 173. 1807.

Trees up to 10 m. Leaves 2 to 4 pinnately compound, 60 – 130 cm; lamina triangular-ovate, 5 – 12 x 3 – 9 cm, glabrous, becoming blue after drying, short acuminate, entire, base subrounded or cordate, oblique. Inflorescences 60 – 140 cm. Flowers usually open at night. Calyx purple, campanulate. Corolla purple-red; tube fleshy; upper lip 2 lobed, lower lip 3 lobed, lobes slightly reflexed. Stamens inserted at middle of corolla tube; anthers ellipsoid, slightly divergent. Disc large, fleshy, 5 lobed. Style 5 – 7 cm. Capsule woody, flattened. Seeds rounded.

*Flowers & Fruits:* September to December.

*Specimen Cited:* Near Forest Bungalow, Rajib & AP Das 0299, dated 10. 02. 2007.

*Local Distribution:* Forests.

*General Distribution:* India: tropical and sub-tropical; Bhutan, China, Nepal, Indonesia, Cambodia, Laos, Malaysia, Myanmar, Philippines, Thailand, Vietnam.

SPATHODEA Palisot de Beauvois, Fl. Oware 1: 46, t. 27. 1805.

***Spathodea campanulata*** Palisot de Beauvois, Fl. Oware 1: 47. 1805. *Spathodea nilotica* Seemon, J. Bot. 3: 333. 1865. *Spathodea tulipifera* (Schuman) G. Don, Gen. Hist. 4: 223. 1838. *Bignonia tulipifera* Schuman, Beskr. Guin. Pl. 273. 1827.

Trees, up to 18 m. Leaves imparipinnate, opposite, estipulate; rachis grooved above, swollen at base; leaflets 9-19, opposite; lamina 5 – 14 x 3 – 7.5 cm, elliptic-oblong to obovate-oblong, acuminate, margin entire, base round to oblique. Flowers bisexual, bright red in terminal racemes. Calyx spathaceous, recurved. Corolla tube bright reddish-orange; lobes 5, deltoid; Stamens subequal, unequally inserted at the base of swollen portion of the tube; staminodium small. Ovary superior, ovate-oblong, pubescent; style slender; stigma 2-lipped, lips flattened. Fruit a capsule, woody, 2-valved; seeds many, winged.

*Flowers & Fruits:* November to May.

*Specimen Cited:* Bochamari, Rajib & AP Das 0176, dated 08. 02. 2007.

*Local Distribution:* Planted in Villages.

*General Distribution:* Cultivated throughout India; Native in Tropical Africa.

**Lamiaceae** Lindley, Nat. Syst. ed. 2. 275. 1836 (*nom. alt. cum Labiatae*); *nom. cons.*

**Key to the genera:**

- 1a. Inflorescences verticillasters 2 to many flowered ..... 2
- 1b. Inflorescences terminal or axillary, racemose, cymose or thyrses ..... 9
- 2a. Style arising above base of ovary; corolla 1 lipped ..... **Ajuga**
- 2b. Style inserted at base of ovary; corolla 2 lipped ..... 3
- 3a. Stamens ascending under upper corolla lip or spreading or projected .... 4
- 3b. Stamens declinate, lying along or included in lower lip of corolla .....7
- 4a. Anthers not globose; corolla tube mostly exserted .....5
- 4b. Anthers globose; corolla tube always included ..... **Pogostemon**
- 5a. Upper lip of corolla mostly short ..... **Anisomeles**
- 5b. Upper lip of corolla larger and convex or galeate .....6
- 6a. Style lobes unequal in length, posterior much shorter than anterior ..... **Leucas**
- 6b. Style lobes subequal or equal in length ..... **Leonurus**
- 7a. Lower lobe of corolla saccate, abruptly reflexed ..... **Hyptis**
- 7b. Lower lobe of corolla navicular or plane or slightly concave ..... 8
- 8a. Lower lobe of corolla longer than other lobes, narrow at base ..... **Isodon**
- 8b. Lower lobe of corolla equal or shorter as other lobes, not  
narrowed at base ..... **Ocimum**
- 9a. Corolla actinomorphic; stamens subequal ..... 10
- 9b. Corolla zygomorphic or slightly oblique; stamens didynamous ..... 11
- 10a. Inflorescences axillary cymes; calyx tube always shorter than fruit ..... **Callicarpa**
- 10b. Inflorescences terminal panicles; calyx inclosing fruit ..... **Tectona**
- 11a. Flower bud conspicuously swollen at tip ..... 12
- 11b. Flower buds not swollen at tip ..... 13
- 12a. Calyx truncate at anthesis ..... **Rotheca**
- 12b. Calyx dentate at anthesis ..... **Clerodendrum**
- 13a. Leaves palmately compound ..... **Vitex**
- 13b. Leaves simple ..... 14
- 14a. Corolla funnellform; stigma lobes very unequal ..... **Gmelina**
- 14b. Corolla tubular; stigma lobes equal ..... **Premna**

ANISOMELES R. Brown, Prodr. 503. 1810.

**Anisomeles indica** (Linnaeus) Kuntze, Revis. Gen. Pl. 2: 512. 1891; Clement in Grierson *et* Long, Fl. Bhut. 2(2): 967. 1999. *Nepeta indica* Linnaeus, Sp. Pl. 571. 1753. *Anisomelis indica* Linnaeus, Sp. Pl. 1: 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. *Monarda zeylanica* Burman *f.*, Fl. Indica 12. 1768. *Marrubium indicum* (Linnaeus) Burman *f.*, Fl. Indica 127. 1768. *Ajuga glabrata* Bentham *ex* Wallich, Numer. List 2041. 1829. *Ajuga disticha* (Linnaeus) Roxburgh, Hort. Bengal. 44. 1814. *Ballota disticha* Linnaeus, Mant. Pl. 1: 83. 1767.



Erect, branched, herbs up to 2 m. Lamina broadly ovate, 4–9 x 2.5–6 cm, abaxially densely white minutely tomentose, acute to short acuminate, irregularly dentate, base broadly truncate cuneate. Flowers in spikes. Calyx hirsute; teeth purple-red, triangular-lanceolate. Corolla purplish; tube funnellform; upper lip oblong; lower lip subhorizontally spreading; middle lobe obcordate; lateral lobes ovate. Ovary glabrous. Nutlets ovoid.

*Flowers & Fruits:* September to December.

*Specimen Cited:* Forest, *Rajib & AP Das 0283*, dated 10.02.2007.

*Local Distribution:* Throughout the study areas.

*General Distribution:* India, Bhutan, Bangladesh, Laos, Malaysia, Cambodia, Myanmar, Philippines, Thailand, Vietnam.

AJUGA Linnaeus, Sp. Pl. 2: 561. 1753.

***Ajuga macrosperma*** Wallich *ex* Benth, Pl. Asiat. Rar. 1: 58. 1830; Clement in Grierson *et* Long, Fl. Bhut. 2(2): 944. 1999. *Bulga macrosperma* (Wallich *ex* Benth) Kuntze, Revis. Gen. Pl. 2: 512. 1891.

Erect herbs, up to 40 cm, pilose to subglabrous when old, young parts densely white villous. Lamina ovate-lanceolate to elliptic-ovate, 4–12 x 2–5 cm, villous to strigose, obtuse to acute, undulate to irregularly undulate-crenate, ciliate, base cuneate-decurrent. Verticillasters 6–12 flowered, in axillary and apically forming spikes; ovate-lanceolate. Calyx funnellform, teeth ovate. Corolla blue to purple, tubular, obliquely spreading; upper lip oblong, straight; middle lobe of lower lip narrowly cordate, emarginate at apex.

*Flowers & Fruits:* January to May.

*Specimen Cited:* Barajan Beel, *Rajib & AP Das 0408*, dated 22.07.2007.

*Local Distribution:* Borojan Beel side herbland.

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

HYPTIS Jacquin, Collectanea 1: 101. 1787, *nom. cons.*

***Hyptis suaveolens*** (Linnaeus) Poiteau, Ann. Mus. Hist. Nat. 7: 472. 1806; Clement in Grierson *et* Long, Fl. Bhut. 2(2): 990. 1999. *Ballota suaveolens* Linnaeus, Syst. Nat. ed. 10 2: 1100. 1759. *Schaueria graveolens* (Blume) Hasskarl, Flora 25(2 Beibl.): 25. 1842. *Mesosphaerum suaveolens* (Linnaeus) Kuntze, Revis. Gen. Pl. 2: 525. 1891. *Marrubium indicum* Blanco, Fl. Filip. 477. 1837. *Bystropogon graveolens* Blume, Bijdr. 824. 1826.

*Vernacular name:* Bontulsi.

Annual, branched, robust herbs, aromatic. Lamina ovate to broadly ovate, 1.5–11 x 1.4–9 cm, adaxially olive green, abaxially pilose, subacute to obtuse, serrulate, base rounded to shallow cordate, oblique. Cymes 2 to 5 flowered, in racemes or panicles. Calyx throat tufted villous, veins very elevated; teeth broadly triangular. Corolla blue; upper lip lobes reflexed; middle lobe of lower lip shorter. Nutlets dark brown.

*Flowers & Fruits:* August to June.

*Specimen Cited:* Forest, *Rajib & AP Das 0318*, dated 21.07.2007.

*Local Distribution:* Pantation forests.

*General Distribution:* India; native in tropical America, widespread tropical weed.

ISODON (Schrader *ex* Benth) Spach, Hist. Nat. Veg. Phan. 9: 162. 1840.

***Isodon rugosus*** (Wallich *ex* Benth) Codd, Taxon 17: 239. 1968; Clement in Grierson *et* Long, Fl. Bhut. 2(2): 997. 1999. *Plectranthus rugosus* Wallich *ex* Benth, Pl. Asiat. Rar. 2: 17. 1830.

*Rabdosia rugosa* (Wallich ex Benth) H.Hara, J. Jap. Bot. 47: 199. 1972.  
*Ocimum densiflorum* Roth, Nov. Pl. Sp. 275. 1821. *Isodon plectranthoides* Schrader ex Benth, Labiat. Gen. Spec. 43. 1832.

Erect shrubs, much branched, up to 2 m; densely stellate tomentose. Stem leaves opposite; lamina ovate to elliptic, 2 – 4 x 0.5 – 2 cm, papery, densely stellate tomentose, obtuse, crenulate, base broadly cuneate to rounded. Cymes axillary, basal cymes long branched to 20 to more flowered, apical cymes 3–5 flowered. Calyx campanulate; teeth broadly triangular, subequal, minute. Corolla white, tinged rose. Stamens included. Nutlets dark brown, triquetrous, oblong.

*Flowers & Fruits:* July to October.

*Specimen Cited:* Forest, Rajib & AP Das 0482, dated 23.07.2007.

*Local Distribution:* Pantation forests.

*General Distribution:* India, Bhutan, Bangladesh, Nepal, Pakistan, Afghanistan.

LEONURUS Linnaeus, Sp. Pl. 2: 584. 1753.

*Leonurus sibiricus* Linnaeus, Sp. Pl. 584. 1753. *Phlomis sibirica* (Linnaeus) Medik., Bot. Beob. 124. 1784. *Leonurus sibiricus* var. *grandiflorus* Benth, Prodr. 12: 502. 1849. *Leonurus occidentalis* Colla, Mem. Reale Accad. Sci. Torino 33: 154. 1829. [PLATE: 7, Figure-64]

*Vernacular name:* Raktadron.

Annual herbs or biennial, up to 80 cm. Lower stem leaves early deciduous. Lamina ovate, 5 – 7 x 2 – 4 cm, sparsely strigose, lobes narrowly oblong-rhombic, 3 lobulate, base broadly cuneate. Verticillasters many flowered, 3 palmatisect; bracteoles spiny, reflexed, shorter than calyx tube, strigose. Flowers sessile. Calyx tubular-campanulate. Corolla reddish to purple-red. Filaments sparsely scaly. Nutlets brown, oblong, triquetrous.

*Flowers & Fruits:* July to September.

*Specimen Cited:* Rasik Beel, Rajib & AP Das 0580, dated 25.07.2007.

*Local Distribution:* Near Noldoba Beel.

*General Distribution:* India, China, Bangladesh, Nepal, Bhutan, Mongolia, Russia.

LEUCAS R. Brown, Prodr. 504. 1810.

### Key to the species:

- 1a. Verticillasters loosely globose, few flowered; calyx teeth narrowly triangular ..... *L. indica*
- 1b. Verticillasters compact-globose, many flowered; calyx teeth broadly triangular ..... *L. aspera*

*Leucas indica* (Linnaeus) R. Brown ex Vatke in Oesterr. Bot. Zeits. 25: 95. 1875; Clement in Grierson et Long, Fl. Bhut. 2(2): 963. 1999. *Leonurus indicus* Linnaeus, Syst. ed 10: 1101. 1760. *Leucas linifolia* (Roth) Spreng., Syst. 2: 743. 1825; Prain, Beng. Pl. 2: 856. 1903. Hooker f., Fl. Brit. Ind. 4: 690. 1885; Haines, Bot. Bihar & Orissa pt. IV: 751. 1922. *Leucas indica* (Linnaeus) Robert Brown ex Smith, Cycl. 20: 5. 1812. *Phlomis indica* Linnaeus, Sp. Pl. 586. 1753. *Spermacoce denticulata* Walpers, Nova Acta Acad. Caes. Leop.-Carol. German. Nat. Cur. 19 (Suppl. 1): 353. 1843. *Leucas zeylanica* var. *linearis* L.H.Cramer, Revised Handb. Fl. Ceylon 3: 184. 1981. [PLATE: 10, Figure-108]

*Vernacular name:* Madhuful.

Annual herbs, up to 30 cm. Lamina linear, 2.5 – 5 x 1 – 1.3 cm, obtuse, margin sparsely crenate to subentire. Verticillasters loosely globose, few flowered, densely hispid; bracts linear, as long as calyx. Calyx tubular; mouth oblique, erect; teeth straight, narrowly triangular. Corolla white, slightly longer than calyx tube. Nutlets brown, oblong.

*Flowers & Fruits:* Through out the Year.

*Specimen Cited:* Garden, *Rajib & AP Das 0292*, dated 10. 02. 2007.

*Local Distribution:* Throughout the study areas.

*General Distribution:* Pantropical hemisphere.

*Leucas aspera* (Willdenow) Link, Enum. Hort. Berol. Alt. 2: 113. 1822; Clement in Grierson *et* Long, Fl. Bhut. 2(2): 963. 1999. *Phlomis aspera* Willdenow, Enum. Pl. 621. 1809. *Leucas dimidiata* Bentham, Prodr. 12: 532. 1848. *Leucas obliqua* Buchanan-Hamilton *ex* Dillwyn, Rev. Hortus Malab. 57. 1839. *Phlomis obliqua* Buch.-Hamilton *ex* Hooker *f.*, Fl. Brit. India 4: 690. 1885.

*Vernacular name:* Madhuful.

Annual herbs, up to 40 cm. Lamina linear to oblong-linear, 2.5 – 6 x 1 – 1.5 cm, obtuse, margin sparsely crenate to subentire. Verticillasters compactly globose, many flowered, densely hispid; bracts linear, as long as calyx, margin hispid ciliate. Calyx tubular; mouth oblique, erect; teeth straight, broadly triangular. Corolla white, slightly longer than calyx tube. Nutlets brown, oblong, triquetrous.

*Flowers & Fruits:* Through out the Year.

*Specimen Cited:* Conservation sector, *Rajib & AP Das 0138*, dated 07. 02. 2007.

*Local Distribution:* Throughout the study areas.

*General Distribution:* India, Indonesia, Malaysia, Philippines, Thailand.

OCIMUM Linnaeus, Sp. Pl. 2: 597. 1753.

### Key to the species:

- 1a. Posterior filaments dentate at base ..... *O. basilicum*
- 1b. Posterior filaments puberulent at base..... *O. tenuiflorum*

*Ocimum basilicum* Linnaeus, Sp. Pl. 1: 597. 1753; Hooker *f.* in Hooker *f.*, Fl. Brit. Ind. 4: 608. 1885; Prain, Beng. Pl. 2: 842. 1903; Clement in Grierson *et* Long, Fl. Bhut. 2(2): 1001. 1999; Haines, Bot. Bihar & Orissa Pt. IV: 728. 1922. *Ocimum album* Linnaeus, Mant. Pl. 1: 85. 1767. *Ocimum ciliare* B. Heyne *ex* Hooker *f.*, Fl. Brit. India 4: 608. 1885. *Ocimum caryophyllatum* Roxburgh, Fl. Ind. ed. 1832 3: 16. 1832. *Ocimum basilicum* var. *album* (Linnaeus) Bentham, Pl. Asiat. Rar. 2: 13. 1830. [PLATE: 6, Figure-61]

*Vernacular name:* Tulsi.

Erect, annual herbs, up to 80 cm. Lamina ovate to oblong, Fl. Bhut. 2: 5 – 5 x 1 – 2.5 cm, subobtuse to acute, irregularly dentate or subentire, base attenuate. Thyrses 10 – 20 cm; bracts sessile, oblanceolate, base attenuate, ciliate, acute. Calyx campanulate, concave, mucronate. Corolla white, limb puberulent outside. Stamens free, slightly exserted, posterior 2 dentate, base puberulent. Nutlets dark brown, ovoid.

*Flowers & Fruits:* July to December.

*Specimen Cited:* Garden, *Rajib & AP Das 0321*, dated 21.07.2007.

*Local Distribution:* Garden.

*General Distribution:* India; Tropical Asia, Africa.

***Ocimum tenuiflorum*** Linnaeus, Sp. Pl. 2: 597. 1753; Clement in Grierson *et* Long, Fl. Bhut. 2(2): 1002. 1999. *Ocimum sanctum* Linnaeus, Mant. Pl. 1: 85. 1767. *Ocimum subserratum* B. Heyne *ex* Hooker *f.*, Fl. Brit. India 4: 609. 1885. *Ocimum sanctum* var. *hirsutum* (Bentham) Hooker *f.*, Fl. Brit. India 4: 609. 1885. *Ocimum scutellarioides* Willdenow *ex* Bentham, Linnaea 11: 344. 1837. *Ocimum inodorum* Burman *f.*, Fl. Indica 130. 1768. *Ocimum hirsutum* Bentham, Pl. Asiat. Rar. 2: 14. 1830.

*Vernacular Name:* Kalo Tulsi.

Erect, subshrubs, up to 1 m, much branched. Lamina oblong, Fl. Bhut. 2.5 – 5.5 x 1 – 3 cm, obtuse, shallowly undulate-serrate, base cuneate to rounded. Verticillasters 6 flowered, in terminal thyrses or panicles; bracts sessile, cordate. Calyx campanulate, villous; middle tooth of upper lip broadly obovate; lateral teeth broadly triangular, shorter than lower lip teeth. Corolla white to reddish purple, slightly exerted. Stamens slightly exerted, free; posterior filaments puberulent at base. Nutlets brown, ovoid.

*Flowers & Fruits:* February to August.

*Specimen Cited:* Bochamari, Rajib & AP Das 0560, dated 24.07.2007.

*Local Distribution:* Panted in Villages.

*General Distribution:* Throughout India; Malaysia, Myanmar, Philippines, Thailand, Cambodia, Indonesia, Laos, Vietnam; Africa, SWAsia, Australia.

POGOSTEMON Desfontaines, M m. Mus. Hist. Nat. 2: 154. 1815.

***Pogostemon amaranthoides*** Bentham in de Candolle, Prodr. 12: 153. 1848; Clarke in Hooker *f.*, Fl. Brit. Ind. 4: 634. 1885; H. Ohashi in Hara, Fl. E. Himal. 280. 1966; Clement in Grierson *et* Long, Fl. Bhut. 2(2): 985. 1999.

Herbs; stems erect or sprawling, pubescent – tomentose in young. Leaves ovate – lanceolate, acute – acuminate, base cuneate-attenuate, numerous glands on lower surface. Calyx obovoid; corolla white. Nutlets trigonous.

*Flowers & Fruits:* September to October.

*Specimen Cited:* Forest, Rajib & AP Das 0603, dated 26.07.2007.

*Local Distribution:* Pantation forests.

*General Distribution:* India, Bhutan, China; pantropical.

CALLICARPA Linnaeus, Sp. Pl. 1: 111. 1753.

***Callicarpa arborea*** Roxburgh, Fl. Ind. 1: 405. 1820; Long in Grierson *et* Long, Fl. Bhut. 2(2): 919. 1999. *Callicarpa arborea* Roxburgh *ex* Clarke in Hooker *f.*, Fl. Brit. Ind. 4: 567. 1885; H. Ohashi in Hara, Fl. E. Himal. 1: 268. 1966; Hara *et al.*, Enn. Fl. Pl. Nep. 3: 145. 1982; Grierson & Long, Fl. Bhut. 2(2): 919. 1999. *Premna arborea* (Roxburgh) Roth, Nov. Pl. Sp. 287. 1821. *Aganum umbellata* Rafinesque, Sylva Tellur. 161. 1838. *Callicarpa magna* Schauer, Prodr. 11: 641. 1847.

Trees, up to 8 m; branchlets, inflorescences, and petioles densely tomentose, hairs stellate. Leaf blade elliptic to elliptic-ovate, 15 – 35 x 7 – 12 cm, leathery, abaxially densely yellow-brown stellate tomentose, adaxially dark green and shiny, base cuneate to rounded, margin entire. Cymes 6 – 10 cm across; peduncle 4 angled, longer than petioles. Calyx cup-shaped, truncate, outside densely gray stellate tomentose. Corolla purple. Stamens much longer than corolla. Ovary densely stellate tomentose. Fruit purple-brown.

*Flowers & Fruits:* April to November.

*Specimen Cited:* Forest, Rajib & AP Das 0295, dated 10. 02. 2007.

*Local Distribution:* Forests.

*General Distribution:* India, Bhutan, China, Myanmar, Malaysia.

CLERODENDRUM Linnaeus, Sp. Pl. 2: 637. 1753.

**Key to the species:**

- 1a. Leaves whorled with 4 – 5 per node ..... *C. indicum*
- 1b. Leaves opposite at node ..... 2
- 2a. Petiole up to 5 cm; flowers in terminal thyrses with dens flowers ..... *C. infortunatum*
- 2b. Petiole up to 18 cm; flowers in terminal lax thyrses with few flowers ..... *C. japonicum*

***Clerodendrum indicum*** (Linnaeus) O. Kuntze, Rev. Gen. Pl. 2: 586. 1891; Long in Grierson *et* Long, Fl. Bhut. 2(2): 931. 1999. *Siphonanthus indicus* Linnaeus, Sp. Pl. 1: 109. 1753. *Clerodendrum siphonanthud* R. Brown in Aiton *f.*, Hort. Kew. 4: 65. 1812; Clarke in Hooker *f.*, Fl. Brit. Ind. 4: 593. 1885. *Clerodendrum verticillatum* D. Don, Prodr. Fl. Nepal. 102. 1825. *Clerodendrum indicum* f. *Semiserratum* (Wallich) Moldenke, Phytologia 22(3): 214. 1971.

Subshrubs to shrubs, up to 4 m. Branchlets purple to purplish, channeled, smooth. Leaves whorled with 4 – 5 per node, subsessile; leaf blade narrowly lanceolate to oblong-lanceolate, 10 – 20 x 1 – 2 cm, membranous, glabrous, base attenuate, margin entire, apex short acuminate; midvein prominent. Inflorescences terminal leafy thyrses; cymes red, many flowered; bracts linear-lanceolate to lanceolate. Calyx densely minute round glandular; lobes ovate-lanceolate, apex acute. Corolla white, becoming cream colored; tube funnellform, curved; lobes spreading, lanceolate to elliptic-oblong, apex obtuse. Stamens long exserted. Ovary glabrous. Fruiting calyx crimson, leathery. Drupes dark blue.

*Flower & Fruits:* June to February.

*Specimen Cited:* Forest, Rajib & AP Das 0316, dated 10. 02. 2007.

*Local Distribution:* Near Deer Rehabilitation centre.

*General Distribution:* India, Bhutan, Bangladesh, Sri Lanka, Myanmar, Nepal, S. China and Malaysia.

***Clerodendrum infortunatum*** Linnaeus, Sp. Pl. 637. 1753. *Clerodendrum viscosum* Ventenat, Jord. Malm. f. 1803; Deb *et al.*, Fl. Ass. 3: 487. 1939; Long in Grierson *et* Long, Fl. Bhut. 2(2): 934. 1999; Prain, Beng. Pl. 2: 82. 1903. *Clerodendrum calycinum* Turczaninow, Bull. Soc. Imp. Naturalistes Moscou 36(2): 222. 1863. *Clerodendrum viscosum* Ventenat, Jard. Malmaison t. 25. 1803. [PLATE: 7, Figure-68]

*Vernacular name:* Vant.

Shrubs, up to 2 m. Branchlets 4 angled, pubescent. Leaves opposite; petiole up to 5 cm, densely pubescent; lamina subcordate, 4 – 14 x 3 – 12 cm, sparsely pubescent, base cordate, margin sparsely serrulate to dentate, acute to obtuse. Inflorescences terminal thyrses with dens flowers; bracts and bractlets reddish or green. Calyx red, deeply 5 lobed, pubescent; lobes ovate-lanceolate to ovate. Corolla red; lobes oblong. Stamens and style longer than corolla tube. Fruiting calyx much longer than fruit, becoming reflexed. Drupes green when young, subglobose.

*Flower & Fruits:* January to September.

*Specimen Cited:* Forest, Rajib & AP Das 0398, dated 22.07.2007.

*Local Distribution:* Throughout forest and open shrubland.

*General Distribution:* India, Bhutan, China, Sri Lanka, Myanmar, Australia.

***Clerodendrum japonicum*** (Thunberg) Sweet, Hort. Brit. 822. 1826; Long in Grierson *et* Long, Fl. Bhut. 2(2): 934. 1999. *Volkameria japonica* Thunberg, Syst. Nat. ed. 14: 578. 1784. *Volkameria dentata* Roxburgh, Fl. Ind. ed. 3: 61. 1832. *Clerodendrum coccineum* H.J.Lam, Verben. Malay. Archip. 296. 1919. *Volkameria japonica* Thunberg, Nova Acta Regiae Soc. Sci. Upsal. 3: 203. 1780.

*Vernacular name:* Bara Vant.

Shrubs, up to 4 m. Branchlets 4 angled, pubescent, nodes sometimes villous. Petiole up to 18 cm, densely yellow-brown pubescent; lamina subcordate, 8–35 x 6–25 cm, sparsely pubescent, base cordate, margin sparsely serrulate to dentate, apex acuminate to acute. Inflorescences terminal thyrses; bracts and bractlets usually reddish. Calyx red, deeply 5 lobed, pubescent, outside glandular; lobes ovate-lanceolate to ovate. Corolla red; lobes oblong. Stamens and style longer than corolla tube. Fruiting calyx much longer than fruit, becoming reflexed. Drupes green when young, blue-black at maturity, subglobose.

*Flowers & Fruits:* May to November.

*Specimen Cited:* Forest, Rajib & AP Das 0430, dated 22.07.2007. *Status:*

*Local Distribution:* Throughout forest and open shrubland.

*General Distribution:* India, Bhutan, Bangladesh, Indonesia, Laos, Malaysia, Vietnam.

ROTHECA Rafinesque-Schmaltz, Fl. Tellur. 4: 69. 1838.

***Rotheca serrata*** (Linnaeus) Steane & Mabberley, Novon 8: 206. 1998. *Clerodendrum serratum* (Linnaeus) Moon, Cat. Ceylon Pl. 46. 1824; Hara *et al.*, Enn. Fl. Pl. Nep. 3: 146. 1982; Long in Grierson *et* Long, Fl. Bhut. 2(2): 933. 1999. *Volkameria serrata* Linnaeus, Mant. Pl. 90. 1767. *Volkameria serrata* Linnaeus, Mant. Pl. 1: 90. 1767. *Volkameria herbacea* Roxburgh, Hort. Bengal. 46. 1814. *Clerodendrum grandifolium* Salisbury, Prodr. Stirp. Chap. Allerton 108. 1796.

Shrubs, up to 3 m. Branchlets densely yellow pubescent, becoming dark brown to gray-yellow and glabrous. Leaves opposite or in threes; leaf sessile; leaf blade obovate-oblong to elliptic-ovate, 6–22 x 3–7 cm, papery, pubescent, margin serrulate, apex acuminate to acute; veins abaxially prominent. Inflorescences terminal thyrses, densely yellow-brown pubescent, cymes sometimes monochasial; bracts sessile, ovate to broadly ovate, pubescent; bractlets lanceolate. Calyx truncate, pubescent. Corolla white, bluish; lobes oblong. Stamens long exerted, base pubescent. Ovary glabrous. Style long exerted. Drupes green when young, becoming black, subglobose.

*Flowers & Fruits:* July to February.

*Specimen Cited:* Batikata Beel, Rajib & AP Das 0463, dated 23.07.2007.

*Local Distribution:* Batikata Beel marginal forest.

*General Distribution:* India, Bhutan, China, Sri Lanka, Bangladesh, Myanmar.

GMELINA Linnaeus, Sp. Pl. 2: 626. 1753.

***Gmelina arborea*** Roxburgh, Hort. Bengal. 46. 1814; Pl. Corom. 3: 4. t. 246. 1815; Clarke in Hooker *f.*, Fl. Brit. Ind. 4: 581. 1885; H. Ohashi in Hara, Fl. E. Himal. 2: 113. 1971; Hara *et al.*, Enn. Fl. Pl. Nep. 3: 147. 1982; Long in Grierson *et* Long, Fl. Bhut. 2(2): 928. 1999. *Gmelina sinuata* Link, Enum. Hort. Berol. Alt. 2: 128. 1822. *Gmelina arborea* var. *canescens* Haines, Forest Fl. Chota Nagpur 82. 1910.

*Vernacular name:* Gamabri

Trees, up to 15 m; bark grayish brown; branchlets, petioles and inflorescences densely yellow-brown tomentose. Branchlets slightly 4 angled when young, becoming terete, lenticellate, leaf scars

prominent. Petiole terete; leaf blade broadly ovate, 8 – 20 x 5 – 15 cm, papery, base broadly cuneate to subcordate, apex acuminate; veins abaxially prominent. Inflorescences terminal, narrow thyrses. Calyx with several black discoid gland patches; teeth 5, sharply triangular. Corolla yellow, 2-lipped, sparsely glandular. Ovary glabrous, glandular. Stigma unequally 2 cleft. Drupes yellow when ripe and black when dry, obovoid-ellipsoid.

Flowers & Fruits: February to June.

*Specimen Cited*: Rasik Beel village, *Rajib & AP Das 0524*, dated 23.07.2007.

*Local Distribution*: Panted in Villages.

*General Distribution*: India, Bhutan, Nepal, Sri Lanka and Philippines.

TECTONA Linnaeus f., Suppl. Pl. 151. 1781 (publ. 1782), *nom. cons.*

***Tectona grandis*** Linnaeus f., Suppl. Pl. 151. 1782; Clarke in Hooker f., Fl. Brit. Ind. 4: 570. 1885; Long in Grierson *et* Long, Fl. Bhut. 2(2): 921. 1999. *Tectona theca* Loureiro, Fl. Cochinch. 137. 1790. *Theka grandis* (Linnaeus f.) de Lamarck, Tabl. Encycl. 2: 111. 1797. *Jatus grandis* (Linnaeus f.) Kuntze, Revis. Gen. Pl. 2: 508. 1891.

*Vernacular name*: Segun.

Trees, up to 40 m. Branchlets gray to grayish brown, 4 angled, yellowish to grayish brown stellate tomentose. Petiole robust, 3 cm; leaf blade ovate-elliptic to ovate, 15 – 50 x 8 – 25 cm, papery, abaxially densely grayish brown to yellowish brown, minutely stellate tomentose, puberulent along veins, base cuneate and de-current, margin entire, apex acuminate to obtuse, veins 7 to 12 pairs. Panicles 30 - 40 cm. Flowers fragrant. Calyx tube with white stellate hairs. Corolla white; tube outside puberulent glandular; lobes obtuse. Ovary strigose. Style 3 mm. Fruit globose, minutely tomentose.

*Flowers & Fruits*: June to December.

*Specimen Cited*: Forest, *Rajib & AP Das 0682*, dated 14. 02. 2008.

*Local Distribution*: Pantation forests.

*General Distribution*: Indo- Malaysia.

VITEX Linnaeus, Sp. Pl. 2: 638. 1753.

***Vitex negundo*** Linnaeus, Sp. Pl. 638. 1753; Clarke in Hooker f., Fl. Brit. Ind. 4: 583. 1885; H. Ohashi in Hara, Fl. E. Himal. 1: 270. 1966; Long in Grierson *et* Long, Fl. Bhut. 2(2): 926. 1999. *Agnus-castus negundo* (Linnaeus) Carri re, Rev. Hort. 42: 415. 1871. *Vitex nogondo* Linnaeus, Hortus Maurit. 258. 1837.

*Vernacular Name*: Nishinda.

Shrubs to small trees. Branchlets densely gray tomentose. Leaves 3 – 5 foliolate; central leaflet distinctly petiolulate, 4 – 13 x 1 – 4 cm, leaflets lanceolate, oblong-lanceolate, base cuneate, margin entire. Inflorescences 10 – 27 cm; peduncle densely gray tomentose. Calyx campanulate, 5 dentate, gray tomentose. Corolla 2 lipped. Stamens exerted. Ovary subglabrous.

*Flower & Fruits*: April to October.

*Specimen Cited*: Bochamari, *Rajib & AP Das 0513*, dated 23.07.2007.

*Local Distribution*: Panted in Villages.

*General Distribution*: India, Bhutan, China, Sri Lanka, Afganistan, Myanmar, Malaysia.

PREMNA Linnaeus, Mant. Pl. 154. 1771, *nom. cons.*

**Key to the species:**

- 1a. Trees; leaves opposite, ovate, cordate ..... *P. latifolia*  
 1b. Subshrubs; leaves rosulate; obovate-oblong to spatulate ..... *P. herbacea*

***Premna latifolia*** Roxb., Fl. Ind. 3: 76. 1832; Hooker f., Fl. Brit India 4: 577. 1885; Long in Grierson *et* Long, Fl. Bhut. 2(2): 924. 1999.

*Vernacular name:* Guniari.

Small trees, up to 8 m. Branchlets dark brown, striate, pubescent when young, subglabrescent. Leaves simple, opposite, estipulate; lamina ovate-oblong to ovate, subrounded or cordate, 5 – 12 x 3 – 5 cm, papery, abaxially densely yellow pilose, base cuneate, rounded, apex acuminate; veins 5 – 7 pairs, reticulate veins obscure. Flowers bisexual, in terminal corymbose cymes; bracts linear, deciduous. Calyx slightly 2 lipped, 5 dentate, outside minutely hirsute, inside glabrous. Corolla dusty yellow, slightly 2 lipped, 5 lobed, outside puberulent, villous in throat. Stamens equal or longer than style, exerted; anthers black. Drupe black, tuberculate, glabrous.

*Flowers & Fruits:* March to June.

*Specimen Cited:* Rasik Beel village, *Rajib & AP Das 0453*, dated 22.07.2007.

*Local Distribution:* Panted in Villages.

*General Distribution:* India: Cambodia, Indonesia, Laos, Myanmar, Philippines, Vietnam

***Premna herbacea*** Roxburgh, Fl. Ind. ed. 1832, 3: 80. 1832; Long in Grierson *et* Long, Fl. Bhut. 2(2): 925. 1999. *Gumira herbacea* (Roxburgh) Kuntze, Revis. Gen. Pl. 2: 507. 1891. *Premna obovata* Merrill, J. Arnold Arbor. 32: 77. 1951.

Subshrubs up to 5 cm. Rhizomes woody. Branches glabrous. Leaves rosulate; lamina obovate-oblong to spatulate, 3 – 10 x 2 – 7 cm, sparsely pubescent and yellow glandular, base cuneate, margin serrate to sparsely crenulate, apex rounded. Inflorescences paniculate capitate corymbs; peduncle densely puberulent; bracts linear to lanceolate. Calyx cup-shaped, outside pubescent and yellow glandular. Corolla purple, white in bloom, slightly 2 lipped, 4 lobed, outside puberulent. Ovary 2 locular.

*Flowers & Fruits:* June to August.

*Specimen Cited:* Road side, *Rajib & AP Das 0338*, dated 21.07.2007.

*Local Distribution:* Road near Leopard rehaBeelitation centre.

*General Distribution:* India, Bhutan, Nepal, Cambodia, Laos, Myanmar, New Guinea, Philippines, Thailand, Vietnam; Australia.

**Lentibulariaceae** L.C. Richard in Poiteau *et* Turpin, Fl. Paris 1: 26. 1808 ('Lenti- bularieae'); *nom. cons.*

UTRICULARIA Linnaeus, Sp. Pl. 1: 18. 1753.

#### Key to the species:

- 1a. Flowers pale yellow with violet spots; capsule globose ..... *U. inflexa*  
 1b. Flower fully bright yellow; capsule sub globose ..... 2  
 2a. Inflorescences with 1 to 3 flowered ..... *U. gibba*  
 2b. Inflorescences with 3 to 10 flowered ..... *U. aurea*

***Utricularia aurea*** Loureiro, Fl. Cochinch. 26. 1790; Noltie in Grierson *et* Long, Fl. Bhut. 2(3): 1339. 2001. *U. flexuosa* Vahl, Fnum. Pl. 1: 198. 1804; Clark in Hooker f., Fl. Brit. Ind. 4: 329. 1884; Prain, Beng. Pl. 2: 581. 1903. *Utricularia blumei* (A. de Candolle) Miquel, Fl. Ned. Ind. 2: 997. 1859. *Utricularia confervifolia* Jackson & D. Don, Prodr. Fl. Nepal. 84. 1825.



*Utricularia fasciculata* Roxburgh, Hort. Bengal. 4. 1814 *Utricularia extensa* Hance, Ann. Bot. Syst. 3: 3. 1852. [PLATE: 8, Figure-89]

*Vernacular name:* Jhanji.

Aquatic floating or suspended herbs; rhizoids usually present. stolons much branched. Stolons filiform to relatively thick, branched. Traps on leaf segments, stalked, obliquely ovoid. Leaves numerous on stolons, 2–8 cm, submerged; whorled, multifid into filiform segments, interspersed with bladders. Inflorescences erect, 9–25 cm, 3 to 10 flowered; bracts basifixed. Calyx lobes ovate, enlarged in fruits. Corolla yellow, lower lip transversely elliptic, base with a prominent 2-lobed swelling. Filaments curved. Ovary ovoid. Capsules globose.

*Flowers & Fruits:* September to January

*Specimen Cited:* Ververi Beel, *Rajib & AP Das 0077*, dated 06. 02. 2007.

*Local Distribution:* Throughout Wetlands.

*General Distribution:* India, China, Nepal, Pakistan, Sri Lanka, Thailand, Vietnam, Malaysia to Tropical Australia.

*Utricularia gibba* Linnaeus, Sp. Pl. 18. 1753; Noltie in Grierson *et* Long, Fl. Bhut. 2(3): 1340. 2001. *Utricularia gibbosa* Linnaeus ssp. *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: 581. 1903. *Utricularia diantha* Roxburgh *ex* Roemer & Schultes, *Mant. Pl. 1: 169. 1822. Utricularia diflora* Roxburgh, *Hort. Bengal. 4. 1814. Utricularia gracilis* Kunth, *Nov. Gen. Sp. (quarto ed.) 2: 225. 1818. Utricularia gibbosa* Hill, *Veg. Syst. 20: 45. 1772. [PLATE: 8, Figure-90]*

*Vernacular name:* Jhanji.

Small, submerged aquatic herbs, usually floating at maturity. Stolons filiform, much branched, often mat-forming. Traps lateral on leaf segments, stalked, ovoid. Leaves numerous on stolons, sparsely filiform simple or divided with capillary segments, one or more represented by racemes; spur conical obtuse. Inflorescences erect, 2–15 cm, 1 to 3 flowered. Calyx lobes subequal, broadly ovate to orbicular. Corolla yellow; lower lip slightly smaller than upper lip, base with a prominent 2-lobed swelling. Ovary globose. Capsules globose; seeds orbicular, flat.

*Flowers & Fruits:* September to January

*Specimen Cited:* Batikata Beel, *Rajib & AP Das 0356*, dated 21.07.2007.

*Local Distribution:* Throughout Wetlands.

*World distribution:* India (Throughout), Bhutan, Nepal, Sri Lanka, Malaysia, China and Africa.

*Utricularia inflexa* Forsskal, Fl. Aegypt.-Arab. 9. 1775. *Utricularia inflexa* Forsskarl var. *stellaris* (Linnaeus *f.*) Taylor, Mitt. Bot. Staat. Munchen 4: 96. 1961 & Kew Bull. 18: 204. 1964. *Utricularia stellaris* Linnaeus *f.* Suppl. 86. 1781; Taylor, Polhill, Fl. Trop. E. Africa-Lentibulariaceae 16: 1973; Clarke, Hooker *f.*, Fl. Brit. Ind. 4: 328. 1884; Prain, Beng. Pl. 2: 581. 1903.

*Vernacular name:* Jhanji.

Submerged aquatic herbs with exposed scape, supported on whorls of spongy floats. Leaves highly dissected. Flowers in aerial racemes; calyx enlarged in fruits; corolla yellow or cream. Capsules globose.

*Flowers & Fruits:* September to January.

*Specimen Cited:* Raichangmari Beel, *Rajib & AP Das 0658*, dated 13. 02. 2008.

*Local Distribution:* Throughout Wetlands.

*General Distribution:* India, Sri Lanka, Malaya, S.E. Asia, Australia and Africa.

**Linderniaceae** Borsch, Kai Mueller *et* Eberhard Fischer, Pl. Biol. (Stuttgart) 7(1): 76. 2005.

**Key to the genera:**

- 1a. Calyx 5-angular; capsule septum persistent ..... *Lindernia*  
 1b. Calyx 5-winged; capsule septum not persistent ..... *Torenia*

LINDERNIA Allioni, Mlanges Philos. Math. Soc. Roy. Turin. 3: 178. 1766.

**Key to the species:**

- 1a. Leaves sessile ..... 2  
 1b. Leaves petiolate ..... 3  
 2a. Leaf margin entire to weakly obtusely toothed ..... *L. procumbens*  
 2b. Leaf margin densely aristate-serrate ..... *L. ciliata*  
 3a. Leaves ovate ..... 4  
 3b. Leaves oblong to oblong oblanceolate ..... *L. antipoda*  
 4a. Corolla white ..... 5  
 4b. Corolla purple ..... *L. crustacea*  
 5a. Capsule linear-ovoid ..... *L. anagallis*  
 5b. Capsule globose ..... *L. viscosa*

*Lindernia anagallis* (Burman f.) Pennell in J. Arnold Arbor. 24(3): 252-253. 1943; Mooney, Suppl. Bot. Bihar & Orissa 100. 1950; Mill in Grierson *et* Long, Fl. Bhut. 2(3): 1123. 2001; Panda *et* Das, Fl. Sambalp. 252. 2004. *Ruellia anagallis* Burman f., fl. Indica 135. 1768. *Vandellia penunculata* Benth, Scorph. India. 37. 1835; Hooker f. in Hooker f., Fl. Brit. Ind. 4: 282. 1884; Prain, Beng. Pl., 2: 769. 1903. *Vandellia cordifolia* (Colsm.) G. Don, Gen. Syst. 4: 549. 1838; Haines, Bot. Bihar & Orissa pt. IV: 610. 1922; Mooney, Suppl. Bot. Bihar & Orissa 94. 1950. *Vandellia anagallis* (Burman f.) T. Yamaz., J. Jap. Bot. 30(6): 176. 1955. *Lindernia cordifolia* (Colsm.) Merr., Enum. Philipp. Fl. Pl. 3: 437. 1923.

Annuals, creeping herbs, up to 40 cm; rooting from nodes. Leaves short petiolate to sessile; lamina triangular-ovate to ovate – oblong, 0.5 – 2 x 0.7 – 1.5 cm, glabrous, rounded to acute, shallowly crenate, base truncate to subcordate. Flowers axillary, solitary. Calyx basally connate; lobes narrowly lanceolate. Corolla white; lower lip slightly longer than upper lip, spreading flat, 3 lobed; upper lip ovate, 2 lobed. Filaments with a clavate appendage. Stigma 2 lobed. Capsule linear-ovoid. Seeds ovoid.

*Flowers & Fruits:* February to October.

*Specimen Cited:* Batikata Beel Margin, Rajib & AP Das 0665, dated 13. 02. 200

*Local Distribution:* Beel margins through out.

*General Distribution:* India, Bhutan, Sri Lanka, Japan, Myanmar, Malaysia, Indonesia, Siam, China, Philippines Islands and Java.

*Lindernia ciliata* (Colsmann) Pennell, J. Arnold Arbor. 24(3): 253. 1943; Mill in Grierson *et* Long, Fl. Bhut. 2(3): 1125. 2001. *Gratiola ciliate* Colsmann, Prodr. Descr. Gratiol. 14. 1793. *Ilysanthes serrata* (Roxburgh) Urban, Ber. Deutsch. Bot. Ges. 2: 436. 1884.

Annual, diffuse herbs, up to 20 cm. Leaves sessile; lamina oblong to lanceolate-oblong, 0.6 – 5 x 0.3 – 1.5 cm, glabrous, acute to obtuse, densely aristateserrate, base amplexicaul. Racemes terminal; bracts lanceolate. Calyx lobes narrowly lanceolate. Corolla white, lower lip as long as upper lip, middle lobe larger than other lobes; upper lip ovate. Fertile stamens 2, posterior; reduced stamens 2, anterior. Style as long as fertile stamens. Capsule cylindrical. Seeds irregularly triangular.

*Flowers & Fruits:* March to October.

*Specimen Cited:* Forest, Rajib & AP Das 0535, dated 23.07.2007.

*Local Distribution:* Throughout study areas.

*General Distribution:* India, Bhutan, China, Japan, Laos, Malaysia, Myanmar, Cambodia, Philippines, Vietnam; N Australia.

***Lindernia crustacea*** (Linnaeus) F. Mueller, Syst. Census Austral. Pl. 1: 97. 1882; Pennell, Scroph. West. Himal. 29. 1943; Mill in Grierson *et* Long, Fl. Bhut. 2(3): 1124. 2001; Guha Bakshi, Fl. Mur. Dist. 227. 1984. *Capraria crustacea* Linnaeus, Mant. Pl. 1: 87. 1767; *Vandellia crustacea* Benth. Scroph. Ind. 35. 1835; Hooker *f.*, Fl. Brit. Ind. 4: 279. 1884; Prain, Beng. Pl. 2: 768. 1903. *Pyxidaria crustacea* (Linnaeus) Kuntze, Revis. Gen. Pl. 2: 464. 1891. *Antirrhinum hexandrum* Forssk., Fl. Aegypt.-Arab. 43. 1775. *Gratiola lucida* Willdenow, Sp. Pl. 1: 103. 1797. *Torenia scabra* R. Brown, Prodr. 440. 1810. *Vandellia alba* Benth. Scroph. Ind. 35. 1835. *Gratiola aspera* Roth, Nov. Pl. Sp. 11. 1821.

Spreading, annuals herbs, up to 20 cm. Leaves shortly petiolate; lamina triangular-ovate to broadly ovate, 1 – 3 x 0.5 – 1.5 cm, obtuse to subacute, shallowly crenate or serrate, base broadly cuneate to rounded. Flowers axillary and solitary. Pedicel slender. Calyx shallowly lobed; lobes triangular-ovate. Corolla purple; tube slightly longer than calyx; lower lip 3 lobed; upper lip ovate. Stamens didynamous. Style fugacious. Capsule broadly ellipsoid. Seeds pale yellow-brown, subglobose.

*Flowers & Fruits:* Throughout the year.

*Specimen Cited:* Forest, Rajib & AP Das 0457, dated 23.07.2007.

*Local Distribution:* Throughout study areas.

*General Distribution:* widely distributed in tropics and subtropics.

***Lindernia antipoda*** (Linnaeus) Alston in Trimen, Handb. Fl. Ceyl. Suppl. 6: 24. 1931; Mill in Grierson *et* Long, Fl. Bhut. 2(3): 1125. 2001. *Ruellia antipoda* Linnaeus, Sp. Pl. 2: 635. 1753. *Bonnaya veronicifolia* (Retzius) Sprengel, Syst. 1: 41. 1824; Hooker *f.*, Fl. Brit. Ind. 4: 285. 1884. *Ilysanthes antipoda* (Linnaeus) Merrill, Interpr. Rumph. Herb. Amb. 467. 1917. *Lindernia veronicifolia* (Retzius) F. Muell., Fragm. Pl. Filip. 6: 101. 1867. *Vandellia veronicifolia* (Retz.) Haines, Bot. Bihar Orissa 4: 633. 1922.

Annuals herbs, up to 30 cm. Petiole short and wide; lamina oblong to oblong-oblongate, 0.6 – 4 x 0.5 – 2 cm, glabrous, acute to rounded, obscurely to sharply serrate, base cuneate and decurrent. Racemes terminal, 4 – 18 flowered. Calyx lanceolate. Corolla purple or white; lower lip 3 lobed; upper lip 2 lobed. Fertile stamens 2, posterior. Reduced stamens 2, anterior; filaments slightly curved. Stigma lamellate. Capsule cylindrical. Seeds brown, irregularly triangular-ovoid.

*Flowers & Fruits:* March to September.

*Specimen Cited:* Bochamari crop field, Rajib & AP Das 0339, dated 21.07.2007.

*Local Distribution:* Throughout study areas.

*General Distribution:* India, Bhutan, Nepal, Japan, Sri Lanka, Laos, Malaysia, Myanmar, Cambodia, Philippines, Thailand, Vietnam; Australia, Pacific Islands.

***Lindernia procumbens*** (Krocker) Borb. s, B k s V megye 80. 1881; Mill in Grierson *et* Long, Fl. Bhut. 2(3): 1121. 2001. *Vandellia erecta* Benth. Scroph. Ind. 36. 1835. *Lindernia erecta* (Benth.) Bonati, Fl. G n. Indo-Chine 4: 420. 1927. *Anagalloides procumbens* Krocker, Fl. Siles 2(1): 398. 1790.

Erect, much branched, herbs, up to 20 cm. Leaves sessile, elliptic to oblong, 1 – 3 x 0.6 – 1.5 cm, glabrous, obtuse to rounded, margin entire to weakly obtusely toothed. Flower axillary, solitary. Pedicel longer than subtending leaf, glabrous. Calyx lobes linear-lanceolate. Corolla pink; 3

lobed, lateral lobes elliptic; 2 lobed. Stamens 4, all fertile. Stigma 2 lobed. Capsule globose to ovoid-globose. Seeds oblong.

*Flowers & Fruits:* June to October.

*Specimen Cited:* Forest, Rajib & AP Das 0190, dated 09. 02. 2007.

*Local Distribution:* Throughout study areas.

*General Distribution:* India, Bhutan, China, Nepal, Pakistan, Indonesia, Japan, Kazakstan, Afghanistan, Laos, Russia, Tajikistan, Thailand, Vietnam; S Europe.

***Lindernia viscosa*** (Hornemann) Merrill, Sp. Blancoan. 14. 1918; Mill in Grierson *et* Long, Fl. Bhut. 2(3): 1122. 2001. *Lindernia hirsuta* (Benth) Wettstein, Nat. Pflauzen.f. 4(3b): 79. 1897; Majumdar, Ind. Agr. 6: 167. 1962. *Vandellia hirsuta* Benth, Scroph. Ind. 36. 1835; Hooker f., Fl. Brit. Ind. 4: 280. 1884; Prain, Beng. Pl. 2: 768. 1903. *Gratiola viscosa* Hornemann, Enum. Pl. Hort. Hafn. 19. 1807. *Lindernia viscosa* (Hornemann) Boldingh, Zakfl. Landb. Java 165. 1916; Datta & Majumdar, Bull. Bot. Soc. Beng. 20(2): 108. 1967. *Pyxidaria viscosa* (Hornemann) Kuntze, Revis. Gen. Pl. 2: 464. 1891.

Sparsely diffuse, striate, annuals herbs. Leaves short petiolate below, sessile above; lamina ovate-oblong, Fl. Bhut. 2 – 5 cm x 2 – 4 cm, obtuse to rounded, undulate and toothed, base decurrent. Upper leaves sessile, wider than long and smaller than basal leaves. Raceme lax, 5 – 10 flowered; recurved after; bracts lanceolate. Calyx lobes narrowly lanceolate. Corolla white; upper lip 2 lobed. Stamens 4. Capsule globose. Seeds ellipsoid-oblong.

*Flowers & Fruits:* June to November.

*Specimen Cited:* Forest, Rajib & AP Das 0563, dated 24.07.2007.

*Local Distribution:* Atiamochar forest.

*General Distribution:* India, Bhutan, China, Bangladesh, Sri Lanka, Philippines Islands, Java and Borneo.

TORENIA Linnaeus, Sp. Pl. 2: 619. 1753.

### Key to the species:

- 1a. Creeping herbs; anterior stamens appendages linear ..... *T. asiatica*
- 1b. Erect herbs; stamens unappendaged ..... *T. violacea*

***Torenia asiatica*** Linnaeus, Sp. Pl. 2: 619. 1753. *Torenia glabra* Osbeck, Dagb. Ostind. Resa 210. 1757. *Lindernia multiflora* (Roxburgh) Mukerjee, J. Indian Bot. Soc. 24: 131. 1945. *Tittmannia trichotoma* Benth, Numer. List 3943. 1831.

Creeping herbs, rooting from nodes. Lamina triangular-ovate to narrowly ovate, 1.5 – 3.5 x 1 – 2 cm, crenate and serrate, base abruptly constricted and subtruncate to broadly cuneate. Flowers axillary and solitary. Calyx 2 lipped, 5 winged; lips narrowly triangular. Corolla purple-red to blue-red. Anterior stamens appendages linear. Capsule 1cm. Seeds yellowish.

*Flowers & Fruits:* June to September.

*Specimen Cited:* Forest, Rajib & AP Das 0636, dated 12. 02. 2008.

*Local Distribution:* Atiamochar forest.

*General Distribution:* India, Bhutan, China, Japan, Vietnam.

***Torenia violacea*** (Azaola ex Blanco) Pennell, J. Arnold Arbor. 24: 255. 1943; Mill in Grierson *et* Long, Fl. Bhut. 2(3): 1120. 2001. *Mimulus violaceus* Azaola ex Blanco, Fl. Filip., ed. 2, 357. 1845.

Erect herbs, up to 30 cm. Leaves decreasing in size upward; lamina ovate to narrowly ovate, 1.5 – 4 x 1 – 2 cm, villous, acuminate, shallowly serrate, base cuneate to somewhat truncate. Flowers in terminal fascicles or solitary in leaf axils. Calyx purple-red, oblong-fusiform, 5 winged; lobes 5. Corolla pale yellow, exceeding calyx by 1 – 2 mm; lower lip lobes with a blue patch, center of middle lobe with an additional yellow patch. Stamens unappendaged. Capsule 1 – 1.5 cm. Seeds yellowish.

*Flowers & Fruits:* June to September.

*Specimen Cited:* Forest, *Rajib & AP Das 0432*, dated 22.07.2007.

*Local Distribution:* Tacomari forest.

*General Distribution:* India, Bhutan, China, Indonesia, Laos, Cambodia, Malaysia, Philippines, Thailand, Vietnam.

**Oleaceae** Hoffmansegg *et* Link, Fl. Port. 1: 386. 1809 ('Oleinae'); *nom. cons.*

JASMINUM Linnaeus, Sp. Pl. 1: 7. 1753.

**Key to the species:**

- 1a. Leaves all simple; calyx sparsely pubescent; lobes 8–9, linear ..... *J. sambac*
- 1b. Leaves compound and simple; calyx glabrous; lobes 5, deltate ..... *J. dispernum*

*Jasminum sambac* (Linnaeus) Aiton, Hort. Kew. 1: 8. 1789; Watson in Grierson *et* Long, Fl. Bhut. 2(2): 590. 1999. *Nyctanthes sambac* Linnaeus, Sp. Pl. 1: 6. 1753. *Jasminum sanjurium* Buchanan-Hamilton *ex de* Candolle, Prodr. 8: 302. 1844. *Jasminum heyneanum* Wallich *ex* G. Don, Gen. Hist. 4: 62. 1837. *Jasminum bicorollatum* Noronha, Verh. Batav. Genootsch. Kunsten 5(4): 10. 1790. *Jasminum odoratum* Noronha, Verh. Batav. Genootsch. Kunsten 5(4): 10. 1790. *Nyctanthes sambac* Linnaeus, Sp. Pl. 1: 6. 1753. *Jasminum sambac* (Linnaeus) Aiton var. *heyneanum* C.B. Clarke in Hooker *f.*, Fl. Brit. India 3(9): 592. 1882 [Dec 1882], as 'var. *Heyneana*'

*Vernacular name:* Jnui.

Erect or scandent shrubs, up to 3m. Leaves opposite, simple; lamina orbicular to elliptic-obovate, 4 – 12 x 2 – 6cm, papery, both ends blunt or base subcordate. Cymes terminal, 1 – 3 flowered; bracts subulate. Flowers very fragrant. Calyx sparsely pubescent; lobes 8–9, linear. Corolla white; lobes oblong to suborbicular. Berry purple-black, globose.

*Flowers & Fruits:* May to October.

*Specimen Cited:* Bochamari village, *Rajib & AP Das 0480*, dated 23.07.2007.

*Local Distribution:* Cultivated in villages.

*General Distribution:* Native to India, widely cultivated in S China and elsewhere in the world for its very fragrant flowers that are used in tea flavoring and in perfumes.

*Jasminum dispernum* Wallich in Roxburgh, Fl. Ind. 1: 99. 1820; Watson in Grierson *et* Long, Fl. Bhut. 2(2): 591. 1999. [PLATE: 9, Figure-105]

*Vernacular name:* Jnui.

Scandent shrubs, up to 6m. Leaves opposite, compound and simple, sometimes all simple; leaflets 3–5, lamina broadly ovate to ovate-lanceolate, 4 – 15 x 3 – 8cm, papery, acute or acuminate, entire, base rounded or subcordate. Paniculate cymes terminal and many flowered or axillary 3 – 20 flowered; bracts linear. Calyx glabrous; lobes 5, deltate. Corolla pink outside, white inside, funnellform; lobes 5, ovate. Berry purple-black, globose to ovoid.

*Flowers & Fruits*: March to April.

*Specimen Cited*: Forest, Rajib & AP Das 0614, dated 11. 02. 2008.

*Local Distribution*: Throughout Forest.

*General Distribution*: Throughout India; Bhutan, Nepal, China.

**Phrymaceae** Schauer in A.P. de Candolle, Prodr. 11: 520. 1847; *nom. cons.*

MAZUS Loureiro, Fl. Cochinch. 2: 385. 1790.

*Mazus pumilus* (Burman f.) Steenis in Nova guinea n. sect. 9(1): 31. 1958; Mill in Grierson *et* Long, Fl. Bhut. 2(3): 1102. 2001. *Lobelia pumila* Burman f., Fl. Ind. 186. t. 60, f. 3. 1768; Panda *et* Das, Fl. Sambalp. 254. 2004. *Mazus rugosus* Loureiro, Fl. Cochinch. 385. 1790; Hooker f. in Hooker f., Fl. Brit. Ind. 4: 259. 1884; Prain Beng. Pl. 2: 759. 1903; Haines, Bot. Bihar & Orissa pt. IV: 621. 1922; *Mazus japonicus* (Thunberg) O. Kuntze, Tev. Gen. 462. 1891; Mooney, Suppl. Bot. Bihar & Orissa 94. 1950.

Erect to ascending, annuals herbs, up to 30 cm, rooting from prostrate nodes. Basal leaves rosulate; lamina obovate-spatulate to ovate-oblongate, 1 – 6 cm x 1 – 3 cm, obtuse to acute, coarsely and irregularly toothed, base cuneate and decurrent. Stem leaves opposite to alternate. Racemes terminal, 2 – 15 flowered. Calyx campanulate; lobes ovate. Corolla white; middle lobe of lower lip smaller than lateral lobes, slightly exerted; upper lip lobes ovate-triangular. Ovary glabrous. Capsule globose.

*Flowers & Fruits*: Almost throughout the year.

*Specimen Cited*: Forest, Rajib & AP Das 0357, dated 21.07.2007.

*Local Distribution*: Throughout study areas.

*General Distribution*: India, Bhutan, China, Nepal, Korea, Burma, Malaya, Afghanistan, Russia, Japan, Java and Philippines.

**Plantaginaceae** A.L. de Jussieu, Gen. Pl. 89. 1789 ('Plantagines'); *nom. cons.*

**Key to the genera:**

- 1a. Leaves heterophilous; Bractioles absent ..... *Limnophilla*
- 1b. Leaves monophilous; Bractioles present ..... 2
- 2a. Plant diffused herb ..... *Bacopa*
- 2b. Plant erect herb ..... *Scoparia*

BACOPA Aublet, Hist. Pl. Guiane 1: 128. 1775.

*Bacopa monnieri* (Linnaeus) Wettst., Nat. Pflanzenfam. 4(3b): 77. 1891. *Bacopa monnieri* (Linnaeus) Pennell, Proc. Acad. Nat. Sci. Philadelphia 98: 96. 1946; Mill in Grierson *et* Long, Fl. Bhut. 2(3): 1112. 2001. *Lysinachia monnieri* Linnaeus, Cent. Pl. II. t. 9. 1756. *Bramia indica* de Lamarck, Encycl. 1: 459. 1785. *Capraria monnieri* Roxburgh, Hort. Bengal. 47. 1814.

*Local name*: Brahmi

Creeping, succulent, herbs with rooting at nodes. Leaves sessile, oblong-oblongate, 0.7 – 1.5 cm x 3 – 5 mm, margin entire, rounded, base attenuated. Flowers axillary. Bracteoles 2, below calyx, linear. Sepals 5; lower and upper sepals ovate-lanceolate; lateral 2 sepals lanceolate to linear. Corolla white, obscurely 2 lipped. Stamens didynamous. Stigma capitate. Capsule narrowly ovoid. Seeds yellow-brown, ellipsoid.

*Flowers & Fruits*: September to February.

*Specimen Cited:* Bochamari Beel Margin, *Rajib & AP Das 0691*, dated 14. 02. 2008.

*Local Distribution:* BOchamari Beel margin.

*General Distribution:* India, tropical & warm-temperate part of world, Australia.

LIMNOPHILA R. Brown, Prodr. 442. 1810.

**Key to the species:**

- 1a. Leaves dimorphic, lower leaves filiform ..... 2
- 1b. leaves monomorphic; flower sessile to sub-sessile ..... *L. repens*
- 2a. Flower pedicillate ..... *L. indica*
- 2b. Flower sessile to sub-sessile ..... 3
- 3a. Plant glabrous; flowers in leafy spike ..... *L. heterophylla*
- 3b. Plant pubescent; flowers solitary ..... *L. sessiliflora*

***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. *Columnea heterophylla* Roxburgh, Fl. Ind. 3: 97. 1832. *Limnophila reflexa* Benth, Scroph. Ind. 25. 1835.

Aquatic, perennials herbs. Aerial stems with sessile glands. Submerged leaves up to 50 cm, multiparted; segments capillary. Aerial leaves opposite to whorled, sessile, oblong, Fl. Bhut. 12 – 15 x 2 – 5 mm, glabrous, subcrenate, base subamplexicaul. Flowers sessile and in terminal spikes and solitary in leaf axils. Bracteoles absent. Calyx with sessile glands. Corolla pale purple. Capsule pale brown, subglobose.

*Flowers & Fruits:* October to February.

*Specimen Cited:* Noldoba Beel, *Rajib & AP Das 0592*, dated 25.07.2007.

*Local Distribution:* Throughout the Water Bodies.

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

***Limnophila indica*** (L.) Druce, Rep. Bot. Exch. Club. Soc. Brit. Isles 3: 420. 1914; Datta, Bull. Bot. Soc. Beng. 29: 5. 1975; Mill in Grierson *et* Long, Fl. Bhut. 2(3): 1110. 2001. *Hottonia indica* Linnaeus, Syst. Nat. ed. 10. 919. 1759 et. Sp. Pl. ed. 2: 208. 1762. *Limnophila gratioloides* R. Brown, Prodr. 442. 1810; Hooker *f*, Fl. Brit. Ind. 4: 271. 1884; Prain, Beng. Pl. 2: 764. 1903.

Perennials, amphibious, much branched herbs. Submerged leaves whorled, 1 – 2.5 cm, pinnatisect. Aerial leaves usually whorled, pinnately lobed. Flowers axillary from aerial leaves, solitary. Pedicel slender. Bracteoles 2. Calyx lobes ovate to lanceolate, short acuminate. Corolla white. Capsule dark brown, compressed, ellipsoid to subglobose.

*Flowers & Fruits:* July to March.

*Specimen Cited:* Barajan Beel, *Rajib & AP Das 0507*, dated 23.07.2007.

*Local Distribution:* Throughout the Water Bodies.

*General Distribution:* India, Malaya Island, China, Nepal, Pakistan, Sri Lanka, Australia, Cambodia, Tropical Africa and Beluchistan.

***Limnophila repens*** Benth, A. de Candolle, Prodr. 10: 387. 1846; Mill in Grierson *et* Long, Fl. Bhut. 2(3): 1112. 2001. *Limnophila sessilis* (Benth) Fischer, Bull. Misc. Inf. Kew 62. 1962. *Limnophila conferta* Benth, in de Candolle, Prodr. 10: 367. 1845; Hooker *f*, Fl. Brit. Ind. 4: 266. 1884; Prain, Beng. Pl. 2: 764. 1903; Mill in Grierson *et* Long Fl. Bhut. 2(3): 1112. 2001. *Stemodia repens* Benth in Lindley, Bot. Reg. 17: ad t.1470. sp. 11. 17. 1832.

Erect, perennial herbs, up to 45 cm. Leaves opposite, sessile, narrowly elliptic to linear-lanceolate, 0.8–3.5 cm x 3–10 mm, serrate, base subamplexicaul. Flowers solitary and axillary. Bracteoles 2–3 mm. Calyx hispidulous; lobes narrowly lanceolate, ciliate, acuminate. Corolla white or blue. Capsule ovoid.

*Flowers & Fruits:* November to February.

*Specimen Cited:* Rasik Bil, *Rajib & AP Das 0433*, dated 22.07.2007.

*Local Distribution:* Throughout Wetlands.

*General Distribution:* India, Bhutan, Nepal, Sri Lanka, Cambodia, Indonesia, Laos, Malaysia, Myanmar, Philippines, Thailand, Vietnam; Australia.

***Limnophila sessiliflora*** (Vahl) Blume, *Bijdr. Fl. Ned. Ind.* 14: 750.1826; Hooker *f.*, *Fl. Brit. Ind.* 4: 270.1884; Mill in Grierson *et Long*, *Fl. Bhut.* 2(3): 1110. 2001; Prain, *Beng. Pl.* 2: 764. 1903; Kanjilal *et al.*, *Fl. Ass.* 3: 379. 1939; Islam, *Fl. Majuli* 224. 1990; Bora & Kumar, *Flor. Div. Ass.* 240. 2003. *Hottonia sessiliflora* Vahl, *Symb. Bot.* 2: 36. 1791. *Limnophila taoyuanensis* Yang *et Yen*, *Bot. Bull. Acad. Sin.* 38: 285-295. 1997.

Perennials, amphibious herbs, up to 40 cm. Submerged stems slender, long, glabrous. Submerged leaves 0.5–4 cm, multiparted; segments flattened. Aerial leaves whorled; lamina elliptic-lanceolate, 4–16 x 3–6 mm, glabrous, crenate to lobed. Flowers sessile, solitary in axils of submerged and aerial leaves. Calyx without raised veins in fruit; lobes ovate, narrowly acuminate. Corolla purple-blue to reddish. Capsule compressed, subglobose.

*Flowers & Fruits:* August to February.

*Specimen Cited:* Bochamari Beel, *Rajib & AP Das 0624*, dated 11. 02. 2008

*Local Distribution:* Throughout Wetlands.

*General Distribution:* India, Bhutan, Nepal, Sri Lanka, Indonesia, Japan, Korea, Malaysia, Myanmar, Vietnam.

SCOPARIA Linnaeus, *Sp. Pl.* 1: 116. 1753.

***Scoparia dulcis*** Linnaeus, *Sp. Pl.* 1: 116.1753; Hooker *f.* in Hooker *f.*, *Fl. Brit. Ind.* 4: 289. 1884; Prain, *Beng. Pl.* 2: 772. 1903; Mill in Grierson *et Long*, *Fl. Bhut.* 2(3): 1130. 2001; Haines, *Bot. Bihar & Orissa pt. IV:* 637. 1922; Guha Bakshi, *Fl. Mur. Dist.* 229. 1984; Panda *et Das*, *Fl. Sambalp.* 257. 2004. *Capraria dulcis* var. *Albiflora* Kuntze, *Revis. Gen. Pl.* 3(2): 230. 1898. *Scoparia grandiflora* Nash, *Bull. Torrey Bot. Club* 23(3): 105. 1896. *Scoparia ternata* Forskal, *Fl. Aegypt.-Arab.* 30. 1775. *Capraria dulcis* (Linnaeus) Kuntze, *Revis. Gen. Pl.* 2: 459. 1891.

*Vernacular name:* Bandhone.

Erect, suffrutescent herbs, up to 1 m. Leaves petiolate; lamina rhomboid-ovate to rhomboid-lanceolate, 2–3.5 x 0.7–1.5 cm, glabrous, obtuse, toothed above middle, base cuneate. Flowers usually axillary, 1–2 per node. Bracteoles absent. Calyx lobed to base; lobes 4, ovate-oblong. Corolla white; upper lobe slightly larger. Stamens exserted. Style erect; stigma truncate to 2 parted.

*Flowers & Fruits:* June to May.

*Specimen Cited:* Garden, *Rajib & AP Das 0501*, dated 23.07.2007.

*Local Distribution:* Throughout study areas.

*General Distribution:* Tropical Asia, Africa, and America.

**Verbenaceae** A.L. de Jussieu, *Ann. Mus. Hist. Nat. Paris* 7: 64. 1806; *nom. cons.*



**Key to the genera:**

- |  |                |
|--|----------------|
| 1a. Inflorescences centripetal .....             | 2              |
| 1b. Inflorescences centrifugal .....             | <i>Duranta</i> |
| 2a. Shrubs; fruit a drupe; stem spiny .....      | <i>Lantana</i> |
| 2b. Herbs; fruit a capsule; stem not spiny ..... | <i>Phyla</i>   |

LANTANA Linnaeus, Sp. Pl. 2: 626. 1753.

*Lantana camara* Linnaeus, Sp. Pl. 2: 627. 1753; Long in Grierson *et* Long, Fl. Bhut. 2(2): 914. 1999. *Camara vulgaris* Benthham, Bot. Voy. Sulphur 154. 1846. *Lantana urticifolia* Miller, Gard. Dict. ed. 8: 5. 1768. *Lantana undulate* Rafinesque, Sylva Tellur. 82. 1838. *Lantana mexicana* Turner, Flor. Kingd. 181. 1876. [PLATE: 8, Figure-83]

Shrubs with long weak branches, armed, stout recurved prickles, pubescent. Petiole 2 cm, pubescent; leaf blade ovate to oblong, 4 – 8 x 1.5 – 4 cm, papery, wrinkled, very rough, with short stiff hairs, aromatic when crushed, base rounded to subcordate, margin crenate; lateral veins 5 pairs, very prominent, elevated. Capitula terminal, 2 cm across. Flowers yellow, red and orange. Ovary glabrous. Drupes deep purple, globose.

*Flowers & Fruits:* Throughout the year.

*Specimen Cited:* Forest margin, Rajib & AP Das 0456, dated 22.07.2007.

*Local Distribution:* Throughout the study areas.

*General Distribution:* Tropical India; tropical and subtro-pical America, often naturalized in other tropical and subtropical regions.

PHYLA Loureiro, Fl. Cochinch. 1: 66. 1790.

*Phyla nudiflora* (Linnaeus) Greene in Pittonia 4: 46. 1899; Long in Grierson *et* Long, Fl. Bhut. 2(2): 916. 1999; Guha Bakshi, Fl. Mur. Dist. 250. 1984. *Verbena nudiflora* Linnaeus, Sp. Pl. 1: 20. 1753. *Lippia nodiflora* (Linnaeus) Michaux, Fl. Bor. Amer. 2: 15. 1803; Clarke in Hooker *f.*, Fl. Brit. Ind. 4: 563. 1885. Haines, Bot. Bihar & Orissa pt. IV: 706. 1922; Mooney, Suppl. Bot. Bihar & Orissa 120: 1950. *Verbena lanata* Willdenow *ex* Walpers, Repert. Bot. Syst. 4: 48. 1845. *Lippia sarmentosa* (Willdenow) Sprengel, Syst. Veg. 2: 752. 1825 *Phyla chinensis* Loureiro, Fl. Cochinch. 66. 1790. [PLATE: 8, Figure-77]

Perennial herbs. Branched, creeping, rooting at distal nodes, minutely strigose. Leaves subsessile; leaf blade spatulate, 1 – 4 x 1 – 1.5 cm, papery, pubescent, base cuneate, margin distally sharply serrate, veins inconspicuously 4 paired. Inflorescences cylindric to ovate capitula, 1 – 2 cm. Corolla pinkish purple, glabrous.

*Flower & Fruits:* January to August.

*Specimen Cited:* Rasik Beel, Rajib & AP Das 0615, dated 11. 02. 2008.

*Local Distribution:* Bochamari Beel Marginal grass land.

*General Distribution:* Pantropical.

DURANTA Linnaeus, Sp. Pl. 2: 637. 1753.

*Duranta erecta* Linnaeus, Sp. Pl. 2: 637. 1753; Long in Grierson *et* Long, Fl. Bhut. 2(2): 918. 1999. *Duranta spinosa* Miller, Gard. Dict. ed. 8: 3. 1768. *Duranta inermis* Linnaeus, Sp. Pl. 637. 1753. *Duranta dentata* Persoon, Syn. Pl. 2: 142. 1806. *Duranta repens* Linnaeus, Sp. Pl. 2: 637. 1753.

*Vernacular name:* Bera gachh.

Large shrubs, often climbing. Branches spiny, pubescent when young. Petiole 1 cm, pubescent; leaf blade ovate to lanceolate, 2 – 6 x 1 – 3 cm, papery, base cuneate, margin entire to distally crenate, veins 6 pairs. Calyx pubescent on both surfaces. Corolla tube 7 mm. Stamens included. Ovary glabrous. Drupes shorter than calyx, shiny, glabrous.

*Flowers & Fruits:* May to October.

*Specimen Cited:* Bochamari, Rajib & AP Das 0488, dated 23.07.2007.

*Local Distribution:* Vallage.

*General Distribution:* India: cultivated through out; North and South America.

**Order: Solanales** Jussieu *ex* Berchtold *et* J. Presl (1820).

**Convolvulaceae** A.L. de Jussieu, Gen. Pl. 132. 1789 ('Convolvuli'); *nom. cons.*

**Key to the genera:**

- |  |                          |
|--|--------------------------|
| 1a. Plants parasitic, leafless, with haustoria .....                         | <b><i>Cuscuta</i></b>    |
| 1b. Plants not parasitic, with well-developed leaves, haustoria absent ..... | 2                        |
| 2a. Pollen finely spiny .....  | 3                        |
| 2b. Pollen never finely spiny .....  | 4                        |
| 3a. Fruit dehiscent .....  | <b><i>Ipomoea</i></b>    |
| 3b. Fruit indehiscent .....  | <b><i>Argyria</i></b>    |
| 4a. Fruit indehiscent; seeds 1 .....   | <b><i>Poranopsis</i></b> |
| 4b. Fruit dehiscent; seeds usually 4 .....                                   | 5                        |
| 5a. Styles 2 .....   | <b><i>Evolvulus</i></b>  |
| 5b. Style 1 .....  | <b><i>Merremia</i></b>   |

ARGYREIA Loureiro, Fl. Cochinch. 1: 95, 134. 1790.

***Argyria roxburghii*** (Wallich) Arnott *ex* Choisy in Mem. Soc. Phys. Hist. Nat. Geneve 6: 419. 1834; Hooker *f.*, Fl. Brit. Ind. 4: 185. 1883; H. Ohashi in Hara, Fl. E. Himal. 1:207. 1966; Hara *et al.*, Enn. Fl. Pl. Nep. 3: 105. 1982; Mill in Grierson *et* Long, Fl. Bhut. 2(2): 841. 1999. *Convolvulus roxburghii* Wallich, Numer. List n. 1415. 1829.

Large climbers. Stems terete, villous. Lamina broadly ovate to circular, 15 – 18 x 12 – 18, pubescent, acuminate to caudate, entire, base cordate. Inflorescences axillary cymose. Sepals unequal. Corolla red-purple, funnel form. Ovary glabrous. Berry enclosed by enlarged calyx, dark purple, ovoid-globose.

*Flowers & Fruits:* February to October.

*Specimen Cited:* Forest, Rajib & AP Das 0664, dated 13.02. 2008.

*Local Distribution:* Through out Forest.

*General Distribution:* Tropical and sub-tropical parts of the world.

EVOLVULUS Linnaeus, Sp. Pl. ed. 2. 391. 1762.

***Evolvulus nummularius*** (Linnaeus) Linnaeus, Sp. Pl. (ed. 2) 1: 391. 1762; Guha Bakshi, Fl. Mur. Dist. 208. 1984. *Convolvulus nummularius* Linnaeus, Sp. Pl. 1: 157. 1753. *Evolvulus veronicaefolius* Kunth, Nov. Gen. Sp. (quarto ed.) 3: 117, t. 215, 117. 1818. *Volvolvopsis nummularium* (Linnaeus) Roberty, Candollea 14: 28. 1952. *Evolvulus repens* D. Parodi, Contrib. fl. Parag. 1: 29. 1877.

Perennial, small herbs. Stems several, rooting at nodes, prostrate, up to 40 cm, slender. Leaves distichous; lamina nearly circular, 1.5 – 2.3 x 1.4 – 2 cm, glabrous, rounded or emarginated, base cordate to rounded. Flowers 1 to 2 per leaf axil. Sepals persistent, oblong-ovate to oblong, ciliate. Corolla broadly campanulate; 5 lobed. Stamens inserted at middle of corolla tube; anthers oblong. Ovary globose. Style lobes linear; stigmas minutely capitate. Capsule ovoid. Seeds ovoid-triangular,

*Flowers & Fruits:* March to December.

*Specimen Cited:* Park, Rajib & AP Das 0684, dated 14. 02. 2008.

*Local Distribution:* Throughout the study area.

*General Distribution:* India, Tropical Africa, Madagascar, Malaya Peninsula, Mexico and West Indies.

IPOMOEA Linnaeus, Sp. Pl. 1: 159. 1753.

### Key to the species:

- 1a. Shrub with milky juice ..... *I. fisulosa*
- 1b. Annual herbs or twiner ..... 2
- 2a. Plants of marshy places or aquatic; stems fistulose ..... *I. aquatica*
- 2b. Plants fully terrestrial; stem not fistulose ..... *I. hederifolia*

***Ipomoea aquatica*** Forsskal, Fl. Aegypt. Arab. 44. 1775; Clark in 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. Ass. 229. 2003. *Ipomoea reptans* Poiret in Lamarck, Encycl., Suppl. 3(2): 460. 1814; Prain Beng. Pl. 2: 547. 1903. *Ipomoea repens* Roth, Nov. Pl. Sp. 110. 1821. *Ipomoea natans* Dinter et Suess, Mitt. Bot. Staatssamml. München 4: 112. 1952. [PLATE: 10, Figure-118]

*Vernacular name:* Kolmi Saak.

Annual herbs, terrestrial or floating. Stems terete, thick, hollow, rooting at nodes. Petiole glabrous; lamina variable, ovate to ovate-lanceolate, 5 – 18 x 2 – 9 cm, acute or acuminate, entire or undulate, base cordate, sagittate to hastate, occasionally truncate. Inflorescences 1 to 3 flowered. Sepals sub equal, glabrous; outer 2 ovate-oblong, mucronulate; inner 3 ovate-elliptic. Corolla pink, with a darker center. Stamens unequal. Ovary conical, glabrous. Stigma 2 lobed. Capsule ovoid to globose.

*Flowers & Fruits:* August to February.

*Specimen Cited:* Bochamari Beel, Rajib & AP Das 0698, dated 14. 02. 2008.

*Local Distribution:* Through out the Beel Complex.

*General Distribution:* Throughout the India; Tropical Asia, Australia and Africa.

***Ipomoea fisulosa*** C. Mart ex Choisy in de Candolle, Prodr. 9: 349. 1845. *Ipomoea carnea* Jacquin, Enum. Syst. Pl. 13. 1760; Mill in Grierson et Long, Fl. Bhut. 2(2): 851. 1999. Haines, Bot. Bihar & Orissa pt. IV: 600. 1922 ssp. *fistulosa* (Choisy) D. Austin in Taxon 26: 237. 1977. *Ipomoea fruticosa* Kuntze, Revis. Gen. Pl. 2: 444. 1891. *Ipomoea crassicaulis* (Bentham) B.L. Robinson, Proc. Amer. Acad. Arts 51(10): 530. 1916. *Ipomoea carnea* f. *albiflora* Moldenke, Phytologia 2: 224. 1947. *Batatas crassicaulis* Bentham, Bot. Voy. Sulphur 134. 1845. [PLATE: 5, Figure-38]

*Vernacular name:* Dhalkolmi.

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,

caduceus. Capsule pale-brown, finely pubescent at base, ovoid, mucronate, 4-celled, 4-valved. Seeds 4 or less, black sericeous.

*Flowers & Fruits:* August to March.

*Specimen Cited:* Noldoba Beel, *Rajib & AP Das 0663*, dated 13. 02. 2008.

*Local Distribution:* Marginal area of Waterbodies.

*General Distribution:* India; Native to America; naturalized in tropical areas.

***Ipomoea hederifolia*** Linnaeus, Syst. Nat. (ed. 10) 925. 1759. *Ipomoea hederifolia* Linnaeus, Sp.Pl. ed. 1. 159. 1753; Mill in Grierson *et* Long, Fl. Bhut. 2(2): 850.1991. *Ipomoea phoenicea* Roxburgh, Fl. Indica (ed. Carey) 2: 92. 1824. *Quamoclit sanguinea* (Vahl) G. Don, Gen. Hist. 4: 259. 1838. *Quamoclit phoenicea* (Roxburgh) Choisy, Convolv. Orient. 51. 1833. *Ipomoea luteola* Jacquin, Collectanea 2: 266. 1788. *Ipomoea angulata* de Lamarck, Tabl. Encycl. 1: 464. 1791. *Ipomoea coccinea* var. *hederifolia* (Linnaeus) A. Gray, Syn. Fl. N. Amer. 2(1): 209. 1878.

Annual twiner, up to 4 m, glabrous. Leaves alternate; lamina ovate to sub-orbicular, 3 – 12 x 2 – 8 cm, acuminate and mucronulate, base cordate, glabrous. Cymes terminal and axillary. Pedicels erect. Sepals oblong-rectangular, erect at anthesis, narrowly linear, herbaceous, inserted just below tip. Corolla scarlet, narrowly infundibular, glabrous; tube 3 cm, very slender. Stamens and style exserted. Capsule globose. Seeds 4, black.

*Flowers & Fruits:* July to December.

*Specimen Cited:* Garden, *Rajib & AP Das 0612*, dated 11. 02. 2008.

*Local Distribution:* Garden margin.

*General Distribution:* Tropical World.

MERREMIA Dennstedt *ex* Endlicher, Gen. Pl. 1: 1403. 1841, *nom. cons.*

### Key to the species:

- 1a. Leaves palmately 3–5 lobed ..... *M. vitifolia*
- 1b. Leaves entire or irregularly coarsely crenate ..... 2
- 2a. Leaves linear to ovate-oblong, base truncate ..... *M. hirta*
- 2b. Leaves ovate-cordate, base cordate to broadly cordate ..... *M. hederacea*

***Merremia hirta*** (Linnaeus) Merrill, Philipp. J. Sci. 7(4): 244-245. 1912; Mill in Grierson *et* Long, Fl. Bhut. 2(2): 854. 1999. *Ipomoea linifolia* Blume, Bijdr. Fl. Ned. Ind. 13: 721. 1825. *Convolvulus hirtus* Linnaeus, Sp. Pl. 1: 159. 1753. *Convolvulus caespitosus* Roxburgh, Fl. Ind., ed. 1832 1: 483-484. 1832. *Skinneria caespitose* (Roxburgh) Choisy, M m. Soc. Phys. Gen. 6: 487. 1833. [PLATE: 5, Figure-40]

*Vernacular name:* Vitachhara.

Twining herbs. Stems rooting at nodes. lamina linear to ovate-oblong, Fl. Bhut. 2 – 6 x 0.5 – 3 cm, obtuse, acute or mucronulate, entire, base truncate, rounded. Inflorescences 1 to 4 flowered. Sepals elliptic to elliptic-oblong, unequal. Corolla whitish, broadly funnelform. Stamens included. Ovary glabrous. Capsule broadly ovoid to globose. Seeds brownish black, trigonous-ellipsoid.

*Flowers & Fruits:* July to January.

*Specimen Cited:* Forest, *Rajib & AP Das 0543*, dated 23.07.2007.

*Local Distribution:* Forest near Conservation sector.

*General Distribution:* India, Indonesia, Laos, Malaysia, Myanmar, Philippines, Thailand, Vietnam; N Australia.

***Merremia hederacea*** (Burman f.) Hallier f., Bot. Jahrb. Syst. 18(1-2): 118. 1893; Mill in Grierson et Long, Fl. Bhut. 2(2): 854. 1999. *Evolvulus hederaceus* Burman f., Fl. Indica 77, pl. 30, f. 2: 77. 1768. *Convolvulus lapathifolius* Sprengel, Syst. Veg. 1: 604. 1825. *Convolvulus flavus* Willdenow, Sp. Pl. 1(2): 852-853. 1797.

Twining herbs; rooting at nodes. Lamina cordate-ovate, 2 – 7.5 x 1 – 5 cm, 3-lobed, entire to irregularly crenate, base cordate to broadly cordate. Inflorescences few to many flowered, umbelliform. Sepals broadly obovate to spatulate-oblong, reflexed in fruit, unequal. Corolla yellow, campanulate. Stamens as long as corolla. Ovary globose, glabrous; stigma globose. Capsule depressed globose to broadly conical. Seeds trigonous-globose.

*Flowers & Fruits:* June to November.

*Specimen Cited:* Forest, Rajib & AP Das 0451, dated 22.07.2007.

*Local Distribution:* Through out Forest.

*General Distribution:* India, Bhutan, China, Nepal, Bangladesh, Sri Lanka, Pakistan, Cambodia, Indonesia, Japan, Laos, Malaysia, Myanmar, New Guinea, Philippines, Thailand, Vietnam; Africa, N Australia, Pacific Islands.

***Merremia vitifolia*** (Burman f.) H. Hallier, Bot. Jahrb. Syst. 16(4-5): 552. 1893; Mill in Grierson et Long, Fl. Bhut. 2(2): 852. 1999. *Convolvulus vitifolius* Burman f., Fl. Indica 45. 1768. *Convolvulus vitifolius* Burman f., Fl. Indica 45-46, pl. 18, f. 1: 45. 1768. *Ipomoea vitifolia* (Burman f.) Blume, Bijdr. Fl. Ned. Ind. 13: 709. 1825. *Convolvulus angularis* Burman f., Fl. Indica 46. 1768.

*Vernacular name:* Vitachhara.

Twining herbs. Lamina circular in outline, 5-15 x 4-15 cm, acuminate to obtuse, palmately 3-5 lobed, lobes broadly triangular or ovate-lanceolate, base cordate. Inflorescences 1 to 3 flowered. Sepals oblong to ovate-oblong, leathery, obtuse to acute. Corolla yellow; limb 5 angled. Anthers spirally twisted. Ovary glabrous. Capsule straw colored, globose. Seeds black-brown, trigonous-ovoid, glabrous.

*Flowers & Fruits:* Throughout the year.

*Specimen Cited:* Forest, Rajib & AP Das 0397, dated 22.07.2007.

*Local Distribution:* Through out Forest.

*General Distribution:* Tropical hemisphere.

**PORANOPSIS** Roberty, Candollea 14: 26. 1952.

***Poranopsis paniculata*** (Roxburgh) Roberty, Candollea 14: 26. 1953. *Porana paniculata* Roxburgh, Pl. Coromandel 3: 31, pl. 235. 31, 1819; Mill in Grierson et Long, Fl. Bhut. 2(2): 857. 1999.

Large climbers. Lamina cordate-circular, 7 – 16 x 5 – 15 cm, smooth to rugulose, base cordate. Flowers in axillary cymes. Sepals lanceolate-linear, concave, equal. Fruiting calyx reddish, loosely clasping; outer 3 sepals elliptic-oblong to narrowly ovate, margin free. Corolla white to cream, narrowly funnelform; 5 lobed. Stamens included, equal. Ovary glabrous. Style obsolete; stigma sessile. Fruit brownish with darker lines, globose-ellipsoid. Seeds dark brown, globose-ellipsoid.

*Flowers & Fruits:* October to April.

*Specimen Cited:* Forest, Rajib & AP Das 0328, dated 21.07.2007.

*Local Distribution:* Through out Forest.

*General Distribution:* India, Bhutan, Nepal, Pakistan, Myanmar.

CUSCUTA Linnaeus, Sp. Pl. 1: 124. 1753.

**Key to the species:**

- |   |                     |
|---|---------------------|
| 1a. Stem thick; flowers in racemes or panicles; style 1 ..... | <i>C. reflexa</i>   |
| 1b. Stem thin; flowers in compact cymose; style 2 .....       | <i>C. chinensis</i> |

*Cuscuta reflexa* Roxburgh, Pl. Corom. 2: 3, t. 104. 1798; Hooker f., Fl. Brit. Ind. 4: 225. 1883; Mill in Grierson *et* Long, Fl. Bhut. 2(2): 863. 1999. *Monogynella reflexa* (Roxburgh) Holub, Folia Geobot. Phytotax. 12(4): 429. 1977. *Cuscuta hookeri* Sweet, Hort. Brit. 290. 1826.

*Vernacular Name:* Swarnalata.

Stems yellow to yellowish green, stout. Inflorescences lateral, few to many flowered, in racemes or panicles; bracts and bractoles scalelike. Calyx cupular; sepals 5, broadly ovate, equal. Corolla white to creamy, fragrant; lobes early deciduous, often reflexed, triangular-ovate. Stamens inserted at throat; filaments shorter than anthers; anthers elliptic-ovate. Ovary ovate-conical. Style 1; stigma divergent. Capsule conical-globose.

*Flowers & Fruits:* February to October.

*Specimen Cited:* Rasik Beel village, *Rajib & AP Das 0328*, dated 21.07.2007.

*Local Distribution:* Villages.

*General Distribution:* India through out; Bhutan, Nepal, Sri Lanka, Pakistan, Malaysia. Afghanistan, Indonesia, Malaysia, Myanmar, Thailand.

*Cuscuta chinensis* de Lamarck, Encycl. 2(1): 229. 1786. *Cuscuta carinata* Robert Brown, Prodr. 491. 1810. *Cuscuta chinensis* var. *carinata* (Robert Brown) Engelman, Trans. Acad. Sci. St. Louis 1(3): 480. 1859. *Cuscuta fimbriata* Bunge ex Engelman, Trans. Acad. Sci. St. Louis 1: 480. 1859.

*Vernacular name:* Swarnalata.

Stems yellow, thin. Inflorescences lateral, compact cymose, few to many flowered; bracts and bracteoles scalelike. Calyx cupular; sepals triangular, obtuse. Corolla white; lobes persistent triangular-ovate, reflexed. Stamens inserted at throat; scales oblong. Ovary subglobose. Styles 2, equal or unequal; stigma globose. Capsule enclosed, globose. Seeds 2–4, pale brown, ovoid.

*Flowers & Fruits:* March to November.

*Specimen Cited:* Riverine forest, *Rajib & AP Das 0280*, dated 10. 02. 2007.

*Local Distribution:* Forest margin.

*General Distribution:* India throughout; Bhutan, Afghanistan, Sri Lanka, Indonesia, Japan, Kazakhstan, Korea, Mongolia, Russia; Africa, SW Asia, Australia.

**Solanaceae** A.L. de Jussieu, Gen. Pl. 124. 1789 ('Solaneae'); *nom. cons.*

**Key to the Genera:**

- |   |                  |
|---|------------------|
| 1a. Berries completely enclosed within the enlarged calyx ..... | <i>Physalis</i>  |
| 1b. Berries not enclosed within the enlarged calyx .....        | 2                |
| 2a. Inflorescence many flowered .....                           | 3                |
| 2b. 1 to 3 flowers per axil .....                               | 4                |
| 3a. Plants spiny; leaves lobed .....                            | <i>Solanum</i>   |
| 3b. Plants without spine; leaves unlobed .....                  | <i>Nicotiana</i> |

- 4a. Calyx 5-lobed; fruit prickly or papillate, 4-valved or irregularly  
dehiscent ..... *Datura*
- 4b. Calyx 5-parted; fruit unarmed, lacking papillae, 2-valved, dehiscent ..... *Petunia*

DATURA Linnaeus, Sp. Pl. 1: 179. 1753.

**Key to the species:**

- 1a. Corolla sometimes doubled or tripled; seeds slightly reniform ..... *D. metel*
- 1b. Corolla usually single funnel form; seeds ovate ..... *D. stramonium*

*Datura metel* Linnaeus, Sp. Pl. 179. 1753; Hooker *f.*, Fl. Brit. Ind. 4: 243. 1883; H. Ohashi in Hara, Fl. E. Himal. 1: 283. 1966; Mill in Grierson *et* Long, Fl. Bhut. 2(3): 1067. 2001. *Datura nigra* Hasskarl, Cat. Hort. Bot. Bogor. 142. 1844. *Datura fruticosa* Horneman, Hort. Bot. Hafn. 1: 212. 1813. *Datura alba* F.Mueller, Fragm. 6: 144. 1868.

*Vernacular name:* Dhutro.

Erect, branched, annual undershrubs, up to 2m. Leaves petiolate, lamina ovate to rhomboid or elliptic, 5–20 x 4–15 cm, membranous, acuminate, sinuate-dentate, base cuneate. Flowers solitary, axillary, erect. Calyx tubular. Corolla purplish, funnellform, sometimes doubled or tripled; lobes elongate. Capsule ovoid, pericarp very sharply spiny. Seed black, slightly reniform.

*Flowers & Fruits:* March to December.

*Specimen Cited:* Rasik Beel, Rajib & AP Das 0484, dated 23.07.2007.

*Local Distribution:* Villages.

*General Distribution:* Native of the Americas, long introduced and naturalized in Asia.

*Datura stramonium* Linnaeus, Sp. Pl. 179.1753; Clark in Hooker *f.*, Fl. Brit. Ind. 4: 242. 1883; Mill in Grierson *et* Long, Fl. Bhut. 2(3): 1067. 2001. *Datura laevis* Linnaeus *f.*, Suppl. Pl. 146. 1782. *Stramonium vulgatum* Joseph Gaertner, Fruct. Sem. Pl. 2: 243, t. 132. 243. *Stramonium spinosum* de Lamarck, Fl. Fran. . 256. 1779. *Datura parviflora* Salisbury, Prodr. Stirp. Chap. Allerton 131. 1796.

*Vernacular name:* Dhutro.

Subshrubs, sometimes robust, up to 3 m. Lamina broadly ovate, 8 – 16 x 4 – 12 cm, membranous, acuminate, irregularly dentate, base asymmetric, cuneate. Flowers erect. Calyx tubular, 5-angular. Corolla white, greenish at base, sometimes purple distally, funnellform; lobes 6 – 10 cm, mucronate at apex. Filaments 2.8 – 3.3 cm. Capsules erect, globose to ovoid, with copious prickles, rarely smooth, dehiscent by 4 equal valves. Seeds black, ovate.

*Flower & Fruits:* April to December.

*Specimen Cited:* Rasik Beel, Rajib & AP Das 0360, dated 21.07.2007.

*Local Distribution:* Villages.

*General Distribution:* Temperate region of world. native of Mexico, now worldwide.

NICOTIANA Linnaeus, Sp. Pl. 1: 180. 1753.

*Nicotiana plumbaginifolia* Viviani, Planch, Pl. Hort. Dinagro, 26. t. 5, 1802 & Elench. Pl. 26, pl. 1, 5 26 1802; Clarke in Hooker *f.*, Fl. Brit. Ind. 4: 246. 1883; Mill in Grierson *et* Long, Fl. Bhut. 2(3): 1074. 2001; Prain, Beng. Pl. 2: 559. 1903; Guha Bakshi, Fl. Mur. Dist. 218. 1984. *Nicotiana pusilla* Linnaeus, Syst. Nat. (ed. 10) 2: 933. 1759. *Nicotiana cavanillesii* Dunal, Prodr. 13(1): 572. 1852. *Nicotiana plantaginea* Dunal, Prodr. 13(1): 559. 1852.

*Vernacular name:* Ban tamak.

Annual herb with 0.7-1 m height. Lamina radical, sessile, obovate or spatulate, obtuse or rounded at apex; upper becoming smaller and passing into bracts, sessile, elliptic, elliptic lanceolate, oblong, acute or acuminate at apex. Flowers in lax racemes. Pedicels 7-9 mm long. Capsule 0.7- 1 cm long, oval, glabrous, 2 or 4 valved. Seeds dark brown.

*Flower & Fruits:* March to November.

*Specimen Cited:* Rasik Beel, *Rajib & AP Das 0373*, dated 21.07.2007.

*Local Distribution:* Agriculture land.

*General Distribution:* India (Assam, West Bengal); Native to Mexico and West Indies.

PETUNIA Jussieu, Ann. Mus. Natl. Hist. Nat. 2: 214. 1803.

***Petunia X hybrida*** Hortulanorum ex Vilmorin, Fl. Pleine Terre 1: 615-616. 1863. *Petunia violacea* var. *hybrida* Hooker f., Bot. Mag. 64: pl. 3556. 1837. *Petunia hybrida* (Hooker f.) Vilmorin, Fl. Pleine Terre ed. 1. 615. 1863; Mill in Grierson *et* Long, Fl. Bhut. 2(3): 1076. 2001. *Petunia violacea* var. *hybrida* Hooker f., Bot. Mag. 64: t. 3556. 1837.

*Vernacular name:* Petuinia.

Annual, herbs up to 60 cm, glandular hairy. Leaves short petiolate to subsessile; lamina ovate, 3 – 8 x 1.5 – 4 cm, acute, entire, base cuneate. Calyx deeply parted; lobes linear, obtuse. Corolla white and yellow, sometimes fragrant, funnellform, limb spreading. Style slightly exceeding stamens. Capsules conical. Seeds subglobose.

*Flowers & Fruits:* March to August.

*Specimen Cited:* Rasik Beel, *Rajib & AP Das 0256*, dated 10. 02. 2007.

*Local Distribution:* Park and Garden.

*General Distribution:* Cultivated World wide.

PHYSALIS Linnaeus, Sp. Pl. 1: 182. 1753.

***Physalis minima*** Linnaeus, Sp. Pl. 183-184. 1753; Clarke in Hooker f., Fl. Brit. Ind. 4: 238. 1883; Mill in Grierson *et* Long, Fl. Bhut. 2(3): 1045. 2001; Prain, Beng. Pl. 2: 750. 1903; Guha Bakshi, Fl. Mur. Dist. 219. 1984. *Physalis parviflora* Lag, Gen. Sp. Pl. 11. 1816. *Physalis parviflora* Robert Brown, Prodr. 447. 1810. *Physalis lanceifolia* Nees, Linnaea 6(3): 473-474. 1831.

*Vernacular name:* Tapari.

Erect or decumbent, annual herbs, up to 1m. Lamina ovate to ovate-lanceolate, 2 – 3 x 1 – 1.5 cm, acuminate, base cuneate, often oblique,. Flowers yellow, solitary, on long slender deflexed pedicels. Calyx campanulate. Corolla often with small spot at the base within. Anthers light yellow. Berries completely enclosed within the enlarged membranous 5-10 ribbed calyx; seeds discoid or reniform.

*Flower & Fruits:* April to January.

*Specimen Cited:* Rasik Beel, *Rajib & AP Das 0312*, dated 10.0 2. 2007.

*Local Distribution:* Through out Forest.

*General Distribution:* Pantropic.

SOLANUM Linnaeus, Sp. Pl. 1: 184. 1753.

**Key to the species:**



- 1a. Corolla yellow; flowers 5–9-merous ..... *S. pimpinellifolium*  
 1b. Corolla usually white, blue, or violet; flowers 4 to 5 merous .... 2  
 2a. Plants with stellate hairs ..... 3  
 2b. Plants glabrous, stellate hairs usually absent ..... 5  
 3a. Inflorescences mostly 1–3-branched ..... 4  
 3b. Inflorescences unbranched ..... *S. melongena*  
 4a. Leaves usually pinnate-parted ..... *S. sisymbriifolium*  
 4b. Leaves subentire or variously lobed ..... *S. rudepannum*  
 5a. Shrubs; leaves borne on woody stems ..... *S. viarum*  
 5b. Herbs; leaves borne on herbaceous shoots ..... 6  
 6a. Fruit yellowish orange to reddish; plants villous ..... *S. villosum*  
 6b. Fruit black; plants glabrescent to puberulent ..... *S. americanum*

***Solanum viarum*** Dunal in A. de Candolle, Prodr. 13(1): 240. 1852; Mill in Grierson *et* Long, Fl. Bhut. 2(3): 1058. 2001. *Solanum khasianum* C.B. Clarke in Hooker *f.*, Hooker *f.*, Fl. Brit. Ind. 4: 234. 1833. [PLATE: 8, Figure-82]

*Vernacular name:* Kantabegun.

Erect, subshrubs, up to 1m, armed. Leaves unequal paired; armed with erect, flat, straight prickles; lamina broadly ovate, 6–15 x 6–12 cm, lobed, lobes blunt at apex, base truncate to short hastate. Inflorescences extra-axillary, subfasciculate, 1–5 flowered racemes. Flowers andromonoecious, only basal ones fertile. Calyx campanulate. Corolla white. Anthers lanceolate, acuminate. Ovary puberulent. Style glabrous. Berry pale yellow, globose. Seeds brown.

*Flowers & Fruits:* June to October.

*Specimen Cited:* Bochamari cultivation field, *Rajib & AP Das 0418*, dated 22.07.2007.

*Local Distribution:* Agriculture land.

*General Distribution:* widespread in tropical Asia and Africa.

***Solanum rudepannum*** Dunal, Prodr. 13(1): 264-265. 1852. *Solanum torvum* Swartz, Prodr. 47. 1788; Clarke in Hooker *f.*, Fl. Brit. Ind. 4: 234. 1883; Mill in Grierson *et* Long, Fl. Bhut. 2(3): 1055. 2001. *Solanum torvum* var. *ochraceo-ferrugineum* Dunal, Prodr. 13(1): 260-261. 1852. *Solanum diversifolium* Schldtle, Linnaea 19: 297-298. 1847. *Solanum auctosepalum* Rusby, Descr. S. Amer. Pl. 114. 1920.

*Vernacular name:* Gotbegun, Titbegun.

Large shrubs, up to 3 m, sparingly armed. Leaves solitary to paired; lamina ovate to elliptic, 6–16 x 4–10 cm, acute, sinuate or usually 5–7-lobed, base cordate to cuneate. Inflorescences extra-axillary, many-flowered racemose panicles. Flowers andromonoecious. Calyx cup-shaped; lobes ovate-lanceolate. Corolla white, rotate; lobes ovate-lanceolate. Fruiting pedicel 1–2 cm. Berry yellow, smooth, glabrous. Seeds discoid.

*Flower & Fruits:* November to August.

*Specimen Cited:* Forest margin near gate, *Rajib & AP Das 0552*, dated 24.07.2007.

*Local Distribution:* Throughout the study area.

*General Distribution:* Tropical India, China, Malaya, Philippines and Tropical America.

***Solanum americanum*** Miller, Gard. Dict. (ed. 8) no. 5 no. 5. 1768. *Solanum nigrum* Linnaeus, Sp. Pl. 1: 186. 1753; Clarke in Hooker *f.*, Fl. Brit. Ind. 4: 229. 1883; Mill in Grierson *et* Long, Fl. Bhut. 2(3): 1052. 2001; Guha Bakshi, Fl. Mur. Dist. 221. 1984. *Solanum nodiflorum* Jacquin,

Icon. Pl. Rar. 2: 11, pl. 326, 11. 1786. *Solanum nigrum* var. *minor* Hooker f., Trans. Linn. Soc. London 20: 201. 1847.

Annual herbs, green, mostly erect, up to 100 cm. Lamina ovate, 4–8 x 2–4 cm, membranous, apex acute, entire or sparingly dentate, base truncate to cuneate. Inflorescences extra-axillary. Calyx cup-shaped; lobes ovate, ciliate. Corolla white; lobes ovate-oblong. Filaments short. Berry shiny black, occasionally ripening green, globose. Seeds discoid.

*Flower & Fruits:* November to March

*Specimen Cited:* Bochamari cultivation field, *Rajib & AP Das 0643*, dated 12. 02. 2008.

*Local Distribution:* Throughout the study area.

*General Distribution:* India, S. E. Asia, Tropical Africa, Australia and America.

***Solanum villosum*** Miller, Gard. Dict. (ed. 8) no. 2. 1768; Mill in Grierson *et* Long, Fl. Bhut. 2(3): 1052. 2001. *Solanum miniatum* Bernham *ex* Willdenow, Enum. Pl. 1: 236. 1809. [PLATE: 8, Figure-85]

Annual, erect, herbs up to 100 cm. Lamina ovate, 4–10 3–7 cm, pubescent, obtuse, entire or coarsely dentate, base cuneate, decurrent. Inflorescences extra-axillary umbels. Calyx cup-shaped; lobes subdeltate, pubescent abaxially, ciliate. Corolla white; lobes ovate-oblong, ciliate, spreading. Filaments 1.5 mm; anthers oblong. Style 5 mm. Fruiting pedicel strongly deflexed. Berry dull black, globose. Seeds discoid.

*Flower & Fruits:* March to November.

*Specimen Cited:* Bochamari cultivation field, *Rajib & AP Das 0240*, dated 09. 02. 2007.

*Local Distribution:* Throughout the study area.

*General Distribution:* India, Japan; SW Asia, Europe.

***Solanum sisymbriifolium*** Lamarke, Tab. Encyl. 2: 25. 1794. *Solanum sisymbriifolium* f. *ililacinum* Kuntze, Revis. Gen. Pl. 3(3): 227. 1898. [PLATE: 5, Figure-41]

Annual herbs, up to 1m, copiously armed. Leaves simple or sometimes pinnate; lamina oblong to ovate, 5–12 x 2.5–5 cm; lobes pinnately lobed or dentate, apex acute. Inflorescences axillary and extra-axillary scorpioid racemes. Calyx cup-shaped; lobes ovate-lanceolate. Corolla white, stellate; lobes ovate. Anthers lanceolate. Ovary puberulent. Fruiting calyx enlarged, longer than fruit, densely prickly, enveloping most berry. Berry bright red, subglobose. Seeds reniform.

*Flowers & Fruits:* February to August.

*Specimen Cited:* Conservation sector, *Rajib & AP Das 0703*, dated 14. 02. 2008.

*Local Distribution:* Forest margin.

*General Distribution:* India, native to South America; naturalized in Africa, Australia.

***Solanum melongena*** Linnaeus, Sp. Pl. 1: 186. 1753; Mill in Grierson *et* Long, Fl. Bhut. 2(3): 1058. 2001.

*Vernacular Name:* Begun.

Woody, branched shrubs, up to 60 cm, sparingly armed. Lamina ovate to oblong-ovate, 6–18 x 5–11 cm, obtuse, sinuate-lobed, base oblique. Inflorescences mostly solitary flowers. Flowers andromonoecious. Calyx stellate tomentose; lobes lanceolate. Corolla purplish; lobes deltate. Berry purple, pink, with a thick, spongy, whitish mesocarp and septal region. Seeds lenticular, yellowish.

*Flowers & Fruits*: January to August.

*Specimen Cited*: Bochamari cultivation field, *Rajib & AP Das 0378*, dated 21.07.2007.

*Local Distribution*: Cultivated.

*General Distribution*: Widely cultivated for its edible fruits.

***Solanum pimpinellifolium*** Linnaeus, Cent. Pl. I 1: 8. 1755. *Lycopersicon pimpinellifolium* (Linnaeus) Miller, Gard. Dict. (ed. 8) no. 4. 1768. *Lycopersicon esculentum* Miller, Gard. Dict. (ed.8) n.2. 1768; Hooker f., Fl. Brit. Ind. 4:237.1883; Mill in Grierson *et* Long, Fl. Bhut. 2(3): 1063. 2001. *Solanum lycopersicum* Linnaeus, Sp. Pl. 185.1753.

*Vernacular name*: Chhoto tomato.

Annual, sprawling, herbs up to 1.3 m, odorous. Lamina mostly pinnately compound to divided, 10 – 40 cm, obtuse, base oblique, cuneate; leaflets mostly unequal, ovate to oblong, entire to irregularly dentate. Racemes 3–7 flowered. Calyx rotate-campanulate, lobes lanceolate. Corolla lobes narrowly oblong, yellow. Berry red to orange-yellow, subglobose, fleshy, juicy, shiny. Seeds straw colored.

*Flowers & Fruits*: May to November.

*Specimen Cited*: Bochamari cultivation field, *Rajib & AP Das 0275*, dated 10. 02. 2007.

*Local Distribution*: Agriculture land.

*General Distribution*: A native to Mexico and South America; cultivated elsewhere; sometime escapes.

## Core-Eudicots: Asterids: Euasterids (II)

### Order: Asterales Link (1829)

**Asteraceae** Link, Handb. 1: 731. 1829 ('Asteroideae'); *nom. nov.* vs. Corymbiferae A. L. de Jussieu, 1789; *nom. alt.* vs. Compositae)

#### Key to the genera:

- |  |                   |
|--|-------------------|
| 1a. Capitula with only male florets or with only female florets .....                        | 2                 |
| 1b. Capitula all alike, homogamous or heterogamous .....                                     | 4                 |
| 2a. Plants monoecious, with male and female capitula on same plant .....                     | 9                 |
| 2b. Plants dioecious, with male and female capitula on different plants .....                | 3                 |
| 3a. Phyllaries with distinct pale or brownish scarious margin .....                          | <b>Artemisia</b>  |
| 3b. Phyllaries whitish brown or yellowish especially in distal part .....                    | <b>Gnaphalium</b> |
| 4a. Capitula homogamous and all florets ligulate, latex present .....                        | 19                |
| 4b. Capitula heterogamous, or if homogamous then corollas<br>zygomorphic, latex absent ..... | 5                 |
| 5a. Capitula homogamous; corollas pseudoligulate, 5-lobed and<br>zygomorphic .....           | 20                |
| 5b. Capitula heterogamous; corollas 3–5-lobed, actinomorphic .....                           | 6                 |
| 6a. Leaves opposite or at least below synflorescence opposite .....                          | 21                |
| 6b. Leaves all alternate .....   | 7                 |
| 7a. Receptacle paleate .....   | 23                |
| 7b. Receptacle epaleate .....  | 8                 |
| 8a. Phyllaries uniseriate; involucre cylindric .....   | 9                 |

- 8b. Phyllaries 2- to several seriate, involucre saucer-shaped to subglobose ..... 25
- 9a. Capitula small and not showy; all florets unisexual ..... **Xanthium**
- 9b. Capitula colorful and attractive; some or all florets bisexual ..... 10
- 10a. Leaves and phyllaries with obvious oil glands ..... **Tagetes**
- 10b. Leaves and phyllaries lacking oil glands ..... 11
- 11a. Only ray florets fertile, ray achenes much longer than sterile disk florets ..... **Parthenium**
- 11b. Disk florets fertile; ray florets present and fertile or sterile or absent ..... 12
- 12a. Pappus of plumose setae or fimbriate ..... 13
- 12b. Pappus absent, or awned ..... 14
- 13a. Pappus of plumose setae ..... **Tridax**
- 13b. Pappus absent or of fimbriate ..... **Galinsoga**
- 14a. Achenes compressed ..... 15
- 14b. Achenes all plump or 3–5-angled in ray florets ..... 17
- 15a. Pappus of retrorsely barbed awns; leaves opposite or upper alternate ..... **Bidens**
- 15b. Pappus absent, or persistent, of 2 bristly cusps or scales; leaves opposite ..... 16
- 16a. Achenes markedly dimorphic, lacerate winged margin, others wingless ..... **Synedrella**
- 16b. Achenes all alike, wingless, not lacerate ..... **Eleutheranthera**
- 17a. Achenes enclosed by inner phyllaries or outer paleae ..... **Enydra**
- 17b. Achenes not enclosed by inner phyllaries ..... 18
- 18a. Paleae narrow, long, flat; 2 seriate ray florets not enclosed by paleae . . **Eclipta**
- 18b. Paleae concave or folded, enclosing florets ..... **Acmella**
- 19a. Pappus white, fine cottony outer bristles intermixed with thicker inner ones ..... **Sonchus**
- 19b. Pappus grayish and yellowish, equal in diameter and stiffness ..... **Youngia**
- 20a. Capitula densely clustered, subtended by 3 leaflike bracts ..... **Elephantopus**
- 20b. Capitula in lax panicles with more than 4 florets ..... **Vernonia**
- 21a. Phyllaries and florets 4 per capitulum ..... **Mikania**
- 21b. Phyllaries and florets not of equal number ..... 22
- 22a. Phyllaries all deciduous leaving a naked receptacle ..... **Chromolaena**
- 22b. At least some basal phyllaries persistent ..... **Ageratum**
- 23a. All florets with pappus ..... **Blumea**
- 23b. Pappus absent ..... **Sphaeranthus**
- 24a. Involucre not calyculate ..... **Emilia**
- 24b. Involucre calyculate ..... **Crassocephalum**
- 25a. Herbs prostrate; involucre patelliform ..... **Grangea**
- 25b. Herbs erect; involucre hemispheric ..... **Erigeron**

**Key to the species:**

- 1a. Capitula discoid ..... *A. paniculata*  
 1b. Capitula ovoid-conical ..... *A. calva*

*Acmella calva* (de Candolle) Jansen, Syst. Bot. Monogr. 8: 41. 1985; Grierson *et* Springate in Grierson *et* Long, Fl. Bhutan 2(3): 1605. 2001. *Spilanthes calva* de Candolle in Wight, Contr. Bot. Ind. 19. 1834; H. Ohashi in Hara, Fl. E. Himal. 2: 141. 1971; Hara *et al.*, Enn. Fl. Pl. Nep. 3: 45. 1982; Fl. Ind. 12: 409. 1995. *Spilanthes acmella* var. *calva* (de Candolle) Clarke, Comp. Ind. 138. 1876; Clarke in Hooker *f.*, Fl. Brit. Ind. 3: 307. 1881. [PLATE: 8, Figure-81]

Perennial, creeping or prostrate herbs. Stems up to 60 cm, rooting at nodes. Petiole 5 – 8 mm; lamina lanceolate, 3 – 8 x 1 – 3 cm, base cuneate, peaked serrate, acuminate or caudate. Capitula ovoid-conical; phyllaries 7 – 9, 2 seriate, subequal, ovate-oblong, ciliate; receptacle columnar-conical. Corollas yellow; ray florets female, lamina short, obovate, shallowly 3-lobed; disk florets bisexual, tubular, 4 to 5 toothed. Achenes brown, oblong; pappus 2.

*Flowers & Fruits:* July to November.

*Specimen Cited:* Parks, Rajib & AP Das 0577, dated 25.07.2007.

*Local Distribution:* Throughout Parks and Garden areas.

*General Distribution:* India, Bhutan, Nepal, Sri Lanka, China, Myanmar, Indonesia, Malaysia.

*Acmella paniculata* (Wallich *ex* de Candolle) R.K. Jansen, Syst. Bot. Monogr. 8: 67. 1985; Grierson *et* Springate in Grierson *et* Long, Fl. Bhutan 2(3): 1605. 2001. *Spilanthes paniculata* Wallich *ex* de Candolle, Prodr. 5: 625. 1836. *Spilanthes acmella* var. *paniculata* (Wallich *ex* de Candolle) C.B. Clarke, Comp. Ind. (1876) 139. 1876.

Annual ascending herbs. Stems branched. Petiole 1–2 cm; lamina ovate to ovate-lanceolate, 2 – 5 x 1 – 3 cm, 3 veined, base cuneate, crenately serrate, acute. Capitula discoid, solitary, terminal; phyllaries 9 – 11, 2 seriate, ovate-lanceolate. Florets 100 – 200; corollas tubular, minute, 4 to 5 lobed. Achenes obovoid, 3 angled; pappus of 2 subequal bristles.

*Flowers & Fruits:* June to November.

*Specimen Cited:* Park, Rajib & AP Das 0700, dated 14. 02. 2008.

*Local Distribution:* Throughout Parks and Garden areas.

*General Distribution:* India, Bhutan, China, Bangladesh, Nepal, Sri Lanka, Indonesia, Laos, Malaysia, Myanmar, Philippines, Vietnam, Thailand.

AGERATUM Linnaeus, Sp. Pl. 2: 839. 1753.

**Key to the species:**

- 1a. Leaf base cordate to truncate ..... *A. houstonianum*  
 1b. Leaf base obtuse to broadly cuneate ..... *A. conyzoides*

*Ageratum houstonianum* Miller, Gard. Dict. ed. 8, Ageratum no. 2. 1768; Grierson *et* Springate in Grierson *et* Long, Fl. Bhutan 2(3): 1627. 2001. *Ageratum mexicanum* Sims, Bot. Mag. T. 2524. 1825. *Ageratum conyzoides* var. *mexicanum* (Sims) de Candolle, Prodr. 5: 108. 1836. *Carelia houstoniana* (Miller) Kuntze, Revis. Gen. Pl. 1: 325. 1891. 325. 1891. *Ageratum cordifolium* Roxburgh, 415. 1832.

*Vernacular name:* Uchuntijhar.

Annual, erect herbs, purple-red branched from middle or lower part, up to 80 cm. Leaves broadly ovate or triangular-ovate; median stem leaves 2 – 6 x 2 – 4 cm; upper and axillary leaves smaller;

both surfaces sparsely to densely white pubescent, base cordate to truncate, crenateserrate, rounded or acute. Synflorescence corymbose. Capitula 6 – 14 or more; involucre campanulate; phyllaries 2 to 3 seriate, narrowly lanceolate; corollas tubular; limb purplish; lobes pubescent. Achenes black.

*Flowers & Fruits:* Through out year.

*Specimen Cited:* Road side, *Rajib & AP Das 0471*, dated 23.07.2007.

*Local Distribution:* Through out study areas.

*General Distribution:* India: throughout; Bhutan, China, Nepal, South China Sea islands, Myanmar, Africa; native to tropical America.

***Ageratum conyzoides*** Linnaeus, Sp. Pl. 2: 839. 1753; C.B. Clarke in Hooker *f.*, Fl. Brit. India 3: 243. 1881; H. Ohashi in Hara, Fl. E. Himal. 1: 330. 1966; Hajra *et al.*, Fl. Ind. 12: 348. 1995; Grierson *et Springate* in Grierson *et Long*, Fl. Bhutan 2(3): 1627. 2001. *Ageratum arsenei* B.L. Robinson, Contr. Gray Herb. 64 3. 1922. [PLATE: 9, Figure-99]

*Vernacular name:* Uchunti jhar.

Annual, erect herbs. Stems robust, simple or branched from middle, stems and branches reddish, or green toward apex, densely spreading long tomentose. Leaves alternate; median leaves ovate, elliptic to oblong, 3 – 7 x 2 – 5 cm; upper leaves gradually smaller, oblong, base obtuse to broadly cuneate, crenate-serrate, acute. Capitula small, 4 – 12, in dense terminal corymbs; involucre campanulate; phyllaries 2 seriate, oblong to lanceolate-oblong; corollas limb purplish, 5 lobed. Achenes black.

*Flowers & Fruits:* Through out year.

*Specimen Cited:* Road side, *Rajib & AP Das 0645*, dated 12. 02. 2008.

*Local Distribution:* Through out.

*General Distribution:* India though out; Bhutan, China, Bangladesh, widespread weed throughout Africa, Malay Peninsula, Myanmar, Nepal, and the South China Sea islands; native to tropical America.

ARTEMISIA Linnaeus, Sp. Pl. 2: 845. 1753.

***Artemisia indica*** Willdenow, Sp. Pl. ed. 4, 3(3): 1846. 1803; Hara *et al.*, Enn. Fl. Pl. Nep. 3: 12. 1982; Hajra *et al.*, Fl. Ind. 12: 27. 1995; Grierson *et Springate* in Grierson *et Long*, Fl. Bhutan 2(3): 1559. 2001. *Artemisia indica* var. *Indica* Willdenow, Sp. Pl., ed. 4. 3: 1846. 1803.

*Vernacular name:* Nagnishinda.

Perennial herbs or small subshrubs, up to 180 cm tall, much branched. Leaves shortly petiolate; lamina tomentose. Leaves ovate to oblong-ovate, 6 – 15 x 3 – 7 cm, pinnatipartite; distal lobes larger; segments 3 to 4 pairs; uppermost leaves pinnatipartite; leaflike bracts 3 lobed or entire. Capitula sessile. Involucre oblong-ovoid to broadly ovoid; phyllaries puberulent to glabrous. Florets 16 – 20. Marginal female florets 4 – 10; corolla tubular, 2 toothed. Disk florets 8 – 12, bisexual, basally glandular. Achenes brown, oblong or obovoid.

*Flowers & Fruits:* August to October.

*Specimen Cited:* Garden, *Rajib & AP Das 0497*, dated 23.07.2007.

*Local Distribution:* Planted in Garden.

*General Distribution:* India: tropical and subtropical; S.E. Asia, North America including Central America, Oceania.

BIDENS Linnaeus, Sp. Pl. 831. 1753

***Bidens pilosa*** Linnaeus, Sp. Pl. ed. 2: 832. 1753; Clarke in Hooker *f.*, Fl. Brit. Ind. 3: 309. 1881; H. Ohashi in Hara, Fl. E. Himal. 1: 333. 1966; Hara *et al.*, Enn. Fl. Pl. Nep. 3: 15. 1982; Fl. Ind.

12: 372. 1995; Grierson *et* Springate in Grierson *et* Long, Fl. Bhutan 2(3): 1619. 2001. *Bidens alba* (Linnaeus) de Candolle, Prodr. 5: 605. 1836. *Coreopsis alba* Linnaeus, Sp. Pl. 2: 908. 1753. [PLATE: 5, Figure-34]

Annual erect or suberect herbs, up to 90 cm. Lamina ovate to lanceolate, 30–90 x 12–25 mm, 3–7 lobes, bases truncate to cuneate, serrate or entire, acute to attenuate. Synflorescence of solitary capitula or lax corymbs. Capitula radiate or discoid; calycular bracts spatulate to linear; phyllaries 8 or 10, lanceolate to oblanceolate. Ray florets absent or 5; lamina whitish. Disk florets 20–60; corollas yellowish. Outer achenes red-brown, 2-grooved; inner achenes blackish, 4 angled, 2-grooved.

*Flowers & Fruits:* June to March.

*Specimen Cited:* Garden margin, Rajib & AP Das 0588, dated 25.07.2007.

*Local Distribution:* Throughout the study areas.

*General Distribution:* Tropical and subtropical regions.

BLUMEA Candolle in Guillemin, Arch. Bot. (Paris) 2: 514. 1833.

*Blumea lacera* (Burmanf.) de Candolle in Wight, Contr. Bot. India, 14. 1834; Hookerf., Fl. Brit. Ind. 3: 263. 1881; Guha Bakshi, Fl. Mur. Dist. 161. 1984; Hajra *et al.*, Fl. Ind. 13: 128. 1995; Grierson *et* Springate in Grierson *et* Long, Fl. Bhutan 2(3): 1504. 2001. *Conyza lacera* Burmann f., Fl. Ind. 180. t. 59. f. 1. 1768. *Blumea hieraciifolia* Hooker f. & Thomson, Fl. Brit. Ind. 3(8): 267. 1881. *Blumea lacera* var. *cinerascens* (de Candolle) Hooker f., Fl. Brit. Ind. 3(8): 263. 1881. *Blumea hieraciifolia* Hooker f. *et* Thomson in Hookerf., Fl. Brit. Ind. 3(8): 267. 1881. *Blumea villosa* Schultz-Bipontinus *ex* Hookerf., Fl. Brit. Ind. 3(8): 263. 1881. [PLATE: 7, Figure-62]

*Vernacular name:* Kukur mota.

Annual or biennial, erect, branched, herbs, up to 100 cm. Leaves sessile and petiolate, elliptic to oblong, Fl. Bhut. 10–15 x 4–5 cm, base attenuate, doubly serrate and sometimes slightly lyrate lobed, obtuse. Capitula in axillary and terminal dense panicles. Involucres campanulate; phyllaries in 2 to 3 series. Receptacle convex, glabrous. Marginal florets 2–5 lobed. Central florets yellowish. Achenes oblong. Pappus white.

*Flowers & Fruits:* March to June.

*Specimen Cited:* Road side, Rajib & AP Das 0578, dated 25.07.2007.

*Local Distribution:* Throughout the study areas.

*General Distribution:* India: pantropical; Bhutan, Japan, Malaysia, Myanmar, Pakistan, Sri Lanka, Thailand, Vietnam; Africa, N Australia, Pacific islands.

CRASSOCEPHALUM Moench, Methodus 516. 1794, *nom. cons.*

*Crassocephalum crepidioides* (Benth) S. Moore in J. Bot. 50: 211. 1912; Hara *et al.*, Enn. Fl. Pl. Nep. 3: 22. 1982; Hajra *et al.*, Fl. Ind. 13: 201. 1995; Grierson *et* Springate in Grierson *et* Long, Fl. Bhutan 2(3): 1597. 2001. *Gynura crepidioides* Benth in Hookerf., Fl. Niger. 438. 1849.

Annual, erect, herbs, up to 120 cm. Lamina elliptic to oblong-elliptic, 8–12 x 4–5 cm, membranous, base cuneate, irregularly serrate or double-serrate, sometimes pinnately lobed at base, acuminate. Capitula numerous in terminal corymbiform cymes. Involucres cylindrical; phyllaries uniseriate, linear-lanceolate. Florets tubular, bisexual; corolla red-brownish. Style papillose. Achenes brownish, narrowly oblong.

*Flowers & Fruits:* April to December.

*Specimen Cited:* Rasik Beel, Rajib & AP Das 0369, dated 21.07.2007.

*Local Distribution:* Throughout forest margin.

*General Distribution:* India, native to Africa; pantropical weed of Africa, S and SE Asia, Australia, Central and South America, and Pacific islands.

ECLIPTA Linnaeus, Mant. Pl. 157, 286. 1771.

***Eclipta prostrata*** (Linnaeus) Linnaeus, Mant. Pl. 2: 286. 1771; Hajra *et al.*, Fl. Ind. 12: 381. 1995; Grierson *et Springate* in Grierson *et Long*, Fl. Bhutan 2(3): 1623. 2001. *Verbesina prostrata* Linnaeus, Sp. Pl. 2: 902. 1753. *Eclipta alba* (Linnaeus) Hasskarl, Pl. Jav. Rav. 528. 1848; Clarke in Hooker *f.*, Fl. Brit. Ind. 3: 304. 1881. *Verbesina alba* Linnaeus, Sp. Pl. 2: 902. 1753.

Annual erect, ascending or prostrate, herbs, up to 60 cm. Leaves lanceolate, 3 – 10 x 0.5 – 2 cm, papery, base narrowed, sessile to shortly petiolate, serrulate, gradually acuminate. Capitula terminal and axillary; peduncle slender; involucre globose-campanulate; phyllaries 5 to 6, in 2 seriate, oblong, acute. Ray florets 2 seriate. Disk florets many; corolla 4-lobed. Achenes ribbed.

*Flowers & Fruits:* Throughout the year.

*Specimen Cited:* Park margin, Rajib & AP Das 0274, dated 10. 02. 2007.

*Local Distribution:* Throughout the study areas.

*General Distribution:* Tropical India; native to America; introduced in Europe, Asia, Africa, Pacific islands, Australia.

ELEPHANTOPUS Linnaeus Sp. Pl. 814. 1753 et Gen. Pl. ed. 5. 5355. 1754.

***Elephantopus scaber*** L., Sp. Pl. 2: 814. 1753; C.B. Clarke in Hooker *f.*, Fl. Brit. India 3: 242. 1881; Hajra *et al.*, Fl. Ind. 13: 333. 1995; Grierson *et Springate* in Grierson *et Long*, Fl. Bhutan 2(3): 1489. 2001. *Scabiosa cochinchinensis* Loureiro, Fl. Cochinch. 1: 68. 1790. *Elephantopus scaber* var. *albiflorus* Kuntze, Revis. Gen. Pl. 1 335. 1891.

Perennial, procumbent or ascending herbs, up to 40 cm. Stems erect, dichotomously branched. Basal leaves persistent by anthesis, rosulate, spatulate or oblanceolate, 8 – 16 x 2 – 4 cm, base gradually attenuate, crenate-serrate, shortly acute; cauline leaves few and small. Synflorescence densely aggregated in compound heads, surrounded by leaflike bracts; bracts broadly ovate, acuminate. Capitula many. Phyllaries oblong-lanceolate, acuminate and spinescent. Florets 4, herbaceous, purplish or pink. Achenes oblong-linear.

*Flowers & Fruits:* June to October.

*Specimen Cited:* Grassland, Rajib & AP Das 0581, dated 25.07.2007.

*Local Distribution:* Throughout grass land.

*General Distribution:* India; widely distributed in tropical Asia, Australia and Africa.

EMILIA Cassini, Bull. Sci. Soc. Philom. Paris 1817: 68. 1817.

***Emilia sonchifolia*** (Linnaeus) de Candolle *ex de Candolle*, "Wight, Contr. Bot. India" 24. 1834; Prain, Beng. Pl. 1: 444. 1903; Hajra *et al.*, Fl. Ind. 13: 212. 1995; Grierson *et Springate* in Grierson *et Long*, Fl. Bhutan 2(3): 1598. 2001; Guha Bakshi, Fl. Mur. Dist. 166. 1984. *Cacalia sonchifolia* Hort *ex* Linnaeus, Sp. Pl.: 835. 1753; Hooker *f.*, Fl. Brit. Ind. 3: 336. 1881.

Annual, erect or ascending herbs, up to 40 cm. Leaves thick, lower leaves crowded, abaxially dark green, often becoming purple, 5 – 12 x 2.5 – 6 cm; terminal lobe large, broadly ovate-triangular, irregularly dentate, obtuse; lateral lobes usually paired, oblong-lanceolate, bluntly dentate, obtuse or acute. Median stem leaves lax, sessile, smaller, ovate-lanceolate; upper leaves few, linear. Capitula pendulous before anthesis, erect later, usually 2 – 5, in terminal lax corymbs. Involucres cylindrical; phyllaries 8 or 9, oblong-linear to linear. Florets pink or purplish. Achenes cylindrical.



*Flowers & Fruits:* June to October.

*Specimen Cited:* Garden, *Rajib & AP Das 0655*, dated 13. 02. 2008.

*Local Distribution:* Through out Park and Garden.

*General Distribution:* India: eastern states throughout; China, Asia and Africa.

ENYDRA Loureiro, Fl. Cochinch. 2: 510. 1790.

*Enydra fluctuans* Loureiro, Fl. Cochinch. 511. 1790; C.B. Clarke in Hooker *f.*, Fl. Brit. India 3: 304. 1881; Hajra *et al.*, Fl. Ind. 12: 384. 1995; Grierson *et* Springate in Grierson *et* Long, Fl. Bhutan 2(3): 1614. 2001. [PLATE: 9, Figure-97]

*Vernacular name:* Helencha.

Annual or biennial, cylindric, slightly fleshy, prostrate herbs, up to 80 cm. Leaves subsessile, oblong to linear-oblong, 3 – 6 cm x 5 – 12 mm, both surfaces glabrous, base amplexicaul, sparsely serrate, obtuse or acute. Capitula terminal and axillary; involucre of 4 phyllaries, ovate-oblong. Ray florets 3 to 4 lobed. Disk florets 5 lobed; stamens 5. Achenes obovoid-cylindric.

*Flowers & Fruits:* November to April.

*Specimen Cited:* Ververi Beel, *Rajib & AP Das 0520*, dated 23.07.2007.

*Local Distribution:* Through out Wetlands.

*General Distribution:* Tropical regions of India; Indonesia, Malaysia, Myanmar, Thailand, Vietnam; Australia, Asia and Africa.

ERIGERON Linnaeus, Sp. Pl. 2: 863. 1753.

*Erigeron canadensis* Linnaeus, Sp. Pl. 2: 863. 1753; Grierson *et* Springate in Grierson *et* Long, Fl. Bhutan 2(3): 1546. 2001. *Conyza canadensis* (Linnaeus) Cronquist, Bull. Torrey Bot. Club. 70: 632. 1943.

Annual, semierect, branched herbs, up to 80 cm. Lower leaves petiolate, lamina oblanceolate, 6 – 10 x 1 – 1.5 cm, base attenuate, sparsely serrate to entire, acute to shortly acuminate; mid and upper leaves subsessile or sessile, lamina linear-lanceolate to linear, smaller, margin entire. Capitula in terminal, large paniculiform synflorescences; peduncles slender. Involucre subcylindric; phyllaries 2 to 3 seriate. Ray florets 20 – 40, white; disk florets 8 – 30, yellowish. Achenes linear-lanceoloid, compressed.

*Flowers & Fruits:* May to September.

*Specimen Cited:* Garden, *Rajib & AP Das 0701*, dated 14. 02. 2008.

*Local Distribution:* Parks and Garden.

*General Distribution:* Through out tropical India; native to North America.

CHROMOLAENA de Candolle, Prodr. 5: 133. 1836.

*Chromolaena odorata* (Linnaeus) R.M. King & Harold Robinson, Phytologia 20: 204. 1970; Grierson *et* Springate in Grierson *et* Long, Fl. Bhutan 2(3): 1628. 2001. *Eupatorium odoratum* Linnaeus, Syst. Nat. ed. 10: 1205. 1759; C.B. Clarke in Hooker *f.*, Fl. Brit. India 3: 244. 1881; Hajra *et al.*, Fl. Ind. 12. 354. 1995.

Perennial, procumbent herbs. Stems erect, up to 2.5 m. Leaves opposite; lamina ovate, triangular, or ovate-triangular, 5 – 10 x 2 – 5 cm, basally 3 veined, base truncate to shallowly cordate, coarsely and irregularly crenate to serrate, acute. Synflorescence of numerous capitula in corymbs or compound corymbs. Capitula 20 – 24 flowered; involucre cylindric; phyllaries 3 to 4 seriate; corollas white. Achenes black-brown.

*Flowers & Fruits*: April to December.

*Specimen Cited*: Rasik Beel, *Rajib & AP Das 0595*, dated 25.07.2007.

*Local Distribution*: Throughout study areas.

*General Distribution*: Throughout India; Native to America; naturalized in tropical countries.

GALINSOGA Ruiz & Pavon, Fl. Peruv. Prodr. 110. 1794.

***Galinsoga parviflora*** Cavanilles, Icon. 3: 41. 1795; Grierson *et* Springate in Grierson *et* Long, Fl. Bhutan 2(3): 1610. 2001.

Suberect or erect herbs up to 40 cm. Lamina 10 – 150 x 5 – 70 mm. Peduncles 10 – 20 mm; involucre campanulate; phyllaries persistent; outer paleae persistent, distal inner phyllaries deciduous, elliptic to obovate, 3 lobed, acute. Ray florets 5; corollas usually dull white. Disk florets 20 – 45. Pappus absent or of 5; disk achenes glabrous or strigose; pappus absent or of 16.

*Flowers & Fruits*: June to October.

*Specimen Cited*: Garden, *Rajib & AP Das 0302*, dated 10. 02. 2007.

*Local Distribution*: Parks and Garden.

*General Distribution*: Tropical India; Bhutan, China, Bangladesh; native to South America.

***Laphangium affine*** (D. Don) Tzvelev, Byull. Moskovsk. Obshch. Isp. Prir., Otd. Biol. 98(6): 105. 1994. *Gnaphalium affine* D. Don, Prodr. Fl. Nepal. 173 1825. *Gnaphalium luteo-album* L. var. *multiceps* de Candolle, Prodr. 6: 222.1838; Hooker *f.*, Fl. Brit. Ind 3: 288. 1881. *Gnaphalium luteo-album* Linnaeus, Sp. Pl. 2: 851. 1753; Hooker *f.*, Fl. Brit. Ind 3: 288. 1881. *Pseudognaphalium affine* (D. Don) Anderberg, Opera Bot. 104: 146. 1991; Grierson *et* Springate in Grierson *et* Long, Fl. Bhutan 2(3): 1522. 2001.

Biennial erect herbs, up to 40 cm. Stems densely white lanate tomentose. Leaves thin; lower leaves smaller than median cauline leaves; cauline leaves spatulate, 2 – 7 x 4 – 10 cm, white lanate on both surfaces, base angular, entire, rounded, mucronulate. Capitula numerous, densely aggregated in terminal corymbs. Involucre globose-campanulate; phyllaries 3 seriate, pale yellow, broadly ovate, obtuse. Outer florets many. Central florets 5 – 10. Achenes oblong, compressed. Pappus white.

*Flowers & Fruits*: December to April.

*Specimen Cited*: Garden, *Rajib & AP Das 0499*, dated 23.07.2007.

*Local Distribution*: Garden.

*General Distribution*: India: tropical states; Bhutan, Nepal, Afghanistan, Pakistan, Indonesia, Japan, Korea, Myanmar, Philippines, Vietnam, Mauritius, Indo-Chin, New Guinea, Australia, Africa and Europe.

GNAPHALIUM Linnaeus, Sp. Pl. 2: 850. 1753.

### Key to the species:

- 1a. Corollas of all florets usually purplish ..... *G. luteo-album ssp. affine*
- 1b. Corollas of all florets usually purplish ..... *G. purpureum*

***Gnaphalium luteo-album*** L. *ssp. affine* (D. Don) Koster in Blumea 4(3): 484.1941; Grierson *et* Springate in Grierson *et* Long, Fl. Bhutan 2(3): 1522. 2001. *Gnaphalium affine* D. Don, Prodr. Fl. Nep. 173. 1825. *Gnaphalium luteo-album* var. *multiceps* de Candolle, Prodr. 6: 222. 1838; Hooker *f.*, Fl. Brit. Ind. 3: 288. 1881.

Biennial herbs; stems up to 40 cm, densely white woolly tomentose. Leaves thin; lower leaves smaller than median cauline leaves; cauline leaves spatulate, 2 – 5 x 4 - 10 cm, apex rounded, mucronulate, base angular, narrowed, sessile, decurrent, margins entire, white woolly on surfaces. Heads numerous, densely aggregated in terminal corymbs. Involucre globose-campanulate, bracts 3-seriate, pale yellow, outer ones shorter, broadly ovate, inner ones oblong, apex obtuse. Outer florets many. Achenes oblong, compressed, papillose. Pappus white, bristles deciduous separately.

*Flowers & Fruits:* December to May.

*Specimen Cited:* Park, *Rajib & AP Das 0416*, dated 22.07.2007.

*Local Distribution:* Parks.

*General Distribution:* Tropical India; Bhutan, China, Myanmar, Thailand, Indo-China, Java, China and Japan.

***Gnaphalium purpureum*** Linnaeus, Sp. Pl. 2: 854. 1753; Hooker *f.*, Fl. Brit. Ind 3: 289. 1881; Hajra *et. al.*, Fl. Ind. 13: 92. 1995. *Gamochaeta purpurea* (Linnaeus) Cabrera, Bol. Soc. Argent. Bot. 9: 377. 1961; Grierson *et* Springate in Grierson *et* Long, Fl. Bhutan 2(3): 1523. 2001. *Gnaphalium littorale* Banks & Solander *ex* Hooker *f.*, 310. 1846. *Gamochaeta rosacea* (I.M. Johnston) Anderberg, Opera Bot. 104: 157. 1991.

Annual or biennial, erect to decumbent-ascending, unbranched or rarely branched herbs. Leaves basal and cauline, basal and proximal cauline in rosettes, withered but persistent at anthesis; lamina oblanceolate to spatulate, 1.5 – 6 cm x 5 – 15 mm, upper ones smaller. Capitula continuous and interrupted arrays, bracteate. Involucre turbinate-cylindric; phyllaries 4 to 5 seriate. Bisexual florets 3 or 4. Corollas of all florets usually purplish. Achenes oblong. Pappus connate.

*Flowers & Fruits:* February to July.

*Specimen Cited:* Forest margin near Gate, *Rajib & AP Das 0300*, dated 10. 02. 2007.

*Local Distribution:* Through out the forest margin.

*General Distribution:* India: Himalayas, W. Ghats, Jammu and Kashmir, West Bengal, Tamil Nadir, Maharashtra; Pakistan, N. and S. America; native to North America; introduced in Asia, Europe, and South America.

GRANGEA Adanson, Fam. 2: 121. 1763.

***Grangea maderaspatana*** (Linnaeus) Poiret in Lamarck, Encycl. Suppl. 2: 825. 1812; Hooker *f.*, Fl. Brit. Ind 3: 247. 1881; Prain, Beng. Pl. 1: 442. 1903; Grierson *et* Springate in Grierson *et* Long, Fl. Bhutan 2(3): 1529. 2001. *Artemisia maderaspatana* Linnaeus, Sp. Pl. 2: 849. 1753. [PLATE: 8, Figure-78]

Annual, slender, procumbent, branched, herbs, up to 30 cm. Leaves usually obovate to oblanceolate, 3 – 8 1.5 – 3 cm; basal sessile, lamina dissected-lobed, 6 – 10 x 2 – 5 cm, base usually auriculate, terminal lobe obovate to suborbicular, coarsely dentate, lateral lobes 2 – 5 paired; upper gradually smaller. Capitula terminal, solitary. Involucre hemispheric; phyllaries 2 to 3 seriate. Receptacles hemispheric. Marginal female florets yellow, 2 to 6 seriate, corolla filiform; disk florets shortly cylindric campanulate. Achenes compressed.

*Flowers & Fruits:* March to August.

*Specimen Cited:* Barajan Beel, *Rajib & AP Das 0413*, dated 22.07.2007.

*Local Distribution:* Through out Beel Margin.

*General Distribution:* India: pantropical; Bhutan, China, Bangladesh, Nepal, Pakistan, Sri Lanka, Indonesia, Laos, Malaysia, Myanmar, Thailand, Vietnam; tropical Africa.

MIKANIA Willdenow, Sp. Pl. ed. 4, 3: 1742. 1803, *nom. cons.*

***Mikania micrantha*** Kunth in Humboldt, Bonpland & Kunth, Nov. Gen. Sp. 4: 134. 1820; Hajra *et al.*, Fl. Ind. 12: 357. 1995; Grierson *et Springate* in Grierson *et Long*, Fl. Bhutan 2(3): 1625. 2001.

Branched, slender, large vines. Leaves opposite; petiole 1–6 cm; lamina ovate, 5 – 15 x 4 – 9 cm, both surfaces glabrate, base cordate, entire to coarsely dentate, shortly acuminate. Synflorescence a corymbose panicle, capitula clustered on subcymose branches; phyllaries oblong; corollas white, tube narrow, limb broadly campanulate, inside papillate. Achenes 4 ribbed, with many scattered glands; pappus setae pale white.

*Flowers & Fruits:* June to December.

*Specimen Cited:* Syzygium forest, *Rajib & AP Das 0694*, dated 14. 02. 2008.

*Local Distribution:* Throughout the study areas.

*General Distribution:* Tropical India; Bhutan, China, Nepal, Myanmar, Malaysia, Philippines; native to the Caribbean, Central and South America, and Mexico; widely introduced in Asia and the Pacific islands.

PARTHENIUM Linnaeus, Sp. Pl. 988. 1753; Gen. Pl. ed. 5, 426. 1754.

***Parthenium hysterophorus*** Linnaeus, Sp. Pl. 2: 988. 1753; Hajra *et al.*, Fl. Ind. 12: 403. 1995; Grierson *et Springate* in Grierson *et Long*, Fl. Bhutan 2(3): 1622. 2001.

Annual erect herbs, much branched, up to 120 cm. Lamina ovate to elliptic, 3 – 15 x 1 – 5 cm, pinnately 2 lobed, ultimate lobes lanceolate to linear, both surfaces with gland-dotted. Synflorescences of open panicles. Capitula obscurely radiate; outer phyllaries 5, elliptic – lanceolate, inner 5, ovate to orbicular. Female florets 5; corolla limbs reniform or orbicular to oblong. Disk florets 15 – 40. Achenes obovoid; pappuslike enations erect, deltate to ovate.

*Flowers & Fruits:* April to December.

*Specimen Cited:* Road side, *Rajib & AP Das 0405*, dated 22.07.2007.

*Local Distribution:* Through out Road side of study areas.

*General Distribution:* Through out India; native to tropical America; a widely introduced weed in the tropics.

SPHAERANTHUS Linnaeus, Sp. Pl. 927. 1753.

***Sphaeranthus indicus*** Linnaeus, Sp. Pl. 2: 927. 1753; Hooker *f.*, Fl. Brit. Ind. 3: 275. 1881; Prain, Beng. Pl. 1: 441. 1903; Guha Bakshi, Fl. Mur. Dist. 174. 1984; Grierson *et Springate* in Grierson *et Long*, Fl. Bhutan 2(3): 1508. 2001.

*Local name:* Bhuikadam.

Annual herbs, up to 25 cm; stems with 4 sharply toothed wings. Leaves oblanceolate to spatulate, 2 – 7 x 1 – 3 cm, obtuse to acute, irregularly biserrate-dentate, strong decurrent at base. Glomerules ovoid-globose; capitulum bracts linear-lanceolate, acuminate, ciliate and stipitate-glandular; phyllaries 10 – 12, linear-oblong to linear-spatulate, more scarious and less glandular than bracts. Female flowers 8 to 14, male flowers 2 to 3. Corollas purplish. Achenes puberulent.

*Flowers & Fruits:* January to April.

*Specimen Cited:* Grass land, *Rajib & AP Das 0400*, dated 22.07.2007.

*Local Distribution:* Grassland near Conservation sector.

*General Distribution:* Tropical India; Nepal, Bangladesh, Myanmar, Sri Lanka, Africa, Malay Islands and Australia.

SONCHUS Linnaeus, Sp. Pl. 2: 793. 1753.

*Sonchus asper* (Linnaeus) Hill, Herb. Brit. 1: 47. 1769; Hooker *f.*, Fl. Brit. Ind. 3: 414. 1881; Grierson *et* Springate in Grierson *et* Long, Fl. Bhutan 2(3): 1479. 2001. *Sonchus oleraceus* Linnaeus var. *asper* Linnaeus, Sp. Pl. 2: 794. 1753.

Annual semi erect or procumbent herbs, up to 50 cm. Stem usually unbranched below synflorescence. Leaves extremely variable, Lamina obovate, spatulate to elliptic, 7 – 12 x 2 – 5 cm, undivided or irregularly pinnatisect, base attenuate, densely spinulose dentate, acute to acuminate. Capitula with many florets; peduncle slender. Involucre campanulate. Phyllaries abaxially glabrous, acute; outer phyllaries narrowly lanceolate. Corolla 1 cm. Achene strongly compressed.

*Flowers & Fruits*: June to November.

*Specimen Cited*: Backside of Forest office, *Rajib & AP Das 0737*, dated 14. 02. 2008.

*Local Distribution*: Forest Office campus.

*General Distribution*: Tropical India; Pakistan, Afghanistan, C. Asia, Europe, Africa, N and S America; originating from Europe and Mediterranean region.

ELEUTHERANTHERA Poiteau, Bull. Sci. Soc. Philom. Paris 3(no. 66): 137. 1802.

*Eleutheranthera ruderalis* (Swartz) Schultz Bipontinus, Bot. Zeitung (Berlin) 24: 165. 1866; Grierson *et* Springate in Grierson *et* Long, Fl. Bhutan 2(3): 1606. 2001. *Melampodium ruderalis* Swartz, Fl. Ind. Occid. 3: 1372. 1806. *Gymnopsis microcephala* Gardner, London J. Bot. 7 292. 1848. [PLATE: 6, Figure-59]

Annual, erect herbs, up to 30 cm. Petiole 1– 2 cm; lamina ovate, 3 – 7 x 2 – 3 cm, entire, or crenulate-dentate, acute to acuminate, base obtuse, 3 veined from near base, both surfaces pubescent-glandular,. Synflorescence terminal. Capitula discoid; phyllaries 2 seriate. Florets 2 – 6; anthers black; style branches lanceolate. Achenes brown, 3 angled; pappus an apical peg.

*Flowers & Fruits*: July to December.

*Specimen Cited*: Road side near forest Office, *Rajib & AP Das 0757*, dated 23. 05. 2008.

*Local Distribution*: Rodaside throughout study area.

*General Distribution*: Tropical India; widespread in Central and South America but also found in W Africa and Australia.

SYNEDRELLA Gaertner, Fruct. Sem. Pl. 2: 456, plate 171, fig. 7. 1791.

*Synedrella nodiflora* (Linnaeus) Gaertner, Fruct. Sem. Pl. 2: 456. 1791; Grierson *et* Springate in Grierson *et* Long, Fl. Bhutan 2(3): 1607. 2001. *Verbesina nodiflora* Linnaeus, Cent. Pl. 1: 28. 1755. *Blainvillea latifolia* (Linnaeus *f.*) de Candolle, Contributions to the Botany of India 17. 1834. *Eclipta latifolia* Linnaeus *f.*, 378. 1782.

Annuals, suberect to ascending, branched herbs, up to 70 cm. Leaves cauline, opposite, petiolate; lamina ovate to elliptic, 3 – 9 x 2 – 4 cm, both surfaces scabrid, usually 3 veined, base cuneate to rounded, toothed. Capitula radiate, sessile in axillary glomerules or capitula solitary; involucre cylindrical to campanulate; phyllaries persistent; receptacle convex. Ray florets 2 – 9, 1 to 2 seriate, female, fertile; corollas yellowish. Disk florets 4 – 15, bisexual, fertile; corollas yellowish, 4-lobed.

*Flowers & Fruits*: throughout the year.

*Specimen Cited*: Road side near gate, *Rajib & AP Das 0743*, dated 22. 05. 2008.

*Local Distribution*: Roadside forest.

*General Distribution*: India, pantropical weed of American origin.

TAGETES Linnaeus, Sp. Pl. 2: 887. 1753.

*Tagetes patula* Linnaeus, Sp. Pl. 887. 1753; Hajra *et al.*, Fl. Ind. 13: 329. 1995; Grierson *et* Springate in Grierson *et* Long, Fl. Bhutan 2(3): 1602. 2001.

*Vernacular Name*: Gandha.

Annual shrubs, up to 1m. Leaves 3 – 8 cm; leaflets 3 – 6 pairs. Peduncles slender with leaves obsolete. Capitula solitary; involucre 7 – 12 mm in diameter; phyllaries 5–8. Ray corolla tube 8 – 9 mm; lamina yellow to orange, red-brown; ligule orange or yellow; flabellate to ovate-quadrangle. Disk florets 40–100. Achenes 6–11 mm; pappus linear-oblong.

*Flowers & Fruits*: September to March.

*Specimen Cited*: Bochamari, *Rajib & AP Das 0753*, dated 22. 05. 2008.

*Local Distribution*: Cultivated in gardens and villages.

*General Distribution*: Native of Mexico; widely cultivated in many parts of the world.

TRIDAX Linnaeus, Sp. Pl. 900. 1753; Gen. Pl. ed. 5, 382. 1754.

*Tridax procumbens* (Linnaeus) Linnaeus, Sp. Pl. 2: 900. 1753; Grierson *et* Springate in Grierson *et* Long, Fl. Bhutan 2(3): 1611. 2001. *Balbisia elongate* Willdenow, Sp. Pl. 3: 2214. 1803. *Balbisia canescens* Richard, Syn. Pl. 2: 470. 1807.

Annual to perennial, caulescent, decumbent herbs up to 40 cm. Stems procumbent, branched at base. Leaves few, shortly petiolate; lamina ovate to ovate-lanceolate, 3 – 5 cm, base cuneate, deeply irregularly serrate, pinnatisect, acute to acuminate. Capitula solitary; involucre subcampanulate; phyllaries few seriate. Ray florets 4, white. Disk florets yellow, limb 5 lobed, lobes reflexed. Achenes brown, oblong.

*Flowers & Fruits*: November to March.

*Specimen Cited*: Backside of Forest office, *Rajib & AP Das 0738*, dated 14. 02. 2008.

*Local Distribution*: Forest office campus.

*General Distribution*: native to tropical America; now a pantropical weed.

CYANTHILLIUM Blume, Bijdr. Fl. Ned. Ind. 15: 889. 1826.

*Cyanthillium cinereum* (Linnaeus) Harold Robinson, Proc. Biol. Soc. Wash. 103: 252. 1990; Grierson *et* Springate in Grierson *et* Long, Fl. Bhutan 2(3): 1488. 2001. *Vernonia cinerea* (Linnaeus) Less in Linnaea 4:291. 1829; Hooker *f.*, Fl. Brit. Ind 3: 233. 1881; Guha Bakshi, Fl. Mur. Dist. 175. 1984. Hajra *et al.*, Fl. Ind. 13: 367. 1995. *Conyza cinerea* Linnaeus, Sp. Pl. 2: 862. 1753.

Annual or perennial, erect, branched above, herbs, up to 100 cm. Lower and middle leaves petiole, lamina rhombic-ovate, rhombic-oblong, 3 – 6 x 1.5 – 3 cm, base cuneately attenuate into winged petiole, remotely mucronate-serrate to repand, acute; upper leaves progressively smaller. Synflorescences terminal. Capitula many. Involucre campanulate; phyllaries 4 seriate. Receptacle flat. Florets 19 – 28; corolla reddish purple, tubular; lobes linear-lanceolate. Achenes cylindrical. Pappus white.

*Flowers & Fruits*: Round the year.

*Specimen Cited*: Garden, *Rajib & AP Das 0739*, dated 14. 02. 2008.

*Local Distribution*: Throughout.

*General Distribution*: India to Indochina Island. Japan, Indonesia and Africa.

XANTHIUM Linnaeus, Sp. Pl. 987. 1753.

***Xanthium strumarium*** Linnaeus, Sp. Pl. 2: 987. 1753; *Xanthium indicum* Koen. ex Roxburgh, Fl. Ind. 3: 601. 1832; Guha Bakshi, Fl. Mur. Dist. 176. 1984. Hajra *et al.*, Fl. Ind 12: 427. 1995, Grierson *et Springate* in Grierson *et Long*, Fl. Bhutan 2(3): 1620. 2001. *Xanthium strumarium* Linnaeus, Sp. Pl. 2: 987. 1753, *p. p.*; Hooker *f.* in Hooker *f.*, Fl. Brit. Ind 3: 303. 1881; Haines, Bot. Bihar & Orissa pt. IV: 478. 1922. [PLATE: 5, Figure-42]

*Vernacular name:* Okra.

Annual, erect, much branched herbs, up to 100 cm. Median cauline leaves ovate-deltate, 9 – 25 cm, papery, densely scabrid on both surfaces, base shallowly cordate to broadly cuneate, irregularly dentate, 3-lobed, apex acute. Capitula monoecious. Male capitula in terminal umbels; phyllaries 1 seriate; outer paleae oblong-lanceolate, inner paleae lanceolate; corolla white, tubular. Female capitula axillary. Fruits sessile, oblong, ellipsoid.

*Flowers & Fruits:* August to April.

*Specimen Cited:* Batikata Beel, Rajib & AP Das 0780, dated 12. 09. 2008.

*Local Distribution:* Beel margin forest.

*General Distribution:* India: through out; Bhutan, China, Iran, Japan, Korea, Mongolia, Russia; North America; originating in the New World.

YOUNGIA Cassini, Ann. Sci. Nat. (Paris) 23: 88. 1831.

***Youngia japonica*** (Linnaeus) de Candolle, Prodr. 7: 194. 1838; Grierson *et Springate* in Grierson *et Long*, Fl. Bhutan 2(3): 1457. 2001. *Prenanthes japonica* Linnaeus, Mant. Pl. 1: 107. 1767. *Youngia formosana* (Hayata) H. Hara, 53. 1938. *Youngia ambigua* de Candolle, Prodr. (de Candolle) 7(1): 193. 1838.

Annual, erect, branched herbs, up to 120 cm. Leaves oblanceolate, lamina 15 – 25 x 4 – 6 cm; base attenuate, sinuate-dentate; lateral lobes few to many, ovate to rhombic-elliptic, gradually smaller toward leaf base; terminal lobe ovate to ovate-lanceolate, rounded to acute. Synflorescence corymbiform, usually with many to numerous capitula. Capitula with 15 – 20 florets. Involucre cylindrical. Phyllaries ovate to triangular, apex acute. Anther tube dark green. Style branches yellow. Achene purplish brown. Pappus white.

*Flowers & Fruits:* April to October.

*Specimen Cited:* Garden, Rajib & AP Das 0736, dated 14. 02. 2008.

*Local Distribution:* Throughout study area.

*General Distribution:* India: tropical; Bhutan, China, Japan, Korea, Malaysia, Philippines; originating probably from China and introduced pantropically, extending into adjacent subtropical regions.

**Menyanthaceae** (Dumortier) Dumortier, Anal. Fam. Pl. 20. 1829 ('Menyanthideae'); *nom. cons.*

NYMPHOIDES S guier, Pl. Veron. 3: 121. 1754.

### Key to the species:

- 1a. Leaves densely glandular; corolla white with a yellow center. .... *N. indica*
- 1b. Leaves glabrous; corolla pure white ..... *N. hydrophylla*

***Nymphoides hydrophylla*** (Loureiro) Kuntze, Revis. Gen. Pl. 2: 429. 1891; Aitken in Grierson *et Long*, Fl. Bhut. 2(2): 258. 1999. *Menyanthes hydrophylla* Loureiro, Fl. Cochinch. 1: 129. 1790. *Limnanthemum cristatum* (Roxburgh) Grisebach, Gen. Sp. Gent. 342. 1839; Clarke in Hooker *f.*, Fl. Brit. Ind. 4: 131. 1883; Prain, Beng. Pl. 2: 527. 1903. *Limnanthemum hydrophyllum* (Loureiro) Grisebach, Gen. Sp. Gent. 348. 1839. [PLATE: 10, Figure-110]

Floating herbs; rooting from nodes. Leaves few per node; petiole 4–10 cm, slender; lamina cordate, 1 – 6 x 1 – 4 cm, submembranous, glabrous, veins indistinct. Flowers 2–10 per node, 5 merous. Pedicel slender. Calyx lobed to near base; lobes narrowly oblong, acute. Corolla white, campanulate. Filaments absent; anthers triangular. Style very short. Capsules globose, 6–10 seeded. Seeds brown, globose.

*Flowers & Fruits:* August to December.

*Specimen Cited:* Bochamari Beel, *Rajib & AP Das 0183*, dated 09. 02. 2007.

*Local Distribution:* Through out the Beel Complex.

*General Distribution:* Tropical India; Bhutan, China, Myanmar, Java and Malasia. Laos, Thailand, Vietnam.

*Nymphoides indica* (Linnaeus) O. Kuntze, Revis. Gen. Pl. 2: 429. 1891. *Menyanthes indica* Linnaeus, Sp. Pl. 1: 145. 1753. *Limnanthemum indicum* (Linnaeus) Thwaites, Enum. 205. 1850; Clarke in Fl. Brit. Ind. 4: 131. 1883; Prain, Beng. Pl. 2: 527. 1903. *Villarsia indica* (Linnaeus) Ventanat, Choix Pl. t. 9. 1803. *Nymphoides thunbergiana* (Grisebach) Kuntze, Revis. Gen. Pl. 2: 429. 1891. [PLATE: 10, Figure-109]

Rhizomes horizontal. Stems cylindric. Petiole cylindric, 1–3 cm; Lamina broadly ovate to subcordate, 3–20 cm, subcoriaceous, abaxially densely glandular, base cordate, margin entire; veins indistinct, palmate. Flowers many, 5 merous, distylous. Pedicel cylindric. Calyx 2.5 – 5 mm, lobed to near base; lobes lanceolate to narrowly elliptic, apex obtuse. Corolla white with a yellow center; lobes ovate elliptic, outside densely fimbriate pilose, apex obtuse. Filaments flattened, linear; anthers sagittate. Style cylindric; stigma lobes triangular. Capsules elliptic, few seeded. Seeds brown, globose; seed coat smooth.

*Flowers & Fruits:* January to December.

*Specimen Cited:* Bochamari Beel, *Rajib & AP Das 0097*, dated 07. 02. 2007.

*Local Distribution:* Through out the Beel Complex.

*General Distribution:* Tropical India; Bhutan, Kabul, S. E. Asia, Malaya, Australia to Fiji.

**Order: Apiales** Nakai (1930).

**Apiaceae** Lindley, Nat. Syst. ed. 2. 21. 1836 (*nom. alt.* vs. **Umbelliferae**); *nom. cons.*

### Key to the Genera:

- 1a. Stem creeping or ascending; lamina reniform or rounded-cordate;  
endocarp woody ..... *Centella*
- 1b. Stem usually erect, not creeping; leaves compound or simple;  
endocarp not woody ..... 2
- 2a. Leaves simple, usually palmately divide to shallowly lobed ..... *Eryngium*
- 2b. Leaves compound ..... 3
- 3a. Calyx teeth minute; fruit ellipsoid, furrowed ..... *Oenanthe*
- 3b. Calyx teeth obsolete; fruit sub-globose, furrow absent, ridges thick ..... *Seseli*

CENTELLA Linnaeus, Sp. Pl., ed. 2, 2. 1393. 1763.

*Centella asiatica* (Linnaeus) Urban, Martius Fl. Brass. 11: 287. 1879; Datta & Majumder, Bull. Bot. Soc. Beng. 20(2): 93. 1966; Watson in Grierson *et* Long, Fl. Bhut. 2(2): 446. 1999; Guha Bakshi, Fl. Mur. Dist. 149. 1984. *Hydrocotyle asiatica* Linnaeus Sp. Pl. 1: 234. 1753; Clarke in Hooker *f.*, Fl. Brit. Ind. 2: 669. 1879; Prain, Beng. Pl. 1: 391. 1903. [PLATE: 6, Figure-56]



*Vernacular name:* Manimuni.

Fleshy, weak, creeping herbs with numerous roots from lower nodes. Lamina orbicular, reniform, peduncle short. Erect small, ovate embracing the flower. Umbel simple, 3-6 pink flowered, axillary. Fruit not vittate, pericarps not thickened. Seeds compressed laterally.

*Flowers & Fruits:* July to February.

*Specimen Cited:* Park, *Rajib & AP Das 0573*, dated 24.07.2007.

*Local Distribution:* Throughout the study area.

*General Distribution:* Throughout India, Bhutan, China, Nepal, Pakistan, Indonesia, Japan, Korea, Laos, Malaysia, Myanmar, Thailand, Vietnam.

ERYNGIUM Linnaeus, Sp. Pl. 1: 232. 1753.

*Eryngium foetidum* Linnaeus, Sp. Pl. 1: 232. 1753; Watson in Grierson *et* Long, Fl. Bhut. 2(2): 447. 1999.

*Vernacular name:* Bilati dhoniya.

Herbs, up to 30 cm from a basal rosette. Stem green. Basal leaves numerous; petiole short or obsolete; lamina lanceolate to oblanceolate, 5 – 30 x 2 – 4 cm, obtuse, crenate to finely spinulose-serrate, base cuneate to decurrent. Upper leaves sessile. Inflorescence divaricately trifurcate; heads numerous. Flower heads cylindrical; margin 1–3 spinulose-serrate. Calyx teeth ovate-lanceolate, acute, equaling petals. Petals white to pale yellow. Styles erect, exceeding calyx teeth. Fruit ovoid-globose.

*Flowers & Fruits:* April to December.

*Specimen Cited:* Rasik Beel village, *Rajib & AP Das 0686*, dated 14. 02. 2008.

*Local Distribution:* Cultivate in Villages.

*General Distribution:* Tropical India; native to Central America; now a widespread weed in tropical and subtropical regions.

OENANTHE Linnaeus, Sp. Pl. 1: 254. 1753.

*Oenanthe javanica* (Blume) de Candolle, Prodr. 4: 138. 1830; Watson in Grierson *et* Long, Fl. Bhut. 2(2): 486. 1999. *Sium javanicum* Blume, Bijdr. 15: 881. 1826. *Oenanthe bengalensis* Benth & Hooker, Gen. Pl. 1: 906: 1862; Clarke in Hooker *f.*, Fl. Brit. Ind. 2: 696. 1879; Prain, Beng. Pl. 1: 394. 1903. [PLATE: 8, Figure-87]

Herbs, 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. Fruit ellipsoid, nearly terete, furrowed, forrow 1-vittate, carpophore 0.

*Flowers & Fruits:* January to April.

*Specimen Cited:* Ververi Beel, *Rajib & AP Das 0479*, dated 23.07.2007.

*Local Distribution:* Throughout the Beel Complex.

*General Distribution:* India throughout; China, Nepal, Pakistan, Malaysia, Myanmar, Japan, Thailand, Vietnam and Java.

SESELI Linnaeus, Sp. Pl. 1: 259. 1753.

*Seseli diffusum* (Roxburgh *ex* Smith) Santapou & Wagh, Bull. Bot. Surv. Ind. 5(2): 108. 1963. *Ligusticum diffusum* Roxburgh *ex* Smith, Rees Cyclop 21: 11. 1812. *Cnidium diffusum* de

Candolle, Prodr. 4: 153. 1830. *Seseli indicum* Wight & Arnott, Prodr. 371. 1874; Clarke in Hooker f., Fl. Brit. Ind. 2: 693. 1879; Prain, Beng. Plants 1: 393. 1903.

*Local name:* Ban Jowan.

Erect or diffuse, annual herb with pubescent branches from the root. 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 umbles. Calyx teeth obsolete. Fruit sub-globose, glabrous or hispid; ridges thick.

*Flowers & Fruits:* January to April.

*Specimen Cited:* Batikata Beel, *Rajib & AP Das 0385*, dated 21.07.2007.

*Local Distribution:* Beel margin.

*General Distribution:* India (Throughout the plains) and Bangladesh.

### **Araliaceae** A. L. de Jussieu, Gen. Pl. 217. 1789 ('Araliae').

HYDROCOTYLE Linnaeus, Sp. Pl. 1: 234. 1753.

*Hydrocotyle sibthorpioides* Lamarck, Encycl. Meith. 3:153. 1789; H. Ohashi in Hara, Fl. E. Himal. 1:230.1966; Hara *et al.*, Enn. Fl. Pl. Nep. 2:187. 1979; Watson in Grierson *et Long*, Fl. Bhut. 2(2): 444. 1999. *Hydrocotyle rotundifolia* Roxburgh *ex de Candolle*, Prodr. 4:64. 1830; Hooker f., Fl. Brit. Ind. 2:668. 1879.

*Vernacular name:* Chhotomanimuni.

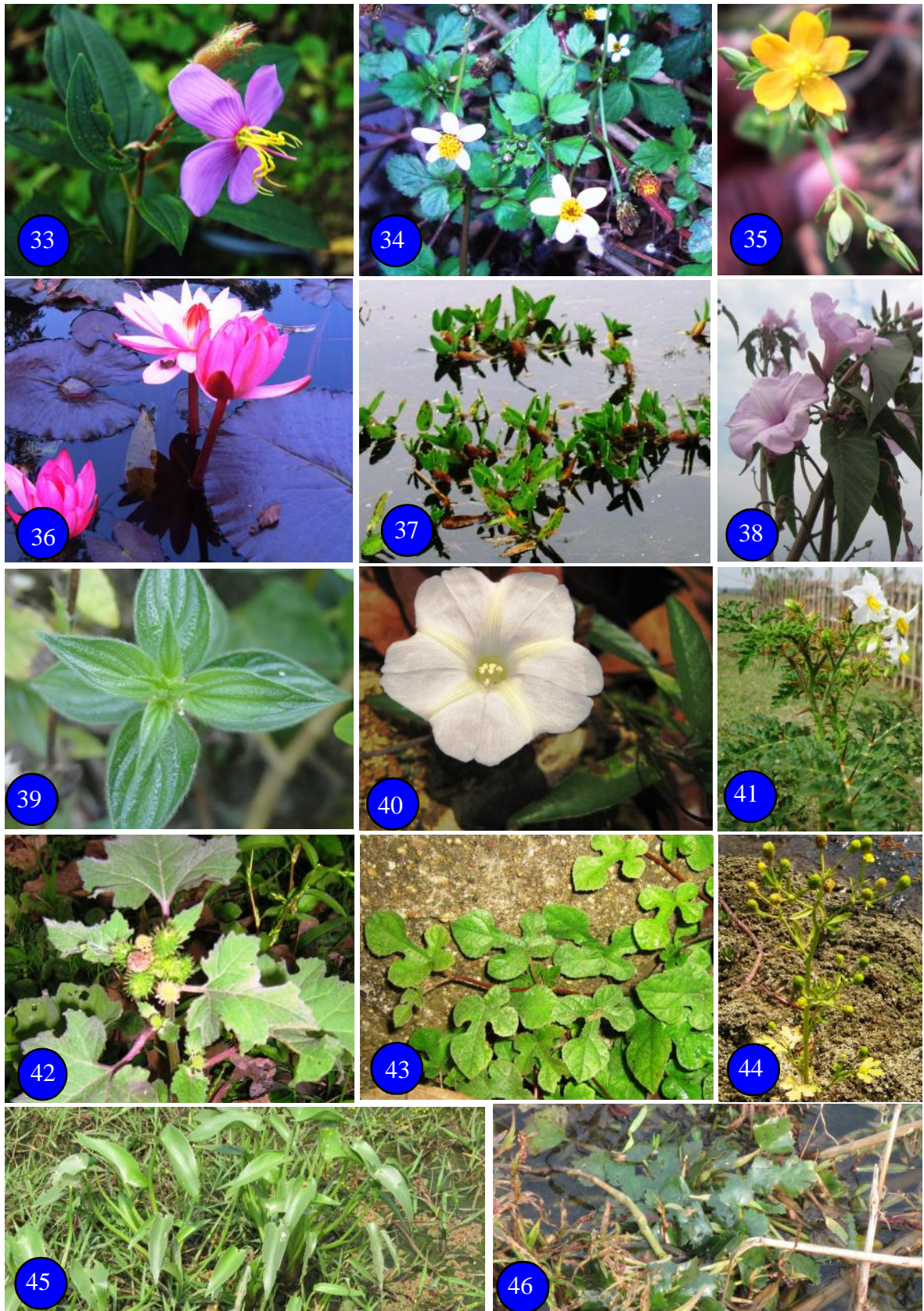
Strongly aromatic herbs. Stem weak, slender, filiform, creeping. Lamina reniform-rounded, 0.5 – 1.5 x 0.8 – 2 cm; membranous, entire or shallowly 5–7-lobed, lobes rounded, base cordate. Umbel solitary at the nodes, each umbel 5–8 flowered. Petals greenish white. Styles spreading. Fruit broadly globose, greenish yellow when young, covered with purplish stains when mature.

*Flowers & Fruits:* April to September.

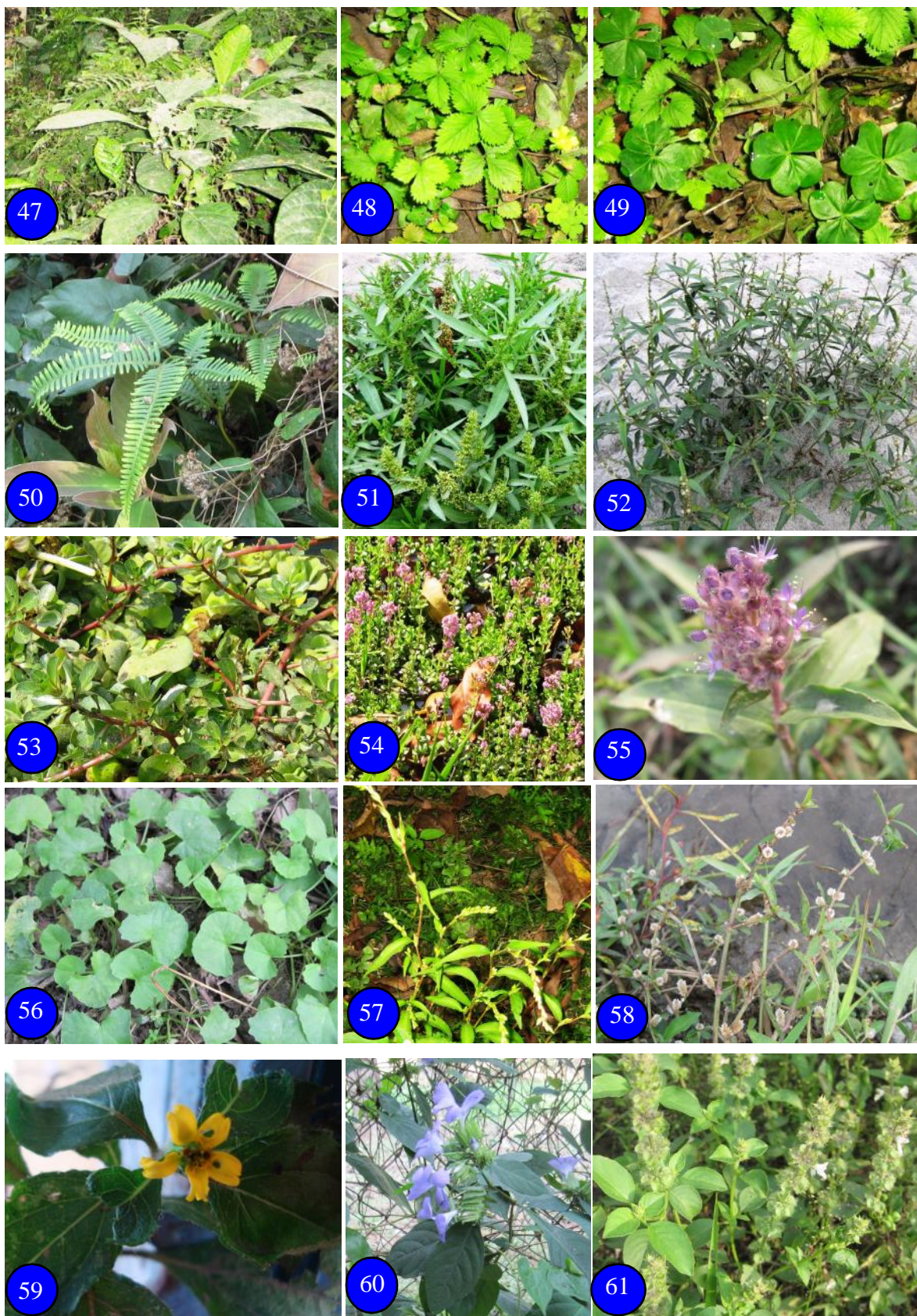
*Specimen Cited:* Park, *Rajib & AP Das 0496*, dated 23.07.2007.

*Local Distribution:* Throughout the study area.

*General Distribution:* India throughout; Bhutan, Nepal, China, Indonesia, Japan, Korea, Philippines, Thailand, Vietnam; tropical Africa.



**PLATE 5: Flora, Figure 33 - 46:** 33. *Melastoma malabathricum*; 34. *Bidens pilosa*; 35. *Hypericum japonicum*; 36. *Nymphaeae rubra*; 37. *Hygroryza aristata*; 38. *Ipomoea fistulosa*; 39. *Pouzolzia zeylanica*; 40. *Merremia hirta*; 41. *Solanum sisymbriifolium*; 42. *Xanthium strumarium*; 43. *Ficus heterophylla*; 44. *Ranunculus sceleratus*; 45. *Monochoria hastata*; 46. *Trapa natans* var. *bispinosa*



**PLATE 6: Flora (continued), Figure 47 - 61:** 47. *Dendrocnide sinuata*; 48. *Duchesnea indica*; 49. *Oxalis debilis* var. *corymbosa*; 50. *Dicranopteris linearis*; 51. *Rumex dentatus*; 52. *Croton bonplandianus*; 53. *Ludwigia adscendens*; 54. *Rotala rotundifolia*; 55. *Floscopa scandens*; 56. *Centella asiatica*; 57. *Persicaria hydropiper*; 58. *Alternanthera paronychioides*; 59. *Eleutheranthera ruderalis*; 60. *Barleria strigosa*; 61. *Ocimum basilicum*



**PLATE 7: Flora (continued), Figure 62 - 75:** 62. *Blumea lacera*; 63. *Drosera burmannii*; 64. *Leonurus sibiricus*; 65. *Trapa natans*; 66. *Woodfordia fruticosa*; 67. *Xanthosoma brasiliense*; 68. *Clerodendrum infortunatum*; 69. *Oplismenus burmannii*; 70. *Coffea bengalensis*; 71. *Calotropis gigantea*; 72. *Tamarix dioca*; 73. *Citrus limon*; 74. *Lasia spinosa*; 75. *Crateva religiosa*



**PLATE 8: Flora (continued), Figure 76 - 90:** 76. *Argemone mexicana*; 77. *Phyla nudiflora*; 78. *Grangea maderaspatana*; 79. *Dentella repens*; 80. *Hygrophila phlomoides*; 81. *Acemella calva*; 82. *Solanum viarum*; 83. *Sagittaria guayanensis*; 84. *Lantana camara*; 85. *Solanum villosum*; 86. *Eichhornia crassipes*; 87. *Oenanthe javanica*; 88. *Hypericum japonicum*; 89. *Utricularia aurea*; 90. *Utricularia gibba*



**PLATE 9: Flora (continued), Figure 91 - 105:** 91. *Echinochloa colona*; 92. *Sagittaria sagittifolia*; 93. *Colocasia esculenta*; 94. *Polygonum pubescens*; 95. *Kyllinga nemoralis*; 96. *Erythrina stricta*; 97. *Enydra fluctuans*; 98. *Ludwigia octovalvis*; 99. *Ageratum conyzoides*; 100. *Phaulopsis imbricata*; 101. *Oldenlandia verticillata*; 102. *Dioscorea esculenta*; 103. *Paederia foetida*; 104. *Chenopodium album*; 105. *Jasminum dispersum*



**PLATE 10: Flora (continued), Figure 106 - 122:** 106. *Monochoria vaginalis*; 107. *Ottelia alismoides*; 108. *Leucas indica*; 109. *Nymphoides indica*; 110. *Nymphoides hydrophylla*; 111. *Azolla pinnata* subsp. *africana*; 112. *Salvinia adnata*; 113. *Salvinia cucullata*; 114. *Salvinia natans*; 115. *Spirodela polyrrhiza*; 116. *Lemna aequinoctialis*; 117. *Pistia stratiotes*; 118. *Ipomoea aquatica*; 119. *Persicaria barbata*; 120. *Marsilea minuta*; 121. *Momordica charantia*; 122. *Tetrastigma serrulatum*



# CHAPTER - VII

## ANALYSIS OF THE FLORA

The Rasik Beel complex is an aggregate of five different wetlands formed by a common water flow of the River Raidak. It is a good house for numerous species of local and migratory birds and is now projected as a tourist's destination and as a bird reserve. The flora and the vegetation structure of Rasik Beel Complex area was not known. So, an attempt was initiated in 2007 to record the flora of this area that has enough potential for conservation as Ransar Site.

### 7.1. Recorded Flora

After the comprehensive floristic survey, it is noted that the wetland complex is bestowed with immensely rich flora. A total of 614 species of vascular plants has been recorded from the intensive survey in the area since the year 2007. Of these, angiosperms are represented by 581 species under 397 genera belonging to 124 families. In addition, 3 species of 3 genera from 3 families of gymnosperms and 30 species of fern and fern allies covering 25 genera belonging to 17 families have been recorded from the Rasik Beel wetland complex during the present exploration. The reason for sustenance of enormous richness in floral diversity within the area is basically due to the perennial nature of water body and about 1/3<sup>rd</sup> area of the Beel remains undisturbed as conservation practices are imposed for that area. However, the remaining 2/3<sup>rd</sup> area is open for fishing and related activities. The species composition is changes there regularly for this. This, in turn, always keeps the inter-specific relationship disturbed. The area receives annual precipitation of 200 – 400 cm, the major amount of which is received mainly during the monsoon months. However, little amount of rain is received almost in all other months. This type of distribution of precipitation maintains a very good water relation for the plants and the vegetation and that is the main reason for the occurrence of rich marginal flora.

The analysis of the flora revealed that there are numerous tropical, subtropical and even temperate elements those are common with the East Himalayan region. The beels, nallahas, other low-laying areas, scrubs, forests etc provided an enormous variety of habitats and that is reflected in the richness of the flora.

The detailed analysis of the total angiosperm flora of the Wetland complex and its surrounding area revealed that the distribution and variation in dicots have much dominance over the monocots.

An analysis of the flora of Rasik Beel further revealed the existence of numerous important plant species which are directly or indirectly beneficial for the human sustenance. Many of the species have been recorded for having varied potential as food, medicines, etc. for humanity, besides an extraordinary rich repository of various plant resources including the large number of valuable and durable timber-yielding trees.

Quite a good number of algae are also found growing in and around the beel area and the species of *Spirogyra sp.*, *Chara sp.*, *Nitela sp.*, *Oedogonium sp.*, *Anabaena sp.*, *Nostoc sp.* etc. are dominating in the study area.

### 7.2. Numerical Distribution of Taxa

The present floristic work on Rasik Beel Wetland deals with the recorded 124 Angiospermic families, out of which 96 are dicotyledonous and the remaining 28 are monocotyledonous; 428 species under 300 genera are recorded from 96 dicotyledons families and 153 species belonging to 97 genera in 28 monocot families. Only 3 species of gymnosperm belonging to 3 genera under 3

families and a total of 30 species of ferns and fern-allies were recorded under 25 genera belonging to 17 families (Table 7.1).

**Table 7.1.** Numerical representation of different floristic elements in Rasik Beel area

Plant Group	Representation					
	Family		Genus		Species	
	No.	%	No.	%	No.	%
Dicotyledons	96	66.7	300	70.6	428	69.7
Monocotyledons	28	19.4	97	22.8	153	24.9
Gymnosperms	3	2.1	3	0.7	3	0.4
Pteridophyta	17	11.8	25	5.9	30	4.9
<b>TOTAL</b>	<b>144</b>	<b>100</b>	<b>425</b>	<b>100</b>	<b>614</b>	<b>99.9</b>

The Tables 7.2 to 7.5 provided accounts of family-wise numerical distribution of Taxa recorded from the Rasik Beel Wetland Complex.

**Table 7.2.** Alphabetically family-wise numerical representation of Angiospermic taxa: A. Dicotyledons for the flora of Rasik Beel

Name of the plants	Genera	Species
Acanthaceae	13	20
Amaranthaceae	9	16
Anacardiaceae	2	2
Annonaceae	4	5
Apiaceae	4	4
Apocynaceae	10	10
Araliaceae	1	1
Aristolochiaceae	1	2
Asteraceae	26	29
Balsaminaceae	1	2
Bignoniaceae	2	2
Bixaceae	1	1
Boraginaceae	2	2
Brassicaceae	3	4
Cactaceae	1	1
Campanulaceae	1	1
Cannabaceae	1	1
Capparaceae	2	2
Caricaceae	1	1
Caryophyllaceae	3	5
Celastraceae	1	1
Ceratophyllaceae	1	1
Chloranthaceae	1	1
Cleomaceae	1	3
Clusiaceae	1	1
Combretaceae	2	5

Table contd.

<b>Name of the plants</b>	<b>Genera</b>	<b>Species</b>
Convolvulaceae	6	10
Cornaceae	1	1
Crassulaceae	1	1
Cucurbitaceae	9	10
Dilleniaceae	2	3
Dipterocarpaceae	1	1
Droseraceae	1	1
Ebenaceae	1	1
Elaeocarpaceae	1	1
Elatinaceae	1	1
Euphorbiaceae	6	10
Fabaceae	25	38
Hydroleaceae	1	1
Hypericaceae	1	1
Icacinaceae	1	1
Lamiaceae	12	16
Lauraceae	2	6
Lecythidaceae	2	2
Lentibulariaceae	1	3
Linderniaceae	2	7
Lythraceae	6	10
Magnoliaceae	1	2
Malvaceae	14	20
Melastomataceae	2	2
Meliaceae	5	6
Menispermaceae	4	5
Menyanthaceae	1	2
Molluginaceae	1	2
Moraceae	4	11
Moringaceae	1	1
Myrtaceae	4	5
Nyctaginaceae	4	5
Nymphaeaceae	1	3
Oleaceae	1	2
Onagraceae	1	3
Oxalidaceae	2	3
Papaveraceae	2	2
Passifloraceae	1	1
Phrymaceae	1	1
Phyllanthaceae	3	7
Piperaceae	2	6
Plantaginaceae	2	2

Table contd.

Name of the plants	Genera	Species
Plumbaginaceae	1	1
Polygalaceae	1	1
Polygonaceae	3	10
Portulacaceae	1	1
Primulaceae	2	2
Proteaceae	1	1
Putranjivaceae	1	1
Ranunculaceae	2	2
Rhamnaceae	3	4
Rosaceae	1	1
Rubiaceae	10	12
Rutaceae	6	7
Salicaceae	1	1
Sapindaceae	1	1
Sapotaceae	1	1
Scrophulariaceae	1	1
Simaroubaceae	1	1
Solanaceae	6	11
Tamaricaceae	1	1
Theaceae	1	1
Ulmaceae	1	2
Urticaceae	6	8
Verbenaceae	4	4
Violaceae	1	1
Vitaceae	4	7
<b>Total</b>	<b>296</b>	<b>422</b>

**Table 7.3.** Family-wise numerical representation of Angiospermic taxa: B. Monocotyledons for the flora of Rasik Beel

Name of the plants	Genera	Species
Alismataceae	2	3
Amaryllidaceae	1	1
Aponogetonaceae	1	3
Araceae	13	15
Arecaceae	5	5
Asparagaceae	1	1
Burmanniaceae	1	1
Cannaceae	1	1
Commelinaceae	6	13
Costaceae	1	1
Cyperaceae	9	29
Dioscoreaceae	1	4
Eriocaulaceae	1	2

Table contd.

Name of the plants	Genera	Species
Hydrocharitaceae	6	7
Hypoxidaceae	2	2
Juncaceae	1	1
Marantaceae	1	1
Musaceae	1	2
Orchidaceae	6	7
Poaceae	28	40
Pontederiaceae	2	3
Potamogetonaceae	1	3
Smilacaceae	1	2
Typhaceae	1	1
Xyridaceae	1	1
Zingiberaceae	4	5
<b>Total</b>	<b>98</b>	<b>154</b>

**Table 7.4.** Family-wise numerical representation of Pinophyta for the flora of Rasik Beel

Family	Genera	Species
Araucariaceae	1	1
Cupressaceae	1	1
Cycadaceae	1	1
<b>Total</b>	<b>3</b>	<b>3</b>

**Table 7.5.** Family-wise numerical representation of Pteridophytes recorded for the flora of Rasik Beel

Family	Genus	Species
Adiantaceae	2	2
Aspleniaceae	1	1
Azollaceae	1	1
Blechnaceae	1	1
Davalliaceae	1	1
Dryopteridaceae	3	3
Gleicheniaceae	1	1
Marsileaceae	1	1
Ophioglossaceae	1	1
Polypodiaceae	3	3
Pteridaceae	3	4
Salviniaceae	1	3
Schizaeaceae	1	2
Selaginellaceae	1	1
Tectariaceae	1	1
Thelypteridaceae	1	1
Woodsiaceae	2	3
<b>Total</b>	<b>25</b>	<b>30</b>

### 7.3. High Representation

Most comprehensive floristic work for the Indian subcontinent was published by Sir J.D. Hooker (1872 – 1897) in his *The Flora of British India*. Recently *The Flora of Eastern Himalaya*, Parts I - III by Hara (1966, 1971) and Ohashi (1975), and *The Flora of Bhutan*, vols. 1 – 3, by Grierson and Long (1983, 1984, 1987, 1991, 1999, 2000), Noltie (1994, 2000) and Pears and Cribb (2002) also presented a monumental work on this region. The first flora, i.e. *The Flora of British India* covers the plants collected from Indian subcontinent, Eastern Himalaya to Pakistan, Bangladesh, Myanmar, Malaysia, etc. *The Flora of Eastern Himalaya* has engrossed the plant collection from the hilly parts of North Bengal, Sikkim, Eastern Nepal and Bhutan regions in the Eastern Himalaya covering an altitudinal range of 300 m to 4400 m. *Flora of Bhutan* covered the *Terai* and *Duars* of North Bengal. In case of Dicotyledonous flora, In *Flora of Eastern Himalaya* (FEH), the family Fabaceae is represented with highest number of species, which is followed by Asteraceae, Lamiaceae, Rubiaceae etc. The *Flora of Bhutan* (FB) recorded Asteraceae as the most represented and is followed by Fabaceae, Rubiaceae, Lamiaceae etc. The present survey recorded 38 species for the Fabaceae and then followed by Asteraceae, Acanthaceae, Malvaceae etc. A comparative account of top 10 families in these three works are given in the Table 7.6.

**Table 7.6.** Comparative study of top 10 dicot Families after the survey of Rasik Beel flora

Name of the plants	FEH		FB		Rasik Beel	
	Genera	Species	Genera	Species	Genera	Species
Fabaceae	71	184	85	277	25	38
Asteraceae	70	166	126	370	26	29
Acanthaceae	19	46	27	83	13	20
Malvaceae	8	18	12	34	14	20
Amaranthaceae	9	16	11	21	9	16
Lamiaceae	39	88	43	117	12	16
Rubiaceae	31	66	55	153	10	12
Moraceae	6	15	7	52	4	11
Solanaceae	7	25	22	50	6	11
Apocynaceae	12	13	22	45	10	10

In case of Monocotyledonous flora, in the *Flora of Eastern Himalaya* (FEH), Orchidaceae is highest represented, which is followed by Poaceae, Cyperaceae, Araceae and Commelinaceae. In *Flora of Bhutan* (FB), Orchidaceae is the largest family and that is followed by Poaceae, Cyperaceae, Araceae and Commelinaceae. In the present survey recorded highest number of 40 species for Poaceae and is followed by Cyperaceae, Araceae, Commelinaceae and then Orchidaceae. A comparison of top 5 families in these three works are given in the Table 7.7.

**Table 7.7.** Comparative study of top five monocot families after the survey of Rasik Beel flora

Name of the plants	FEH		FB		Rasik Beel	
	Genera	Species	Genera	Species	Genera	Species
Poaceae	78	183	125	381	28	40
Cyperaceae	10	114	73	181	9	29
Araceae	14	37	17	44	13	15
Comelinaceae	9	16	11	31	6	13
Orchidaceae	61	188	132	579	6	7

The present work in Rasik Beel complex, the Poaceae appeared as the largest with 28 genera and 40 species and it is followed by Fabaceae, Asteraceae, Cyperaceae, Acanthaceae, Malvaceae, Amaranthaceae, Lamiaceae, Araceae and Commelinaceae and is presented in Table 7.8 with further details.

*The Flora of British India* recorded the plants collected from the entire Indian subcontinent, including Eastern Himalaya to Pakistan, Bangladesh, Nepal, Bhutan, Myanmar, Malaysia, etc. *The Flora of Eastern Himalaya* has engrossed the plant collection from the hilly parts of North Bengal, Sikkim, Eastern Nepal and Bhutan regions in the Eastern Himalaya covering an altitudinal range from 300 m to 4400 m. *Flora of Bhutan* also covered the *Terai* and *Duars* of North Bengal. But, the present survey is restricted to a small area of the Rasik Beel Complex. So, the number of families, genera, species and their highest relative position also varied. A comparative account of top ten families in these four works are given in the Table 7.9.

**Table 7.8.** Top ten families in the flora of Rasik Beel complex

Name of the plants	Genera	Species
Poaceae	28	40
Fabaceae	25	38
Asteraceae	26	29
Cyperaceae	9	29
Acanthaceae	13	20
Malvaceae	14	20
Amaranthaceae	9	16
Lamiaceae	12	16
Araceae	13	15
Commelinaceae	6	13

**Table 7.9.** Comparison of top ten families of Rasik Beel complex with three monumental publications

SN	FBI	FEH	FB	Rasik Beel
1	Orchidaceae	Orchidaceae	Orchidaceae	Poaceae
2	Asteraceae	Fabaceae	Poaceae	Fabaceae
3	Poaceae	Poaceae	Cyperaceae	Asteraceae
4	Rosaceae	Asteraceae	Asteraceae	Cyperaceae
5	Cyperaceae	Cyperaceae	Fabaceae	Acanthaceae
6	Geraniaceae	Rosaceae	Scrophulariaceae	Malvaceae
7	Ericaceae	Scrophulariaceae	Rosaceae	Amaranthaceae
8	Liliaceae	Lamiaceae	Rubiaceae	Lamiaceae
9	Lamiaceae	Ranunculaceae	Lamiaceae	Araceae
10	Apiaceae	Urticaceae	Ranunculaceae	Commelinaceae

The study area is comparatively too small and is housing only 614 species of vascular plants as has been recorded through the intensive survey since the year 2007. Of these, angiosperms are represented by 581 species under 397 genera belonging to 124 families. In addition, 3 species of 3 genera from 3 families of gymnosperms and 30 species of fern and fern allies covering 25 genera covering 17 families have been recorded from the Rasik Beel wetland complex. The largest genus is



*Ficus* of Moraceae with 7 species and is followed by *Cassia* of Fabaceae, *Solanum* of Solanaceae, *Persicaria* of Polygonaceae, *Cyperus* of Cyperaceae etc. are all with 6 species. The best represented 10 genera in the Rasik Beel flora has been presented in Table 7.10.

**Table 7.10.** The highest represented ten genera in Rasik Beel flora

Genus	Family	No. of Species
<i>Ficus</i>	Moraceae	7
<i>Cassia</i>	Fabaceae	6
<i>Solanum</i>	Solanaceae	6
<i>Persicaria</i>	Polygonaceae	6
<i>Cyperus</i>	Cyperaceae	6
<i>Desmodium</i>	Fabaceae	5
<i>Ipomoea</i>	Convolvulaceae	5
<i>Lindernia</i>	Scrophulariaceae	5
<i>Piper</i>	Piperaceae	5
<i>Commelina</i>	Commelinaceae	4

#### 7.4. Rare and threatened plants of Rasik Beel Wetland

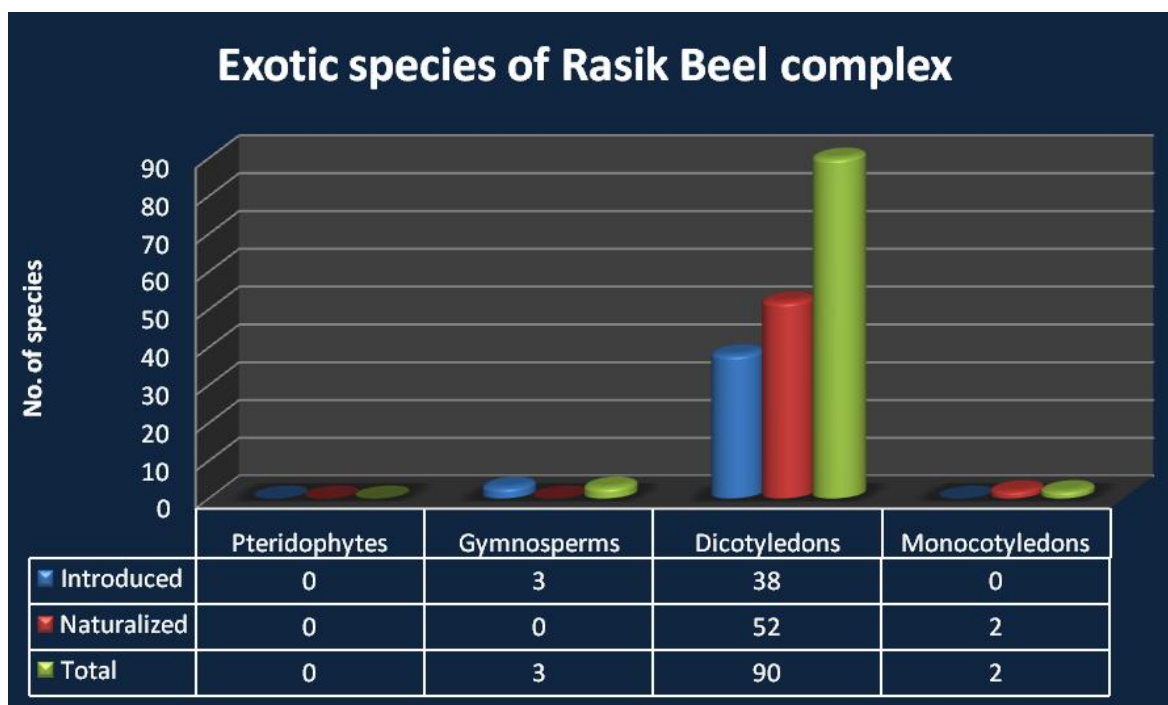
The Rasik Beel is one of the important conservatories for rare and threatened species of plants in the area. During the study, some of the threatened species of India, under Red Data Books of Indian Plants (Nayar and Shastri, 1987, 1988, 1990) has also been recorded. These plants seems to be widely distributed inside the Beel complex. The rarity of or threat to a majority of those could be due to several natural causes, but it could also be due to severe anthropogenic factors like habitat destruction through timber extraction, grazing, fishing, tourisms etc. Unskilled and unscientific harvest of large number of species by local plant-traders for several identical purposes are attributing directly or indirectly in the population structure or even the loss of species from their natural habitat.

The knowledge of plants being used in medicine is high in the Indian Himalayan region. There are major gaps in the knowledge of biological resources and the means by which biological diversity is being maintained (Heywood and Baste, 1995). It is interesting to note that all the recorded plants are till date not recognized under any threat category of IUCN except a few are recorded either as 'Least Concern' or as 'Lower Risk'. two species, *Shorea robusta* and *Toona ciliata* has been recognized as 'Lower Risk/ Least Concern' under ver 2.3 in the Red List of IUCN [<http://www.iucnredlist.org/>], Indian Red Data Book [Nayar and Sastry, 1987, 1988] and Red List of Botanical Survey of India [[http://bsi.gov.in/content/259\\_1\\_InventorisationofEndangeredPlantSpecies.aspx](http://bsi.gov.in/content/259_1_InventorisationofEndangeredPlantSpecies.aspx)].

#### 7.5. Exotic Elements

In the Himalayas and its foothill region is rich with a total of 190 invasive alien species under 112 genera, belonging to 47 families (Chandra Sekar, 2012). Out of 190 invasive alien species, dicotyledons flora is represented by 40 families, 95 genera and 170 species and monocotyledons by 7 families, 17 genera and 20 species. Scattered research work on the exotic and alien species of India has been carried out by Maheswari, 1962; Matthew, 1969; Maiti and Guha Bakshi, 1984; Das, 1984; Das and Chanda, 1986; Das *et al*, 1984; Khuroo *et al*, 2007a, 2008, 2010, 2012; Negi and Hajra, 2007; Singh *et al*, 2010. Nayar (1977) has discussed the changing pattern of vegetation due to some exotic and invasive species. Liu *et al* (2005, 2006, 2008) has worked in detail on the exotics in China that has also included the Himalayan region. A preliminary list of exotic and introduce plants of India has been compiled by Pandey (2000) and Reddy (2008). Out of the

614 species of recorded flora, 95 species has been recognized as exotics. Out of these 54 has been naturalized (Fig. 7.1). The taxonomic distribution of these exotic plants are given bellow:



**Fig. 7.1.** Graphical presentation of Exotic elements in the flora of Rasik Beel complex

Out of 95 exotic species, 24 species came from Tropical America, 14 from South America, 12 from Brazil and Mexico and only 6 species are of Asian origin. List of recorded exotic species is given in Table 7.11.

**Table 7.11.** List of Exotic-alien species of Rasik Beel Complex

Plants	Family	Status
<i>Agave angustifolia</i>	Central America	Naturalized
<i>Ageratum conyzoides</i>	South America	Naturalized
<i>Ageratum houstonianum</i>	Mexico	Naturalized
<i>Alamanda cathartica</i>	South America	Naturalized
<i>Alternanthera paronychioides</i>	Brazil	Naturalized
<i>Alcea rosea</i>	China	Naturalized
<i>Anacardium occidentale</i>	Brazil	Cultivated
<i>Annona reticulata</i>	West Indies	Cultivated
<i>Annona squamosa</i>	Tropical America, West Indies	Cultivated
<i>Argemone mexicana</i>	Mexico	Naturalized
<i>Barleria lupulina</i>	Madagascar	Naturalized
<i>Bougainvillia glabra</i>	Brazil	Cultivated
<i>Bougainvillia spectabilis</i>	Brazil	Cultivated
<i>Bidens pilosa</i>	America	Naturalized
<i>Bixa orellana</i>	Tropical America	Cultivated

Table contd.

<b>Plants</b>	<b>Family</b>	<b>Status</b>
<i>Caesalpinia pulcherima</i>	Tropical America	Cultivated
<i>Cajanus cajan</i>	Africa	Semi-naturalized
<i>Capsicum annum</i>	South America	Semi-naturalized
<i>Carica papaya</i>	Central America	Semi-naturalized
<i>Senna alata</i>	South America	Naturalized
<i>Senna tora</i>	Tropical America	Naturalized
<i>Cassia javanica</i> subsp. <i>nodosa</i>	Sumatra, Java	Semi-naturalized
<i>Catharanthus roseus</i>	West Indies, Madagascar	Naturalized
<i>Chenopodium ambrosioides</i>	Mexico	Naturalized
<i>Chromolaena odorata</i>	Jamaica	Naturalized
<i>Cinnamomum verum</i>	Sri Lanka	Cultivated
<i>Cissampelos pareira</i>	Neo-tropical	Naturalized
<i>Cleome rutidospermum</i>	West Africa	Naturalized
<i>Clitoria ternatea</i>	Tropical America	Semi-naturalized
<i>Corchorus aestuans</i>	Tropical America	Naturalized
<i>Crassocephalum crepidioides</i>	Tropical America	Naturalized
<i>Croton bonplandianum</i>	Paraguay	Naturalized
<i>Datura metel</i>	Tropical America	Naturalized
<i>Delonix regia</i>	Madagascar	Semi-naturalized
<i>Digitaria ciliaris</i>	Tropical America	Naturalized
<i>Eclipta prostrata</i>	South America	Naturalized
<i>Eichhornia crassipes</i>	Tropical America	Naturalized
<i>Emilia sonchifolia</i>	Africa, Asia	Naturalized
<i>Eragrostis tenella</i>	Africa, Asia	Naturalized
<i>Erigeron canadensis</i>	North America	Naturalized
<i>Euphorbia hirta</i>	Tropical America	Naturalized
<i>Evolvulus nummularius</i>	West Indies	Naturalized
<i>Fumaria indica</i>	North temperate region	Naturalized
<i>Galinsoga parviflora</i>	Tropical America	Naturalized
<i>Gnaphalium purpurium</i>	Tropical America	Naturalized
<i>Gravelia robusta</i>	Australia	Cultivated
<i>Hibiscus rosa-sinensis</i>	China	Cultivated
<i>Hibiscus sabdariffa</i>	America	Semi-naturalized
<i>Hyptis suaveolens</i>	South America	Naturalized
<i>Ipomoea carnea</i> ssp. <i>fistulosa</i>	South America	Naturalized
<i>Ipomoea quamoclit</i>	Tropical America	Naturalized
<i>Jatropha curcas</i>	Tropical America	Naturalized
<i>Lagerstroemia indica</i>	China	Cultivated
<i>Lantana camara</i>	West Indies, Jamaica	Naturalized
<i>Lippia javanica</i>	Tropical America	Naturalized

Table contd.

Plants	Family	Status
<i>Litchi chinensis</i>	China	Semi-naturalized
<i>Malva viscosa penduliflora</i>	Mexico	Cultivated
<i>Manilkara zapota</i>	Central America	Cultivated
<i>Mecardonia procumbens</i>	Tropical America	Naturalized
<i>Mikania micrantha</i>	Tropical America	Naturalized
<i>Mimosa invisa</i>	Tropical America	Naturalized
<i>Mimosa pudica</i>	Brazil	Naturalized
<i>Mirabilis jalapa</i>	Tropical America	Semi-naturalized
<i>Nicotiana glauca</i>	Tropical America	Naturalized
<i>Oxalis corniculata</i>	South Europe, North America	Naturalized
<i>Oxalis latifolia</i>	Brazil	Naturalized
<i>Parthenium hysterophorus</i>	West Indies, Central & North America	Naturalized
<i>Peperomia pellucida</i>	Central America	Naturalized
<i>Persicaria hydropiper</i>	Temperate region	Naturalized
<i>Petunia violacea</i>	South America	Cultivated
<i>Physalis minima</i>	South America	Naturalized
<i>Portulaca oleracea</i>	Europe, North Africa	Naturalized
<i>Psidium guajava</i>	Tropical South America	Semi-naturalized
<i>Punica granata</i>	Afghanistan, Baluchistan, Iran	Cultivated
<i>Pupalia lappacea</i>	Afro-Asia	Naturalized
<i>Ricinus communis</i>	Africa	Naturalized
<i>Scoparia dulcis</i>	South America	Naturalized
<i>Senna occidentalis</i>	South America	Naturalized
<i>Senna sophera</i>	America	Naturalized
<i>Sida cordata</i>	Tropical America	Naturalized
<i>Solanum pimpenillifolium</i>	Tropical America	Naturalized
<i>Solanum sysimbrifolium</i>	Brazil	Naturalized
<i>Spathodea campanulata</i>	Tropical Africa	Semi-naturalized
<i>Stachytarpheta indica</i>	South America	Naturalized
<i>Stellaria media</i>	Europe	Naturalized
<i>Synedrella nodiflora</i>	Tropical America	Naturalized
<i>Tagetes patula</i>	Mexico	Semi-naturalized
<i>Tamarindus indica</i>	Tropical Africa	Naturalized
<i>Tridax procumbens</i>	South America	Naturalized
<i>Vicia sativa</i>	West Africa, Europe	Naturalized
<i>Wedelia calendulacea</i>	Austro-Asia	Naturalized
<i>Xanthium strumarium</i>	South America	Naturalized

No exotic Pteridophyte has been recognized in the Rasik Beel flora, but 3 species of Gymnosperms has been detected as exotic elements. Only 2 monocotyledons species found there as naturalized exotic elements (Fig. 7.1).

## 7.6. Flowering calendar

Flowering calendar of the temperate flora of Darjeeling Hills (1500 – 2400 m) was previously prepared by Das and Chanda (1987) and for the Sambalpur District flora by Panda *et al* (1992). The flowering seasons of species in Terai and Duars flora is little known till date. The flowering seasons of majority of the floristic elements of Rasik Beel complex has been recorded during the survey work and has been presented in the Table 7.12.

**Table 7.12.** Flowering Calendar of Rasik Beel Flora [1 – 12 denotes the months of the year]

Plants	Months											
	1	2	3	4	5	6	7	8	9	10	11	12
<i>Abrus pulchellus</i>												
<i>Acacia catechu</i>												
<i>Acacia pennata</i>												
<i>Achyranthes aspera</i>												
<i>Achyranthes bidentata</i>												
<i>Adenanthera pavonina</i>												
<i>Aegle marmelos</i>												
<i>Aerides multiflora</i>												
<i>Aerva sanguinolenta</i>												
<i>Aeschynomene aspera</i>												
<i>Aeschynomene indica</i>												
<i>Ageratum conyzoides</i>												
<i>Ageratum houstonianum</i>												
<i>Albizia chinensis</i>												
<i>Alpinia calcarata</i>												
<i>Alpinia nigra</i>												
<i>Alstonia scholaris</i>												
<i>Alternanthera paronychioides</i>												
<i>Alternanthera philoxeroides</i>												
<i>Alternanthera sessilis</i>												
<i>Amaranthus blitum</i>												
<i>Amaranthus spinosus</i>												
<i>Amaranthus viridis</i>												
<i>Amischotolype hookeri</i>												
<i>Ammannia baccifera</i>												
<i>Ardisia solanacea</i>												
<i>Areca catechu</i>												
<i>Argyreia roxburghii</i>												
<i>Artabotrys hexapetalus</i>												
<i>Artocarpus heterophyllus</i>												
<i>Artocarpus lacucha</i>												
<i>Axonopus compressus</i>												
<i>Balakata baccata</i>												
<i>Barleria cristata</i>												
<i>Barleria lupulina</i>												

Table contd.

Plants	Months											
	1	2	3	4	5	6	7	8	9	10	11	12
<i>Barleria strigosa</i>												
<i>Bauhinia purpurea</i>												
<i>Bauhinia variegata</i>												
<i>Bidens pilosa</i>												
<i>Biophytum sensitivum</i>												
<i>Blumea lacera</i>												
<i>Bolboschoenus maritimus</i>												
<i>Bombax ceiba</i>												
<i>Bougainvillea spectabilis</i>												
<i>Bridelia retusa</i>												
<i>Bryophyllum pinnatum</i>												
<i>Buddleja asiatica</i>												
<i>Burmannia coelestis</i>												
<i>Butea monosperma</i>												
<i>Caesalpinia cucullata</i>												
<i>Calamus tenuis</i>												
<i>Callicarpa arborea</i>												
<i>Calotropis gigantea</i>												
<i>Cannabis sativa</i>												
<i>Capparis zeylanica</i>												
<i>Cardamine hirsuta</i>												
<i>Careya arborea</i>												
<i>Cassia fistula</i>												
<i>Catharanthus roseus</i>												
<i>Centella asiatica</i>												
<i>Cheilocostus speciosus</i>												
<i>Chenopodium album</i>												
<i>Chrysopogon aciculatus</i>												
<i>Cinnamomum tamala</i>												
<i>Cinnamomum verum</i>												
<i>Citrus limon</i>												
<i>Clerodendrum indicum</i>												
<i>Clerodendrum infortunatum</i>												
<i>Clerodendrum japonicum</i>												
<i>Coffea benghalensis</i>												
<i>Colocasia esculenta</i>												
<i>Combretum decandrum</i>												
<i>Commelina benghalensis</i>												
<i>Commelina diffusa</i>												
<i>Commelina suffruticosa</i>												
<i>Crateva religiosa</i>												
<i>Crinum amoenum</i>												
<i>Crotalaria alata</i>												
<i>Crotalaria pallida</i>												
<i>Cuphea procumbens</i>												

Table contd.

Plants	Months											
	1	2	3	4	5	6	7	8	9	10	11	12
<i>Curculigo orchioides</i>												
<i>Cyanotis axillaris</i>												
<i>Cyanotis cristata</i>												
<i>Cyanthillium cinereum</i>												
<i>Cynodon dactylon</i>												
<i>Cynoglossum lanceolatum</i>												
<i>Cyperus compressus</i>												
<i>Cyperus haspan</i>												
<i>Cyperus rotundus</i>												
<i>Cyperus stoloniferus</i>												
<i>Dalbergia sissoo</i>												
<i>Datura metel</i>												
<i>Datura stramonium</i>												
<i>Deeringia amaranthoides</i>												
<i>Dendrobium aphyllum</i>												
<i>Dendrocide sinuata</i>												
<i>Dentella repens</i>												
<i>Desmodium laxiflorum</i>												
<i>Desmodium triflorum</i>												
<i>Dicliptera bupleuroides</i>												
<i>Dillenia pentagyna</i>												
<i>Dioscorea bulbifera</i>												
<i>Dioscorea hamiltonii</i>												
<i>Dioscorea pentaphylla</i>												
<i>Dioscorea prazeri</i>												
<i>Diospyros malabarica</i>												
<i>Drosera burmannii</i>												
<i>Drymaria cordata</i>												
<i>Duchesnea indica</i>												
<i>Duranta erecta</i>												
<i>Dysphania ambrosioides</i>												
<i>Echinochloa crus-galli</i>												
<i>Eichhornia crassipes</i>												
<i>Eleocharis atropurpurea</i>												
<i>Eleusine indica</i>												
<i>Enydra fluctuans</i>												
<i>Eranthemum griffithii</i>												
<i>Eranthemum splendens</i>												
<i>Eryngium foetidum</i>												
<i>Euphorbia hirta</i>												
<i>Evolvulus nummularius</i>												
<i>Ficus benghalensis</i>												
<i>Ficus religiosa</i>												
<i>Fimbristylis aestivalis</i>												
<i>Fimbristylis complanata</i>												

Table contd.

Plants	Months											
	1	2	3	4	5	6	7	8	9	10	11	12
<i>Floscopa scandens</i>												
<i>Flueggea virosa</i>												
<i>Glinus oppositifolius</i>												
<i>Globba multiflora</i>												
<i>Gmelina arborea</i>												
<i>Heliotropium indicum</i>												
<i>Holarrhena pubescens</i>												
<i>Hoya parasitica</i>												
<i>Hydrocotyle sibthorpioides</i>												
<i>Hygrophila phlomoides</i>												
<i>Hygrophila polysperma</i>												
<i>Hypericum japonicum</i>												
<i>Ichnocarpus frutescens</i>												
<i>Impatiens balsamina</i>												
<i>Impatiens trilobata</i>												
<i>Ipomoea aquatica</i>												
<i>Ipomoea hederifolia</i>												
<i>Ixora thwaitesii</i>												
<i>Jasminum caudatum</i>												
<i>Jasminum dispersum</i>												
<i>Jasminum sambac</i>												
<i>Justicia adhatoda</i>												
<i>Kyllinga nemoralis</i>												
<i>Lagerstroemia speciosa</i>												
<i>Lannea coromandelica</i>												
<i>Lasia spinosa</i>												
<i>Leea aequata</i>												
<i>Leea asiatica</i>												
<i>Leea macrophylla</i>												
<i>Lepidagathis incurva</i>												
<i>Leucas zeylanica</i>												
<i>Limnophila heterophylla</i>												
<i>Limnophila sessiliflora</i>												
<i>Lindernia ciliata</i>												
<i>Lindernia crustacea</i>												
<i>Lindernia parviflora</i>												
<i>Lippia alba</i>												
<i>Litchi chinensis</i>												
<i>Litsea glutinosa</i>												
<i>Litsea monopetala</i>												
<i>Ludwigia adscendens</i>												
<i>Ludwigia octovalvis</i>												
<i>Ludwigia perennis</i>												
<i>Maesa indica</i>												
<i>Mallotus philippensis</i>												
<i>Mangifera indica</i>												
<i>Manilkara zapota</i>												
<i>Marsdenia tinctoria</i>												
<i>Mazus pumilus</i>												
<i>Melastoma malabathricum</i>												
<i>Melochia corchorifolia</i>												
<i>Merremia hirta</i>												

Table contd.



Plants	Months											
	1	2	3	4	5	6	7	8	9	10	11	12
<i>Merremia vitifolia</i>												
<i>Meyna spinosa</i>												
<i>Mimosa invisa</i>												
<i>Mimosa pudica</i>												
<i>Monochoria hastata</i>												
<i>Monochoria vaginalis</i>												
<i>Morinda angustifolia</i>												
<i>Morus indica</i>												
<i>Murdannia nudiflora</i>												
<i>Naravelia zeylanica</i>												
<i>Natsiatum herpeticum</i>												
<i>Nelsonia canescens</i>												
<i>Neolamarckia cadamba</i>												
<i>Nicotiana plumbaginifolia</i>												
<i>Nyctanthes arbor-tristis</i>												
<i>Nymphoides hydrophylla</i>												
<i>Nymphoides indica</i>												
<i>Oenanthe javanica</i>												
<i>Oldenlandia corymbosa</i>												
<i>Oplismenus burmanni</i>												
<i>Oplismenus compositus</i>												
<i>Oroxylum indicum</i>												
<i>Osbeckia nepalensis</i>												
<i>Oxalis corniculata</i>												
<i>Oxalis debilis</i> var. <i>corymbosa</i>												
<i>Oxalis latifolia</i>												
<i>Papilionanthe teres</i>												
<i>Persicaria barbata</i>												
<i>Persicaria chinensis</i>												
<i>Persicaria hydropiper</i>												
<i>Persicaria orientalis</i>												
<i>Persicaria strigosa</i>												
<i>Phaulopsis imbricata</i>												
<i>Phlogacanthus thyrsoiflorus</i>												
<i>Phyla nodiflora</i>												
<i>Phyllanthus emblica</i>												
<i>Phyllanthus reticulatus</i>												
<i>Phyllanthus urinaria</i>												
<i>Physalis divaricata</i>												
<i>Pilea cordifolia</i>												
<i>Piper longum</i>												
<i>Piper nigrum</i>												
<i>Piper sylvaticum</i>												
<i>Pistia stratiotes</i>												
<i>Pogostemon amaranthoides</i>												
<i>Polycarpon prostratum</i>												
<i>Polygala chinensis</i>												
<i>Polygonum plebeium</i>												
<i>Polygonum pubescens</i>												
<i>Potamogeton distinctus</i>												
<i>Potamogeton octandrus</i>												
<i>Pouzolzia hirta</i>												

Table contd.

Plants	Months											
	1	2	3	4	5	6	7	8	9	10	11	12
<i>Pouzolzia zeylanica</i>												
<i>Pterospermum acerifolium</i>												
<i>Pueraria phaseoloides</i>												
<i>Pueraria sikkimensis</i>												
<i>Ranunculus sceleratus</i>												
<i>Rauvolfia tetraphylla</i>												
<i>Richardia scabra</i>												
<i>Ricinus communis</i>												
<i>Rotala rotundifolia</i>												
<i>Rothea serrata</i>												
<i>Rumex dentatus</i>												
<i>Rumex maritimus</i>												
<i>Rungia pectinata</i>												
<i>Saccharum spontaneum</i>												
<i>Salomonina ciliata</i>												
<i>Sauropus compressus</i>												
<i>Schoenoplectiella articulata</i>												
<i>Schoenoplectiella juncooides</i>												
<i>Scoparia dulcis</i>												
<i>Senna occidentalis</i>												
<i>Senna tora</i>												
<i>Sida acuta</i>												
<i>Sida cordata</i>												
<i>Sida cordifolia</i>												
<i>Sida rhombifolia</i>												
<i>Smilax ovalifolia</i>												
<i>Smilax perfoliata</i>												
<i>Solanum aculeatissimum</i>												
<i>Solanum americanum</i>												
<i>Solanum indicum</i>												
<i>Solanum pimpinellifolium</i>												
<i>Solanum sisymbriifolium</i>												
<i>Solanum torvum</i>												
<i>Sonchus arvensis</i>												
<i>Spathodea campanulata</i>												
<i>Spermacoce alata</i>												
<i>Sphaeranthus indicus</i>												
<i>Spilanthes acmella</i>												
<i>Stellaria media</i>												
<i>Stellaria uliginosa</i>												
<i>Stellaria wallichiana</i>												
<i>Stephania glabra</i>												
<i>Stephania japonica</i>												
<i>Sterculia villosa</i>												
<i>Synedrella nodiflora</i>												
<i>Syzygium cumini</i>												
<i>Syzygium formosum</i>												
<i>Tabernaemontana divaricata</i>												
<i>Tagetes erecta</i>												
<i>Tectona grandis</i>												
<i>Terminalia bellirica</i>												
<i>Tetracera sarmentosa</i>												

Table contd.

Plants	Months											
	1	2	3	4	5	6	7	8	9	10	11	12
<i>Tetrastigma bracteolatum</i>												
<i>Tetrastigma campylocarpum</i>												
<i>Tetrastigma serrulatum</i>												
<i>Thunbergia fragrans</i>												
<i>Thunbergia grandiflora</i>												
<i>Tinospora sinensis</i>												
<i>Toona ciliata</i>												
<i>Trapa natans</i>												
<i>Trema orientalis</i>												
<i>Trema tomentosa</i>												
<i>Tridax procumbens</i>												
<i>Triumfetta rhomboidea</i>												
<i>Tylophora indica</i>												
<i>Typha elephantina</i>												
<i>Urena lobata</i>												
<i>Utricularia aurea</i>												
<i>Utricularia bifida</i>												
<i>Utricularia hirta</i>												
<i>Uvaria hamiltonii</i>												
<i>Vallisneria natans</i>												
<i>Vitex negundo</i>												
<i>Wahlenbergia marginata</i>												
<i>Wrightia arborea</i>												
<i>Xanthium strumarium</i>												
<i>Youngia japonica</i>												
<i>Ziziphus jujuba</i>												
<i>Ziziphus rugosa</i>												

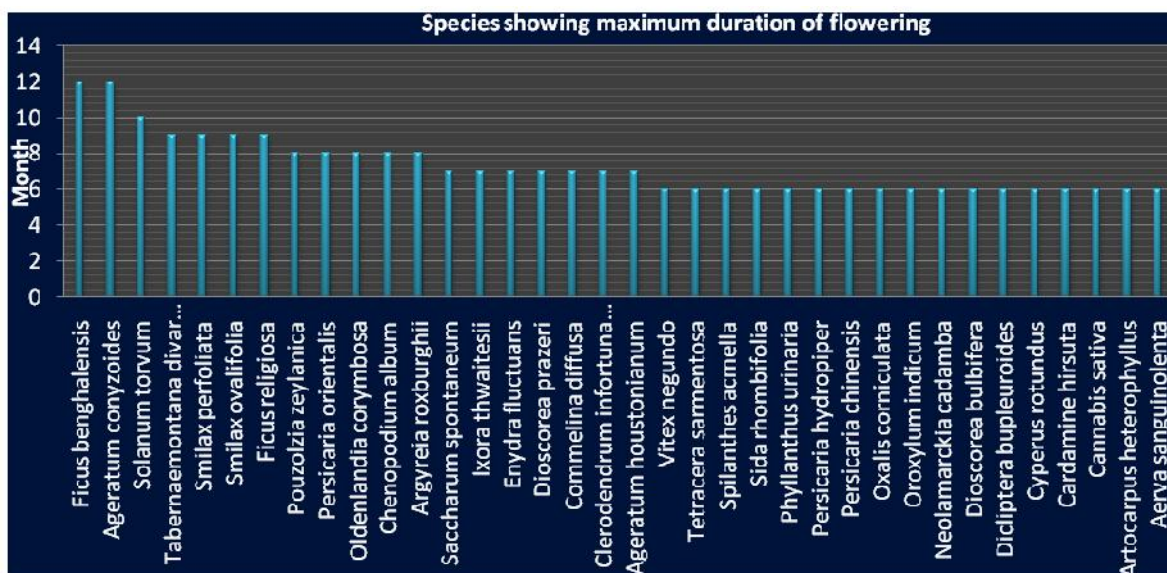


Fig. 7.2. Species showing maximum duration of flowering

*Ficus benghalensis*, *Ageratum conyzoides*, *Solanum torvum*, *Tabernaemontana divaricata*, *Smilax perfoliata*, *Smilax ovalifolia*, *Ficus religiosa*, *Pouzolzia zeylanica*, *Persicaria orientalis*, *Oldenlandia corymbosa*, *Chenopodium album*, *Argyreia roxburghii*, *Saccharum spontaneum* etc are blooming for the longest duration of the year (Fig. 7.2).

April, May, June and later October and November may be called as nature's flower festival of Rasik Beel flora, because maximum flowering species (10% of the total studied flowering species in each month) found to bloom during these two periods every year. March appears to be the resting month, as very less number species go for flowering (Fig. 7.3).

## Monthwise flowering percentage of Rasik Beel flora

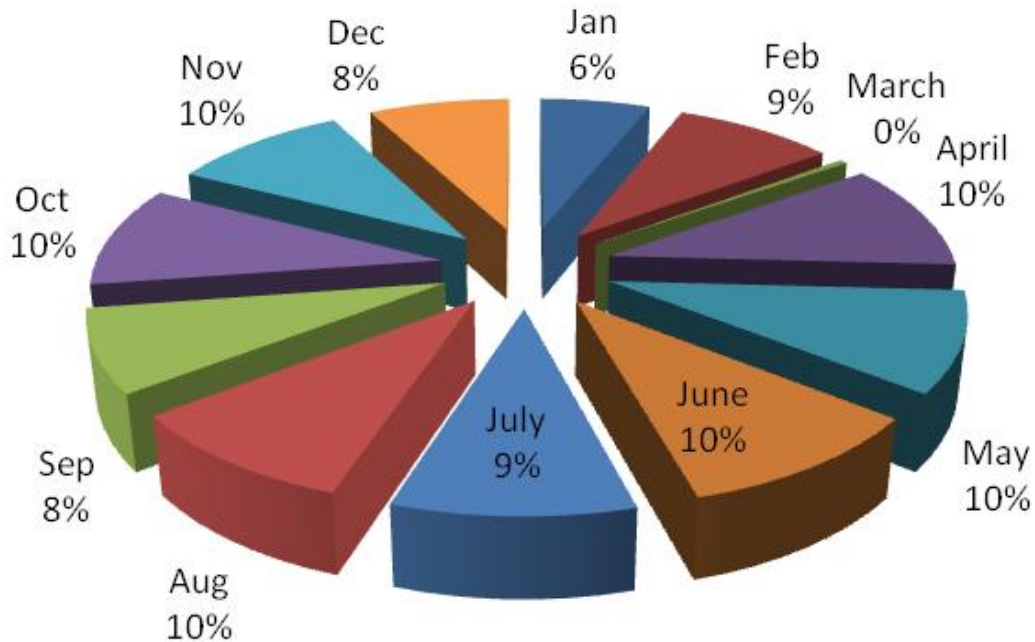


Fig. 7.3. Yearly flowering distribution of Rasik Beel flora

### 7.8. Anthropogenic activities

A large part of the Beel area is allowed free for fishing. The villagers are cultivating commercially important exotic fishes in that part of the Beel. If this practice is continued for few more years, then the local species of fishes will be vanished from the Beel very soon. Through their regular fishing activities they are disturbing the local and migratory aquatic birds and damaging the free-floating and other aquatic vegetation. The population of Aquatic rotifers, Mollusca, Zoo planktons and phytoplanktons are also being seriously affected by them due to fishery related activities. At the same time, the basic stock of food for the Beel-birds, both native and migratory, are being affected.

Poor knowledge of NTFP collection by local villagers is also the cause of damage of diversity and food crisis for aquatic birds. Ecotourism is seriously disturbing the local floral and faunal communities and also the overall environment of the area.

### 7.9. Ex-situ conservation and wetland management system

There is no any facility for the *ex-situ* conservation of plants in the study area except for some widely cultivated ornamentals in the garden and that is only for beautification. On the other hand, *ex-situ* conservation for animals is gradually increasing there through the creation of new tanks and enclosures for keeping Leopards, Deers, Pythons, Peacocks, Ghorials, Tortoises, Gooses etc. But, it appears more as a Zoo devoted to tourism than a centre with conservation activities. Plantation forest area is also increasing and the species under use for the purpose are mainly *Salix tetrasperma*, *Lagerstroemia hirsuta*, *Terminalia arjuna*, *Terminalia bellirica*, *Syzygium cumini*, *Putranjiva*

*roxburghii*, *Cassia javanica* ssp. *nodosa*, *Delonix regia*, *Lagerstroemia indica*, *Litchi chinensis*, *Spathodea campanulata* etc. in the surrounding parts of the Beel. It appears that for a conservatory devoted mainly for the bird conservation enough thought need to be given for the further selection of species for plantation. Plants provide food, shelter and suitable structures for nesting round the year for larger number of bird species, local as well as migratory, may be properly recognized and should be used for plantations.

### 7.10. Ornamental Plants in Park and Garden

There is a park and one associated garden [‘Sishu Udyan’] in the Rasik Beel area developed for beautification and tourism. Also road-side areas and conservatory sites are beautified with plants. As much 70 ornamental species has been recorded from such areas (Fig. 7.4). Those are all common ornamentals used widely for beautification or as garden-plants and has no role in conservation activities. However, some of these produce edible fruits and of medicinal importance. These are of different habit groups like trees, shrubs, climbers and herbs. All the recorded ornamentals are enumerated below:

***Acalypha hispida*** [Amaranthaceae]; V.N. – *Morog Phul*; *Rajib & AP Das 0585*, dtd. 25.07.2007.

*Use*: Garden shrub with attractive leaves and flowers.

***Adenanthera pavonina*** [Fabaceae: Mimosoidae]; V.N. – *Kuch Chandan*; *Rajib & AP Das 0315*, dtd. 10. 02. 2007.

*Use*: Planted in Garden as a beautiful tree.

***Aerva sanguinolenta*** [Amaranthaceae]; V.N. – *Lopang*; *Rajib & AP Das 0093*, dtd. 07. 02. 2007.

*Use*: Garden fence plants.

***Alcea rosea*** [Malvaceae]; Common Name: *Holi-hock*; *Rajib & AP Das 0165*, dtd. 08. 02. 2007.

*Uses*: Cultivated as an ornamental plant.

***Alstonia scholaris*** [Apocynaceae]; V.N. – *Chhatim*; *Rajib & AP Das 0372*, dtd. 21. 07. 2007.

*Use*: Planted in Garden and conservation sectors.

***Areca catechu*** [Arecaceae]; V.N. – *Supari*; *Rajib & AP Das 0089*, dtd. 06. 02. 2007.

*Use*: Planted in Garden fence.

***Artabotrys hexapetalus*** [Annonaceae]; V.N. – *Kaath Champa*; *Rajib & AP Das 0533*, dtd. 23.07.2007.

*Use*: Planted as garden plant.

***Artemisia indica*** [Asteraceae]; V.N. – *Naag Nisinda*; *Rajib & AP Das 0497*, dtd. 23. 07. 2007.

*Use*: Garden plants and also used in medicinally.

***Artocarpus lacucha*** [Moraceae]; V.N. – *Daoa*; *Rajib & AP Das 0719*, dtd. 14. 02. 2008.

*Uses*: Planted in garden for its valuable wood. Fruits edible and leaves are used as fodder.

***Bambusa vulgaris*** [Poaceae]; V.N. – *Halud Bansh*; *Rajib & AP Das 0678*, dtd. 14. 02. 2008.

*Use*: Planted in Garden margin.

***Barleria cristata*** [Acanthaceae]; V.N. – *Jati*; *Rajib & AP Das 0669*, dtd. 13. 02. 2008.

*Use*: Planted in garden for its beautiful flowers.

***Barleria lupulina*** [Acanthaceae]; V.N. – *Halud Ful*; *Rajib & AP Das 0621*, dtd. 11. 02. 2008.

*Use*: Planted in garden for its beautiful flowers.

- Barleria strigosa*** [Acanthaceae]; V.N. – *Neel Jati*; Rajib & AP Das 0536, dtd. 23. 07. 2007.  
Use: Planted in garden for its beautiful flowers.
- Bauhinia purpurea*** [Fabaceae]; V.N. – *Rakta Kanchan*; Rajib & AP Das 0325, dtd. 21. 07. 2007.  
Use: Planted in garden for its beautiful flowers.
- Bauhinia variegata*** [Fabaceae]; V.N. – *Kanchan*; Rajib & AP Das 0311, dtd. 10. 02. 2007.  
Use: Planted in garden for its beautiful foliage and flowers.
- Bougainvillea glabra*** [Nyctaginaceae]; V.N. – *Bagan Bilas*; Rajib & AP Das 0051, dtd. 05. 02. 2007.  
Use: Planted in garden and park.
- Bougainvillea spectabilis*** [Nyctaginaceae]; V.N. – *Bagan Bilas*; Rajib & AP Das 0048, dtd. 05. 02. 2007.  
Use: Planted in garden and park.
- Bryophyllum pinnatum*** [Crassulaceae]; V.N. – *Pathorkuchi*; Rajib & AP Das 0223, dtd. 09. 02. 2007.  
Use: Grown in gardens for its beautiful succulent leaves and flowers.
- Caesalpinia pulcherrima*** [Fabaceae: Caesalpinioideae]; V.N. – *Krishnachura*; Rajib & AP Das 0103, dtd. 07. 02. 2007.  
Use: Planted in garden for its beautiful flowers.
- Callistemon lanceolatus*** [Myrtaceae]; V.N. – *Bottle Brush*; Rajib & AP Das 0269, dtd. 10. 02. 2007.  
Use: Planted in garden for its beautiful flowers.
- Calotropis gigantea*** [Apocynaceae: Asclepiadoideae]; V.N. – *Akanda*; Rajib & AP Das 0410, dtd. 22. 07. 2007.  
Use: Planted in garden side, leaves also used as medicinally.
- Camellia japonica*** [Theaceae]; V.N. – *Camelia*; Rajib & AP Das 0060, dtd. 07. 02. 2007.  
Use: Planted in garden for its beautiful flowers.
- Carica papaya*** [Caricaceae]; V.N. – *Pnepe*; Rajib & AP Das 0096, dtd. 07. 02. 2007.  
Use: Cultivated in garden for its edible fruits.
- Caryota urens*** [Arecaceae]; V.N. – *Paam*; Rajib & AP Das 0088, dtd. 06. 02. 2007.  
Use: Planted in forest margin.
- Cassia fistula*** [Fabaceae: Caesalpinioideae]; V.N. – *Bandar Lathi*; Rajib & AP Das 0142, dtd. 07. 02. 2007.  
Use: Deciduous ornamental small tree with beautiful foliage and flowers.
- Cassia javanica ssp. nodosa*** [Fabaceae: Caesalpinioideae]; V.N. – *Balaram Chura*; Rajib & AP Das 0122, dtd. 07. 02. 2007.  
Use: Ornamental flowering tree.
- Cereus repandus*** [Cactaceae]; V.N. – *Sij Kanta*; Rajib & AP Das 0020, dtd. 05. 02. 2007.  
Use: Cultivated as ornamental plant.
- Catharanthus roseus*** [Apocynaceae]; V.N. – *Nayantara*; Rajib & AP Das 0388, dtd. 21. 07. 2007.  
Use: Plant is grown in gardens.
- Cinnamomum tamala*** [Lauraceae]; V.N. – *Tejpata*; Rajib & AP Das 0540, dtd. 23. 07. 2007.  
Use: Cultivated in garden as spice tree.

- Cinnamomum verum*** [Lauraceae]; V.N. – *Darchini*; *Rajib & AP Das 0412*, dtd. 11. 02. 2008.  
*Use*: Cultivated in garden as spice tree.
- Citrus maxima*** [Rutaceae]; V.N. – *Jambura*; *Rajib & AP Das 0600*, dtd. 26. 07. 2007.  
*Use*: Cultivated garden for its testy fruits.
- Cocos nucifera*** [Arecaceae]; V.N. – *Narkel*; *Rajib & AP Das 0090*, dtd. 07. 02. 2007.  
*Use*: Cultivated garden plants for its fruits.
- Clitoria ternatea*** [Fabaceae: Faboidae]; V.N. – *Nilkantha*; *Rajib & AP Das 0239*, dtd. 09. 02. 2007.  
*Use*: Cultivated for its flower.
- Crinum amoenum*** [Amarylidaceae]; V.N. – *Akashi*; *Rajib & AP Das 0170*, dtd. 08. 02. 2007.  
*Use*: Plants are grown for gardening purposes.
- Duranta erecta*** [Verbenaceae]; V.N. – *Duranta*; *Rajib & AP Das 0488*, dtd. 23.7.2007.  
*Use*: Cultivated for garden fencing.
- Ficus elastica*** [Moraceae]; V.N. – *Rober Bot*; *Rajib & AP Das 0597*, dtd. 25. 07. 2007.  
*Uses*: Planted as ornamental garden tree.
- Hibiscus mutabilis*** [Malvaceae]; V.N. – *Sthal Padma*; *Rajib & AP Das 0487*, dtd. 23. 07. 2007.  
*Uses*: Cultivated as ornamental plants.
- Hibiscus rosa-sinensis*** [Malvaceae]; V.N. – *Rakta Jaba*; *Rajib & AP Das 0080*, dtd. 06. 02. 2007.  
*Uses*: Cultivate in gardens for its beautiful flowers.
- Holarrhena pubescens*** [Apocynaceae]; V.N. – *Kurchi*; *Rajib & AP Das 0459*, dtd. 23. 07. 2007.  
*Uses*: Cultivate in gardens for its beautiful flowers.
- Impatiens balsamina*** [Balsaminaceae]; V.N. – *Dopati*; *Rajib & AP Das 0620*, dtd. 11. 02. 2008.  
*Use*: Ornamental garden annual.
- Impatiens trilobata*** [Balsaminaceae]; V.N. – *Dopati*; *Rajib & AP Das 0554*, dtd. 24. 07. 2007.  
*Use*: Ornamental garden annual.
- Ixora acuminata*** [Rubiaceae]; V.N. – *Rangan*; *Rajib & AP Das 0478*, dtd. 23. 07. 2007.  
*Use*: Grown in gardens for its beautiful flowers.
- Jasminum dispersum*** [Oleaceae]; V.N. – *Juin*; *Rajib & AP Das 0614*, dtd. 11.02.2008.  
*Use*: Grown in gardens for its beautiful flowers.
- Jasminum sambac*** [Oleaceae]; V.N. – *Beli*; *Rajib & AP Das 0480*, dtd. 23.07.2007.  
*Use*: Grown in gardens for its aromatic and beautiful flowers.
- Jatropha curcas*** [Euphorbiaceae]; V.N. – *Varenda, Sada Varenda*; *Rajib & AP Das 0722*, dtd. 14.02.2008.  
*Use*: Grown along the fences for its beautiful foliage.
- Justicia adhatoda*** [Acanthaceae]; V.N. – *Basak*; *Rajib & AP Das 0542*, dtd. 23.07.2007.  
*Use*: Grown along the fences for its beautiful foliage and flowers.
- Justicia gendarussa*** [Acanthaceae]; V.N. – *Kalakasunda*; *Rajib & AP Das 0651*, dtd. 12.02.2008.  
*Use*: Grown along the fences for its beautiful foliage and flowers.
- Litchi chinensis*** [Sapindaceae]; V.N. – *Lichu*; *Rajib & AP Das 0313*, dtd. 10.02.2007.  
*Use*: Cultivated in garden for its testy fruits.

- Magnolia grandiflora*** [Magnoliaceae]; V.N. – *Kathali Champa; Rajib & AP Das 0123*, dtd. 07.02.2007.  
*Use:* Planted in garden for its elegant foliage and flowers.
- Magnolia champaca*** [Magnoliaceae]; V.N. – *Swarna Champa; Rajib & AP Das 0187*, dtd. 09.02.2007.  
*Use:* This species is widely cultivated as an ornamental and for timber.
- Malvaviscus arboreus* var. *penduliflorus*** [Malvaceae]; V.N. – *Lanka Jaba; Rajib & AP Das 0329*, dtd. 21.07.2007.  
*Uses:* Ornamental plants. Grown in gardens for its beautiful flowers.
- Mangifera indica*** [Anacardiaceae]; V.N. – *Aam; Rajib & AP Das 0334*, dtd. 21.07.2007.  
*Uses:* This species is widely cultivated for timber and its tasty fruits.
- Mesua ferrea*** [Clusiaceae]; V.N. – *Nageswar; Rajib & AP Das 0065*, dtd. 07.02.2007.  
*Uses:* Cultivated for beautiful flowers.
- Mirabilis jalapa*** [Nyctaginaceae]; V.N. – *Sandhya Malatai; Rajib & AP Das 0034*, dtd. 05.02.2007.  
*Use:* Grown in gardens for its beautiful flowers.
- Moringa oleifera*** [Moringaceae]; V.N. – *Sajna; Rajib & AP Das 0171*, dtd. 08.02.2007.  
*Use:* Ornamental gared plants.
- Morus australis*** [Moraceae]; V.N. – *Tnut; Rajib & AP Das 0128*, dtd. 07. 02. 2007.  
*Uses:* Ornamental plants.
- Murraya paniculata*** [Rutaceae]; V.N. – *Kamini; Rajib & AP Das 0642*, dtd. 12.02.2008.  
*Use:* Garden plants.
- Neolamarckia cadamba*** [Rubiaceae]; V.N. – *Kadam; Rajib & AP Das 0587*, dtd. 25.07. 2007.  
*Use:* Ornamental tree. Timber also very valuable.
- Nyctanthes arbor-tristis*** [Nyctaginaceae]; V.N. – *Shiuli; Rajib & AP Das 0047*, dtd.05.02. 2007.  
*Use:* Cultivated for its flowers.
- Nymphaea nouchali*** [Nymphaeaceae]; V.N. – *Neel Shaluk; Rajib & AP Das 0336*, dtd. 21.07.2007.  
*Use:* Cultivated in park-side pond.
- Nymphaea pubescens*** [Nymphaeaceae]; V.N. – *Shaluk; Rajib & AP Das 0402*, dtd. 22. 07. 2007.  
*Use:* Cultivated in park-side pond.
- Nymphaea rubra*** [Nymphaeaceae]; V.N. – *Lal Shaluk; Rajib & AP Das 0251*, dtd. 10. 02. 2007.  
*Use:* Cultivated in park-side pond.
- Ocimum basilicum*** [Lamiaceae]; V.N. – *Sada Tulsi; Rajib & AP Das 0321*, dtd. 21. 07. 2007.  
*Use:* Garden aromatic herb.
- Ocimum tenuiflorum*** [Lamiaceae]; V.N. – *Kalo Tulsi; Rajib & AP Das 0560*, dtd. 24. 07. 2007.  
*Use:* Garden plants.
- Phyllanthus emblica*** [Phyllanthaceae]; V.N. – *Amlaki; Rajib & AP Das 0490*, dtd. 23. 07. 2007.  
*Use:* Cultivated garden plants for its fruits.



*Piper longum* [Piperaceae]; V.N. – *Pipla*; Rajib & AP Das 0206, dtd. 09. 02. 2007.

Use: Ornamental plants.

*Piper nigrum* [Piperaceae]; V.N. – *Golmarich*; Rajib & AP Das 0262, dtd. 10. 02. 2007.

Use: Ornamental plants.

*Polyalthia longifolia* [Annonaceae]; V.N. – *Debdaru*; Rajib & AP Das 0440, dtd. 22. 07. 2007.

Uses: This species is widely cultivated as an ornamental and for timber.

*Psidium guajava* [Myrtaceae]; V.N. – *Peyara*; Rajib & AP Das 0258, dtd. 10. 02. 2007.

Use: Cultivated garden plants.

*Roystonea regia* [Arecaceae]; V.N. – *Narkel Paam*; Rajib & AP Das 0092, dtd. 07. 02. 2007.

Use: Ornamental garden palm.

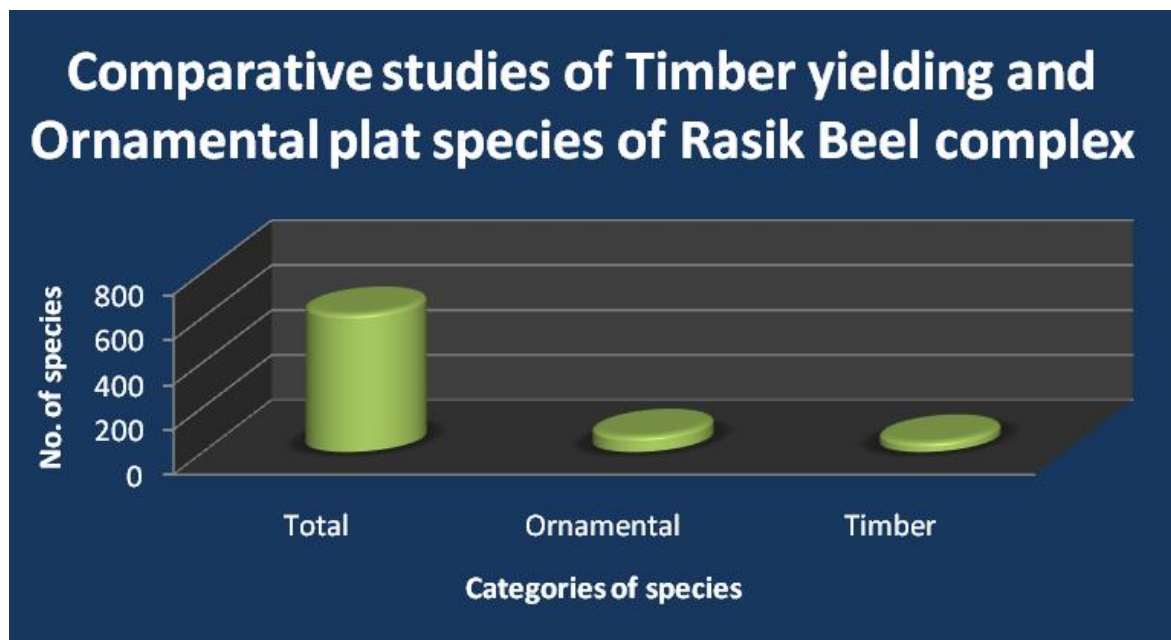


Fig.:7.4. Comparative study of Timber yielding and Ornamental and garden plants of Rasik Beel complex

### 7.11. Important Timber Yielding Plants of Rasik Beel Area

Altogether, 45 species of trees have been recorded from the surrounding forests areas of Rasik Beel complex those produce much valuable wood (Fig. 7.4). These plants are not a part of NTFPs, but their leaves, fruits and flowers are the main sources of NTFPs of the study area. The recorded timber yielding species are enumerated below:

*Amoora rohituka* [Meliaceae]; V.N. – *Rasune*; Rajib & AP Das 0532, dtd. 23. 07. 2007.

*Aglaia spectabilis* [Meliaceae]; V.N. – *Lali*; Rajib & AP Das 0498, dtd. 23. 07. 2007.

*Artocarpus heterophyllus* [Moraceae]; V.N. – *Kanthal*; Rajib & AP Das 0732, dtd. 14. 02. 2008.

*Artocarpus lakoocha* [Moraceae]; V.N. – *Dawa*; Rajib & AP Das 0719, dtd. 14. 02. 2008.

*Barringtonia acutangula* [Lecythidaceae]; V.N. – *Hijal*; Rajib & AP Das 0109, dtd. 07. 02. 2007.

*Bischofia javanica* [Phyllanthaceae]; V.N. – *Kainjal*; Rajib & AP Das 0265, dtd. 10. 02. 2007.

*Bombax ceiba* [Malvaceae]; V.N. – *Shimul*; Rajib & AP Das 0435, dtd. 22. 07. 2007.

- Callicarpa arborea* [Lamiaceae]; Rajib & AP Das 0295, dtd. 10. 02. 2007.
- Careya arborea* [Lecythidaceae]; V.N. – Kumbhi; Rajib & AP Das 0153, dtd. 08. 02. 2007.
- Cassia javanica ssp. nodosa* [Fabaceae: Caesalpinioideae]; V.N. – Balaram chura; Rajib & AP Das 0122, dtd. 07. 02. 2007.
- Senna siamea* [Fabaceae: Caesalpinioideae]; Rajib & AP Das 0127, dtd. 07. 02. 2007.
- Chukrasia tabularis* [Meliaceae]; V.N. – Chikrashi; Rajib & AP Das 0454, dtd. 22. 07. 2007.
- Cinnamomum bejolghota* [Lauraceae]; V.N. – Bon tejpata; Rajib & AP Das 0469, dtd. 23. 07. 2007.
- Dalbergia sissoo* [Fabaceae: Caesalpinioideae]; V.N. – Sishu; Rajib & AP Das 0151, dtd. 08. 02. 2007.
- Dillenia indica* [Dilleniaceae]; V.N. – Chalta; Rajib & AP Das 0666, dtd. 13. 02. 2008.
- Dillenia pentagyna* [Dilleniaceae]; V.N. – Tartari; Rajib & AP Das 0695, dtd. 14. 02. 2008.
- Diospyros malabarica* [Ebenaceae]; V.N. – Gaab; Specimen Cited: Rajib & AP Das 0222, dtd. 09. 02. 2007.
- Elaeocarpus floribundus* [Elaeocarpaceae]; V.N. – Jalpai; Rajib & AP Das 0085, dtd. 06. 02. 2007.
- Gmelina arborea* [Lamiaceae]; V.N. – Gamari; Rajib & AP Das 0524, dtd. 23. 07. 2007.
- Lagerstroemia hirsuta* [Lythraceae]; V.N. – Jarul; Rajib & AP Das 0512, dtd. 23. 07. 2007.
- Lagerstroemia parviflora* [Lythraceae]; V.N. – Sidha; Rajib & AP Das 0511, dtd. 23. 07. 2007.
- Lannea coromandelica* [Anacardiaceae]; V.N. – Jika; Rajib & AP Das 0364, dtd. 21. 07. 2007.
- Litsea glutinosa* [Lauraceae]; V.N. – Pipul; Rajib & AP Das 0618, dtd. 11. 02. 2008.
- Litsea monopetala* [Lauraceae]; V.N. – Bonkathal; Rajib & AP Das 0685, dtd. 14. 02. 2008.
- Mangifera indica* [Anacardiaceae]; V.N. – Aam; Rajib & AP Das 0334, dtd. 21. 07. 2007.
- Melia azedarach* [Meliaceae]; V.N. – Ghora nim; Rajib & AP Das 0243, dtd. 09. 02. 2007.
- Mesua ferrea* [Clusiaceae]; V.N. – Nageswar; Rajib & AP Das 0065, dtd. 07. 02. 2007.
- Magnolia champaca* [Magnoliaceae]; V.N. – Swarna champa; Rajib & AP Das 0187, dtd. 09. 02. 2007.
- Neolamarckia cadamba* [Rubiaceae]; V.N. – Kadam; Rajib & AP Das 0587, dtd. 25. 07. 2007.
- Oroxylum indicum* [Bignoniaceae]; V.N. – Taroyal phal; Rajib & AP Das 0299, dtd. 10. 02. 2007.
- Peltophorum pterocarpum* [Fabaceae: Caesalpinioideae]; V.N. – Radhachura; Rajib & AP Das 0149, dtd. 08. 02. 2007.
- Polyalthia longifolia* [Annonaceae]; V.N. – Debdaru; Rajib & AP Das 0440, dtd. 22. 07. 2007.
- Shorea robusta* [Dipterocarpaceae]; V.N. – Sal; Rajib & AP Das 0648, dtd. 12. 02. 2008.
- Sterculia villosa* [Malvaceae]; V.N. – Odal; Rajib & AP Das 0468, dtd. 23. 07. 2007.
- Swietenia macrophylla* [Meliaceae]; V.N. – Mehogini; Rajib & AP Das 0310, dtd. 10. 02. 2007.
- Swietenia mahagoni* [Meliaceae]; V.N. – Mehogini; Rajib & AP Das 0390, dtd. 21. 07. 2007.
- Syzygium cumini* [Myrtaceae]; V.N. – Kalojam; Rajib & AP Das 0174, dtd. 08. 02. 2007.
- Syzygium jambos* [Myrtaceae]; V.N. – Golap-jam; Rajib & AP Das 0252, dtd. 10. 02. 2007.

- Tamarindus indica* [Fabaceae: *Caesalpinioideae*]; V.N. – *Tentul*; *Rajib & AP Das 0244*, dtd. 09. 02. 2007.
- Tectona grandis* [Lamiaceae]; V.N. – *Segun*; *Rajib & AP Das 0682*, dtd. 14. 02. 2008.
- Terminalia arjuna* [Combretaceae]; V.N. – *Arjun*; *Rajib & AP Das 0541*, dtd. 23. 07. 2007.
- Terminalia bellirica* [Combretaceae]; V.N. – *Bahera*; *Rajib & AP Das 0602*, dtd. 26. 07. 2007.
- Terminalia myriocarpa* [Combretaceae]; V.N. – *Panisaaj*; *Rajib & AP Das 0586*, dtd. 25. 07. 2007.
- Toona ciliata* [Meliaceae]; V.N. – *Toon*; *Rajib & AP Das 0267*, dtd. 10. 02. 2007.
- Wrightia arborea* [Apocynaceae]; V.N. – *Khira*; *Rajib & AP Das 0273*, dtd. 10. 02. 2007.

Recently, *Salix tetrasperma* is also being introduced for its branching nature, which is quite suitable for the nesting by many birds. *Terminalia arjuna* also planted at the middle of the Island and parts of Baroan and Chhotojan Beel areas for the same reason.



**PATE 11: Tourism Threats (continue), Figure. 123 - 130:** 123. Deer park for Tourist attraction; 124. Picnic spot in the middle of forest; 125. Picnic festival in the way within Rasik Beel area; 126. Car parking area within forest; 127. Tourist Bungalow of Forest Department; 128. Park; 129. Garden; 130. Batikata Beel open for Boating



**PATE 12: Tourism Threats, Figure. 131 - 138:** 131. Hanging Bridge over the Beel; 132. Tourist Lodge of Panchayet Samiti; 133. Gate of Rasik Beel; 134. Rasik beel Bus stand; 135. Migratory Birds in Bochamari Beel; 136. Fishing Boat use for Tourist; 137. Forest Department used Boat to entertain Tourist; 138. Tourist Bungalow

# CHAPTER - VIII

## Chapter - VIII

# PHYTOSOCIOLOGICAL ANALYSIS

Phytosociological studies were conducted both in the wetland vegetation, as well as in the surrounding terrestrial vegetation. While the nested quadrat method was applied for the terrestrial vegetation with three sizes of quadrates [20 m x 20 m; 5 m x 5 m; and 1 m x 1 m], for the wetland vegetation only 1 m x 1 m size of quadrat was used extensively. As much as 150 randomly distributed floating but fixed such quadrates were used within the wetland. On the other hand, in the forested vegetation, 25 nested quadrates, i.e. 25 large [20 x 20 m], 50 medium [5 x 5 m] and 125 small [1 x 1 m] quadrates were used to sample the canopy, under-storey and the ground-cover vegetation, respectively.

The sampling was done in three different seasons of the year: (i) Pre-monsoon [March to April], Monsoon [May to July] and Post-monsoon [September to November]. The data obtained were computed to determine different phytosociological parameters, namely Frequency (F), Density (D), Abundance (A), Relative Frequency (RF), Relative Density (RD), Relative Abundance (RA) and Important Value Index (IVI). And, finally, using these processed data different diversity and richness indices were calculated for better understanding of the vegetation of Rasik Beel area.

### 8.1. Seasonal Variations of Flora

Occurrence of floral species varies across the seasons. Pre-monsoon, monsoon and post-monsoon studies enlighten this argument, showing difference of occurring species in respect of density, frequency, abundance and IVI [Annexure – I to X].

#### 8.1.1. Pre-monsoon wetland vegetation

Wetland vegetation during pre-monsoon recorded a mixed result. *Salvinia cucullata* emerged with highest density (4.65) followed by *Nymphoides hydrophylla* (3.92), *Nymphoides indica* (3.62), *Vallisneria natans* (3.15), *Limnophila sessiliflora* (2.62) and *Azolla pinnata* ssp. *Africana* (2.54) (Table 8.1). Similarly highest frequency counted for *Salvinia cucullata* (65.38), *Nymphoides indica* (57.69), *Nymphoides hydrophylla* (50), *Utricularia aurea* (46.15), *Trapa natans* (42.31) (Table 8.2). However highest abundance recorded against *Eriocaulon cinereum* (10.67) followed by *Vallisneria natans* (9.11), *Nymphoides hydrophylla* (7.85), *Salvinia cucullata* (7.12) and *Limnophila sessiliflora* (6.80) (Table 8.3). Highest IVI during pre-monsoon season has been recorded by *Salvinia cucullata* (28.14), *Nymphoides hydrophylla* (24.52), *Nymphoides indica* (23.44), *Vallisneria natans* (21.23) and *Limnophila sessiliflora* (18.36) (Annexure – I, Table 8.4 & Fig. 8.1).

**Table 8.1.** Density of dominant Pre-monsoon wetland species

Name of Plants	D	RD	IVI	Shannon – Weiner Index (SDI)	Simpson's Index (EH)
<i>Salvinia cucullata</i>	4.65	13.039	28.1404	0.983	12.41
<i>Nymphoides hydrophylla</i>	3.92	10.991	24.5191	0.988	13.58
<i>Nymphoides indica</i>	3.62	10.129	23.4431	0.99	14.21
<i>Vallisneria natans</i>	3.15	8.8362	21.2319	0.992	15.37
<i>Limnophila sessiliflora</i>	2.62	7.3276	18.3632	0.995	17.21
<i>Azolla pinnata</i> ssp. <i>Africana</i>	2.54	7.1121	17.983	0.995	17.53

**Table 8.2.** Frequency of dominant Pre-monsoon wetland species

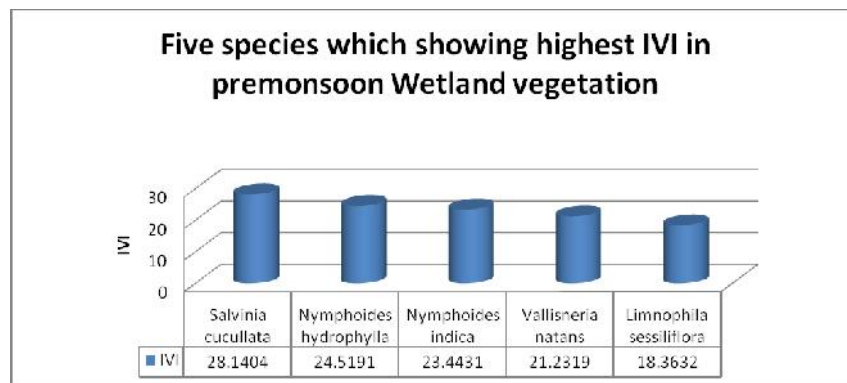
Name of Plants	F	RF	IVI	Shannon – Weiner Index (SDI)	Simpson's Index (EH)
<i>Salvinia cucullata</i>	65.38	9.239	28.1404	0.983	12.41
<i>Nymphoides indica</i>	57.69	8.152	23.4431	0.99	14.21
<i>Nymphoides hydrophylla</i>	50	7.065	24.5191	0.988	13.58
<i>Utricularia aurea</i>	46.15	6.522	16.0472	0.997	19.92
<i>Trapa natans</i>	42.31	5.978	17.667	0.995	17.87

**Table 8.3.** Abundance of dominant Pre-monsoon wetland species

Name of Plants	A	RA	IVI	Shannon – Weiner Index (SDI)	Simpson's Index (EH)
<i>Eriocaulon cinereum</i>	10.67	8.7857	13.8644	0.999	28.38
<i>Vallisneria natans</i>	9.111	7.5044	21.2319	0.992	15.37
<i>Nymphoides hydrophylla</i>	7.846	6.4625	24.5191	0.988	13.58
<i>Salvinia cucullata</i>	7.118	5.8625	28.1404	0.983	12.41
<i>Limnophila sessiliflora</i>	6.8	5.6009	18.3632	0.995	17.21

**Table 8.4.** IVI of dominant Pre-monsoon wetland species

Name of Plants	RF	RA	RD	IVI	Shannon–Weiner Index (SDI)	Simpson's Index (EH)
<i>Salvinia cucullata</i>	9.239	5.8625	13.039	28.1404	0.983	12.41
<i>Nymphoides hydrophylla</i>	7.065	6.4625	10.991	24.5191	0.988	13.58
<i>Nymphoides indica</i>	8.152	5.1616	10.129	23.4431	0.99	14.21
<i>Vallisneria natans</i>	4.891	7.5044	8.8362	21.2319	0.992	15.37
<i>Limnophila sessiliflora</i>	5.435	5.6009	7.3276	18.3632	0.995	17.21

**Fig. 8.1.** Five species with high IVI scores in pre-monsoon wetland vegetation



### 8.1.2. Pre-monsoon Herbs

Herbaceous species during pre-monsoon *Chloranthus elatior* emerged with highest density (0.92) followed by *Triumfetta rhomboidea* (0.8), *Urena lobata* (0.64), *Tabernaemontana divaricata* (0.44) and *Stephania japonica* (0.76) (Table 8.5). Highest frequency was counted for *Acmella uliginosa* (92), *Oplismenus burmannii* (84), *Elephantopus scaber* (80), *Achyropermum wallichianum* (80) and *Boehmeria glomerulifera* (76) (Table 8.6).

**Table 8.5.** Density of dominant Pre-monsoon herbs

Name of the plants	D	RD	IVI	Shannon – Weiner Index (SDI)	Simpson's Index (EH)
<i>Chloranthus elatior</i>	0.92	2.893	8.054	0.999	36.696
<i>Triumfetta rhomboidea</i>	0.8	2.516	7.366	0.999	40.598
<i>Urena lobata</i>	0.64	2.013	6.386	1	47.849
<i>Tabernaemontana divaricata</i>	0.44	1.384	4.951	1	63.506
<i>Stephania japonica</i>	0.76	2.39	7.07	0.999	42.148

**Table 8.6.** Frequency of dominant Pre-monsoon herbs

Name of the plants	F	RF	IVI	Shannon – Weiner Index (SDI)	Simpson's Index (EH)
<i>Acmella uliginosa</i>	92	4	10.92	0.998	27.356
<i>Oplismenus burmannii</i>	84	3.652	8.562	0.999	35.594
<i>Elephantopus scaber</i>	80	3.478	7.649	0.999	40.598
<i>Achyropermum wallichianum</i>	80	3.478	13.487	0.996	22.192
<i>Boehmeria glomerulifera</i>	76	3.304	7.562	0.999	40.598

**Table 8.7.** Abundance of dominant Pre-monsoon herbs

Name of the plants	A	RA	IVI	Shannon – Weiner Index (SDI)	Simpson's Index (EH)
<i>Nelsonia canescens</i>	3.50	5.791	8.248	1	52.876
<i>Duchesnea indica</i>	3.44	5.687	15.388	0.995	20.354
<i>Spermacoce alata</i>	2.50	4.136	6.09	1	68.335
<i>Achyropermum wallichianum</i>	2.40	3.971	13.487	0.996	22.192
<i>Eragrostis tenella</i>	2.33	3.861	5.263	1	90.263

**Table 8.8.** IVI of dominant Pre-monsoon herbs

Name of the plants	RD	RF	RA	IVI	Shannon – Weiner Index (SDI)	Simpson's Index (EH)
<i>Duchesnea indica</i>	2.893	4	5.791	15.39	0.995	20.354
<i>Achyropermum wallichianum</i>	2.516	3.652	5.687	13.49	0.996	22.192
<i>Coffea benghalensis</i>	2.013	3.478	4.136	11.43	0.998	25.878
<i>Acmella uliginosa</i>	1.384	3.478	3.971	10.92	0.998	27.356
<i>Elatostema cornutum</i>	2.39	3.304	3.861	9.87	0.999	29.731

## Five species which showing highest IVI in premonsoon Wetland vegetation

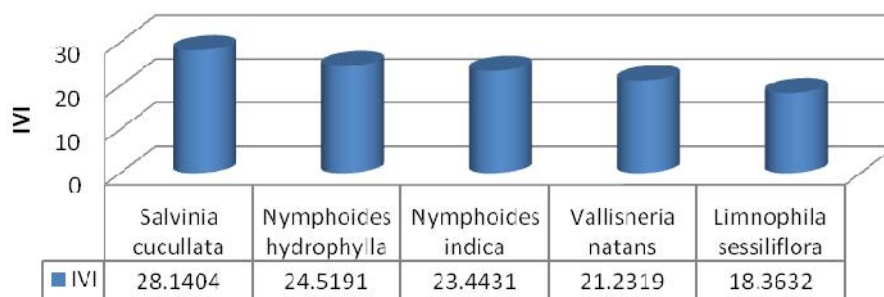


Fig. 8.1. Five species with high IVI scores in pre-monsoon wetland vegetation

### 8.1.2. Pre-monsoon Herbs

Table 8.5. Density of dominant Pre-monsoon herbs

Name of the plants	D	RD	IVI	Shannon – Weiner Index (SDI)	Simpson's Index (EH)
<i>Chloranthus elatior</i>	0.92	2.893	8.054	0.999	36.696
<i>Triumfetta rhomboidea</i>	0.8	2.516	7.366	0.999	40.598
<i>Urena lobata</i>	0.64	2.013	6.386	1	47.849
<i>Tabernaemontana divaricata</i>	0.44	1.384	4.951	1	63.506
<i>Stephania japonica</i>	0.76	2.39	7.07	0.999	42.148

Herbaceous species during pre-monsoon *Chloranthus elatior* emerged with highest density (0.92) followed by *Triumfetta rhomboidea* (0.8), *Urena lobata* (0.64), *Tabernaemontana divaricata* (0.44) and *Stephania japonica* (0.76) (Table 8.5). Highest frequency was counted for *Acmella uliginosa* (92), *Oplismenus burmannii* (84), *Elephantopus scaber* (80), *Achyrospermum wallichianum* (80) and *Boehmeria glomerulifera* (76) (Table 8.6).

Table 8.6. Frequency of dominant Pre-monsoon herbs

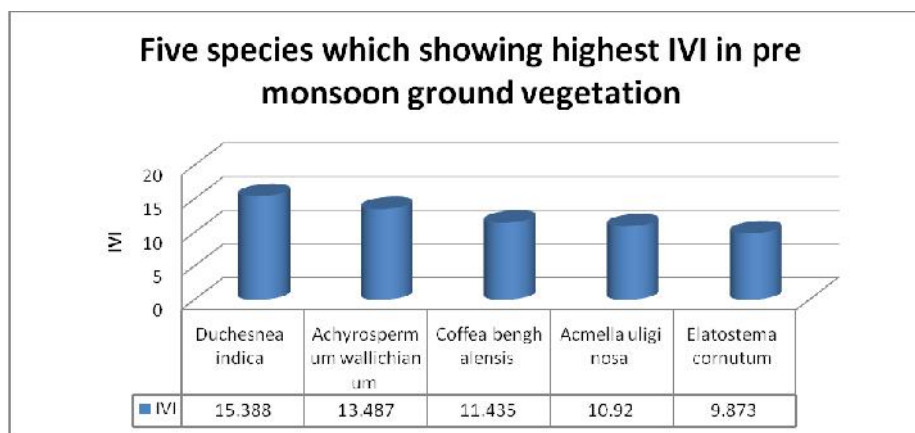
Name of the plants	F	RF	IVI	Shannon – Weiner Index (SDI)	Simpson's Index (EH)
<i>Acmella uliginosa</i>	92	4	10.92	0.998	27.356
<i>Oplismenus burmannii</i>	84	3.652	8.562	0.999	35.594
<i>Elephantopus scaber</i>	80	3.478	7.649	0.999	40.598
<i>Achyrospermum wallichianum</i>	80	3.478	13.487	0.996	22.192
<i>Boehmeria glomerulifera</i>	76	3.304	7.562	0.999	40.598

Table 8.7. Abundance of dominant Pre-monsoon herbs

Name of the plants	A	RA	IVI	Shannon – Weiner Index (SDI)	Simpson's Index (EH)
<i>Nelsonia canescens</i>	3.50	5.791	8.248	1	52.876
<i>Duchesnea indica</i>	3.44	5.687	15.388	0.995	20.354
<i>Spermacoce alata</i>	2.50	4.136	6.09	1	68.335
<i>Achyrospermum wallichianum</i>	2.40	3.971	13.487	0.996	22.192
<i>Eragrostis tenella</i>	2.33	3.861	5.263	1	90.263

**Table 8.8.** IVI of dominant Pre-monsoon herbs

Name of the plants	RD	RF	RA	IVI	Shannon – Weiner Index (SDI)	Simpson's Index (EH)
<i>Duchesnea indica</i>	2.893	4	5.791	15.39	0.995	20.354
<i>Achyrosperrum wallichianum</i>	2.516	3.652	5.687	13.49	0.996	22.192
<i>Coffea benghalensis</i>	2.013	3.478	4.136	11.43	0.998	25.878
<i>Acmella uliginosa</i>	1.384	3.478	3.971	10.92	0.998	27.356
<i>Elatostema cornutum</i>	2.39	3.304	3.861	9.87	0.999	29.731

**Fig. 8.2.** Five species showing high IVI score in pre-monsoon herbs

However highest abundance recorded against *Nelsonia canescens*(3.5) followed by *Duchesnea indica* (3.44), *Spermacoce alata*(2.50), *Achyrosperrum wallichianum*(2.40) and *Eragrostis tenella* (2.33) (Table 8.7). Highest IVI during pre-monsoon season has been recorded for *Duchesnea indica* (15.39) followed by *Achyrosperrum wallichianum* (13.49), *Coffea benghalensis*(11.43), *Acmella uliginosa*(10.92) and *Elatostema cornutum* (9.87) (Table 8.8 & Fig 8.2).

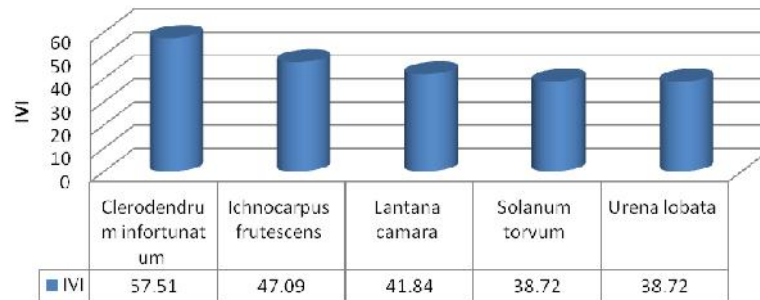
### 8.1.3. Pre-monsoon Shrubs

Limited shrubby species have been recorded during pre-monsoon survey. Highest density, frequency, abundance or IVI are respectively recorded by *Clerodendrum infortunatum* (1.6; 80; 2 & 57.51) followed by *Ichnocarpus frutescens* (1.2; 70; 1.71 & 47.09), *Lantana camara* (1; 70; 1.43 & 41.84), *Solanum torvum* (0.9; 60; 1.5 & 38.72) and *Urena lobata* (0.9; 60; 1.5 & 38.72) (Table 8.9 & Fig 8.3).

**Table 8.9.** Density, Frequency, Abundance and IVI of dominant Pre-monsoon shrubs

Name of the plants	F	RF	A	RA	D	RD	IVI	Shannon–Weiner Index (SDI)	Simpson's Index (EH)
<i>Clerodendrum infortunatum</i>	80	17.78	2	16.21	1.6	23.53	57.51	0.95	6.45
<i>Ichnocarpus frutescens</i>	70	15.56	1.71	13.89	1.2	17.65	47.09	0.97	7.18
<i>Lantana camara</i>	70	15.56	1.43	11.58	1	14.71	41.84	0.98	7.79
<i>Solanum torvum</i>	60	13.33	1.5	12.16	0.9	13.24	38.72	0.98	8.21
<i>Urena lobata</i>	60	13.33	1.5	12.16	0.9	13.24	38.72	0.98	8.21

### Five species which showing highest IVI in pre monsoon shrub vegetation



**Fig. 8.3.** species showing maximum IVI in premonsoon shrub vegetation

#### 8.1.4. Trees

Highest density has been recorded for *Bischofia javanica* (0.75) followed by *Tectona grandis* (0.7), *Chukrassia tabularis* (0.7), *Terminalia bellirica* (0.65) and *Ficus nerifolia* (0.6) (Table 8.10).

**Table 8.10.** Density of dominant trees

Name of the tree	D	RD	IVI	Shannon – Weiner Index (SDI)	Simpson's Index (EH)
<i>Bischofia javanica</i>	0.75	7.5	19.083	0.995	16.14
<i>Tectona grandis</i>	0.7	7	18.176	0.995	16.844
<i>Chukrassia tabularis</i>	0.7	7	18.176	0.995	16.844
<i>Terminalia bellirica</i>	0.65	6.5	17.347	0.996	17.648
<i>Ficus nerifolia</i>	0.6	6	16.357	0.997	18.575

*Bischofia javanica*, *Oroxylum indicum* and *Neolamarckia cadamba* are emerged as the highest frequent tree species (45) followed by *Tectona grandis* and *Chukrassia tabularis* (40) (Table 8.11).

**Table 8.11.** Frequency of dominant Pre-monsoon trees

Name of the tree	F	RF	IVI	Shannon – Weiner Index (SDI)	Simpson's Index (EH)
<i>Bischofia javanica</i>	45	6.122	19.083	0.995	16.14
<i>Oroxylum indicum</i>	45	6.122	15.627	0.997	19.655
<i>Neolamarckia cadamba</i>	45	6.122	15.627	0.997	19.655
<i>Tectona grandis</i>	40	5.442	18.176	0.995	16.844
<i>Chukrassia tabularis</i>	40	5.442	18.176	0.995	16.844

Among the dominant tree species during, highest abundance recorded by *Terminalia bellirica* (1.86) followed by *Bombax ceiba* (1.8), *Tectona grandis* and *Chukrassia tabularis* (1.75) and *Bischofia javanica* (1.67) (Table 8.12).

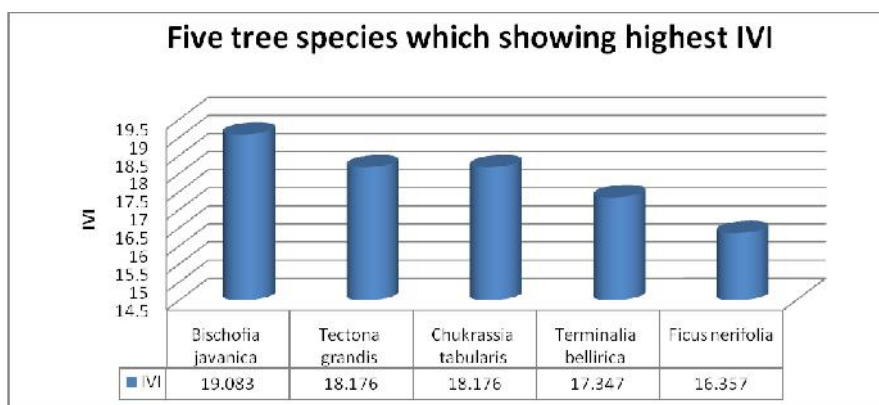
**Table 8.12.** Abundance of dominant trees

Name of the tree	A	RA	IVI	Shannon – Weiner Index (SDI)	Simpson's Index (EH)
<i>Terminalia bellirica</i>	1.857	6.085	17.347	0.996	17.648
<i>Bombax ceiba</i>	1.8	5.898	13.799	0.998	22.469
<i>Tectona grandis</i>	1.75	5.734	18.176	0.995	16.844
<i>Chukrassia tabularis</i>	1.75	5.734	18.176	0.995	16.844
<i>Bischofia javanica</i>	1.667	5.461	19.083	0.995	16.14

**Table 8.13.** IVI of dominant trees

Name of the tree	IVI	Shannon – Weiner Index (SDI)	Simpson's Index (EH)
<i>Bischofia javanica</i>	19.083	0.995	16.14
<i>Tectona grandis</i>	18.176	0.995	16.844
<i>Chukrassia tabularis</i>	18.176	0.995	16.844
<i>Terminalia bellirica</i>	17.347	0.996	17.648
<i>Ficus nerifolia</i>	16.357	0.997	18.575

Highest IVI of tree species recorded against *Bischofia javanica* (19.08) followed by *Tectona grandis* and *Chukrassia tabularis* (18.18), *Terminalia bellirica* (17.35) and *Ficus nerifolia* (16.36) (Table 8.13 & Fig 8.4).

**Fig. 8.4.** Five tree species with high IVI scores

### 8.1.5. Monsoon Wetland

Wetland vegetation during monsoon recorded *Najas graminea* with highest density (4.65) followed by *Limnophila heterophylla* (3.92), *Cyperus pangorei* (3.92), *Nymphoides hydrophylla* (3.61) and *Vallisneria natans* (3.61) (Table 8.14).

**Table 8.14.** Density of dominant monsoon wetland species

Name of Plants	D	RD	IVI	Shannon – Weiner Index (SDI)	Simpson's Index (EH)
<i>Najas graminea</i>	4.654	9.79	17.562	0.99	15.501
<i>Limnophila heterophylla</i>	3.923	8.252	14.587	0.993	17.129
<i>Cyperus pangorei</i>	3.923	8.252	14.587	0.993	17.129
<i>Nymphoides hydrophylla</i>	3.615	7.605	14.644	0.994	17.998
<i>Vallisneria natans</i>	3.154	6.634	11.727	0.996	19.593

**Table 8.15.** Frequency of dominant monsoon wetland species

Name of Plants	F	RF	IVI	Shannon – Weiner Index (SDI)	Simpson's Index (EH)
<i>Najas graminea</i>	65.385	7.054	17.562	0.99	15.501
<i>Nymphoides hydrophylla</i>	57.692	6.224	14.644	0.994	17.998
<i>Sagittaria sagittifolia</i>	53.846	5.809	11.779	0.997	23.243
<i>Limnophila heterophylla</i>	50	5.394	14.587	0.993	17.129
<i>Cyperus pangorei</i>	50	5.394	14.587	0.993	17.129

Similarly highest frequency counted for *Najas graminea* (65.38) followed by *Nymphoides hydrophylla* (57.69), *Sagittaria sagittifolia* (53.85), *Limnophila heterophylla* (50) and *Cyperus pangorei* (50), (Table 8.15).

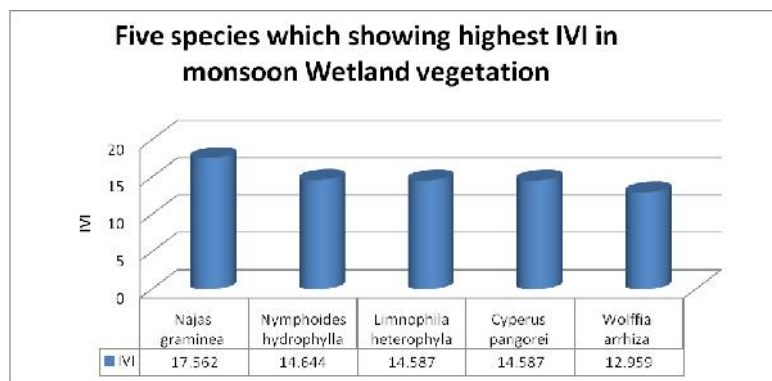
**Table 8.16.** Abundance of dominant monsoon wetland species

Name of Plants	A	RA	IVI	Shannon – Weiner Index (SDI)	Simpson's Index (EH)
<i>Wolffia arrhiza</i>	26	12.22	12.959	1	190.054
<i>Colocasia esculenta</i>	26	12.22	12.878	1	241.298
<i>Potamogeton nodosus</i>	13	6.11	9.205	1	41.1
<i>Cryptocoryne ciliata</i>	13	6.11	7.345	1	158.201
<i>Schoenoplectus juncoides</i>	13	6.11	7.345	1	158.201

However highest abundance recorded against *Wolffia arrhiza*, *Colocasia esculenta* (26) followed by *Potamogeton nodosus*, *Cryptocoryne ciliate* and *Schoenoplectus juncoides* (13) (Table 8.16). Highest IVI during pre-monsoon season has been recorded by *Najas graminea* (17.56), *Nymphoides hydrophylla* (14.64), *Limnophila heterophylla*, *Cyperus pangorei* (14.59) and *Wolffia arrhiza* (12.96) (Table 8.17 & Fig 8.5).

**Table 8.17.** IVI of dominant monsoon wetland species

Name of Plants	RF	RA	RD	IVI
<i>Najas graminea</i>	7.054	0.719	9.79	17.562
<i>Nymphoides hydrophylla</i>	6.224	0.815	7.605	14.644
<i>Limnophila heterophylla</i>	5.394	0.94	8.252	14.587
<i>Cyperus pangorei</i>	5.394	0.94	8.252	14.587
<i>Wolffia arrhiza</i>	0.415	12.22	0.324	12.959

**Fig. 8.5.** Five species showing high IVI scores in monsoon wetland vegetation

### 8.1.6. Monsoon Herbs

Herbaceous species during monsoon *Oplismenus burmannii* emerged with highest density (8.04) followed by *Setaria palmifolia* (6.16), *Ageratum conyzoides* (3.40), *Kyllinga nemoralis* (2.24) and *Coffea benghalensis* (2.04) (Table 8.18).

**Table 8.18.** Density of dominant monsoon herbs

Name of the plants	D	RD	IVI	Shannon – Weiner Index (SDI)	Simpson's Index (EH)
<i>Oplismenus burmannii</i>	8.04	17.313	33.131	0.97	12.231
<i>Setaria palmifolia</i>	6.16	13.264	27.151	0.983	13.859
<i>Ageratum conyzoides</i>	3.4	7.321	16.55	0.995	19.402
<i>Kyllinga nemoralis</i>	2.24	4.823	12.382	0.998	25.395
<i>Coffea benghalensis</i>	2.04	4.393	11.541	0.998	27.05

**Table 8.19.** Frequency of dominant monsoon herbs

Name of the plants	F	RF	IVI	Shannon – Weiner Index (SDI)	Simpson's Index (EH)
<i>Ageratum conyzoides</i>	100	4.789	16.55	0.995	19.402
<i>Oplismenus burmannii</i>	92	4.406	33.131	0.97	12.231
<i>Setaria palmifolia</i>	80	3.831	27.151	0.983	13.859
<i>Nelsonia canescens</i>	76	3.64	10.763	0.998	29.032
<i>Coffea benghalensis</i>	72	3.448	11.541	0.998	27.05

Highest frequency counted for *Ageratum conyzoides*(100), *Oplismenus burmannii* (92), *Setaria palmifolia* (80), *Nelsonia canescens*(76) and *Coffea benghalensis*(72) (Table 8.19).

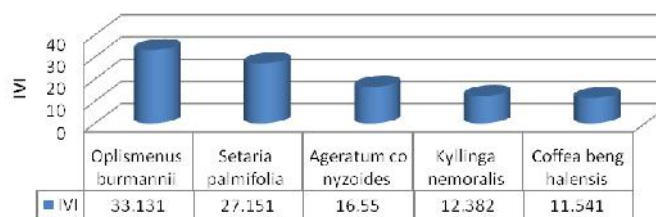
However highest abundance recorded against *Oplismenus burmannii* (8.74) followed by *Setaria palmifolia* (7.70), *Ageratum conyzoides*(3.40), *Kyllinga nemoralis* (3.30) and *Coffea benghalensis*(2.83) (Table 8.20). Highest IVI during pre-monsoon season has been recorded for *Oplismenus burmannii* (33.13) followed by *Setaria palmifolia* (27.15), *Ageratum conyzoides*(16.55), *Kyllinga nemoralis* (12.38) and *Coffea benghalensis*(11.54) (Table 8.21 & Fig 8.6).

**Table 8.20.** Abundance of dominant monsoon herbs

Name of the plants	A	RA	IVI	Shannon – Weiner Index (SDI)	Simpson's Index (EH)
<i>Oplismenus burmannii</i>	8.739	11.412	33.131	0.97	12.231
<i>Setaria palmifolia</i>	7.7	10.055	27.151	0.983	13.859
<i>Ageratum conyzoides</i>	3.4	4.44	16.55	0.995	19.402
<i>Kyllinga nemoralis</i>	3.294	4.302	12.382	0.998	25.395
<i>Coffea benghalensis</i>	2.833	3.7	11.541	0.998	27.05

**Table 8.21.** IVI of dominant monsoon herbs

Name of the plants	RF	RA	RD	IVI
<i>Oplismenus burmannii</i>	4.406	11.412	17.313	33.131
<i>Setaria palmifolia</i>	3.831	10.055	13.264	27.151
<i>Ageratum conyzoides</i>	4.789	4.44	7.321	16.55
<i>Kyllinga nemoralis</i>	3.257	4.302	4.823	12.382
<i>Coffea benghalensis</i>	3.448	3.7	4.393	11.541

**Five species which showing highest IVI in monsoon ground vegetation****Fig. 8.6.** Five species with maximum IVI score in monsoon ground-cover vegetation

### 8.1.7. Monsoon Shrubs

*Ichnocarpus frutescens*, *Clerodendrum infortunatum*, *Lantana camara*, *Capparis zeylanica* and *Chromolaena odorata* are most dominant five shrubby species with high density, frequency

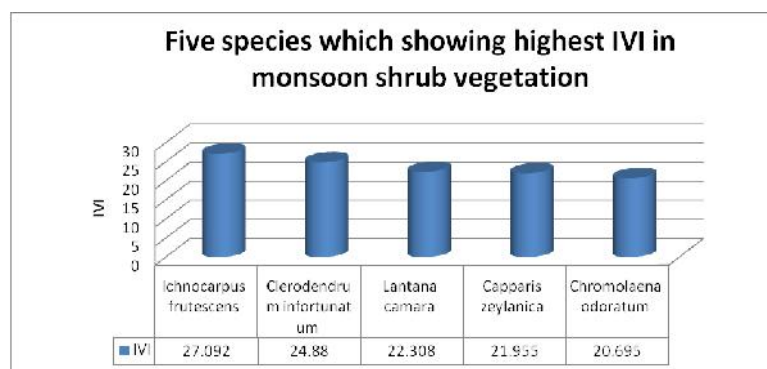
and IVI (Table 8.22). Highest IVI has been schematically shown in Fig 8.7. However some changes has been noticed to calculate their abundance (8.7.2). Highest abundance recorded against *Capparis zeylanica* and *Streblus asper* (1.5) followed by *Ichnocarpus frutescens* (1.45), *Ardisia solanacea* (1.43) and *Chromolaena odorata* (1.37) (Table 8.23).

**Table 8.22.** Density, Frequency and IVI of dominant monsoon shrubs

Name of the plants	F	RF	A	RA	D	RD	IVI
<i>Ichnocarpus frutescens</i>	78.571	9.402	1.455	6.579	1.143	11.111	27.092
<i>Clerodendrum infortunatum</i>	78.571	9.402	1.273	5.756	1	9.722	24.88
<i>Lantana camara</i>	71.429	8.547	1.2	5.427	0.857	8.333	22.308
<i>Capparis zeylanica</i>	57.143	6.838	1.5	6.784	0.857	8.333	21.955
<i>Chromolaena odorata</i>	57.143	6.838	1.375	6.219	0.786	7.639	20.695

**Table 8.23.** Abundance of dominant monsoon shrubs

Name of the plants	A	RA	IVI	Shannon – Weiner Index (SDI)	Simpson's Index (EH)
<i>Capparis zeylanica</i>	1.5	6.784	21.955	0.994	14.219
<i>Streblus asper</i>	1.5	6.784	18.162	0.997	16.992
<i>Ichnocarpus frutescens</i>	1.455	6.579	27.092	0.988	12.061
<i>Ardisia solanacea</i>	1.429	6.461	19.389	0.996	15.897
<i>Chromolaena odorata</i>	1.375	6.219	20.695	0.995	14.987



**Fig. 8.7.** Five species with maximum IVI scores in monsoon shrub vegetation

### 8.1.8. Post-monsoon wetland vegetation

Wetland vegetation during post-monsoon recorded *Azolla pinnata* subsp. *africana* with highest density (3.47) followed by *Nymphoides hydrophylla* (3.3), *Nymphaea pubescens* (3.27), *Limnophila heterophylla* (3.22) and *Grangea maderaspatana* (3.2) (Table 8.24).

**Table 8.24.** Density of dominant post-monsoon wetland species

Name of Plants	D	RD	IVI	Shannon – Weiner Index (SDI)	Simpson's Index (EH)
<i>Azolla pinnata</i> ssp. <i>africana</i>	3.475	6.922	16.282	0.995	19.956
<i>Nymphoides hydrophylla</i>	3.3	6.574	15.28	0.996	20.615
<i>Nymphaea pubescens</i>	3.275	6.524	15.2	0.996	20.714
<i>Limnophila heterophylla</i>	3.225	6.424	15.122	0.996	20.918
<i>Grangea maderaspatana</i>	3.2	6.375	15.252	0.996	21.021

Similarly highest frequency counted for *Salvinia natans* (62.5) followed by *Najas graminea* (60), *Limnophila heterophylla* (57.5), *Monochoria hastata* (55) and (52.5), (Table 8.25).



**Table 8.25.** Frequency of dominant post-monsoon wetland species

Name of Plants	F	RF	IVI	Shannon – Weiner Index (SDI)	Simpson's Index (EH)
<i>Salvinia natans</i>	62.5	5.447	13.209	0.997	24.37
<i>Najas graminea</i>	60	5.229	14.724	0.996	21.564
<i>Limnophila heterophylla</i>	57.5	5.011	15.122	0.996	20.918
<i>Monochoria hastata</i>	55	4.793	13.319	0.997	23.61
<i>Nymphaea pubescens</i>	52.5	4.575	15.2	0.996	20.714

**Table 8.26.** Abundance of dominant post-monsoon wetland species

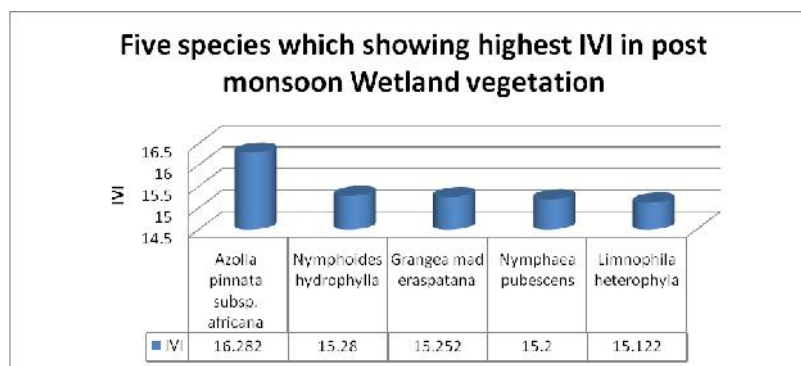
Name of Plants	A	RA	IVI	Shannon – Weiner Index (SDI)	Simpson's Index (EH)
<i>Potamogeton nodosus</i>	11	7.232	9.529	1	54.635
<i>Azolla pinnata</i> ssp. <i>africana</i>	9.267	6.092	16.282	0.995	19.956
<i>Trapa natans</i>	8.75	5.752	8.367	1	52.262
<i>Grangea maderaspatana</i>	8.533	5.61	15.252	0.996	21.021
<i>Nymphoides hydrophylla</i>	6.947	4.567	15.28	0.996	20.615

However highest abundance recorded against *Potamogeton nodosus* (11) followed by *Azolla pinnata* subsp. *Africana* (9.27), *Trapa natans* (8.75), *Grangea maderaspatana* (8.53) and *Nymphoides hydrophylla* (6.95) (Table 8.26).

**Table 8.27.** IVI of dominant post-monsoon wetland species

Name of Plants	RF	RA	RD	IVI	Shannon – Weiner Index (SDI)	Simpson's Index (EH)
<i>Azolla pinnata</i> ssp. <i>africana</i>	3.268	6.092	6.922	16.282	0.995	19.956
<i>Nymphoides hydrophylla</i>	4.139	4.567	6.574	15.28	0.996	20.615
<i>Grangea maderaspatana</i>	3.268	5.61	6.375	15.252	0.996	21.021
<i>Nymphaea pubescens</i>	4.575	4.101	6.524	15.2	0.996	20.714
<i>Limnophila heterophylla</i>	5.011	3.687	6.424	15.122	0.996	20.918

Highest IVI during post-monsoon season has been recorded by *Azolla pinnata* subsp. *africana* (16.28), *Nymphoides hydrophylla* (15.28), *Grangea maderaspatana* (15.25), *Nymphaea pubescens* (15.2) and *Limnophila heterophylla* (15.12) (Table 8.27 & Fig 8.8).

**Fig. 8.8.** Five species from wetland vegetation with high IVI scores during post monsoon season

### 8.1.9. Post–monsoon Herbs

Herbaceous species during post-monsoon *Pilea cordifolia* emerged with highest density (3.92) followed by *Elatostema cornutum* (3.8), *Chloranthus elatior* (2.52), *Synedrella nodiflora* (2.48) and *Nelsonia canescens* (2.24) (Table 8.28).

**Table 8.28.** Density of dominant post-monsoon herbs

Name of plants	D	RD	IVI	Shannon – Weiner Index (SDI)	Simpson's Index (EH)
<i>Pilea cordifolia</i>	3.92	7.778	14.735	0.994	21.6
<i>Elatostema cornutum</i>	3.8	7.54	14.397	0.994	22.014
<i>Chloranthus elatior</i>	2.52	5	10.597	0.998	28.644
<i>Synedrella nodiflora</i>	2.48	4.921	10.606	0.998	28.951
<i>Nelsonia canescens</i>	2.24	4.444	9.838	0.998	31.005

**Table 8.29.** Frequency of dominant post-monsoon herbs

Name of plants	F	RF	IVI	Shannon – Weiner Index (SDI)	Simpson's Index (EH)
<i>Pilea cordifolia</i>	60	3.497	14.735	0.994	21.6
<i>Synedrella nodiflora</i>	60	3.497	10.606	0.998	28.951
<i>Elatostema cornutum</i>	56	3.263	14.397	0.994	22.014
<i>Coffea benghalensis</i>	56	3.263	9.123	0.998	33.506
<i>Chloranthus elatior</i>	52	3.03	10.597	0.998	28.644

Highest frequency counted for *Pilea cordifolia* (60), *Synedrella nodiflora* (60), *Elatostema cornutum* (56), *Coffea benghalensis* (56) and *Chloranthus elatior* (52) (Table 8.29).

However highest abundance recorded against *Achyrospermum wallichianum* (9) followed by *Desmodium triflorum* (8.75), *Elatostema cornutum* (6.79), *Pilea cordifolia* (6.53) and *Nelsonia canescens* (6.22) (Table 8.30).

**Table 8.30.** Abundance of dominant post-monsoon herbs

Name of plants	A	RA	IVI	Shannon – Weiner Index (SDI)	Simpson's Index (EH)
<i>Achyrospermum wallichianum</i>	9	4.767	10.451	0.998	31.782
<i>Desmodium triflorum</i>	8.75	4.634	8.344	0.999	43.102
<i>Elatostema cornutum</i>	6.786	3.594	14.397	0.994	22.014
<i>Pilea cordifolia</i>	6.533	3.46	14.735	0.994	21.6
<i>Nelsonia canescens</i>	6.222	3.295	9.838	0.998	31.005

**Table 8.31.** IVI of dominant post-monsoon herbs

Name of plants	RF	RA	RD	IVI	Shannon – Weiner Index (SDI)	Simpson's Index (EH)
<i>Pilea cordifolia</i>	3.497	3.46	7.778	14.735	0.994	21.6
<i>Elatostema cornutum</i>	3.263	3.594	7.54	14.397	0.994	22.014
<i>Synedrella nodiflora</i>	3.497	2.189	4.921	10.606	0.998	28.951
<i>Chloranthus elatior</i>	3.03	2.567	5	10.597	0.998	28.644
<i>Achyrospermum wallichianum</i>	1.399	4.767	4.286	10.451	0.998	31.782

Highest IVI during post-monsoon season has been recorded for *Pilea cordifolia* (14.73) followed by *Elatostema cornutum* (14.4), *Synedrella nodiflora* (10.61), *Chloranthus elatior* (10.6) and *Achyrospermum wallichianum* (10.45) (Table 8.31 & Fig. 8.9).

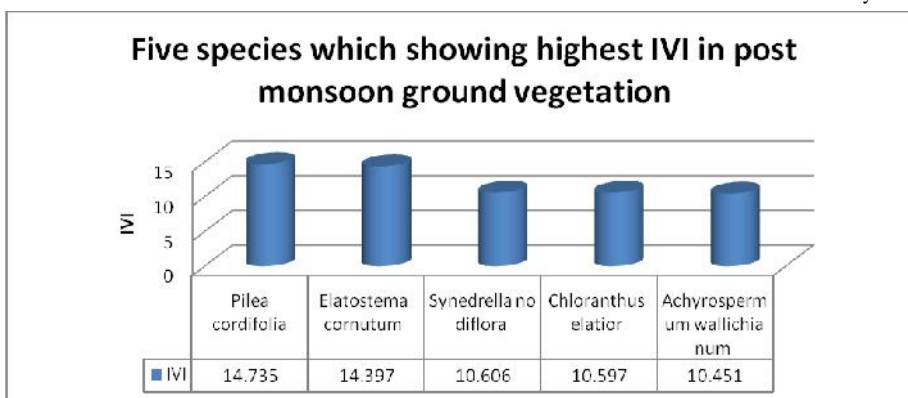


Fig. 8.9. Five species recorded with high IVI scores from the post-monsoon ground vegetation

### 8.1.10. Post-monsoon Shrubs

*Lantana camara* (1.37) scored the highest dense species in post-monsoon season followed by *Solanum torvum* (1.31), *Clerodendrum infortunatum* (1.12), *Chromolaena odorata* (1.12) and *Argyreia roxburghii* (0.94) (Table 8.32).

Table 8.32. Density of dominant post-monsoon shrubs

Name of the plants	D	RD	IVI	Shannon – Weiner Index (SDI)	Simpson's Index (EH)
<i>Lantana camara</i>	1.375	8.943	20.749	0.992	14.522
<i>Solanum torvum</i>	1.313	8.537	36.431	0.993	14.926
<i>Clerodendrum infortunatum</i>	1.125	7.317	18.026	0.995	16.387
<i>Chromolaena odorata</i>	1.125	7.317	17.847	0.995	16.387
<i>Argyreia roxburghii</i>	0.938	6.098	15.865	0.997	18.383

*Lantana camara* (75) scored as the most frequently available species in post-monsoon season followed by *Clerodendrum infortunatum* (68.75), *Ichnocarpus frutescens* (68.75), *Chromolaena odorata* (62.5) and *Argyreia roxburghii* (62.5) (Table 8.33).

Table 8.33. Frequency of dominant post-monsoon shrubs

Name of the plants	F	RF	IVI	Shannon – Weiner Index (SDI)	Simpson's Index (EH)
<i>Lantana camara</i>	75	7.143	20.749	0.992	14.522
<i>Clerodendrum infortunatum</i>	68.75	6.548	18.026	0.995	16.387
<i>Ichnocarpus frutescens</i>	68.75	6.548	13.562	0.998	22.566
<i>Chromolaena odorata</i>	62.5	5.952	17.847	0.995	16.387
<i>Argyreia roxburghii</i>	62.5	5.952	15.865	0.997	18.383

Highest abundance recorded against *Solanum torvum* (10.5) followed by *Lantana camara* (1.83), *Chromolaena odorata* (1.8), *Clerodendrum infortunatum* (1.64) and *Urena lobata* (1.6) (Table 8.34).

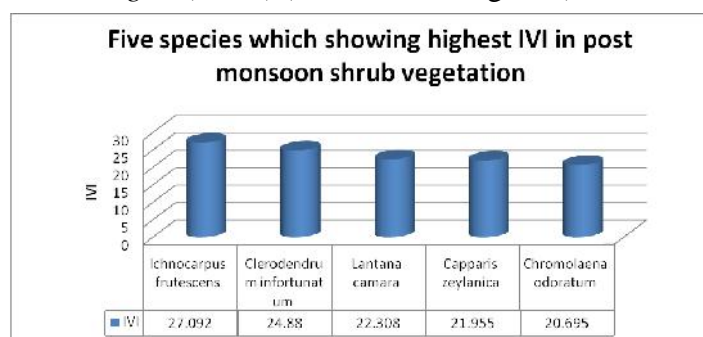
Table 8.34. Abundance of dominant post-monsoon shrubs

Name of the plants	A	RA	IVI	Shannon – Weiner Index (SDI)	Simpson's Index (EH)
<i>Solanum torvum</i>	10.5	26.704	36.431	0.993	14.926
<i>Lantana camara</i>	1.833	4.663	20.749	0.992	14.522
<i>Chromolaena odorata</i>	1.8	4.578	17.847	0.995	16.387
<i>Clerodendrum infortunatum</i>	1.636	4.162	18.026	0.995	16.387
<i>Urena lobata</i>	1.6	4.069	10.297	0.999	28.143

**Table 8.35.** IVI of dominant post-monsoon shrubs

Name of the plants	RF	RA	RD	IVI	Shannon – Weiner Index (SDI)	Simpson's Index (EH)
<i>Solanum torvum</i>	1.19	26.704	8.537	36.431	0.993	14.926
<i>Lantana camara</i>	7.143	4.663	8.943	20.749	0.992	14.522
<i>Clerodendrum infortunatum</i>	6.548	4.162	7.317	18.026	0.995	16.387
<i>Chromolaena odorata</i>	5.952	4.578	7.317	17.847	0.995	16.387
<i>Argyrea roxburghii</i>	5.952	3.815	6.098	15.865	0.997	18.383

During post-monsoon season *Solanum torvum* (36.43) scored the highest IVI followed by *Lantana camara* (20.75), *Clerodendrum infortunatum* (18.03), *Chromolaena odorata* (17.85) and *Argyrea roxburghii* (15.86) (Table 8.35 & Fig 8.10).

**Fig. 8.10.** Species showing maximum IVI in postmonsoon shrubs

## 8.2. Comparative analysis between dominant wetland species in three seasons

*Salvinia cucullata* in pre-monsoon (4.65) and *Najas graminea* during monsoon (4.65) and premonsoon (3.07) (Table 8.36) emerged as the highest dense species in this wetland. Among the five species enlisted for their superiority, only 57.14% of them grow in pre-monsoon, 71.43% during monsoon and 85.71% in post-monsoon season. Except *Salvinia natans* all other species have mutual existence. *Salvinia natans* only grow in post-monsoon atmosphere and disappear by end of this season. *Salvinia cucullata* is well represented when water level is either medium or less and absent during monsoon. It's germinated in post-monsoon and finishes its cycle before monsoon. *Eriocaulon cinereum* is absent in post-monsoon season. It occurs and flourishes in pre-monsoon and disappear by end of monsoon season. *Najas graminea* and *Wolffia arrhiza* appears in monsoon and finish the cycle by post-monsoon season. *Potamogeton nodosus* and *Azolla pinnata* subsp. *Africana* are present throughout the year.

**Table 8.36.** Comparative scenario of dominant wetland species

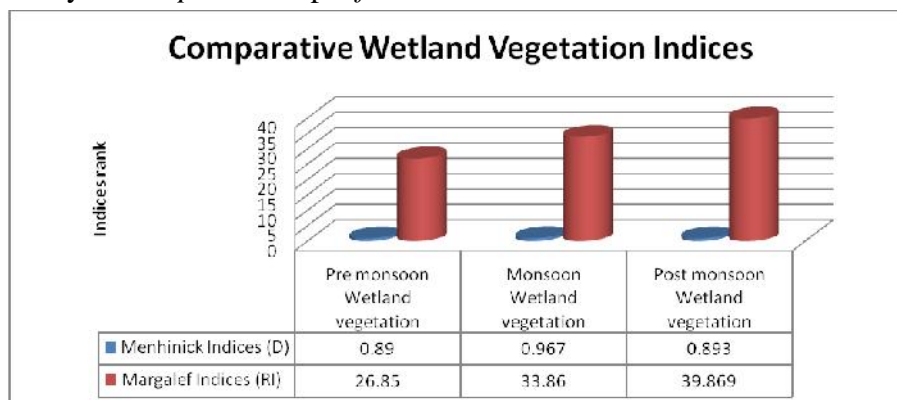
Name of the plants	Pre-monsoon			Monsoon			Post-monsoon		
	D	F	A	D	F	A	D	F	A
<i>Salvinia cucullata</i>	4.65	65.38	7.118	-	-	-	0.27	27.5	1.0
<i>Eriocaulon cinereum</i>	1.23	11.54	10.67	0.27	11.54	8.67	-	-	-
<i>Najas graminea</i>	-	-	-	4.65	65.38	1.529	3.07	60.0	5.12
<i>Wolffia arrhiza</i>	-	-	-	0.15	3.85	26.0	0.20	5.0	4.0
<i>Salvinia natans</i>	-	-	-	-	-	-	2.55	62.5	4.08
<i>Potamogeton nodosus</i>	1.08	7.69	14.0	1.08	7.69	13.0	0.82	7.5	11.0
<i>Azolla pinnata</i> ssp. <i>africana</i>	2.54	38.46	6.6	2.54	34.61	2.89	3.47	37.5	9.27

## 8.3. Diversity Indices

### 8.3.1. Wetland Vegetation

Pre monsoon Wetland vegetation, 16 species showing (Fig 8.11) highest SDI 1. Highest EH showing by *Schoenoplectus juncooides* 177.79, *Nymphaea pubescens* and

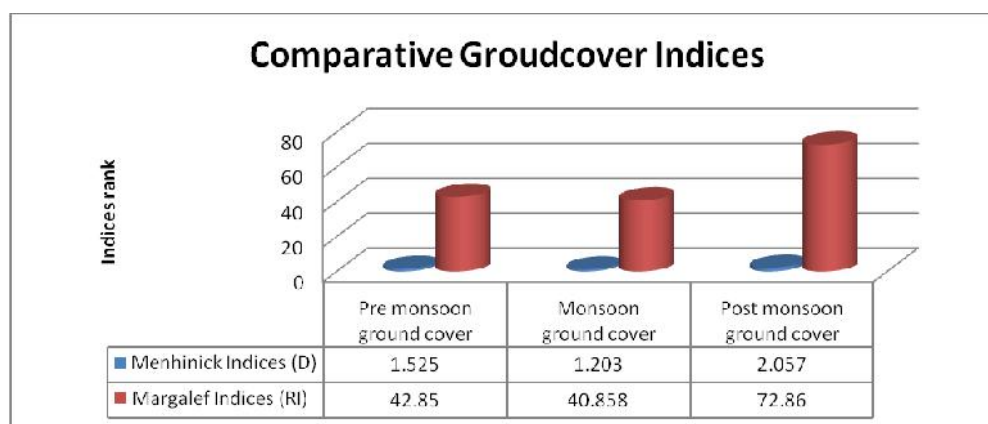
*Grangea maderaspatana* 140.38, *Cyanotis axillaris* 117.10, *Ranunculus sceleratus* 101.12. 21 species showing highest SDI 1 in the monsoon. Highest EH shows by *Colocasia esculenta* 241.29 and followed by *Typha elephantina* and *Wolffia arrhiza* 190.05. Lowest EH shows by *Najas graminea* 15.5. Post monsoon vegetation is very rich and 24 species showing highest SDI 1. *Typha elephantina* showing highest EH 535.84, *Ludwigia adscendens* 379.49. Lowest EH presented by *Azolla pinnata* ssp. *africana* 19.95.



**Fig. 8.11.** Comparative Wetland vegetation indices

### 8.3.2. Forested Vegetation

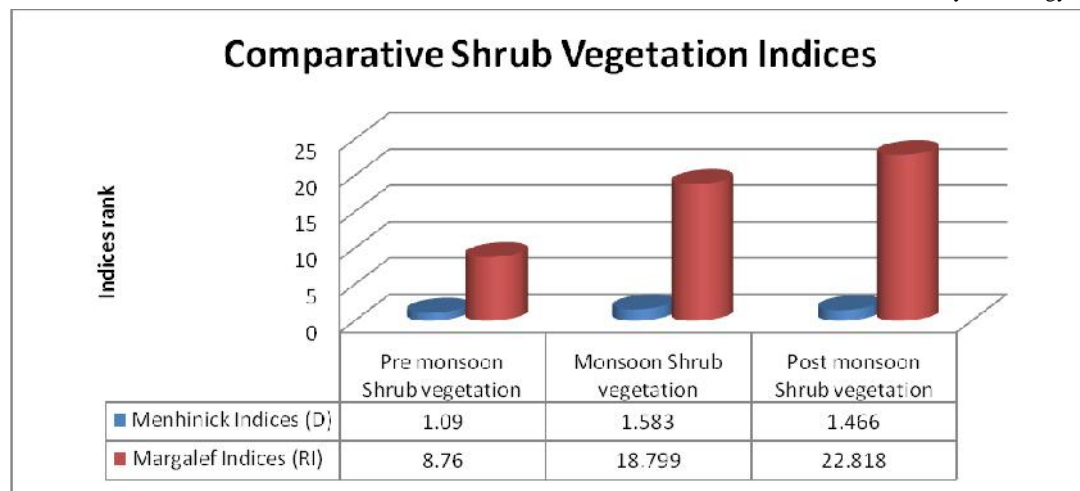
In pre monsoon ground cover, 24 species (Fig 8.12) showing SDI 1. Highest EH presented by *Solanum indicum* 447.74. In the monsoon vegetation, 29 species presented maximum 1 SDI. Maximum EH presented by *Clausena excavate* 190.07. In the post monsoon ground cover, *Cheilocostus speciosus*, *Crinum amoenum* and *Molinaria capitulata* but this three species showing maximum EH 419.35. In the sampling species, 54 species presented highest SDI 1. From pre-monsoon shrub data, highest SDI 1 and highest EH 21.18 presented by *Dendrocnide sinuate*, *Streblus asper* and *Morus indica*.



**Fig. 8.12.** Comparative groundcover indices

In the monsoon shrubs (Fig. 8.13) *Zizyphus mauritiana*, *Bridelia retusa* and *Premna latifolia* presented highest SDI 1. Highest EH presented by *Zizyphus mauritiana* and *Bridelia retusa* 85.31. In the post monsoon shrub vegetation, highest SDI 1 presented by *Melastoma malabathricum*, *Ardisia solanacea*, *Capparis zeylanica*, *Grewia optiva* and *Streblus asper*. *Melastoma malabathricum* also presented highest EH. And lowest 14.52 presented by *Lantana camara*.

In the tree vegetation, highest SDI 1 presented by *Chukrassia tabularis*, *Polyalthia longifolia* and *Magnolia champaca*. Highest EH shows by *Polyalthia longifolia* 68.08 and lowest by *Bischofia javanica* 16.14. Menhinick Indices (D) showing 1.626 and Margalef Indices (RI) is 22.811 in canopy cover.



**Fig. 8.13.** Comparative shrub vegetation indices

#### 8.4. Conclusion

In the study of premonsoon Wetland Vegetation, *Salvinia cucullata* showing highest frequency 65.38 and lowest frequency shows by *Cyanotis axillaris* and *Potamogeton nodosus* 7.69. *Eriocaulon cinereum* showing highest abundance 10.67 and lowest abundance showing by *Ipomoea aquatica* 1. In case of density, *Salvinia cucullata* has highest density 4.65 and *Schoenoplectus juncooides* showing lowest density 0.12. in monsoon season, whole wetland vegetation turns to change and highest frequency shows by *Najas graminea* 65.38. *Wolffia arrhiza*, *Colocasia esculenta* showing highest abundance 26. Highest density presented by *Najas graminea* 4.65. In postmonsoon Wetland vegetation, *Salvinia natans* has highest frequency 62.5, highest abundance showing by *Potamogeton nodosus* 11.0, highest density showing by *Azolla pinnata* subsp. *Africana* 3.48 which makes a different floristic structure in the wetland diversity. 16 species showing highest SDI 1 in the Premonsoon Wetland vegetation and it increases to 21 number of species in the monsoon and highest number of species 24 has been presented highest SD 1 in the post monsoon vegetation. Highest EH showing by *Schoenoplectus juncooides* 177.79 in the pre monsoon Wetland vegetation. In monsoon wetland vegetation highest EH shows by *Colocasia esculenta* 241.29 and lowest by *Najas graminea* 15.5. *Typha elephantina* showing highest EH 535.84 and lowest EH presented by *Azolla pinnata* subsp. *Africana* 19.95 in the Post monsoon vegetation.

In premonsoon ground cover, *Acmella uliginosa* has maximum frequency 92. Highest abundance 3.5 presented by *Nelsonia canescens* and maximum density 1.92 presented by *Achyrospermum wallichianum* *Duchesnea indica* showing maximum IVI 15.38. 24 species showing SDI 1. Highest EH presented by *Solanum indicum* 447.74. This ground cover has been changed in the monsoon vegetation and *Ageratum conyzoides* contain highest 100 frequency. *Clausena excavate*. *Oplismenus burmannii* presented maximum abundance 8.74, highest density 8.04 and also has maximum IVI 33.13. In the sampling species, 29 species presented maximum 1 SDI. Maximum EH presented by *Clausena excavate* 190.07. *Pilea cordifolia* and *Synedrella nodiflora* presented highest frequency 60 in the post monsoon ground cover which is totally different from previous season's floral structure. Maximum abundance 9 represented by *Achyrospermum wallichianum* and *Cheilocostus speciosus*, *Crinum amoenum*, *Molinieria capitulata* showing maximum EH 419.35 in the post monsoon ground cover. 54 species presented highest SDI 1. Highest IVI presented by *Pilea cordifolia* 14.74. In premonsoon ground cover, 24 species showing SDI 1. In monsoon vegetation, the highest SD presented species number increases to 29 in the present study and turns to maximum 54 species in post monsoon ground

cover. Highest EH presented by *Solanum indicum* 447.74 in pre monsoon ground cover. In the monsoon vegetation, maximum EH presented by *Clausena excavate* 190.07 and *Cheilocostus speciosus*, *Crinum amoenum* and *Molinaria capitulata* showing maximum EH 419.35 in the post monsoon ground cover.

From pre-monsoon shrub, *Clerodendrum infortunatum* is dominating species and it makes middle green layer in that drought season. So, *Clerodendrum infortunatum* showing highest frequency 80, highest abundance 2, highest density 1.6, highest IVI 57.51. Highest SDI 1 and highest EH 21.18 presented by *Dendrocnide sinuate*, *Streblus asper* and *Morus indica*.

In the monsoon, *Ichnocarpus frutescens* presented highest frequency 78.57 with *Clerodendrum infortunatum* and start to change the middle layer of the vegetation cover. Highest density presented by *Ichnocarpus frutescens* 1.14. *Zizyphus mauritiana*, *Bridelia retusa* and *Premna latifolia* presented highest SDI 1. Highest EH presented by *Zizyphus mauritiana* and *Bridelia retusa* 85.31. Highest IVI presented by *Ichnocarpus frutescens* 27.09. Maximum density middle layer seen in post monsoon season. *Lantana camara* showing highest frequency 75.0. Highest abundance 10.5 presented by *Solanum torvum*. *Lantana camara* showing highest density 1.37. *Solanum torvum* presented highest IVI. Highest SDI 1 presented by *Melastoma malabathricum*, *Ardisia solanacea*, *Capparis zeylanica*, *Grewia optiva* and *Streblus asper*. *Melastoma malabathricum* also presented highest EH in the post monsoon shrub layer. From pre monsoon shrub data, highest SDI 1 and highest EH 21.18 presented by *Dendrocnide sinuate*, *Streblus asper* and *Morus indica*. *Zizyphus mauritiana*, *Bridelia retusa* and *Premna latifolia* presented highest SDI 1. Highest EH presented by *Zizyphus mauritiana* and *Bridelia retusa* 85.31. In post monsoon shrub vegetation, highest SDI 1 presented by *Melastoma malabathricum*, *Ardisia solanacea*, *Capparis zeylanica*, *Grewia optiva* and *Streblus asper*. *Melastoma malabathricum* also presented highest EH. And lowest 14.52 presented by *Lantana camara*.

In canopy layer of the vegetation, *Oroxylum indicum*, *Neolamarckia cadamba* and *Bischofia javanica* presented highest frequency. *Polyalthia longifolia* presented lowest frequency 10. Highest abundance showing by *Terminalia bellirica* 1.85. Highest density showing by *Bischofia javanica* 0.75 and lowest density *Polyalthia longifolia* 0.1. In the tree vegetation, highest SDI 1 presented by *Chukrassia tabularis*, *Polyalthia longifolia* and *Magnolia champaca*. Highest EH shows by *Polyalthia longifolia* 68.08 and lowest by *Bischofia javanica* 16.14. Menhinick Indices (D) showing 1.626 and Margalef Indices (RI) is 22.811 in canopy cover.

# CHAPTER - IX



## NON-TIMBER FOREST PRODUCTS

Man has started their journey for civilization from the wilderness. At that time, they were completely dependent on forests for their survival. Almost all needs of their livelihood were natural products. Apart from food, shelter and materials for making houses, only a few other articles were essential to meet up their needs like making of hunting instruments, dresses, satisfying evil forces which (they believed) were causing distress and diseases to man and their pets, etc (Ajita Sarkar, 2011; Animesh Sarkar, 2014). City dwellers prefer to keep a distance from the wild environments. They visit forest for enjoyment as a tourist. But the forest villagers, who forms the part of the wild environment, has the know-how to use the wide array of forest products for their sustenance. City dwellers also uses forest products collecting from markets, may be in partial processed condition. For to fulfil their every need, forest-villagers are generally unethically used by some agents for destroying forest through over and and unscientific collections of natural products. In this aspect Moore (1995) said, "Economic growth by its very nature creates negative spill over effects for the environment". Sarkar (2014) argued that, "today humans continue to extract resources from the environment and dump the waste back into the environment, in the past two hundred years, the rate of forest extraction continued to increase with the improvement of health care techniques, as the population structure also continued to increase in parallel".

### 9.1. Importance of NTFP

According to Vandebroek *et al.* (2011), our socio-cultural environment grew within the human society for its own survival and separate knowledge base has developed in the form of ethnobotany or ethnomedicine, etc. 'Scientific research is revealing an ever increasing number of links between biodiversity and human health, not only in terms of food resources or food security, but also with regard to materials to treat and cure diseases' (Pandey *et al.*, 2010; Chakravorty *et al.*, 2011). Apart from timber, forests and different other types of vegetation are the store houses for wide array of 'Non-Timber Forest Products' (NTFP). And, the present trend of forest management is to reduce the timber extraction and, on the other hand, increasing the exploitation of numerous marketable NTFPs (Pandit *et al.*, 2004). People of forest villages and of nearby areas regularly harvest twigs/ leaves/ fruits/ flowers/ rhizomes/ tubers, etc. from wild vegetation and put on sale for the urban people. Such sustainable harvest do not disturb the formation of the vegetation, and, certainly, helps in better forest management. Medicinal plants forms a very important class of NTFPs, which constitute the principal source of ingredients for traditional medicines (Almeida *et al.*, 2006; Kumar *et al.*, 2011; Machkour-M'Rabet *et al.*, 2011). Over the World, so far, about 4,22,000 species of flowering plants are reported (Govaerts, 2001), of which over 50,000 species are used for medicinal purposes (Schippmann *et al.*, 2002). In India 43 % of the total available flowering plants are used as medicinal (Pushpangadan, 1995). The use of different plant substances for medicine is a bridge, linking conservative users of all groups and religions. Forest dwellers inherit a rich traditional knowledge and are very much concerned about their degradation in wild (Uniyal *et al.*, 2006). NTFPs collected by forest villagers for making ropes, plate from leaves, collecting and selling wild mushroom and honey (Moerman, 1998). People also harvest and use different fruits and nuts, vegetables, mushrooms for their subsistence (FAO, 2010). Around 75,000 flowering plants are edible of which about 3000 are regarded as source of food (Krishnamurthy, 2003).

During the present study, survey for traditional uses of local plants was conducted in the nearby villages and in the markets and/or bazars with the help of many local people, including collectors and practitioners. Most important of them are Mr. Bipul Barman from Rasik Beel village and Mr. Dinu Barman, a traditional medicine practitioner of Bochamari village. A total of 283 species of useful plants recorded of which 92 species are medicinal, 27 species ethnoveterinary medicinal, 54 species as vegetable or riped fruits, 14 species used in various religious purposes, 4 species as spice, and 173 species used as fodder for their domestic animals (Table 9.1).

**Table 9.1.** NTF species reported and recognized from the Rasik Beel complex and its adjoining areas

Used as	No. of species
Ethnomedicinal plants	92
Ethno-veterinary medicinal plants	27
Edible plants	54
Poisonous plants	14
Ornamental or decorative	70
Religious plants	19
Fodder plants	173
Fuel wood	23
Spices	4

During 2009 – 2010, the survey was conducted in the Bochamari bazaar, and recorded some NTFPs and their prices. The recorded price list is given in Table 9.2.

**Table 9.2.** The prices of NTFPs on sale in the Bochamari Bazar during 2009 – 2010

Name of plant [Family]	Vernacular name	Plant part marketed	Unit for sale	Rate in Rs.
<i>Aegle marmelos</i> [Rutaceae]	<i>Bel</i>	Fruit	1 piece	5.00
<i>Aeschynomene indica</i> [Leguminosae: Faboidae]	<i>Ful Shola</i>	Stem	1 piece	10.00
<i>Amaranthus viridis</i> [Amaranthaceae]	<i>Notey</i>	Whole Plant or leafy twig	250 gm/ bunch	5.00
<i>Amorphophallus bulbifer</i> [Araceae]	<i>Buno Ol</i>	Inflorescence	1 piece	2.00
<i>Annona reticulata</i> [Annonaceae]	<i>Nona</i>	Fruit	1 piece	2.00
<i>Annona squamosa</i> [Annonaceae]	<i>Ata</i>	Fruit	1 piece	3.00
<i>Areca catechu</i> [Arecaceae]	<i>Supari</i>	Fruit	1 piece	1.00
<i>Artocarpus heterophyllus</i> [Moraceae]	<i>Kanthal</i>	Fruit	1 piece	5.00 – 10.00
<i>Artocarpus lakoocha</i> [Moraceae]	<i>Dawa</i>	Fruit	1 piece	1.00
<i>Bambusa balcooa</i> [Poaceae]	<i>Boro bansh</i>	Culm	1 piece	60.00
<i>Bambusa tulda</i> [Poaceae]	<i>Talda bansh</i>	Culm	1 piece	45.00
<i>Carica papaya</i> [Caricaceae]	<i>Pepe</i>	Fruit	1 kg	8.00
<i>Chenopodium album</i> [Amaranthaceae]	<i>Balia sak/ Bathua</i>	Whole plant	250 gm/ bunch	5.00
<i>Chenopodium giganteum</i> [Amaranthaceae]	<i>Balia sak/ Bathua</i>	Whole plant	3 pieces/ bunch	5.00
<i>Cinnamomum tamala</i> [Lauraceae]	<i>Tejpata</i>	Dry leaves	50 gm/ pkt	5.00
<i>Cinnamomum verum</i> [Lauraceae]	<i>Darchini</i>	Dry bark	25 gm/ pkt	5.00
<i>Citrus limon</i> [Rutaceae]	<i>Gandharaj</i>	Fruit	1 piece	1.00
<i>Citrus maxima</i> [Rutaceae]	<i>Jambura</i>	Fruit	1 piece	3.00

Name of plant [Family]	Vernacular name	Plant part marketed	Unit for sale	Rate in Rs.
<i>Cocos nucifera</i> [Arecaceae]	<i>Narkel</i>	Fruit	1 piece	30.00
	<i>Narkel Jharu</i>	Leaf vein	1 kg	20.00
<i>Colocasia esculenta</i> [Araceae]	<i>Kachu</i>	Whole plant	1 piece	5.00
<i>Curcuma longa</i> [Zingiberaceae]	<i>Halud</i>	Fresh rhizome	1 kg	30.00
<i>Dillenia indica</i> [Dilleniaceae]	<i>Chalta</i>	Fruit	1 piece	2.00
<i>Dioscorea bulbifera</i> [Dioscoreaceae]	<i>Mati alu</i>	Rhizome and bulbil	1 kg	6.00
<i>Diospyros malabarica</i> [Ebenaceae]	<i>Gab</i>	Fruit	1 kg	12.00
<i>Elaeocarpus floribundus</i> [Elaeocarpaceae]	<i>Jalpai</i>	Fruit	1 kg	4.00
<i>Enydra fluctuans</i> [Asteraceae]	<i>Helenchu</i>	Leafy twig	250 gm/ bunch	3.00
<i>Glinus oppositifolius</i> [Molluginaceae]	<i>Gima</i>	Whole plant	250 gm/ bunch	3.00
<i>Ipomoea aquatica</i> [Convolvulaceae]	<i>Kalmi</i>	Leafy twig	250 gm/bunch	3.00
<i>Lasia spinosa</i> [Araceae]	<i>Kanta kochu</i>	Inflorescence	1 piece	2.00
<i>Litchi chinensis</i> [Sapindaceae]	<i>Lichu</i>	Fruit	1 kg	25.00
<i>Luffa acutangula</i> [Cucurbitaceae]	<i>Dundul</i>	Fruit	1 kg	8.00
<i>Luffa aegyptiaca</i> [Cucurbitaceae]	<i>Jhinga</i>	Fruit	1 kg	8.00
<i>Lycopersicon esculentum</i> [Solanaceae]	<i>Bon tomato</i>	Fruit	1 kg	2.00
<i>Malva verticillata</i> [Malvaceae]	<i>Lafa</i>	Leafy twig	250 gm/ bunch	5.00
<i>Mangifera indica</i> [Anacardiaceae]	<i>Aam</i>	Fruit	1 kg	25.00
<i>Momordica charantia</i> [Cucurbitaceae]	<i>Uchche</i>	Fruit	1 kg	7.00
<i>Musa balbisiana</i> [Musaceae]	<i>Bicha kola</i>	Fruit	4 pieces	8.00
<i>Nymphaea nouchali</i> [Nymphaeaceae]	<i>Nil shaluk</i>	Peduncle	5 – 7 pieces/ bunch	5.00
<i>Nymphaea pubescens</i> [Nymphaeaceae]	<i>Shaluk</i>	Peduncle	5 – 7 pieces/ bunch	5.00
<i>Nymphaea rubra</i> [Nymphaeaceae]	<i>Lal shaluk</i>	Peduncle	5 – 7 pieces/ bunch	5.00
<i>Phyllanthus emblica</i> [Phyllanthaceae]	<i>Amlaki</i>	Fruit	1 kg	10.00
<i>Piper betle</i> [Piperaceae]	<i>Jangli pan</i>	Leaf	10 pieces	8.00
<i>Piper nigrum</i> [Piperaceae]	<i>Golmarich</i>	Dry fruit	50 gm/ pkt	15.00
<i>Psidium guajava</i> [Myrtaceae]	<i>Peyara</i>	Fruit	1 piece	1.00
<i>Punica granatum</i> [Lythaceae]	<i>Dalim</i>	Fruit	1 piece	20.00
<i>Sida acuta</i> [Malvaceae]	<i>Jharu</i>	Whole plant	5 – 8 dry plants/ bunch	5.00
<i>Syzygium cumini</i> [Myrtaceae]	<i>Kalo jam</i>	Fruit	1 kg	6.00
<i>Tagetes patula</i> [Asteraceae]	<i>Gandha</i>	Flower	1 Chain	5.00
<i>Tamarindus indica</i> [Fabaceae]	<i>Tetul</i>	Fruit	1 kg	25.00

## 9.2. Enumeration of Ethnomedicinal Plants

The villagers are now adopted to modern treatment system. They regularly consult with doctors and health assistant of local health centre. So the knowledge of use the medicinal plants in various diseases decreases regularly. The local *Kabiraj* Mr. Dinu Barman said that, once upon a time, his

father was treated 20 to 30 patient per day. But, now a few people, who have no capability to bear the cost of modern medicin, come to him for treatment. So he became a daily labour of NREGS projects. Local people came to him regularly to treat their pet animals. From his knowledgw, 92 medicinal plant species has been recorded from the study areas and enumerated below:

- Achyranthus aspera*** [Amaranthaceae]; V.N. – Chirchiti; *Rajib & AP Das 0102*, dtd. 07.02.2007; Whole plant.  
*Uses*: Stomach troubles, extractfor stones in the gall bladder, uterine stimulant, rheumatism.
- Achyranthes bidentata*** [Amaranthaceae]; V.N. – Chirchiti; *Rajib & AP Das 0113*, dtd. 07.02.2007; Roots.  
*Uses*: Rheumatism, dysmenorrhoea, hyper tention, haematuria, sore throat.
- Alternanthera sessilis*** [Amaranthaceae]; V.N. – Nunia Saak; *Rajib & AP Das 0710*, dtd. 14.02.2008; Whole plants.  
*Uses*: Digestive, skin diseases, burning sensation, diarrhoea, leprosy and fever.
- Amaranthus spinosus*** [Amaranthaceae]; V.N. – Kanta notey; *Rajib & AP Das 0117*, dtd. 07.02.2007; Whole plants.  
*Uses*: Eczema, leprosy, bronchitis, leucorrhoea, boils, burns, fever, also used as tonic.
- Amaranthus viridis*** [Amaranthaceae]; V.N. – Notey; *Rajib & AP Das 0135*, dtd. 07.02.2007; Whole plants.  
*Usse*: Bronchitis, leucorrhoea, boils, burns, fever.
- Aerva sanguinolenta*** [Amaranthaceae]; V.N. – Lopang; *Rajib & AP Das 0093*, dtd. 07.02.2007; Whole plants.  
*Uses*: Diuretic, vermifuge, treat boils, cough.
- Abelmoschus moschatus*** [Malvaceae]; V.N. – Muska; *Rajib & AP Das, 0379*, dtd. 21.07.2007; Seeds, leaves and roots.  
*Uses*: Seeds as stomachic, diuretic, dryness of the throat; leaves and roots in nervous disorders and in hysteria.
- Ageratum conyzoides*** [Asteraceae]; V.N. – Bhusre; *Rajib & AP Das 0645*, dtd. 12.02.2008; Leaves, roots, flowers and whole plants.  
*Uses*: Leaves in wounds, cuts and burns; root as antibiotic; whole plants to cure fever.
- Alstonia scholaris*** [Apocynaceae]; V.N. – Chhatim; *Rajib & AP Das 0372*, dtd. 21.07.2007; Bark and leaves.  
*Uses*: Anthelmintic, laxative; good in heart and skin diseases, leucoderma, asthma, ulcers.
- Ambroma augusta*** [Malvaceae]; V.N. –Ulat kambal; *Rajib & AP Das, 0073*, dtd. 06.02.2007; Bark, leaves and root.  
*Uses*: Uterine tonic, powdered root for abortion and anti-fertility agent. Leaves for uterine disorders, diabetes, rheumatic paine of joints, and headache with sinusitis.
- Annona squamosa*** [Annonaceae]; V.N. – Ata; *Rajib & AP Das 0229*, dtd. 09.02.2007; Roots, leaves, fruits and seeds.  
*Uses*: Roots in mental depression and spinal disorders, fruits in anaemia, burning sensation, vomiting, cough, seeds are abortifacient and insecticidal.
- Ardisia solanacea*** [Primulaceae]; V.N. – Kurla; *Rajib & AP Das, 0249*, dtd. 10. 2. 2007; Roots.  
*Uses*: Fever, rheumatism, diarrhea.
- Argemone mexicana*** [Papaveraceae]; V.N. – Shiyal kanta; *Rajib & AP Das 0294*, dtd. 10.02.2007; Whole plants.

*Uses:* The plant as diuretic, sedative, roots in skin diseases, leprosy, malarial fever, leaves in cough, wounds, ulcers and skin diseases, seeds in cough, asthma, latex is useful in dropsy, jaundice, skin diseases, leprosy, conjunctivitis.

***Aristolochia indica*** [Aristolochiaceae]; V.N. – Ishwarmul; *Rajib & AP Das 0086*, dtd. 06.02.2007; Roots.

*Uses:* Gastric stimulant.

***Aristolochia tagala*** [Aristolochiaceae]; V.N. – Belikol; *Rajib & AP Das 0298*, dtd. 10.02.2007; Roots.

*Uses:* Carminative, tonic.

***Artocarpus heterophyllus*** [Moraceae]; V.N. – Kanthal; *Rajib & AP Das 0732*, dtd. 14.02.2008; Fruits, young leaves and roots.

*Uses:* Unripe fruits as carminative, astringent, tonic, cooling; seeds are diuretic; young leaves are good in skin disease, leaves ash in ulcers; roots in skin disease, asthma, diarrhea.

***Artocarpus lakoocha*** [Moraceae]; V.N. – Dawa; *Rajib & AP Das 0719*, dtd. 14.02.2008; Latex, fruits and seeds.

*Uses:* Latex in dysentery; unripe fruits in blood complaints, eye trouble and cough; ripe fruits in appetite, improve test; seeds purgative; stem is vermifuge, in spleen complaints and bone fracture of cattle.

***Azadirachta indica*** [Meliaceae]; V.N. – Nim; *Rajib & AP Das 0452*, dtd. 22.07.2007; Leaves, bark and roots.

*Uses:* Bark and leaves in fever, skin diseases; leaves bad test in mouth, cough, ulcers, inflammation, leprosy, urinary discharge, astringent, in eczema, ringworm, antiviral, eye disease, insecticide, snake bite and is antiscorpion sting.

***Bauhinia purpurea*** [Fabaceae]; V.N. – Rakta Kanchan; *Rajib & AP Das 0325*, dtd. 21.07.2007; Barks, roots and flowers.

*Uses:* Barks in diarrhoea; roots in animal bite; flowers are laxative and roots carminative.

***Bauhinia variegata*** [Fabaceae]; V.N. – Kanchan; *Rajib & AP Das 0311*, dtd. 10.02.2007; Barks, leaves and flowers.

*Uses:* As alterative astringent tonic, toothache, ulcers, skin disease, diarrhoea, cough, dysentery, flowers are laxative.

***Bischofia javanica*** [Phyllanthaceae]; V.N. – Kainjal; *Rajib & AP Das 0265*, dtd. 10.02.2007; Leaves.

*Uses:* Leaves juice in sores, tonsillitis, throat pain.

***Bombax ceiba*** [Malvaceae]; V.N. – Shimul; *Rajib & AP Das 0435*, dtd. 22.07.2007; Roots, gums and flowers.

*Uses:* In diarrhoea, dysentery, as astringent, stimulant.

***Brassica juncea*** [Brassicaceae]; V.N. – Rai Shorse; *Rajib & AP Das 0173*, dtd. 08.02.2007; Seeds and leaves.

*Uses:* Thermogenic, digestive, fever, dyspepsia, inflammation, vomiting, cold, burning sensation.

***Bryophyllum pinnatum*** [Crassulaceae]; V.N. – Pathorkuchi; *Rajib & AP Das 0223*, dtd. 09.02.2007; Leaves.

*Uses:* Toasted leaves are applied on wounds, boils, and bites of venomous insects.

***Calotropis gigantea*** [Apocynaceae]; V.N. – Akanda; *Rajib & AP Das 0410*, dtd. 22.07.2007; Whole plant.

*Uses:* Sores & skin disease, leprosy, leucoderma, ulcers. Leaves to paralysed parts, painful joints, swellings, bronchitis, asthma, skeletal fracture. Plants are purgative, antifungal.

- Cannabis sativa*** [Cannabidaceae/Cannabaceae]; V.N. – Bhang; *Rajib & AP Das 0374*, dtd. 21.07.2007; Leaves and Inflorescence.  
*Uses:* In hysteria, asthma, neuralgia, stomachic, astringent, alterative, hypertention, diabetes, spas-modic cough and indigestion.
- Careya arborea*** [Lecythidaceae]; V.N. – Kumbhi; *Rajib & AP Das 0153*, dtd. 08.02.2007; Bark.  
*Uses:* In toothache, ulcers, diarrhoea, dysentery.
- Carica papaya*** [Caricaceae]; V.N. – Pepe; *Rajib & AP Das 0096*, dtd. 07.02.2007; Fruit and latex.  
*Uses:* Jaundice, liver problem, enlargement of spleen, piles, stomachic, ringworm, skin disease; as digestive.
- Cassia fistula*** [Fabaceae]; V.N. – Bandar lathi; *Rajib & AP Das 0142*, dtd. 07.02.2007; Leaves, bark, root and seeds.  
*Uses:* Ringworm, purgative, laxative, astringent, tonic, syphilis, skin disease, leprosy, ulcers, antipyretic, ophthalmic, dyspepsia, constipation, fever, strangury, diabetes, demulcent.
- Catharanthus roseus*** [Apocynaceae]; V.N. – Nayantara; *Rajib & AP Das 0388*, dtd. 21.07.2007; Whole Plant.  
*Uses:* In leukaemia, as diuretic, anticancer and antitumour.
- Celosia argentea*** [Amaranthaceae]; V.N. – Chutki sak; *Rajib & AP Das 0019*, dtd. 05.02.2007; Whole plant.  
*Uses:* Acute conjunctivitis, diuretic.
- Centella asiatica*** [Apiaceae]; V.N. – Thankuni; *Rajib & AP Das 0573*, dtd. 24.07.2007; Whole Plant.  
*Uses:* Diabetes, pneumonia, tonic, diuretic, digestive, diarrhoea, dysentery, jaundice, constipation, leucorrhoea.
- Cheilocostus speciosus*** [Costaceae]; V.N. – Keu; *Rajib & AP Das 0195*, dtd. 09.02.2007; Rhizomes.  
*Uses:* The rhizomes in diabetes, fever, rheumatism, neuralgia, febrifuge, also in burning sensation, constipation, skin diseases, asthma, bronchitis and anaemia.
- Cinnamomum tamala*** [Lauraceae]; V.N. – Tejpata; *Rajib & AP Das 0540*, dtd. 23.07.2007; Leaves.  
*Uses:* In piles, bad test, heart troubles, gonorrhoea, rheumatism; it is anthelmintic, diuretic and antibacterial.
- Cinnamomum verum*** [Lauraceae]; V.N. – Darchini; *Rajib & AP Das 0412*, dtd. 11.02.2008; Bark.  
*Uses:* Astringent, stimulant and carminative, checks nausea.
- Citrullus vulgaris*** [Cucurbitaceae]; V.N. – Futki; *Rajib & AP Das 0214*, dtd. 09.02.2007; Fruits and young plants.  
*Uses:* Seeds contain edible oil; fruit coats as energetic.
- Citrus limon*** [Rutaceae]; V.N. – Gandharaj; *Rajib & AP Das 0594*, dtd. 25.07.2007; Fruits.  
*Uses:* In typhoid, indigestion, dysentery.
- Citrus maxima*** [Rutaceae]; V.N. – Jambura; *Rajib & AP Das 0600*, dtd. 26.07.2007; Fruits.  
*Uses:* To leprosy, asthma, cough, epilepsy, mental aberration, anthelmintic, tonic, diarrhoea, headache, eye trouble, cardiogenic.

- Cissus quadrangularis*** [Vitaceae]; V.N. – Harjora; *Rajib & AP Das 0461*, dtd. 23.07.2007; Whole plant.  
*Uses:* Shoots in colon pain, scurvy, asthma, burns and wounds. Paste stem for bone fractures.
- Coccinia grandis*** [Cucurbitaceae]; V.N. – Telakucha; *Rajib & AP Das 0157*, dtd. 08.02.2007; Leaves, roots and fruits.  
*Uses:* Roots in vomiting, burning sensation and uterine discharges, fruits are antipyretic, in burning sensation, leprosy, skin diseases, fruits and leaves as digestive, febrifuge.
- Curcuma longa*** [Zingiberaceae]; V.N. – Halud; *Rajib & AP Das 0141*, dtd. 07.02.2007; Rhizome.  
*Uses:* Cough & cold, blood disease, urinary disease, leucoderma, small pox, snake bite, diarrhoea, bronchitis, hysteria.
- Curcuma zedoaria*** [Zingiberaceae]; V.N. – Sati; *Rajib & AP Das 0348*, dtd. 21.07.2007; Rhizome.  
*Uses:* As antipyretic, leucoderma, bronchitis, piles, asthma, fever, epilepsy, pains, toothache and leucorrhoea.
- Datura metel*** [Solanaceae]; V.N. – Kalodhutra; *Rajib & AP Das 0484*, dtd. 23.07.2007; Fruit.  
*Uses:* Hydrophobia, convulsion, neuralgia, rheumatic swelling, sciatica, dog bite, asthma.
- Datura stramonium*** [Solanaceae]; V.N. – Sada dhutra; *Rajib & AP Das 0360*, dtd. 21.07.2007; Fruit.  
*Uses:* Asthma, whooping cough, bronchial and gastro intestinal problems, digestive, neuralgia, rheumatic pain.
- Deeringia amaranthoides*** [Amaranthaceae]; V.N. – Golamohani; *Rajib & AP Das 0056*, dtd. 07.02.2007; Roots and leaves.  
*Uses:* Roots as a wounds, leaves applied to sores.
- Dillenia pentagyna*** [Dilleniaceae]; V.N. – Tartari; *Rajib & AP Das 0695*, dtd. 14.02.2008; Barks, leaves and fruits.  
*Uses:* Stomachache, fever and cough, astringent, laxative.
- Dioscorea bulbifera*** [Dioscoreaceae]; V.N. – Mati alu; *Rajib & AP Das 0330*, dtd. 21.07.2007; Tuber.  
*Uses:* Stomachic, anthelmintic, urinary discharge, bronchitis, leucoderma, piles, tumours, asthma, ulcers.
- Drymaria cordata*** [Caryophyllaceae]; V.N. – Golpata; *Rajib & AP Das 0030*, dtd. 05.02.2007; Whole plants.  
*Uses:* In sinus, headache, cold, snake bite, fever, asthma, diphtheria, pneumonia, throat pain.
- Ficus benghalensis*** [Moraceae]; V.N. – Bot; *Rajib & AP Das 0596*, dtd. 25.07.2007; Bark and latex.  
*Uses:* Ulcers, vomiting, fever, leprosy, piles, disease of nose, gonorrhoea, syphilis, dysentery, liver problems, rheumatism, toothache, diabetes.
- Ficus religiosa*** [Moraceae]; V.N. – Pakur; *Rajib & AP Das 0333*, dtd. 21.07.2007; Whole plants.  
*Uses:* Blood disease, leucorrhoea, burning sensation, ulcers, bone fracture, urine discharge, vomiting, asthma, antibacterial.
- Glinus oppositifolius*** [Molluginaceae]; V.N. – Gima; *Rajib & AP Das 0021*, dtd. 05.02.2007; Whole plants.  
*Uses:* As vermifuge, diabetes, burning sensation, ulcers, urine discharge, vomiting, gonorrhoea, asthma, antibacterial.

- Holarrhena pubescens*** [Apocynaceae]; V.N. – Kurchi; *Rajib & AP Das 0459*, dtd. 23.07.2007; Bark and roots.  
*Uses*: In fever and dysentery, lung disease, tumour.
- Imperata cylindrica*** [Poaceae]; V.N. – Kush; *Rajib & AP Das 0656*, dtd. 13.02.2008; Whole plants.  
*Uses*: Antiviral, good in fever, cough, jaundice, kidney problems, internal bleeding, nose bleeding.
- Justicia adhatoda*** [Acanthaceae]; V.N. – Basak; *Rajib & AP Das 0542*, dtd. 23. 07. 2007; Leaves.  
*Uses*: Piles, bronchial asthma, bronchitis, pyorrhoea, cough, ulcers, menorrhagia, tuberculosis.
- Litsea glutinosa*** [Lauraceae]; V.N. – Pipul; *Rajib & AP Das 0618*, dtd. 11. 02. 2008; Leaves and bark.  
*Uses*: Mucilaginous bark and leaves in diarrhoea and dysentery.
- Mangifera indica*** [Anacardiaceae]; V.N. – Aam; *Rajib & AP Das 0334*, dtd. 21.07.2007; Bark and fruits.  
*Uses*: Dysentery, liver problems, digestive problems, ulcer.
- Mimosa pudica*** [Fabaceae]; V.N. – Lajjabati; *Rajib & AP Das 0110*, dtd. 07.02.2007; Leaves, roots and seeds.  
*Uses*: Toothache, leprosy, dysentery, vaginal and uterine complaints, fatigue, bilious fevers, jaundice, leprosy, ulcers, small pox, piles.
- Morinda angustifolia*** [Rubiaceae]; V.N. – Haldikath; *Rajib & AP Das 0662*, dtd. 13.02.2008; Leaves, bark, fruits and roots.  
*Uses*: To cure ulcers, dysentery, diabetes, asthma, leaves febrifuge.
- Morus australis*** [Moraceae]; V.N. – Tut; *Rajib & AP Das 0128*, dtd. 07.02.2007; Leaves, bark, roots, fruits.  
*Uses*: Burning sensation; diuretic, anthelmintic.
- Musa balbisiana*** [Musaceae]; V.N. – Bicha kola; *Rajib & AP Das 0567*, dtd. 24.07.2007; Fruits, stem and roots.  
*Uses*: Menstrual disorder, leprosy, diabetes, urinary discharge, bronchitis, diarrhea.
- Naravelia zeylanica*** [Ranunculaceae]; V.N. – Boli; Rasik Bil, *Rajib & AP Das 0014*, dtd. 05.02.2007; Plants.  
*Uses*: In leprosy, wounds and ulcers.
- Ocimum basilicum*** [Lamiaceae]; V.N. – Sada tulsi; *Rajib & AP Das 0321*, dtd. 21.07.2007; Leaves, flowers, seeds and roots.  
*Uses*: To cold and cough, diuretic, gonorrhoea, dysentery.
- Ocimum tenuiflorum*** [Lamiaceae]; V.N. – Kalo tulsi; *Rajib & AP Das 0560*, dtd. 24.07.2007; Leaves, seeds and roots.  
*Uses*: As tonic, gastritis, throat trouble, bronchitis, digestive problems, ring worm, skin disease, malaria fever, leaves in insect repellent.
- Oroxylum indicum*** [Bignoniaceae]; V.N. – Taroyal fal; *Rajib & AP Das 0299*, dtd. 10.02.2007; Bark, seeds.  
*Uses*: Diabetes, rheumatic swellings, tonic, fever, bronchitis, vomiting, dysentery, stomachic, heart trouble, piles.
- Oxalis corniculata*** [Oxalidaceae]; V.N. – Amboli; *Rajib & AP Das, 0706*, dtd. 14.02.2008; Whole plants.  
*Uses*: Dysentery, diarrhoea, piles, asthma, skin disease.



- Paederia foetida*** [Rubiaceae]; V.N. – Gandal; *Rajib & AP Das 0412*, dtd. 22.07.2007; Leaves and Stem.  
*Uses:* Tooth decay, digestive problems, tonic, piles, fever, eye disease.
- Phlogacanthus thyrsoiflorus*** [Acanthaceae]; V.N. – Kalo basak; *Rajib & AP Das 0467*, dtd. 23.07.2007; Leaves, bark, flowers.  
*Uses:* Cough and cold, antipyretic, leprosy, vomiting, asthma, bronchitis.
- Phyllanthus emblica*** [Phyllanthaceae]; V.N. – Amlaki; *Rajib & AP Das 0490*, dtd. 23.07.2007; Fruits, leaves, barks, roots.  
*Uses:* Indigestion, antipyretic, carminative, leprosy, vomiting, constipation, asthma, bronchitis.
- Piper betle*** [Piperaceae]; V.N. – Jangli paan; *Rajib & AP Das 0175*, dtd. 08.02.2007; Leaves.  
*Uses:* Leaves are antibacterial, leaves extracts in treating and wash wounds, topically applied to the chest for cure cough and asthma.
- Piper longum*** [Piperaceae]; V.N. – Pipla; *Rajib & AP Das 0206*, dtd. 09.02.2007; Fruit.  
*Uses:* Menstrual disorder, enlarged spleen, tumour, liver problems, diuretic, digestive, jaundice.
- Piper nigrum*** [Piperaceae]; V.N. – Golmarich; *Rajib & AP Das 0262*, dtd. 10.02.2007; Fruits.  
*Uses:* Spleen problem, liver problems, gout, diuretic, digestive, vomiting, constipation, jaundice.
- Premna latifolia*** [Lamiaceae]; V.N. – Gunari; *Rajib & AP Das 0453*, dtd. 22.07.2007; Leaves.  
*Uses:* Diuretic, dropsy, digestive, colic.
- Psidium guajava*** [Myrtaceae]; V.N. – Peyara; *Rajib & AP Das 0258*, dtd. 10.02.2007; Leaves, bark and fruit.  
*Uses:* Dysentery, astringent, ulcers, bronchitis, colic, diarrhoea, toothache.
- Punica granatum*** [Lythaceae]; V.N. – Dalim; *Rajib & AP Das 0221*, dtd. 09.02.2007; Plants, fruits, roots.  
*Uses:* Unripe fruits in vomiting, fever, diarrhoea, dysentery, heart disease, chest trouble, sore eye, bronchitis, brain disease.
- Pupalia lappacea*** [Amaranthaceae]; V.N. – Chhoto apang; *Rajib & AP Das 0115*, dtd. 07. 02. 2007; Whole plants.  
*Uses:* Soup taken for cough and fever, in leprosy sores.
- Raphanus sativus*** [Brassicaceae]; V.N. – Mula; *Rajib & AP Das 0650*, dtd. 12.02.2008; Leaves and roots.  
*Uses:* Piles, tumour, heart disease, diuretic.
- Ricinus communis*** [Euphorbiaceae]; V.N. – Vanna; *Rajib & AP Das 0371*, dtd. 21.07.2007; Root bark, seeds.  
*Uses:* To clear the digestive tract, infected wounds, boils, fevers, headache, skin disease.
- Scoparia dulcis*** [Plantaginaceae]; V.N. – Bondhoniya; *Rajib & AP Das 0501*, dtd. 23.07.2007; Plants.  
*Uses:* Piles, diuretic, cough, sore throat, boils, menorrhigia.
- Shorea robusta*** [Dipterocarpaceae]; V.N. – Sal; *Rajib & AP Das 0648*, dtd. 12.02.2008; Resin and leaves.  
*Uses:* Diarrhoea, dysentery.
- Sida acuta*** [Malvaceae]; V.N. – Jharu; *Rajib & AP Das 0125*, dtd. 07.02.2007; Leaves and roots.  
*Uses:* Leaves in swellings and in elephantiasis, decoction of leaves and roots in stomachic, antipyretic.

- Sida cordata*** [Malvaceae]; V.N. – Berala; *Rajib & AP Das 0126*, dtd. 07.02.2007; Roots.  
*Uses:* The roots are sweet, in leucorrhoea, gonorrhoea, fever.
- Sida cordifolia*** [Malvaceae]; V.N. – Swet barala; *Rajib & AP Das 0134*, dtd. 07.02.2007; Plants.  
*Uses:* Plant as tonic, leaves and stem in fever, leucorrhoea, colic, nervous disorders, general debility and heart irregularity.
- Sida rhombifolia*** [Malvaceae]; V.N. – Jharu; *Rajib & AP Das 0132*, dtd. 07.02.2007; Roots and leaves.  
*Uses:* The roots and leaves are used in weakness, arthritis and diarrhoea.
- Stephania glabra*** [Menispermaceae]; V.N. – Bhui kumra; *Rajib & AP Das 0098*, dtd. 07.02.2007; Root tuber.  
*Uses:* Jaundice, diabetes, asthma, dysentery, tuberculosis, fever.
- Stephania japonica*** [Menispermaceae]; V.N. – Chhoto bhui kumra; *Rajib & AP Das 0518*, dtd. 23.07.2007; Roots and tuber.  
*Uses:* Jaundice, diabetes, fever, diarrhoea, piles, urinary discharge.
- Tagetes patula*** [Asteraceae]; V.N. – Gandha; *Rajib & AP Das 0753*, dtd. 22.05.2008; Flowers, leaves.  
*Uses:* Pneumonia, antiseptic, eye disease, ulcers, piles.
- Terminalia arjuna*** [Combretaceae]; V.N. – Arjun; *Rajib & AP Das 0541*, dtd. 23.07.2007; Bark.  
*Uses:* In stomachic, dysentery, vomiting, anaemia, elephantiasis, disease of eye.
- Terminalia bellirica*** [Combretaceae]; V.N. – Bahera; *Rajib & AP Das 0602*, dtd. 26.07.2007; Fruits and bark.  
*Uses:* Anaemia, bronchitis, disease of eye and nose, problems of gall bladder and piles.
- Terminalia myriocarpa*** [Combretaceae]; V.N. – Pani Saj; *Rajib & AP Das 0586*, dtd. 25.07.2007; Bark.  
*Uses:* Cardiac stimulant and diuretic.
- Tinospora cordifolia*** [Menispermaceae]; V.N. – Gulancha; *Rajib & AP Das 0551*, dtd. 24.07.2007; Leaves, stems and aerial roots.  
*Uses:* Ear pain, infection, fever, jaundice, vomiting, skin disease, piles.
- Trichosanthes lepiniana*** [Cucurbitaceae]; V.N. – Makal; *Rajib & AP Das 0230*, dtd. 09.02.2007; Whole plants.  
*Uses:* Leaves, stem, roots are in constipation, fever, skin infections, wounds, leaves taken to improve digestion.
- Vitex negundo*** [Lamiaceae]; V.N. – Nishinda; *Rajib & AP Das 0513*, dtd. 23.07.2007; Leaves, roots and plant.  
*Uses:* Toothache, asthma, bronchitis, leucoderma, tonic, rheumatism, antidote to venom and scorpion sting, fever, febrifuge, enlargement of spleen.
- Zizyphus mauritiana*** [Rhamnaceae]; V.N. – Kul; *Rajib & AP Das 0705*, dtd. 14.02.2008; Leaves, bark, fruits and root.  
*Uses:* Dysentery, diarrhoea, blood disease, eye disease, ulcers, antipyretic, headache, wounds.

### 9.3. Enumeration of plants for Veterinary Medicine

Main domesticated animals of Rasik Beel complex and its surrounding villages are cows, goats, pigs, cats, dogs and fowls. These animals also suffer from different diseases and they are also treated by local traditional way of treatment. The Animal Hospital is not so popular or known to the villagers. So they treated mainly using plant materials. The present detail study shows that, the villagers use 27 species of plant materials to treat their pets which are enumerated below:

- Alstonia scholaris*** [Apocynaceae]; V.N. – Chhatim; *Rajib & AP Das 0372*, dtd. 21.07.2007; Bark.  
*Uses:* Bark powder as vermicide of pigs, cows and goats.
- Amaranthus spinosus*** [Amaranthaceae]; V.N. – Kanta notey; *Rajib & AP Das 0117*, dtd. 07.02.2007; Whole plants.  
*Uses:* Plants are fed to cows and buffaloes to enhance lactation.
- Amorphophallus bulbifer*** [Araceae]; V.N. – Buno Ol; *Rajib & AP Das 0105*, dtd. 07.02.2007; Tuber.  
*Uses:* Tuber smeared with little amount of salt and rubbed on tongue of cow for curing sore on tongue.
- Annona reticulata*** [Annonaceae]; V.N. – Nona; *Rajib & AP Das 0253*, dtd. 10.02.2007; Leaves.  
*Uses:* Leaf paste is massage on body of cattle for removing lice.
- Azadirachta indica*** [Meliaceae]; V.N. – Nim; *Rajib & AP Das 0452*, dtd. 22.07.2007; Leaves.  
*Uses:* Leaf extracts use in skin diseases of cows and goats.
- Cannabis sativa*** [Canabaceae]; V.N. – Bhang; *Rajib & AP Das 0374*, dtd. 21.07.2007; Shoots.  
*Uses:* Fresh shoots are kept in the fowl shed in time of incubation for removing/ repelling insects from the place and as anti-mosquito agent.
- Centella asiatica*** [Apiaceae]; V.N. – Thankuni; *Rajib & AP Das 0573*, dtd. 24.07.2007; Whole Plant.  
*Uses:* In case of drowsiness and white stool in hen, leaves with dry fish powder is administered.
- Coccinia grandis*** [Cucurbitaceae]; V.N. – Telakucha; *Rajib & AP Das 0157*, dtd. 08.02.2007; Leafy shoots..  
*Uses:* Leafy shoots are fed to the catle in indigestion.
- Colocasia esculenta*** [Araceae]; V.N. – Kachu; *Rajib & AP Das 0036*, dtd. 05.02.2007; Leaves.  
*Uses:* Lamina and petioles are chopped and boiled in sufficient water and fed to the pigs to induce fertility.
- Crinum amoenum*** [Amaryllidaceae]; V.N. – Akashi; *Rajib & AP Das 0170*, dtd. 08.02.2007; Bulb.  
*Uses:* Bulb along with garlic (*Alium sativum* Linnaeus) is given in asthma of cows, and is also fed to prevent flatulence of stomach.
- Curcuma longa*** [Zingiberaceae]; V.N. – Halud; *Rajib & AP Das 0141*, dtd. 07.02.2007; Rhizome.  
*Uses:* Paste of rhizome is applied on swellings and sores of cows and goats.
- Cynodon dactylon*** [Poaceae]; V.N. – Dubba; *Rajib & AP Das 0689*, dtd. 14.02.2008; Whole Plant.  
*Uses:* In body-sore of cattle, with the rhizome of *Curcuma longa*.
- Euphorbia hirta*** [Euphorbiaceae]; V.N. – Dudhi; *Rajib & AP Das 0382*, dtd. 21.07.2007; Whole Plant.  
*Uses:* Leaves are fed to milking cows for improving lactation.
- Ficus benghalensis*** [Moraceae]; V.N. – Bot; *Rajib & AP Das 0596*, dtd. 25.07.2007; Leaves, bark and latex.

*Uses:* Indigestion and dysentery of cows and goats.

***Hibiscus sabdariffa*** [Malvaceae]; V.N. – Chukka; *Rajib & AP Das 0075*, dtd. 06.02.2007; Leaves and young twigs.

*Uses:* Leaves and young twigs are fed with rice water in dysentery.

***Hydrocotyle sibthorpioides*** [Araliaceae]; V.N. – Chhoto thankuni; *Rajib & AP Das 0496*, dtd. 23.07.2007; Whole Plant.

*Uses:* Leaves fed to the cow with cinnamon and cardamom in pneumonia.

***Jatropha curcas*** [Euphobiaceae]; V.N. – Varena; *Rajib & AP Das 0722*, dtd. 14.02.2008; Leaves and bark.

*Uses:* Extract of stem bark and leaves are applied on the body of cows and buffaloes to cure skin sores.

***Justicia adhatoda*** [Acanthaceae]; V.N. – Basak; *Rajib & AP Das 0542*, dtd. 23.07.2007; Leaves.

*Uses:* Leaves are pounded and given to the cows to cure pneumonia.

***Mimosa pudica*** [Fabaceae]; V.N. – Lajjabati; *Rajib & AP Das 0110*, dtd. 07.02.2007; Young shoots.

*Uses:* Shoots extract is externally applied on wounds of cows.

***Musa balbisiana*** [Musaceae]; V.N. – Bicha kola; *Rajib & AP Das 0567*, dtd. 24.07.2007; Fruits, pseudostem.

*Uses:* Pseudostem given to the cattle to prevent heatstroke, ripen fruits are fed to the cows to check dysentery.

***Nyctanthes arbor-tristis*** [Nyctaginaceae]; V.N. – Sheuli; *Rajib & AP Das 0047*, dtd. 05.02.2007; Leaves.

*Uses:* Leaf extract fed to the hens to cure fever.

***Paederia foetida*** [Rubiaceae]; V.N. – Gandal; *Rajib & AP Das 0412*, dtd. 22.07.2007; Leaf and Stem.

*Uses:* Leafy shoots are fed in flatulence of stomach of cows.

***Pericampylus glaucus*** [Menispermaceae]; *Rajib & AP Das 0254*, dtd. 10.02.2007; Leafy shoots.

*Uses:* Leafy shoots is fed to the cows and goats in case of hyper salivation.

***Persicaria hydropiper*** [Polygonaceae]; V.N. – Bish jhar; *Rajib & AP Das*, 0130, dtd. 07.02.2007; Leafy shoots.

*Uses:* Leafy shoots are rubbed on the body of cattle for removing lice.

***Piper longum*** [Piperaceae]; V.N. – Pipla; *Rajib & AP Das 0206*, dtd. 09.02.2007; Fruit.

*Uses:* Fruits paste is mixed with rice water in digestive problems of cows and goats.

***Stephania japonica*** [Menispermaceae]; V.N. – Chhoto bhui kumra; *Rajib & AP Das 0518*, dtd. 23.07.2007; Leafy shoots.

*Uses:* Leafy shoots is fed to the cows and goats in fever.

***Vitex negundo*** [Lamiaceae]; V.N. – Nishinda; *Rajib & AP Das 0513*, dtd. 23.07.2007; Leaves.

*Uses:* Leaves in body pain and wound of catles.

#### 9.4. Enumeration of Poisonous Plants of Rasik Beel areas

Local people uses some plants as fish poison to catch fishes in dry seasons mainly. They also use some plants to cath birds from the Wetlands. From their knowledge, some poisonus plants enumerated below:

- Alstonia scholaris*** [Apocynaceae]; V.N. – Chhatim; *Rajib & AP Das 0372*, dtd. 21.07.2007.  
Bark and leaves.  
*Use:* Crushed stem-bark and leaves are use as fish poison.
- Cannabis sativa*** [Cannabaceae]; V.N. – Bhang; Ganja; *Rajib & AP Das 0374*, dtd. 21.07.2007;  
Leaves and inflorescence.  
*Uses:* Leaves and inflorescence extract have harmful effects for human nervous system; hallucinogenic.
- Careya arborea*** [Lecythidaceae]; V.N. – Kumbhi; *Rajib & AP Das 0153*, dtd. 08.02.2007;  
Bark.  
*Uses:* Extracts of root and stem-bark is used to stupify fishes.
- Cheilocostus speciosus*** [Costaceae]; V.N. – Keu; *Rajib & AP Das 0195*, dtd. 09.02.2007;  
Rhizomes.  
*Uses:* Rhizome extract is a fish poison.
- Datura metel*** [Solanaceae]; V.N. – Kalodhutra; *Rajib & AP Das 0484*, dtd. 23.07.2007; Fruits and leaves.  
*Uses:* Juice of fruits and leaves can create madness in people.
- Datura stramonium*** [Solanaceae]; V.N. – Sada dhutra; *Rajib & AP Das 0360*, dtd. 21.07.2007;  
Fruit and leaves.  
*Use:* Juice of fruits and leaves can create madness in people.
- Diospyros malabarica*** [Ebenaceae]; V.N. – Gab; *Rajib & AP Das 0222*, dtd. 09.02.2007;  
Fruits.  
*Uses:* Boiled young fruits can make the birds temporarily unconsusness.
- Meyna spinosa*** [Rubiaceae]; V.N. – Bish gota; *Rajib & AP Das 0637*, dtd. 12.02.2008; Fruits.  
*Uses:* Fruits are pounded and mixed in pond water for killing fishes.
- Moringa oleifera*** [Moringaceae]; V.N. – Sojna; *Rajib & AP Das 0171*, dtd. 08.02.2007; Root and Bark.  
*Uses:* Roots and bark extracts causes vomiting of human.
- Murraya koenigii*** [Rutaceae]; V.N. – Karipata; *Rajib & AP Das 0679*, dtd. 14.02.2008; Bark, fruits.  
*Uses:* Bark and fruits extract as insect poison.
- Persicaria hydropiper*** [Polygonaceae]; V.N. – Bish jhar; *Rajib & AP Das 0130*, dtd. 07.02.2007;  
Leafy shoots.  
*Uses:* Leafy shoots extract as insecticide and fish poison.
- Plumbago zeylanica*** [Plumbaginaceae]; V.N. – Chita; *Rajib & AP Das 0727*, dtd. 14.02.2008; Roots.  
*Uses:* Root extract is poisonous for human health.
- Tabernamontana divaricata*** [Apocynaceae]; V.N. – Tagor; *Rajib & AP Das 0306*, dtd. 10.02.2007; Latex, leaves and fruits.  
*Uses:* Highly poisonus to human health.
- Xanthium indicum*** [Asteraceae]; V.N. – Okra; *Rajib & AP Das 0780*, dtd. 12.09.2008; Leaves, roots and fruits.  
*Uses:* Roots, fruits and leaves extract have harmful effects for human nervous system. It creates madness and can even cause death.

### 9.5. Enumeration of Religious Plants

The local villagers of Rasik Beel and its adjoining villages are Bangali and Rajbanshi, some peple from Rava community. Their place of worship is mainly two types – (i) every house has own *Lakshmi*

*asana* and also *Kali* and *Shiva* and (ii) out side of the house (mainly roadside) under the *Ficus benghalensis* has *Mashan debota* and also *Than*. They has also other pujas like *Swaswati puja*, *Shani puja*, *Janma astami*, *Manasha puja*, *Ambubachi*, *Ganga puja* etc. every pujas and their traditional social activities has selected some plant materials which they regularly use. The plants which they use their different religious purposes are enumerated below:

***Aegle marmelos*** [Rutaceae]; V.N. – Bel; *Rajib & AP Das 0598*, dtd. 26.07.2007; Leaves and fruits.

*Uses*: Leaves and young fruits are use in worship of God Shiva and leaves are in different religious ceremonies.

***Areca catechu*** [Arecaceae]; V.N. – Supari; *Rajib & AP Das 0089*, dtd. 06.02.2007; Fruits and seeds.

*Uses*: Fruits and seeds are used for different traditional ritual purposes and all type of worship.

***Bambusa tulda*** [Poaceae]; V.N. – Talda bansh; *Rajib & AP Das 0715*, dtd. 14.02.2008; Culm and leaves.

*Uses*: Bamboo culm is used in make all tools for Puja and leaves also used in Rakhali Puja.

***Bombax ceiba*** [Malvaceae]; V.N. – Shimul; *Rajib & AP Das 0435*, dtd. 22.07.2007; Flowers and hairy endocarp (floss).

*Uses*: Floss is used in all type of ceremonies in masterd oil lamp and flowers used to worship in than and Mashan Puja.

***Catharanthus roseus*** [Apocynaceae]; V.N. – Nayantara; *Rajib & AP Das 0388*, dtd. 21.07.2007; Flowers.

*Uses*: Flowers are used to worship deities.

***Clitoria ternatea*** [Fabaceae]; V.N. – Nilkantha; *Rajib & AP Das 0239*, dtd. 09.02.2007; Flowers.

*Uses*: Flowers used in Shani puja.

***Cynodon dactylon*** [Poaceae]; V.N. – Dubba; *Rajib & AP Das 0689*, dtd. 14.02.2008; Culm tip with leaves.

*Uses*: Twigs with 3 to 5 leaves are useful in all religious ceremonies.

***Datura metel*** [Solanaceae]; V.N. – Kalodhutra; *Rajib & AP Das 0484*, dtd. 23.07.2007; Fruit and flowers.

*Uses*: Flowers and fruits are dedicated to God Shiva.

***Datura stramonium*** [Solanaceae]; V.N. – Sada dhutra; *Rajib & AP Das 0360*, dtd. 21.07.2007; Fruit and flowers.

*Uses*: Flowers and fruits are dedicated to God Shiva.

***Hibiscus mutabilis*** [Malvaceae]; V.N. – Sthal padma; *Rajib & AP Das 0487*, dtd. 23.07.2007; Flowers.

*Uses*: Flowers are used for worshiping of deities specialy in Lakshmi puja.

***Hibiscus rosa-sinensis*** [Malvaceae]; V.N. – Rakta Jaba; *Rajib & AP Das 0080*, dtd. 06.02.2007; Flowers.

*Uses*: Flowers are used to worship deities.

***Malvaviscus arboreus* var. *penduliflorus*** [Malvaceae]; V.N. – Lanka Jaba; *Rajib & AP Das 0329*, dtd. 21.07.2007; Flowers.

*Uses*: Flowers are used to worship deities and other religious ceremonies.

***Mirabilis jalapa*** [Nyctaginaceae]; V.N. – Sandhya malati; *Rajib & AP Das 0034*, dtd. 05.02.2007; Flowers.

*Uses*: Flowers are used to worship deities.

- Musa x balbisiana*** [Musaceae]; V.N. – Bicha kola; *Rajib & AP Das 0567*, dtd. 24.07.2007; Leaves, leaf sheaths, pseudostem and fruits.  
*Uses:* Leaves, leaf sheaths, pseudostem and fruits are used in different rituals. Whole plant and pseudostem are also used for all type of ceremonial decorations. Fruits are used to worship deities.
- Ocimum tenuiflorum*** [Lamiaceae]; V.N. – Kalo tulsi; *Rajib & AP Das 0560*, dtd. 24.07.2007; Leaves.  
*Uses:* Flowers are used to worship deities.
- Saccharum spontaneum*** [Poaceae]; V.N. – Kash; *Rajib & AP Das 0322*, dtd. 21.07.2007; Culm and whole plants.  
*Uses:* Culm used in worshipping of deities and whole plants used in after death ritual *i.e.* Shraddha.
- Shorea robusta*** [Dipterocarpaceae]; V.N. – Sal; *Rajib & AP Das 0648*, dtd. 12.02.2008; Resin.  
*Uses:* The resin is used as incense in religious ceremonies.
- Tabernamontana divaricata*** [Apocynaceae]; V.N. – Tagor; *Rajib & AP Das 0306*, dtd. 10.02.2007; Flowers.  
*Uses:* Flowers are used in all religious ceremonies and worship deities.
- Tagetes patula*** [Asteraceae]; V.N. – Gandha; *Rajib & AP Das 0753*, dtd. 22.05.2008; Flowers.  
*Uses:* Flowers are used to worship deities.

### 9.6. Enumeration of Edible Species of Rasik Beel

People of local villages collected their daily usable vegetables, fruits and flowers from the wild or some they also planted in their won house are enumerated below –

- Alternanthea philoxeroides*** [Amaranthaceae]; V.N. – Malancha; *Rajib & AP Das 0172*, dtd. 08.02.2007; Leafy shoot.  
*Uses:* Cooked as vegetable.
- Alternanthera paronychioides*** [Amaranthaceae]; V.N. – Chhoto Malancha; *Rajib & AP Das 0068*, dtd. 06.02.2007; Leafy shoot.  
*Uses:* Cooked as vegetable.
- Alternanthera sessilis*** [Amaranthaceae]; V.N. – Nunia sak; *Rajib & AP Das 0710*, dtd. 14.02.2008; Leafy shoot.  
*Uses:* Cooked as vegetable.
- Amaranthus blitum*** subsp. *oleraceus* [Amaranthaceae]; V.N. – Chhoto notey; *Rajib & AP Das 0424*, dtd. 22.07.2007; Leafy shoot.  
*Uses:* Cooked as vegetable.
- Amaranthus spinosus*** [Amaranthaceae]; V.N. – Kanta notey; *Rajib & AP Das 0117*, dtd. 07.02.2007; Leafy shoot.  
*Uses:* Cooked as vegetable.
- Amaranthus viridis*** [Amaranthaceae]; V.N. – Notey; *Rajib & AP Das 0135*, dtd. 07.02.2007; Leafy shoot.  
*Uses:* Cooked as vegetable.
- Celosia argentea*** [Amaranthaceae]; V.N. – Chutki sak; *Rajib & AP Das 0019*, dtd. 05.02.2007; Leafy shoot.  
*Uses:* Cooked as vegetable.

- Annona reticulata*** [Annonaceae]; V.N. – Nona; *Rajib & AP Das 0253*, dtd. 10.02.2007; Fruits.  
*Uses:* Ripe fruits edible.
- Annona squamosa*** [Annonaceae]; V.N. – Aata; *Rajib & AP Das 0229*, dtd. 09.02.2007; Fruits.  
*Uses:* Ripe fruits edible.
- Artocarpus heterophyllus*** [Moraceae]; V.N. – Kanthal; *Rajib & AP Das 0732*, dtd. 14.02.2008; Fruits.  
*Uses:* Young fruits cooked as vegetable and ripen fruits eaten fresh.
- Artocarpus lakoocha*** [Moraceae]; V.N. – Dawa; *Rajib & AP Das 0719*, dtd. 14.02.2008; Fruits.  
*Uses:* Ripe fruits edible.
- Azadirachta indica*** [Meliaceae]; V.N. – Nim; *Rajib & AP Das 0452*, dtd. 22.07.2007; Young leafy twigs.  
*Uses:* Cooked as vegetable.
- Carica papaya*** [Caricaceae]; V.N. – Penpe; *Rajib & AP Das 0096*, dtd. 07.02.2007; Fruits.  
*Uses:* Young fruits cooked as vegetable and ripe fruits eaten fresh.
- Chenopodium album*** [Chenopodiaceae]; V.N. – Balia saak/ Bathua; *Rajib & AP Das 0072*, dtd. 06.02.2007; Leafy shoot.  
*Uses:* Cooked as vegetable.
- Chenopodium giganteum*** [Chenopodiaceae]; V.N. – Balia saak/ Bathua; *Rajib & AP Das 0066*, dtd. 06.02.2007; Leafy shoot.  
*Uses:* Cooked as vegetable.
- Cinnamomum tamala*** [Lauraceae]; V.N. – Tejpatata; *Rajib & AP Das 0540*, dtd. 23.07.2007; Dried matured leaves.  
*Uses:* As aromatic spice in cooking.
- Cinnamomum verum*** [Lauraceae]; V.N. – Daruchini; *Rajib & AP Das 0412*, dtd. 11.02.2008; Bark and leaves.  
*Uses:* As aromatic spice.
- Citrullus vulgaris*** [Cucurbitaceae]; V.N. – Phutki, Phutik; *Rajib & AP Das 0214*, dtd. 09.02.2007; Fruits.  
*Uses:* Ripe fruits edible.
- Citrus limon*** [Rutaceae]; V.N. – Gandharaj; *Rajib & AP Das 0594*, dtd. 25.07.2007; Fruits.  
*Uses:* Fruits edible.
- Citrus maxima*** [Rutaceae]; V.N. – Jambura; *Rajib & AP Das 0600*, dtd. 26.07.2007; Fruits.  
*Uses:* Fruits edible.
- Coccinia grandis*** [Cucurbitaceae]; V.N. – Telakucha; *Rajib & AP Das 0157*, dtd. 08.02.2007; Leaves and fruits.  
*Uses:* Cooked as vegetable.
- Deeringia amaranthoides*** [Amaranthaceae]; V.N. – Golamohani; *Rajib & AP Das 0056*, dtd. 07.02.2007; Young leafy shoot.  
*Uses:* Cooked as vegetable.
- Dillenia indica*** [Dilleniaceae]; V.N. – Chalta; *Rajib & AP Das 0666*, dtd. 13.02.2008; Pseudocarps.  
*Uses:* Pseudocarps edible.
- Dillenia pentagyna*** [Dilleniaceae]; V.N. – Tartari; *Rajib & AP Das 0695*, dtd. 14.02.2008; Pseudocarps.  
*Uses:* Pseudocarps edible.



- Dioscorea bulbifera*** [Dioscoreaceae]; V.N. – Mati alu; *Rajib & AP Das 0330*, dtd. 21.07.2007; Tuber.  
*Uses*: Tuber and under ground rhizome cooked as vegetable.
- Diospyros malabarica*** [Ebenaceae]; V.N. – Gab; *Rajib & AP Das 0222*, dtd. 09.02.2007; Fruits.  
*Uses*: Ripe fruits edible.
- Elaeocarpus floribundus*** [Elaeocarpaceae]; V.N. – Jalpai; *Rajib & AP Das 0085*, dtd. 06.02.2007; Fruits.  
*Uses*: Ripe fruits edible.
- Enydra fluctuans*** [Asteraceae]; V.N. –Helencha; *Rajib & AP Das 0520*, dtd. 23.07.2007; Leafy shoot.  
*Uses*: Cooked as vegetable.
- Ficus hispida*** [Moraceae]; V.N. – Dumur; *Rajib & AP Das 0593*, dtd. 25.07.2007; Figs.  
*Uses*: Cooked as vegetable.
- Glinus oppositifolius*** [Molluginaceae]; V.N. – Gima; *Rajib & AP Das 0021*, dtd. 05.02.2007; Leafy shoot.  
*Uses*: Cooked as vegetable.
- Hibiscus sabdariffa*** [Malvaceae]; V.N. – Chukka; *Rajib & AP Das 0075*, dtd. 06.02.2007; Calyx and leaves..  
*Uses*: Cooked as vegetable and also in preparation of Jelly.
- Ipomoea aquatica*** [Convolvulaceae]; V.N. – Kalmi sak; *Rajib & AP Das 0698*, dtd. 14.02.2008; Leafy shoot.  
*Uses*: Cooked as vegetable.
- Leucas indica*** [Lamiaceae]; V.N. – Dulfi sak; *Rajib & AP Das 0292*, dtd. 10.02.2007; Leafy shoot.  
*Uses*: Cooked as vegetable.
- Litchi chinensis*** [Sapindaceae]; V.N. – Lichu; *Rajib & AP Das 0313*, dtd. 10.02.2007; Fruits.  
*Uses*: Ripe fruits edible.
- Luffa acutangula*** [Cucurbitaceae]; V.N. – Dundul; *Rajib & AP Das 0284*, dtd. 10.02.2007; Fruits.  
*Uses*: Cooked as vegetable.
- Luffa aegyptiaca*** [Cucurbitaceae]; V.N. – Jhinga; *Rajib & AP Das 0227*, dtd. 09.02.2007; Fruits.  
*Uses*: Cooked as vegetable.
- Malva verticillata*** [Malvaceae]; V.N. –Lafa; *Rajib & AP Das 0205*, dtd. 09.02.2007; Leafy shoot.  
*Uses*: Cooked as vegetable.
- Momordica charantia*** [Cucurbitaceae]; V.N. – Uchche; *Rajib & AP Das 0226*, dtd. 09.02.2007; Fruits and leaves.  
*Uses*: Cooked as vegetable.
- Morus australis*** [Moraceae]; V.N. – Tut; *Rajib & AP Das 0128*, dtd. 07.02.2007; Fruits.  
*Uses*: Ripe fruits edible.
- Nymphaea nouchali*** [Nymphaeaceae]; V.N. – Nil shaluk; *Rajib & AP Das 0336*, dtd. 21.07.2007; Petiole and seeds.

*Uses:* Petiole cooked as vegetable.and seeds eaten after boiled or fried.

***Nymphaea pubescens*** [Nymphaeaceae]; V.N. – Shaluk; *Rajib & AP Das 0402*, dtd. 22.07.2007; Petiole and seeds.

*Uses:* Petiole cooked as vegetable.and seeds eaten after boiled or fried.

***Nymphaea rubra*** [Nymphaeaceae]; V.N. – Lal shaluk; *Rajib & AP Das 0251*, dtd. 10.02.2007; Petiole and seeds.

*Uses:* Petiole cooked as vegetable.and seeds eaten after boiled or fried.

***Phyllanthus emblica*** [Phyllanthaceae]; V.N. – Amlaki; *Rajib & AP Das 0490*, dtd. 23.07.2007; Fruits.

*Uses:* Ripe fruits edible.

***Piper longum*** [Piperaceae]; V.N. – Pipla; *Rajib & AP Das 0206*, dtd. 09.02.2007; Fruits and leafy twig.

*Uses:* Cooked as vegetable.

***Piper nigrum*** [Piperaceae]; V.N. – Golmarich; *Rajib & AP Das 0262*, dtd. 10.02.2007; Fruits.

*Uses:* Cooked as as spice.

***Syzygium cumini*** [Myrtaceae]; V.N. – Kalo jam; *Rajib & AP Das 0174*, dtd. 08.02.2007; Fruits.

*Uses:* Ripe fruits edible.

***Tamarindus indica*** [Fabaceae]; V.N. – Tetul; *Rajib & AP Das 0244*, dtd. 09.02.2007; Fruits.

*Uses:* Ripe fruits edible.

***Trapa natans* var. *bispinosa*** [Lythraceae]; V.N. – Jalsingara; *Rajib & AP Das 0197*, dtd. 09.02.2007; Fruits.

*Uses:* Ripe fruits edible.

***Zizyphus mauritiana*** [Rhamnaceae]; V.N. – Kul; *Rajib & AP Das 0705*, dtd. 14.02.2008; Fruits.

*Uses:* Ripe fruits edible.

### 9.7. Fodder Plants of Rasik Beel

The local people of surrounding villages collected fodder plants from the forest and wetlands vegetation. They collected 173 species of plants for their pet like cows, goats, pigs, buffaloes etc. all species, which they use as fodder are enumerated below:

***Achyranthes bidentata*** [Amaranthaceae]; V.N. – Chirchiti; *Rajib & AP Das 0113*, dtd. 07.02.2007; Leafy shoots.

*Uses:* Fodder for cows.

***Acmella calva*** [Asteraceae]; V.N. – Ushani sak; *Rajib & AP Das 0577*, dtd. 25.07.2007; Leafy shoots.

*Uses:* Fodder for pigs.

***Aeschynomene indica*** [Fabaceae]; V.N. – Shola; *Rajib & AP Das 0121*, dtd. 07.02.2007; Leaves.

*Uses:* Fodder for cows.

***Alstonia scholaris*** [Apocynaceae]; V.N. – Chhatim; *Rajib & AP Das 0372*, dtd. 21.07.2007; Leaves.

*Uses:* Cattle feed.

- Alternanthea philoxeroides*** [Amaranthaceae]; V.N. – Malancha; *Rajib & AP Das 0172*, dtd. 08.02.2007; Leafy shoot.  
*Uses:* Fodder for cows.
- Alternanthera paronychioides*** [Amaranthaceae]; V.N. – Malancha; *Rajib & AP Das 0068*, dtd. 06.02.2007; Leafy shoot.  
*Uses:* Fodder for cows.
- Alternanthera sessilis*** [Amaranthaceae]; V.N. – Nunia sak; *Rajib & AP Das 0710*, dtd. 14.02.2008; Whole plants.  
*Uses:* Cattle fodder.
- Amaranthus blitum*** subsp. *oleraceus* [Amaranthaceae]; V.N. – Chhoto notey; *Rajib & AP Das 0424*, dtd. 22.07.2007; Whole plants.  
*Uses:* Cattle fodder.
- Amaranthus spinosus*** [Amaranthaceae]; V.N. – Kanta notey; *Rajib & AP Das 0117*, dtd. 07.02.2007; Whole plants and shoots.  
*Uses:* Cattle fodder.
- Amaranthus viridis*** [Amaranthaceae]; V.N. – Notey; *Rajib & AP Das 0135*, dtd. 07.02.2007; Whole plants.  
*Uses:* Eaten by cattle.
- Ammannia multiflora*** [Lythraceae]; *Rajib & AP Das 0161*, dtd. 08.02.2007; Whole plants.  
*Uses:* Eaten by cattle.
- Ampelocissus sikkimensis*** [Vitaceae]; *Rajib & AP Das 0519*, dtd. 23.07.2007; Whole plants.  
*Uses:* Eaten by cattle.
- Argyreia roxburghii*** [Convolvulaceae]; V.N. – Baro dudhi lata; *Rajib & AP Das 0664*, dtd. 13.02.2008; Whole plants.  
*Uses:* Eaten by cattle.
- Artocarpus heterophyllus*** [Moraceae]; V.N. – Kanthal; *Rajib & AP Das 0732*, dtd. 14.02.2008; Leaves and fruits.  
*Uses:* Eaten by cows and goats.
- Artocarpus lakoocha*** [Moraceae]; V.N. – Dawa; *Rajib & AP Das 0719*, dtd. 14.02.2008; Leaves and fruits.  
*Uses:* Cattle fodder.
- Asystasia macrocarpa*** [Acanthaceae]; V.N. – *Rajib & AP Das 0571*, dtd. 24.07.2007; Whole plants.  
*Uses:* Eaten by cattle.
- Amischotolype hookeri*** [Commelinaceae]; *Rajib & AP Das 0148*, dtd. 08.02.2007; Whole plants.  
*Uses:* Cattle fodder.
- Axonopus compressus*** [Poaceae]; V.N. – Chhoto chepti ghas; *Rajib & AP Das 0605*, dtd. 26.07.2007; Whole plants.  
*Uses:* Fodder for cows.
- Bambusa balcooa*** [Poaceae]; V.N. – Bansh; *Rajib & AP Das 0702*, dtd. 14.02.2008; Leaves.  
*Uses:* Eaten by goats and cows.
- Bidens pilosa*** [Asteraceae]; *Rajib & AP Das 0588*, dtd. 25. 07. 2007; Whole plants.  
*Uses:* Eaten by pigs.

- Boerhavia coccinea*** [Nyctaginaceae]; V.N. – Punarnaba; *Rajib & AP Das 0017*, dtd. 05.02.2007; Whole plants.  
*Uses*: Cattle fodder.
- Bombax ceiba*** [Malvaceae]; V.N. – Shimul; *Rajib & AP Das 0435*, dtd. 22.07.2007; Leaves.  
*Uses*: Eaten by goats.
- Bridelia retusa*** [Phyllanthaceae]; V.N. – Gota; *Rajib & AP Das 0575*, dtd. 25.07.2007; Leaves.  
*Uses*: Eaten by catle.
- Careya arborea*** [Lecythidaceae]; V.N. – Kumbhi; *Rajib & AP Das 0153*, dtd. 08.02.2007; Leaves and fruits.  
*Uses*: Good fodder of cattle.
- Cassia fistula*** [Fabaceae]; V.N. – Bandar lathi; *Rajib & AP Das 0142*, dtd. 07.02.2007; Leaves.  
*Uses*: Fodder of cattle.
- Cassia nodosa*** [Fabaceae]; V.N. – Balaram chura; *Rajib & AP Das 0122*, dtd. 07.02.2007; Leaves.  
*Uses*: Fodder of cattle.
- Cassia occidentalis*** [Fabaceae]; V.N. – Jhunjhuni; *Rajib & AP Das 0162*, dtd. 08.02.2007; Leaves.  
*Uses*: Fodder of cattle.
- Cassia siamea*** [Fabaceae]; *Rajib & AP Das 0127*, dtd. 07.02.2007; Leaves.  
*Uses*: Cattle fodder.
- Cassia sophera*** [Fabaceae]; *Rajib & AP Das 0193*, dtd. 09.02.2007; Leaves.  
*Uses*: Cattle fodder.
- Celosia argentea*** [Amaranthaceae]; V.N. – Chutki sak; *Rajib & AP Das 0019*, dtd. 05.02.2007; Leafy shoot.  
*Uses*: Cattle fodder.
- Chenopodium album*** [Amaranthaceae]; V.N. – Balia sak/ Bathua; *Rajib & AP Das 0072*, dtd. 06.02.2007; Whole plants.  
*Uses*: Cattle fodder.
- Chenopodium ambrosiodes*** [Amaranthaceae]; *Rajib & AP Das 0145*, dtd. 08.02.2007; Whole plants.  
*Uses*: Cattle fodder.
- Chenopodium giganteum*** [Amaranthaceae]; V.N. – Balia sak; *Rajib & AP Das 0066*, dtd. 06.02.2007; Whole plants.  
*Uses*: Cattle fodder.
- Chromolaena odoratum*** [Asteraceae]; V.N. – Bhusre; *Rajib & AP Das 0595*, dtd. 25.07.2007; Leafy shoot.  
*Uses*: Fodder for cattle.
- Chukrassia tabularis*** [Meliaceae]; V.N. – Chikrasi; *Rajib & AP Das 0454*, dtd. 22.07.2007; Leaves.  
*Uses*: Good fodder of cattle.
- Cinnamomum bejolghota*** [Lauraceae]; *Rajib & AP Das 0469*, dtd. 23.07.2007; Leaves.  
*Uses*: Cattle fodder.
- Cissampelos pareira*** [Menispermaceae]; *Rajib & AP Das 0123*, dtd. 07.02.2007; Whole plants.  
*Uses*: Cattle fodder.

- Clausena excavata*** [Rutaceae]; V.N. – Bon kari; *Rajib & AP Das 0528*, dtd. 23.07.2007; Leaves.  
Uses: Fodder of goat.
- Cleome viscosa*** [Cleomaceae]; *Rajib & AP Das 0108*, dtd. 07. 02. 2007; Whole plants.  
Uses: Cattle fodder.
- Clerodendrum infortunatum*** [Lamiaceae]; V.N. – Vant; Rasik Bil, *Rajib & AP Das*, 0398, dtd. 22.07.2007; Leaves.  
Uses: Fodder of cattle.
- Coccinia grandis*** [Cucurbitaceae]; V.N. – Telakucha; *Rajib & AP Das 0157*, dtd. 08.02.2007; Whole plants.  
Uses: Cattle fodder.
- Coix lachryma-jobi*** [Poaceae]; V.N. – Kuch; *Rajib & AP Das 0657*, dtd. 13.02.2008; Leaves.  
Uses: Fodder of cattle.
- Colocasia esculenta*** [Araceae]; V.N. – Shola Kochu; *Rajib & AP Das 0091*, dtd. 07.02.2007; Whole plants.  
Uses: Fodder of Pigs.
- Colocasia fallax*** [Araceae]; V.N. – Kochu; *Rajib & AP Das 0025*, dtd. 05.02.2007; Whole plants.  
Uses: Fodder of Pigs.
- Commelina benghalensis*** [Commelinaceae]; V.N. – Kanchhera; *Rajib & AP Das 0156*, dtd. 08.02.2007; Whole plants.  
Uses: Cattle feed.
- Commelina diffusa*** [Commelinaceae]; V.N. – Kanchhera; *Rajib & AP Das 0201*, dtd. 09.02.2007; Whole plants.  
Uses: Cattle feed.
- Commelina sufruticosa*** [Commelinaceae]; V.N. – Kanchhera; *Rajib & AP Das 0201*, dtd. 09.02.2007; Whole plants.  
Use: Cattle feed.
- Corchorus aestuens*** [Malvaceae] V.N. – Buno pat; *Rajib & AP Das 0164*, dtd. 08.02.2007; Whole plants.  
Uses: Cattle fodder.
- Crassocephalum crepidioides*** [Asteraceae]; *Rajib & AP Das 0369*, dtd. 21.07.2007; Whole plants.  
Use: Cattle fodder.
- Cyanoglossum lanceolatum*** [Boraginaceae]; *Rajib & AP Das 0332*, dtd. 21.07.2007; Whole plants.  
Uses: Pig-fodder.
- Cynodon dactylon*** [Poaceae]; V.N. – Dubba; *Rajib & AP Das 0689*, dtd. 14.02.2008; Whole plants.  
Uses: Cattle feed.
- Cyperus cyperoides*** [Cyperaceae]; *Rajib & AP Das 0237*, dtd. 09.02.2007; Whole plants.  
Use: Cattle feed.
- Cyperus pangorei*** [Cyperaceae]; *Rajib & AP Das 0084*, dtd. 06.02.2007; Whole plants.  
Uses: Cattle feed.
- Cyperus pilosus*** [Cyperaceae]; *Rajib & AP Das 0099*, dtd. 07.02.2007; Whole plants.  
Use: Cattle feed.

- Cyperus rotundus*** [Cyperaceae]; V.N. – Mutha; *Rajib & AP Das 0370*, dtd. 21.07.2007; Whole plants.  
*Uses*: Cattle fodder.
- Dactyloctenium aegyptium*** [Poaceae]; V.N. – Khudi bansh; *Rajib & AP Das 0718*, dtd. 14.02.2008; Whole plants.  
*Uses*: Cattle fodder.
- Dalbergia sissoo*** [Fabaceae]; V.N. – Sisu; *Rajib & AP Das 0151*, dtd. 08.02.2007; Leaves.  
*Uses*: Fodder of cattle.
- Deeringia amaranthoides*** [Amaranthaceae]; V.N. – Golamohani; *Rajib & AP Das 0056*, dtd. 07.02.2007; Leafy shoot.  
*Uses*: Fodder for cows.
- Dicliptera bupleuroides*** [Acanthaceae]; *Rajib & AP Das 0546*, dtd. 23.07.2007; Whole plants.  
*Use*: Cattle feed.
- Digitaria ciliaris*** [Poaceae]; *Rajib & AP Das 0674*, dtd. 13.02.2008; Whole plants.  
*Uses*: Cattle fodder.
- Dillenia indica*** [Dilleniaceae]; V.N. – Chalta; *Rajib & AP Das 0666*, dtd. 13.02.2008; Pseudocarps and leaves.  
*Uses*: Leaves are eaten by goats, pseudocarps used as cattle fodder.
- Dillenia pentagyna*** [Dilleniaceae]; V.N. – tartari; *Rajib & AP Das 0695*, dtd. 14.02.2008; Pseudocarps and leaves.  
*Uses*: Cattle feed.
- Diospyros malabarica*** [Ebenaceae]; V.N. – Gab; *Rajib & AP Das 0222*, dtd. 09.02.2007; Leaves and tender shoots.  
*Uses*: Fodder for goats.
- Drymaria cordata*** [Caryophyllaceae]; V.N. – Golpata; *Rajib & AP Das 0030*, dtd. 05.02.2007; Whole plants.  
*Uses*: Cattle feed.
- Duchesnea indica*** [Rosaceae]; *Rajib & AP Das 0137*, dtd. 07.02.2007; Whole plants.  
*Uses*: Cattle feed.
- Eichhornia crassipes*** [Pontederiaceae]; V.N. – Kachuri pana; *Rajib & AP Das 0179*, dtd. 09.02.2007; Leaves and culms.  
*Uses*: Fodder of cattle.
- Elaeocarpus floribundus*** [Elaeocarpaceae]; V.N. – Jalpai; *Rajib & AP Das 0085*, dtd. 06.02.2007; Leaves.  
*Uses*: Eaten by cows.
- Enydra fluctuans*** [Asteraceae]; *Rajib & AP Das 0520*, dtd. 23.07.2007; Whole plants.  
*Uses*: Cattle fodder.
- Evolvulus nummularius*** [Convolvulaceae]; *Rajib & AP Das 0684*, dtd. 14.02.2008; Whole plants.  
*Uses*: Cattle feed.
- Euphorbia hirta*** [Euphorbiaceae]; V.N. – Dudhi; *Rajib & AP Das 0382*, dtd. 21.07.2007; Whole Plant.  
*Uses*: Cattle feed.
- Ficus benghalensis*** [Moraceae]; V.N. – Bot; *Rajib & AP Das 0596*, dtd. 25.07.2007; Leaves.

*Use:* Cattle feed.

***Ficus heterophylla*** [Moraceae]; *Rajib & AP Das 0731*, dtd. 14.02.2008; Leaves.

*Uses:* Cattle feed.

***Ficus hispida*** [Moraceae]; V.N. – Dumur; *Rajib & AP Das 0593*, dtd. 25.07.2007; Leaves and figs.

*Uses:* Leaves are eaten by cows and goats; fruits are much liked by pigs.

***Ficus religiosa*** [Moraceae]; V.N. – Pakur; *Rajib & AP Das 0333*, dtd. 21.07.2007; Leaves.

*Uses:* Cattle feed.

***Ficus semicordata*** [Moraceae]; *Rajib & AP Das 0641*, dtd. 12.02.2008; Leaves.

*Uses:* Cattle feed.

***Flacourtia indica*** [Salicaceae]; V.N. – Panial; *Rajib & AP Das 0150*, dtd. 08.02.2007; Leaves.

*Uses:* Cattle feed.

***Flueggea virosa*** [Phyllanthaceae]; *Rajib & AP Das 0704*, dtd. 14.02.2008; Leaves.

*Uses:* Fodder of cattle.

***Glinus lotoides*** [Molluginaceae]; *Rajib & AP Das 0129*, dtd. 07.02.2007; Whole plants.

*Uses:* Cattle fodder.

***Glycosmis pentaphylla*** [Rutaceae]; *Rajib & AP Das 0561*, dtd. 24.07.2007; Leaves.

*Uses:* Fodder of cattle.

***Gmelina arborea*** [Lamiaceae]; V.N. – Gamar; *Rajib & AP Das 0524*, dtd. 23.07.2007; Leaves and fruits.

*Uses:* Eaten by cows and goats.

***Grangea maderaspatana*** [Asteraceae]; *Rajib & AP Das 0413*, dtd. 22.07.2007; Whole plants.

*Uses:* Cattle fodder.

***Holarrhena pubescens*** [Apocynaceae]; V.N. – Kurchi; *Rajib & AP Das 0459*, dtd. 23.07.2007; Leaves.

*Uses:* Eaten by goats.

***Hygrophila phlomiodes*** [Acanthaceae]; *Rajib & AP Das 0426*, dtd. 22.07.2007; Whole plants.

*Uses:* Cattle fodder.

***Hygrophila polysperma*** [Acanthaceae]; *Rajib & AP Das 0562*, dtd. 24.07.2007; Whole plants.

*Uses:* Cattle feed.

***Hygroryza aristata*** [Poaceae]; V.N. – Kola ghas; *Rajib & AP Das 0623*, dtd. 11.02.2008; Leaves and culms.

*Uses:* Good fodder of cattle.

***Ichnocarpus frutescens*** [Apocynaceae]; V.N. –Dudhi lata; *Rajib & AP Das 0506*, dtd. 23.07.2007; Whole plants.

*Uses:* Cattle feed.

***Imperata cylindrica*** [Poaceae]; V.N. – Kush; *Rajib & AP Das 0656*, dtd. 13.02.2008; Whole plants.

*Uses:* Fodder for cows.

***Ipomoea aquatica*** [Convolvulaceae]; V.N. – Kalmi; *Rajib & AP Das 0698*, dtd. 14.02.2008; Whole plants.

*Uses:* Fodder for cows.

***Ipomoea hederifolia*** [Convolvulaceae]; *Rajib & AP Das 0612*, dtd. 11.02.2008; Whole plants.

*Uses:* Fodder for cows.

- Kyllinga nemoralis*** [Cyperaceae]; V.N. – Keli ghas; *Rajib & AP Das 0550*, dtd. 24.07.2007; Whole plants.  
*Uses:* Fodder for cows and Pigs.
- Lagerstroemia hirsuta*** [Lythraceae]; V.N. – Jarul; *Rajib & AP Das 0512*, dtd. 23.07.2007; Leaves.  
*Uses:* Cattle fodder.
- Lannea coromandelica*** [Anacardiaceae]; V.N. – Jika; *Rajib & AP Das 0364*, dtd. 21.07.2007; Leaves.  
*Use:* Fodder of pig.
- Lasia spinosa*** [Araceae]; V.N. – Kanta kochu; *Rajib & AP Das 0038*, dtd. 05.02.2007; Whole plants.  
*Uses:* Cattle feed.
- Leea asiatica*** [Vitaceae]; *Rajib & AP Das 0375*, dtd. 21.07.2007; Leaves.  
*Use:* Good fodder of pig.
- Lepidagathis incurva*** [Acanthaceae]; V.N. – Kukur suka; *Rajib & AP Das 0634*, dtd. 12.02.2008; Whole plants.  
*Uses:* Cattle fodder.
- Leucas indica*** [Lamiaceae]; V.N. – Dulfi sak; *Rajib & AP Das 0292*, dtd. 10.02.2007; Whole plants.  
*Uses:* Cattle feed.
- Limnophila indica*** [Scrophulariaceae]; *Rajib & AP Das 0507*, dtd. 23.07.2007; Whole plants.  
*Uses:* Cattle fodder.
- Limnophila repens*** [Scrophulariaceae]; *Rajib & AP Das 0433*, dtd. 22.07.2007; Whole plants.  
*Uses:* Cattle fodder.
- Lindernia parviflora*** [Linderniaceae]; *Rajib & AP Das 0563*, dtd. 24.07.2007; Whole plants.  
*Uses:* Cattle fodder.
- Lindernia procumbens*** [Linderniaceae]; *Rajib & AP Das 0190*, dtd. 09.02.2007; Whole plants.  
*Uses:* Cattle feed.
- Lippia javanica*** [Lamiaceae]; V.N. – Gondhalu; *Rajib & AP Das 0530*, dtd. 23.07.2007; Whole plants.  
*Uses:* Fodder of Goat and pig.
- Litchi chinensis*** [Sapindaceae]; V.N. – Lichu; *Rajib & AP Das 0313*, dtd. 10.02.2007; Leaves.  
*Use:* Fodder of cattle.
- Litsea glutinosa*** [Lauraceae]; V.N. – Pipul; *Rajib & AP Das 0618*, dtd. 11.02.2008; Leaves.  
*Uses:* Fodder of cattle.
- Litsea monopetala*** [Lauraceae]; V.N. – Bonkathal; *Rajib & AP Das 0685*, dtd. 14.02.2008; Leaves.  
*Use:* Fodder of cattle.
- Ludwigia adscendens*** [Onagraceae]; V.N. – Polta gachh; *Rajib & AP Das 0304*, dtd. 10.02.2007; Whole plants.  
*Uses:* Whole plant is used as fodder.
- Ludwigia octovalvis*** [Onagraceae]; *Rajib & AP Das 0307*, dtd. 10.02.2007; Whole plants.  
*Uses:* Cattle feed.
- Ludwigia perennis*** [Onagraceae]; *Rajib & AP Das 0346*, dtd. 21.07.2007; Whole plants.  
*Uses:* Cattle fodder.



- Luffa acutangula*** [Cucurbitaceae]; V.N. – Dundul; *Rajib & AP Das 0284*, dtd. 10.02.2007; Leafy shoots and fruits.  
*Uses*: Cattle fodder.
- Luffa aegyptiaca*** [Cucurbitaceae]; V.N. – Jhinga; *Rajib & AP Das 0227*, dtd. 09.02.2007; Leafy shoots and fruits.  
*Uses*: Cattle fodder.
- Lycopersicon esculentum*** [Solanaceae]; V.N. – Bon tomato; *Rajib & AP Das 0275*, dtd. 10.02.2007; Leafy shoots and fruits.  
*Uses*: Cattle fodder.
- Mangifera indica*** [Anacardiaceae] V.N. – Aam; *Rajib & AP Das 0334*, dtd. 21.07.2007; Leaves.  
*Uses*: Cattle feed.
- Melia azedarach*** [Meliaceae]; V.N. – Ghora nim; *Rajib & AP Das 0243*, dtd. 09.02.2007; Leaves.  
*Uses*: Eaten by goats.
- Merremia hederacea*** [Convolvulaceae]; V.N. – Vitachhara; *Rajib & AP Das 0451*, dtd.22.07.2007; Whole plants.  
*Uses*: Cattle feed.
- Merremia vitifolia*** [Convolvulaceae]; V.N. – Vitachhara; *Rajib & AP Das 0397*, dtd. 22.07.2007; Whole plants.  
*Uses*: Cattle fodder.
- Mesua ferrea*** [Clusiaceae]; V.N. – Nageswar; *Rajib & AP Das 0065*, dtd. 07.02.2007; Leaves.  
*Uses*: Eaten by goat.
- Magnolia champaca*** [Magnoliaceae]; V.N. – Swarna champa; *Rajib & AP Das 0187*, dtd. 09.02.2007; Leaves.  
*Uses*: Fodder of cattle.
- Mikania micrantha*** [Asteraceae]; V.N. – Assam lata; *Rajib & AP Das 0694*, dtd. 14.02.2008; Whole plants.  
*Uses*: Cattle fodder.
- Monochoria hastata*** [Pontederiaceae]; *Rajib & AP Das 0212*, dtd. 09.02.2007; Leaves and petioles.  
*Uses*: Cattle fodder.
- Monochoria vaginalis*** [Pontederiaceae]; *Rajib & AP Das 0257*, dtd. 10.02.2007; Leaves and petioles.  
*Uses*: Cattle fodder.
- Mukia maderaspatana*** [Cucurbitaceae]; *Rajib & AP Das 0051*, dtd. 05.02.2007; Whole plants.  
*Uses*: Cattle fodder.
- Musa balbisiana*** [Musaceae]; V.N. – Bicha kola; *Rajib & AP Das 0567*, dtd. 24.07.2007; Fruits, stem and roots.  
*Uses*: Eaten by cows and goats.
- Natsiatum herpeticum*** [Icacinaceae]; *Rajib & AP Das 0610*, dtd. 26.07.2007; Whole plants.  
*Uses*: Cattle fodder.
- Nelsonia canescens*** [Acanthaceae]; *Rajib & AP Das 0681*, dtd. 14.02.2008; Whole plants.  
*Uses*: Cattle fodder.
- Neolamarckia cadamba*** [Rubiaceae]; V.N. – Kadam; *Rajib & AP Das 0587*, dtd. 25.07.2007; Leaves and fruits.  
*Uses*: Cattle fodder.

- Oplismenus burmannii*** [Poaceae]; *Rajib & AP Das 0396*, dtd. 22.07.2007; Whole plant.  
*Uses:* Cattle fodder.
- Oplismenus compositus*** [Poaceae]; *Rajib & AP Das 0443*, dtd. 22.07.2007; Whole plant.  
*Uses:* Fodder of cattle.
- Oenanthe javanica*** [Apiaceae]; *Rajib & AP Das 0479*, dtd. 23.07.2007; Whole plants.  
*Uses:* Cattle fodder.
- Oroxylum indicum*** [Bignoniaceae]; V.N. – Taroyal fal; *Rajib & AP Das 0299*, dtd. 10.02.2007;  
 Leaves.  
*Uses:* Eaten by cattle.
- Oryza rufipogon*** [Poaceae]; V.N. – Borga dhan; *Rajib & AP Das 0401*, dtd. 22.07.2007; Whole  
 plant.  
*Uses:* Fodder of cattle.
- Paederia foetida*** [Rubiaceae]; V.N. – Gadai; *Rajib & AP Das 0412*, dtd. 22.07.2007; Whole  
 plants.  
*Uses:* Cattle fodder.
- Paspalum conjugatum*** [Poaceae]; V.N. – Chhoto ghas; *Rajib & AP Das 0403*, dtd. 22.07.2007;  
 Leaves.  
*Uses:* Cattle fodder.
- Persicaria chinensis*** [Polygonaceae]; *Rajib & AP Das 0395*, dtd. 22.07.2007; Whole plants.  
*Uses:* Cattle feed.
- Phaulopsis imbricate*** [Acanthaceae]; *Rajib & AP Das 0570*, dtd. 24.07.2007; Whole plants.  
*Uses:* Cattle fodder.
- Phlogacanthus thyrsiflorus*** [Acanthaceae]; V.N. – Kalo basak; *Rajib & AP Das 0467*, dtd.  
 23.07.2007; Whole plants.  
*Uses:* Cattle feed.
- Phrynium pubinerve*** [Marantaceae]; *Rajib & AP Das 0232*, dtd. 09.02.2007; Leaves.  
*Uses:* Fodder of cattle.
- Phyllanthus amarus*** [Phyllanthaceae]; *Rajib & AP Das 0431*, dtd. 22.07.2007; Whole plants.  
*Uses:* Cattle feed.
- Polyalthia longifolia*** [Annonaceae]; V.N. – Debbaru; *Rajib & AP Das 0440*, dtd. 22.07.2007;  
 Leaves.  
*Uses:* Fodder of cattle.
- Portulaca oleracea*** [Portulacaceae]; *Rajib & AP Das 0057*, dtd. 07.02.2007; Whole plants.  
*Uses:* Cattle fodder.
- Pouzolzia zeylanica*** [Urticaceae]; *Rajib & AP Das 0159*, dtd. 08.02.2007; Whole plants.  
*Uses:* Cattle feed.
- Psidium guajava*** [Myrtaceae]; V.N. – Peyara; *Rajib & AP Das 0258*, dtd. 10.02.2007; Leaves.  
*Uses:* Eaten by goat.
- Rorippa benghalensis*** [Brassicaceae]; V.N. – Bon shorshe; *Rajib & AP Das 0107*, dtd.  
 07.02.2007; Whole plants.  
*Uses:* Cattle fodder.
- Rotala densiflora*** [Lythraceae]; *Rajib & AP Das 0087*, dtd. 06.02.2007; Whole plants.  
*Uses:* Cattle fodder.
- Rotala rotundifolia*** [Lythraceae]; *Rajib & AP Das 0158*, dtd. 08.02.2007; Whole plants.  
*Uses:* Cattle fodder.
- Rumex dentatus*** [Polygonaceae]; *Rajib & AP Das 0040*, dtd. 05.02.2007; Whole plants.

*Uses:* Cattle feed.

***Rumex maritimus*** [Polygonaceae]; *Rajib & AP Das 0050*, dtd. 05.02.2007; Whole plants.

*Uses:* Cattle feed.

***Rungia pectinata*** [Acanthaceae]; *Rajib & AP Das 0344*, dtd. 21.07.2007; Whole plants.

*Uses:* Cattle fodder.

***Saccharum spontaneum*** [Poaceae]; V.N. – Kash; *Rajib & AP Das 0322*, dtd. 21.07.2007; Leaves.

*Uses:* Good fodder of cattle.

***Sauropus quadrangularis*** [Phyllanthaceae]; V.N. – Chikti; *Rajib & AP Das 0366*, dtd. 21.07.2007; Whole plants.

*Uses:* Cattle fodder.

***Scoparia dulsis*** [Plantaginaceae]; V.N. – Bondhoniya; *Rajib & AP Das 0501*, dtd. 23.07.2007; Whole plants.

*Uses:* Cattle fodder.

***Setaria palmifolia*** [Poaceae]; V.N. – Supari ghas; *Rajib & AP Das 0450*, dtd. 22.07.2007; Whole plant.

*Uses:* Good fodder of cattle.

***Shorea robusta*** [Dipterocarpaceae]; V.N. – Sal; *Rajib & AP Das 0648*, dtd. 12.02.2008; Leaves.

*Uses:* Fodder of goat.

***Spathodea campanulata*** [Bignoniaceae]; V.N. – Parul; *Rajib & AP Das 0342*, dtd. 21.07.2007; Leaves.

*Uses:* Fodder of cattle.

***Spilanthes acmella*** [Asteraceae]; *Rajib & AP Das 0700*, dtd. 14.02.2008; Whole plants.

*Uses:* Cattle fodder.

***Stellaria wallichiana*** [Caryophyllaceae]; *Rajib & AP Das 0363*, dtd. 21.07.2007; Whole plants.

*Uses:* Cattle fodder.

***Stellaria media*** [Caryophyllaceae]; *Rajib & AP Das 0053*, dtd. 05.02.2007; Whole plants.

*Uses:* Cattle fodder.

***Stellaria uliginosa*** [Caryophyllaceae]; *Rajib & AP Das 0712*, dtd. 14.02.2008; Whole plants.

*Uses:* Fodder of cattle.

***Stephania glabra*** [Menispermaceae]; V.N. – Bhui kumra; *Rajib & AP Das 0098*, dtd. 07.02.2007; Whole plants.

*Uses:* Fodder of cattle.

***Stephania japonica*** [Menispermaceae]; V.N. – Chhoto bhui kumra; *Rajib & AP Das 0518*, dtd. 23.07.2007; Whole plants.

*Uses:* Fodder of cattle.

***Streblus asper*** [Moraceae]; V.N. – Sheora; *Rajib & AP Das 0071*, dtd. 06.02.2007; Leaves.

*Uses:* Fodder for goats.

***Synedrella nodiflora*** [Asteraceae]; *Rajib & AP Das 0743*, dtd. 22.05.2008; Whole plants.

*Uses:* Fodder of cattle.

***Syzygium cumini*** [Myrtaceae]; V.N. – Kalo jam; *Rajib & AP Das 0174*, dtd. 08.02.2007; Leaves.

*Uses:* Eaten by cattle.

***Tetrastigma bracteolatum*** [Vitaceae]; V.N. – Panchpata; *Rajib & AP Das 0441*, dtd. 22.07.2007; Whole plants.

*Uses:* Fodder of cattle.

- Tetrastigma campylocarpum*** [Vitaceae]; V.N. – Panchpata; *Rajib & AP Das 0376*, dtd. 21.07.2007; Whole plants.  
*Uses:* Fodder of cattle.
- Typha elephantina*** [Typhaceae]; V.N. – Hogla; *Rajib & AP Das 0566*, dtd. 24.07.2007; Leaves.  
*Uses:* Good fodder of cattle.
- Typhonium trilobatum*** [Araceae]; V.N. – Kharkon; *Rajib & AP Das 0054*, dtd. 07.02.2007; Whole plant.  
*Uses:* Good fodder of Pig.
- Tetrastigma serrulatum*** [Vitaceae]; V.N. – Panchpata; *Rajib & AP Das 0391*, dtd. 21.07.2007; Whole plants.  
*Uses:* Fodder of cattle.
- Toona ciliata*** [Meliaceae]; V.N. – Toon; *Rajib & AP Das 0267*, dtd. 10.02.2007; Leaves.  
*Uses:* Fodder for cattle.
- Trichosanthes lepiniana*** [Cucurbitaceae]; V.N. – Makal; *Rajib & AP Das 0230*, dtd. 09.02.2007; Whole plants.  
*Uses:* Fodder of cattle.
- Vallis solanacea*** [Apocynaceae]; *Rajib & AP Das 0393*, dtd. 22.07.2007; Whole plants.  
*Uses:* Fodder of cattle.
- Vernonia cinerea*** [Asteraceae]; *Rajib & AP Das 0739*, dtd. 14.02.2008; Whole plants.  
*Uses:* Eaten by goat.
- Wrightia arborea*** [Apocynaceae]; V.N. – Khira; *Rajib & AP Das 0273*, dtd. 10.02.2007; Leaves.  
*Uses:* Fodder of cattle.
- Xanthosoma brasiliense*** [Araceae]; V.N. – Pancha mukhi kachu; *Rajib & AP Das 0697*, dtd. 14.02.2008; Whole plant.  
*Uses:* Fodder of Pig.
- Youngia japonica*** [Asteraceae]; *Rajib & AP Das 0736*, dtd. 14.02.2008; Whole plants.  
*Uses:* Fodder of cattle.
- Zanonia indica*** [Cucurbitaceae]; *Rajib & AP Das 0305*, dtd. 10.02.2007; Whole plants.  
*Uses:* Eaten by pigs.

## 9.8. Discussion

From the present survey, 614 species of plants are recorded from the study areas, in which 283 species plants (45% of total recorded flora) are used by local people to their daily life style and social activities. But only 52 species are recorded as NTFPs marketed species. The NTFPs marketed species price also very low. Total 92 species of medicinal plants (12% of total recorded flora), 27 species (4% of total recorded flora) ethnoveterinary medicinal plants, 54 plants (7% of total recorded flora) are edible as vegetable or riped fruits, 14 plants (3% of total recorded flora) used in various religious purposes, 4 species (1% of total recorded flora) of plants use as spice are recorded from the study areas (Fig. 9.1). But, only some edible fruits and few vegetables are marketed, others are collected by the people for their own use puposes, which has no price in the market.

*Aegle marmelos*, *Annona reticulata*, *Annona squamosa*, *Areca catechu*, *Artocarpus heterophyllus*, *Carica papaya*, *Cinnamomum tamala*, *Cinnamomum verum*, *Cocos nucifera*, *Curcuma longa*, *Litchi chinensis*, *Piper nigrum* etc not available in the forests areas, but they cultivated in their forest villages and forests land of village side. *Aeschynomene indica*, *Colocasia esculenta*, *Enydra fluctuans*, *Lasia spinosa*, *Nymphaea nouchali*, *Nymphaea pubescens*, *Nymphaea rubra*, *Trapa natans* var. *bispinosa* etc they collected from Rasik Beel complex.

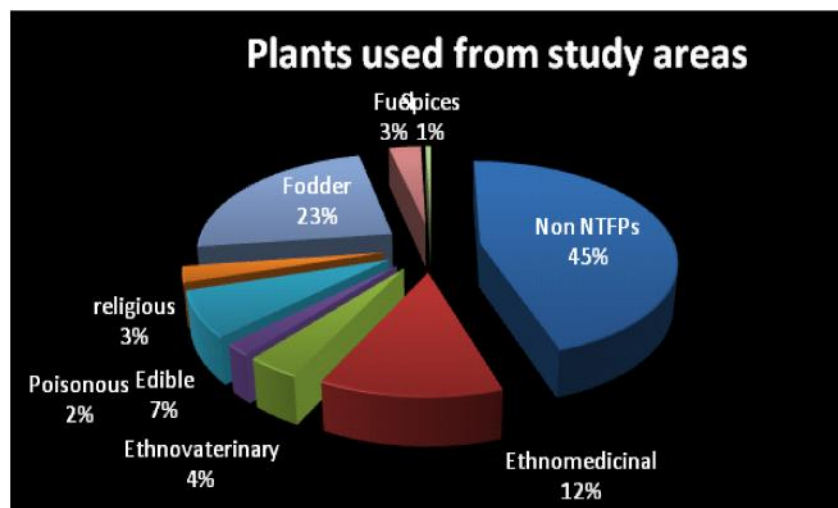


Fig. 9.1. Graph showing the total plants use percentage from the Study area

*Amaranthus viridis*, *Amorphophallus bulbifer*, *Artocarpus lakoocha*, *Bambusa balcooa*, *Bambusa tulda*, *Chenopodium album*, *Chenopodium giganteum*, *Citrus limon*, *Citrus maxima*, *Dillenia indica*, *Dioscorea bulbifera*, *Diospyros malabarica*, *Elaeocarpus floribundus*, *Luffa acutangula*, *Luffa aegyptiaca*, *Lycopersicon esculentum*, *Momordica charantia*, *Musa balbisiana*, *Phyllanthus emblica*, *Sida acuta*, *Syzygium cumini*, *Tamarindus indica*, *Terminalia bellirica* and *Zizyphus mauritiana* they collecting from the forests.

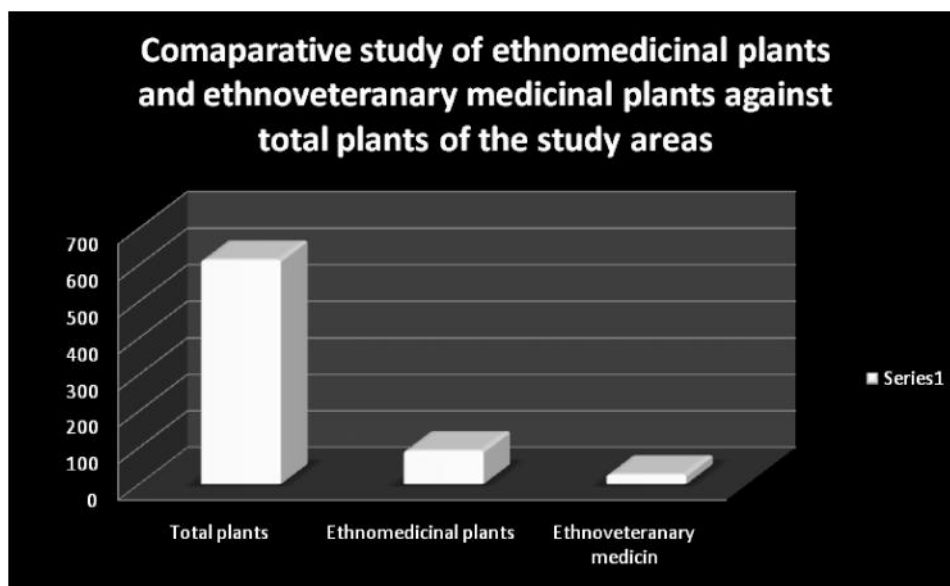
From the present survey, 92 species are recorded as ethnomedicinal plants (Fig. 9.2). So many plants which they use for treatment of disease, but the plants or plant parts they use as vegetable regularly or they eat ripe fruits regularly.

Local kabiraj ie. Medicin practitioner suggested his patients to take regularly *Alternanthera sessilis*, *Amaranthus spinosus*, *Amaranthus viridis*, *Annona squamosa*, *Azadirachta indica*, *Carica papaya*, *Centella asiatica*, *Citrullus vulgaris*, *Citrus limon*, *Citrus maxima*, *Glinus oppositifolius*, *Mangifera indica*, *Morus alba*, *Paederia foetida*, *Piper longum*, *Premna latifolia*, *Psidium guajava*, *Punica granatum* etc for good health. And he also advice *Alternanthera sessilis*, *Amaranthus spinosus*, *Amaranthus viridis*, *Azadirachta indica*, *Carica papaya*, *Centella asiatica*, *Glinus oppositifolius*, *Paederia foetida* and *Premna latifolia* to use as regular vegetable.

From the present survey, 27 species of plants are recorded, which uses as ethnoveterinary medicinal plants. Somany plants which they use for human treatment also. *Alstonia scholaris*, *Amorphophallus bulbifer*, *Cannabis sativa*, *Nyctanthes arbor-tristis*, *Persicaria hydropiper* and *Vitex negundo*. *Vitex negundo* are poisonous plants, but the use these for removing lice or body sores or vermicides.

From the present survey, 14 species of plants are recorded, which uses poisonous plants (Fig.9.3). Some poisonous plants they use as ethnomedicinal or ethnoveterinary medicinal plants. *Alstonia scholaris*, *Cannabis sativa*, *Careya arborea*, *Cheilocostus speciosus*, *Datura metel*, *Datura stramonium*, *Diospyros malabarica*, *Moringa oleifera*, *Murraya koenigii*, *Plumbago zeylanica* etc use as ethnomedicinal or ethnoveterinary plants. *Murraya koenigii* and *Moringa oleifera* they use as vegetable also. The ripen fruits of *Diospyros malabarica* is edible and very testy.

From the present survey, 19 species of plants are recorded, which uses in various religious activities. The leaves of *Aegle marmelos*, *Cynodon dactylon*, *Ocimum tenuiflorum* and *Saccharum spontaneum* and the fruits of *Aegle marmelos*, *Areca catechu*, *Datura metel*, *Datura stramonium* are uses in various worship. The *Tagetes patula*, *Tabernamontana divaricata*,



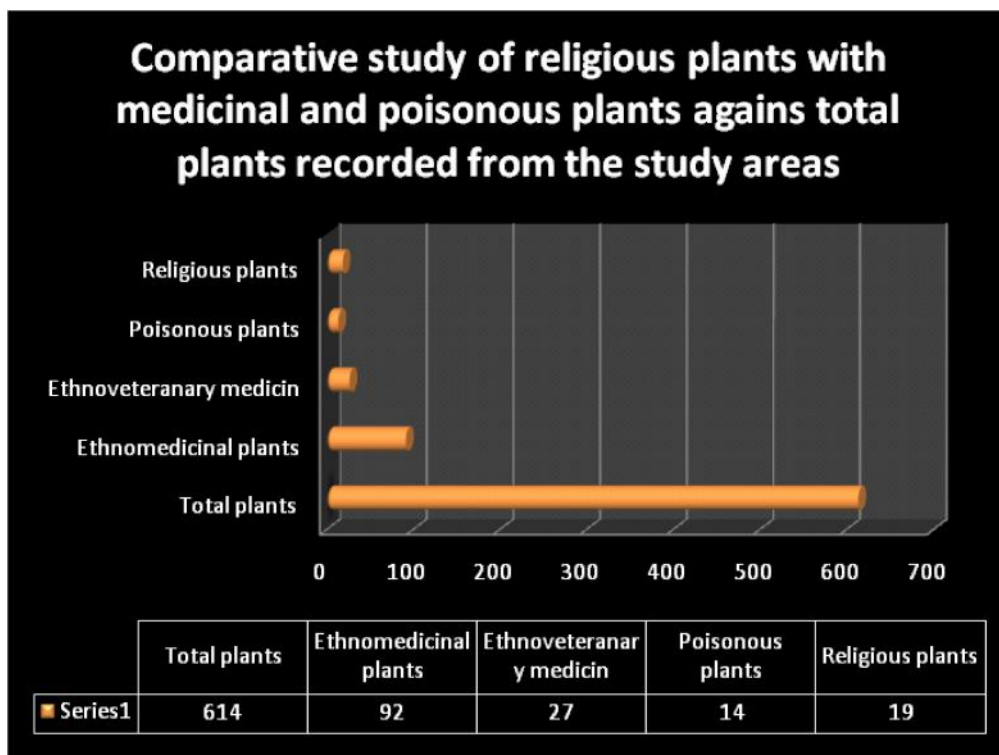
**Fig. 9.2.** Comparative study of ethnomedicinal plants and ethnoveterinary medicinal plants

*Malvaviscus arboreus* var. *penduliflorus*, *Hibiscus rosa-sinensis*, *Datura metel*, *Datura stramonium*, *Clitoria ternatea*, *Catharanthus roseus* etc flowers uses in worship. *Clitoria ternatea* flowers uses only in Shoni puja. Flowers and fruits of *Datura metel* and *Datura stramonium* uses only in Shiva puja.

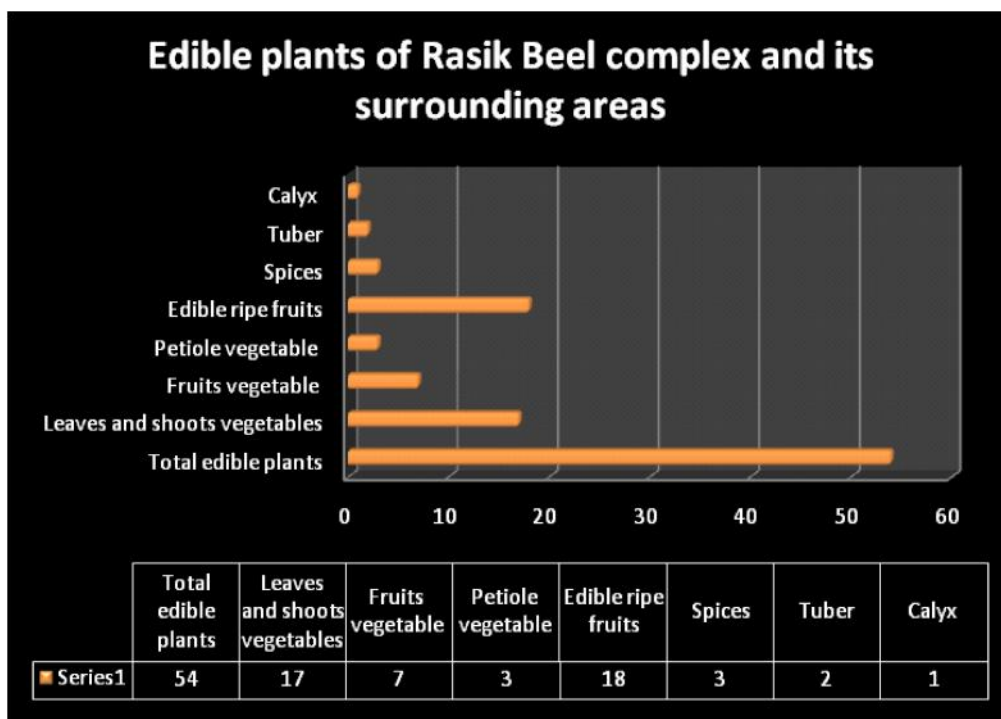
*Alternanthea philoxeroides*, *Alternanthera paronychioides*, *Alternanthera sessilis*, *Amaranthus blitum* subsp. *oleraceus*, *Amaranthus spinosus*, *Amaranthus viridis*, *Celosia argentea*, *Chenopodium album*, *Chenopodium giganteum*, *Coccinia grandis*, *Deeringia amaranthoides*, *Enydra fluctuans*, *Glinus oppositifolius*, *Ipomoea aquatica*, *Leucas indica*, *Malva verticillata*, *Momordica charantia* and *Piper longum* leaves and tender shoots are used as vegetables. *Nymphaea rubra*, *Nymphaea pubescens* and *Nymphaea nouchali* petiole is used as vegetables and its boiled or fried seeds are eaten as like as rice. Fruits of *Momordica charantia*, *Coccinia grandis*, *Luffa aegyptiaca*, *Luffa acutangula*, *Ficus hispida*, *Carica papaya*, *Artocarpus heterophyllus* etc used as vegetables (Fig. 9.4).

Ripe fruits of *Annona reticulata*, *Annona squamosa*, *Artocarpus heterophyllus*, *Artocarpus lakoocha*, *Carica papaya*, *Citrullus vulgaris*, *Citrus limon*, *Citrus maxima*, *Dillenia indica*, *Dillenia pentagyna*, *Elaeocarpus floribundus*, *Litchi chinensis*, *Morus australis*, *Phyllanthus emblica*, *Syzygium cumini*, *Tamarindus indica*, *Trapa natans* var. *bispinosa* and *Zizyphus mauritiana* are directly eaten. Seeds of *Piper nigrum*, bark of *Cinnamomum verum* and leaves of *Cinnamomum tamala* are used as spice.

Total 173 species of fodder plants are recorded from the study areas. In which 3 species are cultivated for Deer conservation, 27 species of fodder plants are totally aquatic, 35 species tree are recorded which leaves are good fodder, 16 species of climbers found as good fodder. *Aeschynomene indica*, *Alternanthea philoxeroides*, *Alternanthera paronychioides*, *Alternanthera paronychioides*, *Alternanthera pungens*, *Alternanthera sessilis*, *Amischotolype hookeri*, *Celosia argentea*, *Coix lachryma-jobi*, *Cyperus pangorei*, *Eichhornia crassipes*, *Enydra fluctuans*, *Hygrophila phlomioides*, *Hygroryza aristata*, *Ipomoea aquatica*, *Limnophila repens*, *Monochoria hastata* etc are very good fodder of aquatic bodies.



**Fig. 9.3.** Comparative study of religious plants with medicinal plants and poisonous plants against total recorded plants of study areas



**Fig. 9.4.** Types and number of edible plants of study areas



**PATE 13: NTFP, Figure. 139 - 146:** 139. *Diplazium esculentum* a good vegetable, 140. collected *Enydra flactuens*, 141. Village Woman collecting *Diplazium esculentum*, 142. Foresters collecting resin from *Shorea robusta*, 143. Villager collecting Musroom, 144. Local medicin practitioner collect- ing *Piper longum* fruits, 145. Villagers catching fish, 146. Village women carrying fuel wood.



# CHAPTER - X

The Rasik Beel complex is an aggregate of five different wetlands formed by a common water flow of the River Raidak. It is a good house for numerous species of local and migratory birds and is now projected as a tourist's destination and as a bird reserve. This is one well-known wetland in the area not only for its winged guests but also for the aquatic flora and fauna. The desire for declaring Rasik Beel Complex as a Ramsar Site is in the mind of conservationists. But, even today there is no any major step by the authority to demarcate and declare it a wetland of international importance for the conservation of its local as well as the migratory biological elements.

The present attempt to understand the vegetation and flora of the Rasik Beel Complex is an attempt to develop necessary database so that this important wetland can be given much more weightage towards its selection as a Ramsar Site.

### 10.1. The Flora

The present floristic work on Rasik Beel Wetland deals with the recorded 124 angiospermic families, out of which 96 are dicotyledonous and the remaining 28 are monocotyledonous. The details of the numerical classification of the recorded floristic elements are shown in Table 8.1. Out of the recorded total of 614 species, 581 are angiospermic (dicotyledonous 428 and monocotyledonous 153), 3 gymnospermic and the remaining 30 species are pteridophytic.

**Table 10.1.** Numerical representation of different major taxa in Rasik Beel flora

TAXA	Numerical representation		
	Family	Genus	Species
Pteridophyta	17	25	30
Gymnospermia	03	03	03
Dicotyledonae	96	300	428
Monocotyledonae	28	97	153
<b>TOTAL:</b>	<b>144</b>	<b>425</b>	<b>614</b>

**Table 10.2.** Taxonomic distribution of recorded exotics in Rasik Beel flora

Taxa	Numerical representation		
	Cultured	Naturalized	Total
Pteridophyta	0	0	0
Gymnospermia	3	0	3
Dicotyledonae	38	52	90
Monocotyledonae	0	2	2
<b>TOTAL:</b>	<b>41</b>	<b>54</b>	<b>95</b>

In the back ground of local natural vegetation, the flora of the entire study area has been greatly modified. Main reason behind the changes is the establishment of tourism center around Rasik Beel. Clearing of local native vegetation developing plantations with desired species for ornamentation, fodder production, domestic requirement, etc. are the main reasons of modification. Critical analysis of the distribution pattern of all the recorded elements of the Rasik Beel flora

revealed that out of the 614 species, 95 species has been recognized as exotics. Of these 54 species looks completely naturalized and are surviving in the vegetation through self-perpetuation. However, a search into the basic distribution of recorded exotics revealed that 24 of these plants are basically Tropical American, 14 are from South America, 12 from Brazil and Mexico and only 6 species are coming from different other Asian regions.

## 10.2. Exotic Elements

Some of the naturalized exotics are dominating in the area's vegetation and are certainly changing the basic vegetation pattern. Some such species include *Ageratum houstonianum*, *Alternanthera paronychioides*, *Argemone mexicana*, *Chenopodium ambrosioides*, *Chromolaena odorata*, *Cleome rutidospermum*, *Croton bonplandianum*, *Eichhornia crassipes*, *Hyptis suaveolens*, *Lantana camara*, *Mikania micrantha*, *Mimosa invisa*, *Oxalis corniculata*, *Parthenium hysterophorus*, *Stellaria media*, and *Xanthium strumarium*. As the population of all these species are increasing very fast due to their very broad ecological amplitude, so, special attention need to be given to look after their population.

## 10.3. Phyto Sociology

In the pre monsoon Wetland Vegetation, *Salvinia cucullata* showing highest frequency and *Salvinia cucullata* showing highest density. In monsoon season, whole wetland vegetation turns to change and highest frequency and density shows by *Najas graminea*. In postmonsoon Wetland vegetation, *Salvinia natans* has highest frequency but highest density showing by *Azolla pinnata* subsp. *Africana*. Highest EH showing by *Schoenoplectus juncooides* in the pre monsoon Wetland vegetation. In monsoon wetland vegetation highest EH shows by *Colocasia esculenta* and *Typha elephantina* showing heist EH in the Post monsoon vegetation.

In premonsoon ground cover, *Acmella uliginosa* has maximum frequency and maximum density presented by *Achyrospermum wallichianum* *Duchesnea indica* showing maximum IVI. Highest EH presented by *Solanum indicum* This ground cover scenario has been changed in the monsoon vegetation and *Ageratum conyzoides* contain highest frequency. *Clausena excavate*. *Oplismenus burmannii* presented maximum abundance, highest density and also has maximum IVI. Maximum EH presented by *Clausena excavate*. *Pilea cordifolia* and *Synedrella nodiflora* presented highest frequency in the post monsoon ground cover which is totally different from previous season's floral structure. *Crinum amoenum*, *Molinaria capitulata* showing maximum EH in the post monsoon ground cover. Highest IVI presented by *Pilea cordifolia*.

From pre monsoon shrub, *Clerodendrum infortunatum* is dominating species and it makes middle green layer in that drought season. So, *Clerodendrum infortunatum* showing highest frequency, highest abundance, highest density, highest IVI. Highest SDI and highest EH presented by *Dendrocnide sinuate*, *Streblus asper* and *Morus indica*. In the monsoon, *Ichnocarpus frutescens* presented highest frequency with *Clerodendrum infortunatum* and start to change the middle layer of the vegetation cover. Highest density presented by *Ichnocarpus frutescens*. Highest EH presented by *Zizyphus mauritiana* and *Bridelia retusa*. Highest IVI presented by *Ichnocarpus frutescens*. Maximum dence middle layer seen in post monsoon season. *Lantana camara* showing highest frequency and highest density. *Solanum torvum* presented highest IVI. *Melastoma malabathricum* presented highest EH in the post monsoon shrub layer. From pre monsoon shrub data, highest SDI and highest EH presented by *Dendrocnide sinuate*, *Streblus asper* and *Morus indica*. *Zizyphus mauritiana*, *Bridelia retusa* and *Premna latifolia* presented highest SDI. In post monsoon shrub vegetation, *Melastoma malabathricum* presented highest EH.

In canopy layer of the vegetation, *Oroxylum indicum*, *Neolamarckia cadamba* and *Bischofia javanica* presented highest frequency. Highest density showing by *Bischofia javanica*.

In the tree vegetation, highest SDI presented by *Chukrassia tabularis*, *Polyalthia longifolia* and *Magnolia champaca*. Highest EH shows by *Polyalthia longifolia* and lowest by *Bischofia javanica*. Menhinick Indices (D) showing 1.626 and Margalef Indices (RI) is 22.811 in canopy cover.

#### 10.4. Common Fauna

Biological diversity is not only deals with plants, it also deals with faunal and microbial diversity. During the study, very little attention was expended for observing and listing of faunal diversity. However, present survey recorded: 3 species of Annelids, 37 species of fishes, Amphibians 4 species, Reptiles 9 species, Mollusca 5, Mammals 9 and Birds 135 species.

**10.4.1. Threats from Free Fishing:** A large part of the beel area is allowed free for fishing. The villagers cultivate economically important exotic fishes in that area. There is no obstacle between the conserved and free-fishing areas. So, the exotic fishes are certainly migrating into the conserved area, thereby affecting the original ichthyofauna of Rasik Beel. Due to regular harvesting of fishes, the local fishermen are also disturbing the local and migratory avifauna and damaging the free-floating and other aquatic vegetation. Aquatic rotifers, molluscs, zooplanktons and phytoplanktons are also highly affected by due to fishing and related activities. Poor knowledge of NTFP collection by local villagers is also one important cause of disturbing the food production and food-web leading to the food crisis of aquatic birds. Ecotourism also seriously disturbing the local floral and faunal communities.

#### 10.5. Introduced Ornamentals

From the present survey, 70 species of plants have been recorded, which are planted in the park, gardens and other conservatory sites. *Roystonea regia* has been planted on the forest margin near the entrance gate. *Polyalthia longifolia* planted almost in all sectors of park and gardens. *Nymphaea nouchali*, *Nymphaea pubescens*, *Nymphaea rubra* are abundant aquatic plants in the protected part of Rasik Beel complex near the park and Shishu Udyan. *Bougainvillea glabra*, *Bougainvillea spectabilis*, *Acalypha hispida*, *Aerva sanguinolenta*, *Alcea rosea*, *Artemisia indica*, *Barleria cristata*, *Barleria lupulina*, *Barleria strigosa*, *Bauhinia purpurea*, *Bauhinia variegata*, *Caesalpinia pulcherrima*, *Callistemon lanceolatus*, *Camellia japonica*, *Cereus repandus*, *Catharanthus roseus*, *Clitoria ternatea*, *Hibiscus mutabilis*, *Hibiscus rosa-sinensis*, *Impatiens balsamina*, *Impatiens trilobata*, *Ixora acuminata*, *Jasminum sambac*, *Mirabilis jalapa*, *Ocimum tenuiflorum*, *Ocimum basilicum*, *Piper nigrum* etc. are planted in the main park of the Rasik Beel only for beautification.

#### 10.6. Useful Plants

**10.6.1. Trees:** As much as 45 species of tree has been planted in the area which have good timber value. However, some of these are also having other types of importance too! Bird-food, bird-nesting etc. are desired characters in such a bird sanctuary. *Bischofia javanica*, *Magnolia champaca*, *Peltophorum pterocarpum*, *Shorea robusta*, *Swietenia macrophylla*, *Swietenia mahagoni*, *Tectona grandis*, *Terminalia arjuna*, *Terminalia bellirica* are planted by forest department basically for these purposes.

*Salix tetrasperma* is also introduced recently for the nature of its branching, which is very much suitable for bird nesting. *Terminalia arjuna* also planted in the middle Island and parts of Baroijan and Chhotoijan Beel areas for its Bird-nest supporting branching pattern.

**10.6.2. Ethno-NTFP Plants:** During the present study, survey for traditional uses of local plants was conducted in the nearby villages and in the markets and/or bazars of the nearby areas with the help of many local people, including collectors and medical practitioners. Most important of them

were Mr. Bipul Barman from Rasik Beel village and Mr. Dinu Barman, a traditional medicine practitioner of Bochamari village. A total of 283 species of useful plants recorded of which 92 species are medicinal, 27 species ethnoveterinary, 54 species as vegetable or edible fruit producing, 14 species used in various religious purposes, 4 species as spice, and 173 species used as fodder for their domestic animals. However, till date no detailed ethnobotanical survey has been conducted in the Coochbehar district though good proportion of district-population is tribal. Former kings of Coochbehar were encouraging Ayurvedic treatment and there was well established Ayurved Dispensary and an Ayurvedic Garden inside the Coochbehar Township. Sporadic publications records of Medicinal Plants (Bandyopadhyay *et al.* 2005) from some areas of Coochbehar and nearby districts. But, the fast reduction of natural vegetation in the entire region is also endangering the Medicinal Plants. So, it is now important to take up complete survey for Medicinal Plants in the entire area and to take up necessary measures for their sustainable conservation.

From the present survey, 614 species of plants are recorded from the study area, of which 283 species are used by local people to their daily life and in different social activities. But, only 52 species are recorded as marketable NTFP plants. But, the price fetched by the NTFPs in local markets is very low. As much as 92 species of medicinal plants, 27 ethnoveterinary plants, 54 edible plants as vegetable or ripe fruits, 14 plants used in various religious purposes, 4 plants use as spice are recorded from the study areas. However, only some edible fruits and few vegetables are marketed, others are collected by the people for their own use consumption and has no priced demand in the market.

**10.6.2.1. Sources:** *Aegle marmelos*, *Annona reticulata*, *Annona squamosa*, *Areca catechu*, *Artocarpus heterophyllus*, *Carica papaya*, *Cinnamomum tamala*, *Cinnamomum verum*, *Cocos nucifera*, *Curcuma longa*, *Litchi chinensis*, *Piper nigrum* etc not available in the forests areas, but those are cultivated in their forest villages and forests land of village side. *Aeschynomene indica*, *Colocasia esculenta*, *Enydra fluctuans*, *Lasia spinosa*, *Nymphaea nouchali*, *Nymphaea pubescens*, *Nymphaea rubra*, *Trapa natans* var. *bispinosa* etc they collected from Rasik Beel complex. *Amaranthus viridis*, *Amorphophallus bulbifer*, *Artocarpus lakoocha*, *Bambusa balcooa*, *Bambusa tulda*, *Chenopodium album*, *Chenopodium giganteum*, *Citrus limon*, *Citrus maxima*, *Dillenia indica*, *Dioscorea bulbifera*, *Diospyros malabarica*, *Elaeocarpus floribundus*, *Luffa acutangula*, *Luffa aegyptiaca*, *Lycopersicon esculentum*, *Momordica charantia*, *Musa balbisiana*, *Phyllanthus emblica*, *Sida acuta*, *Syzygium cumini*, *Tamarindus indica*, *Terminalia bellirica* and *Zizyphus mauritiana* they collecting from the forests.

**10.6.2.2. Ethnomedicinal Plants:** From the present survey, 92 species are recorded as ethnomedicinal plants. So many plants which they use for treatment of disease, but the plants or plant parts they use as vegetable regularly or they eat ripe fruits regularly. Local kabiraj ie. Medicin practitioner suggested his patients to take regularly *Alternanthera sessilis*, *Amaranthus spinosus*, *Amaranthus viridis*, *Annona squamosa*, *Azadirachta indica*, *Carica papaya*, *Centella asiatica*, *Citrullus vulgaris*, *Citrus limon*, *Citrus maxima*, *Glinus oppositifolius*, *Mangifera indica*, *Morus alba*, *Paederia foetida*, *Piper longum*, *Premna latifolia*, *Psidium guajava*, *Punica granatum* etc for good health. And he also advice *Alternanthera sessilis*, *Amaranthus spinosus*, *Amaranthus viridis*, *Azadirachta indica*, *Carica papaya*, *Centella asiatica*, *Glinus oppositifolius*, *Paederia foetida* and *Premna latifolia* to use as regular vegetable.

**10.6.2.3. Ethnoveterinary Plants:** From the present survey, 27 species of plants are recorded, which are uses as ethnoveterinary medicinal plants. Somany plants which they use for human treatment also. *Alstonia scholaris*, *Amorphophallus bulbifer*, *Cannabis sativa*, *Nyctanthes arbor-tristis*, *Persicaria hydropiper* and *Vitex negundo* are poisonous plants, but the use these for removing lice or body sores or vermicides.

**10.6.2.4. Poisonous Plants:** From the present survey, 14 species of plants are recorded those are uses poisonous plants. Some poisonous plants they use include ethnomedicinal or ethnoveterinary plants. *Alstonia scholaris*, *Cannabis sativa*, *Careya arborea*, *Cheilocostus speciosus*, *Datura metel*, *Datura stramonium*, *Diospyros malabarica*, *Moringa oleifera*, *Murraya koenigii*, *Plumbago zeylanica* etc use as ethnomedicinal or ethnoveterinary plants. *Murraya koenigii* and *Moringa oleifera* they use as vegetable also. The ripen fruits of *Diospyros malabarica* is edible and very testy.

**10.6.2.5. Religious & Cultural Plants:** From the present survey, 19 species of plants are recorded to use in various religious activities. The leaves of *Aegle marmelos*, *Cynodon dactylon*, *Ocimum tenuiflorum* and *Saccharum spontaneum* and the fruits of *Aegle marmelos*, *Areca catechu*, *Datura metel*, *Datura stramonium* are uses in various worship. The *Tagetes patula*, *Tabernamontana divaricata*, *Malvaviscus arboreus* var. *penduliflorus*, *Hibiscus rosa-sinensis*, *Datura metel*, *Datura stramonium*, *Clitoria ternatea*, *Catharanthus roseus* etc flowers uses in worship. *Clitoria ternatea* flowers uses only in Shoni puja. Flowers and fruits of *Datura metel* and *Datura stramonium* uses only in Shiva puja.

**10.6.2.5. Edible Plants:** From the present survey, 54 species of plants are recorded as edible plants. Of these 3 species used as species. The tender shoots and leaves of 17 species use as vegetable. In addition, the fruits of 7 species and the long pedicel of 3 species of *Nymphaea* are used as vegetables.

Leaves and tender shoots of *Alternanthera philoxeroides*, *Alternanthera paronychioides*, *Alternanthera sessilis*, *Amaranthus blitum* subsp. *oleraceus*, *Amaranthus spinosus*, *Amaranthus viridis*, *Celosia argentea*, *Chenopodium album*, *Chenopodium giganteum*, *Coccinia grandis*, *Deeringia amaranthoides*, *Enydra fluctuans*, *Glinus oppositifolius*, *Ipomoea aquatica*, *Leucas indica*, *Malva verticillata*, *Momordica charantia* and *Piper longum* are used as vegetables. Pedicels of *Nymphaea rubra*, *N. pubescens* and *N. nouchali* are used as vegetables and their seeds are boiled or fried and eaten as substitute to rice. Fruits of *Momordica charantia*, *Coccinia grandis*, *Luffa aegyptiaca*, *Luffa acutangula*, *Ficus hispida*, *Carica papaya*, *Artocarpus heterophyllus* etc. are also used as vegetables.

Ripe fruits of *Annona reticulata*, *Annona squamosa*, *Artocarpus heterophyllus*, *Artocarpus lakoocha*, *Carica papaya*, *Citrullus vulgaris*, *Citrus limon*, *Citrus maxima*, *Dillenia indica*, *Dillenia pentagyna*, *Elaeocarpus floribundus*, *Litchi chinensis*, *Morus australis*, *Phyllanthus emblica*, *Syzygium cumini*, *Tamarindus indica*, *Trapa natans* var. *bispinosa* and *Ziziphus jujuba* are directly eaten. Seeds of *Piper nigrum*, bark of *Cinnamomum verum* and leaves of *Cinnamomum tamala* are used as spices.

**10.6.2.6. Fodders:** A total of 173 species of fodder plants have been recorded from the study areas. Of these 3 species – *Alpinia nigra*, *Zingiber montanum* and *Saccharum spontaneum* are cultivated to feed the herd of Deer under conservation, 27 species of fodder plants are totally aquatic; the leaves and twigs of 35 species of trees were found to be good fodder; 16 species of climbers were also as good fodder. *Aeschynomene indica*, *Alternanthea philoxeroides*, *Alternanthera paronychioides*, *Alternanthera pungens*, *Alternanthera sessilis*, *Amischotholype hookeri*, *Celosia argentea*, *Coix lachryma-jobi*, *Cyperus pangorei*, *Eichhornia crassipes*, *Enydra fluctuans*, *Hygrophila phlomioides*, *Hygroryza aristata*, *Ipomoea aquatica*, *Limnophila repens*, *Monochoria hastata* etc are very good fodder from aquatic habitat.

## 10.7. Main Threats

Rasik Beel complex become a popular tourist spot since 2003 after establishment of Ghorial, Tortoise, Deer and Leopard ex-situ conservation center. Local people, Tourists, Students regularly visited there and create threats.

### 10.7.1. Threats from Free Fishing

**10.7.1.1. Threats to Native fishes:** A large part of the beel area is allowed free for fishing. The villagers cultivate economically important exotic fishes in that area. There is no obstacle between the conserved and free-fishing areas. So, the original ichthyofauna of Rasik Beel regularly decreases. Natural habitat of the local fishes has been damaged and due to exotic fish culture, the food habit of local ichthyofauna has been changed. Local farmers use pesticide in their beel side cultivation lands and make a great threats to the native fishes.

**10.7.1.2. Threats to Birds:** Due to regular harvesting of fishes, the local fishermen are also disturbing the local and migratory avifauna and damaging the free-floating and other aquatic vegetation. Many times avifauna catches by the local people with fishing net. Nests and eggs of local aquatic birds also damaged by the fishermen in time of fishing. Poor knowledge of NTFP collection by local villagers is also one important cause of disturbing the food production and food-web leading to the food crisis of aquatic birds. Ecotourism also seriously disturbing the local floral and faunal communities. In picnic time more the 100 of Mick create noise in the forests within 100m of Beel areas and disturbing Birds.

**10.7.1.3. Threats to other aquatic organisms:** Aquatic rotifers, molluscs, zooplanktons and phytoplanktons are also highly affected by due to fishing and related activities. Fisher men damaging the natural habitat and uprooted and uplifted aquatic plants due to clearing the fishing area and damaging the faunal population.

**10.7.1.4. Threats to Vegetation:** Poor knowledge of NTFP collection by local villagers the forests vegetation facing threats. So many species like *Rauwolfia serpentine*, *Aristolochia indica* etc uprooted by the local people before flowering and fruiting. They collected fodder and fuel regularly by cutting of immature shrubs and juvenile trees and damaging the vegetation. In the picnic season, more than 100 picnic parties cooked their foods and enjoying in the marginal forests areas and damaging the forest vegetation. Tourists also damaging the forests vegetation.

**10.7.1.5. Threats created by Foresters:** For more tourists attraction and earn more money, Forest Department, Government and NGOs are establishing Tourism Business and Lodging system, Watch Towers etc and increasing ex-situ conservation and exotic plantation which makes threats to the local environments and natural population.

**10.7.1.4. Threats to Wetlands:** Local people acquired submerge and immerse lands for paddy cultivation. After 2 – 3 years of acquiring land, they establish house and the Wetland complex area decreasing every day.

### 10.8. Possible Remedies

**10.8.1. Controlling Fish culture:** Surrounding village people of the water bodies are fisher men and a large part of the beel area is allowed free for fishing. The villagers cultivate economically important exotic fishes in that area. It is not possible to stop fishing, but may possible to aware and proper training them about fish culture and how we save native fishes for our future. Need to made a barrier between the conserved and free-fishing areas. Forest Department can run a project to change their livelihood pattern. They need to proper training and economic help to change their life style and livelihood which can change them from fisher men to other. Young and educated villagers can involve for protection of the natural resources and forests.

Local farmers using pesticides in their crop field which is wash and flow to the beels causes to fish death. So, local farmers also need to proper awareness about this problems.

**10.8.2. Awareness about migratory Birds:** Villagers need to aware about migratory Birds and how can we care them and save them. Villagers can be involved in floral and faunal survey and as a tourist guide with proper training. Fisher men need to training to save nests and egg of aquatic birds during their fishing and creating distance to migratory birds dominated areas.

**10.8.3. Training about Natural resources:** Poor knowledge of NTFPs collection by local villagers is also one important cause of damaging natural resources. So, need to regular awareness programme about collection procedure of various natural resources, collection time, government and scientific formalities and procedure. And also create a market for the collected forests products where the collectors would not be cheated by the agents.

**10.8.4. Controlling Ecotourism:** Tourism business is the most popular business to Forest Departments, Tourism Departments, NGOs etc and not possible to stop this tends. But it should be controlled by proper rules and acts by the Government. Tourism related personnel should be trained and knowledgeable and also nature loved than money. Picnic spot need to shifted away from the water bodies.

**10.8.5. Save water bodies:** Local people acquired submerge and immerge lands for paddy cultivation. Forest Department should take step to stop those activities with the help of other administrative section and Land Department.

## 10.9. Final Assessment

In the back ground of local natural vegetation, the flora of the entire study area has been greatly modified. Main reason behind the changes is the establishment of tourism center around Rasik Beel. Clearing of local native vegetation developing plantations with desired species for ornamentation, fodder production, domestic requirement, etc. are the main reasons of modification. Rasik Beel Wetland deals with the recorded 124 angiospermic families, out of which 96 are dicotyledonous and the remaining 28 are monocotyledonous. Out of the recorded total of 614 species, 581 are angiospermic (dicotyledonous 428 and monocotyledonous 153), 3 gymnospermic and the remaining 30 species are pteridophytic. Out of the 614 species, 95 species has been recognized as exotics. Of these 54 species looks completely naturalized.

Biological diversity is also very rich. From the present survey 3 species of Annelids, 37 species of fishes, Amphibians 4 species, Reptiles 9 species, Mollusca 5, Mammals 9 and Birds 135 species has been recorded.

This forest and Beel complex is the mother of local forest villagers. Their life and livelihood depends on the Forest parts and wetlands. From the present survey, 614 species of plants are recorded from the study area, of which 283 species are used by local people to their daily life and in different social activities. But, only 52 species are recorded as marketable NTFP plants. The price fetched by the NTFPs in local markets is very low. As much as 92 species of medicinal plants, 27 ethnoveterinary plants, 54 edible plants as vegetable or ripe fruits, 14 plants used in various religious purposes, 4 plants use as spice are recorded from the study areas. 173 species used as fodder for their domestic animals. However, only some edible fruits and few vegetables are marketed, others are collected by the people for their own use consumption and have no priced demand in the market.

A total 70 species of ornamental and garden plants have been recorded, which are planted in the park, gardens and other conservatory sites. And as much as 45 species of tree has been planted in the area which have good timber value.

*Salix tetrasperma* is introduced recently for the nature of its branching, which is very much suitable for bird nesting. *Terminalia arjuna* also planted in the middle Island and parts of Barojan and Chhotojan Beel areas for its Bird-nest supporting branching pattern.



Rasik Beel complex is a popular tourist spot and there establishes Ghorial, Tortoise, Deer and Leopard ex-situ conservation center cum rehabilitation centre by the Forest Department. Local people, Tourists, Students regularly visited there and create threats.

A large part of the beel area is allowed free for fishing. The villagers cultivate economically important exotic fishes in that area. There is no obstacle between the conserved and free-fishing areas. So, the exotic fishes are certainly migrating into the conserved area, thereby affecting the original ichthyofauna of Rasik Beel. Due to regular harvesting of fishes, the local fishermen are also disturbing the local and migratory avifauna and damaging the free-floating and other aquatic vegetation. Aquatic rotifers, molluscs, zooplanktons and phytoplanktons are also highly affected by due to fishing and related activities. Poor knowledge of NTFP collection by local villagers is also one important cause of disturbing the food production and food-web leading to the food crisis of aquatic birds. Ecotourism also seriously disturbing the local floral and faunal communities. In the picnic season, more than 100 picnic parties cooked their foods and enjoying in the marginal forests areas and damaging the forest vegetation. Tourists also damaging the forests vegetation. Local people acquired submerge and immerse lands for paddy cultivation. After 2 – 3 years of acquiring land, they establish house and the Wetland complex area decreasing every day.

# CHAPTER - XI

## CONCLUSION

Cooch Behar is a historically important district of West Bengal in India. The name 'Cooch Behar' has been derived from the *Koch Rajbongshi* tribe who were indigenous to this area since the time of Banasura, the great king of Asura. A Sanskrit word 'Bihar' (to travel) is the key source of word 'Behar', which means the land used to travel by 'Koch Rajbangshi' king. Koch Rajbangshi king has ruled the area since 16<sup>th</sup> century. In 1947, the state came to the dominion of India and merged with the Union of India shortly afterwards. On 19<sup>th</sup> January 1950, the state of Cooch Behar emerged as a new District for the Indian state of West Bengal (Banerjee, 1884; Ahamed, 1990). District Cooch Behar is located at the northeastern corner boundary of the State West Bengal. The Northern side is bounded by Jalpaiguri district, state of Assam in the eastern side to south and there is Bangladesh on the western border. The district is an important part of Himalayan Foothills and Duars of West Bengal.

In Bengali, the word 'Beel' means large water body. Rasik Beel is a complex of eight large wetlands and are known by different names: Noldoba Beel, Bochamari Beel, Rasik Beel, Batikata Beel, Ververi Beel, Borojan Beel, Chhotojan Beel and Raichangmari Beel. The Rasik Beel complex is lies between *Burah Raidak* and *Ghoramara* Rivers in the Salbari Block under Tufanganj Sub-Division of the District of Cooch Behar. The geographical location at the central part of the lake is 89°44' 10" E Longitude and 26° 25' 40" N Latitude. The Rasik Beel is located very near to two IUCN recognized Hotspots for Conservation, namely 'Himalaya' and 'Indo-Burma' (Biswas, 2013). It is an Ox Bow Lake and is a left over detached part of the river Raidak. The area of the Beel is 178 hectors (Chowdhuri and Pal, 2010; Ahamed, 1990; Chowdhuri, 1903; Paul, 2013). The nearby areas of the Beel was covered with dense forest vegetation (Annonimus, 2005). The Western and North-Western sides are covered with Changmari Protected Forests, North Eastern side is surrounded with Atiamocher Protected Forest and Takomari Protected Forest is spreading on the Eastern side of the Beel complex. But due to rapid increase of human settlements, acquiring land for cultivation and due to continuous legal and illegal timber extraction most of the forested area are now either missing or disappearing fast (Annonimus, 2011). Shifting of the courses of rivers in this part of the country was a common phenomenon in recent-past (Chowdhuri, 1903; Paul, 2013). And, that has created a number of large and small Ox Bow lakes in this region like Rasik Beel, Nildoba Beel, Raichangmari Beel, Bochamari Beel, etc. Rasik Beel wetland complex is surrounded by Chengmari, Baro Salmari, Atiamochar and Takomari protected forests. In Champion & Seth's (1968) classification the area's vegetation matches partially with 4D/SS<sub>2</sub> and 4D/SS<sub>4</sub> *Tropical Seasonal Forest: Syzygium cumini swamp forest* and *Low Swamp Forest*. In the surrounding area, there are about eight villages mostly inhabited by tribal people.

The original vegetation in the surrounding area was basically *Syzygium cumini* dominated semi-evergreen type but most of the natural forests have been removed. Plantations of different exotic and native plants are developing in many areas including the contour of the central island. The Central island is now planted with mainly *Salix tetrasperma*, *Terminalia arjuna* and *Lagerstroemia hirsuta*.

Rasik Beel Wetland deals with the recorded 124 angiospermic families, out of which 96 are dicotyledonous and the remaining 28 are monocotyledonous. Out of the recorded total of 614

species, 581 are angiospermic (dicotyledonous 428 and monocotyledonous 153), 3 gymnospermic and the remaining 30 species are pteridophytic.

In the back ground of local natural vegetation, the flora of the entire study area has been greatly modified. Main reason behind the changes is the establishment of tourism center around Rasik Beel. Clearing of local native vegetation developing plantations with desired species for ornamentation, fodder production, domestic requirement, etc. are the main reasons of modification. Critical analysis of the distribution pattern of all the recorded elements of the Rasik Beel flora revealed that out of the 614 species, 95 species has been recognized as exotics. Of these 54 species looks completely naturalized and are surviving in the vegetation through self-perpetuation. However, a search into the basic distribution of recorded exotics revealed that 24 of these plants are basically Tropical American, 14 are from South America, 12 from Brazil and Mexico and only 6 species are coming from different other Asian regions.

In the pre monsoon Wetland Vegetation, *Salvinia cucullata* showing highest frequency and *Salvinia cucullata* showing highest density. In monsoon season, whole wetland vegetation turns to change and highest frequency and density shows by *Najas graminea*. In postmonsoon Wetland vegetation, *Salvinia natans* has highest frequency but highest density showing by *Azolla pinnata* subsp. *Africana*. Highest EH showing by *Schoenoplectus juncooides* in the pre monsoon Wetland vegetation. In monsoon wetland vegetation highest EH shows by *Colocasia esculenta* and *Typha elephantina* showing heist EH in the Post monsoon vegetation.

In premonsoon ground cover, *Acmella uliginosa* has maximum frequency and maximum density presented by *Achyrospermum wallichianum* *Duchesnea indica* showing maximum IVI. Highest EH presented by *Solanum indicum* This ground cover scenario has been changed in the monsoon vegetation and *Ageratum conyzoides* contain highest frequency. *Clausena excavate*. *Oplismenus burmannii* presented maximum abundance, highest density and also has maximum IVI. Maximum EH presented by *Clausena excavate*. *Pilea cordifolia* and *Synedrella nodiflora* presented highest frequency in the post monsoon ground cover which is totally different from previous season's floral structure. *Crinum amoenum*, *Molineria capitulata* showing maximum EH in the post monsoon ground cover. Highest IVI presented by *Pilea cordifolia*.

From pre monsoon shrub, *Clerodendrum infortunatum* is dominating species and it makes middle green layer in that drought season. So, *Clerodendrum infortunatum* showing highest frequency, highest abundance, highest density, highest IVI. Highest SDI and highest EH presented by *Dendrocnide sinuate*, *Streblus asper* and *Morus indica*. In the monsoon, *Ichnocarpus frutescens* presented highest frequency with *Clerodendrum infortunatum* and start to change the middle layer of the vegetation cover. Highest density presented by *Ichnocarpus frutescens*. Highest EH presented by *Zizyphus mauritiana* and *Bridelia retusa*. Highest IVI presented by *Ichnocarpus frutescens*. Maximum dence middle layer seen in post monsoon season. *Lantana camara* showing highest frequency and highest density. *Solanum torvum* presented highest IVI. *Melastoma malabathricum* presented highest EH in the post monsoon shrub layer. From pre monsoon shrub data, highest SDI and highest EH presented by *Dendrocnide sinuate*, *Streblus asper* and *Morus indica*. *Zizyphus mauritiana*, *Bridelia retusa* and *Premna latifolia* presented highest SDI. In post monsoon shrub vegetation, *Melastoma malabathricum* presented highest EH.

In canopy layer of the vegetation, *Oroxylum indicum*, *Neolamarckia cadamba* and *Bischofia javanica* presented highest frequency. Highest density showing by *Bischofia javanica*. In the tree vegetation, highest SDI presented by *Chukrassia tabularis*, *Polyalthia longifolia* and *Magnolia champaca*. Highest EH shows by *Polyalthia longifolia* and lowest by *Bischofia javanica*. Menhinick Indices (D) showing 1.626 and Margalef Indices (RI) is 22.811 in canopy cover.

Biological diversity is not only deals with plants, it also deals with faunal and microbial diversity. During the study, very little attention was expended for observing and listing of faunal diversity. However, present survey recorded 3 species of Annelids, 37 species of fishes, Amphibians 4 species, Reptiles 9 species, Mollusca 5, Mammals 9 and Birds 135 species.

A large part of the beel area is allowed free for fishing. The villagers cultivate economically important exotic fishes in that area. There is no obstacle between the conserved and free-fishing areas. So, the exotic fishes are certainly migrating into the conserved area, thereby affecting the original ichthyofauna of Rasik Beel. Due to regular harvesting of fishes, the local fishermen are also disturbing the local and migratory avifauna and damaging the free-floating and other aquatic vegetation. Aquatic rotifers, molluscs, zooplanktons and phytoplanktons are also highly affected by due to fishing and related activities. Poor knowledge of NTFP collection by local villagers is also one important cause of disturbing the food production and food-web leading to the food crisis of aquatic birds. Ecotourism also seriously disturbing the local floral and faunal communities.

From the present survey, 70 species of plants have been recorded, which are planted in the park, gardens and other conservatory sites. As much as 45 species of tree has been planted in the area which have good timber value. However, some of these are also having other types of importance too! Bird-food, bird-nesting etc. are desired characters in such a bird sanctuary. *Bischofia javanica*, *Magnolia champaca*, *Peltophorum pterocarpum*, *Shorea robusta*, *Swietenia macrophylla*, *Swietenia mahagoni*, *Tectona grandis*, *Terminalia arjuna*, *Terminalia bellirica* are planted by forest department basically for these purposes.

*Salix tetrasperma* is also introduced recently for the nature of its branching, which is very much suitable for bird nesting. *Terminalia arjuna* also planted in the middle Island and parts of Baroijan and Chhotojan Beel ares for its Bird-nest supporting branching pattern.

From the present survey, 614 species of plants are recorded from the study area, of which 283 species are used by local people to their daily life and in different social activities. But, only 52 species are recorded as marketable NTFP plants. But, the price fetched by the NTFPs in local markets is very low. As much as 92 species of medicinal plants, 27 ethnoveterinary plants, 54 edible plants as vegetable or ripe fruits, 14 plants used in various religious purposes, 4 plants use as spice are recorded from the study areas. and 173 species used as fodder for their domestic animals. However, only some edible fruits and few vegetables are marketed, others are collected by the people for their own use consumption and has no priced demand in the market.

Rasik Beel complex become a popular tourist spot since 2003 after establishment of Ghorial, Tortoise, Deer and Leopard ex-situ conservation center. Local people, Tourists, Students regularly visited there and create threats.

A large part of the beel area is allowed free for fishing. The villagers cultivate economically important exotic fishes in that area. There is no obstacle between the conserved and free-fishing areas. So, the original ichthyofauna of Rasik Beel regularly decreases. Natural habitat of the local fishes has been damaged and due to exotic fish culture, the food habit of local ichthyofauna has been changed. Local farmers use pesticide in their beel side cultivation lands and make a great threats to the native fishes.

Due to regular harvesting of fishes, the local fishermen are also disturbing the local and migratory avifauna and damaging the free-floating and other aquatic vegetation. Many times avifauna catches by the local people with fishing net. Nests and eggs of local aquatic birds also damaged by the fishermen in time of fishing. Poor knowledge of NTFP collection by local villagers is also one important cause of disturbing the food production and food-web leading to the food crisis of aquatic birds. Ecotourism also seriously disturbing the local floral and faunal communities. In picnic time

more the 100 of Mick create noise in the forests within 100m of beel areas and disturbing Birds. In the picnic season, more than 100 picnic parties cooked their foods and enjoying in the marginal forests areas and damaging the forest vegetation. Tourists also damaging the forests vegetation.

Local people acquired submerge and immerge lands for paddy cultivation. After 2 – 3 years of acquiring land, they establish house and the Wetland complex area decreasing every day.

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# **ANNEXURE**

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## Floristic diversity of Rasik Beel and its adjoining areas in Coochbehar district of West Bengal, India

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### Abstract

Rasik Beel falls under Cooch Behar Forest Division and is a large natural wetland of North Bengal, one-third of which is protected and the remaining part used for all purposes. Vegetation of the area partially matches with 4D/SS2 and 4D/SS4 vegetation types in Champion & Seth's (1968) forest type classification. Floristic survey of this beel complex recorded the occurrence of 614 species of plants, belonging 421 genera of 146 families. Of these, 456 species are belonging to Magnoliopsida, 119 species for Liliopsida, 3 species of gymnosperms and Pteridophytes are represented by 36 species. Floral diversity in both aquatic and land vegetation are very rich.

**Key words:** Rasik Beel, aquatic & land vegetation, plant diversity.

### INTRODUCTION

*Flora of British India* (Hooker 1872 – 1897) had covered all terrestrial and aquatic flora of India. Trees and shrubs of the Northern part of West Bengal had been explored by Cowan & Cowan (1929). Banerjee (1993) and Das *et al.* (2003) worked on Jaldapara National Park and Biswas *et al.* (2012) published a detail dicotyledonous flora of Gossaihat Beel. Wetlands of India were floristically explored by many people including Biswas & Calder (1937), Subramanyam (1962), Deb (1976), Cook (1996) and Fassett (2000). Pal & Dutta Choudhury (2010) and Das (2013) worked on the wetlands of Assam. The conservation of wetlands and their macrophytic flora in India was reviewed by IUCN (1971), Gopal (1973), WWF India (1993) and Williams (1997). Bandyopadhyay *et al* (2005) listed aquatic and wetland vascular plants of Cooch Behar district. But, a detail study on Rasik Beel area was not done previously.

Shifting of the courses of rivers in this part of the country was a common phenomenon in recent-past. That has created a number of large and small Ox Bow lakes in this region like Rasik Beel, Nildoba Beel, Raichangmari Beel, Bochamari Beel, etc. The Rasik Beel is located very near to two IUCN recognized biodiversity Hotspots, namely 'Himalaya' and 'Indo-Burma'. It is situated in the Tufanganj Subdivision of the District of Coochbehar in the northern part of West Bengal and geographically located at the central part of the lake is 89°44'10" E Longitude and 26° 25' 40" N Latitude. It is an Ox Bow Lake and is a left over detached part of the river Raidak. The area of the Beel is 178 hectars. Two branches of this

river are now flowing through two sides of the Rasik Beel in north-south direction and are referred as Raidak I and Raidak II. This wetland complex is surrounded by Chengmari, Baro Salmari, Atiamochar and Takomari protected forests. The Rasik Beel is a wetland complex of five different wetlands formed by a common water flow. In Champion & Seth's (1968) classification the area's vegetation partially matches with 4D/SS<sub>2</sub> and 4D/SS<sub>4</sub> Tropical Seasonal Forest: *Syzygium cumini* swamp forest and Low Swamp Forest. In the surrounding area, there are about eight villages mostly inhabited by tribal people.

### Methodology

Random survey was made throughout the beel area during the years 2007 to 2012. Plants growing in the beel and of the surrounding forest lands were collected, tagged and recorded in the field note book immediately. Specimens were then processed and identified through conventional techniques (Jain & Rao 1977) in the Taxonomy and Environmental Biology Laboratory of the University of North Bengal. Preliminary identification of specimens were made using literature like Grierson *et al.* (1983 – 2001), Bora & Kumar (2003); Hajra *et al.* (1995, 1997); Sharma *et al.* (1993a, 1993b, 1993c); Singh *et al.* (2000) and Anonymous (1997). Finally the specimens are matched at NBU and CAL and stored in the NBU herbarium.

## RESULT AND DISCUSSION

### The flora

After the comprehensive floristic survey, it is realized that the Rasik Beel wetland complex is bestowed with immensely rich flora. A total of 575 species under 391 genera belonging to 124 families of angiosperms, 3 genera and 3 species of gymnosperms under 3 families, besides 36 species of fern and fern allies under 27 genera belonging to 19 families have been recorded from Rasik Beel wetland area during the present exploration. The reason for sustentation of enormous richness in floral diversity within the area is because of the perennial nature of this water body, a large portion of which kept undisturbed for many years. However, 2/3<sup>rd</sup> area of the beel is open for fishing and water sports in the name of ecotourism. Such activities generally force changes in the habitat, which, in turn, promote the changes in the floristic composition of vegetation and their natural complex inter-relationships. The other reason could be the sufficient rainfall varying from 200 – 400 cm per annum distributed in 7 – 8 months of the year forced many terrestrial species to adopt in a marsh habitat and these are enriching the marginal flora of the water body.

The study area is located very near to the "Himalaya Biodiversity Hotspot" in the East Himalayan region – an area which is very much well known for its extremely rich and diversified biological resources. The water courses and surrounding vegetation of Rasik Beel provided enormous variation leading to the creation of diversified micro-habitat structures allowing wide diversity of plants to find their suitable home in the area.

The detailed analysis of the total angiosperm flora of the wetland complex and its surrounding area revealed that the distribution and variation in dicots is more prominent over the monocots. It further revealed the existence of numerous important plant species those are directly or indirectly beneficial for the human sustenance. Many of these species have been recorded for their varied potential as food, medicines, etc. for the local inhabitants. Besides, the area is a rich repository of various plant resources including large number of valuable and durable timber-yielding species. A huge number of algal elements are distributed throughout the water body including the species of *Spirogyra*, *Chara*, *Nitela*, *Oedogonium*, *Anabaena*, *Nostoc*, etc.



### Numerical Distribution of Taxa

The present floristic work on Rasik Beel wetland complex deals with an account of 124 Angiosperm families, out of which 97 are of Magnoliopsida and the remaining 27 are of Liliopsida. Again, there are 456 species under 312 genera recorded from the 97 families of Magnoliopsida and 119 species belonging to 79 genera from 27 families of Liliopsida. Only 3 species of Pinophyta belonging to 3 genera under 3 families and a total of 36 species of ferns and fern-allies were recorded under 27 genera belonging to 19 families (Table 1). So, like most of the tropical vegetation dicotyledons are dominating with 66.5 % families, 74.1 % genera and 74.3 % species.

**Table 1.** Numerical distribution of different floristic elements in Rasik Beel wetland complex

Taxa	Numerical representation					
	Family		Genus		Species	
	No.	%	No.	%	No.	%
Pteridophyta	19	13.0	27	6.4	36	5.9
Pinophyta	03	2.0	03	0.7	03	0.4
Magnoliopsida	97	66.5	312	74.1	456	74.3
Liliopsida	27	18.5	79	18.8	119	19.4
<b>TOTAL</b>	<b>146</b>		<b>421</b>		<b>614</b>	

Table 2 provided the detailed numerical representation of different category of taxa, from family to species, represented in Rasik Beel vegetation. A close look into this table expresses the floristic diversity in the study area.

**Table 2.** Numerical representation of Angiospermic taxa for the flora of Rasik Beel

#### A. Magnoliopsida

Family	Genus	Species	Family	Genus	Species
Ranunculaceae	2	2	Onagraceae	1	4
Dilleniaceae	2	2	Trapaceae	1	1
Magnoliaceae	1	1	Passifloreae	1	1
Anonaceae	4	5	Caricaceae	1	1
Menispermaceae	3	4	Cucurbitaceae	9	10
Nymphaeaceae	1	3	Cactaceae	1	1
Papaveraceae	1	1	Molluginaceae	1	2
Fumariaceae	1	1	Apiaceae	4	4
Brassicaceae	4	4	Araliaceae	1	1
Capparidaceae	2	2	Rubiaceae	11	15
Cleomaceae	1	3	Asteraceae	26	30
Violaceae	1	1	Campanulaceae	1	1
Bixineae	1	1	Lobeliaceae	1	2
Polygalaceae	2	3	Myrsinaceae	2	2
Caryophyllaceae	3	5	Sapotaceae	1	1
Portulacaceae	1	2	Ebenaceae	1	1
Tamaricaceae	1	1	Oleaceae	1	3
Elatinaceae	1	1	Apocynaceae	7	7
Hypericineae	1	1	Asclepiadeae	6	6
Guttiferae	1	1	Buddlejaceae	1	1
Ternstroemiaceae	1	1	Gentianaceae	3	3
Dipterocarpaceae	1	1	Hydrophyllaceae	1	1
Malvaceae	4	8	Boraginaceae	2	2
Bombacaceae	1	1	Convolvulaceae	5	10

Family	Genus	Species	Family	Genus	Species
Sterculiaceae	4	4	Cuscutaceae	1	2
Tiliaceae	3	4	Solanaceae	6	12
Oxalidaceae	2	4	Scrophulariaceae	8	16
Balsaminaceae	1	2	Lentibulariaceae	1	3
Rutaceae	7	9	Menyanthaceae	1	2
Simarubaceae	1	1	Bignoniaceae	3	3
Meliaceae	5	7	Acanthaceae	13	22
Icacinaceae	1	1	Verbenaceae	8	13
Celastraceae	1	1	Lamiaceae	7	10
Rhamnaceae	3	4	Nyctaginaceae	4	5
Vitaceae	3	5	Amaranthaceae	8	13
Leeaceae	1	3	Chenopodiaceae	1	2
Sapindaceae	1	1	Polygonaceae	3	10
Anacardiaceae	2	2	Aristolochiaceae	1	1
Moringaceae	1	1	Piperaceae	2	6
Leguminosae	25	44	Lauraceae	2	6
Rosaceae	3	3	Proteaceae	1	1
Crassulaceae	1	1	Euphorbiaceae	12	19
Droseraceae	1	1	Bischofiaceae	1	1
Combretaceae	3	5	Ulmaceae	1	2
Myrtaceae	4	6	Cannabaceae	1	1
Lecythidaceae	1	1	Moraceae	4	11
Melastomataceae	2	2	Urticaceae	7	8
Lythraceae	4	8	Salicaceae	1	1
Punicaceae	1	1			

### B. Liliopsida

Family	Genus	Species	Family	Genus	Species
Hydrocharitaceae	4	4	Juncaceae	1	1
Burmanniaceae	1	1	Arecaceae	5	6
Orchidaceae	6	7	Typhaceae	1	1
Cannaceae	1	1	Araceae	10	11
Zingiberaceae	4	5	Lemnaceae	2	2
Costaceae	1	1	Alismaceae	1	1
Musaceae	2	4	Limnocharitaceae	1	1
Amaryllidaceae	1	1	Potamogetonaceae	1	2
Agavaceae	1	2	Aponogetonaceae	1	1
Hypoxidaceae	1	3	Najadaceae	1	1
Dioscoreaceae	1	4	Eriocaulaceae	1	2
Smilacaceae	1	2	Cyperaceae	7	17
Pontederiaceae	2	3	Gramineae	15	24
Commelinaceae	6	11			

Similarly, Tables 3 and 4 are showing the numerical distribution of gymnosperms and pteridophytes in Rasik Beel vegetation. It is not difficult to realize that all the three recorded gymnosperms are introduced ornamentals. On the other hand, record of 36 species of pteridophytes in the area is a good representation but, certainly, these plants are never dominating in the vegetation.

**Table 3.** Family-wise Numerical representation of Pinophyta of Rasik Beel Wetland.

Family	Genus	Species
Araucariaceae	1	1
Cupressaceae	1	1
Cycadaceae	1	1

**Table 4.** Family-wise numerical representation of Pteridophytes of Rasik Beel Wetland.

Family	Genus	Species	Family	Genus	Species
Adiantaceae	1	1	Ophioglossaceae	1	1
Athyriaceae	1	2	Parkeriaceae	1	2
Azollaceae	1	1	Polypodiaceae	5	6
Dennstaedtiaceae	1	1	Pteridaceae	2	4
Dryopteridaceae	2	2	Salviniaceae	1	2
Equisetaceae	1	1	Schizaeaceae	1	2
Gleicheniaceae	1	1	Selaginellaceae	1	2
Hemionitidaceae	1	1	Tectariaceae	1	1
Huperziaceae	1	2	Thelypteridaceae	3	3
Marsiliaceae	1	1			

### The future

With the recognition of Rasik Beel as a popular tourist spot, the overall morphology of the area is changing very fast. Hundreds of people regularly visiting the place, tourism supporting structures like roads, hotels, offices, recreation facilities, animal cages, etc. are being constructed and all these are affecting the natural habitat of this 'supposed to be' protected area. Numerous species of exotic plants are now introduced for beautification and for raising plantations.

Rasik Beel needs to enjoy all the facilities of one *in situ* conservatory. But, on the contrary, it is now developing as one mixed structure. While, authorities need to consider declaring Rasik Beel as one Ramsar Site, the fact is that like many other protected areas in the country, it is also being exploited for earning revenue only.

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