

## Phytogeography of Barpeta District of Assam, India

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### Abstract

The paper highlights the phytogeographical aspects of the Angiospermic flora of the Barpeta District of Assam, India, which includes the Manas Biosphere Reserve – a world heritage site.

**Key words:** Phytogeography, Barpeta District, Assam.

### INTRODUCTION

Phytogeographically, North-East India represents a highly transitional region where large-scale mingling of the Asiatic and Indian Peninsular floristic elements occurs. The present-day Assam is still lacking an exhaustive publication on its flora and so also a comprehensive phytogeographical treatment of its flora.

The District of Barpeta lies between 26°6' and 26°51' N latitudes and 90°38' and 91°21' E longitudes. It is spreading over an area of 3245 sq km and consists of a nearly uniform plain in the northern bank of the river Brahmaputra where the altitude vary from 40 – 81 m AMSL. The area along the northern boundary is represented by a narrow tract of low foothill of the Bhutan Himalaya (Plate 1).

The district, as a whole, represents a low lying area. Inundation by flood waters is almost an annual feature. The district possesses a large number of aquatic bodies like rivers, ponds, pools, ditches, swamps, etc. The important rivers are the Brahmaputra, Manas, Beki, Chaoulkhowa and Pohumara. The northern strip of the district along the Indo-Bhutan border represents the major part of the Manas Biosphere Reserve – a world heritage site. Except this tract the remaining part of the district has human habitations. Geologically, the district is part of the Himalayan foreland basin that was formed due to the uplifted Himalaya and subsequently filled up by the sediments generated from the Himalayan catchment and brought down by numerous transversely flowing rivers.

The climate of the district is characterized by hot summer with high humidity and moderately cold winter. Perpetual humidity, frequent and heavy rainfall and moderate temperature, warm summer and a cool winter especially distinguish the study area.

The vegetation of the study area consists of Tropical semi-evergreen forests, Tropical deciduous forests, Riparian forests, Tropical grasslands, Tropical savannah, Swamp vegetation, Aquatic vegetation, Roadside vegetation, Plants of house-hold compound, and Vegetation of 'Char' (island) areas.

Some common Angiospermic species contributing to these vegetational types include *Bombax ceiba*, *Duabanga grandiflora*, *Tamarix dioica*, *Artemisia vulgaris*, *Dalbergia sissoo*, *Cassia occidentalis*, *C. tora*, *Acacia catechu*, *Albizia lucida*, *Lannea coromandelica*, *Embllica officinalis*, *Bridelia dichotoma*, *Trewia nudiflora*, *Litsea salicifolia*, *Ceratophyllum demersum*, *Nymphoides*

*hydrophylla*, *Lippia javanica*, *Clerodendrum viscosum*, *Stereospermum chelonoides*, *Grewia sapida*, *Cordia dichotoma*, *Dillenia indica*, *Casearia vareca*, *Alpinia nigra*, *Eichhornia crassipes*, *Scleria levis*, *Cyperus brevifolius*, *Scirpus erectus*, *Saccharum arundinaceum*, *Apluda mutica*, *Chrysopogon zizanioides*, *Themeda arundinacea*, *Axonopus compressus*, *Imperata cylindrica*, *Hemarthria protensa* and *Cynodon dactylon*.

Occurrence of such a variety of taxa in the study area indicates the rich fertility of the soil (Rowntree 1954). Growth pattern of plants exhibits a tendency towards tropical configuration (Plate-2; Fig. 2, 3 & 5). This view authenticates the observation made by earlier workers (Rowntree 1954; Rao & Panigrahi 1961) who suggested that the ultimate climatic climax of the study area would be *Tropical evergreen formation*.

### MATERIALS AND METHODS

Field studies were carried out for five years during 1999 to 2004. Herbarium specimens were prepared following standard herbarium techniques (Jain & Rao 1977). Identification was carried out through direct comparison of the collected specimens with the specimens in different herbaria in the country and that was followed by collection of information regarding distributional significance of all the taxa present in the study area. All the available literature was consulted before analyzing the data for the purpose. Works of Rowntree (1954), Rajkhowa (1961), Rao & Panigrahi (1961), Das & Rajkhowa (1968), Meher-Homji & Misra (1971), Rao (1974) and Jain & Hajra (1975) were found to be handy in compiling the present report.

### RESULTS AND DISCUSSION

A total of 750 taxa (representing species and infra-specific categories), belonging to 134 families of Angiosperms were found to occur in the study area. Out of these, 556 taxa (species and varieties) belong to 106 Dicot families and the remaining 194 taxa belong to 28 monocot families. Table-1 shows the frequency of distribution of the families, genera, species and infra-specific taxa occurring in the study area and in different parts of the world. It reveals that a considerable number of these taxa, especially the species and infra-specific ones, are having distribution only in three geographical areas viz., Asia, South-East Asia and Indo-Malaya. The remaining taxa, however, exhibit wide variation in their distribution viz., Indo-China, Australia, America, Europe, Africa, Mediterranean regions and Himalaya, and thus covering almost the whole world. As such, the phytogeographical distribution shown by the taxa occurring in the study area has more or less authenticated the views expressed by earlier workers. Special mention in this regard may be made of Hooker (1872-1897) who opined that the vast area under the British India is perhaps the richest and is certainly the most varied botanical area on the surface of the globe and one which contains representatives of the floras of both the Eastern and Western Hemispheres.

Table 2 shows the range of distribution of the species and infra-specific taxa occurring in the study area and in other parts of India. It is seen that as many as 187 taxa are reported to be occurring almost throughout India. The two subsequent positions are occupied by the North-East India and Northern India with 149 and 67 species and infra-specific taxa respectively.

Data presented in Tables 1 and 2 show the near conformity with the views put forward by Rao (1974) who was of the opinion that the north east India and north Myanmar represent a highly transitional region, where large-scale mingling of the Asiatic and Indian Peninsular floras has occurred.

**Table 1:** Frequency of distribution of families, genera, species and infra-specific taxa of the study area in different parts of the world.

Name of Region	Frequency of families			Frequency of genera			Frequency of species		
	Total	Dicot	Monocot	Total	Dicot	Monocot	Total	Dicot	Monocot
Indo-China	11	9	2	19	16	3	17	13	4
Indo-Malaya	11	9	2	44	39	5	88	86	2
Asia	18	15	3	60	39	21	113	60	53
South-East Asia	15	12	3	27	21	6	98	66	32
Australia	19	16	3	27	20	7	28	19	9
America	20	16	4	43	34	9	44	33	11
Europe	15	12	3	19	15	4	10	7	3
Africa	19	16	3	46	31	15	48	23	25
Mediterranean	11	9	2	18	13	5	5	3	2
Himalayas	11	9	2	17	14	3	53	46	7

**Table 2:** Frequency of occurrence of species and infra-specific taxa of the study area in other parts of India.

Region of India	Frequency of species			Region of India	Frequency of species		
	Total	Dicots	Monocots		Total	Dicots	Monocots
Throughout	187	143	44	Western India	13	7	6
Greater part	32	26	6	Central India	14	4	10
Throughout plains	7	6	1	N W India	4	3	1
Tropical areas	19	16	3	S W India	9	6	3
Subtropical areas	2	2	0	SE India	1	1	0

Ridley (1942) observed that modern Asiatic flora is largely a relic of the Oligocene flora, as represented in Europe, and which probably occupied all tropical lands. Many of the early genera and perhaps orders seem to have disappeared, owing to changes in land surfaces and climate, but some species of that period seem to have persisted to the present day. Lakhanpal (1970) has attempted to visualize the palaeogeography of India during the early Eocene and Miocene times on the basis of evidence of fossil plants and animals. He lists from the Middle Tertiary of North East India nearly twenty fossil woods, referable to living genera of fourteen families of flowering plants viz., Clusiaceae, Dipterocarpaceae, Elaeocarpaceae, Anacardiaceae, Fabaceae, Combretaceae, Ebenaceae, Sterculiaceae, Burseraceae, Sapindaceae and Lecythidaceae. Significantly, all these families except Dipterocarpaceae and Ebenaceae are represented in the study area. He refers to the palynological evidences for the occurrence of Cyatheaceae, Polypodiaceae, Parkeriaceae, Pinaceae, Schizaeaceae, Podocarpaceae, Potamogetonaceae, Poaceae, Bombacaceae, Rutaceae, Anacardiaceae, Caesalpinaceae, Ericaceae, Polygonaceae, Euphorbiaceae and Fagaceae in the Miocene of North East India. Most of these families are also found to be represented in the present study area. Lakhanpal (1970) believed that the profusion of Dipterocarpaceae in the Middle Tertiary of Eastern India would show that after the first phase of upheaval culminating in the Oligocene, there was continuity of land from western Malaysia to Eastern India, by which the *Dipterocarpus* spread northwards into India. During the Miocene, with rise of the Himalayas, large areas previously occupied by the Tethys Sea were converted into land with numerous water basins. Such moist conditions must have

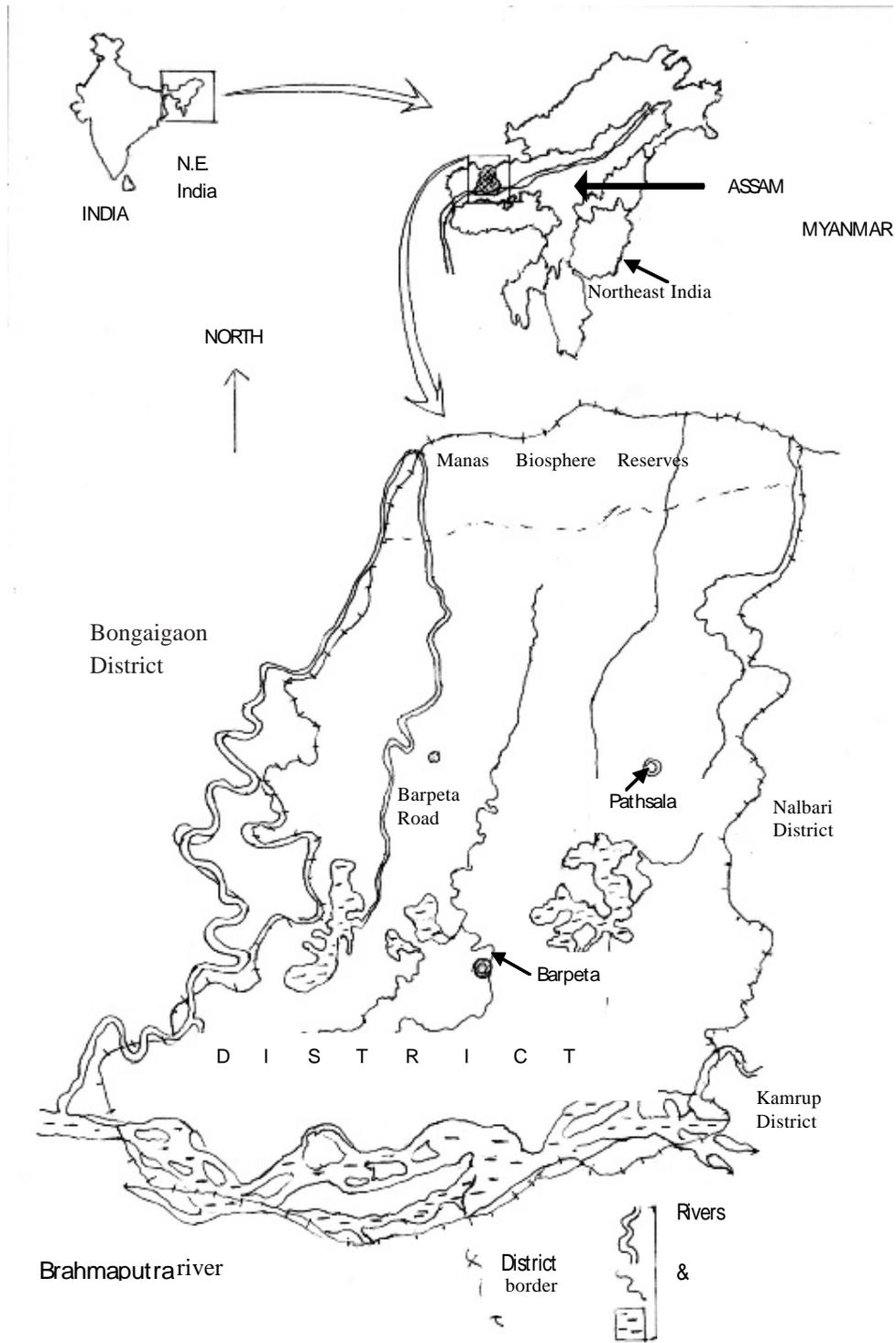


Plate 1: Location map of Barpeta District (not to the scale)



**Figs. 1 - 6:** (1) River Manas at Mathanguri under Manas Biosphere Reserve (MBR). Bhutan foothills are in the background. (2) A rivulet at Kasimdaha at Bansbari under MBR. (3) A loose clump of *Exacum bicolor* Roxburgh (Gentianaceae) among the grasses at Bansbari under MBR. (4) A patch of savannah at Bansbari under MBR with *Plectranthus ternifolius* D. Don (Lamiaceae) in bloom. (5) A stretch of cultivated field at Nagaon village near Barpeta. The white flowered grass at left is *Saccharum arundinaceum* Retzius (Poaceae). (6) Aquatic vegetation dominating with *Hydrilla verticillata* Presler (Hydrocharitaceae) at Gati village near Salbari.

prevailed all along the erstwhile Tethyan region up to Africa, furnishing ideal environment for *Dipterocarpus* to spread upwards.

Hooker (1906) used a unit of ten dominant families in his various botanical provinces as a measure for comparison on the distribution of these families in relation to their distribution in the whole of India. These ten dominant families of flowering plants for India on the basis of the descending order are: Orchidaceae, Fabaceae, Poaceae, Asteraceae, Rubiaceae, Acanthaceae, Euphorbiaceae, Lamiaceae, Cyperaceae and Scrophulariaceae. For North East India, on the other hand, the first ten dominant families of flowering plants in order of their decreasing number of species are: Orchidaceae (550 spp), Poaceae (435 spp), Fabaceae (317 spp), Asteraceae (218 spp), Cyperaceae (182 spp), Euphorbiaceae (165 spp), Rubiaceae (156 spp), Lamiaceae (101 spp), Acanthaceae (90 spp) and Zingiberaceae (75 spp) (Rao 1974; Table 3). According to this account, the single largest genus is *Dendrobium* (62 spp) followed by *Habenaria* (44 spp) and *Impatiens* (42 spp). All these families are represented in the study area although with difference in number of taxa (Table 3).

**Table-3:** Comparative strength of five dominant families in India, North-East India and in the study area in respect of number of species and infra-specific taxa including the names of dominant genera (Figures in bracket denotes the number of species and infra-specific taxa) (after Karthikeyan 2000; Rao 1974)

Dicot Family		Monocot Family		Both Dicot & Monocot Family		
National	Study Area	National	Study Area	National	N. E. India	Study Area
Fabaceae (1158)	Fabaceae (66)	Poaceae (1445)	Poaceae (83)	Poaceae (1445)	Orchidaceae (550)	Poaceae (83)
Asteraceae (906)	Asteraceae (53)	Orchidaceae (1301)	Cyperaceae (36)	Orchidaceae (1301)	Poaceae (435)	Fabaceae (66)
Rubiaceae (695)	Euphorbiaceae (32)	Cyperaceae (652)	Commelinaceae (13)	Fabaceae (1158)	Fabaceae (317)	Asteraceae (53)
Euphorbiaceae (600)	Verbenaceae (22)	Liliaceae (248)	Orchidaceae (10)	Asteraceae (906)	Asteraceae (218)	Cyperaceae (36)
Acanthaceae (584)	Lamiaceae (20)	Zingiberaceae (206)	Araceae (9)	Rubiaceae (695)	Cyperaceae (182)	Euphorbiaceae (32)
<i>Impatiens</i> (200)	<i>Polygonum</i> (18)	<i>Carex</i> (160)	<i>Cyperus</i> (21)	<i>Impatiens</i> (200)	<i>Dendrobium</i> (62)	<i>Cyperus</i> (21)

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The primitive family Magnoliaceae in India has most of its members confined only in the Eastern Himalaya and North East India. The related family Annonaceae is mostly limited to North East India and in the Deccan Peninsula. Among the Balsaminaceae, *Impatiens* is one of the large genera in North East India (Table 3). Six species viz., *Impatiens radicans*, *I. bella*, *I. fimbriata*, *I. acuminata*, *I. porrecta* and *I. paludosa* were reported to be endemic to the Shillong Plateau (Rao 1974). Surprisingly one of these six species i.e., *I. radicans* (*Syn.* of *I. benthamii*) has been recorded from the study area.

Rosaceae is well represented in the North East India with species of *Pyrus*, *Prunus*, *Photinia*, *Eriobotrya*, *Pygeum*, *Rubus* and *Potentilla* (Rao 1974). In the Barpeta district the family is relatively well represented with species like *Duchesnea indica*, *Potentilla supina*, *Prunus salicina* and *Rubus alceifolius*. The family Gesneriaceae is represented by one species, *Aeschynanthus bracteatus*, in the study area. However, this genus is well represented in the entire North East India, particularly in the Shillong Plateau and Eastern Himalaya, with many of those having ornamental flowers and foliage. Acanthaceae is a fairly well represented family in the study area. Members of the genus *Phlogacanthus* are more attractive shrubs in the hills of the region. Occurrence of Lamiaceae with 16 species in the study area is also found to be rich with several aromatic members. Euphorbiaceae is another family found even at fairly high altitudes of North East India with species of *Croton*, *Phyllanthus*, *Mallotus* and *Macaranga* being some of the frequent elements. The family is well represented in the study area with as much as 19 genera, though *Macaranga* being absent.

In his account, Rao (1974) has reported thirty four families of Monocotyledons in the North East India. The present study area is found to possess as many as 28 families of Monocotyledons. However, the dominant family of the region is no longer Orchidaceae (Karthikeyan 2000; Table 3). It has been replaced by Poaceae. Other large Monocotyledonous families are Cyperaceae, Zingiberaceae, and Commelinaceae. Zingiberaceae is represented by 8 species in the study area without any endemic member as reported by Rao (1974). The Pandanaceae is represented by *Pandanus nepalensis*.

### CONCLUSIONS

In the Barpeta district the dominant family is Poaceae with as many as 83 species. Burkill (1924) reported that the flora of the valley of Brahmaputra along with Dihang makes a strong affinity with almost all the present North-East Indian states except Arunachal Pradesh. Deb (1958) observed that Manipur forms a phytogeographical part of Assam (NE India) with very high percentage of Indo-Malayan elements. Thus, according to him the North East India possesses more affinities with the flora of Indo-Malaya. Arora (1964), on the other hand, suggests that the North East India is better represented by the temperate elements. On the basis our analysis, it is presumed that the district of Barpeta of Assam possesses certain phytogeographical features of its own.

### LITERATURE CITED

- Arora, R. K. 1964. Phytogeographical notes on the humid tropical flora of India-World distribution and analysis of the woody dicotyledonous flora of Western Ghats and Assam. *J. India Bot. Soc.* 43 (2): 220 – 228.
- Burkill, I.H. 1924. The Botany of the Abor Expedition. *Rec. Bot. Surv. India* 10(1):155-420.
- Das, B.N. & Rajkhowa, S. 1968. Woodlands of Assam. *Indian Forester* 94(2): 137 – 146.

- Deb, D.B. 1958. Endemism and outside influence on the flora of Manipur. *J. Bombay Nat. Hist. Soc.* 55(2): 313 – 317.
- Hajra, P.K. 1996. *Materials for the Flora of Arunachal Pradesh*. Vol. 1. BSI, Calcutta.
- Hooker, J.D. 1872-1897. *Flora of British India*. Vols. 1 – 7. London.
- Hooker, J.D. 1906. *A Sketch of the Flora of British India*. London.
- Jain, S.K. & Hajra, P.K. 1975. On the Botany of Manas Wild Life Sanctuary in Assam. *Bull. Bot. Surv. Ind.* 17(1-4): 75 – 86.
- Jain, S.K. & Rao, R.R. 1977. *A handbook of field and herbarium methods*. Today & Tomorrow's Printers & Publishers, New Delhi.
- Karthikeyan, S. 2000. A statistical analysis of flowering plants of India. In Singh, et al.(Eds.) *Flora of India*. Introd. Vol.(2): 201 – 217.
- Lakhanpal, R.N. 1970. Tertiary floras of India and their bearing on the historical geology of the Region. *Taxon* 19(5): 675 – 694.
- Meher-Homji, V.M. & Misra, K.C. 1971. Phytogeography of the Indian Subcontinent. In M. S. Mani (Ed.) *Progress of Plant Ecology in India* 1: 9 - 89. Dr. W. Junk N.V. The Hague.
- Rajkhowa, S. 1961. Forest types of Assam with special reference to the evergreen and semi-evergreen forests. *Indian Forester* 87: 520 – 541.
- Rao, A.S. 1974. The Vegetation and Phytogeography of Assam-Burma. In M. S. Mani (Ed.) *Ecology and Biogeography in India*. The Hague.
- Rao, R.S. & Panigrahi, G. 1961. Distribution of vegetational types and their dominant species in eastern India. *J. Indian Bot. Soc.* 40: 274 – 285.
- Ridley, H.N. 1942. Distribution areas of Indian floras. *150<sup>th</sup> Aniv. Vol. Roy. Bot. Gard. Calcutta*, 49 – 52.
- Rowntree, J.B. 1954. An Introduction to the Vegetation of Assam Valley. *Indian Forest Records (New Series)*. 9(1): 1 – 87.