HERBACEOUS FLORA OF KARIMGANJ DISTRICT, ASSAM, WITH REFERENCE TO THEIR ECONOMIC UTILITY.

Vol - I

A Thesis Submitted in fulfillment of requirements for the Degree of Doctor of Philosophy in Life Science under the School of Life Sciences of Assam University, Silchar.
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DEDICATION

The thesis (Vol-I & Vol-II) is dedicated to Dr. S. Chowdhury, (Retd.) Prof. & Head, Department of Botany, Gauhati University, Guwahati, Assam, who happens to be the guiding light & inspiration for me in persuing Taxonomic Research.

PARTHA SARATHI DAS

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असम विश्वविद्यालय
(संसद के अधिनियम तेरह वर्ष 1989 के अन्तर्गत
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TO WHOM IT MAY CONCERN

This is to certify that the thesis entitled "*Herbaceous Flora of Karimganj District,Assam,with refererence to their Economic Utility*" has been prepared by Mr. Partha Sarathi Das, M.Sc. for Degree of Doctor of Philosophy in Life Science under School of Life Sciences of Assam University, Silchar.

The Research work has been carried out under our joint supervision. This thesis is the result of Mr. Partha Sarathi Das's own research work and no part of the thesis has been submitted to this or to any other University for any Degree. The content of the thesis has been divided into TWO VOLUMES because of its exhaustive nature. Mr. Das has fulfilled all the requirements under Ph.D. regulations of Assam University, Silchar.

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DECLARATION

I do hereby declear that the thesis entilled "*Herbaceous Flora of Karimganj District with reference to their Economic Utility*" submitted to the Assam University, Silchar for the Degree of Doctor of Philosophy (Ph.D.) is the result of my own research work carried out under joint supervision of Dr. M. Dutta Choudhury and Prof. B. K. Dutta. The result presented here has not been previously submiited to any University or Institution for any Degree, Diploma, Associateship or Fellowship what so ever.

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ABBREVIATION

Apud	:	In the publication of.
Ass	:	Assam.
Auctorum (auct..).	:	of authors.
Auctorum non (auct.non.).	:	Not of authors.
AUS.	:	Assam University Silchar.
B. & O.	:	Bihar and Orissa.
BBSB.	:	Bulletin of Botanical Society of Bengal, Calcutta.
BBSI.	:	Bulletin of Botanical Survey of India, Calcutta.
BEES.	:	Society For Biometry, Ecology & Econometrics. Karimganj College.
BHHM.	:	Botany and History of Hortus, Malabaricus, New Delhi (Ed. K. S. Manilal).
B.	:	Bengali name.
Ca.	:	*Circa,Criticier :* about.
EFPN.	:	An Enumeration of the Flowering Plants of Nepal, London (Ed.Hara *et al.*,)
emend.	:	*emendatus;*emended.
ex.	:	form.

excl.	:	**Excluding, excluses.**
et.	:	**And.**
etc.	:	**et cetra and others.**
et aliorum (et.al).	:	**And of others**
Filius (f.).	:	**Son (in author citation).**
Figura	:	**figure.**
FA.	:	**Flora of Assam (Kanjilal *et al.*& Bor).**
FBI.	:	**Flora of British India (Ed. J.D. Hoocker).**
FEH.	:	**Flora of Eastern Himalayas, Tokyo. (Ed. H.Hara)**
FFI.	:	**Fascicles of Flora of India, Howrah.**
FHD.	:	**Flora of Hassan District, New Delhi (Ed.CT Saldhana & D.H.Nicolson.)**
FJ.	:	**Flora of Jowai (N.P.Balakrishnan). Howrah.**
FN.	:	**Flora of Nongpoh (J.Joseph).**
FT.	:	**Flora of Tripura State (D.B.Deb), New Delhi.**
GBCIP.	:	**The Grasses of Burma,Ceylon, India and Pakistan, London.**
G.U.	:	**Gauhati University.**
ICBN.	:	**International Code of Botanical nomenclature.**
Ind.For.	:	**Indian Forester (Dehradun).**
JASB.	:	**Journal of Asiatic Society of Bengal, Calcutta.**
l.c.	:	***loco citato* : at the place cited.**

nom.alt.	:	*nomen alternativum* : alternative name.
nom.cons.	:	*nomen conservandum* : conserved name.
nom. nud.	:	*nomen nudum.*
PAR.	:	Plantae Asiaticae Rariores, London. (Ed.N.Wallich).
Pflanzenfam .	:	Die Naturlichen Pflanzenfamilen.
Pro Parte (P.P.).	:	Partly, in Part.
RBSI.	:	Records of Botanical Survey of India,Calcutta.
RARS.	:	Regional Agricultural Research Station. Akbarpur. Karimganj District (Under Assam Agricultural University, Jorhat).
Sensu.	:	in the sense of.
Sensu lato(s.l.)	:	in the broad sense.
Sensu stricto(s.s.)	:	in a narrow sense.
Soc.	:	Society.
sp.	:	Species (Singular).
Spp.	:	Species (plural).
Sp.Pl.	:	Species Plantarum. (Linnaeus, 1753)
spp.	:	Sub Species.
Syn.	:	Synonym.
Tabula (t).	:	Plate.
Type(T) .	:	Nomenclatural type.
Var.	:	Varieties.

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A.
INTRODUCTORY ACCOUNT

A. INTRODUCTORY ACCOUNT

01. PREFACE

The thesis entitled "***Herbaceous Flora of Karimganj District, Assam, with reference to their Economic Utility***" has been presented for the Degree of Doctor of Philosophy in Life science under the School of Life Sciences, Assam University, Silchar. The topic of the investigation has been suggested by my supervisor Dr.M.Dutta Choudhury, Reader, Dept of Life Science, Assam University, Silchar, in consultation with my teacher Dr. S.Chowdhury, (Retd.) Prof and Head Deptt of Botany, Gauhati University. The work has been done under joint supervision of Dr. M.Dutta Choudhury and Prof. B.K.Dutta, Dean School of Environmental Sciences, Assam University, Silchar.

The work was started in May 2003 and continued till February 2007.The work has been mostly carried out with my own financial assistance. However, little financial assistance in the form of Minor Research Project was received from the University Grants Commission (NERO) in 2004.

Considering the exhaustive nature of the work the thesis has been presented in two volumes. Vol.-I contains Introductory Account with detailed Introduction, Geographical features, Historical background, Demographic pattern, Materials & Methods, Vegetation and Taxonomic Account & Economic utility of Fern & Fern-allies while Vol. II contains Taxonomic Account & Economic utility of Angiosperms, Discussion, Summery & Conclusion, Bibliography and Index to the families.

I am greatly indebted to my respected supervisors Dr.M.Dutta Choudhury and Prof.B.K.Dutta for providing their skillful guidance, constant supervisions, great encouragements and valuable help in every step of my work. I am really fortunate enough that they have given their kind consent to supervise the entire work. I offer my profound respect and deep sense of gratitude to them. It would have been impossible to complete this mammoth task without procuring their great encouragement and skillful supervisions. I recon with all sincerity and profound respect the skillful guidance and great interest inculcated in my mind about the plant taxonomy by Prof. S.Chowdhury, Prof and Head (Retd.), Deptt of Botany, Gauhati University, while persuing the M.Sc with Plant Taxonomy as special paper. I also offer my heartfelt gratefulness to him for his valuable suggestion in selecting this topic and to carry out research on the said topic.

I sincerely acknowledge with deep sense of gratitude the assistance rendered by Dr P.K.Hazra, former Director, Botanical Survey of India, Howrah by providing valuable suggestions and identification of collected specimens. I am indebted to Present Director Botanical Survey of India, Howrah for the assistance rendered; and the Joint Director, Eastern circle, Shillong for free access in utilizing the resources available in Central National Herbarioum, Howrah (CAL) and Kanjilal Herbarium, Shillong (ASSAM) and also for availing Library facilities.

I express my sincere thanks to the Divisional Forest Office (DFO) and other staff of Forest Deptt, Karimganj for granting permission to explore and collect Herbaceous Flora from all the reserve forests of the district. I convey my thanks to Dr.A.C.Sharma, chief scientist i/c, Regional Agricultural Research Station (RARS) for providing the comprehensive and updated meteorological data of the district.I extend my thanks extend to the in-charge, District Information Center of the Deputy Commissioner's Office, Karimganj, who has provided the detail informations and general profile of the district. I also thank Dr. Kamaluddin Ahmed, Former Principal, Karimganj College, Karimganj for providing necessary historical data of the study area.

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Karimganj
The ..1st Sept, 2008.

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02. INTRODUCTION:

The North-Eastern Region of India is one of the most flora-rich region of the country. It represents more than 50 percent of the flora of the Indian sub-continent. The region is botanically very interesting due to the occurrence of varied kinds of floristic elements. This is the place where Takhtajan (1969) found the *cradle of flowering plants* on the basis of concentration of a number of primitive land plants particularly of Angiosperms. The forests here produce a large variety of valuable tree species, shrubs, climbers, bamboos along with a number of other plants which are of immense economic and ecological value. The flora consists of numerous herbaceous plants having aromatic and other economic values.

The region is known for its verdant rain forest and rich vegetation with unique ecosystem. The fertility of the soil coupled with varied climatic condition favour the luxuriant growth of plant population. This is particularly untouched virgin land of India that is least explored by naturalists and botanists. Utility of a vast majority of plant species are still remained untrapped. Most of the areas are still without proper communication and inhabited by most backward ethnic groups of people. Unfortunately, the Flora of North Eastern Region of India is gradually facing extinction and many of which are on the verge of it even without receiving scientific look not only in regard to their identity but also to their utility aspect .

The forest is a powerful ecological factor effecting the environment in India, as elsewhere in the world. The moderate extremes of heat and cold, enriched soil with leaf litters, increase porosity and water holding capacity. The forest in hilly areas retard the run-off water ,fed the underground springs and promote a perennial flow in the streams and tend to prevent sudden and violent rises in water level during the rains. Thus, forests help to prevent land slides, erosions, silting and consequent danger of floods. The destruction of forests reserves all the above beneficial effects.

After reorganization of the states of North-Eastern region in 1972 carving out the hill states of Meghalaya, Mizoram Nagaland and Arunachal pradesh -Assam now occupies the Brahmaputra valley, the Barak valley and the intervening hill ranges of Karbi anglong and North Cachar Hills. It covers an area of 78,523 sq km and is situated in the North-Eastern corner of India lying in between 24^0 08′ to 27^0 59′ North latitude and 89^0 42′ to 96^0 01′ East longitude. The state known as the floristic gate

way of North Eastern Region, has boundaries common to Arunachal pradesh, Meghalaya, Mizoram, Nagaland and Tripura. It has also common international boundary c.500 km with Bhutan and c.200 Km with Bangladesh.

Brahmaputra valley - the largest plain in the north-east formed by the mighty river the Brahmaputra with its network of 25 tributaries from the North and 15 tributaries from the South, flows nearly 760 km along the entire length of Assam. The valley is enclosed by hills on all sides except in the west and generally it is of uniform width almost up to the southern sector of the river with the exception where Karbi-Anglong projects from the Borail range. Its numerous islands including the largest River Island of the world -Majuli, along with extensive scattered swamps and marshes. National park , Biosphere reserves and all most all the wild life sanctuaries of Assam ,which lie on either side of the river and its tributaries.

The large river Barak with its nine tributaries forms the Barak valley, a level plain surrounded by hills on three sides. The Barak has its origin from slopes of Naga hills and flows south in a zigzag course through the hills of Manipur and then enters in cachar district in eastern side. The river traverses through the heart of Cachar and karimagnj districts flowing nearly 169 km and reaches the western side where it divided into two branches-Surma and Kushiyara near Haritikar. A number of natural perennial water reservoirs-such as beels-the largest being 'Son beel 'haors and ox-bow- lakes are found in the valley region.

The hill ranges of Karbi –Anglong and North cachar hills lie in the Borail range.A rugged terrain—the highest elevation in Assam lies in the North cachar Hills at Thunjang klang, having the altitude of c.1866m. The North eastern part of the state, which is the continuation of Eastern Himalayan hill ranges, is flanked by low hills with varying altitudes ranging from 30 m to 300m and can be considered as the foot hills of Arunachal pradesh.

Assam is a highly humid tropical region with heterogenic physiography bears a separate identity phyto-geographically [Clarke (1898) and Chatterjee (1939,1962)] with a number of types of plant communities .This is due to its varied climate – rainfall at places ,ranging from 5^0 C to 38^0 C and Relative Humidity varying from 73 % to 95 % annually. It is a unique eco- system considered as natures Botanical laboratory and it is unparalleled compared with any places in the world. Assam may

rightly be called the floristic gate way of India for its richness of vegetative wealth and diversity of vegetation and flora. The major type of plant communities can be grouped under Moist Ever green forests, Hydrophytes in vast stretches of wetlands (Riparian belts, Swamps and Marshes),bamboo brakes, degreaded or scrub lands, grasslands and Savannahs (Both wet and dry) in alluvial plains.

As a treasure house of multitudinal biotypes in terms of economically important species Assam is the center of origin of a good number of plants (Vavilob.1952) including species of *Musa* (Chakrabarty 1951; *Citrus* (Tanaka,1958);*Mangifera indica* (Mukherjee 1949,1972), *Zizyphus* (Mehra 1967) and *Camellia sinensis* (DeCondolle 1886) etc. Further occurrence of a number of endemic plant species and most primitive Angiosperms are seen .Some of these are not found elsewhere in India and hence the great plant Taxonomist and plant Geographer Armen L.Takhtajan (1969) rightly considered that the ***Cradle of flowering plant'*** lies between Assam and Fiji.(Sarkar,1993).

A journey through out the length and breadth of the state by rail or road brings into sharp focus the deplorable condition of the once thickly forested areas. G.A.Gamine (1895)commented *The country is well wooded around Gauhati* while visiting Assam for plant exploration to Lakhimpur district (*s.l.)* in 1894. Now, not only the valleys but also the hills are denuded of their natural green cover giving place to scrub jungles. The reasons for this damage are not far to seek. The man made factor other than natural processes are occurring mere deleterious effect towards the depletion of the natural cover. The degradation of forests has taken place due to urbanization ,industrialization, human settlements, conversions for agriculture, jhuming or shifting cultivation, raising of artificial forests by monoculture of some economically important species like *Shorea robusta* ,*Tactona grandis* along with natural calamities like earthquake and flood. Population explosion and the increased natural demand have caused unprecedented pressure on the tropical and sub-tropical forests .The denudation of forest is going on at a faster rate than ever before causing enormous loss to genetic diversity, natural resources are dwindling everyday due to over exploitation and habitat destruction.(Chowdhury *et al.*, 2005)

Karimganj district- the South-Western part of Southern Assam has a peculiar political history. At different time the present Karimganj district was under different administrative control. Up to 1785 about 50 percent of the land (Patharkandi and

Ratabari Thana) was under the control of independent Tripura kingdom,where as remaining portion (i.e. Karimganj and Badarpur Thana) were under the administrative control of sylhet Sarkar (later converted in to Sylhet district) of Bengal since 1765. In 1875 patharkandi and Ratabari Thana were annexed by the British Rulers and were included in the Sylhet district of Bengal. In 1878, Karimganj was given a status of subdivision whose jurisdiction was whole of modern Karimganj district, Zakiganj upazila and half of modern Maulavi bazar district of Bangladesh.

At the time of publication of *Flora of British India* (1872-87) by Sir J.D. Hooker, this piece of land was under Syllhet district of Bengal province. During that period the only means of communication to this part of Bengal province was the river communication with country boat. Navigation system in the area developed after 1880 and the railway line between Silchar to Chittagang (Present Bangladesh) via Karimganj was established in 1899. In 1903 when exhaustive floristic work of Bengal province under the title *Bengal Plants* was published by D.Prain this piece of land along with the whole of then Sylhet district was under the administrative control of Assam province of British India as it was separated from Bengal in 1874 and railway line connecting Karimganj with other parts of Assam first appeared in 1903.During the period of publication of *Flora of Assam* (1934-1940) this land was a part of Surma valley of Assam and at the time of independence in 1947 this particular portion of land was separated from remaining part of Sylhet District (now in Bangladesh).

This peculiar political history of the area along with its truncated communication system during early days lead to assume that very little attention could be given on the floristic account of the district by early workers.

A perusal of literature on Botanical accounts of Assam show that classical collections were made from time to time but very little methodical exploration works have been made so far in various parts of Assam. In the *Flora of Assam* published by U.N. Kanjilal *et al.* (1934 – 1940) in 4 volumes, perhaps the first Regional Flora by Indian Workers before Independence, mainly had a strong emphasis on woody material with a natural neglect of herbaceous plants can not be considered as exhaustive and complete (Rao, 1974). While publishing the first volume of *Flora of Assam*, A. Das commented *some herbaceous plants have been included, which are beyond the real scope of the work.* The statement indicated that very little emphasis on herbaceous plants of Assam had been given by the then workers during the

publication of *Flora of Assam* as most of the authors were Silviculturists having keen interests on woody plants. The fifth volume of "*Flora of Assam*" published exclusively on Gramineae by N. L. Bor (1940) had also a very little representation from the then Karimganj district.

An intensive analysis & review of *Flora of Assam* as regards to record of plants from the then Karimganj District reveals that in Vol. I (Ranunculaceae to Elaeocarpaceae), a total of 76 species were reported from the then Karimganj district, out of which only 15 species were herbs while 47 species are trees and 14 were shrubs. Similarly in Vol. II (Leguminosae to Cornaceae), out of 67 plants, 34 were trees, 21 were shrubs and rest 12 species were herbs. The Vol. III (Rubiaceae to Verbenaceae) has a total record of 126 plants & out of which 47 were trees, 64 were shrubs and only 15 species were herbs. The Vol. IV (Nyctaginaceae to Fagaceae) had a total record of 81 species where 48 species were trees, 25 were shrubs and only 8 plants were herbs. The Vol. V on Graminae suggested that out of 44 plants 14 were trees, 2 were shrubs and rest 28 plants were herbs.

Even after the establishment of Eastern circle Head Quarters in Shillong of the Botanical Survey of India since 1956, the circumscribed political boundary of Assam has not been given due importance for exploration and to study the Flora. Dr. A. S. Rao commented *over half the area of Assam still remains more or less completely unexplored and even the areas which have been investigated need further intensive study* which is very significant in this context. Only in a few sporadic publications we could find references of Herbaceous plants and that too appeared for the whole of present North East Region, Kar & Panigrahi (1963), Kataki & Panigrahi (1964) made enumeration of the families "Rubiaceae and Ranunculaceae". Panigrahi (1965), Rao & Verma (1972 – 1982) brought out publication on Monocotyledonous plants as incomplete study. In these works also sporadic references have been made for the plants of Karimganj district ; where as Rao & Rabha (1967) published botanical accounts of Kamrup district (Southern part) and Chowdhury *et al.* (1970); Chowdhury (1982, 1987, 1988, 1990), Baruah *et al.*, (1988), Chowdhury & Singh (1991 a, b), Sarkar (1993) brought out Novelties explicitely for Assam but without a reference of plants of Karimganj district. On the other hand except for a few sporadic studies on some families or groups of plants, the exhaustive floristic accounts of the district are still lacking. Astapati & Bhattacharya (1998), Astapati *et al.*, (2002), Bhattacharjee

(2002), Bhattacharya (1994), Bhattacharya (2002), Bhattacharya & Das (2003), Chowdhury *et al.*, (2002), Das (2007), Das & Bhattacharya (2002), Das & Bhattacharya (2003), Dutta Choudhury (1997), Dutta Choudhury & Chowdhury (2002), Dutta Choudhury & Bhattacharya (1994), Mazumder & Paul (2002) and Mazumder *et al.*,(2002) have been found in the list of contributors but none of them have met the requirements of full botanical knowledge of the district.

In his exhaustive account entitled *Assam's Flora*, Chowdhury *et al.*, (2005) beautifully catalogued the history of past floristic explorations in Assam conducted since 1835 as follows-

Assam has been a centre of classical botanical collections. It has attracted the attention of a number of Botanists – both professionals and amateurs. Francis Buchanan (latter in 1820 Hamilton) pioneered the botanical collection around Guwahati (erstwhile Gauhati) in 1808 – 1809. Wild growing Tea plant in Assam was reported by Robert Bruce in 1823 on information from Singhpho village chief – an area was known as 'Bisa' in former Lakhimpur Frontier Tract near Burhi Dihing river – nearly 75 Km in a straight line from Sadiya. David Scott (1826 – 1830), the Governor General's Agent of North East Frontier in 1826 got a leafy twig from Manipur and it was identified by N. Wallich as *Camellia scottiana* with a question mark. Col. Lister made a good collection of plants during 1828 – 1832 between Cherrapunji and Guwahati. Later Francies Jenkins during his stay at Guwahati from 1831 to 1854 as the Governor General's Agent, along with his collector Simons, gathered a number of plants from various places chiefly around Brahmaputra Valley and the Mikir Hills (now Karbi – Anglong and North Cachar hills). He got a twig of wild Tea through Charles Alexander Bruce, the younger brother of Robert Bruce and Captain Andrew Charlton. Griftith identified the plant as *Camellia theifera* Griff. In 1834 but the publication was made in 1854. The up–to–date nomenclature of the true Tea plant is *Camellia sinensis* (L.) O. Kuntze. This led to the formation of a Tea delegation of East India Company headed by N. Wallich (surgeon) with his associates W. Griffith (surgeon) and John Mc Clelland (soil chemist) to study the areas of tea growing in the Wild and the possibility of its cultivation in Assam. They started the journey from Calcutta on 31st August, 1835 by boat and reached Guwahati through Sylhet on 23rd November 1835 and arrived at Sadiya by boat on 16th January 1836, collecting plants on the way. They also made short trips to Dibrugarh and Jorhat.

Griffith's contribution was more than his associates who stayed at Sadiya till February, 1837. Griffith published an excellent treatise in 1838 entitled *The Tract producing indigenous Tea plant* in Transactions of Agricultural and Horticultural Society of India Vol. V. Griffith revisited the region in 1838 including the present Kamrup district. He with his associates and personally collected as many as 2500 species. Of these, major collection was from Assam and some from present day Meghalaya and Nagaland and the Mishmi hills of erstwhile NEFA (now in Arunachal Pradesh). This in brief is the history of the earliest botanical works in Assam.

Many other explorers enriched the collection of plant species in the year that followed. Notable amongst them are John White (a sub – assistant under Jenkins) and Masters during 1834 – 1873 in Golaghat, Nagaon an Sadiya. Masters in 1844 described a new indigenous Tea plant from Assam and named it *Thea assamica* Masters in 1844, the valid name of the plant is now *Camellia sinensis* (L.) O. Kitamura. J. D. Hooker & T. Thomson made a large number of collections from the Khasi hills in 1850 staying nearly 6 months in the region. Falconer and his collectors (1852 – 1854) from Mikir Hills; R. L. Keenan (1872 – 1873) and also Klein and Prazer from Cachar; Peal from Sibsagar contributed to the sporadic collection. Charles Baron Clarke – a Mathematician who came to India in 1866, joined as a Lecturer in Presidency College, Calcutta, also made collection tours to K. & J. Hills in 1866, 1872 and 1877. Later as Inspector of Schools in Assam during 1883 – 1887 he extensively toured Shillong and its neighboring areas. In October – November 1885 he made valuable collections in several areas of Golaghat, Kohima and Manipur.I. H. Burkill (1965) has provided an authentic list of the pioneer plant explorers of Assam.

Gustav Mann – the first Conservator of Forests of Assam during 1863 – 1881 made splendid collections from different parts for a detailed knowledge of the Flora of Assam. He was the first to conceive the idea of the establishment of Herbarium of Assam for the preservation of voucher specimens mounted on writing paper only and deposited a fairly large collection. G. Watt in 1882 and 1883 collected plants from Golaghat and Cachar.

All the above mentioned collectors and others had made valuable contribution to the study of the Flora of Assam. However, most of the specimens (the better preserved ones) were sent to the Kew Herbarium, London with but a few duplicates left for Sibpore Herbarium, now known as Central National Herbarium, Howrah

(CAL), making us to depend on Kew Herbarium for any critical Taxonomic study of Assam plants.

Based on these collections and explorations, different workers have published their floristic accounts on the plants of Assam. Notable amongst them were F. Buchanan Hamilton (1820), W. Roxburgh (an army surgeon) (1820, 1824, 1832), W. Robinson (1834, 1838, 1847), J. D. Hooker (1854) and J. D. Hooker & T. Thomson (1855). Ultimately, Sir, J. D. Hooker (1872 – 1897) has mentioned all of these including the area of collection, in his monumental publication in 7 volumes of the *Flora of Brithsh India*. The localities they refer to are not precise. They are mentioned as Upper Assam, Lower Assam or Assam, Assam plains, Brahmaputra Valley or Surma Valley (the major portion of Sylhet district is now in Bangladesh) for the plain areas; on the other hand the hilly regions are termed as Mikir Hills and so on.

The establishment of Botanical Survey of India on 13th February ,1890 under the leadership of George King – the First Director, activated the exploration work in different parts of India including that of Assam. G. A. Gammie made collections in the months of March and April in 1894 in the areas of former Lakhimpur district centred around the present Dibrugarh and Tinsukia districts and published his work in 1895. In the early part of the 20th Century Meebold in 1906 and 1907 collected plants from areas of Golaghat, Kohima and Manipur. H. G. Carter and D. N. Carter made 2 tours in spring and autumn in 1915 and collected specimens from different places of Lakhimpur district *(sensu lato)* and published their account in the Records of Botanical Survey of India entittled *Useful plants of the district of Lakhimpur* in Assam in 1895.

At the initiative of Sir Archdale Earle, the then Chief Commissioner of Assam, U. N. Kanjilal joined the Forest Service of Assam. During his tenure (1906 – 1928), he made extensive and intensive collections from most parts of erstwhile Assam and also engaged most of the forest staff members spread over the length and breadth of the region with a view to publishing the Flora of Assam. He had to his credit, the establishment of Assam Forest Herbarium in 1927 as Extra – Deputy Conservator of Forest of Assam. Even after retirement, he worked on the manuscripts of the First Volume of the *Flora of Assam* but expired on 25th October, 1928 before its publication. His monumental collections, mostly identified or confirmed at Sibpore

Herbarium, and invaluable elaborate field notes and drafts have remained assets to his successors. The progress of the Flora Project of Assam slowed down till P. C. Kanjilal – Deputy Conservator of Forests, U. P. was invited to complete the work. He had also made exhaustive collections from various parts of Assam and enriched the Herbarium to nearly 40000 specimens with the assistance of workers like G. K. Deka, S. R. Sharma, D. N. Pal, R. Sunar, H. K. Deka, S. R. Talukdar, M. R. Dhar, R. N. Dey, D. N. Kalita, B. B. Shyam and others. P. C. Kanjilal before leaving Assam completed the final draft and described a few Families of Monochlamydae. Later, A. Das – the Silviculturist and Botanical Forests Officer took over the responsibility in 1931 and brought out the publication of all the 4 vols. of the *Flora of Assam* even after his retirement. Vol. I (part I & II) and Vol. II were published under his exclusive editorship. Vol. III was published with the help of his associates C. S. Purkayastha and Vol. IV with R. N. De (both Forest Officers) and the publication was completed between 1934 and 1940. The *Flora of Assam* stands out as the last Regional Flora of India authored by Indians before Independence.

During the Publication of the *Flora of Assam*, N. L. Bor came as Political Officer in the Naga hills and Aka Hills (Kameng). He took keen interest in Grasses and started collecting since 1936 when he became the Botanical Forest Officer. He extensively travelled most of the parts of erstwhile Assam collecting grasses, took all his collections and compared with earlier collections at Kew and published the 5th volume of the *Flora of Assam*, only on Gramineae of Monocotyledones in 1940. From 1937 to 1948 R. N. De, M. M. Srinivasan, M. L. Saikia (all Sylviculturists); S. R. Sharma and G. K. Deka made substantial collections for the Forest Herbarium. There was negligible collection till the establishment of Botanical survey of India on 9th August, 1956 with its Regional Head Quarters in Shillong. Mr. M. C. Jacob, the then Chief Conservator of Forests, played a key role in transferring the Assam Forest Herbarium with its staff members to the newly established Botanical Survey of India. With its 5 volumes of *Flora of Assam*, the Forest Department of Assam had made splendid contribution towards the knowledge of 3431 species including a few varieties of plants. But the work of the Forest Botanists, however significant they may be, can not be described as exhaustive or complete. It takes into account mainly the flowering plants and that too only the woody ones, which have much value in Forestry. Only sporadic references have been made to the herbaceous plants. But, it

connotes a landmark in the history of Botanical studies in Assam by Indian Botanists. Except for the publication of Garmineae (Poaceae) in the 5 th volume of the *Flora of Assam* by Bor (1940), other Monocotyledonous Families remained unrecorded.

The Botanical Survey of India, Eastern Circle station, was set up in Shillong in 1956. It took over the charge of Assam Forest Herbarium on 8th August, 1956. Thereafter, various members of the organisation have undertaken exploration work and collected all types of plants from different areas of North Eastern Region with the aim of completing the *Flora of Assam.* Study of literature and herbarium specimens reveal that they visited only certain selected parts of Assam and that also did not cover all the seasons of the year. They could study only 25% of Flora of Assam. according to M. S. Swaminathan and J. Jopesh (1985). Notable among the collectors who have enriched the Assam Forest Herbarium now called "Kanjilal Herbarium" (ASSAM) are R. S. Rao, G. Panigrahi, D. B. Deb., A. S. Rao, S. Chowdhury, S. K. Kataki, L. C. Rabha, D. N. Verma, S. Das, R. B. Majumdar and P. K. Hajra. They have published their results of collection trips outlining the Vegetation and enumerated the species mainly covering Hill States of North East Region but sporadically of plain areas of Assam. The contributions made by Panigrahi (1960, 65); R. S. Rao & Panigrahi (1961); Chowdhury (1961); Naik & Panigrahi (1962); Kar & Panigrahi (1963); Kataki & Panigrahi (1964); Naik (1965); A. S. Rao & Rabha (1966); Panigrahi & Kar (1967); A. S. Rao (1969, 70, 74, 77); A. S. Rao & Deori (1976); A. S. Rao & Hajra (1977); Jain & Hajra (1975a, b, 1978); Borthakur & Hajra (1976); Hajra (1978, 1980); Majumdar (1980, 1983) and Kataki & Barua (1989) are worth mentioning. On the otherhand Panigrahi (1960); Panigrahi & Chowdhury (1961, 1962); Panigrahi & Patnaik (1961, 1968) have made valuable contributions to the study of Fern Allies and Ferns of North East Region.

A. S. Rao & D. M. Verma (1972 – 1979, 1982) have brought out a series of publications to complete the Monocot Flora of Assam (Old region) but could not do so as there are a number of Families of Monocotyledones still left out, including the Orchidaceae. U. Shukla has recently published *The Grasses of North Eastern India* in 1996. As such the Monocot Flora of Assam still remains incomplete.

The work on Taxonomic and Floristic research of present Assam has been initiated and activated by Dr. S. Chowdhury from the date of his joining the Department of Botany, Gauhati University in 1967. He has developed and enriched

the Herbarium of the department and at the time of his retirement as Prof. & Head, the Herbarium holds nearly 10,000 specimens from almost all the parts of Assam. Apart from these, the herbarium also contain collection of his students and Research Scholars engaged in floristic works under Research Projects at the District level, Sub-divisional level of Assam. Most of the studies have been made covering all the seasons of the year. Extensive and intensive collections have been made in the districts of Lakhimpur, Dhemaji, Kamrup, Sonitpur, Golaghat, Karbi – Anglong, Tinsukia, Dibrugarh, Cachar and some parts of the districts of N. C. Hills, Hailakandi, Karimganj, Jorhat, Sibsagar, Dhubri, Nagaon, Morigaon and Darrang (particularly Orang Wildlife Sanctuary) and they have contributed much to the knowledge of floristic elements and vegetation of Assam. The Taxonomy Laboratory of the Department of Botany is now Internationally recognised as a Centre for Taxonomic Research.

Prof. Chowdhury has made notable contribution highlighting the plant resources of Assam and its novelties in National and International Journals. He discovered several species of plants New to science and also recorded a number of plants previously unknown from areas within Assam [cf. Chowdhury 1961, 1974a, b, 1982, 1987, 1988, 1990, 1993a, b, 1996 and Chowdhury, Baruah & Majumder (1970), Chowdhury, Baruah & Baruah (1971), Choudhury & Phukan (1974), Chowdhury & Baruah(1976), Chowdhury & Singh (1991, 1992), Chowdhury, Kataki & Baruah (1974, 1978); Handique, Medhi, Goswami, Goswami & Chowdhury (1987); Sarkar, Handique, Goswami, Goswami & Chowdhury (1989); Baruah & Chowdhury & Neog (1988); Chakraborty, Prasad & Chowdhury (1990); Goswami & Chowhury (1990); Prasad, Majumdar, Chowdhury & Chakraborty (1992); Nath & Chowdhury (1994); Malakar & Chowdhury (1997); Singh & Chowdhury (1997); Dutta Choudhury & Chowdhury (1997)]. Novelties include 3 New species of orchids discovered in the mainland of Assam viz., *Dendrobium assamicum* Chowdhury (1988), *Eulophia kamarupa* Chowdhury (1993) and *Zeuxine debrajiana* Chowdhury (1996). Other New species described by him with associates from North East Region are *Oberonia sulcata* Joseph & Chowdhury (1966), *Katherinea navicularis* Balakr. & Chowdhury (1966), *Agapetes bhutanica* Balakr. & Chowdhury (1966), *Bulbophyllum leopardianum var. tuberculatum* Balakr. & Chowdhury (1967) and *Arthromeris jarettii* Sastry & Chowdhury (1972).

While most of the workers concentrated on collection and study of flowering plants, atleast two persons, R. H. Beddome and C. B. Clarke have made substantial contributions to the ferns of the Indian subcontinent as a whole. The work of Clarke (1880), based on collections for about eleven years from Kashmir to Chittagong and eastwards and those of specimens from the present state of Assam also.

With the reorganisation of the Botanical Survey of India in 1956, a separate regional Circle was set up in Shillong for botanical exploration of northeastern India, and although, since then a number of officers of the Survey have made extensive collections from various parts of the region, the state of Assam remains almost unexplored as far as Pteridophytic flora is concerned.

After the monumental publications of Beddome (1883, 1892) and Clarke (1880) the only worthwhile accounts of the Pteridiphytic plants of the earlier Assam (which includes entire northeastern states viz., Assam, Meghalaya, Mizoram, Nagaland and Arunachal Pradesh) are those of Kachroo (1953, 1975), Panigrahi (1960, 1968), Panigrahi & Choudhury (1961, 1962), Panigrahi & Patnaik (1961a, 1961b), Bir *et al.*, (1989 &1992) Bir (1987a & b) and Vasudeva *et al.*, (1990). Recently Handique & Konger (1986) and Barua *et al.*, (1989) published enumeration lists of ferns and fern-allies from Guwahati and Kamrup district respectively.

Past botanical accounts of Karimganj district indicate that the vegetation and its component of floristic elements and particularly of Herbaceous plants is still scientifically remained unexplored. The floristic component of this area needs extensive survey and study. The study of plants, particularly the herbaceous ones has a vast economic importance Watt. (1889 – 1896, 1908); Jain (1967&1968); Jain (1981), (Kirtikar & Basu, (1933 & 1975); Chopra *et al.*, (1956, 1958, 1969) ; Maheswari & Singh, (1965); Hertwig, (1985); Dwyer, 1986, Nayar & Giri (1988); Nayar (1984); Nayar *et al.*, (1989); Nayar & Shastry (1987,1988, 1999); for the benefit of local people. This has necessitated the systematic study of the Herbaceous Flora of Karimganj district so as to enable to assess the diversity of resources and their probable utility. Properly investigated taxa with their correct taxonomic information can lead to the discovery of additional useful species and several of plants and new uses of already known species for better utility.

Keeping these in view the present investigation has been undertaken with the

aim to collect and identify all the herbaceous plants of the Karimganj district of Assam by making intensive field survey in all seasons of the year. The period of study has been extended from May, 2003 to Feb, 2007 for collection of plant materials along with taken into account of earlier collections of the district deposited in Kanjilal Herberium, Assam. The emphasis has been given to study the ecological adaptations of individual species, distribution pattern, providing analytical drawings of interesting ones based on live specimens as also photographs depicting vegetation and rare plants of the area along with taxonomic treatment as to their correct identity; key characters for easy identification of Families, Genera and Species followed by brief Herbaceous Flora description and Economic Utility so as to bring out an illustrative account on of *Herbaceous Flora of Karimganj district, Assam, with reference to their Economic utility.*

03. GEOGRAPHICAL FEATURES.

03.1. **Location**

The Karimganj district is one of the three districts of southern Assam, popularly known as Barak Vally and is sittated in the North-East of India. The district covers an area 1809 sq. kms. Stretches vertically from lalitude $24^0 15^/$ to $25^0 55^/$ North and spreads horizontally from longitude 92^0 $35^/$ East approximately. The district is named after its head quaters town ie, Karimganj, which is situated at a distance of 49 kms. West of Silchar (Cachar district) & 338 kms from the state capital (Dispur, Guwahati). The district is bounded by Bangladesh and parts of Cachar district on the northern side while the Hailakandi district forms the Eastern boundary. In the southern part of the district Mizoram and Tripur states form the boundary & on the West lie the state of Tripura and the Sylhet District of Bangladesh. The district was a sub division of Cachar district after partition of the country and was upgraded to a district on 1st July, 1983 to facilitate smooth administration.

03.2. Topography

The district shows some low hill areas with elevation of about 300m, a long central strip of undulating plain with hillock (tillahs) and narrow valleys in the extreme southern part of the district, a broad mender plains and some low lying depressions, locally known as beels or haors

03.3 Natural Division

The district shares 92 kms. of International Boarder with the neighboring country in Bangladesh. Of which 41 kms is demarcated by the river Kushiara while 51 kms is land border. On some stretches, there is no natural geographical demarcation for the border which cuts across open agricultural or grazing fields. However, on post parts, the international border with Bangladesh is marked by either the river Kushiara or the sub-mountain tracts of the Adamail range. In a sense, Karimganj, along with the neighboring district of Cachar demarcates the frontier between the plains of the Padma – Meghna basin and the hilly North – East India.

03.4. Hilly Terrains

Karimganj district is actually shut in between two hill ranges, where as there is a thrid hill that runs through the southern part of the district.

The chhatachurra range that starts from the South – East border, forms the whole length of border with Hailakandi district. The summit of the range is called chhatachura peak and its height 12087 feet above the sea level. The hills gradually decline in height and in the middle section, which bears the name Sarashpur, are only 1000 feet above the sea level near the Barak River. At the lowest level, where they are known as Badarpur hills, the average height is about 500 feet. The chhatachura range is about 50 miles from north to south and some parts, 13 miles in breadth.

The Adamail or Patharia range marks the western border of the district forming the international borders with Bangladesh. Running from the south to the north, its length is about 28 miles and breadth about 7 to 8 miles. The highest point of the range is about 800 feet above sea level.

The third hilly range crossing through the district is the Duhalia range, also called the Pratapgarh range. It runs through the mid south of the district demarcating the Longai valley and the Chorgola valley. The length of the range in the district is about 28 miles with highest peak at 1500 feet above sea level.

Besides these three main ranges, the plains of the district are also dotted with hillocks and forests. The north and north – eastern portion of the district are mainly plains where as the south and south western parts are mainly covered with forest

03.5. The River System

Kushiara, Longai and Shingla are the main rivers flowing through the district.

The river Barak enters the district through its north eastern corner near Badarpurghat and after traversing a length of sever miles upto a place called Haritikar near Bhanga, is divided into two branches – namely, the Kushiara and the Surma. From the point of bifurcation, the Kushiara flows westwards to Bangladesh forming the northern boundary of the district. The town of Karimganj is situated on the bank of this river. The old name of the Kushiara near Karimganj town was "Bagali". In Bangladesh, the river is again divided near Bahadurpur in Moulavi Bazar district, the northern branch assuming the name "Bibiyana" and the southern branch, "Shakha Barak". The Bibiyana is later merged with the Surma river near Markuli steamer station in Habiganj district of Bangladesh, assuming the name "Kalni", and then "Bhera Mohana", and ultimately this huge combined stream merges with the grate river Meghna of Bangladesh. The southern stream of Kushiara resumes the original name Barak or Shakha Barak and flows in a south westerly direction through Habiganj district and finally falls into the old bed of the "Brahmaputra" near Bhairab Bazar in Mumansingh District (Bangladesh).

The Longai river originited in the Jampai Hills of Tripura state and traveling a course of northerly direction, turns south west near Longai Railway Station near Karimganj town. Near Latu village, it enters Bangladesh and then flows to meet the Hakaluki Haor (Haor = Atoll like span of water) which absorbs the entire inflow during the winter. During the rainy season, an outlet springs out which ultimately merges with the Kushiara near Fechuganj in Sylhet district (Bangladesh).

The Singla River originates from Mizoram state and taking a north ward direction, it falls in Sonbeel Haor where from the stream emerges bifurcated forming two rivulets – Kachua and Kakra.

The Kushiara and the Longai are perennial rivers, whereas the others dry up during the winter.

03.6. Climate and Rainfall

Climate: Being a part of the tropical zone of South – East Asia, the region exhibits subtropical monsoonal climate in which annual rainfall exceeds annual loss of water due to evaporation and transpiration. The district experiences a very damp

and humid weather with frequent rainfall.

Rain fall: The average rainfall of the region is 4288.94mm with an average 149 rainy days per annum. There are three rainfall Zones in the district:-

The high rainfall zone (ie, above 4000mm) is found in the north western part of the district bordering Meghalaya, comprising of high hill areas.

The medium Rainfall Zone (ie between 3000 – 4000 mm rainfall) covering the largest area of the district spreading over to Bangladesh boarder in the west.

The low Rainfall Zone (i.e., below 3000mm. Rainfall) covers the southern part bordering Tripura State.

Generally, the period from December to February is rather dry with scanty rainfall where as the periods from March – April & October - November are characterised by low erratic rainfall with occassional hailstroms. The period between May to September is characterised by high intensity of precipitation with apprehension of floods. The monthly distribution pattern is not uniform & about 62% of the total rainfall is confined to the period between June to September.

Table I Season wise average normal rainfall.

Season	**Months**	**Rainfall (mm)**
Winter	December – February	74.7
Summer The monsoon	March – May	2591.1
Monsoon	June – September	4462.1
Post monsoon	October – November	497.2

Table II. Distribution of monthly average rainfall (in mm) of Karimganj District from 2002 – 2006.

Month	2002	2003	2004	2005	2006
January	6.6	NIL	NIL	NIL	NIL
February	NIL	3.0	3.8	99.0	35.4
March	53.0	119.6	38.6	580.4	17.5
April	351.6	277.0	814.4	292.6	271.2
May	582.4	378.2	976.6	800.2	845.6
June	569.4	953.8	839.8	450.5	760.1
July	965.4	515.4	1576.1	1192.9	559.3
August	311.6	455.8	987.8	539.6	347.3
September	307.8	493.9	735.0	340.9	484.1
October	138.4	441.0	201.0	267.9	284.7
November	75.5	NIL	13.4	NIL	13.6
December	12.8	34.2	14.8	NIL	14.5

Table III Number of rainy days (month wise) for Karimganj District from 2002 – 2006.

Month	2002	2003	2004	2005	2006
January	3	NIL	NIL	NIL	NIL
February	NIL	1	1	3.0	4
March	7	11	6	16	1
April	15.0	16.0	21	15	14
May	23	22	17	24	18
June	27	25	20	24	26
July	27	24	27	27	22
August	26	23	25	26	20
September	15	24	17.0	12	14
October	6	13.0	9.0	9	8
November	3	NIL	2	NIL	2
December	1	3	1	NIL	1

03.7 Temparature:

The average annual maximum temperature is 32^0c and the average minimum temperature is 17^0c. The average minimum temperature of 10.2^0c is recorded in the month of January and the average maximum temperature of 33.5^0c is recorded in the

month of August. The temperature is therefore moderate and winter is less severe than other parts of the state.

Table – IV Temperature in centigrade for the district (2002 – 2006)

Months	Temperature in degree centigrade (^{o}C)									
	2002		2003		2004		2005		2006	
	Max	**Mini**	**Max**	**Mini**	**Max**	**Mini**	**Max.**	**Mini**	**Max**	**Mini**
January	23.5	10.6	25.1	10.4	26.5	10.9	25.3	9.7	26.8	9.6
February	28.0	13.4	28.2	13.6	29.4	10.8	28.5	13.8	30.0	14.2
March	30.7	17.5	31.7	17.8	32.9	17.2	29.3	17.1	32.8	16.2
April	32.6	21.9	32.6	22.1	28.8	18.7	31.6	18.9	31.5	19.2
May	33.1	23.9	32.9	22.4	32.8	20.8	29.8	21.1	32.5	21.8
June	33.6	25.2	31.1	22.9	31.9	21.6	32.7	24.4	30.8	24.1
July	32.2	25.1	32.5	23.7	31.1	20.9	31.5	24.1	33.0	24.6
August	33.8	25.4	33.7	23.3	34.0	21.3	32.0	24.4	34.4	23.6
September	32.1	24.2	32.9	22.4	30.1	19.8	33.7	23.9	33.0	22.7
October	32.2	22.2	32.2	21.3	31.6	17.2	32.2	22.1	30.8	21.1
November	30.6	18.0	31.6	14.7	30.7	16.5	30.9	15.9	30.5	16.3
December	28.3	11.4	28.2	12.0	28.3	9.8	29.4	11.6	28.1	10.6

03.8 Relative humidity :

The morning relative humidity is much (above 90 percent) than in the afternoon (66.75 percent). Further monthly variation in relative humidity is much less in the morning ranging from 92 to 97 percent as compare to that of afternoon varying from 43-78 percent. Normally the morning relative humidity is higher due to foggy weather in winter than in the rainy seasons.

Table V Monthly Relative Humidity (Morning & Afternoon) in percentage (%) for the district (2002 – 2006)

Months	2002		2003		2004		2005		2006	
	M	A	M	A	M	A	M	A	M	A
January	97	60	92	52	95	56	95	54	94	50
February	95	51	96	49	95	45	94	51	94	51
March	92	50	94	44	90	51	91	62	84	40
April	92	69	93	64	92	74	90	68	84	65
May	93	74	95	63	88	71	92	77	85	70
June	94	79	95	84	93	80	93	80	95	83

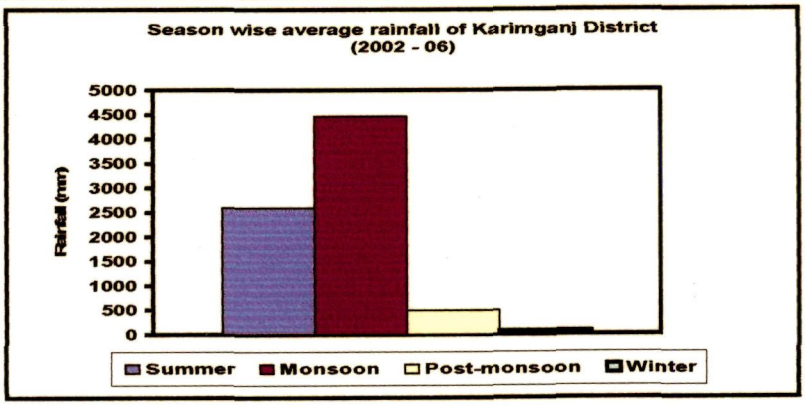
July	97	87	94	79	95	84	92	80	92	76
August	94	75	94	73	94	74	92	72	92	68
September	95	71	96	77	95	83	92	72	93	74
October	91	70	97	75	93	75	92	71	91	72
November	97	60	96	58	96	55	94	54	96	56
December	96	55	96	60	94	49	96	49	95	58

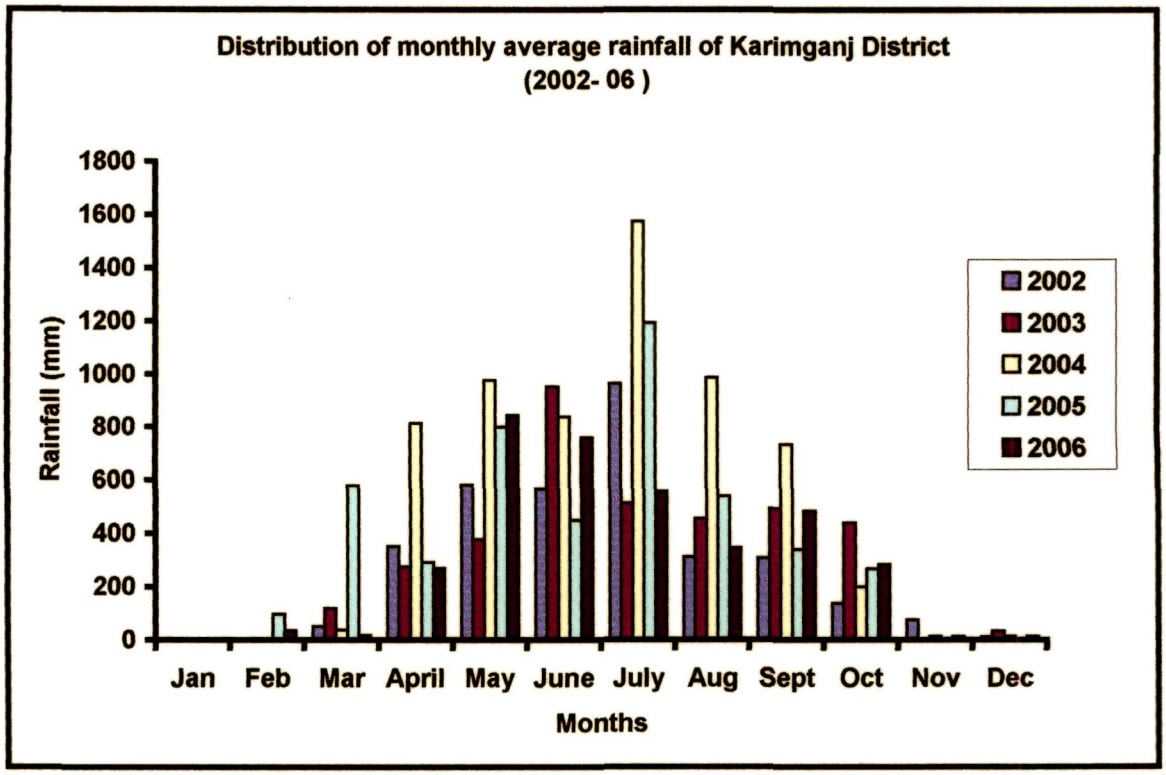
03. 9 Bright Sunshine Hours (BSSH)

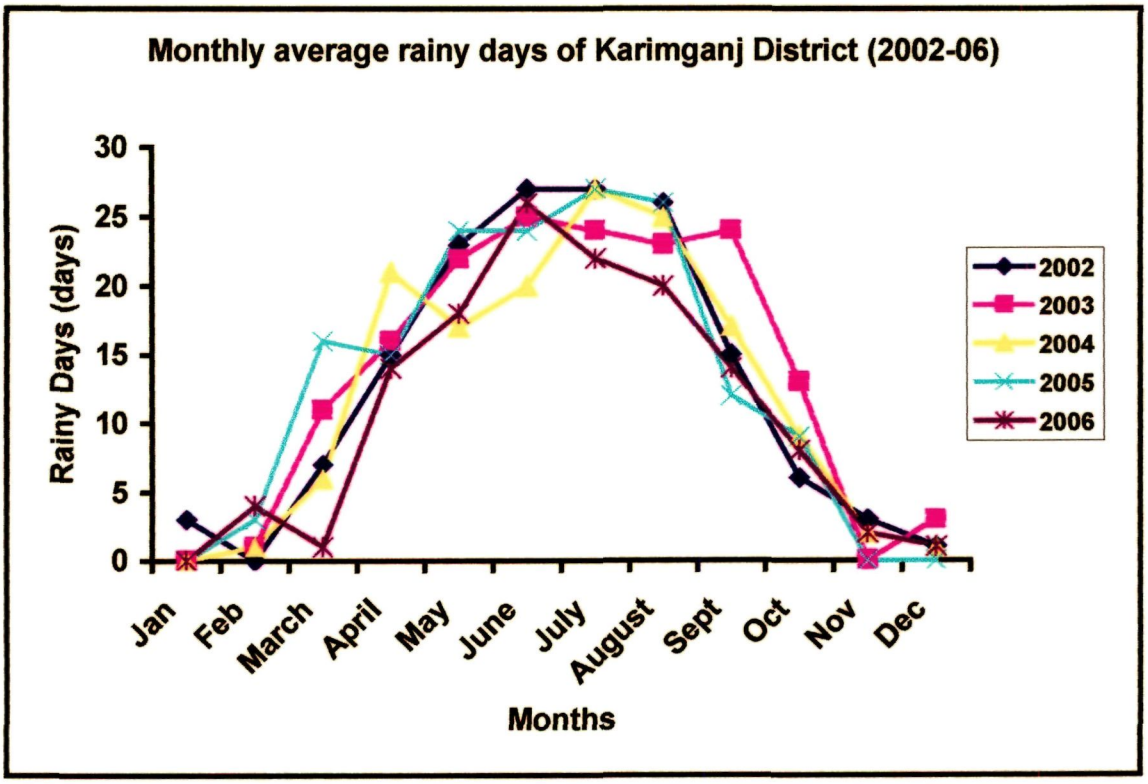
BSSH is the duration of intense sunshine in a day & is measured in hours. The apparatus consists of a sunshine recorder with calibrated recorder card. Each calibrated recorder card unit burns in one hour & total number of units burnt in a day represent BSSH of the day. Generally, BSSH is more during winter season & the average value is 5.6 hrs.

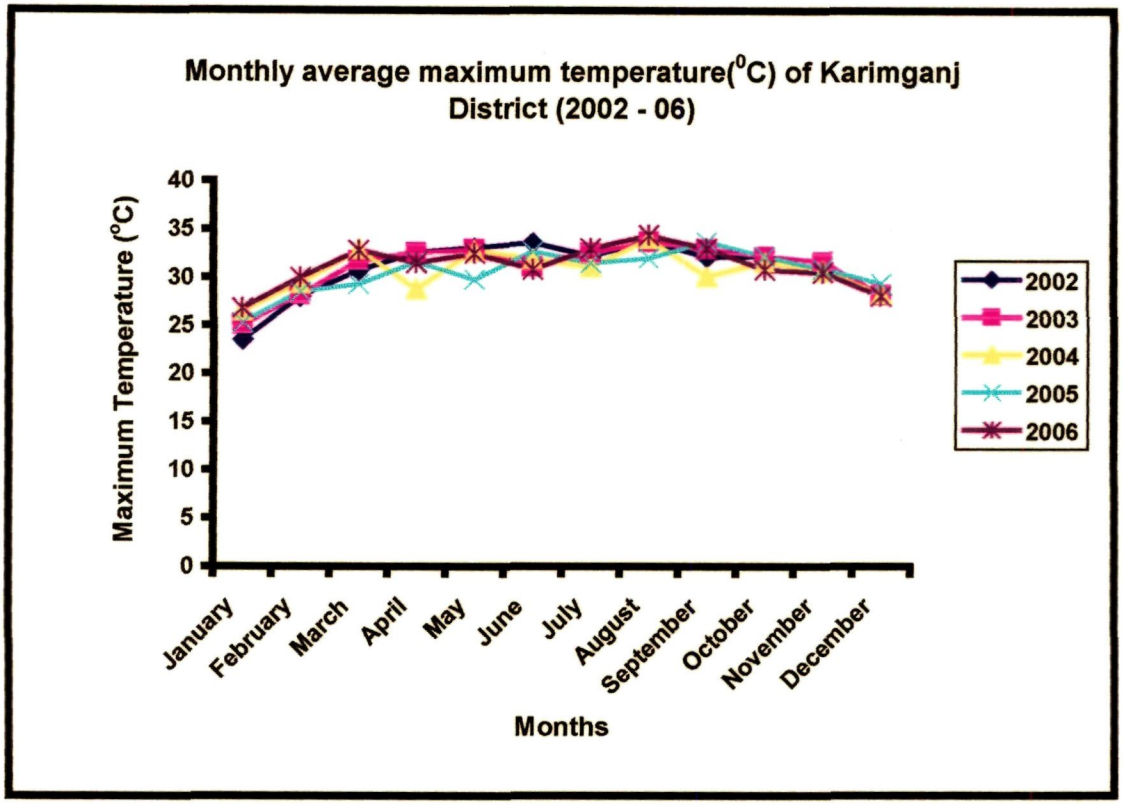
Table VI : Monthly Average Bright Sun Shine Hours of Karimganj District (2002-2006)

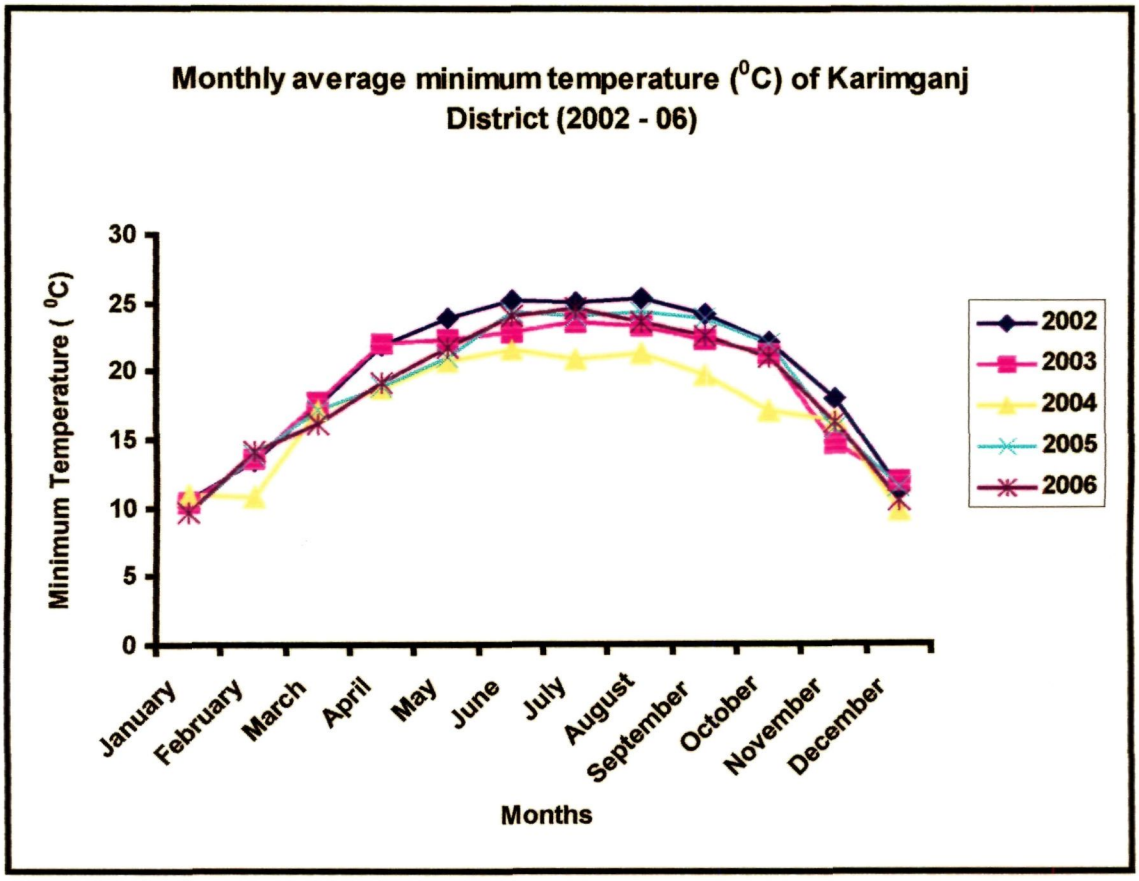
Month	2002	2003	2004	2005	2006
January	6.1	6.9	5.8	5.7	6.6
February	7.6	6.9	7.6	6.1	6.4
March	7.2	6.5	6.1	5.9	8.1
April	5.3	7.3	4.9	7.6	6.7
May	5.1	5.2	5.0	5.3	6.1
June	1.8	2.7	3.2	4.2	3.5
July	1.0	3.9	2.9	4.5	4.3
August	3.0	5.1	5.5	2.5	6.7
September	5.7	4.1	2.7	5.4	4.7
October	6.6	4.9	6.7	6.0	6.2
November	6.9	8.8	8.4	8.5	8.7
December	7.3	6.8	7.0	8.3	7.4

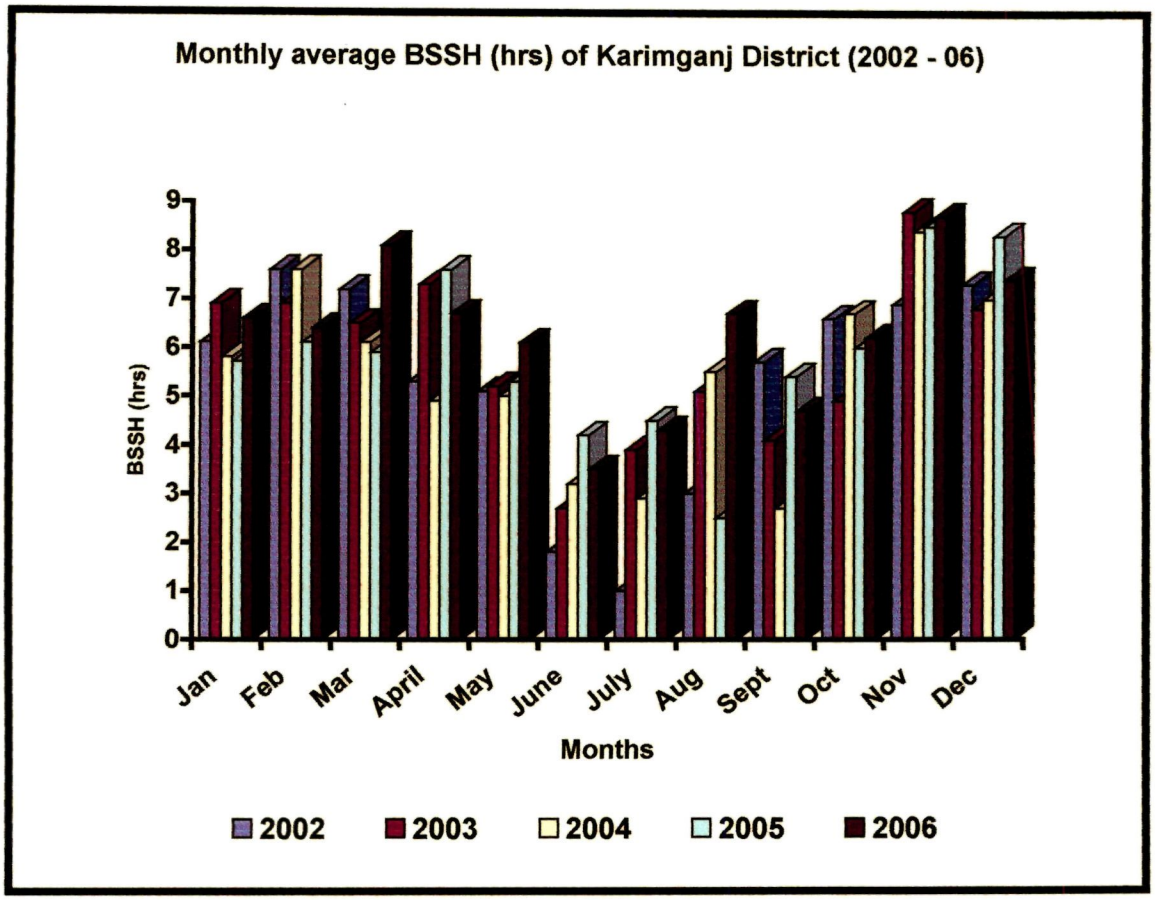


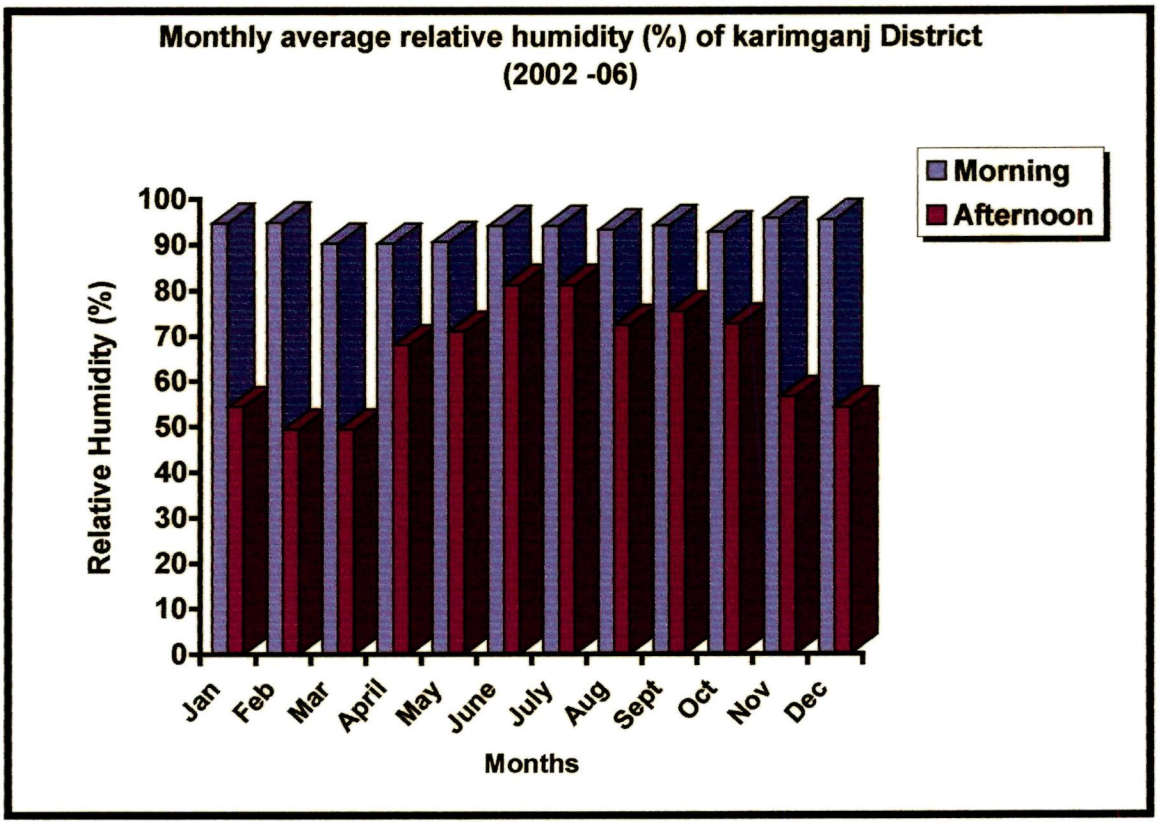

Distribution of monthly average rainfall of Karimganj District
(2002- 06)
Rainfall (mm)
1800
1600
1400
1200
1000
800
600
400
200
0
Jan
Feb
Mar
April
May
June
July
Aug
Sept
Oct
Nov
Dec
Months
2002
2003
2004
2005
2006


Monthly average rainy days of Karimganj District (2002-06)
Rainy Days (days)
30
25
20
15
10
5
0
Jan
Feb
March
April
May
June
July
August
Sept
Oct
Nov
Dec
Months
2002
2003
2004
2005
2006


Monthly average maximum temperature(°C) of Karimganj District (2002 - 06)
Maximum Temperature (°C)
40
35
30
25
20
15
10
5
0
January
February
March
April
May
June
July
August
September
October
November
December
Months
2002
2003
2004
2005
2006


Monthly average minimum temperature (°C) of Karimganj District (2002 - 06)
Minimum Temperature (°C)
30
25
20
15
10
5
0
January
February
March
April
May
June
July
August
September
October
November
December
Months
2002
2003
2004
2005
2006


Monthly average BSSH (hrs) of Karimganj District (2002 - 06)
BSSH (hrs)
0
1
2
3
4
5
6
7
8
9
Jan
Feb
Mar
April
May
June
July
Aug
Sept
Oct
Nov
Dec
Months
2002
2003
2004
2005
2006


Monthly average relative humidity (%) of karimganj District (2002 -06)
Morning
Afternoon
Relative Humidity (%)
0
10
20
30
40
50
60
70
80
90
100
Jan
Feb
Mar
April
May
June
July
Aug
Sept
Oct
Nov
Dec
Months

03. 10 Soil Types:

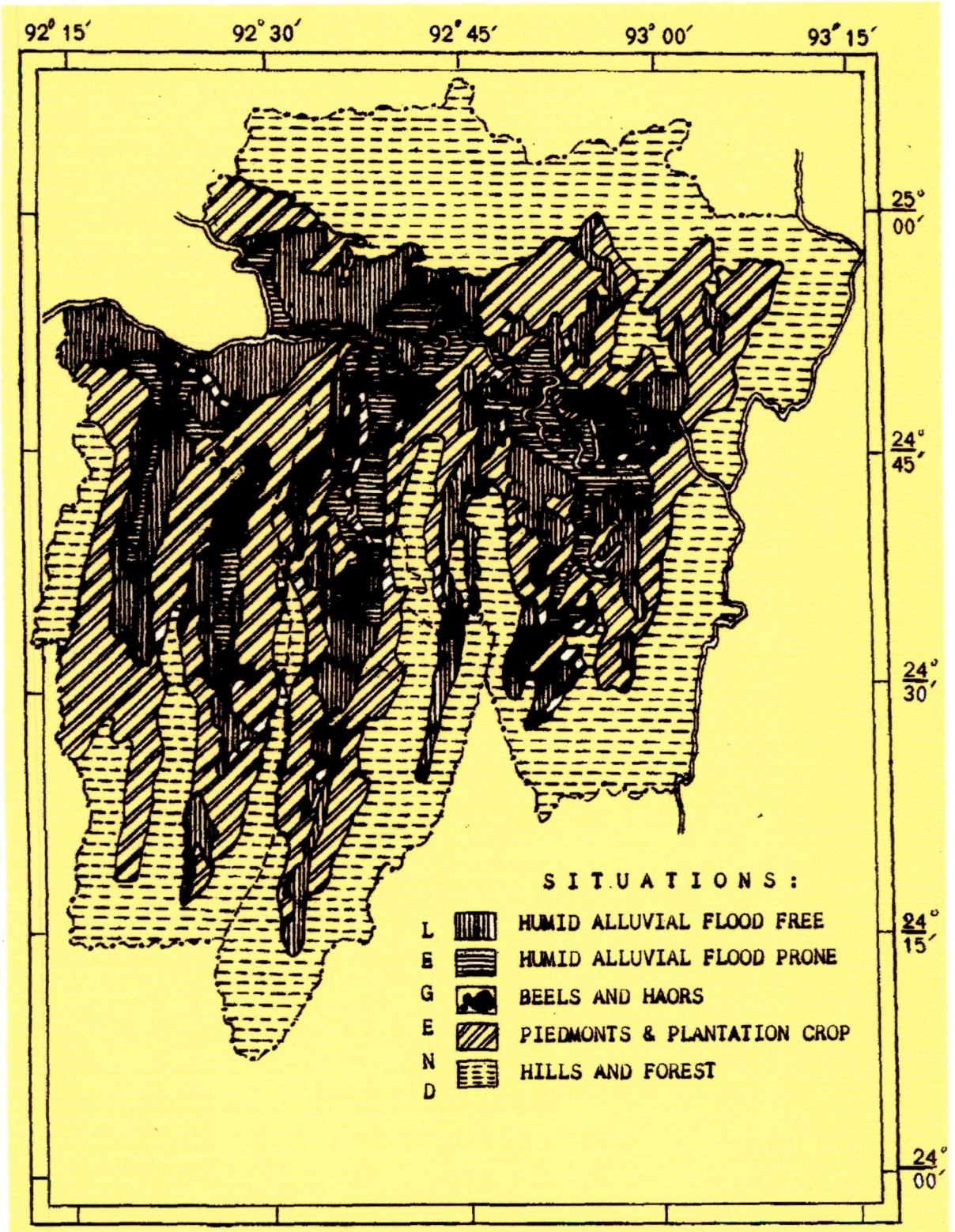
The major soil types of the district varies from sandy to clayed in nature with acidic P^{H} range from 4.6 – 5.7. Regarding the fertility status, the nitrogen content is moderate to high; phosphorous is low to medium while the soil is deficient in potash. The major soil classes of the district are:

(i) Old riverine alluvium soil: This type of soil is mainly confined to the banks of Kushiara and Longai rivers. The texture of this type of soil varies from sandy to fine silty loam type.

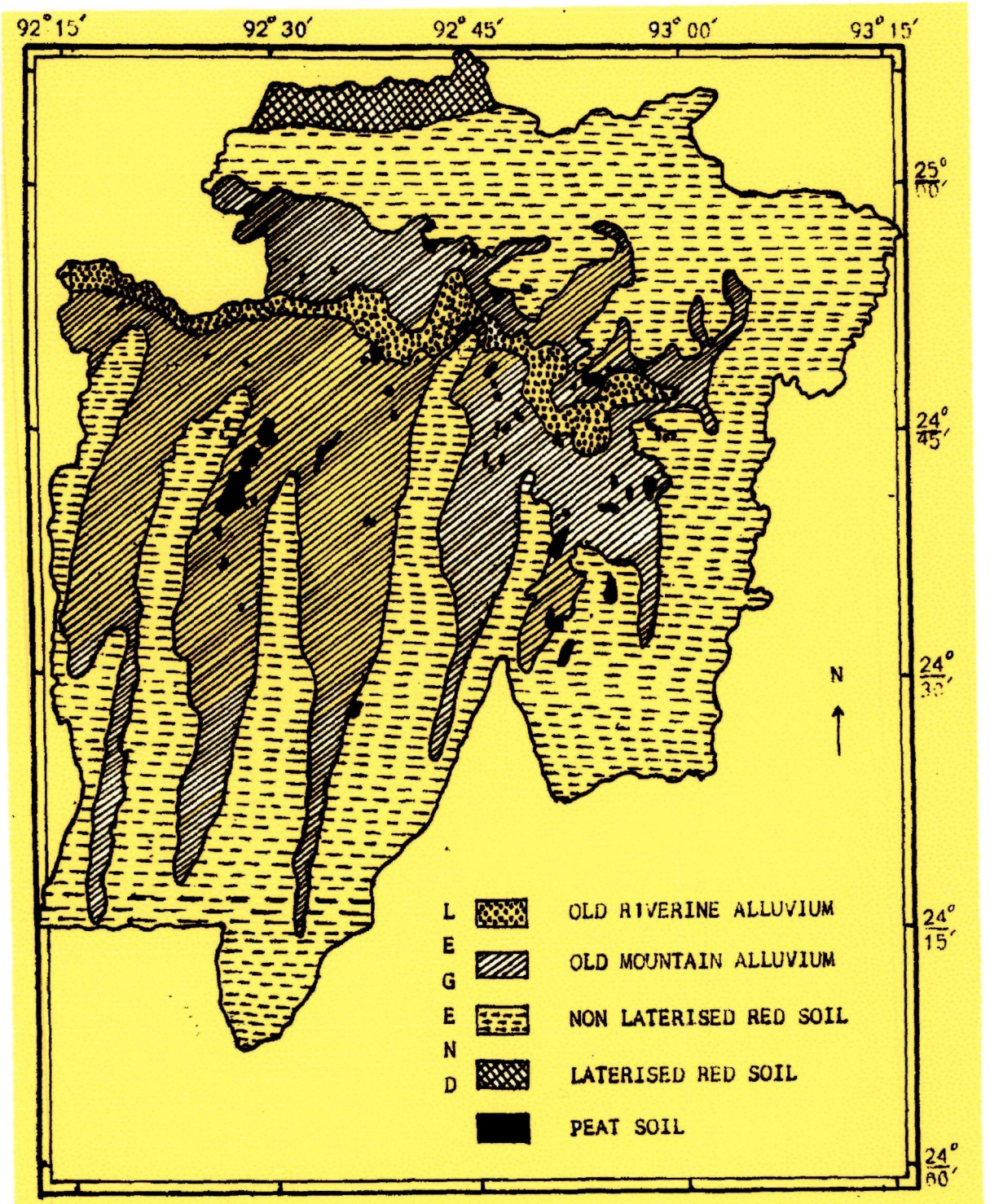
(ii) Old Mountain alluvium: This type of soil occur, in broad meander plains and undulating plains bordering the old riverine alluvium. This type of soil is formed from the sedimentary rocks like sand – stone, shale and sandy shale. The texture varies from sandy to clay.

(iii) Non – laterised soil: The entire alluvial region is surrounded almost on all sides by non – laterised red soil and this type cover the largest area of the district.

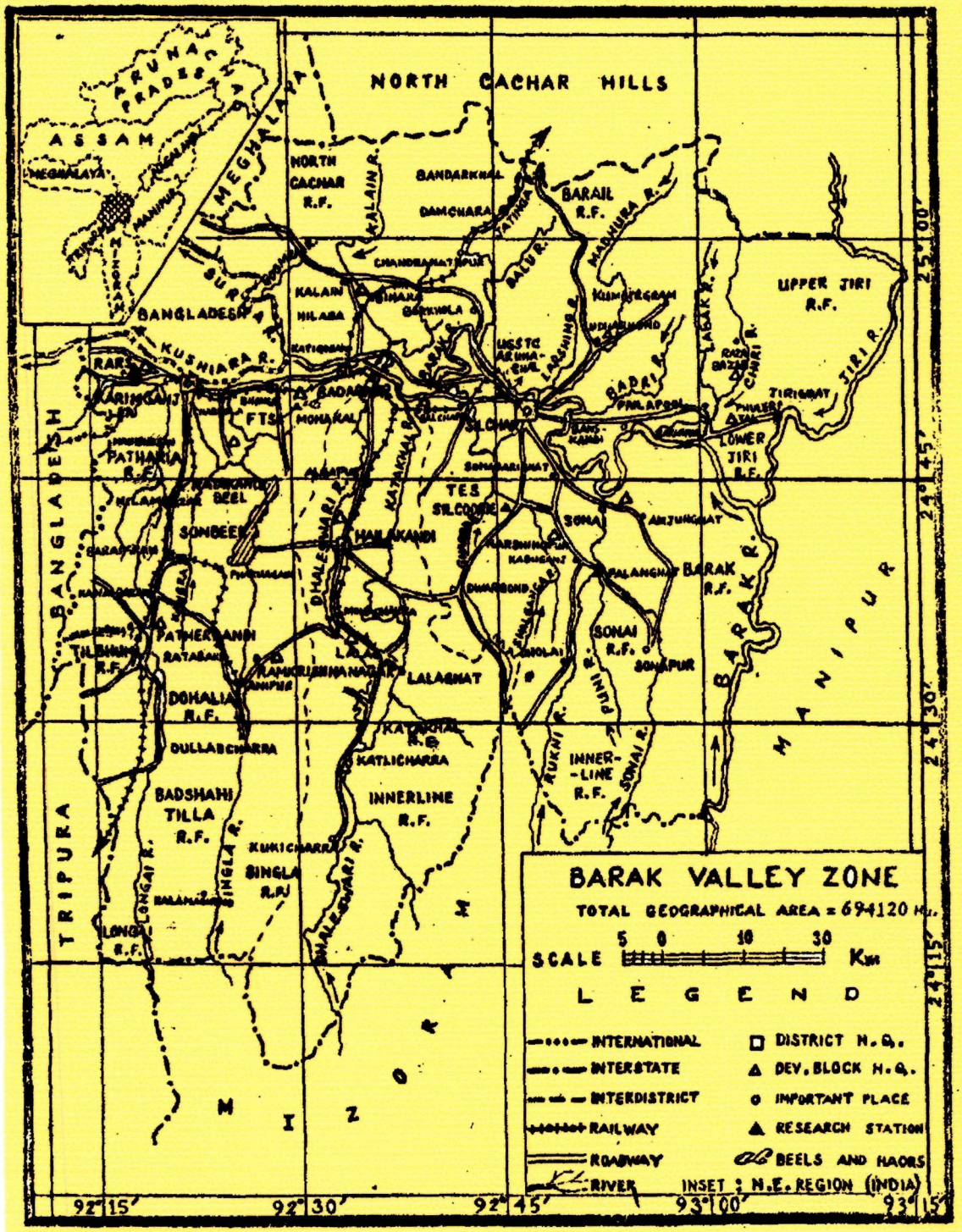
(iv) Peat Soil: This soil occurs in scattered patches of low lying areas ie, in beels and haors. The soil is rich in organic matters, usually dark gray in color & heavy in texture.



Map 1 : Agroecological situations in Barak Valley zone



Map 2 : Soil map of Barak Valley zone



Map 3 : Base map of Barak Valley zone

04. HISTORICAL FEATURES AND DEMOGRAPHIC PATTERN OF THE DISTRICT.

04.1. Historical Background of the District

Early Period

The early history of present district of Karimganj, Assam, is hazy and obscure. With available source materials and evidences, it is different to construct a chronological comprehensive account of early history of the region. Only a broad outline, with major gaps, can be attempted.

From the " Nidhanpur copper inscriptions " issued by king Bhaskarbarman, it is learnt that the region has been within the Kamrupa Kingdom about a hundred years since A. D. sixth century. The Aryanisation of the region under the leadership of the pioneer immigrant Brahmins with plough – based agriculture as economic basis had its beginning during this period. From the " Kalapur copper plates " issued by Samata Marundanatha, it is learnt that in the 7th century A. D., this region, along with foothills of North Cachar Hills had passed on to the Samatata Kingdom of the Eastern Bengal. Of course, there is no direct evidence to prove it. In the 10th century A. D. King Srichandra of the renowned Chandra Dynasty of Eastern Bengal incorporated the entire region within his Vanga Kingdom : During this period, The Chandrapura Matha or Monastery, situated at Panchakhanda (8 miles from Karimganj town, now in Bangladesh), became a very reputed center of learning. According to the renowned historian D. C. Sarkar, the Chandrapura Matha was the greatest center of Hindu – learning in the entire Eastern India of the early period. From two Bhatera inscriptions of Govindakeshava Deva and Ishana Deva, it is learnt that there was an independent Srihatta Rajya in the 12th century within which the entire Karimganj District along with a major portion of the Cachar plains were incorporated.

Middle Age

When Hazarat Shah Total, a warrior Muslim saint from Yemen, conqured sylhat in 1328 A.D., Srihatta, along with a major portion of Karimganj district passed on to the Bengal Sultanate. A portion of Karimganj district comprising the present thana area of Patherkandi was under the control of Tripura king at that period. However, during the reign of Hussain Shah (1483 – 1519), this region – at that time known as Praragarh also came under sultanate. We have two inscriptions one of Hussain Shah, and another of his son Mahmud Shah, found respectively at Kaliganj and Suprakandi, to show that Bengal sultanate had sway over this entire region. The region, along with other parts of Sylhet, was incorporated within the Mughal Empire

in 1576 during the region of Akbar. According to Ain – I – Akbari, most of the areas of the district were placed under the pratapgarh Revenue Mahal of the Sylhet Sarkar of the Mughals. The district continued to be part of the Selhet Sarkar and Bangla Suba of Mughals.

British Era and Freedom Movement

In 1765, the dewani of the Bangla Suba was taken over by the British East India Company and the District of Sylhet, of which Karimganj was a part, passed on to the British. However, upto 1786, the British could not establish their hegemony over the entire region. A local Zamindar, Radharam, brought under his administrative control, a vast region of Southern Karimganj, and local people started calling him Nawab Radharam. His blatant defiance of British authority brought the matters to a head, but Radharam could survive two successive expeditions of the British contingents. Ultimately, a reinforced contingent succeeded in capturing him after defeating his native force. While he was being carried to Sylhet by the Company soldiers, Radharam reportedly committed suicide. It is only with his fall in 1786 that the British could establish their complete authority in the region around Karimganj.

In November 1857, three companies of the 34th Native Infantry stationed at Chittagong mutinied and they subsequently emerged in the south – east of the Sylhet District. At Latu village of present Karimganj district, these rebel soldiers encountered a contingent of the Sylhet Light Infantry under the command of Major Byng. The sepoys were defeated, but Major Byng was killed. At Malegar hillock of Latu village, the graves of the fallen rebels are still venerated by the local people.

The Sub division of Karimganj under the Sylhet District was created in 1878 with Karimganj town as its headquarters. The Sub – division played an important role in the freedom movement. The famous Chargola exodus, one of the earliest organised labour movements of the country, had its origin in the Chargola valley tea – belt of Karimganj Sub division.

Partition & post – partition period

At the time of partition of the country, in 1947, the district of Sylhet was transferred to East Pakistan barring three and half thana areas (Ratabari, Patherkandi, Badarpur and half of Karimganj thana) of the Karimganj sub division. This truncated Karimganj sub division was incorporated in the Cachar District of Assam as a full - fledged sub division. This sub division was upgraded to a district on the 1st of July, 1983, vide Govt. Notification no. GAG 15 / 83 / 1 dated June 14, 1983.

04.2.Communication Transportation

Karimganj district is located at the southern fringe of the state of Assam, in the North East India. Although various modes of communication to this district is available, due to the remoteness from the mainland of India, the existing transportation and communication facility is a major bottleneck in the development process of the distict.

Road Communication

The major road link to the district is National Highway 44 which starts from Shillong in Meghalaya and after passing through Karimganj, goes up to Agartala in Tripura state. It also provides a major intra – district communication backbone as it covers a stretch of more than 83 Kms in this district. After entering through Karimganj – Hailakandi border at Badarpurghat, it connects important places like Badarpur, Karimganj Town, Nilambazar, Patherkandi, Lowairpoa etc, before entering Tripura at Churaibari. Road link to the nearest major town Silchar is provided by N. H. 53. Besides, a new National Highway 151 has been sanctioned for connecting Karimganj Town with Sutarkandi on the Bangladesh. This is largely meant to facilitate border trade with Bangladesh by road.

The total road length in Karimganj district as on 31st March, 1998 was 1455.23 kms. Out of which 249.45 Kms. Is metalled 1205.78 Kms. is kuchcha. These roads are built and maintained by various organisations like BRO, PWD, NEC, Forest, DRDA, local bodies and so on.

For both goods and passenger transportation, road is the most widely used mode. Karimganj is well connected by direct night service buses from Guwahati, Shillong, Aizwal etc. operated by many operators, mostly private. Agartala is also connected through direct day service buses. Silchar, Badarpur, Patherkandi, R. K. Nagar and other places are connected by various transports like bus, minibus, utility vans etc.

Rail Communication

In earlier times, rail communication used to be the most preferred mode of Communication both for passenger and cargo. In the Pre independence era, Karimganj Railway station was a major hub of rail communication as the whole of Assam and present day North East was connected by a major rail link passing through present day Bangladesh. After independence of India, which was accompanied by partition of the land, the main rail link was sealed and Karimganj railway junction lost much of its importance. Even now, a train service is operated through this truncated

rail – link from Karimganj junction to the border station of Mahishasan which is just at a distance of 12 Kms.

Badarpur, in Karimganj district is still now the major railway junction and main hub in the entire Barak Valley and Southern Assam. Direct train services are available to Guwahati, Lumding, Silchar, Dharmanagar – Kumarghat (in Tripura), Bhairabi (in Mizoram). Silchar – Badarpur – Karimganj – Dharmanagar train service is also an important railway service, although with the rising popularity of the road transport system, this has lost much of its importance in the last few years. Rail links also exist between Karimganj and Dullavcherra through Baraigram Junction.

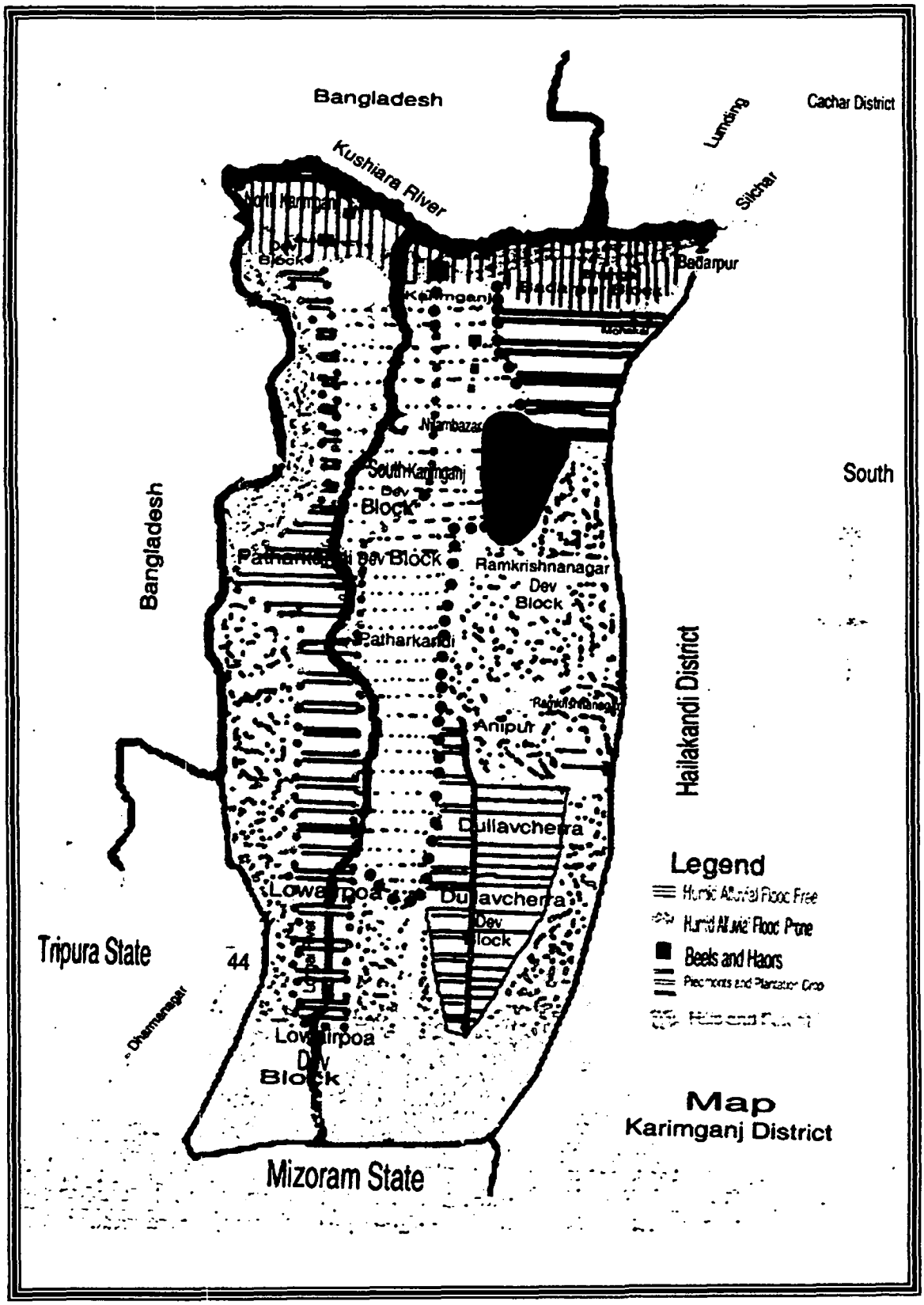
The Hill Section of the N. F. Railway, connecting Lumding and Badarpur is a major arterial rail link of Barak Valley with the rest of the country. This single – track meter – gauge line passing through tortuous hill tracks in North Cachar Hills plays a role of immense importance in the economy of Karimganj District, and for that matter, for entire Barak valley, Tripper, Mizoram and part of Manipur.

Air Communication

Karimganj district does not have its own airport. However, the nearest airport is at Kumbhirgram (near Silchar in cachar district) at a distance of 83 Kms. from Karimganj town(48 Kms. from Badarpurghat) serves as the major communication link point for the people of Karimganj. Indian Airlines (Alliance Air) operates flight services in the Silchar – Kolkata (6 days per week) and Silchar – Imphal (3 days per week) routes this airport.

River Communication

River transportation link exits between Karimganj and Kolkata through Bangladesh. Central Inland Water Transport Corporation maintains jetty and warehouse at Karimganj Town by the side of Kushiara River for handling and storage of cargo carried by steamers by this route. Although this provides a very cheap mode of cargo transportation, the service has largely been an irregular one.



Map 4 : District map of Karimganj

04.3. Population and Demographic structure of the District.

As per the last population census held in 2001, the population of Karimganj District is 10, 07, 976 of which 5,17,680 were Males (ie, 51.3%) and 4,90,296 were Females (ie 48.6%). The Density of population of Karimganj District is one of the highest in India. With a total land area of 1809 sq. Km, the Density stands at 557 persons per sq. Km. This figure far outstrips the corresponding state figure of 340 and the national of 273. In fact, this is the third highest district level density in the whole of North East. With the further growth of population in the last few years, the density has gone up further.

The total population of the district is about 4% of the total population of the State of Assam which is 26,655,528 as per 2001 census.

As much as 93% of the district population lives in rural areas. Urban population accounts for only about 7% compared to 11% of the state (Assam) and 26% for the country (Table VII).

A fairly large percentage (13%) of the population belongs to Scheduled Caste (SC) community comprising Kaibarta and Namashudra castes. The total population of Scheduled Tribe (ST) of the district as per 2001 census was 2901 (0.30%) – a figure largely disputed by many and according to whom the ST population was grossly under – enumerated in the census. The tribal population of the district largely comprises of Dimasas, Khasis, Barmans, Tripuras, Halam, Hmar and many others(Table VIII a&b).

The religion wise classification of the population of the district showed that, 4,14,731 are Hindus (50.15%), 4,06,706 are Muslims (49.17%) & rest are Christian, Jain, Buddhist, & others(Table IX).

The percentage of literacy of the district is 66.2% compared to 63.3% of the state (Assam) and 65.4% of the National Literacy (Table X).

The sex ratio (Female to Male) for the total population of the district is 947 (per 1000 males) & the figure for the state is 935 & the nation is 933. After Independence, the population of Karimganj district is increasing at an alarming speed and as a result the Density of population is also raising. The decenial growth of population also shows a steep raising trend from 1951 to 2001.(Table XI)

The predominant language of the district is Bengali (particularly, Sylheti, a dialect of Bengali spoken by the people of Sylhet, now in Bangladesh, to which Karimganj once belonged). The other important languages spoken in the district are Hindi (used largely by the tea plantation workers who migrated from Bihar, Eastern UP and other states), Manipuri, Assamese, Dimasa, Khasi & so on.

Table VII. Classification of population by Area.

Particulars	Unit	Population			
		Male	Female	Total	Percentage
Total Geographical area	Sq. Km	-	-	1,809	-
Total Population	Persons	517680	490296	10,07,976	-
Rural Population	Persons	479530	454596	934126	92.60
Urban Population	Persons	38150	35700	73850	7.3
Literates	Persons	319205	230914	550119	66.2
Females to Male Ratio	Per thousand Males	-	-	947	-

Table VIII a. Classification of population by caste

Category	Population	Percentage
General	874118	86.7
Schedule caste	130957	12.9
Schedule tribe	2901	0.29
Total	1007976	100

Table VIII.b. Circle wise classification of population

Circle	**Total Population**	**SC Population**	**ST Population**	**Percentage of S. C.**	**Percentage of S. T.**
Karimganj	2, 32, 214	28, 264	273	12.2	0.1
Badarpur	1, 34, 695	13, 532	184	10.0	0.1
Nilambazar	1, 91, 615	18, 549	19	9.7	0.0
Patherkandi	2, 14, 057	24, 145	846	11.3	0.4
Ramkrishna Nagar	2, 35, 395	46, 467	1, 579	19.7	0.7
District Total	10, 07, 976	1, 30, 957	2, 901	13.0	0.3

Table IX. Classification of population by Religion.

Religion	Population	Percentage
Hindu	4, 14, 731	50.15 %
Muslim	4, 06, 706	49.17 %
Christian	4, 774	0.58 %
Jain	409	0.05 %
Buddhist	286	0.01 %
Sikh	50	0.01 %
Not Stated	107	0.01 %
Total	8, 27, 063	100.00 %

Table X. Classification of population by literacy

Category	No. of Literates			Percentage of Literacy			No. of Literates			Percentage of Literacy		
	Male	Female	Total	Male	Female	Total	Male	Female	Total	Male	Female	Total
Urban	32337	28078	60415	93.5	87.0	90.4	25.406	21.306	46.712	91.05	84.02	87.70
Rural	286868	202836	489704	73.0	54.7	64.1	194.746	122.927	3,17.673	61.66	41.40	51.85
Total	550119	319205	230914	74.7	57.3	66.2	220.154	144.233	3.64.385	64.05	44.76	54.71
National Literacy Average : 65.38							National Literacy Average : 52.21 %					
Census of Assam 2001							Census of Assam 1991					

Table XI. Classification of population by decennial growth.

Year	Area in Sq. Km.	Population	Density in Sq. Km.	Decennial Variation	Percentage
1951	1, 839	3, 78, 324	205	—	—
1961	1, 839	4. 65. 198	252	+ 86, 874	22. 96 %
1971	1, 839	5, 82, 108	316	+1, 16, 910	25. 13 %
1981	No census was conducted in Assam 1981.				
1991	1, 809	8, 27, 063	457	2, 44, 955	42. 08 %
2001	1, 809	10, 07, 976	557	+1, 8 0, 913	33 %
* % of variation for 2 decades from 1971 to 1991.					

04.4.Socio-Economic condition and Developmental status of the District

Economy and Development

Development status

Developmental scenario of Karimganj district is not very bright. In fact, it is one of the most backward districts of India in terms of socio-economic development. The CMIE index (a comparative index of development generated by the Centre for Monitoring of Indian Economy with index for India as base of 100) for Karimganj District stands at 39 in comparison to 54 for the state of Assam and 100 for India. Geographical remoteness from the main part of the country coupled with poor communication and other infra-structural facilities are the main factors behind the low level of development.

Workforce and Employment

As per 2001 census, out of the total population of 1007976, only 235,016 (23%) persons constitute the main work-force, 68,278 (7%) account for marginal workers, leaving the rest 70% population non-workers and hence, economically non-productive.

Distribution of Workforce

Out of the 235,016 main workers again, 153,321 (68%) are engaged in agriculture and allied activities like farming, fishing, forestry, horticulture etc. Industries (household as well as non-household), mining & quarrying, construction works etc. all combine account for only 16,859 (8%) of main workers. Trade, commerce, transportation, communication etc. account for another 26,730 (12%). The rest 25,750 (12%) are engaged in the service sector.

Primary Sector

Agriculture : Econony of Karimganj district is agrarian in character with as much as 60% of the active workforce engaged in cultivation. Together with Farming, Livestock, Fishery, Forestry etc, the Primary sector of economy engages a total of 68% of active workforce. But the net area sown at around 35% of the total land area has remained more or less stagnant for years due to low rate of multiple cropping, which again, is the result of poor irrigation facility, even though the district is fed by three perennial rivers, large swamps and watersheds. As a consequence, the

productivity is rather low. For example, in 1997-98, winter Rice - the main farm product - registered a productivity of 1,759 Kg/Ha. Sugarcane, areca nut, vegetables etc are also significant farm products. Sugarcane production in 1995-96 was put at 121,355 M.T. while areca nut production was 1,083 M.T. Other cultivated crops are large in variety, but low in quantity having little marketable surplus. Leaving 30% of total land area under forest, the remaining 35% is either barren, fallow or uncultivable wasteland.

Plantation : Among plantation crops, Tea and Rubber are the major ones with the turnover of the former being 77 Lakh Kg. and the latter, about 1 Lakh Kg. The total land area under 27 tea gardens in the district is about 25,000 Hectares, although only about one-third of this land is under actual tea plantation. Rubber plantation in the district is relatively new and occupies only a fraction of the land under tea plantation. Most of tea and almost whole of the rubber output is exported to other states/countries.

Fishing : Karimganj District has huge potential for fishery, being endowed with a large number of rivers, swamps, ponds and other natural water bodies. There are 49 registered beels covering a total area of 4,420 Hectares and about 23,535 smaller ponds and lakes covering another 3,545 Hectares. Besides, there are 7 river based fisheries in operation. Total Fish production in the district in 1997-98 was 8372.97 M.T. Besides, about 176.338 Million fry and fingerlings were also produced in the same year. In spite of this, the district is far from being self-sufficient in fish production, particularly, owing to the huge consumption of the item. Large quantities of fish is imported from distant states of Uttar Pradesh, Andhra Pradesh and also neighbouing country of Bangladesh.

Farming : Livestock and Poultry occupy an important place in the rural economy and also act as household assets. Cattle, buffalo, goat, sheep, pig etc are the most common livestock animals while hen and duck comprise the poultry birds. However, egg production is very much deficient and therefore imported from other states in large quantity.

Secondary Sector

Industry : There is no large or medium scale industry in the district. The only sugar mill located at Chargola near Ratabari is closed for more than five years. Number of industries like textiles, polythene etc. set up in the Badarpur Industrial Estates a few years back have mostly closed down due to infra-structural problems. All existing industries in the district are in the small or cottage sector. Tea processing, Food Products, Bamboo & Cane Products, Saw & Plywood, Weaving etc. are the industries comprising the entire Secondary Sector of economy. Cane furniture, mats, decoration pieces manufactured in the cottage industries of Karimganj are supplied to all over India and are in great demand all over.

Oil & Natural Gas exploration : Oil and Natural Gas Corporation (ONGC) has been engaged in exploration works at several drilling sites in the district. There are indictions of large reserve of natural gas in the region. Already natural gas is being drilled on commercial basis from one drill site at Adamtilla in Patharkandi Block. A small gas-turbine based power station with an installed capacity of 15 MW has been set up at that location by DLF Corporation to generate and distribute eletricity, which has been functioning for the last 3 years.

Tertiary Sector

The Tertiary Sector of Economy is a key sector constituted by

(a) Construction (engaging 2.30% of Active Workforce),

(b) Trade & Commerce (9%),

(c) Transport & Communication (3.30%),

(d) Other Services (11.50%)

Trade & Commerce : As per last general Census held in 2001, around 9% of the active workforce in Karimganj district is engaged in trade and commerce. Before independence, Karimganj town was an important centre for trade and commerce in the entire region due to good communication links both by rail and by steamer services through what is now Bangladesh. Direct trade links with Calcutta snapped after partition of the land in 1947 and gradually the importance of Karimganj as a trading centre also lost its glory. The direct rail service was totally stopped and the steamer service continued in a limping manner. Presently the rail link through

Badarpur-Lumding-Guwahati-New Jalpaiguri/Siliguri is the only railway link, albeit a very long one, connecting Karimganj to the rest of the country. Similarly, the national highway through Badarpur-Shillong-Guwahati is the only viable road link available. In view of the immense importance of this road link on the entire economy of this region, the road has been considerably improved, making it more stable, wider and less landslide prone. Karimganj has to has to depend on the supply from rest of India for most of the items of daily need, such as food grains, spices, sugar and other food items, textiles & garments, construction materials, automobiles & auto-parts, stationery items and so on. The supply of Kerosene, Petrol, diesel, L.P.G., paper etc comes from other parts of Assam. Among the export items, tea, bamboo & bamboo products, cane & cane products, forest products like timber & stone, areca nut (betelnut) are the major ones. Internal trade in the district has been seriously

Gross Domestic Product - District Level

The Economics & Statistics Deptt. has made a tentative assessment of contributions made by some of the sectors of economy in the district. Although not complete or perfect, some indications regarding the general economic status is available from this study. The estimated contributions of various sectors towards District Domestic Product (DDP) are as follows :

Agriculture : Rs. 203 Crores

Fishing : Rs. 83 Crores

Farming : Rs. 70 Crores

Forest : Rs. 5 Crores

Industry : Rs. 71 Crores

Basic information with regard to the share of the tertiary sector is not available yet. However, after taking certain assumptions, the per capita DDP in 1996-97 was put at Rs. 1,628 /- based on 1980-81 price level and at Rs. 6,663 /- at current price level.

To arrive at Gross Income, we have to add the total foreign exchange remittances received from family members living and earning abroad, the estimated value of which may be put at around Rs. 100 Crores per annum.

Forestry: There are sin reserve forests in the district which produce huge quantity of Timber, Bamboo, Cane and stone. There are about 54 thousand hecture of forest area

covering almost 30% of the total area. The forests are rich in various costly timbers like Teak, Sundi, Gamari, etc. Huge quantity of bamboo is harvested and supplied regularly to Hindustan Paper Mill (The second largest in Asia) in the neighbouring Hailakandi District. However, in the last few years, restrictions have been imposed on cutting of trees to prevent large scale deforestation and as a result, timber production has gone down considerably. The Social Forest Division of the district is rendering good services by planting saplings *Polyathia longifolia, Musea ferea, Delonix regia, Accacia auriculiformis* etc. on the road sides and other important locations of the district.

Item

Table XII. Area under Reserve forest.

Item	Area in Hectares	Percentage
Reserve Forest.	**48, 057.17**	**26.58**
Proposed Reserve Forest.	**6, 479.08**	**3.59**
Total Forest. (Excluding unclassified state forest)	*** 54, 536.25**	**30.17**

* The area of R. F. as shown is exclusive of 25238.65 hect. of N. C. Hills R. F. falling under Cachar Civil Territory but managed by Karimganj Forest Division.

Table XIII. Target & Achievement of social Forestry

Reference Year	Target in Hect.	Achievement in Hect.	No. of Seedling planted.
2003 – 2004	35.00	35.00	87, 563
2004 – 2005	75.00	75.00	43, 387

Table XIV. Distribution of workforce.

Particulars	Population			
	Male	Female	Total	Percentage
Total Population	5, 17, 680	4, 90, 296	10, 07, 976	—
Total Workers	2, 46, 077	57, 217	3, 03, 294	30.08
Main Workers	2, 07, 854	27, 162	2, 35, 016	23.31
Cultivators	68, 207	7, 753	75, 960	7.53
Agricultural Labourers	37, 066	8, 669	45, 735	4.53
Marginal Workers	38, 223	30, 055	68, 278	6.77
Workers in House hold	5, 097	8, 582	13, 679	1.35

04.5. Problems and Prospects of the District:

Problems : The district suffers from lack of infra structure and poor communication facilities. The main sector of economy is agriculture and is primitive in nature with poor productivity. In the other sectors too, lack of entrepreneurship, low credit – Deposit ratio, erratic electricity supply, unstable road communications during monsoon etc. have greatly affected the development of the district. The district being a flood prone zone of Assam and so frequent floods causing a great havoc to the people and economy. The recurrence of floods cause great threat to the forest and also cause soil erosion. The district witnesses a very high population density (557 / sq km in 2001) which is the third highest in the entire North East, puts a grate pressure on the limited cultivable & forest land as major portion of the land area is being encroached every year by the refugees migrated mainly from the neighbouring country of Bangladesh. Because of this huge population explosion many natural aquatic habitats like ponds, beels, haors & marsby places etc are being earthfilled for human settlement, which reflects to great depletion of aquatic vegetation of the

district. The shifting cultivation or Jhum cultivation as practiced by many tribal groups of the district pose threats to the natural vegetation & along with. This some tribal groups of the district also practice "pan jhum" where large trees are cut atop and betel leves are cultivated in an extensive manner.

For more than a century tea cultivation is being widely practiced in the district and for extensive cultivation of tea plants, many virgin forests have been cleaned wantonly since 1935. The recent growth of various terrorist and insurgent outfit in the reserve forests of the district make it difficult for the plant scientists to collect flora from the core zone of the forests, which hinders the path of creation of exact phytodiversity data-bank of the district.

Prospects: There is enough scope for development if the inherent strengths and unique advantage, are adequately harnessed. Vast forest reserve, huge potential for fishery, horticulture and other agro – based industries, possible natural gas reserve and also immense possibility of border trade with Bangladesh – provide a bright hope for an economic turnaround. National Highway – 44, the main road link with rest of the country is now in a much better condition than earlier. Conversion of existing Meter Gauge rail link through Hill Section to Broad Gauge is in progress and once completed, will facilitate direct and uninterrupted rail communication to any where in the country. Talks are also on regarding opening up Border trade with Bangladesh for resumption of direct rail, road and steamer communication with Kolkata. Hopefully, the coming years will witness a sea – change and rapid development in the economic status of the district.

05. MATERIALS AND METHOD

Collection : Several collection tours have been undertaken during the period from May 2003 to February 2007 visiting all the seasons of the year so as to collect maximum number of herbaceous species from Karimganj district of Assam.Emphasis has been given to collect plant materials preferably in flowering or fruiting stage from it's natural habitats.

Thorough observations have been made on the spot of collection and recorded field data of the individual plant species as regards to their natural habitat, ecological adaptation including the associated plants, distribution pattern,the colour of the

flowers, aroma, nature of roots or rhizomes / bulbs etc.and other relevant characters which could not be observed after drying the specimens or preserved in preservatives.

Collection numbers have been tagged on the spot of collection for better recording of data and also for recording of associated plants, the delicate ones are pressed in the field itself, other specimens collected in the plastic bags and brought to the camp and pressed in plant press for drying. The succulent ones including bulbous, rhizomatous etc.boiled in water for a few minutes till the specimen turned yellow to prevent abscission and then put under pressure.Every care has been taken to change the press frequently so that the specimens are properly dried. Two sets of individual plant species have been made; of the larger plants the representatives twings and in case of delicate herbs and bulbous ,rhizomatous and cormus ones, the whole plant is uprooted and a total specimen is preserved. For better morphological study some of the interesting plant with their flowers and fruits have been preserved in FAA (5cc.Formaldehyde+5cc.Glacial Acetic acid+50 % 90cc Alcohol). Following proper procedures the dried specimens are poisoned with saturated solutions of Mercuric Chloride dissolved in Absolute Alcohol and then mounted on standard herbarium sheet (42x28 cm) with the help of fish glue. A printed label is affixed at the bottom right- hand corner of the mounting board showing collection number, date of collection, the family, the genus and specis, locality, habitat, duistributon, description, photo data, vernacular names etc. All related data recorded in the field note book have been transferred on to the printed level of the herbarium sheet. One copy each of the herbarium sheets have been deposited to Assam University Herbarium of the department of Life Science with Accession No. 5101 to 5502 for future reference.

Identification: Critical morphological studies have been made of the collected plant specimens by dissection of a number of flowers both live and preserved ; analytical drawings of some of the rare and interesting live sprcimens have been made and noted down brief description. For easy identification of the plants a number of Floras and Monogarphs have been consulted specially of *Flora of British India*; Vol. 1-7 Hooker(1972-1087); *Flora of Assam*, Vol.1- 4, Kanjilal *et al.*,(1934-40) and Vol. 5 (Bor,1940) along with neighboring floras viz. *Flora of Jowai*, Vol.1& 2, Balakrishnan.(1981&1983); *Flora of Nongpoh*, Joseph,(1982); *Flora of Tripura State*, Vol 1 & 2, Deb, (1981 & 1983) *Herbaceous Flora of Dehradun*, Babu (1977) etc. and finally confirmed the identification by consulting herbaria and literature available

in Kanjilal Herbarium(ASSAM), Central National herbarium. Sibpore, Howrah (CAL) and Assam University herbarium of dept of Life Science.

Enumeration: Enumeration of species is mainly based on collection made during the period the from May 2003 to February 2007 and taken in to account the species recorded in published Floras viz; Kanjilal *et al.*(1934-40),N.L.Bor (1940),Rao and Verma (1972-82) and Deb (1981-1983). The results of this investigation –the first of its kind on herbaceous species of Karimganj district put forward to get an idea on the occurrence of species and infraspecific taxa available in the area. Along with enumeration, for most of the plants local utility by the village people or ethnic groups are provided and also compared with the established reports of utility.

Presentation:

(a) **Classification** : The families of Ferns and Fern allies are arranged according to Pichi Sermolli (1977,1982) with little modifications after Ching (a 1978) and Dixit (1984). While Angiosperms are arranged after Benthum and Hooker's system of classification (1862-1883) with slight modification of internationally accepted spiltted families as appended in appendix II of International Code of Botanical Nomencalature,Lanjour *et al.*(1961).

(b) **Keys** : Based on salient featues of morpfological chatacters the artificial dichotomous keys have been constructed for easy identification of families, Genera, Specis and infra-specific taxa.

(I) a general key to families

(II) key to genera of each family,when more than one genus in a family

(III) key to the species when more than one species

(IV) key to infra specific taxa as varieties or sub-species when more than one in a species.

Alphabetical arrangements of Genera and species with in the key are strictly followed .

(C) Nomenclature and Citation of references: The accepted correct name has been given for a species according to International Code of Botanical Nomenclature. In most cases that have been verified from a number of literature including Bennet (1987) and latest ICBN code (Vienna code-2005). The name of the species or infra-

specific taxa have been cited with the author(s) name referring the original publication and whenever there is name changes the basionames and synonymes are cited in major publication (s).The usual citation of referrences of occurrence of plants in *Flora of British India, Flora of Assam* etc. have been provided and whenever that is found not reported in aforesaid floras, referrences have been mentioned of Floras of neighboring stares of North–Eastern region including Deb's (1981,1983) and latest monographs and taxonomic revisions appeared particularly of *Fascicles of Flora of India*. This has been followed by Vernacular name(s) of the species.

(D) Description: A concise description of the species and infra-specific taxa have been provided using botanical terms .In most cases macroscopic diagnostic characters are accounted for easy idetification.This is followed by phenological data,particulatly,the flowering and fruiting period;distribution pattern;ecological adaptation including associated plants and cited the exact locality,date of collection,collection number and specimens examined.Note on the cultivation of wild plants for day to day use has also been appended.

(E) Economic utility: The data on economic utility of each and every species have been provided based on information gathered on local and reported in Flora of Assam (Kanjilal *et al.*) and classified according to their mode of uses A number of literature have been consulted and provided as established report of utility which are based on wealth of India, Anonymous (1948-1972), Anonymous, (1969,1992); Dastur (1952-1969); Dey (1986) Nandkarni (1995); Chopra *et al.*(1956,1958 &1969); Wall (1972); Kirtikar and Basu(1975,2nd ed); Asolkar *et al*;(1992), Chatarjee *et al*,(1997), Nayer *et al.*, (1989) and others.

(F) Maps,Photographs and analytical drawings : Maps are provided showing location of the states of Assam in India; the district Karimganj in Assam and district as a whole with its boundaries.

Coloured photographs depicting vegetation types, rare and interesting plants and also plants utilized by local inhabitants have been provided with their respective legends.

Analytical line drawings of live specimens are made with indelible ink giving actual magnification .

06. VEGETATION

As the present study is mainly concentrated on herbaceous and sub woody plants growing as forests undergrowth, it would be essential to study the types of vegetation that favors the growth of such plants and also to indicate the influence of trees, large shrubs or lianae on herbaceous elements. While collecting herbaceous plants species, a number of trees, shrubs, lianae etc. were observed during the field study.

Assam comprises of two large valleys, the Brahmputra valley and the Barak Valley separated by intervening range of hills in N C Hills and Karbi Anglong. The Karimganj district lies in Barak Valley alongwith Cachar and Hailakandi districts. The vegetation and Ecology of Assam (*s.l.*) has been known through the contributions made by a number of plant Geographers like J. D Hooker (1854, 1904); Kanjilal *et al.* (1934-40) and others.

Physiography, Geology and Soil, climatic factors and also courses of two major rivers – the Brahmaputra and the Barak with their turbulent tributaries have a great impact on the composition of floristic elements of Assam. The vegetation of Assam is predominantly a Tropical one except in Hamren sub-Division (Dambukso, 1363m MSL and Singhashan, 1359m MSL) of Karbi Anglong District and parts of Borail ranges along Kaukaina (1736m MSL) and Thanjang Klang (1861 to 1866m MSL) in North Cachar Hills District present sub-tropical vegetation..

Even to this data, due importance of study of the vegetation types has not been given to tropical areas. Rao and Panigrahi (1961) classified vegetation types of North-Eastern Region on the basis of attitudinal variations. Rajkhowa (1961) also classified vegetation types of Assam (*s.l*) and followed Champions (1936) with slight modifications. Rao (1974) studied the vegetation and physiography of Assam (*s.l.*) alongwith Burma; Baruah & Chowdhury (1978) made observation on floristic composition of North-Eastern Region, the latest of its kind for Assam *(s.l)*. However, classification of vegetation types of a comparatively small area like Karimganj District is hardly possible. Therefore, categorization of vegetation of Karimganj district with certainity could not be done.

Karimganj district with its total geographical area of 1809 Sq Kms which comprises varied geographical features like agricultural plains, shallow wetlands,

hilly terrains with gentle slopes and valleys in between the hillocks- these areas comprised of the reserved forests, unclassed forest and the shifting cultivation areas. The total forested land of the district is 54,504 Hacters (approx) showing percentage of forest cover is nearly 30% of land area (District information cell, Karimganj, 2005)

Depending on the altitude and the land use pattern, the vegetation composition varies from area to area and can be attributed broadly into following types :-

1. Tropical Semi-Evergreen vegetation
2. Tropical Moist and Dry Deciduous vegetation.
3. Secondary vegetation and Bamboo brakes.
4. Highland Savannah.
5. Grass land in Alluvial plain.
6. Swamps and wet-lands.
7. Riparian

Besides these, the study has been included here as Miscellaneous for the plants which are growing in (a) Waste highland; (b) Weeds along the road-sides. (c) Weeds in cultivated fields and plantations of Social Forestry Scheme (d) Cultivated plants.

1. Tropical Semi-Evergreen vegetation

This type of vegetation is mainly found in the Reserve forests of Duhalia, Singla and Longai. Consequent on the disturbance of the primary vegetation there developed more of deciduous trees than the evergreen and the Semi-evergreen vegetation and is gradually turning to be a secondary semi-evergreen forests. There is lesser number of large trees, often more of medium or short trees are found and large number of shrubs entangled by lianas are also found. Bulbous, cormous and rhizomatous plants are scattered in association with herbaceous Angiosperms; Ferns and Fern-allies. Luxuriant growth of several epiphytic orchids and ferns adorn this vegetation. There forested areas are the treasure house of plant resources. The local inhabitants hunted these forests in their day to day use.

The important tree spices of this vegetation are *Artocarpus chama; Anthocephalus chinesis; Albizia procera; Baccaurea ramiflora; Dillenia indica; Elaeocarpus floribunda; E. sphaericus; Gmelina arborea; Michelia champaca; Syzygium anisopetalum; S. cumini; Tamarindus indica; Terminalia chebula; T. myriocarpa etc.*

Amongst the shrubby species which are found to be common *Abroma augusta; Boehmeria macrophylla: Clerodendrum indicum; Chloranthus elatior;Clausena, heptaphylla; Ficus racemosa; Mussaenda roxburghii; Phlogacanthus curviflorus with a few lianae or vines Ampelocissus latifolia; Bauhinia acuminata; Entada pusaetha; Jasminum amplexicaule etc*

The forest undergrowths are represented with number of herbaceous species both perennials and annuals. The common species are *Achyranthes aspera; Ageratum conyzoides; Begonia roxburghii; Costus speciosus; Elatostema lineolatum; Globba clarkei; Leea asiatica; Dysophylla auricularia; Panicum auritum; Polygonum auriculatum; Rumex maritimus; Sida rhomtifolia; Spilanthes paniculata etc.*

The epiphytes are mainly orchids viz. *Acampe papillosa; Bulbphyllum careyanum; Cymbidium aloifolium Dendrobium anceps; Eria pubescens & Rhynchostylis retusa.*The epiphytic ferns include *Asplenium nidus; Drymoglossum piloselloides; Drynaria propiqnua; Pyrrosia adnascens.*

The Common Fern allies and Ferns grow well in shady moist situation are *Palhinea cernua; Selaginella helferi; Adiantum caudatum; Blechnum orientale; Christella parasitica; Dicranopteris linearis; Onychium siliculossum; Pteris biaurta; Tectaria variolosa etc.*

2. Tropical Moist and Dry Deciduous vegetation

The major part of the district are with moist and dry deciduous forests and these are attributed to unclassed forests and commonly dominated by species *Sterospermum chelonoides* – a tallest tree attaining 30-50 m in height along with *S. glandulosum; Halophragma adenophyllum; Oroxylum indicum; Albizia lebbek; Rhus semialata; Callicarpa arborea; Bauhinia purpurea; Cassia fistula; Ficus glomerata; F. benghalensis; Mangifera indica; Alstonia scholaris; Dillenia indica; Sterculia villosa* etc. These trees are mostly covered with a good number of creepers and climbers namely *Thunbergia grandiflora, Paederia foetida; Mikania micrantha etc.* The forest edges are covered with patches of herbaceous plants such *Eupatorium odoratum; different species of Dioscorea; Zizyphus sp; Xanthium strumarium; species of Solanum; Phrynium capitatum; Species Sida; Ferns like Pteris cretica Diplazium esculentum etc.* The district is also rich in orchid flora. The predominant species are *Aerides multiflorum; A. odoratum; Cymbidium aloifolium; Papilionanthe teres; Dendrobium aphyllum, Acampe papillosa etc.*

Dry deciduous vegetation is represented by *Aegle marmelos; Gamelina arborea; Litsea cubeba; Gynocardia odorata; Moringa olifera; Terminalia chebula; Melia azedarach.*

The forests undergrowth is a mixed one of the large erect herbs and woody shrubs with other small herbs of varying habits. It is the ground floor vegetation which renders the forests impenetrable by their luxuriant growth and being inextricably entangled by numerous twining stout shrubs and slender herbs forming dense thickets. Along the water source and on the moist hill slopes; following species are found: *Colocasia esculenta; Costus speciosus; Elatostoma lineolatum ; Globba clarkei; ; Impatiens balsamina; Cyperus sp; Floscopa scanders; Ludwigia octavalvis; Murdania nudiflora etc.*

The common large woody shrubs are *clerodendrum viscosum; C. glandulosum; Phyllanthus sp. Mussaenda roxburghii; Glycosmis arborea.*

Common herbs along the way side and forest margins are *Achyranthes aspera; Amaranthus spinosus; A. viridis, Celosia argentea; Cyathula prostrata; Euphorbia hirta; and many species of grasses like; Panicum sp, Setaria indica; Imperata cylindrical etc.*

3. Secondary vegetation and Bamboo brakes.

The primary forests in several places have been modified into secondary forests by degradation of Reserved forests. That has been caused due to encroachment of forest areas, shifting cultivation (Jhuming), ruthless felling of trees etc.

The areas transformed woody scrub jungles with scattered deciduous tree species. The species which are prevalent in these areas are the obnoxious weeds *Eupatorium odoratum Caesalpinia bonduc, Phlogacanthus curviflorus, Cassia occidentalis, C. tora, Mimosa pudica, Scoparia dulcis, Euphorbia hirta, Tabernemontana divaricata, Calotropis gigantea, Croton bonplandianum, Pogonatherum crinatum, Thysanolaena maxima etc., with climbers like Thunbergia grandiflora, Mikania micrantha, Argyreia speciosa, Cissampelos pareira* and with the occurrence of tree species viz. *Cassia fistula, Bambox ceiba, Zizyphus mauritiana, Aegle marmelos, Anthocephalus chinesis etc. The epiphytes with common orchid species viz. Dendrobium aphyllum, Acampe papillosa, Cymbidium aloifolium, Papilionanthe teres and Hoya parasitica* etc.

In Karimganj district the clump forming bamboos are *Dendrocalamus strictus, D. hamiltonii, D. gigantea, Bambusa tulda, Bambusa arundinacea* forming brakes.

About 30% of the total forested area is occupied by bamboo species. The extensive hilly slopes has been occupied by *Melocanna bambusioides.* These species have been exploited by local inhabitatnts for making different crafts items and even for fencing and making roofs of houses.

4. Highland Savannah.

It is made up of various grasses like *Imperata cylindrica, Eriocaulon cinereum, Paspalidiun flavidum,Panicum brevifolium etc* with fire-handy shrubs like *Leea acsatica, Grewia serrulata* etc. Occasional Seedlings of *Phyllanthus embelica, Lagerostromia parviflora, Bombax ceiba* etc also crop up in such formation.

5. Grass land in Alluvial plain

Extensive flat plateu of the district presents a grassland formation with luxuriant growth of various members of poaceae and cyperaceae. The common species are *Imperata cylindrica, Arundinella nepalensis, Saccharum spontaneum, Paspalidium flavidum etc.* and sedges like *Cyperus compressus, Scirpus juncoides.* Few shrubs and herbs are associated with these grasses, the predominant ones are *Leea asiatica, Solanum torvum, S. anguivi, Vernonia cinerea, Blumea lacera, Ageratum conyzoides, Emilia sonchifolia, Elephantopus scaber, Colocasia esculenta. Alocasia forniculata* etc.

6. Swamps and wet-lands vegetation.

The district is with a number of stagnating water pools, low lying areas annually inundated by the river kushirya and sometimes obstructed perennial streams form Swamps or marshy and wetlands. The tallest grasses that are found in abundance are *Arundo donax, Phragmites karka,, Hymenachne assamica and Nelumbo nucifera, Nymphaea nouchali, Nymphoides indicum* and in stagnating water pools and wetlands *Enhydra fluctuans, , Eichhornia crassipes, Monochoria hastata, Pistia stratiotes. Trapa bispinosa var natans, Ludwigia adscendens. L. octavulvis, Alternanthera philoxeroides, Polygonum hydropiper, Eragrostis tenella , Sparobolus diander etc.*

7. Riparian Vegetation

Riparian belt of vegetation are found along the banks of river Kushirya, Longai, Singla and others where predominating species are *Lagerstroemia speciosa, Barringatonia acutangula, Anthocephalus chinesis, Dillenia indica, Vitex negunda* and herbaceous ones are with *Scoparia dulcis, Melastoma malabathricum, Cleome gynandra, Centella asiatica, Commelina benghalensis, Cuphhea balsamona, Hedyotis*

corymbosa, Murdania nudiflora, Polygonum auriculatum, Oxalis corniculata, Rotala indica and ferns like Cyclosorus parasiticus, Macrothelpteris torresiana etc are found. The common grasses include *Sacciolepis indica, Stetaria glauca , Imperata cylindrica, Oplismenus burmanii and Scripus juncoides, Cyperus brevifolius, C. iria etc.*

Miscellaneous

a. Waste highland vegetation : The plants which are found in these waste highlands generally are shrubby in nature and mixed with herbaceous ones .Species which are commonly met with *viz. Sida acuta, S. rhombifolia, S. cordata, Solanum anguivi, S. torvum, Clerodendrum viscosum, Cassia sophera, C. occidentalis, Eupatorium odoratum etc.*

b. Weeds along roadsides and in places of plantations under Social Forestry Scheme: The most common weeds are *Ageratum conyzoides, Achyranthes aspera, Croton bonplandianum, Clerodendrum viscosum, Scoparia dulcis, Datura stramonium, Argemone maxicana, Solanum Spp.*

c. Weeds in cultivated fields and Social Forestry Plantations : The commonly found weeds of cultivated fields are the following. *Leucas plukentii, Eclipta prostrata, Solanum spp, Amaranthus spinosa, Scoparia dulcis, Euphorbia hirta, Oxalis corniculata, Alternanthera sessilis etc.*

d. Cultivated plants (i) Cropt plant : The most important crop is paddy

Oryza sativa). The secondary corps are Maize *(Zea mays)*, Cotton *(Gossypium spp), Castor seed (Ricinus communis).* etc. There are many tea gardens in the district and a vast majority of land area of the district are under the cultivation of tea.

(ii) Vegetables : The common garden vegetable crops are *Brassica spp; Coriandrum sativum, Pisum sativum Alluim cepa, A. sativum, Benincasa hispida,Cucurbita maxima, C.pepo, Momordica charantia, M.dioca,Trichosanthes anguina,Lablab purpuriense, Moringa olifera, Curcuma longa, Carica papaya etc.*

Among the tree species, *Tectona grandis (Teak), Gmelina arborea (Gamari), Shorea robusta (sal), Acacia catechu (Khoir), Artocarpus chaplasa (Cham), Bombax ceiba (Simul), Dillenia indica (chalta) etc.* are worth mentioning.

(iii) Timber-Yielding Plants. : The most important timber-yeilding plants are of different species of *Dendrocalamus, Melocanna bambusioides, Bambusa tulda,*

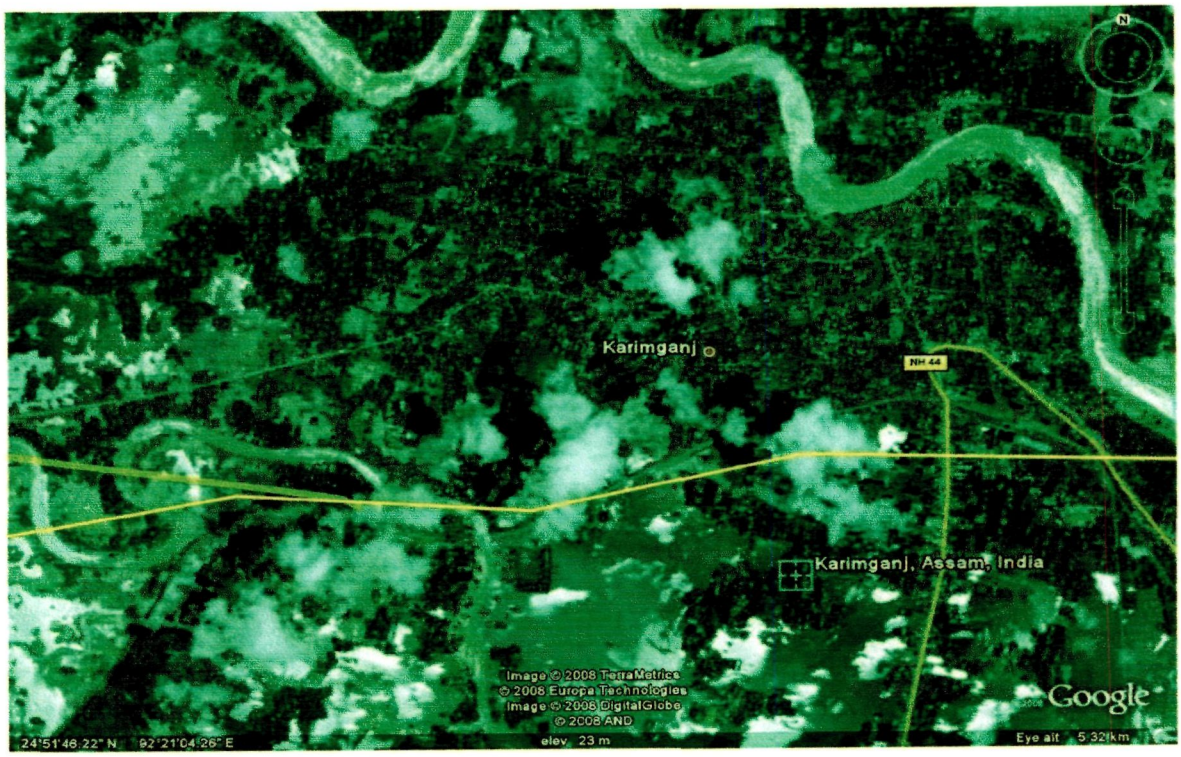
Gmelina arborea, Shorea robusta, Tectona grandis, Bombax cieba, Cassia fistula, Rhus succedanea, Sterculia villosa etc.

(iv) Fruit trees. : The common fruit trees seen under cultivation are *Mangifera indica, Carica papya, Citrus limon, Artocarpus hetrophyllus, Phyllanthus emblica, Syzygium cumini, Areca catechu, Zizyphus mauritiana, Anonas comosus* etc.

(v) Ornaments : The most common species of ornamental plants are *Mirabilis jalapa, Catharathus rosues, Acalypha hispida, Clitoria ternatea, Bauhinia purpurea, B. acuminata, Jasminum scanders ,Ixora cuneifolia, Datura metel, Ruellia tuberosa, Aerides multiflorum, Cymbidium aloifolium, Dendrobium aphyllum, Acampe papillosa, Papilionanthe teres etc.*

(vi) Plants cultivated under Social Forestry Department, Govt.of Assam:

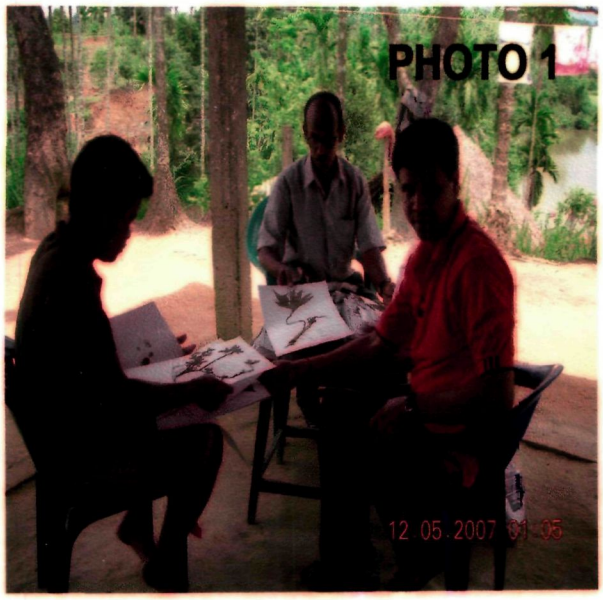
Department of Social Forestry of late, has started cultivating certain common fast growing plants to give a green coverage that too mostly along the road sides : The species are *Acacia auriculiformis, Eucalyptus citriodora, Delonix regia, Caesalpinia pulcherrima, Polyalthia longifolia, Saraca asoca* and in some areas *Dalbergia sissoo, Gamelina arborea and Melia azadiracta.*



Map 5 – Satellite image map of vegetation of Karimganj district

Source : www.googleearth

PHOTOGRAPHS
From 1 to 36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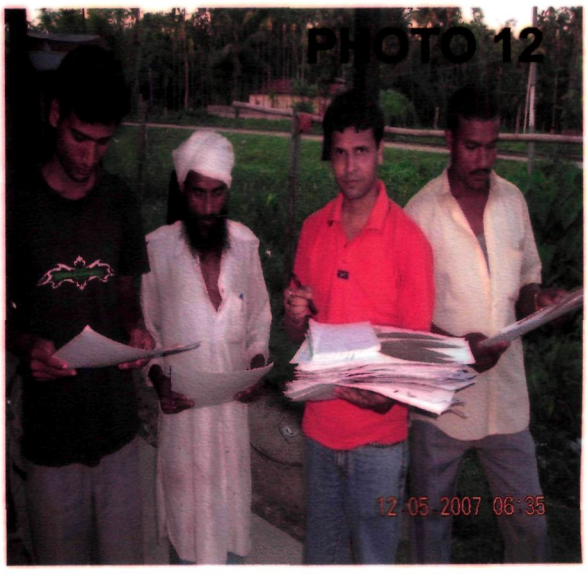

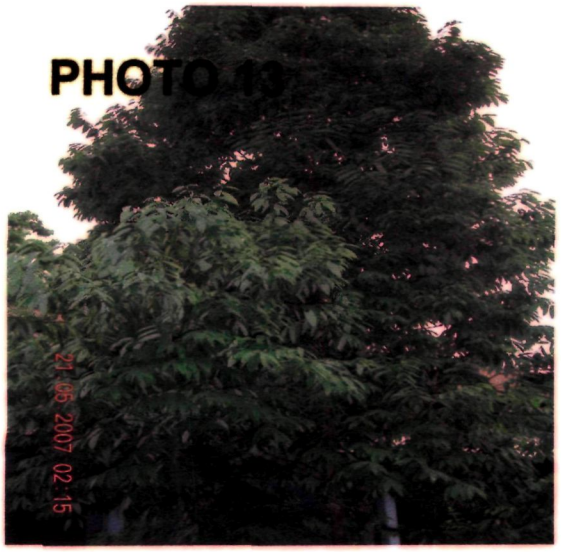

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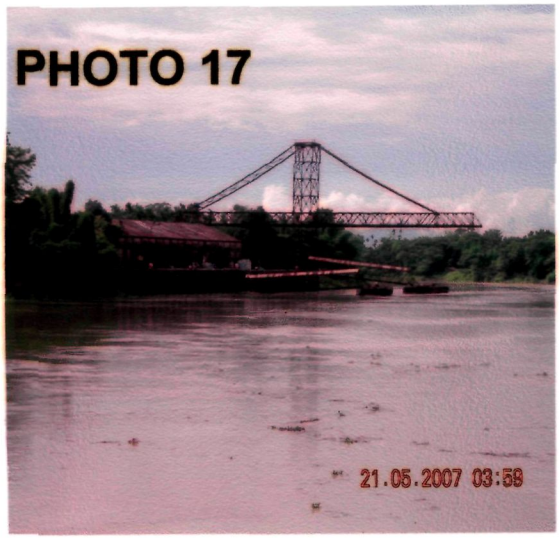

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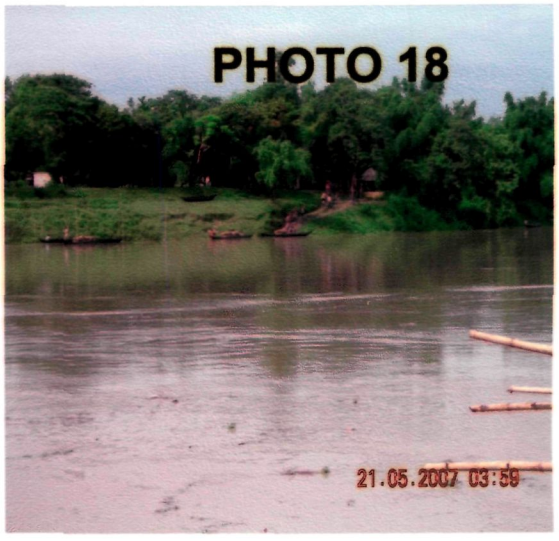

PHOTO 18

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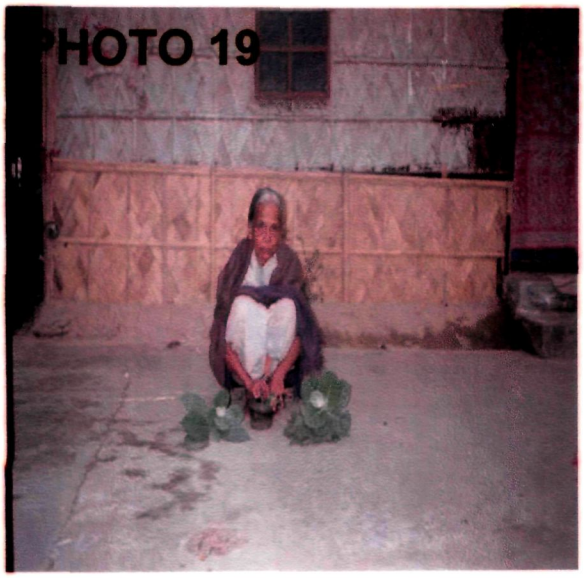

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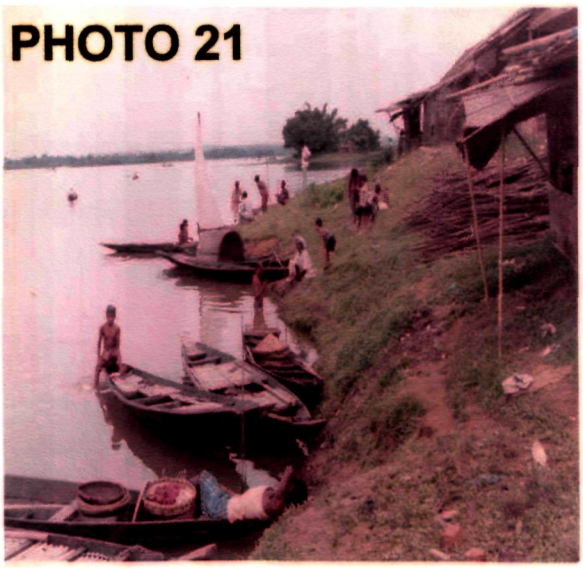

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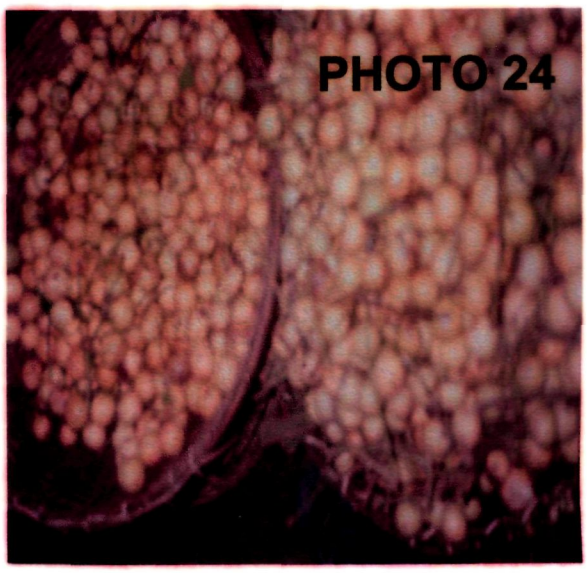


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B. TAXONOMIC ACCOUNT

&

ECONOMIC UTILISATION

0.1 LIST OF FAMILIES OF FERN AND FERNALLIES

[Arranged after Pichi Sermoli (1977, 1982) with little modifications after Ching (1978) & Dixit (1984)]

1. LYCOPODIACEAE.
2. SELAGINELLACEAE.
3. HELMINTHOSTACHYACEAE.
4. OPHIOGLOSSACEAE
5. ANGIOPTERIDACEAE.
6. DICRANOPTERIDACEAE
7. LOXOGRAMMACEAE
8. POLYPODIACEAE
9. DRYNARIACEAE
10. DIPTERIDACEAE
11. LYGODIACEAE
12. CHEILANTHACEAE
13. CRYPTOGRAMMACEAE
14. PTERIDACEAE
15. ADIANTACEAE
16. HEMIONITIDACEAE
17. VITTARIACEAE
18. PARKERIACEAE
19. MARSILEACEAE
20. DENNSTEDTIACEAE
21. LINDSACEAE
22. THELYPTERIDACEAE
23. ASPLENIACEAE
24. ATHYRIACEAE
25. TECTARIACEAE
26. PERANEMATACEAE
27. DRYOPTERIDACEAE
28. BOLBITIDACEAE
29. NEPHROLEPIDACEAE
30. DAVALLIACEAE
31. BLECHNACEAE
32. STENOCHLAENACEAE
33. AZOLLACEAE
34. SALVINIACEAE

02. KEY TO THE FAMILIES OF FERN & FERN-ALLIES

1. Aquatic or marshy plants.
   2. Plants free floating.
      3. Sporocarps in branches; normal leaves above 0.8 x 0.5 c.m — **SALVINIACEAE**
      3′. Sporocarps in pairs; normal leaves below 1 x 0.8 mm, covered by simple trichomes. — **AZOLLACEAE**
   2′. Plants rooted in mud.
      4. Leaves distinctly 4- lobed; Sporangia in sporocarp at the base of the stipes. — **MARSILEACEAE.**
      4′. Leaves not 4 – lobed. Pinnately compound; Sporangia on narrow leaflets with reflexed edges. — **PARKERIACEAE.**

1′. Terrestrial or epiphytic plants.
   5. Leaves microphyllous, univeined; steles without any leafgaps.
      6. Leaves eligulate, monomorphic, spiral or decussate; sporangia homosporous. — **LYCOPODIACEAE.**
      6′. Leaves ligulate, polymorphic, generally arranged in 4-rows; sporangia heterosporous. — **SELAGINENNACEAE.**
   5′. Leaves macrophyllous, with variously branched veins; a leaf-gap usually present at the base of each leaf- trace.
      7. Soprangia borne on erect stalked spikes.
         8. Blade simple; veins anastomosing. — **OPHIOGLOSSACEAE.**
         8′. Blade compound; veins free. — **HELMINTHOSTACHYACEA.**
      7′. Soprangia borne on abaxial surface or edges of the fronds; if on spike like outgrowths, these are stalless and at the apex of the fronds.
         9. Sporangia wall more then one cell in thickness; annulus absent, dehiscing by a slit into 2 valves. — **ANGIOPTERIDACEAE.**

9′. Sporangia wall one cell in thickness; annulus well developed, dehiscence varies. — **LYGODIACEAE.**
   10. Sori acrostichoid; fronds dimorphic.

11. Climbing on trees; rhizomes scandant, long creeping. **STENOCHLAENACEAE.**

11′. Terrestrial or lithophytic; rhizomes short creeping or erect. **BOLBITIDACEAE.**

10′. Sori not acrostichoid; if acrostichoid fronds not dimorphic.

12. Linear sori oblique to costa.

13. Lamina simple, obovate to oblanceolate. **LOXOGRAMMACEAE.**

13′. Lamina pinnate; if simple, hastate or sagittate. **HEMIONITIDACEAE.**

12′. Linear sori marginal or parallel to margin **VITTARIACEAE.**

14. Fronds fan shaped, deeply cleft into 2 halves, each part dichotomously lobed **DIPTERIDACEAE**

14′. Fronds pinnate or pseudo dichotomously branched, repeatedly forked. **DICRANOPTERIDACEAE.**

15. Predominantly epiphytic, rarely terrestrial; lamina simple or rarely pinnate.

16. Humus collecting fronds distinct, separate sterile fronds present. **DRYNARIACEAE.**

16′. Humus collecting fronds mostly absent if present not separate, represented by leaf bases only. **POLYPODIACEAE.**

15′. Terrestrials; lamina bipinnatifid to tripinnate. **THYLEPTERIDACEAE.**

17. Sori continuous along the edge of Leaflets **PTERIDACEAE.**

17′. Sori single at the ends of veins **DENNSTAEDTIACEAE.**

18. Indusia formed by reflexed mariginal flaps.

19. Marginal flaps meeting at the costa. **CRYPTOGRAMMACEAE.**

19′. Marginal flaps restricted to sub-marginal region

20. Fronds with white powdery beneath.**CHEILANTHACEAE.**

20′. Fronts without powdery beneath.

21. Pinnules dimidiate; stipes dark and polished. **ADIANTACEAE.**

21′. Pinnules not dimidiate; stipes straw colors. **PTERIDAECEAE.**

18′. Indusia not formed by reflexed margin.

22. Sori linear on both sides the costa. **BLECHNACEAE.**

22′. Sori otherwise.

23. Sori marginal, at the tip of veins. **LINDSAEACEAE.**

23′. Sori not marginal along the veins.

24. Scales clathrate; indusia single. **ASPLENIACEAE.**

24′. Scales never clathrate; indusia usually double. **ATHYRIACEAE.**

25. Sori stalked. **PERANEMATACEAE.**

25′. Sori not stalked.

26. Stipes articulate on rhizome.

27. Lamina simple, pinnate; indusia round to reniform. **NEHROLEPIDACEAE.**

27′. Lamina decompound; indusia half cup shaped. **DAVALLICEAE.**

26′. Stipes not articulate on rhizome.

28. Lamina covered by unicellular hairs; veins of adjacent groups unite to form an excurrent vein. **THELYPTERIDACEAE.**

28′. Lamina glabrous or with multicellular hairs; Excurrent vein absent.

29. Rachis grooved on the upper surface and open to rachilla grooves; ctenitis hairs absent. **DRYOPTERIDACEAE.**

29′. Rachis not grooved or if grooved not open to rachilla grooves; ctenitas hairs usually along the dotcell surface of rachis, rachillae and costae. **TECTARIACEAE.**

0.3 KEY TO THE GENERA & KEY TO THE SPECIES OF RESPECTIVE FAMILIES WITH BOTANICAL DESCRIPTION AND ECONOMIC UTILITY OF THE SPECIES.

1. LYCOPODIACEAE P.Beauv ex.Mirb. Hist.Nat.Veg.4:293.1802

Key to the Genera:

1. Stems isotomously brached, roots usually forming one basal cleft;

Sporophylls and vegetative leaves almost alike. **1. *Huperzia*.**

1′. Stems anisotomously branched, roots emerging at intervals; **2. *Palhinhaea***

.Sporophylls modified, peltate, sub-peltate or ephemeral.

1. *Huperzia* Bern.J.Bot(Schrad.)1800(2):126.1801.

H.phlegmaria. (L) Rothm. in Feddes Report. Sp. Nov. 54:62.1944. *Lycopodium phlegmaria* L., Sp. Pl. 2: 1101. 1753; Baker, Handb. Fern Allies:22.1887; Sledge in Bot. Journ. Linn. Soc. 84:8.1982. *Urostachys phlegmaria* (L.) Herter ex Nessel, Barlappgewachse: 215.1939. *Phlegmariurus phlegmaria* (L.) Holub in Preslia 36:21.1964; Sen and Sen in Fern Gaz.11(6): 421.f.4. 1978; Ching in Acta Bot.Yunnanica 4(2): 122.1982; Dixit, Lycopod. India:70, Plate 4, fig.15. fig.1b. 1988.

Epiphytic, pendulous: roots stout, branched. Stems tufted, 15-45cm long, ribbed, simple to once or twice dichotomously branched. Leaves spiral, patent in 3-rows, sessile or subsessile, lanceolate to oblong-lanceolate, acuminate, pointed, distinct, univeined, drying pale thin,subcoriaceous. Strobili distinct, 2-3 dichotomously branched, axes again become sterile bearing trophophylls in the middle of the cones, younger sporophylls upwards. Sporangia orbicular to round, thick, dehiscing by one vertical slit; spores trilete, hyaline, minutely pitted or sparsely verrucose.

Habitat & Ecology : Found as epiphyte on tree trunks or rotten logs.

Sporulation: June- July.

Specimen examined: Duhalia Part I, PSD 0019, dt. 21.6.03.

Economic utility :

Forms of use locally:

Parts used: Whole plant

Uses : Portion of plant crushed, the paste so obtained is applied over fresh cuts and wounds for antiseptic action. Fresh poultice is given every day for quick recovery.

Established reports of utility: Spores are used as Lycopodium powder in medicine **(Ghosh, *et al.*,2004).**

* **Note:** Medicinal utility of the plant is reported here as new.

2. ***Palhinhaea*** Franco. & Vasc. in Vasc.&Franco Bot.Soc.Broter.Ser.II, 41:25.1967

P. cernua (L.) Franco. & Vasc. in Vasc.&Franco. Bot.Soc.Broter.Ser.II, 41:25.1967; Ching in Acta Bot.Yunnanica 4(3); 213.1982; Ching and S.K.Wu, Fl.Xizangica 1:14.1983; Dixit, Cens.Indian Pterid:10.1984, et Lycopod.India:90, fig.24 B, F, PlateVI, fig.24.1988.**Bon paloi(B).**

Terrestrial .Main stems creeping, rooting distantly, growth unlimited, 3-4mm across, leaves sparse; the fertile stems arising near the base on the long arching stems that root at the tip. Leaves spiral, sessile, entire, acuminate, veins absent, thick, not soft, green to pale green. Strobili markedly distinctly sessile, pendulous, solitary at the end of the branches; sporophylls spiral, broad ovate and suddenly narrowed-acuminate, margin thinner and long hairy; sporangia less than 1mm long, ovoid, sessile; spores smooth to alveolate.

Habitat & Ecology: Found frequently in exposed places in hills and forests.

Sporulation: July – August.

Specimen examined: Kamalpur, PSD 0071, dt. 8.2.04.

Economic utility:

Forms of use locally:

Parts used :Whole plant

Uses : Plant extract is effective in skin diseases and cough

Established reports of utility: Whole plants decoctions used as lotions in Beri-beri,cough and uneasiness in the chest. Embrocation of ashes in vinegar is recommended for skin eruptions.Plants used for stuffing pillows after drying **(Singh & Panigrahi,2005)**.

2. SELAGINELLACEAE Will.Anleit.Stud.Bot.2:163.1854

Selaginella P.Beauv.Prod.Fam.Actheog:101.1805

Key to the Species:

1. Sporophylls dimorphic; spikes complanate. **3. *S.tenuifolia.***

1′. Sporophylls monomorphic; spikes cylindric.

2. Leaves and sporophylls entire throughout.

3. Microcpores with perispore folded. **1. *S.helferi.***

3′. Microspores with perispore tuberculated. **4. *S.wallichii.***

2′. Leaves toothed throughout or atleast on acroscopic rounded base and margin; sporophylls always toothed **2. *S.involvens.***

1. *S.helferi* Warb, Monsunia 1:107, 121.1900; Alston in Proc. Nat. Inst. Sci.India 11:224.1945; Panigr. and Dixit in J. Indian Bot. Soc.46 226. f.6.1967, p.p.*typo*

tantum; Tagawa and K.Iwats., Fl. Thailand 3(1): 18.f.2,9-12. Dixit, *Selaginella*. India:43.Pl.1,figs. 10A-G.1992.**Ghas paloi(B)**.

Terrestrial.Stem upto 3m long, glabrous, branches irregular, distant. Leaves dimorphic through out, contiguous on the branches, entire.Sporophylls uniform, ovate-acuminate, entire. Strobilus upto 2cm long, both mega and microsporangia in the same strobilus.

Habitat& Ecology: Frequent in moist and shaded places of the area.

Sporolution: May - August

Specimen examined: Kamalpur, PSD 0087, dt. 8.2.04.

Economic utility:

Forms of use locally:

Parts used: Whole plant.

Uses : Plant paste used in cuts and wounds.

Established reports of utility: No other established report is found..

* **Note:** Reported here as new.

2. *S.involvens* (Sw) spring, Bull, Acad.Brux.10: 136, 1843. Emend. Hieron. In Hedwigia 50:2.1911; Baker, Handb. Fern Allies: 87. 1887; Alston in Proc. Nat. Inst. Sci. India 11: 220. 1945; Panigr. and Dixit in J. Indian Bot. Soc. 46(2-3): 229. f.8.A-G1. 1967: Tagawa And K.Iwats., Fl. Thailand 3(1): 24.1979: DeVol in Fl. Taiwan 1:45. Ching and S.K.Wu in Fl.Xizangica 1:27.1983;Dixit, *Selaginella*.India: 46, Pl.13,fig.12A-I.1992. **Paloi (B).**

Terrestrials. Stem rigid, 5-16 cm long, branches from the middle of the erect stem, flattened, giving a foliar appearance; rhizophores and stolons arising from the base,wide creeping,light pink.Leaves compact,spirally arranged,dimorphic; lateral

leaves oblique,cordate acuminate, dentate ; median leaves in two rows,compactly arranged, alternating with each other. Leaves on the erect stem deciduous leaving spiral leave scars.

Habitat& Ecology: Found scattered in moist and shaded places

Sporulation: May- August.

Specimen examined: Churaibari, PSD 0116, dt. 18.12.04.

Economic utility:

Forms of use locally:

Parts used: Whole young sporophytic plant.

Uses : Plant extract is used in cuts and wounds.

Established reports of utility : No other established report is found.

* **Note:** Reported here as new.

3. S.teunifolia. Spring in Mem. Acad. Roy. Sci. Belg. 24:253.1850; Panigr. and Dixit in Proc. Nat. Inst. Sci. India 36 B(1): 104. pl.6. f.2, A-G.1966; Tagawa and K.Iwats., Fl.Thailand (1):29.1979; Dixit, Selaginella. India:98.Pl.59,f.60 A-G.1992 .**Paloi(B).**

Terrestrials.Plants long , rooting at the base, rhizophores small in basal nodes; stems glabrous, pinnately branched; stem-leaves dimorphic; lateral leaves broad ovate, acroscopic base curved, minutely toothed on acroscopic margin, cartilaginous,obtuse, thin, not overlapping; dorsal leaves in 2 rows,alternate; branches 1.5-3.0cm long, pinnately branched, dorsal leaves and lateral leaves similar to branches. Strobili 6.5x3.0mm; sporophylls dimorphic, dorsal sterile sporophylls similar to the ventral leaves of branches, unequal sided, obtuse; ventral fertile leaves sporophylls in 3 rows, broad elliptic ovate, margin ciliated and cartilaginous, thin; spores –microspores trilete,

golden yellow, minutely densely tuberculated; megaspores trilete, pale yellow, tuberculated on dorsal side.

Habitat & Ecology: Found scattered in moist and shaded places.

Sporulation: May - July

Specimen examined: Duhalia, Part I, PSD 0001, dt. 21.6.03.

Economic utility:

Forms of use locally:

Parts used: Whole young sporophytic plant.

Uses : Plant extract is used in cuts and wounds.

Established reports of utility: No other established report is found.

Note: Reported here as new.

4. S.wallichii. *(*Hook & Grev) Spring. Mart. Fl. Bros.1(2) : 124, 1840; Baker, Handb. Fern Allies: 90.1887; Alston in Proc. Nat. Sci. India 11:224. 1945; Panigr. Dixit in Proc. Nat. Inst. Sci. India 34 B(4): 204.Pl.15.f.5. text f.10.A-F. 1969; Deb and Dutta in Journ. Bombay nat. Hist. Soc. 68(3):581. 1972; Tagawa and K.Iwats., Fl.Thailand 3(1):20.f.2.15-16. 1979; Dixit, *Selaginella.* India: 68. Pl.33, f.32A-G. 1992. **Paloi(B).**

Terrestrials. Long trailing procumbent herbs, upto 2 m long : branches pinnate, lateral branches bipinnate, tip of the branches long, stender, pinnatifid; rooting at base; leaves dimorphic; distant; lateral leaves obliquely ovate, acute, entire; median leaves ovate, acuminate, entire, axillary leaves distant on main stem.Sporophylls uniform, ovate, acuminate, entire. Sopres oval, trilete.

Habitat &Ecology : Found in moist and shaded places.

Sporulation : May – July.

Specimen examined : Kamalpur, PSD 0080, dt. 8.2.04.

Economic Utility:

Forms of use locally:

Parts used: Whole young sporophytic plant.

Uses : Plant extract used in cuts and wounds.

Established reports of utility: No other established report is found.

* **Note:** Reported here as new.

3. HELMINTHOSTACHYACEAE Ching. Bull. Fam. Mem. Inst. Biol. Bot.10:235.1949.

Helminthostachys Kaulf. Enum. Fil.28.1824.

H. zeylanica (L.) *H*ook .Gen. Fil.t.47, 1840; Gen .Fil.t.47:1840; Bedd. Handb.Ferns Brit. India, 467. t.292.1883: Suppl. 109.1892; Baishya & Rao, Ferns & Fern-allies, Meghalaya, 32; 1982; Manickam & Irudayaraj, Pterid. Fl. West. Ghats- .India, 55.t.33.1992. *Osmunda zeylanica* L.Sp.Pl.2.1063.1753. **Phona paloi(B).**

Terrrestrial erect herbs, upto 60cm tall. Rhizome long creeping, fleshy. glabrous ; roots fleshy, glabrous. Spike glabrous, upto 45cm long base covered with membranous sheath scales. Sterile segments; palmatifid, lobes 5-11, veins free, simple dichotomous. Fertile segment representing a terminal spike, stalk 10-18 cm long, glabrous, fleshy; spike upto 13 cm long.Sporangia borne superficially on the spike,numerous.Spores globose dark.

Habitat & Ecology : Found in moist,shaded and humus rich forest floor.Very rare.

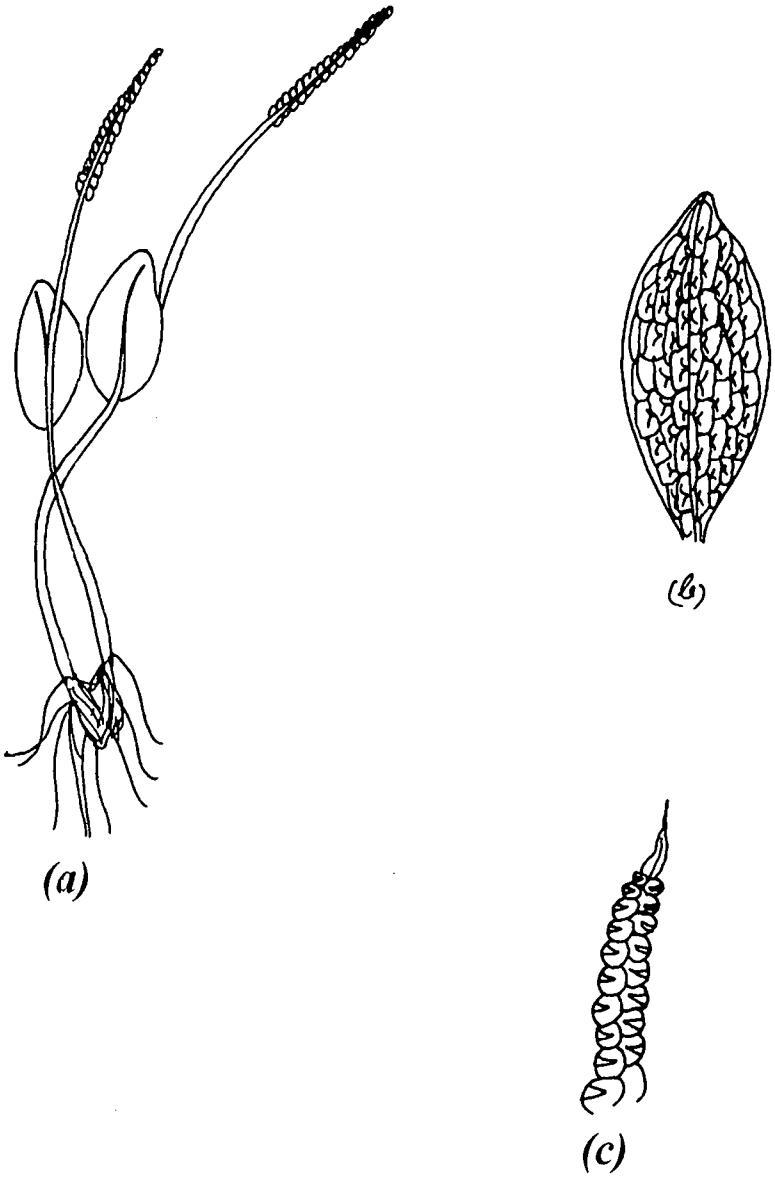
Sporulation : May - July

Specimen examined:

Economic Utility : Churaibari, PSD 0032, dt. 18.12.04.

Forms of use locally:

PLATE 1



Ophioglossum reticulatum: (a) Habit (b) Pinna showing venation (c) Spike.

Parts used :Tender plant.

Uses : Tender plant edible. Plant extract used in dysentery, jaundice and sciatica.

Established reports of utility : Plant is mild asperient, intoxicant anodyne and used in sciatica. Decoction of rhizome is used in impotency. Leaves juice relieves tongue blisters. Powdered rhizome along with cow milk is used for vitality and brain tonic **(Singh *et el.* 1989).** The young fronds and fleshy rhizomes are eaten in Gorakpur, Garhal and Assam.Rhizome used in dysentery, catarrah, sciatica, malaria **(Borthakur. *et al* , 2001).**

4. OPHIOGLOSSACEAE (R.Br) Agardh. Aphor. Bot. 8:113.1822.

Ophioglossum L., Sp.Pl.2; 1062. 1753.

O. reticulatum L. Sp.Pl.21063, 1753; Bedd. FernsS-India, 23.t.70.1864; Handb. Ferns Brit. India, 465.t.291.1883; Suppl. 109.1892. Dhir, Ferns N.W.Himalayas, 26. 1980; Baishya & Rao, Ferns & Fern-allies Meghalaya, 33.1982; Manickam & Irudayaraj, Pterid. Fi. West.Ghats, S-India, 51.t.29.1992. **Jibba(B).**

Terrestrial. Rhizome short, cylindrical, roots fleshy, numerous. Stipe upto 10 cm long, slender. Sterile segment single on the middle of the frond, spathulate-cordate, sub-membraneous to coriaceous, veins reticulate, midrib not well differentiated. Fertile segment arising from the base of the sterile ones, erect, bearing terminal spike, 3 cm long. Peduncle 6-9 cm long, slender. Sporangia 15-40 in each row, globose.

Habitat & Ecology : Found in moist and sandy soil along with grasses.

Sporulation : April – August.

Specimen examined : Churaibari, PSD 0431, dt. 11.6.05.

Economic Utility :

Forms of use locally :

Parts used : Tender fronds.

Uses : Tender fronds edible and used in wounds.

Established reports of utility : The fresh fronds are eaten as vegetables in curries. Paste of plant is used as cooling agent in burnings and in the treatment of inflammations and wounds. Fronds are used as tonic and styptic in contusions and haemorrhages. **(Borthakur *et al.*, 2001)**.

5. ANGIOPTERIDACAE Fee. ex Bonner in Bull. Soc. Roy. bot. Belgique. 5:359. *t.*1(6), 5(10). 1866.

Angiopteris Hoff. Comm. Soc. Reg. Sci. Gotting 12:29.1796, *nosm. Cons.*

A. evecta. (Frost.) Hoffm. Comm. Soc. Reg. Gott.12 : 29 : t.5. 1793-94. Bedd. Ferns South. India, t.78.1864; Handb. Ferns & Fern-allies Meghalaya, 34.1982; Jamir & Rao, Ferns Nagaland, 39.1988; Manickam & Irudayaraj, Pterid. Fl.West. Ghats-S.India, 56.t.34.1992. *Polypodium evectum* Forst. Prodr. 81.1786. **Bhut paloi(B).**

Terrestrial, Rhizome erect, broad, fleshy pink inside. Stipes swollen at base, adaxially flattened, abaxially rounded, whitish linear streaks all over,with small brown scales and minute hairs.Lamina long bipinnate; pinnae sub-opposite with swollen stalk, oblong–lanceolate, with a terminal pinnule; veins simple or forked twice, almost parallel, reaching upto the margin. Sori sub-marginal, ellipsoidal; sporangia upto 6 pairs in 2 rows, which is boat shaped. Spores hyaline, pale green.

Habitat & Ecology : Grows along hill slopes.

Sporulation : February- November

Specimen examined : Kamalpur, PSD 0072, dt. 8.2.04.

Economic Utility :

Forms of use locally :

Parts used : Tender shoot.

Uses : Tender shoot edible. Paste of stipe used to cure leprosy and rib's pain.

Established reports of utility : The massive stem is cooked and eaten by tribals of Assam,an intoxicating drink called 'ruchshi' is made out of it. The stem is widely used as base for transportation of orchids. Base of the stipe is used in the treatment of leprosy and the roots are used as a cure for rib's pain **(Borthakur, *et al.*, 2001).**

6. DICRANOPTERIDACEAE Ching *in* Acta Phytotax. Sin. 3:94.1954.

Dicranopteris Bernh. Schrad. New. J. Bot.1(2).38.1806.

D. linearis (Burm.f.) Underw. Bull. Torrey Bot. Club. 34.250.1907. var. Altissima Holtt. Fl.Malaya, 2.69.1954; et Reinw. 4.276.1957; Dhir, Ferns N.W. Himalayas, 60.1980; Baishya & Rao, Ferns & Fern-allies Meghalaya, 40.1982; Jamir & Rao, Ferns Nagaland, 50.1988. **Dhar paloi(B).**

Terrestrials. Rhizome long creeping, about 0.4cm thick, densely covered with hairs, scales absent; hairs minute, multicellular, reddish-brown. Stipes about 11-28 x 0.1-2.5cm, slender, straggling, rigid and polished; apical bud covered by brown hairs and stipule like small, 1cm long, lobed bracts. Fronds about 2m long, pinnate or dichotomously branched, lanceolate, apex acute or acuminate, deeply pinnatifid, nearly reaching upto the costa; segments narrowly linear or subulate, margin curved, deeply covered with brown hairs; rachis repeatedly forked, covered with dark brown hairs; costae and costules sparsely hairy; veins prominent, 2-forked lamina light green; texture hard. Sori small, globose, without paraphyses, in 2 rows on both sides of the costa. Spores numerous trilete, deeply grooved.

Habitat & Ecology : Forming thickets in open areas and on hill slopes.

Sporulation : June- July.

Specimen examined : Duhalia Part II, PSD 0002, dt. 22.6.03.

Economic Utility :

Forms of use locally :

Parts used : Whole plant.

Uses : Rachis used for making baskets, caps, mats. Plant paste used as anthelmintic and in wounds. Fronds used in asthma.

Established reports of utility : Rhizomes anthelmintic, fronds used in asthma and show anti microbial properties. Stipes used for preparing school pens, stalk used for making mats, chairs, seats, caps, fishingtraps, baskets. Plant is reported to have anticancer activity (**Asolkar *et al.*,1992**). Tender fronds used to remove sterility in women and in fever. **(Borthakur *et al.*,2001).**

7. LOXOGRAMMACEAE Ching ex Pio. Sec.in Webbia 29(1):11.1974.

Loxogramme (Bl.) Presl. Tent. Pterid.124. *t.*9. *f.*8.1836.

L.involuta (D.Don) Presl. Tent. Pterid. 215. 1836. p.p.: Bedd., Handb. Ferns Brit. India: 393. f.228. 1883; Mehra and Bir in Res. Bull. Panjab Uni.n.s.15; 160.1964; Punetha in *Indian Fern J.*2:74.1985; Dixit & Silpi Das in *Indian Fern J.*11:27,29, figs.1-2.1994 ;et Ibid. 14:89-92.1997.

Epiphytic. Rhizomes short creeping, thick, paleaceous. Paleae upto 5 x 0.5 mm, lanceolate, entire, acuminate, brown on the rhizomes only. Fronds 25 x 3 cm wide, sessile, closely placed, simple, elliptic or lanceolate, rachis raised on upper surface, lower surface veins hidden, veinlets very few; leathery texture. Sori elongate, oblique, overlapping, small to very long. Spores pale green.

Habitat & Ecology : Scattered in moist and shaded places of the area.

Sporulation : June- July

Specimen examined : Modan Mohan, PSD 0176, dt. 12.6.05.

Economic utility :

Forms of use locally : Not available.

Established reports of utility : Not recorded so far.

8. POLYPODIACEAE Bercht & Presl. Prirozen.Rostlin.1:272.1820.

Key to the genera:

1. Fronds covered by stellate hairs throughout.

2. Sori acrostichoid, covering the surface of the fertile lamina. ***7. Pyrrosia***

2′. Sori marginal, linear – confluent. ***2. Drymoglossum***

1′. Fronds glabrous or with simple gland like hairs.

3. Fronds at dimorphic. ***4. Leptochilus.***

3′. Fronds not dimorphic.

4. veins inconspicuous, sori always in more then 2 rows along rachis or costac or scattered, superficial. ***5. Microsorium.***

4′. Venis prominient sori linear, forming coenosori In one row on each side of the rachis, oblique or Parallel. ***1. Colysis.***

5. Spores planoconvex; sori large, more then 3 m.m in diameters ***6. Phymatosorus.***

5′. Spores oval, sori small, less then 3 mm in diameters. ***3. Goniophebium.***

1. ***Colysis*** Presl, Epim. Bot.146.1851.

C. pedunculata (Hook & Grev.) Ching, Bull. Fan. Mem. Inst. Bio. 14 : 321, 1933. Baishya & Rao, Ferns & Fern-allies Meghalaya, 57.1982; Jamir & Rao, Ferns

Nagaland, 128.1988. *Ceterach pedunculata* Hook. Et.Grev. Icon. Fil. t.5.1827. *Gymnogramma hamiltoniana* Hook. Sp. Fil. 5.160.1864; Clarke, Trans. Linn. Soc. Lond.II. Bot.I. 570.1880. *Selliguea hamiltoniana*; Bedd. Ferns. Brit. India, t.239. 1866; Handb. Ferns Brit. India, t.239.1866; Handb. Ferns Brit. India, 390. t. 226.1883.

Terrestrial. Rhizome creeping, dorsiventral, bearing short and stiff roots; scales lanceolate, terminating into hair like tip. Fronds slightly dimorphic, simple, long, stipitate; stipe upto 5 cm long in the sterile frond and upto 20 cm long in the fertile fronds, glabrous margin wavy, fertile lamina apparently smaller. Lateral veins prominent, veinlets obsecure. Sporangia oval, slender, stalked accompanied with multicellular hairs. Spores oval, hyaline, light brown.

Habitat & Ecology : Found in moist, humus rich soil and base of tree trunk,rare.

Sporulation: July – October.

Specimen examined : R.K. Nagar, PSD 0206, dt. 5.9.05.

Economic utility:

Forms of use locally : Not available.

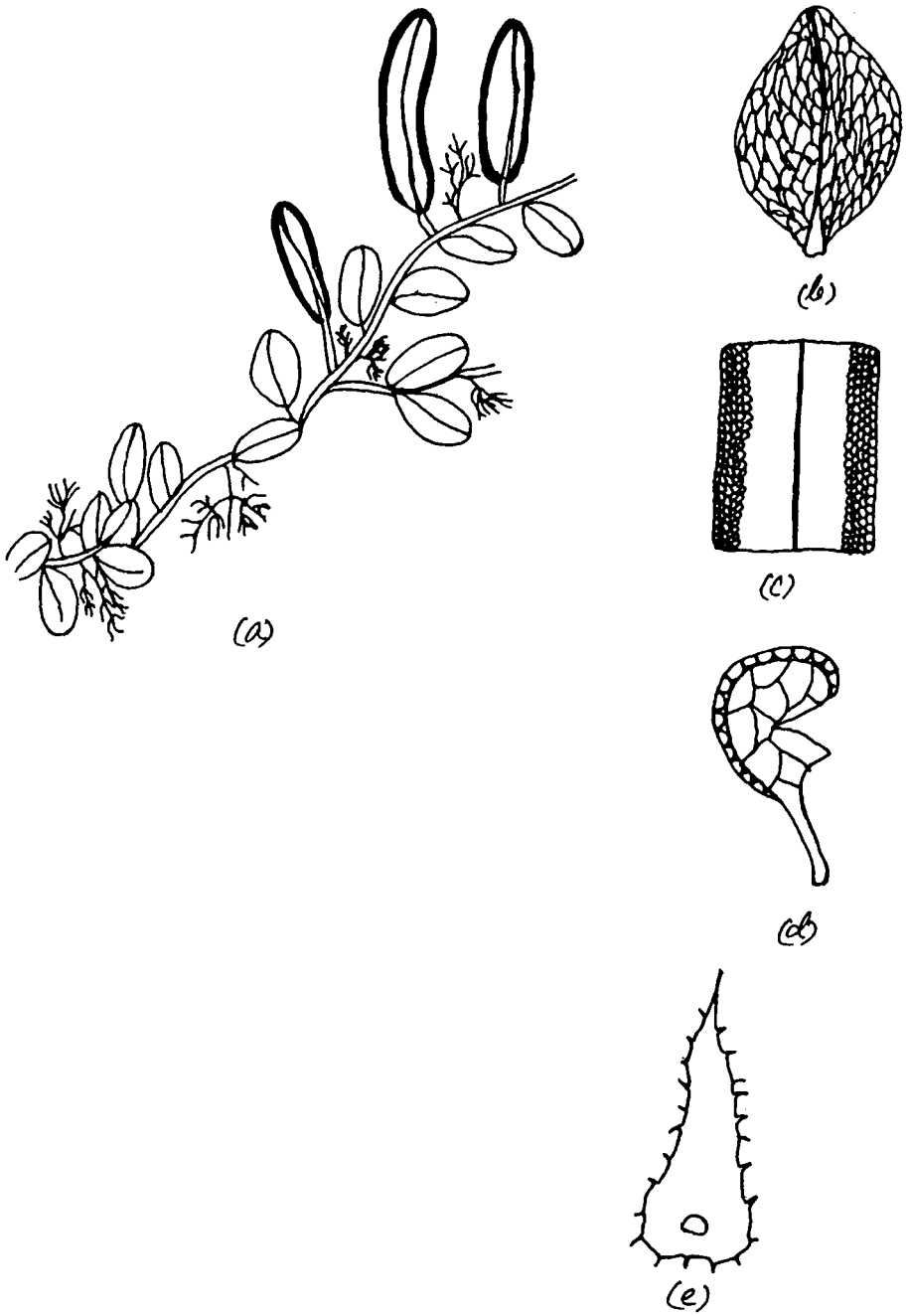
Established reports of utility : Not recorded so far.

2. Drymoglossum Presl. Tent. Pterid.t.10.f.5-6.1836.

D. piloselloides Thunb., Fl. Japan.: 331. 1784, non L.(1753); (L) C. Presl. *Drymoglossum microphyllum* (C.Presl) C. Chr., Ind.Fil.: 246. 1905. *Taenitis microphylla* (C.Presl) Mett. In Kuhn, Fil. Africanae: 58. 1868. *Drymoglossum carnosum* var. *minor* Hook., Sp. Fil. 5: 180. 1864. **Ampaloi (B).**

Epiphytic. Rhizome long creeping, about 0.2 cm thick, wiry, clothed with scales; scales adpressed, diamond shaped, acuminate, some times hair like pointed; lamina dimorphic, simple; sterile lamina sessile or shortly stalked, roundish or obovate, base cuneate, margin entire; texture thick and fleshy, when young covered by stellate

PLATE 2



Drymoglossum piloselloides; (a) Habit (b) Sterile lamina showing venation (c) Portion of fertile lamina showing sori (d) Sporangium (e) Scale.

hairs; stipe of fertile lamina scaly at base, straw coloured; fertile lamina linear to oblong, apex round,margin entire; veins indistinct, with free, forked or simple veinlets. Sori marginal, linear, continuous along the tip of lamina; sporangia oval, short stalked, with a few stellate paraphysis, dark brown. Spores oval to elliptic, light brown.

Habitat & Ecology : Common on tree trunks, forming large colonies.

Sporulation : November - March.

Specimen examined : Shibbari Road, Karimganj, PSD 0316, dt. 29.12.06.

Economic Utility:

Forms of use locally:

Parts used : Lamina.

Uses : The lamina of the plant is used as a paste and applied externally in the form of poultice on fractured bones after setting up the bones.Bamboo splints are usually tied around so as to prevent displacement of fractured bones.

Established reports of utility : The plant is used in the treatment of eczema, itch and haemorrhage. The leaves are used to treat constipation, cough, gonorrhoea, headache and small pox. **(Borthakur *et al.*, 2001).**

Note : Additional utility is reported here.

3. *Goniophlebium* (Blume).Presl.Pterid. :185.1836.

G. amoenum (Wall.ex.Mett.) J.Sm. in Hook.Gen. Fil. t.51,1840; Bedd. Ferns Brit. India, t.5.1866; Handb. Ferns Brit. India, 317. 1883. *Polypodium amoenum* Wall.ex Mett. Abh. Senckneb. Naturf. Ges. 2.80.1857; Clarke, Trans. Linn. Soc. Lond. II. Bot.1. 550. 1880; Dhir, Ferns N.W. Himalayas, 118.1980; Baishya & Rao, Ferns & Fern-allies Meghalaya ,70.1982; Jamir & Rao, Ferns Nagaland ,66. 1988.

Epiphytes. Rhizome long creeping, about 1 cm thick, solid, fleshy, covered by scales; scales lanceolate-subulate, apex acuminate, base broad, adpressed, grey-brown.

Stipes glabrous, shining, stramineous or brown. Lamina simple, deeply pinnatifid, ovate; lateral segments numerous, alternate or opposite; largest segments about 12 x 2.5 cm, lanceolate, margin entire or dentate-serrate, lowest pair deflexed; costa slighty raised; veins prominent, reticulate, forming one series of areoles with single included veinlets, marginal veins free. Sori large, round, terminal on included veinlets of the areoles. Spores oval to bean shaped, hyaline, yellow.

Habitat & Ecology : Found commonly on tree trunks and humus rich shady slopes.

Sporulation : May - December.

Specimen examined : Duhalia Part I, PSD 0041, dt. 25.12.03.

Economic utility :

Forms of use locally :

Parts used : Rhizomes .

Uses : Rhizome paste used in cuts and wounds, also in urinary troubles.

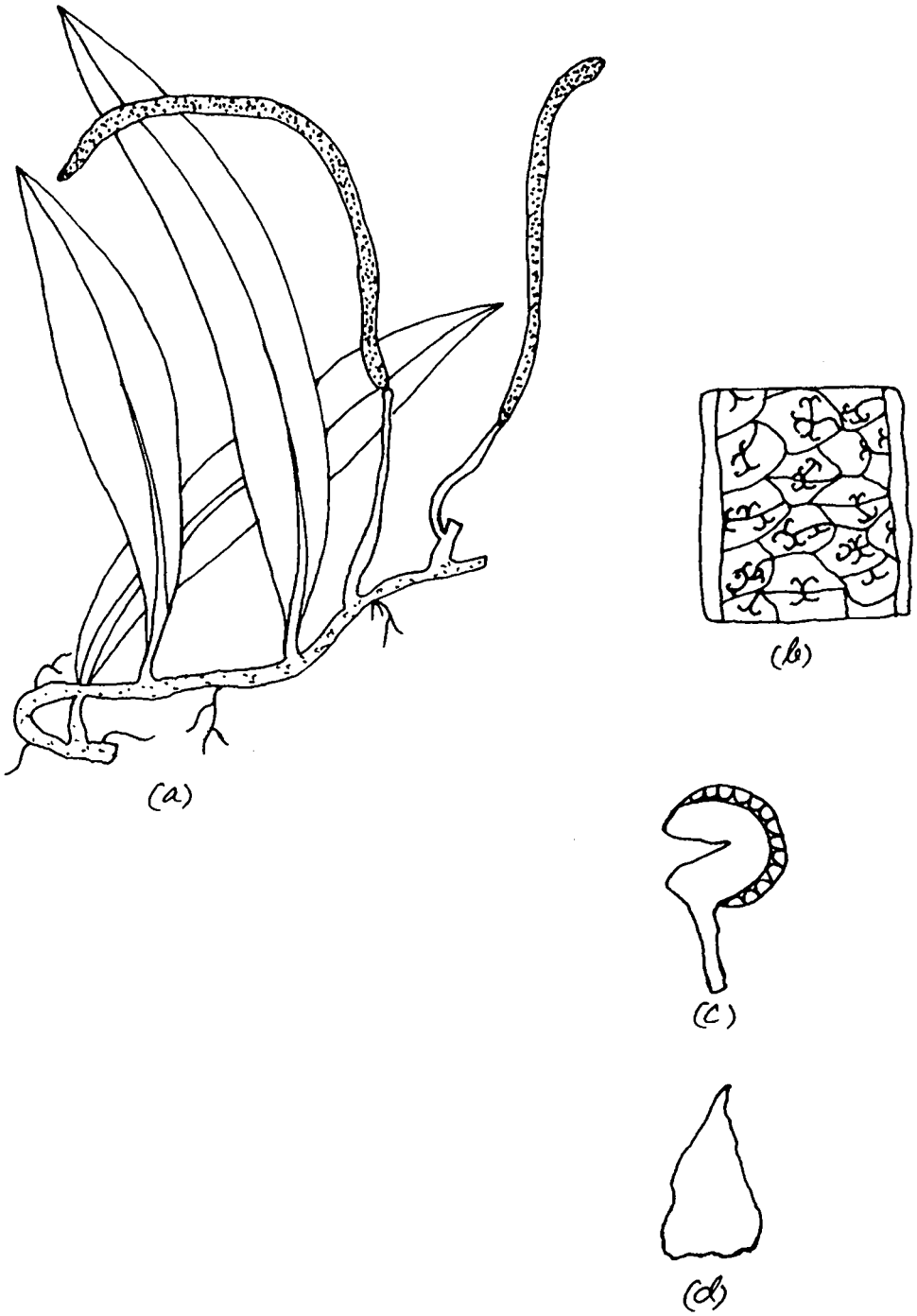
Established reports of utility : Rhizomes of the plants is used as diuretic, pectoral astringent, used in urinary calculus and rheumatism; decoction of the whole plant is used to stop haemorrhages **(Borthakur *et al.*,, 2001).**

4. *Leptochilus* Kaulf.Enum.Fil.147.1824.

L. axillaris (*Cav.*) Kaulf. Enum. Fil. 147. t.l.f 10, 1824; Jamir & Rao, Ferns Nagaland, 120. 1988; Manickam & Irudayaraj, Pterid. Fl. West. Ghats-S. India, 307.t.233. 1992. *Acrostichum axillare Cav.* Ann. Hist. Nat. 1.101.1799; Clarke, Trans. Linn. Soc. Lond. II. Bot.1. 579.1880. *Gymnopteris variabilis* var.*axillaris* (*Cav*). Bedd. Ferns. Brit. India, t.271. 1866; Handb. Ferns. Brit. India. 430. 1883.

Epiphytes. Rhyzome scales linear, margin sparsely toothed, dark brown. Fronds dimorphic, slender, stipitate, stipe up to 10 cm long; entire, decurrent on stipe; giving

PLATE 3



Leptochilus axillaris; (a) Habit (b) Portion of lamina showing venation (c) Sporangium

winged appearance. Veins obscure.Fertile fronds linear upto 30x .5 cm.Sori exindusiate, sporangia oval, spores elliptic.

Habitat & Ecology : Found as low climbing fern, scattered.

Sporulation : December - February.

Specimen examined : Duhalia Part I, PSD 0069, dt. 25.12.03.

Economic utility :

Forms of use locally : Not available.

Established reports of utility: Not recorded so far.

5. ***Microsorium*** Link. Hort. Berol. 2:110. 1833.

Key to the species:

1. Lamina simple, lanceolate.

2. Lamina membranous, veins prominently raised ***5a.M.membranaceum***

2′. Lamina criaceous or, sub-coriaceous; veins indistinct.

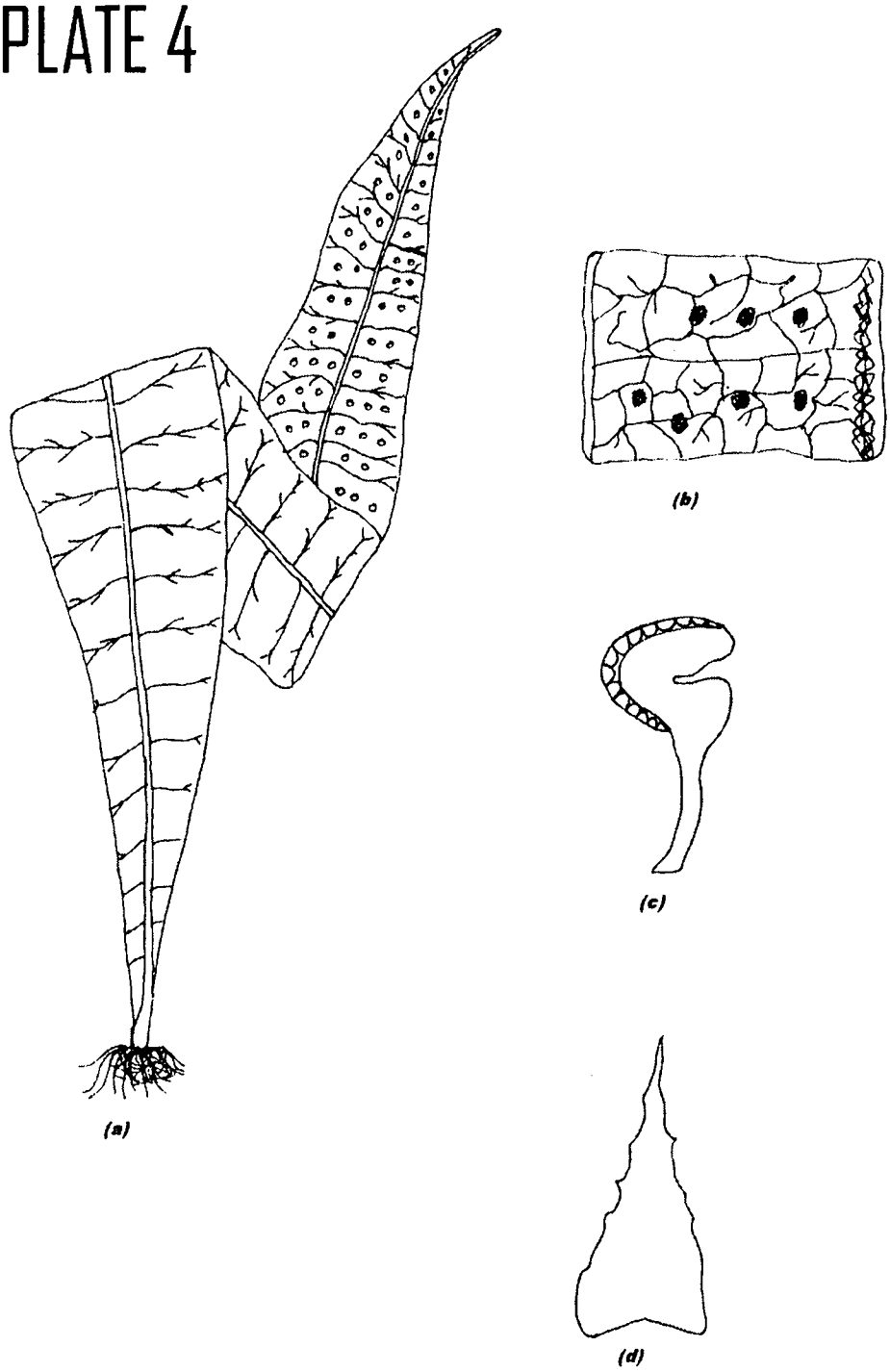
3.Lamina slender,stipitate;sori superficial,throught the surface ***5d.M.superficiale.***

3′.Lamina sessile; sori scattered, more or less immersed along the upper half of the lamina. ***5c.M.punctatum.***

1′. Lamina pinnate or pinnatifid. ***5b.M.pteropus.***

5a. ***M. membranaceum*** (D.Don) Ching, Bull. Fan Mem. Inst. Biol. Bot. 4.309.1933; Dhir, Ferns N.W.Himalayas, 131. 1980; Baishya & Rao, Ferns and Fern-allies Meghalaya, 67. 1982; Jamir & Rao. Fern Nagaland, 112. 1988; Manickam & Irudayaraj, Pterid. Fl West. Ghats-S.India. 326.t.248.1992. *Polypodium membranaceum* D. Don, Prodr. Fl. Nepal, 2.1825; Clarke, Trans. Linn. Soc. Lond.II. Bot.1.560.1880; *Pleopeltis membranacea* Moore, Ind. Fil. 191.1857; Bedd. Handb. Ferns. Brit. India. 355.1880; *Polypodium heterocarpum* Bedd. Ferns. South. India, t.177.1864. **Am paloi(B).**

PLATE 4



Microsorium membranacum; (a) Habit (b) Portion of lamina showing venation (c) Sporangium (d) Scale

Terrestrial. Rhizome short creeping densely covered with fibrous roots and scales. Fronds obovate-lanceolate, narrowly decurrent at the stipe, membranous. Stipe very short, upto 1 cm long.Veins prominently raised, reticulate, lateral veins parallel with veinlets. Sori globose, irregular scattered along the veinlets. Spores oval to elliptical.

Habitat& Ecology : Found on moist, humus rich area, very common.

Sporulation : July - October.

Specimen examined : Dullabcherra, PSD 0214, dt. 6.9.05.

Economic Utility :

Forms of use locally :

Parts used : Whole plant.

Uses : Used as ornamental.

Established reports of utility: Grows as an ornamental plant **(Borthakur *et al.*, 2001).**

5b. M. pteropus.(Bl.)Copel. Univ. *Cal*if. Publ. Bot.16.112.1929; Manickam & Irudayaraj, Pterid. Fl. West. Ghats-S. India, 329. t.147, 1992; *Polypodium pteropus* Bl. Enum. Pl. Jav. ad. 3.1828; Clarke, Trans. Linn. Soc. Lond.II. Bot.1. 562. 1880. *Polypodium tridactylon* Wall.ex. Hook. *et.* Grev. Icon. Fil.6. 209.1831; Bedd. Ferns. Brit. India, t.11.1866. *Pleopeltis pteropus* Moore, Ind. Fil.78.1867; Bedd. Handb. Ferns. Brit. India, 359. t.203.1883. *Kaulina pteropus* (Bl.) Nayar, Taxon 13.67.1964; Baishya & Rao, Ferns & Fern-allies, Meghalaya, 62.1982; Jamir & Rao, Ferns Nagaland, 119.1988

Aquatic. Rhizome creeping about 0.5 cm thick, fleshy green, apex scaly ; scales about 5 x 0.5 mm, lanceolate, long, acuminate, entire, pale brown. Stipes about 3 x 12 cm long, winged upwards, sparsely covered by scales. Fronds simple,

lanceolate acuminate, margin entire ; terminal lobe about 20 x 2.5 cm, linear-lanceolate, acuminate apex, base long-tapering into a gradually decurrent wing upon the petiole ; all lobes scaly on the midrib beneath, glabrous above; midrib raised and rounded below, flattened above ; veins distinct above and below.

Habitat & Ecology : Found as lithophytes on big rocks or boulders near moist area.

Sporulation : April – September.

Specimen examined : Maizgram, PSD 0091, dt. 19.5.04.

Economic utility:

Forms of use locally:

Parts used : Whole sporophytic plant.

Uses : The plant is crushed along with leaves of bringal and applied locally to cuts and wounds of dogs for haemostatic and antiseptic action.

Established reports of utility : Not known so far.

* **Note**: Medicinal utility of the plant is reported here as new.

5c. M. Punctatum (L.)Cope. Uni. *Cal*if. Publ. Bot. 16:111.1929; Ching. Bull. fan. Men. Inst. Biol. 4:307. 1933; Holt. Rec. Fl. Malaya 2:179.1955. *Acrostichum punctatum* L., Sp. Pl.ed. 2,2:1524. 1763. *Pleopelpis puctata*(L.) Bedd., Ferns Brit. Ind.: 357.t. 201. 1883. **Miranimura Paloi(B)**.

Rhizomes short-creeping, thic, stout, paleaceous, roots very profuse hairy. Fronds 40-80 x 5-7 c.m., close, sessile, simple elliptic, narrowing gradually towards both ends, entire or repand, acuminate. Sori round to slightly elongated, minute, irregularly distributed on the veins and vein-plexus in apical half of the frond.

Habitat & Ecology : Widely grows in moist shaded places inside the forest, epiphytic.

Sporulation : April – September.

Specimen examined : Jhumbasti, Badarpur, PSD 02656, dt. 20.4.06.

Economic utility:

Forms of use locally:

Parts used : Whole sporophytic plant.

Uses : The plant paste applied in cuts and wounds.

Established reports of utility : Not known so far.

* **Note**: Medicinal utility of the plant is reported here as new.

5d. M. superficiale. (Bl.) Ching, Bull. Fan Mem. Inst. Biol. Bot. 4.308. 1933; Baishya & Rao, Ferns & Fern-allies Meghalaya, 68.1982. Jamir & Rao, Ferns Nagaland, 115.1988. *Polypodium superficiale* Bl.Enum. Pl.Jav. 130. t.56.f.l. 1828. Bedd. Ferns Brit. India, t.75. 1866; Clarke, Trans. Lin. soc. Lond.II. Bot.l. 551. 1880 (*excel.*var.). *Pleopeltis superficialis* (Bl). Bedd. Handb. Ferns. Brit. India, 350.1883. **Am paloi (B).**

Terrestrial.Rhizome scandent, wide creeping, clothed with lanceolate, brown, spreading scales. Stipes upto 13 cm long, slender, often sparsely covered with brown scales. Fronds lanceolate, narrowed at both ends, entire, 16-45 x 3-4.5 cm, glabrous dark green. Veins obscure. Sori large, copius, superficiale, irregularly scattered on the whole surface of lamina.

Habitat & Ecology : Found in moist and hunid places.

Sporulation : December - February

Specimen examined : Durganagar T.E., PSD 0141, dt. 9.2.04.

Ecomomic utility:

Forms of use locally:

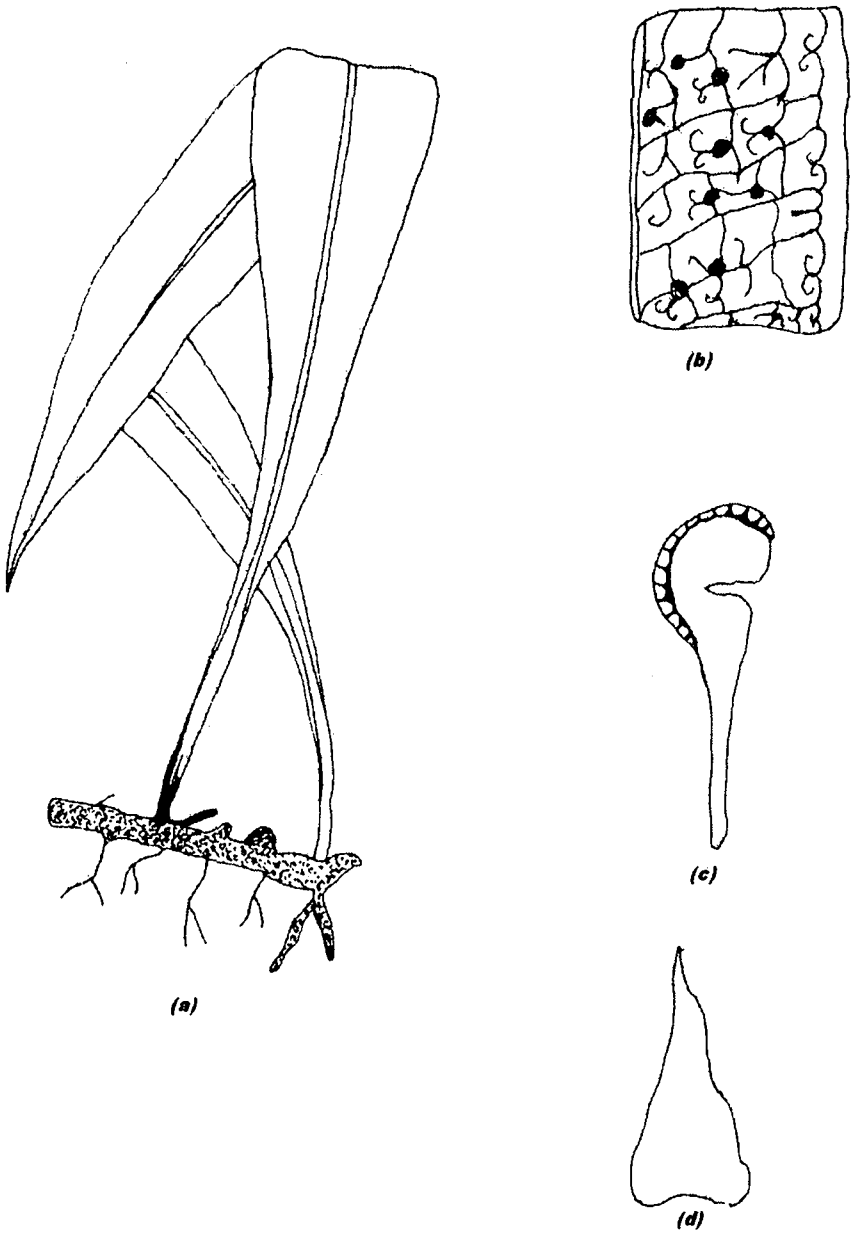
Parts used : Rhizome.

Uses : Paste of rhizome applied on cuts and wounds.

Established reports of utility : Not known so far.

* **Note**: Medicinal utility of the plant is reported here as new.

PLATE 5



Microsorium superficiale; (a) Habit (b) Portion pf lamina showing venation and sori (c) Sporongium (d) Scale.

6. *Phymatosorus* Pic.Ser.Webbia.28.457.1973.

P.lucidus (Roxb.ex.Griff.) Pic. Ser. Webbia 28.459.1973: Manickam & Irudayaraj. Pterid. Fl. West. Ghats. S.India. 316. t.241. 1992. *Polypodium lucidium* Roxb. ex Griff. Cali. Journ. Nat. Hist. 4.486.1944. *Pleopeltis leiorhizum* Wall. Cat .n. 303. 1828 (*nom.nud.*); Clarke, Trans. Linn. Soc. Lond.II. Bot.1.567.1864; Handb. Brit. India, 372.1883.

Rhizome wide creeping, about 2 cm thick, covered with ovate adpressed peltate, scaly brown scales. stipes pale or grey brown, adaxially grooved.abaxaially rounded, glabrous. Lamina pinnatifid, ovate about 55 x 45 cm, triforked at apex, base broadly cuneate, pinnae opposite or sub-opposite, basal one or two pairs sessile, others adnate, narrow lanceolate, acuminate at the apex, margin entire, both sides glabrous, dark green, texture herbaceous. Rachis narrowly winged ; costa well raised below,areoles with copious free veinlets.Sori large, median between the margin of pinna and costa, superficial, in two parallel rows on both side of the costa. Spores plano-convex.

Habitat & Ecology : Found as a lithophytes in shaded areas.

Sporulation : January - May

Specimen examined : Akbarpur, PSD 0101, dt. 19.5.04.

Economic Utility : Not available.

Established reports of utility : Not recorded so far.

7. *Pyrrosia* Mirb.Lam.et Mirb. Hist. Nat. Veg. 3:471. 1802.

Key to the species:

1. Lamina dimorphic; sripes adaxialli groved, ***7a. P. adnascens.***
scaly at base, glabrous above.

1′. Lamina uniform; stipes terete, clothed with ***7b. P.heteracta***
stellate hairs, thick and hard

7a. P. adnascens (Sw.) Ching, Bull. Chin. Bot. Soc. 1.69.1935; Dhir, Ferns N.W. Himalayas, 118.1980; Baishya & Rao, Ferns & Fern-allies Meghalaya, 74. 1982; Jamir & Rao, Ferns Nagaland, 93.1988. *Polypodium adnascens* Sw. Syn. Fil. 25, 222. t.2. f.1806. *Niphobolus adnascens* (Sw.) Kaulf.Enum. Fil. 124. 1824; Bedd. Handb. Ferns Brit. India, 325. 1883 *(pro parte).* **Am paloi(B).**

Epiphytes. Rhizome wiry, creeping, compactly scaly, scales peltate. Stipes upto 5 cm long, glabrous. Lamina linear, coriaceous, glabrous, midrib prominently raised. Veins obscure.Sori scattered in the upper half of lamina, globose, depressed. Sporangia oval, slender stalked. spores round, bilobed.

Habitat & Ecology : Found abundantly on tree trunk as epiphyte in open places; also as lithophytes.

Sporulation : May - February

Specimen examined : Botoroshi, PSD 0092, dt. 19.5.04.

Economic utility:

Forms of use locally :

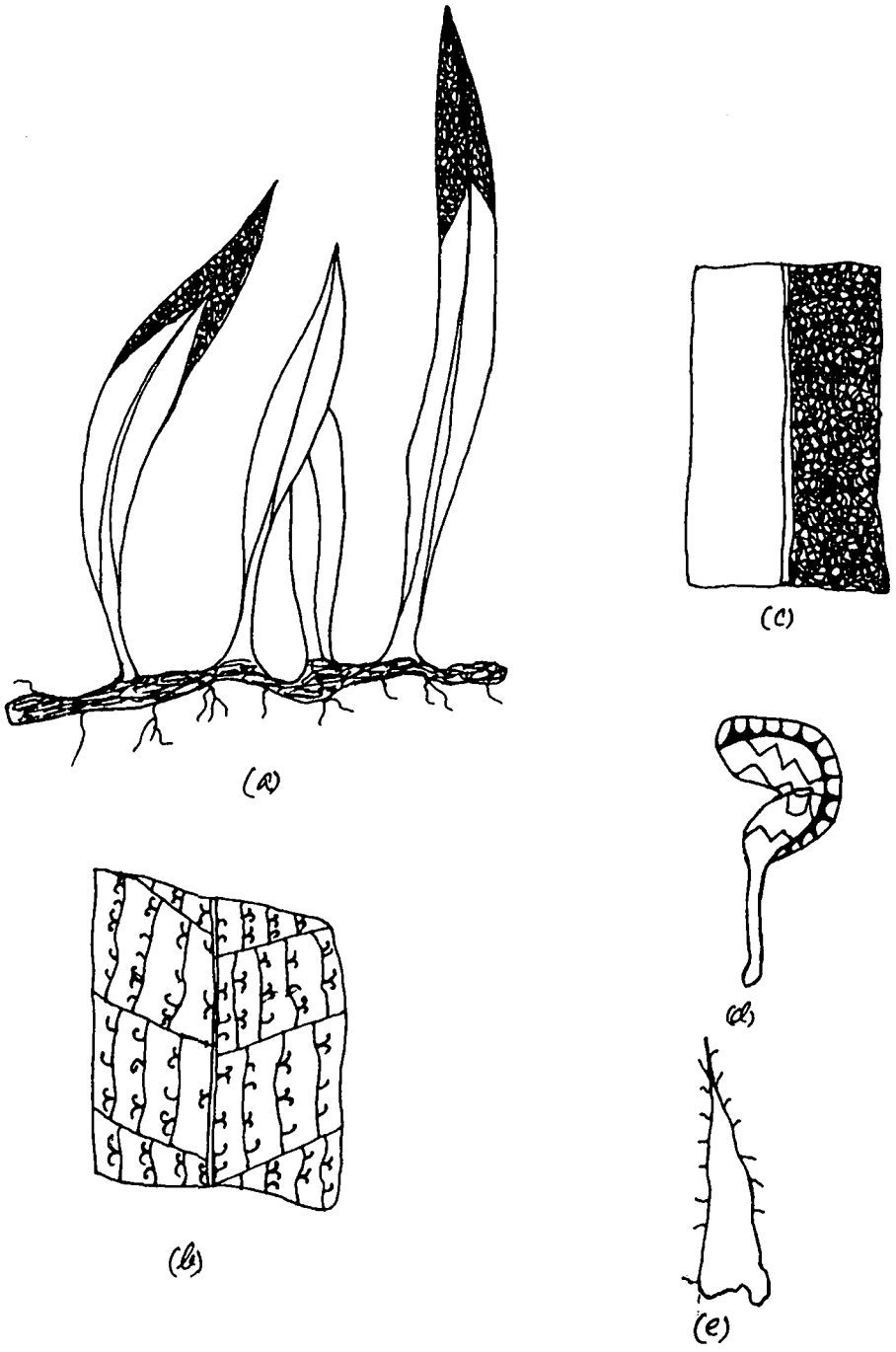
Parts used : Rhizome.

Uses : Cold decoction of the rhizome is mixed with little powdered seeds of *Piper nigrum* and taken orally, twice a day for curing cold and cough, for seven days by the Reang tribe. Extract of frond applied locally for curing cancerous acute skin disease. Fresh extract is applied every day till the disease is cured by the Chorei tribe.

Established reports of utility : Fronds of the plant are used medicinally to treat dysentery and burn injuries. **(Borthakur *et al.*, 2001). Dutta Choudhury (1999)** reported the use of the plant in cough and cold.

* Note: Additional medicinal utility of the plant is reported here.

PLATE 6



Pyrrosia adnascens; (a) Habit (b) Potion of lamina showing venation (c) Portion of lamina showing Sori (d) Sporangium (e) Scale.

7b. P.heteracta. (Mett.ex Kuhn) Ching, Bull. Chin. Bot. Soc. 1.57. 1935. Baishya & Rao, Ferns & Fern-allies, Meghalaya, 75.1982; Jamir & Rao, Ferns Nagaland, 94, 1988; *Polypodium heteractis* Mett.ex Kuhn in Linnaea 36.140. 1869; Clarke, Trans. Linn. Soc. Lond.II. Bot.1. 553.1883. *N.ligua* sensu Bedd. Ferns Brit. India Suppl.22.t.385.1876 (*non* Spr., 1827). **Am-paloi (B).**

Epiphytes. Rhizome wiry, creeping, densely scaly; scales ciliate towards the tip. Stipe terete, upto 15 cm long, woolly; Lamina elliptic, 10- 20 x 2-6 cm, woolly, tomentose through out the surface beneath, hairs stellate, pale brown; midrib and lateral veins prominently raised, reaching the margin. Sori globose, scattered through out. Sporangia oval, shortly stalked, spores round.

Habitat & Ecology : Found on moist tree trunks and moss covered rocks.

Sporulation : July - December

Specimen examined : Duhalia Part I, PSD 0042, dt. 25.12.03.

Economic utility :

Forms of use locally:

Parts used : Rhizome

Uses : Cold decoction of the rhizome is mixed with little powdered seeds of *Piper nigrum* and taken orally, twice a day for curing cold and cough, for seven days by the Reang tribe. Extract of frond applied locally for curing cancerus acute skin disease. Fresh extract is applied every day till the disease is cured by the Choroi tribe.

Established reports of utility : Not recorded so far.

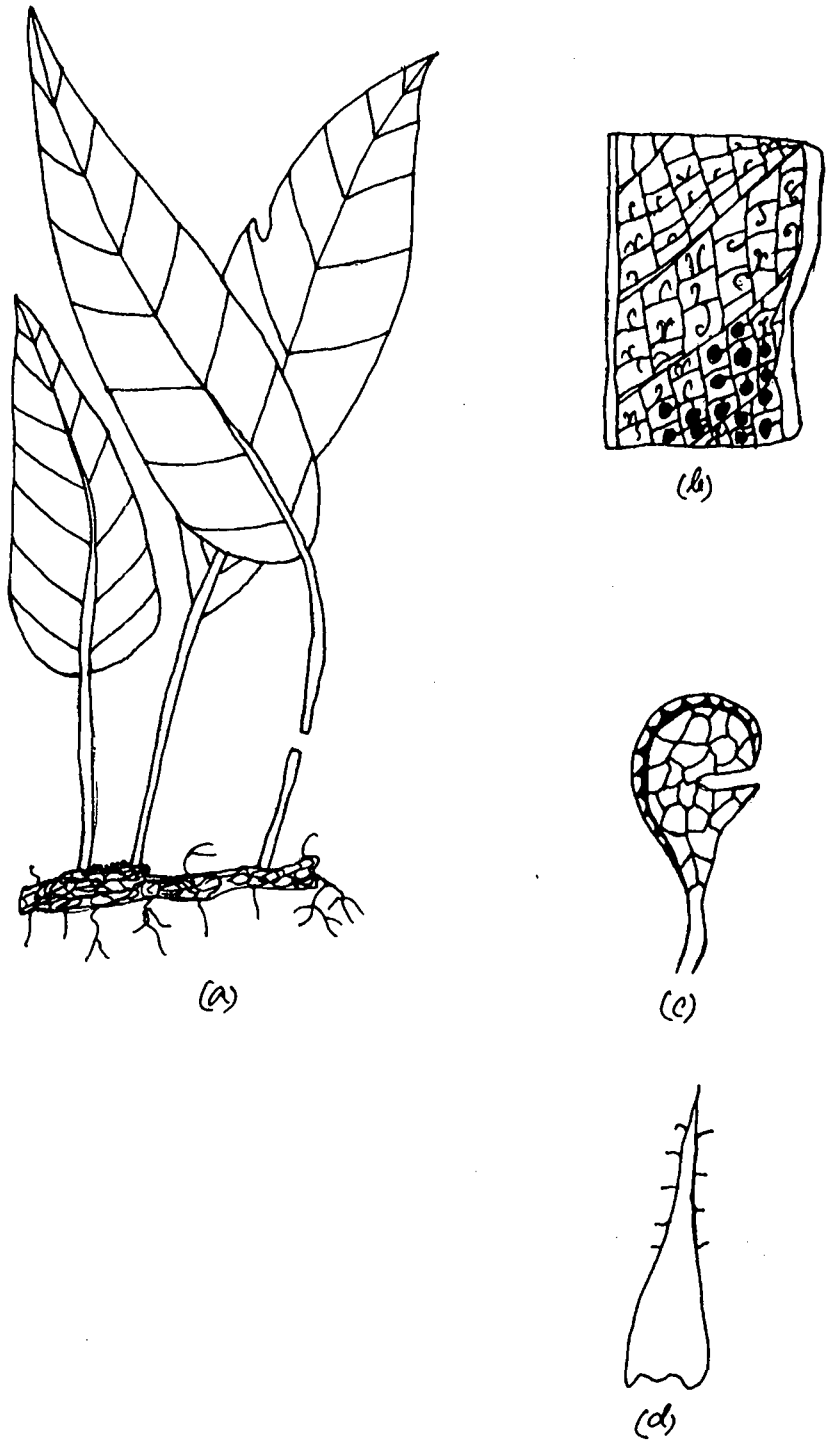
* Note: Recorded here as new.

9. DRYNARIACEAE Ching. Acta. Phytotax. Sin.16 (4):1-37. 1978.

Drynaria (Bory.) J.Smith. Hook. J.Bot. 4:60.1841. *nom. cons*

Key to the species:

PLATE 7



Pyrrosia heteracta; (a) Habit (b) Potion of lamina showing venation & sori (c) Sporangium (d) Scale

1. Scales with hairy margin.Leaf margin subtruncate sori on one or either side of the midribof the leafe lobes. ***1.D.propinqua.***

1′. Scales with dinate margin. Leaf margin entire, Sori in many irregular rows on either side of the midrib of the leaf lobes

2. Steribe lamina with oblong margin; fertile lamina flaccid and apical portion slightly dropping; sori in two regular rows on either side of the main lateral vains and devoid of paraphyses. ***2.D.quarcifelia.***

2′. Sterile Lamina with wavy margin; fertile leaves stiff & erect never dropping, sori irregularly scattered and with club-shaped paraphyses. ***3.D. sparsisora.***

1. D.propinqua. (Wall.ex Mett.) J.Sm. Journ. Bot.4.61. 1842; Bedd. Ferns Brit. India, t.160. 1866; Hand. Ferns Brit. India, 339. t.189. 1883; Dhir, Ferns N.W. Himalayas,131.1980; Baishya & Rao, Ferns & Fern-allies Meghalaya, 61.1982; Jamir & Rao, Ferns Nagaland, 131.1988. *Polypodium propinqum* Wall.ex Mett. In Abh. Senckneb. Naturf.Ges.2.120.t.3.f. 50.1857. *Pleopeltis parishii* Bedd. Ferns Brit. India, t.135. 1866; Clarke, Trans. Linn. Soc. Lond.II. Bot.l. 556. 1880. *Drynaria parishii* (Bedd.) Bedd.Ferns Brit.India Suppl.24.1876 **Ashokatri(B).**

Epiphytes. Rhizome creeping, fleshy, light brown. Scales light yellowish, lanceolate hairy. Stipe glabrous. Fronds dimorphic glabrous ; barren frond distant on the rhizome, much smaller than the fertile ones, with appearance of net with reticulate venation. Fertile frond 45 x 25 cm, deeply cleft, frond pinna spindle shaped, entire, texture thick. Veins prominent on ventral surface. Sori globous, hairy in a single row on each side of midrib.

Habitat & Ecology : Found as epiphyte on moss covered tree trunks.

Sporulation : May - October

Specimen examined : Mahakhal, PSD 0177, dt. 12.6.05.

Economic utility :

Forms of use locally :

Parts used : Rhizomes.

Uses : Base of the rhizomes used fof decorative purposes.

Established reports of utility : Not recorded so far.

Note: Recorded here as new.

2.D. quercifolia (L.) J.Sm. in Hook. Journ. Bot. 3.398. 1841. Bedd. FernsSouth. India, t.186. 1864; Bedd. Handb. Ferns Brit. Indi a, 341. t.191. 1883; Baishya & Rao, Ferns & Fern-allies Meghalaya, 61.1982; Jamir & Rao, Ferns Nagaland, 132.1988; Manickam & Irudayaraj, Pterid. Fl. West. Ghats-S.India, 312. t.238.1992. *Polypodium quercifolium* L. Sp. Pl.2. 1087. 1753; Clarke, Trans. Linn. Soc. Lond. in. Bot. 1.558.1880. **Upat koril / Ulat kombol (B).**

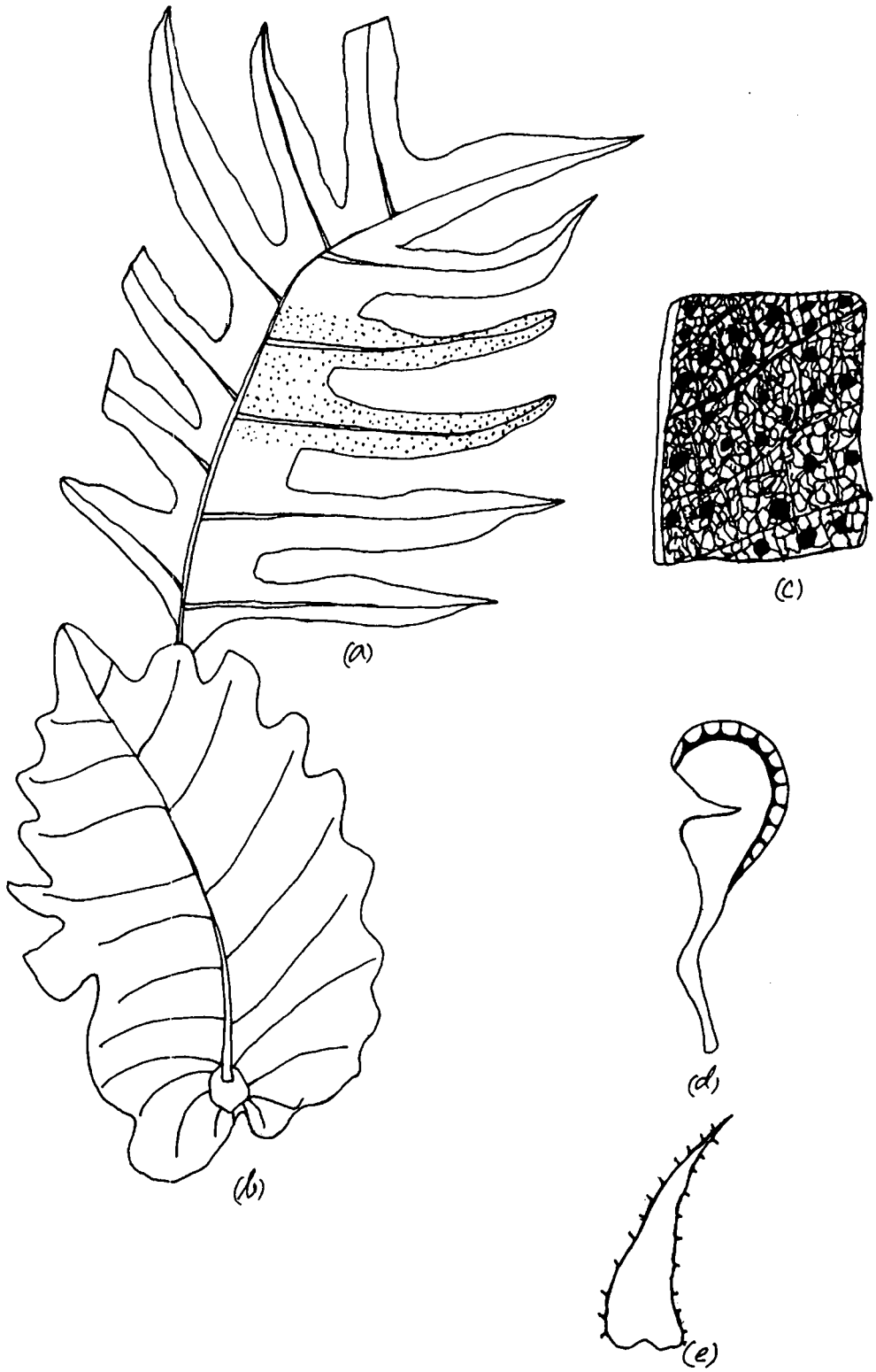
Epiphytes. Rhizome fleshy, creeping, upto2 cm diameter, densely covered with dark roots and scales, scales linear, terminating into hair like tip. Sterile frond over-lapping at the base of the fertile fronds, ovate, sessile, margin deeply lobed, entire and glabrous; fertile fronds pinnatifid, upto 1 m long, slender stipitite ; stipe upto 25 cm long, glabrous, pinnae linear oblong with acute apex, margin wavy, both basal margin decurrent on axis giving winged appearance. Veins reticulate, prominently raised, included veinlets absent. Sori small globose, scattered throughout the surface of the lamina. Sporangia round, slender, stalked ; spores oval, hyaline, exine with minute blunt projections.

Habitat &Ecology : Found on shady and exposed tree trunks forming brakets .

Sporulation : October - June

Specimen examined : Churaibari, PSD 0291, dt 16.6.06.

PLATE 8



Drynaria quercifolia; (a) Fertile lamina (b) Sterile lamina (c) Portion of lobe of fertile lamina showing venation & sori (d) Sporangium (e) Scale.

Economic Utility:

Forms of use locally :

Parts used : Rhizomes.

Uses : Rhizome paste used in bone fracture and skin disease.

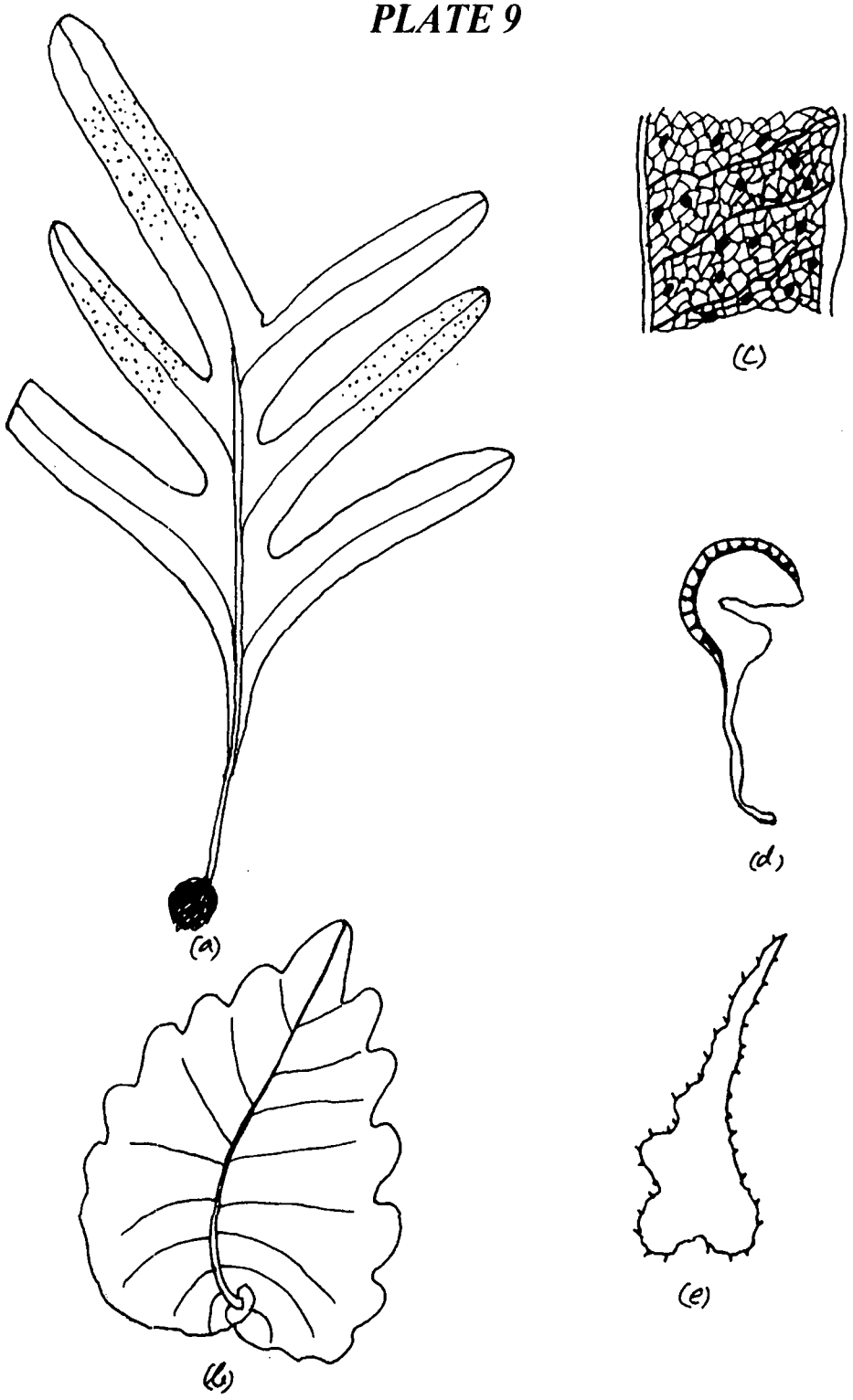
Established reports of utlisation: Rhizomes of the plant are used as astringent ; fronds is used in epithesis, hectic fever, dyspepsia and cough. The decoction of the plant is used in typhoid fever. The fluid extracted from the fronds have anti bacterial properties. The plants is used in the treatment of body ache, rheumatism, skin diseases and as tonic, expectorant and anthelmintic. Fronds anti bacterial and used to treat swellings. Rhizome is used to treat bone fracture, cough, headache and typhoid fever. The rhizome extract is mixed with honey and used to cure asthma and bronchitis. **(Borthakur *et al.*, 2001).**

3. D.sparsisora. (Desv.) Moore. Ind. Fil.348.1857. *Polypodium sparsisorum* Desv. Berl. Mag. 5:315.1811. *Drynaria linnaei* (Bory) Bedd. Ferns Brit. India, t.315. 1866; Handb. Ferns Brit. India, 343.1883. **Upot koril(B).**

Epiphytes. Rhizoem long creeping, stout, flattened dorsiventrally, covered by scales; scales about 0.4-0.7 cm long, basal region shield like, tips uniseriate and bear glandular hairs, margin dentate, dark brown. Sterile leaves about 12 x 8.5 cm, adpressed to the rhizome, ovate, sessile, apex blunt or acute, margin broadly wavy,ultimate margin entire, veins prominently raised, dull brown. Fertile leaves erect, stiff. Leaf lobes alternate, lanceolate, basal region faintly constricted, apex acuminate, texture leathery, margin cartilagenous and irregularly undulate, venation prominent. Sori small, in two rows one on each side of the main lateral veins of the leaf.Spores brownish, monolete.

Habitat & Ecology : Growing on shaded rock surface and tree trunks.

PLATE 9



Drynaria sparsisora; (a) Fertile lamina (b) Sterile lamina (c) Portion of lobe of fertile lamina showing venation & sori (d) Sporangium (e) Scale

Sporulation : April - July

Specimen examined : Duhalia Part II, PSD 0351, dt. 28.5.06.

Economic utlisation : Not available.

Established reports of utility : Not recorded so far.

10. DIPTERIDACEAE. E.(Diels) Seward & Dale. Philos. Trans. Roy. Soc. Lon. Ser. B.194:487. 1901.

Dipteris: Reinw. Soill. Pl. nov. Ratisb. 2:3.1825.

D.wallichii (R.Br.) Moore, Ind. Fil.80. 1857; Bedd. Ferns Brit. India, t.80.1866; Handb. Ferns. Brit. India, 334. T. 184. 1883; Clarke, Trans. Linn. Soc. Lond.II. Bot.1.184.1880; Baishya & Rao, Ferns & Fern-allies Meghalaya, 60. 1982; Jamir & Rao, Ferns Nagaland, 134. 1988; Choudhry & Bhattacharya, Indian Fern Journ.13:18-21. 1996. *Polypodium wallichii* R.Br.in Hook. *et* Grev. Icon. Fil. t.168-169. 1931.

Phona paloi(B).

Terrestrials. Rhizome creeping, about 1.5cm thick, stout, densely scaly;scales narrow, linear, hard, subulate-setaceous, margin shortly tubercled, black. Stipes erect, grooved above, hard, polished and smooth, glabrous. Lamina about 30-50.5cm long and much wider than long, fan-like, bipartite into two equal broad-cuneate portions which are palmately and dichotomously divided; segments oblong, apex acuminate, margin entire; costae prominently raised above and below, from the summit of the stipe dichotomously repeatedly branched veins pass through the frond with 2 main costae run through each segment which are united at the apex;venation prominently raised below, reticulate; all the costae are united by transverse flexuose costules; free veinlets present in the aereoles; texture coriaceous; lamina glossy-green above, coppery-green beneath, glabrous. Sori small, round, copius, superficial, scattered in the

aeroles; sporangia oval, short-stalked, light-brown. Spores oval, hyaline, pale-white, exine smooth.

Habitat & Ecology : Found in slopes of hilly region in shaded non-laterised sandy soil, very rare.

Sporulation : March - September.

Specimen examined : Debbarma Village, Churaibari, PSD 0456, dt. 3.2.06.

Economic utility:

Forms of use locally:

Parts used : Leaves.

Uses : Leaves paste used in cuts and wounds.

Established reports of utility : The rhizome is used in Hepatitis **(Dutta Choudhury, 1999).**

Note: Additional utility reported here.

11. LYGODIACEAE Presl. Suppl. Tent. Pterid. 98.1845.

Lygodium Sw. Schrad. J.Bot. 1800(2).7.106. 1801. *nom. cons.*

Key to the species:

1. Pinnules mostly laceolate with cordate base in barren; fertile pinnules broadly obate. 3.***L.microphyllum.***

1′. Pinnules linear, oblong, margin actuly serrulate.

2. Sterile lateral pinnae bipinnate, secondary pinnae pinnitifid at base. 2.***L.japonicum.***

2′ Sterile lateral pinnae unipinnate, secondary pinnae often trilobed or tripartite at base. 1.***l.flexuosum.***

1. L.flexuosum. (L.) Sw. Schrad. Journ. 1800(2).7.106. 1801; Bedd. Ferns South India, t.63. t.1864; Handb. FernsBrit. India, 457.f.283. 1883; Clarke, Trans. Linn. Soc. Lond.II. Bot.l. 584. 1880; Dhir, Ferns N.W. Himalayas, 28.1980; Baishya & Rao, Ferns & Fern-allies, Meghalaya, 37.1982; Jamir & Rao, Ferns Nagaland, 136.1988; Manickam & Irudayaraj, Pterid. Fl. West. Ghats. S-India, 61.t.38.1992. *Ophioglossum flexuosum* L.Sp.Pl.2.1063. 1753. **Loti paloi(B).**

Terrestrial climibing ferns. Rhizome creeping, short, covered by dark brown hairs. Stipes about 35 x 0.4cm, glabrous, abaxially rounded and adaxially flattened, dark brown. Fronds wide spreading, tripinnate, glabrous; primary pinnae alternate about 14 cm apart with about 2.5 mm long common stalk forked once and bearing a dormant bud on the forking axis; each forked branch bears 2–3 pinnules alternately. Sterile leaflets finely toothed; texture firm; rachis and costa densely or sparsely pubescent all over; veins distinct, 1–3 forked, free, reaching the margin; fertile leaflets little narrower than the sterile ones. Sprorangia arranged adaxilly on spikes of size 4 x 1 mm, protruding from the margin; sporangia large, short stalked about 5 pairs, arranged in two rows, alternate. Spores small, trilete, yellowish green.

Habitat & Ecology : Found in shady and open areas, often twining on bushes.

Sporulation : February - December

Specimen examined : Kamalpur, PSD 0073, dt. 8.2.04.

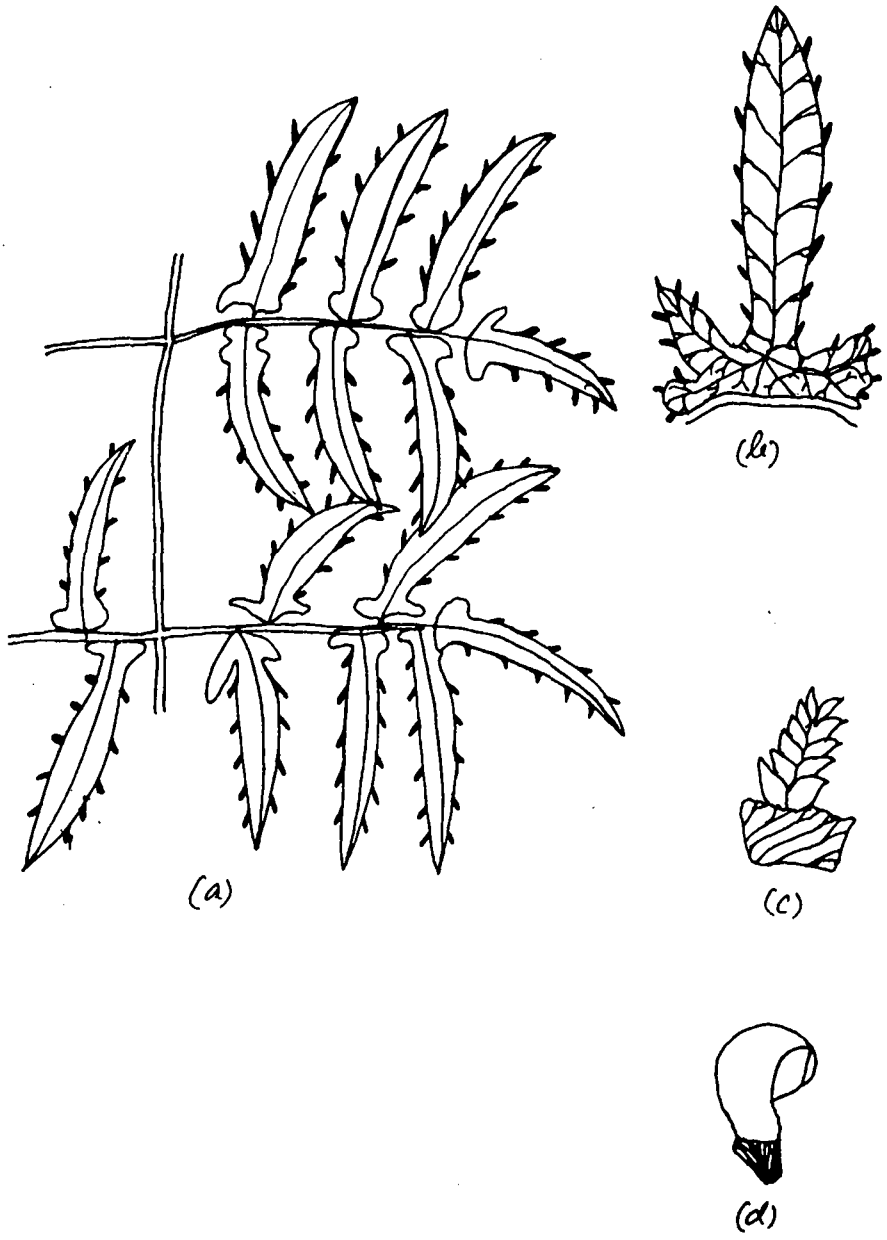
Economic utlisation :

Forms of use locally :

Parts used : whole plant.

Uses : Rachis of the plant is tied on hand to be secured from evil sprit. The same is tied over forehead to reduce headache by the Reang tribe.

PLATE 10



Lygodium flexuosum; (a) Potion of lamina (b) Pinnule showing venation (c) Arrangement of sori (d) Sporangium

Established reports of utility : The plants are used as expectorant ; rhizomes boiled mustard oil and locally applied on carbuncles and in rheumatism, sprains, scabies, ulcers, eczema and cuts. The aquous extracts of the rhizomes is used to cure gonorrhoea. The paste of the rhizome is applied on piles and the rhizome is also tied on the waist. Rhizome is used as abortifacient and as appetizer; it is also used for treatment of abdominal pain, cholera, cuts, eczema, indigestion, jaundice, *sca*bies and ulcers. The plant is also used in pleuricy.**(Borthakur *et al.*, 2001).**

***Note:** Additional utility reported here.

2. L. japonicum *(*Thunb.) Sw. Schrad. Journ. Bot.1800(2).7.106. 1801; Bedd. Ferns South India, t.64.1864; Handb. Ferns Brit. India, 452.1883; Clarke, Trans. Linn. Soc. Lond.II. Bot.1. 584.1880; Dhir, Ferns N.W. Himalayas, 28.1980; Baishya & Rao, Ferns & Fern-allies, Meghalaya, 37.1982; Jamir & Rao, Ferns Nagaland, 137.1988. *Ophioglossum japonicum* Thunb. Fl. Jap.328.1784**. Loti paloi(B).**

Terrestrial. Rhizomes long creeping. Fronds 200–300 x 20–60 cm ; rchis about 1.5 mm across, dorsal surface pubescent; pinnae in sterile fronds tripinnate and fertile fronds quadripinnate to further decompound; primary rachis–branches 6–8 mm long, pubescent, dormant, apex hairs long in sterile frond pinnate and in fertile frond tripinnate to further decompound,pubescent; margin in sterile frond crenate and deeply cleft to midvein in fertile ; lamina pubescent; midvein and veins pubescent below; texture firm. Sporophores up to 6.5 mm long, 4–7 solitary sporangia; spores colliculate.

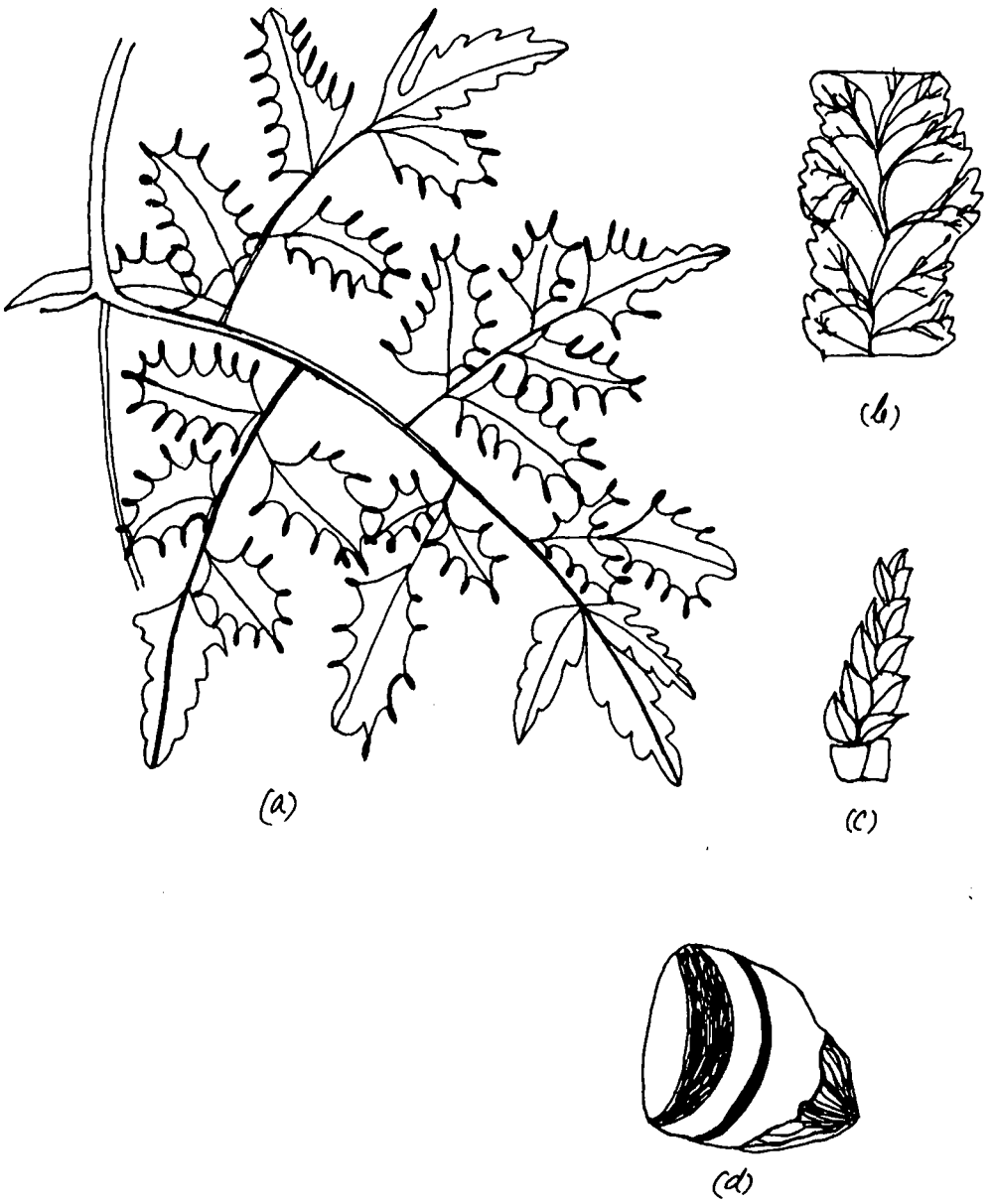
Habitat & Ecology : Found in moist open places, often twining on bushes.

Sporulation : July – November.

Specimen examined : Khasiapunji, Durganagar T.E., PSD 0516, dt. 29.11.06.

Economic Utility:

PLATE 11



Lygodium japonicum; (a) Potion of lamina (b) Pinnule showing venation (c) Arrangement of sori (d) Sporangium

Forms of use locally:

Parts used : Rhizome.

Uses : Rhizome paste is taken orally mixing with water to get cured from food poisoning. Stem used as ropes for carrying fish and vegetables in village markets.

Established reports of utility : The plant is used as expectorant; decoction of vegetative parts and spores is used as diuretic or cathartic. Roots are used as veterinary medicine to treat animal wounds. **(Borthakur *et al.*, 2001).**

***Note**: Additional medicinal uses reported.

3. L.microphyllum (*Cav.*) R. Br. Prod. Fl. Nov. Holl.162. 1810; Clarke, Trans. Linn. Soc. Lond.II. Bot.I. 583.1880; Bedd. Handb. Ferns Brit. India, 455. t.282.1883; Manickam & Irudayaraj, Pterid. Fl. West. Ghats-S. India, 62. t.39. 1992. *Ugenia microphyllum Cav* Icon. Descr. Pl.6. 76.t. 595.1801. *Lygodium scandens* Bedd. Ferns South. India, t.61.1864. *Ophioglossum filiforme* Roxb.ex. Griff. *Cal*a. Journ. Nat. Hist. 4.476. t.26. f.3.1844. **Loti paloi (B).**

Terrestrial twining fern.Rhizome long creeping about 0.6 cm thick, densely coverd by hairs. Stipes about 2 mm thick, abaxially rounded, adaxially flattened, brown; rachis twining, similar to stipe. Fronds about 200–300 x 20 cm; primary branches about 5 x 1 m, upto 10 cm apart, alternate, covered by hairs, bearing a dormant apex. Secondary branches about 7x3cm, pinnate, oblong, with an apical pinna similar to lateral ones which is more or less lobed; veins distinct, branched, free, reaching the margin; texture herbaceous, pinnules glabrous, pale green. Sori finger-like about 0.5 cm long, round the margin of the pinnules except the base; sporangia short stalked, up to 6 pairs in two rows. Spores trilete, exine densely verrucate.

Habitat & Ecology : Found in open moist places, rare.

Sporulation : July - September

Specimen examined : Kalinagar T.E., PSD 0223, dt. 6.9.05.

Economic utility :

Forms of use locally :

Parts used : Whole plant.

Uses : Rachis of the plant is tied on hand to be secured from evil sprit. The same is tied over forehead to reduce headache by the Reang tribe.

Established reports of utility : Young leaves eaten; their decoction used in dysentery; poultice of leaves applied to skin diseases. Old stems are used for basket making **(Borthakur, *et al.*, 2001).**

Note: Additional utility is reported.

12. CHEILANTHACEAE (Smith) Nayar in Taxon.19:233.1970.

Cheilanthes Sw. Syn. Fil.5.126.1806. *nom. cons*

Key to the Species:

1. Undersurface of lamina without silvery crest ***4.C.tenuifolia.***

1′. Undersurface of lamina with silvery crest.

2. Stipe and rachis dark-puplish crest. ***2.C.balangiri.***

2′. Stipe and rachis otherwise;

3. Scales on rhizome with translucent magin; indusium with flabellate margin bearing small glandular hairs. ***1.C.albomarginata.***

3′. Scales on rhizome without translucent magin; margin of indusium nearly smooth or serrate. ***3.C.farinosa.***

1. *C.albomarginata.* Clarke, Trans. Linn. Soc. Lond.II. Bot.1. 456. t.52. 1880; Bedd. Handb. Ferns Brit. India, 94.1883; Dhir, Ferns N.W. Himalayas. 36.1980; Baishya & Rao, Fern & Fern-allies. Meghalaya. 143.1982; Jamir & Rao. Ferns Nagaland.

139.1988. *Cheilanthes farinose* var.*albomarginata* Bedd. Handb. Ferns. Brit. India. Suppl. 22.1892.

Terrestrials. Rhizomes short erect, about 1.5 cm thick,coverd with scales;s cales long lanceolate, hair pointed, acuminate apex, blackish-brown, margin translucent. Stipes cylindrical, slender, shining, reddish brown, sparsely covered with lanceolate hair-like scales. Lamina about 4.5 – 16 x 2.5-9 cm, bipinnatifid, ovate lanceolate to deltoid-lanceolate, acute apex; pinna upto 12 pairs, sub-opposite; elongate-ovate, apex blunt, deeply pinnatifid; lowest pair of pinna slightly enlarged than others ; rachis similar to stipe; texture rough and coriaceous; upper surface of lamina glossy, lower surface bears scales as well as hairy and covered a white silvery crust.Veins free, forked once,reaching the margin. Sori marginal, confluent. Sporangia large, short stalked, spores globose, blackish.

Habitat &Ecology : Found on hill slopes, roadsides.

Sporulation : October - February

Specimen examined : Dasgram, PSD 0241, dt. 11.1.06.

Economic Utility:

Forms of use locally :

Parts used : Whole plant.

Uses : Plant paste used in cuts and wounds.

Established reports of utility : Young plants are used in making Tonic. Extract mixed with honey is taken after meal by person suffering from weakness due to Tuberculosis **(Borthakur *et al.*, 2001).**

2. C.belangiri (Bory) C.Chr. Ind. Fil. 172. 1905; Baishya & Rao. Ferns & Fern-allies Meghalaya, 144.1982. *Pteris belangiri* Bory, Bel. Voy. bot. 2.44. 1833. *C.varians*

Wall. ex Hook. Sp. Fil. 2.89. t.103A. 1852; Bedd. Ferns South India, t.189.1864; Handb. Ferns Brit. India, 91. t.47. 1883.

Terrestrials. Rhizomes short, semi-erect, with numerous branched roots, clothed with scales. Scales narrow, lanceolate, hair-like at apex, costaneous brown. Stipes about 14 x 0.15 cm long, slender, scaly at base, glabrous above, ebaneous-glossy, plane and margined on the upper side, dark purplish-brown. Lamina unipinnate about 48 cm long, with few basal pair of pinnae separating basal pinnules at their base, pinnatifid upwards, pinnae light brownish green, glaucous beneath, basal pinnules obliquely oblong, with lobed margin, glabrous. Sori confluent along the margin of lobes, leaving no sterile region, except the apex ; indusia lacerate at margin.

Sporulation : July to November.

Habitat & Ecology : Found in open roadsides and hill slopes.

Specimen examined : Duhalia Part I, PSD 0481, dt. 8.1.07.

Economic utility :

Forms of use locally : Not available.

Established reports of utility in medicine : Not known so far.

3. C.farinosa. (Forsk.) Kaulf. Enum. Fil. 212. 1824; Clarke, Trans Linn. Soc. Lond. II.Bot. 1. 457. 1880. Bedd. Ferns South. India, t.191. 1864; Handb. Ferns Brit. India, 92.1883; Dhir, Ferns N.W. Himalayas, 37.1980; Baishya & Rao, Ferns & Fern-allies, Meghalaya, 144.1982; Jamir & Rao, Ferns Nagaland, 141.1988; Manickam & Irudayaraj, Pterid. Fl. West. Ghats-S.India, 87. t.63. *Pteris farinosa* Forsk. Fl. Aegypt. Arab. 187.1775.

Terrestrials. Rhizome short, stout, roots tufted ; scales brown, linear, hair pointed. Stipe glabrous, ebonous glossy, slender, 4–5.5 cm long with deciduous elongate scales. Fronds deltoid-lanceolate, upto 18 cm long, 2 pinnate at base,

pinnatifid at apex, basioscopic pinnae of basal pairs upto 5.5 cm long, under surface covered whitish small waxy paleae, glabrous above, texture thin, coriaceous. Sori scariose-rounded in continuous margin. Indusia false, dark brown; sporangia large, short stalked.Spores globose, dark brown, exine with dense reticulate, raised thickenings.

Habitat & Ecology : Found along roadsides and hill slopes .

Sporulation : July – February.

Specimen examined : Latu, PSD 0247, dt. 11.1.06.

Economic utlisation:

Forms of use locally:

Parts Used : Root.

Uses : Roots of the plants are used to treat eczema and stomach-ache: fronds are to treat periodic disorders.

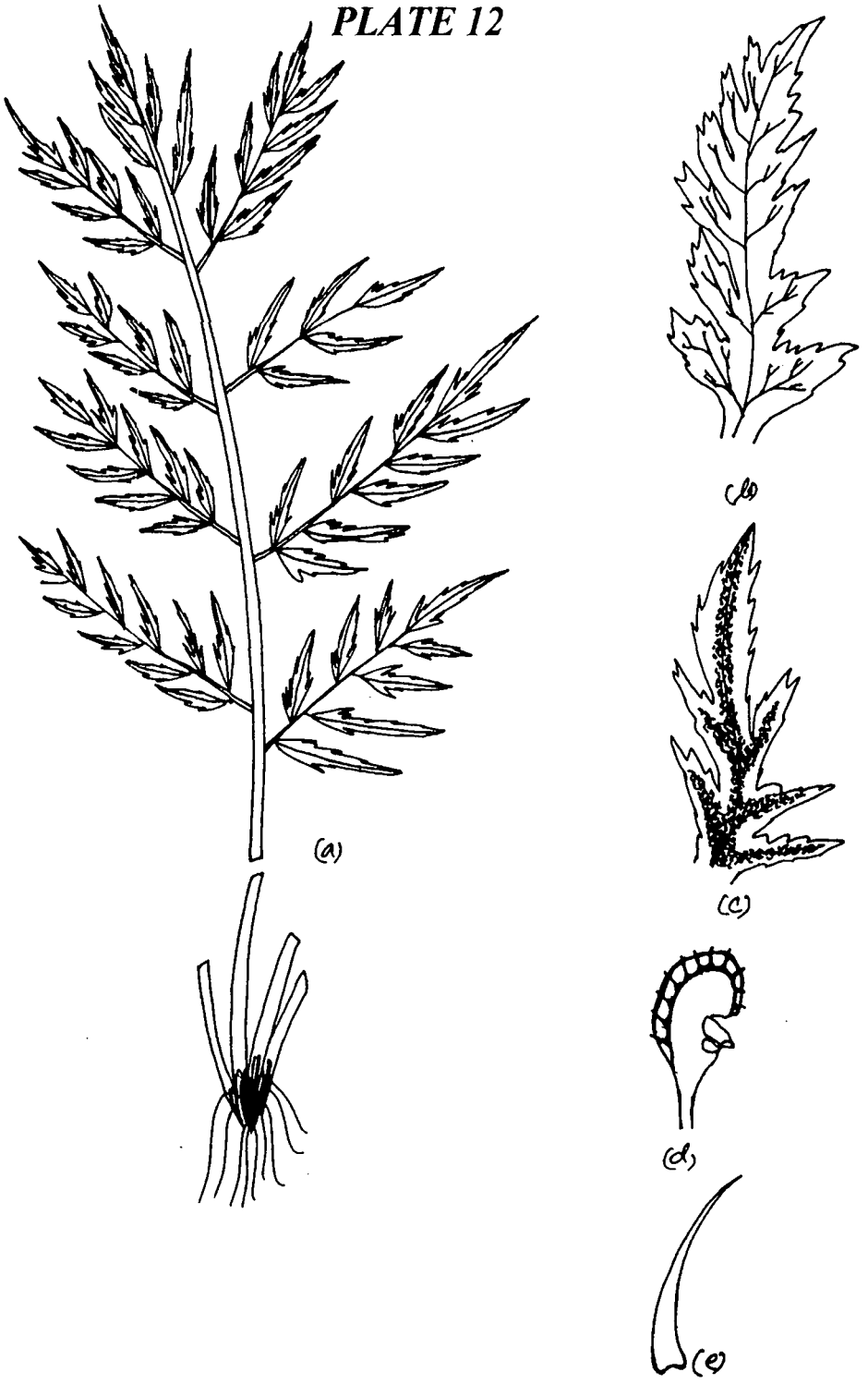
Established reports of utility : Not known so far.

Note: Medicinal utility reported here as new.

4. C.tenuifolia (Burn.f.) Sw. Syn. Fil. 129.332.1806; Bedd. Ferns South. India, t.188.1864; Handb. Ferns Brit. India, 92.1883; Clarke, Trans. Linn. Soc. Lond.II. Bot.1. 455.1880; Baishya & Rao, Ferns & Fern-allies, Meghalaya; Jamir & Rao FernsNagaland, 142.1988; Manickam & Irudayaraj, Pterid. Fl. West. Ghats-S. India, 90. t.1992. *Trichomanes tenuifolia* Burm. f.Fl. India. 237. 1768.

Terrestrial. Rhizome small, short, creeping or sub-erect about 1 cm thick. apex scaly; scales lanceolate, acuminate, entire, brownish. Stipes scaly at base, glabrous above, glossy, rounded below, above grooved, erect, dark purplish. Lamina ovate-lanceolate, tripinnate below, bipinnate middle and unipinnate above, apex acuminate. Rachis similar to the stipe ; lamina green,glabrous ; texture herbaceous ; veins of the

PLATE 12



Chelianthes tenuifolia; (a) Habit (b) Secondary pinna showing venation (c) Secondary pinna showing sori (d) Sporangium

upper surface not visible but slightly distinct below, forked once or twice, free.Sori marginal on each ultimate lobes, protected by reflexed margin of the lamina, indusia very short, undulate. Spores dark brown, tetrahedral.

Habitat & Ecology : Found on foot hills and in plain areas.

Sporulation : July - October

Specimen examined : Gandhai, PSD 0517, dt. 29.1.07.

Economic Utility:

Forms of use locally:

Parts used : Fronds.

Uses : Fronds crushed and made into paste and applied on abscess in the form of poultice to liberate pus. Believed to have antiseptic action. The poultice given once a day till the abscess is dried up.

Established reports of utility : Roots and rhizomes are used by tribals as a general tonic. The plant is used as hair tonic. **(Borthakur *et al.*, 2001).**

***Note:** - Recorded here for additional mode of utility.

13. CRYPTOGRAMMACEAE, Pic.Ser, Webbia. 29:1. 1975.

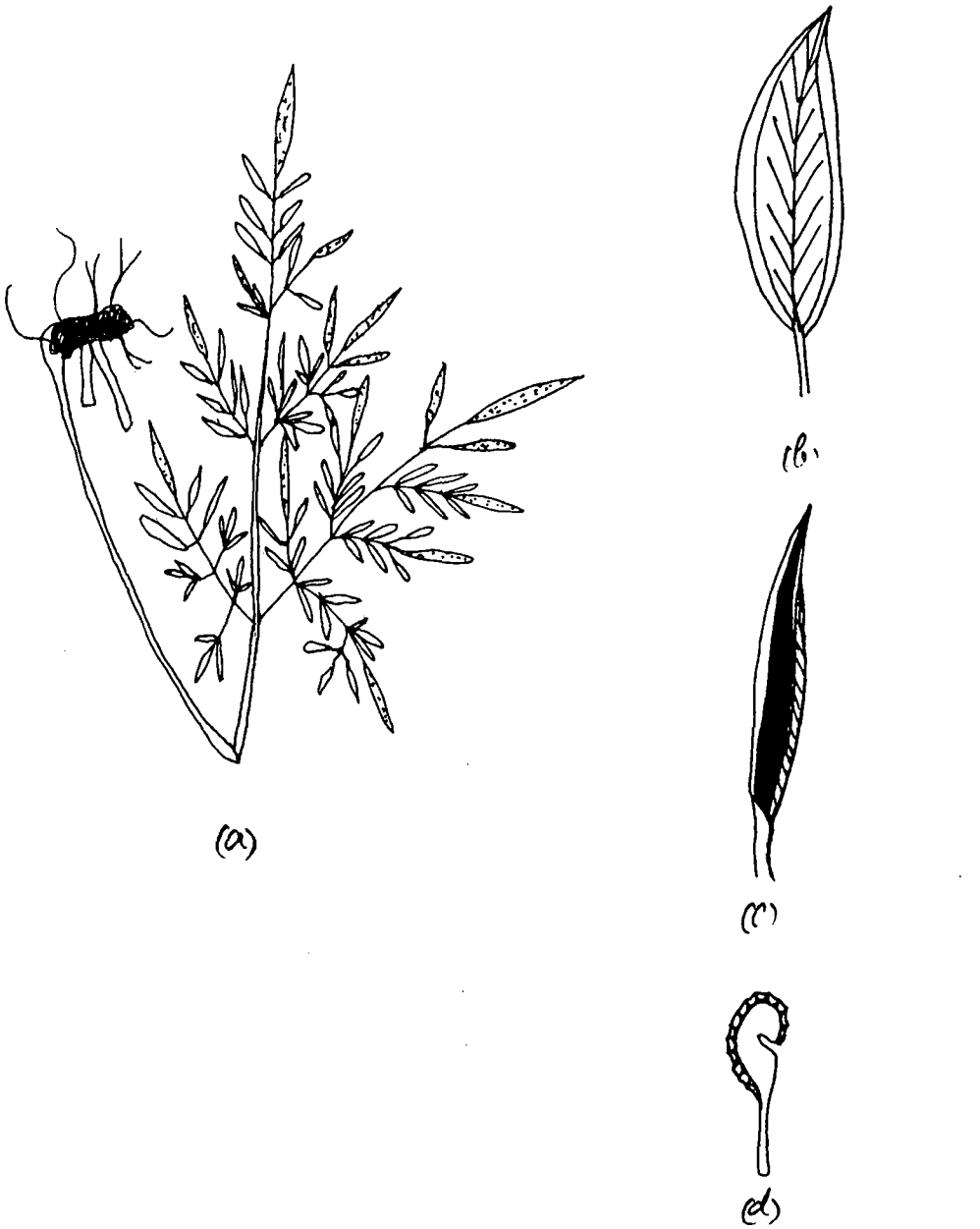
Onychium Kaulf. Berlin Jahrb. Pharm. 21:45.1820.

O. siliculosum. (Desv.) C.Chr. Ind. Fil. 469.1906; Ching in Lingnan Sci. Journ. 13; 495.1934; Copel., Fern Fl. Philip.1:156, 1958; Deb and Dutta in Journ. Bombay nat. Hist. Soc. 68(3): 582. 1972; Morton in Contrib. U.S. Nation. Herb. 38(7):368. 1974.

Sunali paloi (B).

Terrestrials. Rhizome short, semi-erect, densely clothed with scales; scales narrow, lanceolate, acuminate, hair tipped apex. brown. Stipe stout, erect, glabrous, cylindrical, staw coloured or pale- brown. Lamina about 35 x 15 cm quadripinnate,

PLATE 13



Onychium siliculosum; (a) Habit (b) Pinnule showing venation (c) Pinnule showing sori (d) Sporangium

ovate, apex acuminate; pinnae alternate or sub-opposite, about 8 pairs or more ; margin entire; fertile segments bear terminal pinnules much longer, pod-like, apex usually trifid ; veins free; rachis glabrous. Sori sub-marginal, continuous along both margins, connected with veinlets, bright golden yellow; indusia membraneous, margin fimbri*cat*e; sporangia golden brown. Spores small, tetrahedral.

Habitat & Ecology : Found in dry sandy red soil in open places and forests.

Sporulation : January - October

Specimen examined : Nilmani Road, Karimganj, PSD 0298, dt. 16.6.06.

Economic Utility:

Forms of use locally:

Parts used : Frond.

Uses : Used as ornamental plant and also used in cuts & wounds.

Established reports of utility : Fronds are used to treat baldness and dysentery **(Borthakur *et al.*, 2001).**

***Note:** Additional Medicinal utility reported here .

14. PTERIDACEAE. Reichb. Handb. Nat. Pflan. 138. 1837

Pteris L., Sp. Pl. 2:1073. 1753.

Key to the species:

1. Lamina dimorphic.

2. Basal pair of pinnae bipartite, pinneae uniform.

3. Pinnae shortly stipitate. Linear-lanceolate, finely serrated,

Terminal pinnae decurrent on the rachis; veins prominent ***2.P.cretica.***

3′. Pinnae sessile, alternate at base, margin deeply lobed, lobes

Serrated, terminal pinna not decurrent on rachis; veins obscure ***4.P.grevilleana.***

2′. Basal pair of pinnae not bipartite, pinnae not uniform ***3.P.ensiformis.***

1′. Lamina monomorphic.

4. Lamina simple pinnate.

5. Pinnae sub-entire on the upper margin and the lower margin pinnately divided. ***7.P.semipinnata.***

5′. Pinnae undivided on both margins. ***8.P.vittata.***

4′. Lamina bipinnatifid or bipinnate.

6. Bassal veins anoastomosing to form series costal areols. ***1.P.biaurita.***

6′. Bassal veins not anoastomosing.

7. Spinules present both on costa and costules. ***6.P.quadriaurita.***

7′. Spinules present on costa only ***5.P.linearis.***

1. P.biaurita. L.Sp. Pl.2. 1076. 1753; Clarke, Trans. Linn. Soc. Lond.II. Bot.1. 469.1880; Dhir, Ferns N.W. Himalayas, 49.1980; Baishya & Rao, Ferns & Fern-allies Meghalaya, 110. 1982; Jamir & Rao, Ferns Nagaland, 146.1988; Manickam & Irudayaraj, Pterid. Fl. West. Ghat.-S.India, 73. t.49.1992. *Campteria biaurita* (L.) Hook. Gen. Fil. t.65A. 1841; Bedd. Ferns South. India, t.44. 1864; Handb. Ferns Brit. India, 115.1883. **Bon paloi (B).**

Terrestrial. Rhizome short, sub-erect, densely hairy and scaly; scales dark brown, linear-lanceolate. Fronds unipinnate, 35-50 x 20 cm, basiocopic pinnae forked once downwards at base, base oblique, pinnae membraneous, glabrous, cut down nearly two-third distance to costae, margins entire. Stipe and rachis glabrous. Veins forked, one pair opposite sides uniting just above the sinus. Sori confluent or along the margin connecting all the veinlets.

Habitat & Ecology : Common along road sides and hill slopes in shaded area.

Sporulation : July - December.

Specimen examined : Harinagar, PSD 0215, dt. 6.9.05.

Economic utlisation:

Forms of use locally: Not available.

Established reports of utility : Rhizomes are used in treatment of wounds. **(Borthakur *et al.*, 2001).**

2.. P.cretica. L. Mant.130. 1767; Bedd. Ferns South. India, t.39.1864; Handb. Ferns Brit. India, 106.1883; Clarke, Trans. Linn. Soc. Linn. Soc. Lond.II. Bot.1. 452.1880; Dhir, Ferns N.W. Himalayas, 47.1980; Baishya & Rao, Ferns & Fern-allies Meghalaya, 110.1982; Jamir & Rao, Ferns Nagaland, 147. 1988; Manickam & Irudayaraj, Pterid. Fl. West. Ghats-S. India, 70. t.45. 1992. **Bon paloi (B).**

Terrestrial. Rhizomes short creeping; stipe erect 16x35 cm long, naked or with lanceolate brown scales near the base. Fronds dimorphic; sterile fronds smaller than fertile once; 20-35 cm long; fertile once more than double the length of sterile ones.Lamina sub-unipinnate, basioscopic 2-3 pairs of pinnae unequally forked to the costae on posterior base, pinnae few, sessile; fertile pinnae linear, entire. Rachis naked, veins forked ones, simple. Sori confluent along the margin except at the base and apex.

Habitat &Ecology : Common in dry open places along the roadsides and forests.

Sporulation : July - October.

Specimen examined : Duhalia Part II, PSD 0382, dt. 8.1.07.

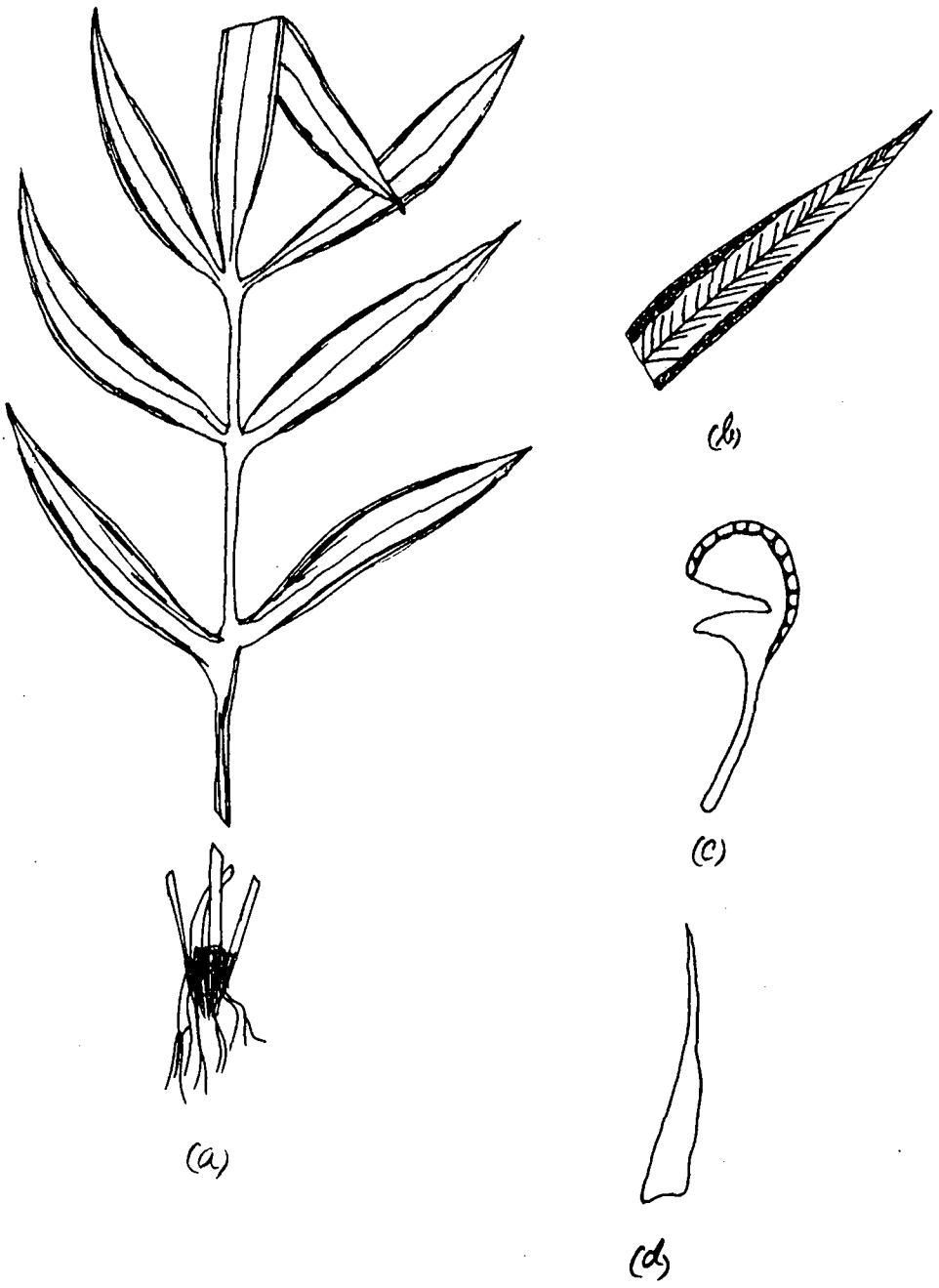
Economic utility :

Forms of use locally : Not available.

Established reports of utility : Not known so far.

3. P.ensiformis. Burm. f.Fl. India.:230. 1768; Clarke, Trans. Linn. Soc. Lond. li. Bot.l. 463.1880; Bedd. Handb. Ferns. Brit. India, 107.1883; Baishya & Rao, Ferns & Fern-

PLATE 14



Pteris cretica; (a) Habit (b) Portion of fertile pinna showing venation & sori (c) Sporangium (d) Scale

allies Meghalaya, 110. 1982; Jamir & Rao, Ferns Nagaland, 147.1988. P.crenata Sw. Schrad. Journ. Bot. 1800(2). 65. 1801; Bedd. Ferns South. India, t.35. 1864.

Terrestrial. Rhizome short creeping, scaly not hairy. Scales linear-lanceolate, narrowed at apex. Stipe slender, short, 5-25 cm long, glabrous. Fronds herbaceous, glabrous membranous, simple pinnate; basioscopic one pair of pinnae lobed; lobs oval to elongate-obovate, margin sharply dentate ; apical pinnae linear, entire. Sterile frond 18-10 cm, fertile pinnae narrower. Veins free. Sori confluent, marginal, developing in basipetal succession.

Habitat & Ecology : Found in moist humus rich area and rock crevices.

Sporulation : June - November.

Specimen examined : Modan Mohan, PSD 0178, dt. 12.6.05.

Economic utlisation:

Forms of use locally:

Parts used : Fronds.

Uses : Paste of fresh fronds with water is applied locally twice a day for curing swelling of joints.

Established reports of utility : Decoction of fronds is used for dysentery; leaf juice is used as astringent, root juice is used for glandular swellings of neck , tender fronds edible. **(Borthakur *et al.*, 2001).**

Note: Additional medicinal utility of the plant is recorded here.

4. *P. grevilleana* wall. Ex Agardh. Rec Sp. Gen. Pteridis. 23.1839: Clarke. Trans. Linn. Soc. Lond II. Bot.1.466. t.56.1880; Bedd. Handb. Ferns Brit. India.112.1883: Suppl. 24.1892. Rhizome erect ca 3 cm thick, scaly at apex; scales *ca* 0.3 x 0.1 cm. tinear lanccolate. Apex acuminate, brown. Lamina dimorphic; stipe of sterile lamina shorter than fertile ones. *ca* 12 x 0.3 cm. abaxcilly rounded. Adaxially grooved. Scaly at base.

glabrous above, slightly winged towards the apex, straminious. Sterile lamina *ca* 12 x 10 cm. pedately 5-fid, apical pinna largest, *ca* 10 x 3 cm, sessile, ovate-lanccolate, apex abtuse orrounded, alternate at base margin deeply lobed nearly to the costae, lobes *ca* 0.4 cm wide, overlapping, oblong, obtuse at apex mergin serrated: stipe of fertile lamina similar to the sterile one but slender and longer *ca* 25 cm long: Fertile lamina *ca* 15 x 10 cm. bipinnatified with 5 pinnae, to sterile ones but lobes somewhat distant, linear-oblong falcate: venis obscure free, forked once. Sori linear along the mergin except at apex and base; indusia linear; sporangia slender stalked.

Habitat & Ecology : Found in dry and rocky surfaces of the area..

Sporulation : August - December.

Specimen examined : Kotamoni, PSD 0117, dt. 18.12.04.

Economic utility :

Forms of use locally:

Parts used : Whole plant.

Uses : Used as an ornamental.

Established reports of utility : Not known so far.

5. *P. linearis* Poir in Encycl. 5.723. 1804; Manickam & Irudayaraj, Pterid Fl.West. Ghat-S.India, 80. t.56.1992. Rhizome erect upto 5 cm thick, densely clothed with scales; scales *ca* 8 x1 mm, linear-lanccolate, apex long acuminate, mergin ciliated, pale-brown at the periphery and dark brown at the centre. Stipes *ca* 9 x 0.8 cm. scaly at base, glabrous above, polished, abaxially rounded, daxially grooved, chestnut brown at the base, stramineous above. Lamina *ca* 40-75 x 22-32 cm. ovate bipinnate, pinnea upto 10 pairs, opposite or sub-opposite shortly stalked or sessile; largest unequal, margin pinnatifid upto 2-3 mm to the costa; basal pair of pinnea bear an accessory branch on the basal basiscopic side; pinnea pale-green; costa, costules and veins raised

above and below; veins up to 20 pairs, all veins except a few pairs in distant part of the pinnea lobes forked ones, free basal basiscopic vinis arising from the costa while basal acrscopic ones arised from the axis of costa and costule, basal most pair of vainlets of adjacent lobes reaching the base of sinus independently; spinules present at the junction of costae and costule. Sori continuous all along the mergin exceptat apex of the lobes: indusia, rigid, pale-brown, Spores yellowish-green.

Habitat & Ecology : Found in moist and shady places along the edge of the forests.

Sporulation : February –July .

Specimen examined : Kamalpur, PSD 0074, dt. 8.2.04.

Economic utility :

Forms of use locally :

Parts used : Whole plant .

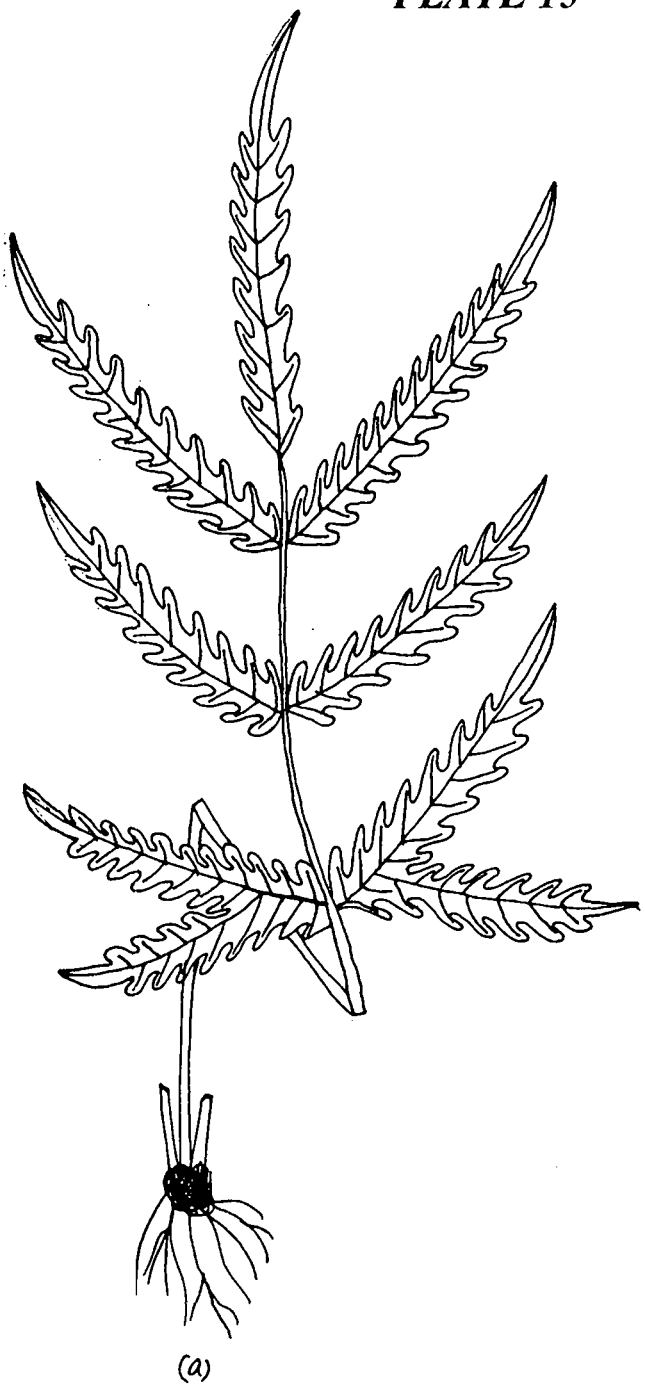
Uses : Used as an ornamental.

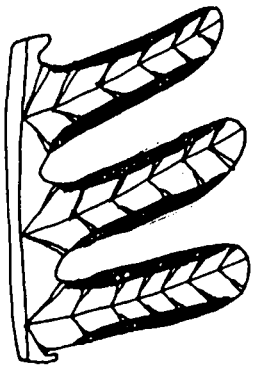
Established report of utilisation : Not known so far .

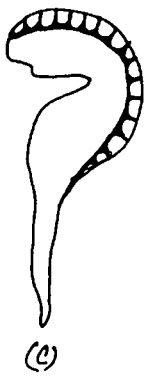
6. P.quadriaurita. Retz. Obs. Bot. 6.38.1791; Bedd. Ferns South. India t.31.1864; Handb. Ferns Brit. India, India, 110.1883; Clarke, Trans. Linn. Soc. Lond. Ii. Bot. 1.465.1880 (pro parte); Dhir, Ferns N.W. Himalayas, 48.1980; Baishya & Rao, Ferns & Fern-allies, Meghalaya, 111. 1982; Jamir & Rao, Ferns Nagaland, 152. 1988; Manikam & Irudayaraj, Pterid. Fl. West. Ghats-S. India, 79. t.55.1992. **Bon paloi (B).**

Terrestrial. Rhizome short, sub-erect, hairs absent, densely scaly at the apical portion ; scales linear, hair-pointed at apex, dark brown. Fronds bipinnatifid, upto 17-18 cm, glabrous, coriaceous; basioscopic, margin of basal pair of pinnae bipartite, rarely more pairs of pinnae divided; pinnules distinctly cut down to the costae, oblong; stipe erect, upto 40 cm long, glabrous, light purple. Spinnules present on upper surface of costae and costules.Veins forked, free, raised on the ventral side.

PLATE 15







Pteris quadriaurita; (a) Habit (b) Pinna lobes showing venation & sori (c) Sporangium

Habitat & Ecology : Very common in moist shady places and waste areas.

Sporulation : July - December.

Specimen examined : Duhalia Part I, PSD 0043. dt. 25.12.03.

Economic utlisation:

Forms of use locally:

Parts used : Stipe

Uses : Stipe is used as straw for drinking local liquor by tribal people of the area. It is believed that drinking alcohol through this is good for health.

Established reports of utility : Not known so far.

***Note**: Medicinal utility reported here as new.

*7. **P.semipinnata.*** L.Sp. Pl. 2.1076. 1753; Bedd. Ferns South. India, t.34.1864; Handb. Ferns Brit. India, 109. t.58.1883; Clarke, Trans Linn. Soc. Lond.II. Bot.l. 464. 1880; Baishya & Rao, Ferns & Fern-allies, Meghalaya,111.1982; Jamir & Rao, Ferns Nagaland, 155.1988. **Bon paloi (B).**

Terrestrial. Rhizome short creeping, densely scaly; stipe erect upto 45 cm long, basal pairs of pinnae distant and distinct, apical lamina pinnae like with linear entire tip; pinnae sub-equal at lower margin, upper margin sub-entire, finely serrate; pinnules linear with acute apex, veins depressed. Costae and costules minutely ridged,with dense spinules, scaly at base. Sori linear, marginal; indusia reaching the sinus; tip of pinnules sterile. Spores triangular to oval, yellowish brown.

Habitat & Ecology : Found frequently on moist, humus rich soil in secondary forests.

Sporulation : February – October.

Specimen examined : Kamalpur, PSD 0084, dt. 8.2.04.

Economic utlisation:

Forms of use locally:

Parts used : Fronds.

Uses : Paste of fronds is used with water for application locally around carbuncles for bursting it and reducing pain.

Established reports of utility : Not known so far.

Note: Recorded here as new.

8. P.vittata. L. Sp. Pl.2. 1074. 1753; Dhir, Ferns N.W. Himalayas, 46.1980; Baishya & Rao, Ferns & Fern-allies, Meghalaya, 111.1982; Jamir & Rao, Ferns Nagaland, 154.1988; Manickam & Irudayaraj, Pterid, Fl. West. Ghats-S. India, 68. t.42. 1992. *Pteris longifolia auct.quoad.* Pl. Asiat. Rar. Bedd. Ferns South. India, t.33.1864; Handb. Ferns Brit. India, 106. t.55.1883; Clarke, Trans. Linn. Soc. Lond.II. Bot.1. 461.1880. **Bon paloi (B).**

Terrestrial. Rhizome sub-erect, densely hairy and silky brown linear scales. Fronds imparipinnate, 20-75 x 8-15 cm, densely covered with whitish hairs; pinnae elongate linear, deltoid-cordate at base, serrulate, few pairs of basal pinnae reduced to auricle like appendages; terminal pinnae elongate-linear; veins free. Sori marginal, continuous. Spores round, bright brown.

Habitat & Ecology : Common along road cuttings and rock crevices.

Sporulation : July – February.

Specimen examined : Kayasthagram, PSD 0142, dt. 9.2.04.

Economic Utility:

Forms of use locally:

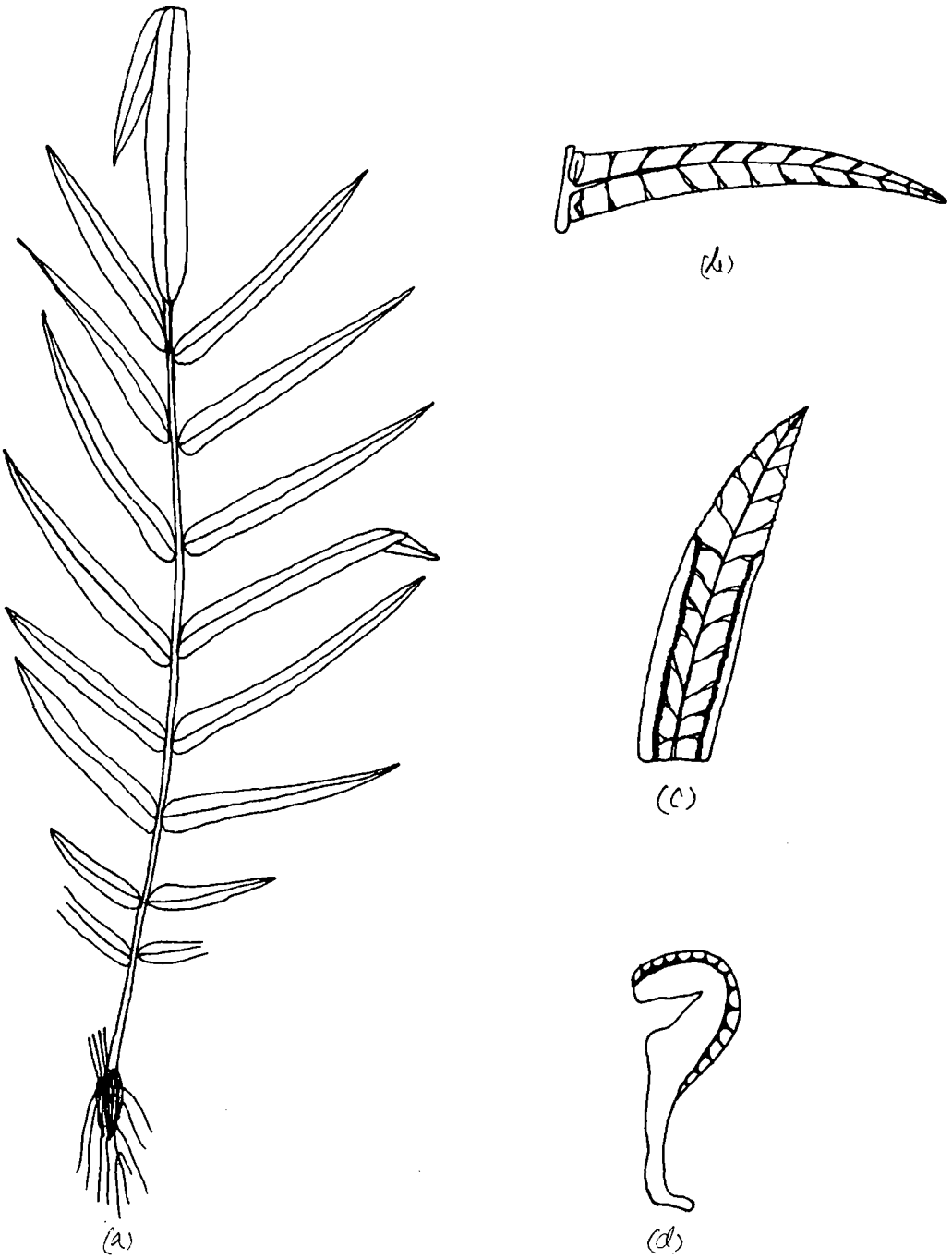
Parts used : Whole plant.

Uses : Plant paste used in pain and swelling.

Established reports of utility : Used by Kachries as tonic after boiling in water. Roots are used demulcent **(Borthakur *et al.*, 2001).**

Note: Additional utility is reported.

PLATE 16



Pteris vittata; (a) Habit (b) Pinna showing venation (c) Portion of pinna enlarged showing venation & sori (d) Sporangium

15. ADIANTACEAE (Presl.) Ching. in Sunyatsenia 5:229. 1940.

Adiantum: L., Sp. Pl.2: 1094.1753.

Key to the species:

1. Lamina simple pinnate.

2. Sori transverslly elongated, forming a partially interrupted or un interrupted line; pinnae glabrous. ***3. A.philippense***

2′. Sori small, not forming a continuos line; pinnae densely hairy all over. ***1. A.caudatum.***

1′. Lamina bipinnate, lanceolate, cuneate, glabrous. ***2. A.capillus-veneris.***

1. *A. Capillus-veneris.* L.Sp. Pl.1096.1753; Bedd. Ferns South. India, t.4. 1864; Handb. Ferns Brit. India, 84.1883; Clarke, Trans. Linn. Soc. Lond.II. Bot.1, 453.1880; Dhir, Ferns N.W. Himalayas, 30.1980; Baishya & Rao, Ferns & Fern-allies, Meghalaya, 141.1980; Jamir & Rao, Ferns Nagaland, 159.1988; Manikam & Irudayaraj, Pterid. Fl.West.Ghats-S. India, 103.1992. **Hansaraj(B).**

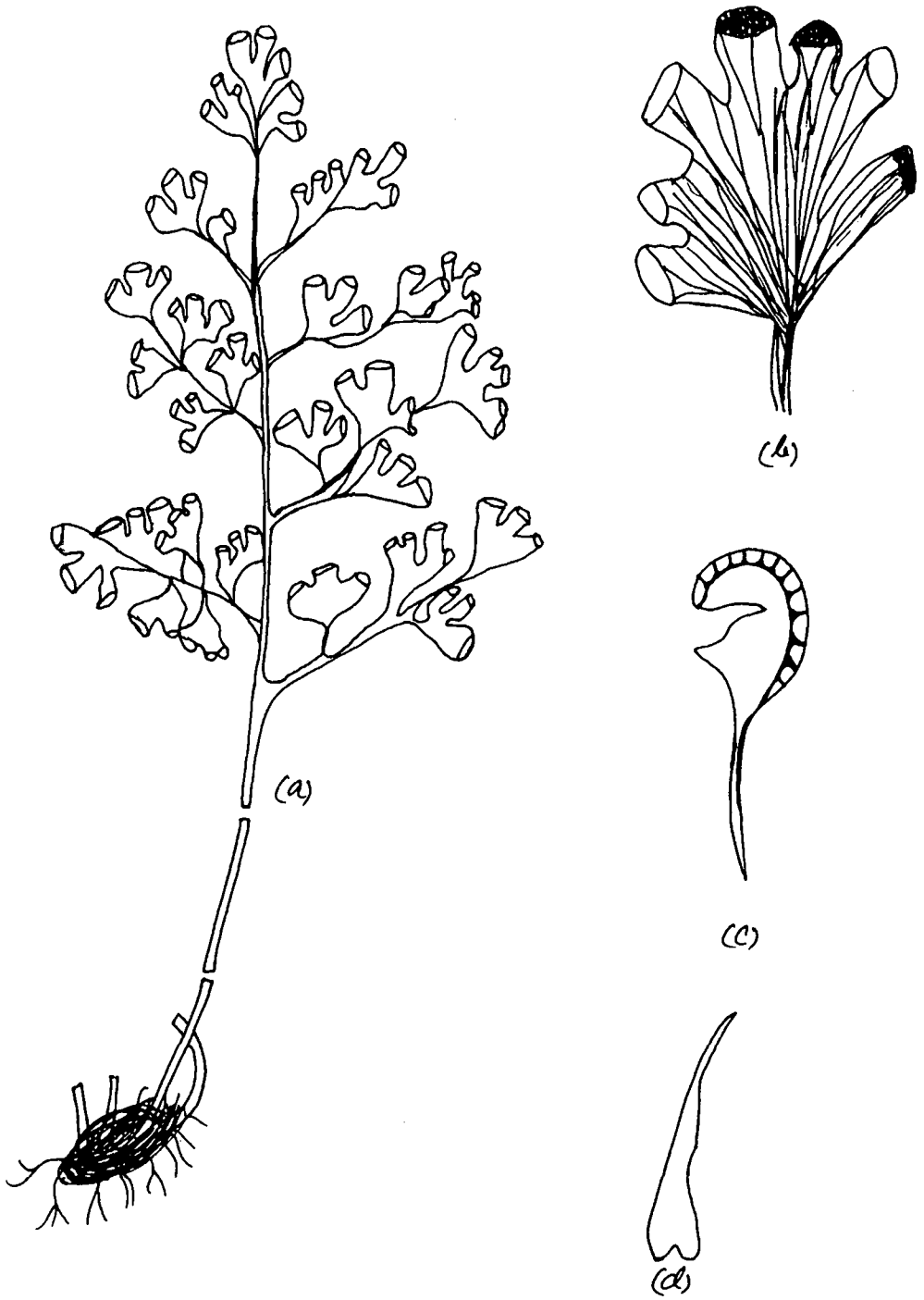
Terrestrial. Rhizomes short or wide creeping densely clothed with brown linear scales. Stipe dark brown, glabrous, shining, slender, wire, scaly at base. Lamina tripinate to dicompound, spreading, firm, glabrous, glaucous green; pinnules shortly stalked, obovate cuneate, superior margin 2-3 lobed and finely dentate; fertile lobes 2-notched. Sori large coverd with sub-membranous reniform-lobate indusia, formed by the reflexed margin of lamina. Sporangia small globose. Spores tetrahedral, triangular, yellow.

Habitat & Ecology : Found along road cuttings and slopes of hills.

Sporulation : May - June

Specimen examined : Mahishasan, PSD 0115, dt. 19.5.04.

PLATE 17



Adiantum capillus-veneris; ; (a) Habit (b) Pinnule enlarged showing venation & sori (c) Sporangium (d) Scale.

Economic utility:

Forms of use locally:

Parts Used : Whole plant.

Uses : Plant paste used in fever, respiratory diseases by mixing with honey. Plant is used as ornamental.

Established reports of utility : Fronds used as pectoral demulscent, expectorant, diuretic, eenagogue, and tonic, fibrifuge; whole plant is steamed for small pox cure. Fronds used in cold imposthumes of uterus, hard swelling and tumours of spleen; fronds are used in fever, sores and catarrhal infection. Fronds are used to treat bronchitis, cold, cough, fever and menstrual irregularities **(Borthakur *et al.*, 2001).**

2. A.caudatum. L.Mant. 308.1771; Bedd. Ferns South. India, t.2.1864; Handb. Ferns Brit. India, 83. t.44.1883; Clarke, Trans. Linn. Soc. Lond.II. Bot.1.453.1880 (*pro parte*); Baishya & Rao, Ferns & Fern-allies, Meghalaya, 142.1982; Jamir & Rao, Ferns Nagaland, 162. 1988; *Adiantum incisum* Forssk. Fl. Aeg. 187.1775; Manikam & Irudayaraj, Pterid. Fl. West. Ghats-S. India, 96. t.71.1992. **Mayur sikha(B).**

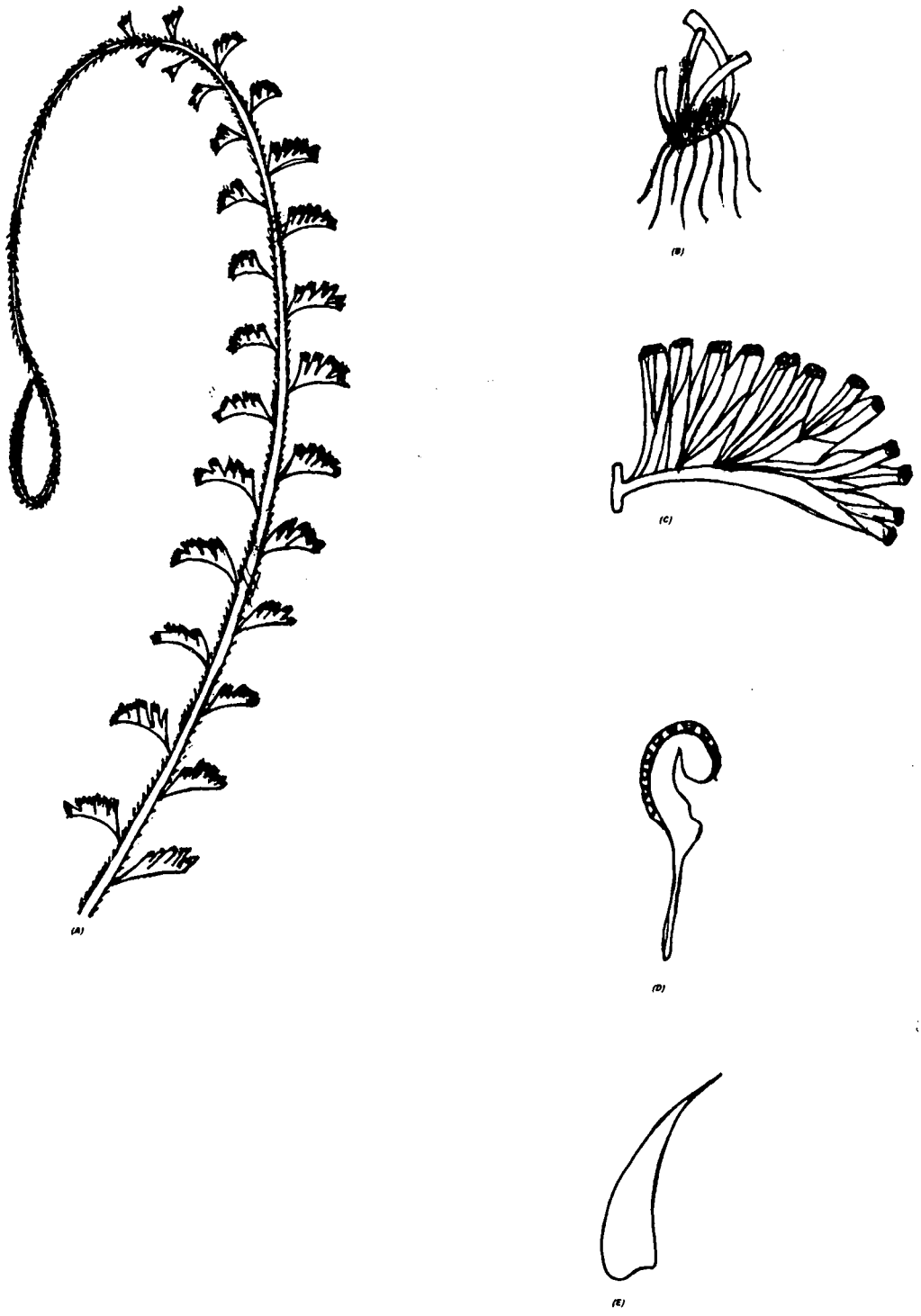
Terrestrial. Rhizome short, asending, densely covered by stiff roots and dark brown, hair like linear scales. Stipe 5-25 cm long, densely paleate. Lamina unipinnate, upto 30 cm long, densely hispid hairy throughout, apical lamina not pinnae like, terminating into slender axis bearing proliferating, vegetative buds. Pinnae oblique-ovate, sessile. Sori reniform to slightly elongate on the apical margin of pinnae lobes; indusia cordate at base, round and entire outwards, densely hispidulous.

Habitat & Ecology : Common along road cuttings in moist areas and slopes of the hills.

Sporulation : August – December.

Specimen examined : Duhalia Part I, PSD 0070, dt. 25.12.03.

PLATE 18



Adiantum caudatum; (a) Portion of lamina (b) Rhizome (c) Pinnule showing venation and sori (d) Sporangium (e) Scale

Economic utility:

Forms of use locally:

Parts used : Whole plant.

Uses : Used in dysentery, ulcers, burning sensation and asthma. Plant is used ornamental.

Established reports of utility : Used in skin diseases, diabetes, cough and fever **(Borthakur *et al.*, 2001).**

3. A. philippense. L.Sp. Pl.2. 1094.1753; Jamir & Rao, Ferns Nagaland, 162.1988. *A.lunulatum* Burm. f. Fl. Ind. 235.1768; Bedd. Ferns South. India, t.1.1864; Handb. Ferns Brit. India, 82.1883; Clarke, Linn. Soc. Lond.II. Bot.l. 452.1880; Dhir. Ferns N.W. Himalayas, 31.1980; Mnikam & Irudayaraj, Pterid. Fl.West. Ghats-S. India, 98.t. 73. 1992.

Terrestrial. Rhizome short, ascending, densely clothed with stiff roots. Stipe and rachis purplish-black, shining, glabrous. Fronds unipinnate, 25-45 cm long, with about 15 cm long stipe, apical lamina pinnae-like; pinnae entire, upper margin lobed, thin, slender, stalked ; stalks 1-2 cm long, shining, purplish-black. Sori linear, confluent or not, along the margin of pinna-lobes. Indusia coriaceous, entire, reddish brown.

Habitat & Ecology : Common in moist shady places in forests and rock crevices.

Sporulation : August – December.

Specimen examined : R.K. Nagar, PSD 0207, dt. 6.9.05.

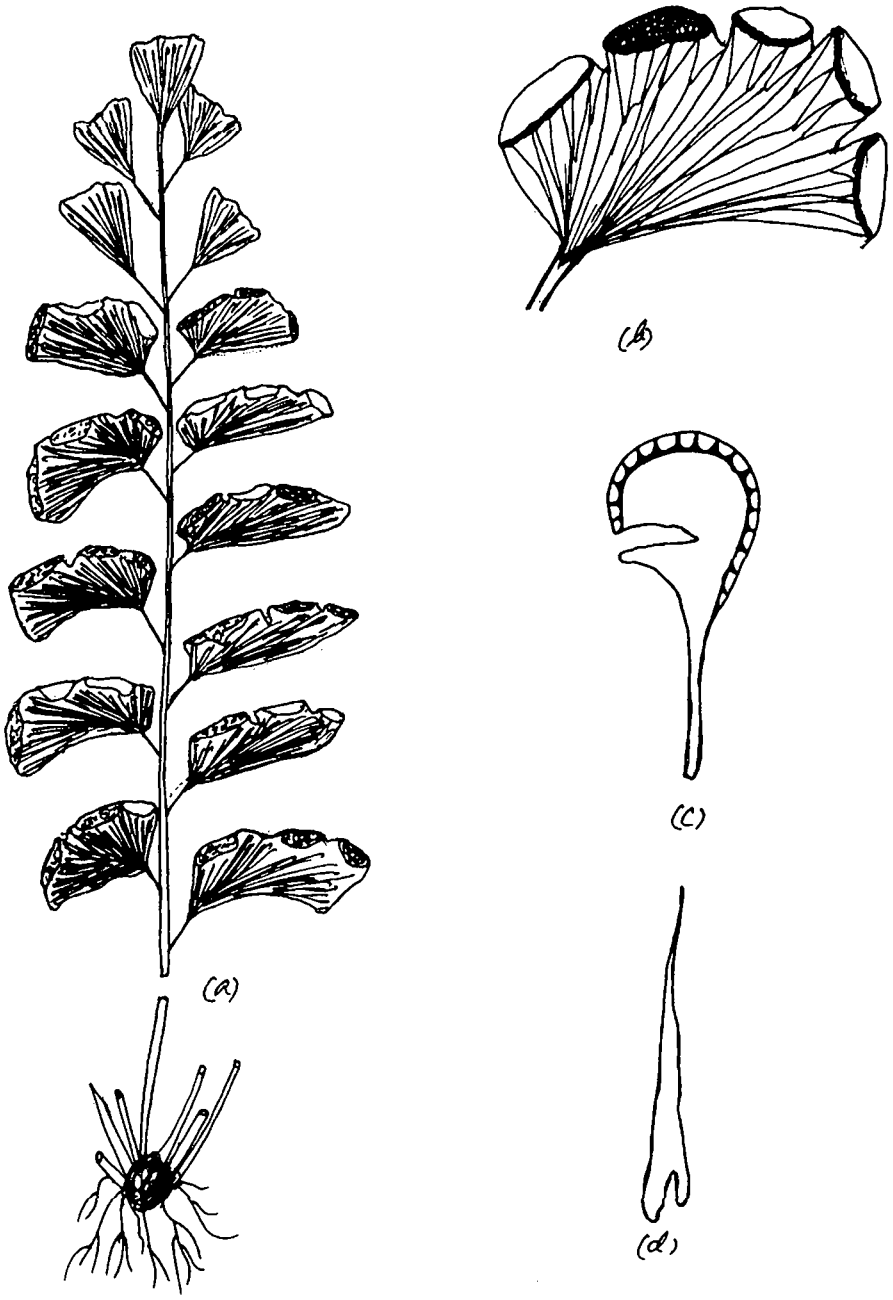
Economic utility:

Forms of use locally:

Parts used : Whole plant.

Uses : Plant paste used in swelling and pain, Plant is used ornamental.

PLATE 19



Adiantum philippense ; (a) Habit (b) Portion showing venation & sori (c) Sporangium (d) Scale.

Established reports of utility : Used in fever, blood diseases, epileptic fits, rabies.Roots are used in dysentery, ulcers and muscular pains. Paste of the plant applied externally for skin disease. Fresh application is given every day till the disease is cured **(Borthakur *et al.*, 2001).**

16. HEMIONITIDACEAE Pic.Ser.in Webbia. 21:487. 1966.

Key to the genera :

1. Lamina simple, dimorphic; lower surface covered by multicellular hairs. **1. *Hemionitis.***

1′. Lamina pinnate, monomophic; lower surface covered by white, waxy, powdery substance. **2. *Pityrogramma.***

1. Hemionitis L., Sp. Pl. 2: 1077.1753.

H. arifolia (Burm.) Moore. Ind. Fil. 114.1859; Bedd. Handb. Ferns Brit. India, 413. t. 245.1883; Manikam & Irudayaraj, Pterid. Fl. West. Ghats-S. India, 93. t.68. 1992. *Asplenium arifolium* Burm. Fl. Ind. 231.1768. *Hemionitis cordifolia* Roxb.ex. Bedd. Ferns South. India, t. 53.1864. **Indur kan paloi(B).**

Terrestrials. Rhizome sub-erect, short, hard and covered by scales; scales ovate lanceolate, acuminate at apex, entire but sparsely toothed towards base, light brown. Stipes about 26cm long in fertile fronds and about 20cm long in sterile ones, shining, terete, scaly, black to dark brown. Lamina dimorphic, simple, about 11x7cm., ovate-cordate, tending to be hastate or sagittate, apex acute or rounded, margin entire; texture coriaceous; lamina pale-green, upper surface glossy and lower surface covered by multi-cellular hairs and small, soft, pale brown scales; costa raised below, grooved above; venation reticulate with small elongated areoles devoid of included veinlets; fertile lamina similar to sterile ones but slightly smaller than sterile ones. Sori

continuous along the veins; sporangia small, long stalked. Spores spherical, trilete, exine with incomplete reticulation.

Habitat & Ecology : Found in shaded earth cuttings on steep slopes.

Sporulation : September – January.

Specimen examined : Kamalpur, PSD 0086, dt. 8.2.04.

Economic utility:

Forms of use locally : Not available.

Established reports of utility : The fronds are used in the treatment of aches and as vermifuge. **(Borthakur *et al.*, 2001).**

2. Pityogramma Link. Handb. Erken. Gew.3:19.1833.

P. calomelanos (L.) Link., Handb. Erken. Gew. 3:20.1883; Baishya & Rao, Ferns & Fern-allies, Meghalaya, 146.1982; Jamir & Rao, Ferns Nagaland, 171.1988; Manickam & Irudayaraj, Pterid. Fl. West. Ghats-S. India, 94. t.69.1992. *Acrostichum calomelanos* L.Sp. Pl.2. 1072.1753. *Pteris calomelanos* (L.) Bedd. Handb. Ferns Brit. India. 104.1883.**Rupali paloi (B).**

Terrestrials. Rhizome scales narrow, lanceolate, slender, thin. Stipe and rachis dark purple. Fronds tufted on rhizome, up to 80 cm long, glabrous above, glaucous whitish beneath. Lamina bipinnate with deeply pinnatifid pinnae; pinnae linear-subulate, margin crenato-lobate, thin. Veins obscure. Fertile pinnae constricted narrowly; sporangia borne along the veins, scattered, sessile.

Habitat & Ecology : Found in dry open places along road cuttings.

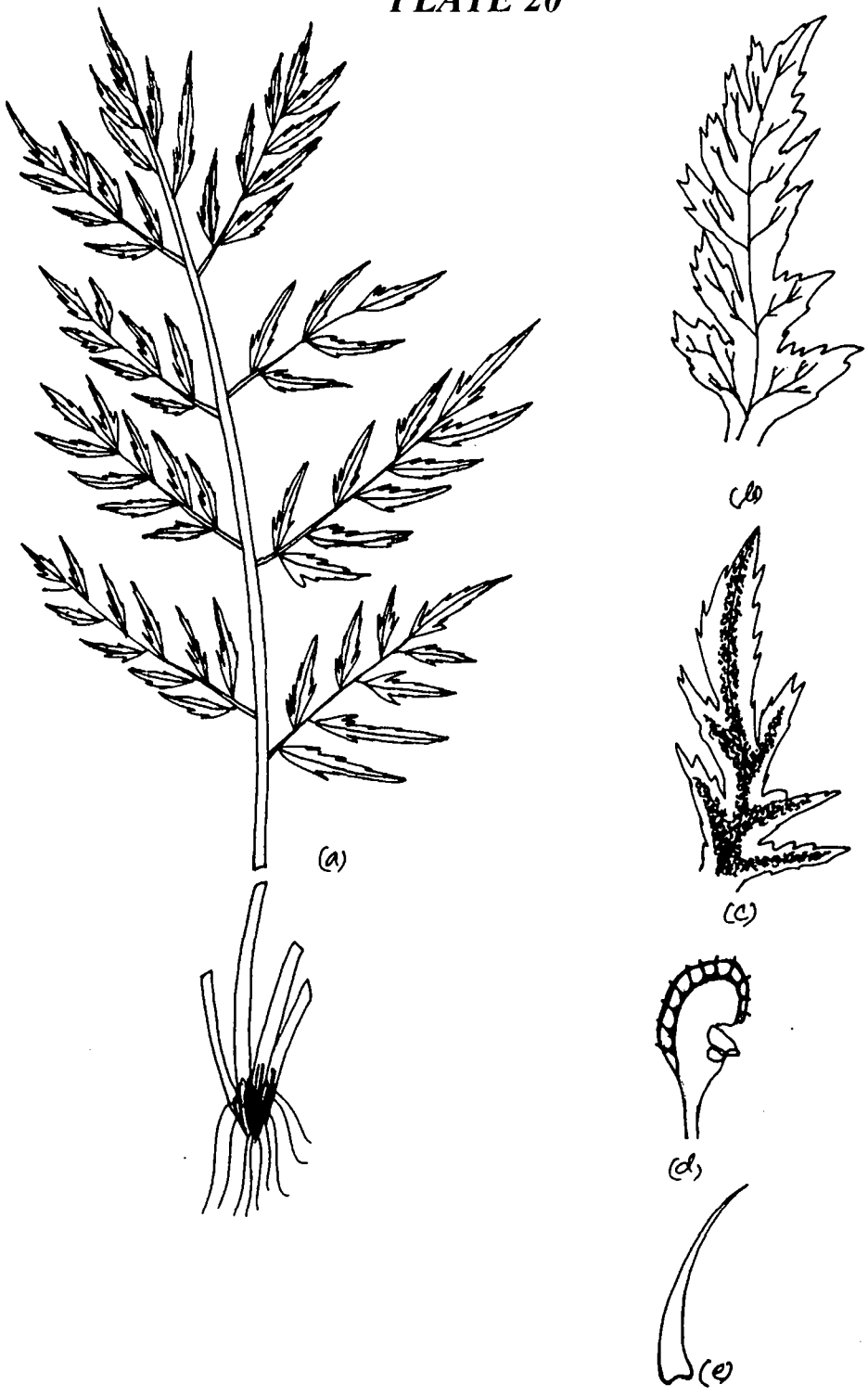
Sporulation : October - November.

Specimen examined : Roynagar, Karimganj, PSD 0317, dt. 29.12.06.

Economic Utility:

Forms of use locally :

PLATE 20



Pityrogamma calomelanos: (a) Habit (b) Pinnule showing venation (c) Pinnule (d) Sporangium (e) Scale

Parts used : Whole plant.

Uses : Plant paste used as insecticides in poultry firms and also as ornamental.

Established reports of utility : Plant decoction is used for kidney troubles; tea prepared out of the frond is used as a cure for flu, hypertension, fever and cough.**(Borthakur *et al.*, 2001).**

***Note:** Additional utility reported here.

17. VITTARIACEAE (Presl.) Ching in Sunyatsenia 5:232. 1940.

Vittaria Sm. Mem. Acad. Sci. Turin. 5:413. 1793

V.elongata. Sw., Syn. Fil.:109, 302.1806; Bedd., Handb. Ferns Brit. India: 404.f. 238. 1883; Ching in Sinensia 1(12): 179.1931; Holttum, Rev. Fl. Malaya 2:614.1955; Mehra and Bir in Res. Bull. Panjab Univ.n.s.15:106.1964; Morton in Contrib. U.S. Nation. Herb. 38 (7)369.1974; Dixit in J.Econ. Tax. Bot. 2:210. Fig.1-7.1981.

Epiphytic. Rhizomes creeping, about 2.5mm across, paleaceous throughout; paleae peltate, lanceolate, long acuminate, dentate, apex with gland; blackish brown. Fronds about 14-33 x 5 mm, caespitose, sub-sessile to stipes, paleaceous at base; lamina linear-lanceolate, long acuminate, base decurrent ; rachis invisible, veins thin, not overlapping, ending into margin. Sori long elongate, marginal, sunk in the lamina; sporangium with thick stalk, glandular, paraphyses branched, funnel shaped ; spores pale green, reniform, smooth.

Habitat & Ecology : Common on moss covered tree trunks as wel on rocky surfaces.

Sporulation : February – December.

Specimen examined : Kamalpur, PSD 0089, dt. 8.2.04.

Economic utility:

Forms of use locally:

Parts Used : Leaves.

Uses : Young leaves crushed to made paste and applied over fresh cuts and wounds for blood coagulation and prevention of microbial gowth. Fresh poultice is given a day till it is cured.

Established reports of utility in medicine : Fronds are used in treatment of rheumatism **(Borthakur *et al.*, 2001).**

Note: Additional medicinal uses recorded here.

18. PARKERIACEAE Hook. Exot. Fl. 2:147. 1825.

***Ceratopteris* Brongn.** Bull. Sci. Soc. Philom.III. 8:186. 1822.

C.thalictroides. (L.) Ad. Brongn. Bull. Sci. Soc. Philom. Paris1821. 186. 1822; Clarke, Trans. Linn. Soc. Lond. II. Bot.1. 471.1880; Bedd. Ferns South. India, t.75. 1864; Handb. Ferns Brit. India, 123. t.63. 1883; Dhir, Ferns N.W. Himalayas, 45.1980; Baishya & Rao, Ferns & Fern-allies Meghalaya, 148.1882; Jamir & Rao, Ferns Nagaland, 179. 1988; Manickam & Irudayaraj, Pterid. Fl. West. Ghats-S. India, 91. t.67. 1992. *Acrostichum thalictroides* L.Sp. Pl.2 1070. 1753. **Pani paloi (B).**

Aquatic annuals. Rhizome with dense, fleshy roots; stipe fleshy, up to 12 cm long, glabrous, ribbed; sterile lamina unipinnate, upto 18 cm long, with deeply pinnatifid pinnae; glabrous, thin-membranous, whitish green, segments variously lobed, with narrow angular tip. Veins depressed. Fertile lamina with much branched pinnae; pinnae linear, acicular, dichotomously branched. Sori exindusiate, often protected by a continuous, reflexed margin of lamina; sporangia sessile, placed along the veins; spores tetrahedral.

Habitat & Ecology : Found in muddy and swampy areas or sometimes floating.

Sporulation : July - October.

Specimen examined : Sonbeel, PSD 0179, dt. 12.6.05.

Economic utility :

Forms of use locally :

Parts used : Whole plant

Uses : Plant paste used in skin diseases and edible as non-conventional food plant also as green manure in rice field.

Established reports of utility : Used as poultice in skin complaints and as tonic in stypic. Vegetative fronds are edible both as green salad or after cooking as pot-herb; it is sometimes susceptible to fungal attack. It is ploughed in rice field as part of the green manure in rice fields. **(Singh & Panigrahi, 2005).**

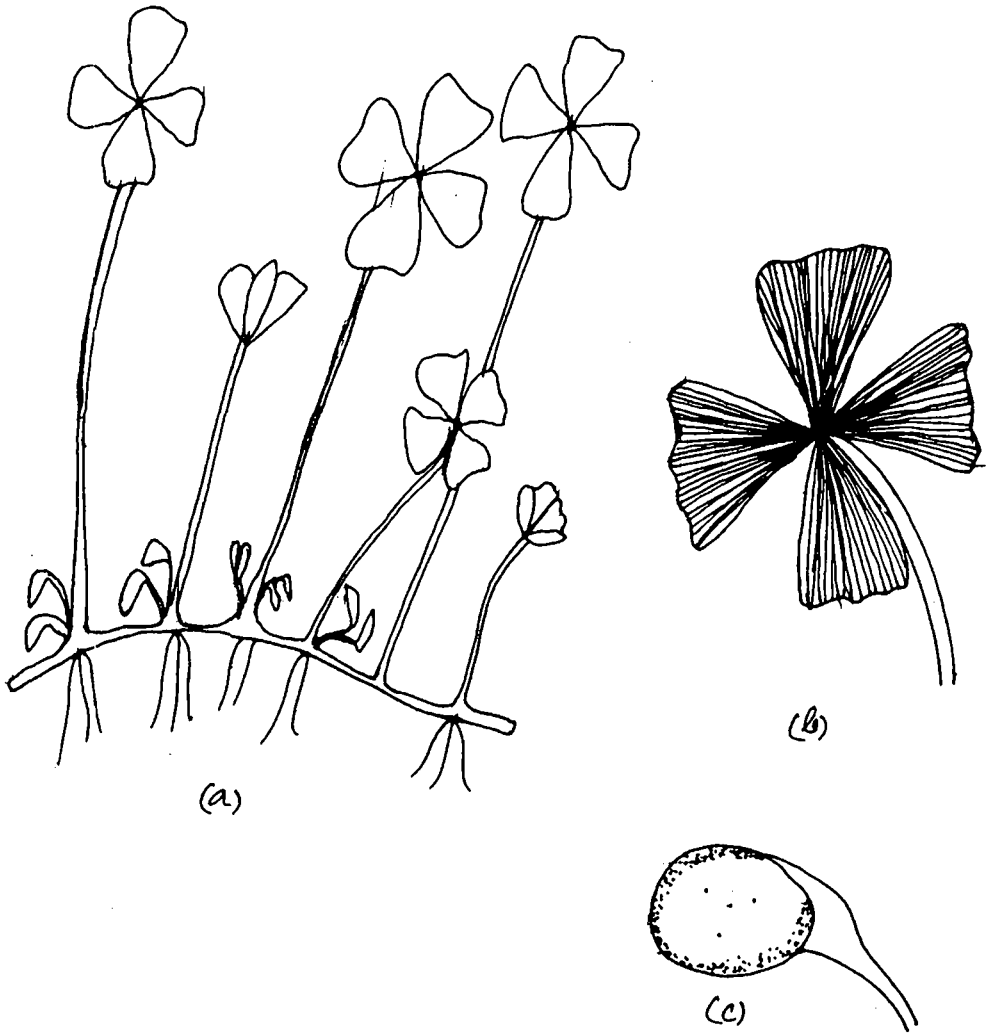
19. MARSILEACEAE Mirb. Hist. Vog. 5:126. 1802.

Marsilea L., Sp. Pl.2: 1099. 1753.

M. minuta L. .Mant. 308. 1771; Dhir, Ferns N.W. Himalayas, 29.1980; Manickam & Irudayaraj, Pterid. Fl. West. Ghats-S. India, 342. t.259. 1992. **Susni sak (B).**

Aquatic. Rhizome long creeping, branched, subterranean, with nodes and internodes, submerged in water or partly out of water, green or pale brown, covered by hairs all over. Hairs soft, slender, whitish. Leaves sessile, arranged at the tip of the stipe in clover leaf model, obovate or wedge-shaped, apex rounded, base cuneate, margin entire; veins distinct, above and below, branched, occasionally connected by lateral veins; texture thin, herbaceous; leaves green, glabrous. Sporocarps borne in clusters at the nodes alternaltly, five per cluster; sporocarps oval to bean–shaped with stalk, heterosprous with both mega and micro sporangia in the same sporocarp. Micro spores globose, mega spores ovate.

PLATE 21



Marsilea minuta; (a) Habit (b) Leaflets showing venation (c) Sporocarp

Habitat & Ecology : Found common in lowlands along paddy fields as wel asin shallow,stagnant water bodies.

Sporulation : November - February.

Specimen examined : Railway Karimganj, PSD 0318, dt. 29.12.06.

Economic utility:

Forms of use locally:

Parts used : Whole plant.

Uses : The plant is used as vegetable for general health. Juice obtained by crushing the plant is applied locally in cuts and wounds for antiseptic action. The same is taken orally to prevent dysentery.

Established reports of utility : Whole plant is used in cough. spastic condition of leg muscle, etc.and also as sedative and in insomnia; the leaves and sprouts are used as vegetables. **(Borthakur *et al.*, 2001).**

Note: Additional medicinal utility is recorded here.

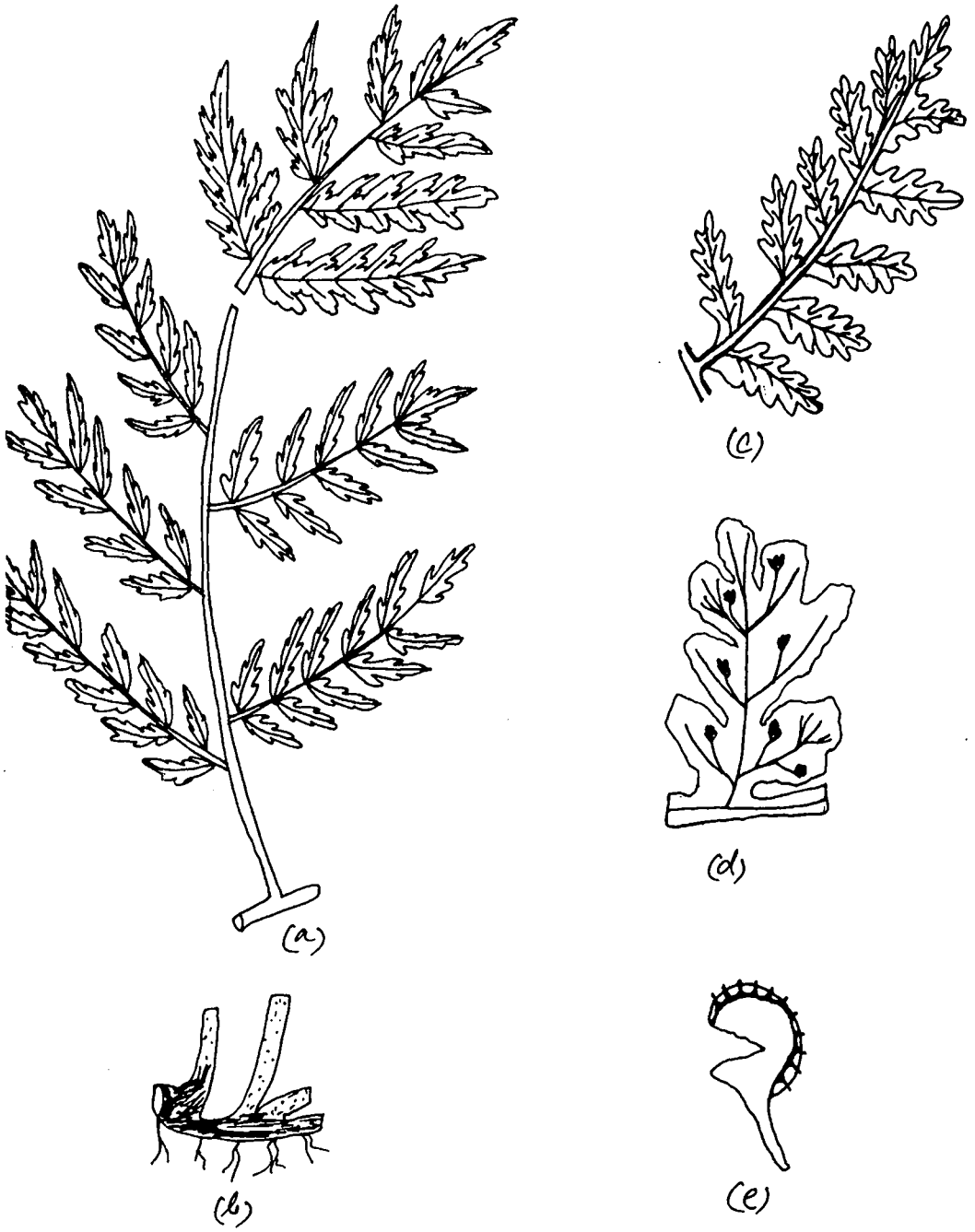
20. DENNSTAEDTIACEAE Ching *ex.* Pic. Ser. in Webbia 24:704. 1970.

Microlepia Presl. Tent. Pterid. 124. 1836.

M. speluncae (L.)Moore, Ind. Fil. 93. 1857; Bedd. Handb. Ferns Brit. India, 67. 1883; Baishya & Rao, Ferns & Fern-allies, Meghalaya, 92.1982; Jamir & Rao Ferns Nagaland, 213. 1988; Manickam & Irudayaraj, Pterid. Fl. West.Ghats-S. India. 119. t.93. 1992. *Polypodium spelunceae* L.Sp. Pl.2. 1093.1753.

Terrestrials. Rhizome short, creeping, densely hairy. Fronds 115-180 x 45-80 cm closely originated, ovate-lanceolate, caudate, quadripinnate; stipe about 75 cm long, grooved dorsally, glabrous to very fine pubescent, brown, rachis densely hairy on both sides, upper surface haris reddish brown, while lower surface haris needle like

PLATE 22



Microlepia speluncae; (a) Primary pinna (b) Rhizome pinna (c) Tertiary pinna showing venation and sori (d) Sporangium

hyaline ; pinnae basal pair-the largest, widest at base, alternate. Pinnules basal basioscopic-the largest about 6-9 x 2.5-4 cm, alternate, sessile, oblong laceolate, deltoid-lanceolate, narrowing from base. Sori near to mrgin, davalliloid, terminal, above sinus, indusium medium sized, pushed back, subentire, surface densely hairy ; spores trilete, hyaline, minutely regularly pitted.

Habitat & Ecology : Frequently found in moist, shady places of the area.

Sporulation : October - November.

Specimen examined : Duhalia Part I, PSD 0056, dt. 25.12.03.

Economic utility:

Forms of use locally:

Parts used : Fronds.

Uses : Used in cuts and wounds.

Established reports of utility : Fronds are used medicinlly to treat fever **(Borthakur, *et al.*, 2001).**

Note: Additional utility is reported here.

21. LINDSAEACEAE Ching *ex.* Pic. Ser.in Webbia 24(2): 707. 1970.

Key to the genera:

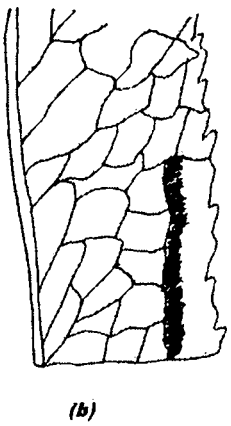
1. Lamina simple, pinnate; sori numerous or more or less confluent, indusia marginal. **1. *Lindsaea***

1′. Lamina tripinnate or quadripinnatifid;sori single at the apices of lobes;indusia sub-marginal. **2.*Sphenomeris***

1. *Lindsaea* Dryand *ex.* Smith. Mem. Acad. Sci. Turin. 5:413. 1793.

L. ensifolia Sw. Schrad. J. Bot. 1800(2). 77. 1801; Clarke, Trans. Linn. Soc. Lond.II. Bot. 1. 452.1880; Baishya & Rao. Ferns & Fern-allies, Meghalaya, 97. 1982; Jamir &

PLATE 23



(b)

(c)

(d)

Lindsaea ensifolia; (a) Habit (b) Portion of pinna showing venation & sori (c) Sporangium (d) Scale

Rao, Ferns Nagaland, 229. 1988; Manickam & Irudayaraj, Pterid. Fl. West Ghats-S. India, 125. t.98. 1992. *Schizoloma ensifolia* (Sw.) J. Sm.in Hook. Journ. Bot. 3.414. 1841; Bedd. Ferns South. India, t. 25.1864; Handb. Ferns Brit. India, 80.t.41.1883.

Terrestrials. Rhizomes short creeping, paleaceous; roots thin but firm; palae of rhizomes and stipe upto 3x0.4mm, basifixed. linear or linear-lanceolate, entire, dark-brown. Fronds about 40x150cm long, rhomboid, trilobed, pinnate with one pair of pinnae. Stipes about 20cm long, brown at base, smooth, rectangular; lamina about 20cm long; veins anastomosing, aeroles without free included veinlets. Sori marginal or anti-marginal elongated, indusium about 1mm wide, folding back on maturity, paraphyses absent. Spores trilete, pale brown or brown, postulate, plenty.

Habitat & Ecology : Common on roadsides in open places.

Sporulation : February - July.

Specimen examinen : Kamalpur, PSD 0074, dt. 8.2.04.

Economic utility :

Forms of use locally : Not available.

Established reports of utilisation : Not known so far.

2. *Sphenomeris* Maxon. J. Wash. Acad. Sci. 3:144. 1913. nom.cons.

S.chinensis. (L.) Maxon, Journ. Wash. Acad. Sci. 3.144. 1913; Dhir, Ferns N.W. Himalayas, 56. 1980; Baishya & Rao, Ferns & Fern-allies Meghalaya, 97.1982; Jamir & Rao Ferns Nagaland, 226. 1988. *Trichomanes chinensis* L.Sp. Pl.2. 1099. 1753. *Davallia chinensis* Clarke, Trans. Linn. Soc. Lond.II. Bot. 1. 449. 1880. *D.tenuifolia.* Sw. Schrad. Journ. Bot. 1800 (2) 88.1801; Bedd. Ferns South.India, t.16.1964. *Stenoloma chinensis* (L.) Bedd. Handb. Ferns. Brit. India, 70. t.1883.*Odontosoria chinensis* (L.) Smith, Bot. Voy. Herald, 430.1857; Manickam & Irudayaraj, Pterid. Fl. West. Ghats-S. India, 121. t.95. 1992.

Terrestrials. Rhizome short creeping to semi-erect, densely covered with palae. Palae hair-like, ferruginous. Fronds bi or tripinnate, lanceolate, upto 8-45x3-18cm., glabrous; pinnae much dissected, rather dichotomously forked into 2-4 pinnules; pinnules rhomboidal, each again forked into 2-4 lobes. Sori marginal, rather sub-marginal inside the marginal flaps, terminal on free veinlets. Indusium attached at base and sides open outwards. Spores bean-shaped with one longitudinal dark slit, light brown, hyaline.

Habitat & Ecology : Found in sloples of hillocks and along roadsides.

Sporulation : July - December.

Specimen examined : Duhalia Part II, PSD 0044, dt. 25.12.04.

Economic utility :

Forms of use locally :

Parts Used : Leaves

Uses : Crushed leaves applied over burns for cooling affect and also for antiseptic action.

Established reports of utilisation : Used internally for the treatment of chronic enteritis. **(Borthakur *et al.*, 2001).** .

Note: Additional medicinal utility is reported.

22. THELYPTERIDACEAE (Presl.) Pic. Ser. in Webbia. 24:709. 1970.

Key to the genera:

1. Costae grooved on dorsal surface; veins reching the margin.

2. Anastomosed basal veins more than 3 pairs; pinnae lobed one forth to half way to costa. ***5. Pronephrium.***

2'. Anastomosed basal veins less more than 3 pairs; pinnae lobed

one third to half way to costa. ***3. Cyclosorus.***

3. Pinnae with sessile orange glands on the lower surface. ***1. Amphineuron.***

3/. . Pinnae without glands on the lower surface. **2. *Christella.***

1/. Costae not grooved on dorsal surface; veins not reching the margin. ***4. Macrothelypteris.***

1. *Amphineuron* Holtt. Blumea. 19.45. 1971.

A. immersum. (Bl.) Holtt. in Nayar & Kaur, Comp. to Bedd. Handb. 203. 1974. *Aspidium immersum* (Bl.) Enum. Pl. Jav. 156.1828. *Lastrea immerse* (Bl.) Moore, Ind. Fil. 139. 1857; Bedd. Ferns Brit. India, t.252. 1866; Handb. Ferns Brit. India, 234.1883. **Bish dekia(B).**

Terrestrials. Rhizomes short creeping about 1 cm thick,covered with scales all over; scales narrow, linear-lanceolate, apex acuminate, base broad, dark brown. Stipes erect, grooved adaxially, scaly at base, above glabrous or slightly pubescent. Lamina have size of about 65 x 24 cm, simple pinnate, ovate-oblong, apex acuminate; pinnae numerous, alternate or sub-opposite; basal pinnae some time small; largest pinnae have a size of about 14.5 x 2 cm, lanceolate, apex acuminate, margin cut down nearly to the costae into lobes; lobes linear, oblique, apex round, margin serrate ; rachis strigose and with minute yellow glandular dots; veins 12-14 on each side of the costa,simple with few inconspicuous hairs, costules and veins bearing yellow glands; texture coriaceous; lamnina green glabrous. Sori medial, one on each vein,immersed; indusia large, persistent, hairy, reniform. Sporangia stalked; stalk hairy. Spores drak, exine tuberculate.

Habitat & Ecology : Very commonly found in wet grounds in low lands.

Sporulation : August - December.

Specimen examined : Kalinagar T.E., PSD 0208, dt. 6.9.05.

Economic utility:

Forms of use locally :

Parts used : Fronds.

Uses : Fronds are edible.

Established reports of utilisation : The fresh fronds are eaten as cooked vegetables in Darjeeling. Fronds are aperient, alterative **(Borthakur *et al.*, 2001).**

2. *Christella* Leveillie. Fl. Kouy-Tcheou. 472. 1915.

Key to the species:

1. Lamina oblanceolate, simple pinnate;stipes scaly at base ,glabrous above,pale-brown to dark brown ***2a. C.dentata.***

1′.Lamina broadly ovate, deltoid or cordate;stipes hairy at apex, grey-green. ***2b.C.parasitica.***

2a. C. dentata. (Forssk.) Brownsey et Jermy, Brit. Fern Gaz. 10.338. 1973; Baishya & Rao, Ferns & Fern-allies Meghalaya, 81.1982; Jamir & Rao, Ferns Nagaland, 266. 1988; Manickam & Irudayaraj, Pterid. Fl. West. Ghats-S. India. 198. t.149. 1992. *Polypodium dentatum* Forssk. Fl. Aegypt. Arab. 185.1773. *Cyclosorus dentates* (Forssk.) Ching, Bull. Fan. Mem. Inst. Biol. Bot. 8.206. 1938; Dhir, Ferns N.W. Himalayas, 103. 1980.

Terrestrial. Rhizome short creeping. Stipe very variable in length, hairy, scaly at base ; scales narrowly lanceolate. Lamina upto 90 cm long, pinnae 15-25 pairs, lower 2-4 pairs gradually reduced, upto 4-5 cm long, distant; auricled at acroscopic base, auricle lobed. Largest pinnae 8-12 x 1-2.5 cm long, often larger, acuminate, lobed. Veins 8-9 pairs, lower pair anastomosing with excurrent vein to sinus, immediate next pair to the side of sinus membrane. Both surface of costae and constules hairy. Sori medial.Indusia hairy.

Habitat & Ecology : Found common along shady roadside slopes and forest clearings.

Sporulation : July - December.

Specimen examined : Duhalia Part I, PSD 0002, dt. 21.6.03.

Economic utilisation :

Forms of use locally : Not available.

Established reports of utility : Not known so far.

2b. C.parasitica.(L.) Lev. Kouy-Tcheou, 475.1951; Baishya & Rao, Ferns & Fern-allies Meghalaya, 81.1982; Jamir & Rao, Ferns Nagaland, 267.1988; Manickam & Irudayaraj, Pterid. Fl. West. Ghats-S. India, 195. t.147. 1992. *Polypodium parasiticum* L.Sp. Pl.2. 1090.1753. *Nephrodium parasiticum* (L.)Desv. Mem. Soc. Linn. Paris. 6.260. 1827; Clarke, Trans. Linn. Soc. Lond.II. Bot.1. 533.1880 (*pro parte*) *N.didymosorum* Parish ex Bedd. Ferns Brit. India, t. 200.1866. *N.Procurrens* (Mett.) Bak.Syn. Fil. 290.1867; Bedd. Handb. Ferns Brit. India, 279. 1883. *N.tectum* Bedd. Handb. Ferns Brit. India, Suppl .79. 1892. *Cyclosorus didymosorum* (Parish ex Bedd.) Nayar & Kaur, Comp.to. Bedd . Handb. 208.1974.

Terrestrials. Rhizome short or long creeping. Stipe upto 40 cm long, softly hairy. Lamina upto 52 cm long or more, unipinnate ; veins 8-10 pairs, lowest pair joining to form an excurrent veinlet to sinus membrane. Lower surface of pinnae covered with spreading hairs, glandular haris usually present on veins in the lobes ; upper surface of costae with thick acicular hairs, scattered on costules and veins. Sori medial, lower ones divergent, basal on veins from adjacent costules, sometimes touching ; indusia hairy.

Habitat & Ecology : Found in forest floor, forest clearings etc.

Sporulation : October - December.

Specimen examined : Churaibari, PSD 0118, dt. 18.12.04.

Economic utility:

Forms of use locally : Not available.

Established reports of utility : Fronds of the plants are used in the treatment of gout and rheumatism **(Borthakur *et al.*, 2001).**

3. Cyclosorus Link. Hort. Reg. Berol. 2:128. 1833.

Key to the species:

1. Rhizome scales linear-lanceolate;stipes 45cm.long;basal pair of pinnae shortened; Base of pinnae truncate or cuneate. ***3a. C.gongylodes.***

1/. Rhizome scales ovate;stipes 70 cm. long;basal pinnae not reduced; Base of the pinnae broadly cuneate. ***3b. C.interruptus.***.

3a. C. gongylodes. (Schkuhr) Link. Hort. Reg. Bot. Berol. 2.128. 1833; Jamir & Rao, Ferns Nagaland, 240.1988. *Aspidium gongylodes* Schkur, Kr.Gew.1.193. t.33c. 1809.

Terrestrial. Rhizome long creeping about 0.6 cm thick, slender, covered with scales ; scales narrow linear-lanceolate, light brown. Stipe about 20-40 x 0.5 cm, scaly at base, rest glabrous, adaxially grooved, pale brown. Lamina about 40 x 20 cm, simple pinnate, broadly ovate-lanceolate, terminal pinnae similar to lateral ones except for its broader base. Pinnae sessile or may be stalked, alternate or sub-opposite, lowest pair of pinnae somewhat shorter. Pinnae lobed, apex rounded or acute, margin entire; rachis glabrous or sparsely hairy on lower surface; lower surface of costae with or without hairs and covered with scales; costules and veins glabrous below with hairs like the costae, usually with round orange glands. Veins 8-10 pairs, most of the veins running up to the margins. Lamina pale green, texture chartaceous, lower surface hairy upper surface glabrous. Sori medial, globose, in a continuous row; indusia reniform, hairy; spores monolete.

Habitat & Ecology : Found commonly in swampy places and by the side of ponds.

Sporulation : April – September.

Specimen examined : Jhumbasti, Badarpur, PSD 0267, dt. 20.4.06.

Economic utility:

Forms of use locally : Not available.

Established reports of utility : Not known so far.

3b. C. interruptus. (Willd.) H. Ito, Bot. Mag. Tokyo, 51.714. 1937 (*nomen tantum*); Manickam & I rudayaraj, Pterid. Fl. West. Ghats-S. India, 187. t.142. 1992. *Pteris interrupta* Willd. Phytographia, 13. t.10.f.1. 1794. *Nephrodium propinqum* R.Br. Prod. Fl. Nov. Holl. 148.1810; Bedd. Ferns South. India, t.89. 1864. *N.pteroides* Hook. et. Bak. Syn. Fil. 289.1867; Bedd. Handb. Ferns Brit. India, 269.1883. *N.unitum sensu* Bedd. Handb. Brit. India, 268. 1883.

Terrestrials. Rhizomes long creeping,clothed with scales at the apex, scales are ovate, acuminate at the apex, margin entire. Stipes about 65 x 0.5 cm, slender, sparsely scaly and black at the base, glabrous and brown above, adaxially grooved, abaxially flattened. Lamina elliptic-lanceolate, simple pinnate with a apical pinna similar to lateral ones but the base is somewhat broad; lateral pinnae numerous, sub-opposite, sessile or very shortly stalked, basal pinnae not reduced. Rachis grooved above and below, hairy; costae slightly raised and grooved above or distinctly and flattened below; veins slightly distinct below; lower surface of costae, costules, veins and intervenal areas densely covered by long, soft acicular hairs, upper surface glabrous ; lamina pale green. Sori medial on the veins in two rows, arranged in V shape. Indusia reniform, hairy ; sporangial stalk bears capitate hairs. Spores monolete, pale brown, exine finely spinulose.

Habitat & Ecology : Found as large colonies in open, marshy places and border of paddy fields.

Sporulation : October – February.

Specimen examined : Kamalpur, PSD 0074, dt. 8.2.04.

Economic utility:

Forms of use locally:

Established reports of utility : Not known so far.

4. *Macrothelypteris* Ching. Acta. Phytotax. Sin. 8:308.1963.

M. torresiana. (Gaud.) Ching, Acta Phytotax. Sin. 8.310.1963; Jamir & Rao, Ferns Nagaland, 238.1988; Manickam & Irudayaraj, Pterid. Fl. West. Ghats-S. India. 172. t.131. 1992. *Polystichum torresianum* Gaud.in Freyc.Voy. Bot. 333.1824. *Nephrodium teneri caule* Hook. Sp. Fil. 4.142. 1862. (*excl.t.*269); Clarke, Trans. Linn. Soc. Lond.II. Bot.1. 528. 1880. *Lastrea tenericaulis* Moore, Ind. Fil. 99.1858; Bedd. Handb. Brit. India, 266.1883.

Terrestrial. Rhizomes short creeping, stout, densely scaly; scales about 1x0.2 cm, linear-lanceolate, apex acuminate, gland tipped, margin with long acicular hairs, pale brown. Stipes stout, adaxially grooved, abaxially rounded, scaly and dark brown at the base, pale brown above and with minute dark brown spots of persistant scale bases.Lamina ovate, about 80 x 45 cm, lanceolate, tripinnatifid ; primary pinnae upto 15 pairs, subopposite or alternate, sessile or shortly stalked, apex acuminate; veins indistinct, free, forked, not reaching the margin, rachis glabrous, pale yellowish brown; lower surface of costae, costules and veins sparsely covered by long acicular, septate hairs; upper surface of costa and rachis densely covered by slender, acicular hairs; texture herbaceous lamina pale green. Sori round, on the basal acroscopic veinlets of each lobe just above the forking point ; indusia inconspicuous ; sporangia shortly stalked, with 2-4 capitate hair. Spores reniform, round, exine sinulose.

Habitat & Ecology : Found in forest clearings and along roadsides.

Sporulation : July – February.

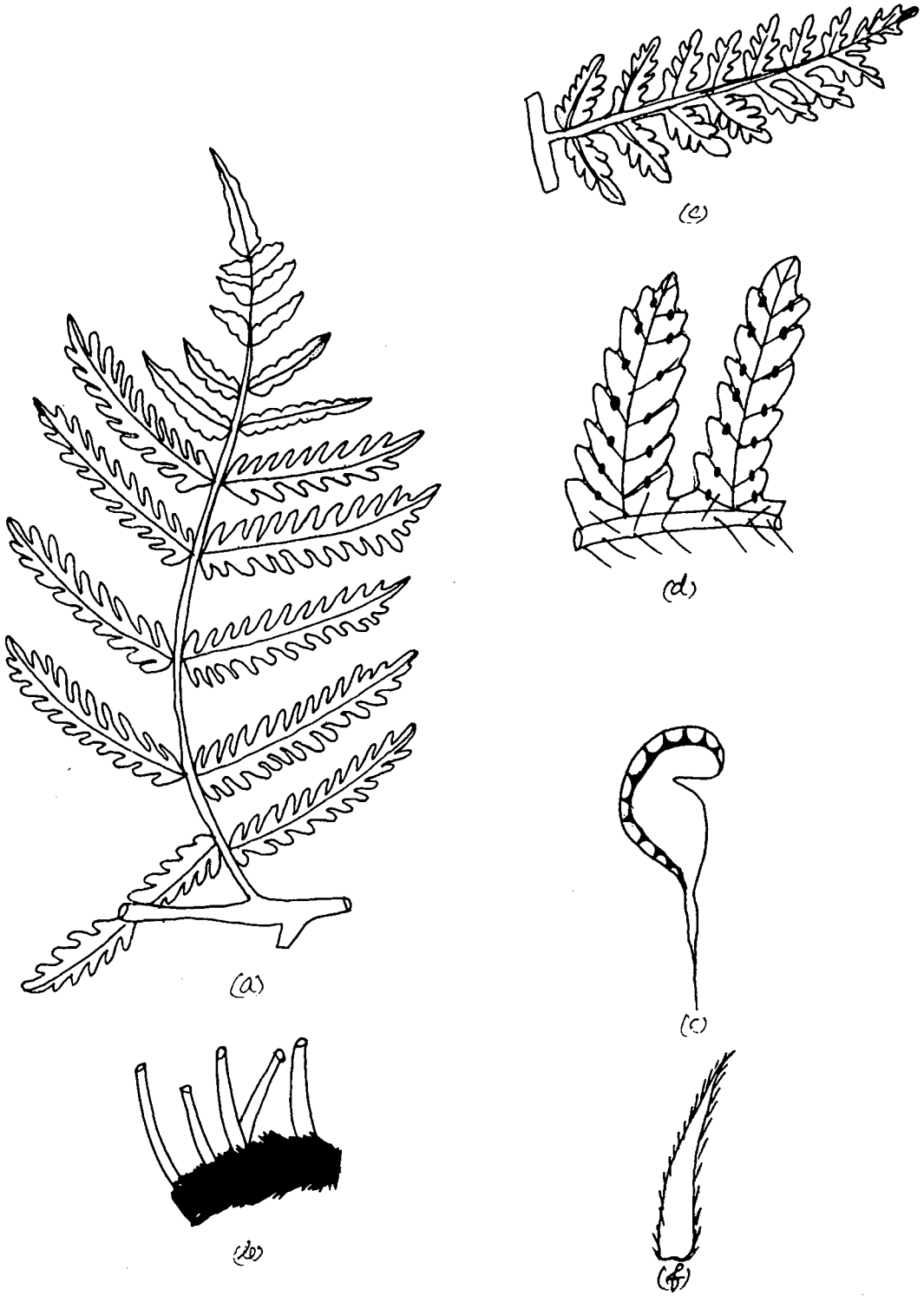
Specimen examined : Durganagar T.E., PSD 0142, dt. 9.2.04.

Economic utility:

Forms of use locally : Not available.

Established reports of utility : Not known so far.

PLATE 24



Macrothelypteris torresiana; (a) Primary pinna (b) Rhizome (c) Secondary pinna (d) Two leaves of Secondary pinna showing venation and sori (e) Sporangium (f) Scale

5. *Pronephrium* Presl.Epim.Bot.258.1851.

Key to the species

1. Lamina trifoliate ***5b. P.triphyllum.***

1'. Lamina simple pinnate. ***5a. P.nudatum.***

5a. P. nudatum. (Roxb.ex.Griff.) Holtt. Blumea, 21(1). 111.1972; Dhir, Ferns N.W. Himalayas, 105. 1980; Baishya & Rao, Ferns & Fern-allies, Meghalaya, 85.1982; Jamir & Rao, Ferns Nagaland, 258.1988. *Polypodium nudatum* Roxb. ex.Griff. *Ca*la. Journ. Nat. Hist. 4.491. 1844. *Goniopteris multilineata* Bedd. Ferns Brit. India, t. 231. 1866. *Nephrodium moulumeinse* Bedd. FernsBrit. India, Suppl. t.18.1876; Handb. Ferns Brit. India: 275.1883.

Terrestrial. Rhizomes widely creeping. Stipe upto 70 cm long, scabrous, sparsely covered with dark brown membranous scales, distant on rhizome. Lamina unipinnate, upto 155 x 65 cm, rough, coriaceous, pinnae 10-15 pairs, largest pinnae widest near the base than very gradually tapering, base broadly cuneate, acuminate, margin sharply crenate, strongly *ca*rtilaginous. Veins 16-20 pairs, free excurrent veins rare. Lower surface of pinnae postular, variously hairy; upper surface hairy on costa only. Sori small, round, medial ; indusia small often rudimentary, hairy, sporangia glabrous. Spores dark, exine.

Habitat & Ecology : Common in moist, shady places of the area .

Sporulation : July - October.

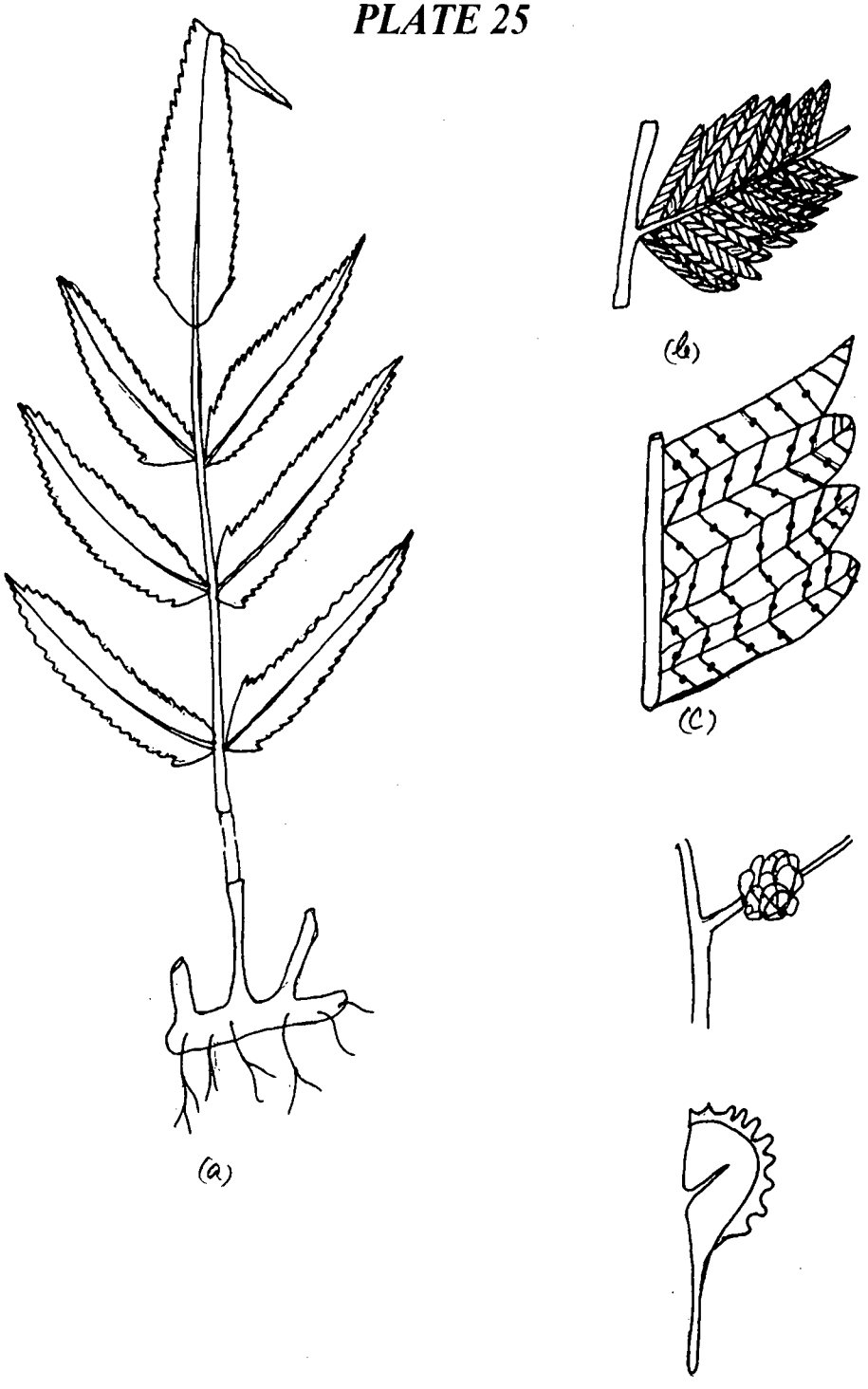
Specimen examined : Churaibari, PSD 0119, dt. 18.12.04.

Economic utility :

Forms of use locally :

Parts used : Pinnae.

PLATE 25



Pronephrium nudatum; (a) Habit (b) Portion of pinna showing adaxial side (c) Portion of pinna showing venation & sori (d) Sorus (e) Sporangium

Uses : Cold decoction of pinnae is used for acute pyrrhoea, as mouth wash. The process is repeated 2-3 times till cured. The Plant is used in the religious festival for removing evil spirit.

Established reports of utility : Not known so far.

Note: Recorded here as new medicinal plant.

5b. P. triphyllum. (Sw.) Holtt. Blumea, 20(1).122. 1972; Baishya & Rao, Ferns & Fern-allies, Meghalaya, 86.1982; Jamir & Rao, Ferns Nagaland, 261. 1988; Manickam & Irudayaraj, Pterid. Fl. West. Ghats-S. India, 185. t.140.1988. *Mensicium triphyllum* Sw. Schrad. Journ. Bot. 1800.(2).16.1801; Bedd. Ferns South. India, t.56.1864; Handb. Ferns Brit. India, 367. t. 231.1883. **Tin pati paloi (B).**

Terrestrials. Rhizomes wide creeping, with distant frods. Stipe slender, 10-45 cm long, purplish at maturity, hairy, grooved and scaly at base ; scales linear, dark brown, hairy on surface. Rachis grooved on upper surface densely hairy. Lamina 12-20 cm long, trifoliate, apical. Lamina gradually narrowed at base, rarely auricled, acuminate broad at middle, coriaceous, margin finely undulating. Costae and lateral veins densely hairy on the lower surface, glabrous in between veins ; upper surface sparsely hairy ; costae densely hairy. Veins prominently raised, reticulate,excurrent ; veinlets not free. Sori along the veinlets, exindusiate.

Habitat & Ecology : Found in open shaded area along the edge of the forest .

Sporulation : April – July.

Specimen examined : Duhalia Part I, PSD 0023, dt. 22.6.03.

Economic Utility:

Forms of use locally :

Parts used : Whole plant.

Uses : A paste obtained by crushing whole plant is applied externally as poultice over legs during nerve pain.

Established reports of utility : Not known so far.

Note: Recorded here as new medicinal plant.

23. ASPLENIACEAE Mett. ex. Frank.

A. nidus. L.Sp.Pl.2.1079. 1753; Clarke, Trans. Lin. Soc. Lond. II. Bot.1. 457. 1880; Dhir, Ferns N.W. Himalayas, 113. 1980; Baishya & Rao, Ferns & Fern-allies Meghalaya, 115. 1982; Jamir & Rao, Ferns Nagaland,184. 1988; Manickam & Irudayaraj, Pterid. Fl. West. Ghats-S. India, 206.t. 153. 1992. *Thamnopteris nidus* Presl, Epim. Bot.68. 1849; Bedd. Ferns Brit. India, t .197. 1866; Handb. Ferns Brit. India, 137.1883.

Epiphytes. Rhizome short, sub-erect, massive, small, covered with numerous broad acuminate whitish brown scales. Fronds simple, lanceolate, acute at apex,gradually narrowed at base, upto 30x5 cm, glabrous, midrib prominent. Sori linear, oblique in between two veins, towards the apex of the lamina. Indusium linear, superficially attached at the base just above the veins, opening outwards, slightly curved, greenish grey when young

Habitat & Ecology : Found as a pendent epiphytes on tree trunk.

Sporulation : July - October.

Specimen examined : Churaibari, PSD 0432, dt. 11.06.05.

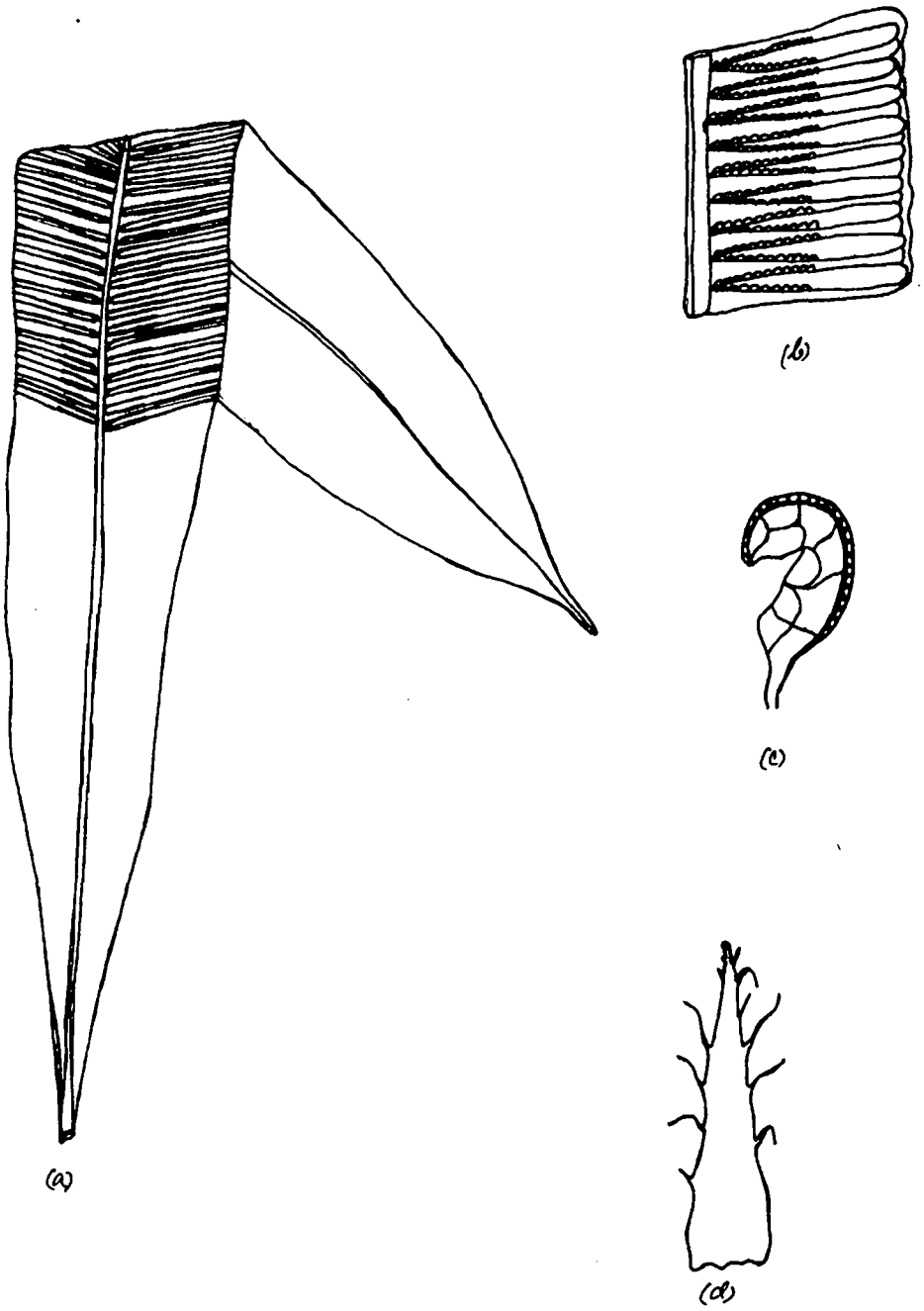
Economic Utility:

Forms of use locally :

Parts used : Leaves.

Uses : Extract obtained by crushing leaves applied locally to cure skin diseases.

PLATE 26



Asplenium nidus; (a) Lamina (b) Portion of lamina showing venation & sori (c) Sporangium (d) Scale

Established reports of utility : The plant is used medicinally to cure sores and ulcers and also as depurative and sedative. **(Borthakur *et al.*, 2001).**

24. ATHYRIACEAE Alston in Taxon 5:25.1956.

Diplazium Sw. Schrad. J. Bot. 4:61.1801.

Key to the species:

1. Veins anatomosing; stipes scaly and blackish-brown at base. ***2.D.esculentum.***

1'. Veins free; stipes stout, erect, sparsely scaly at base. ***1. D.bontamensa***

1.D. bantamensa. Bl. Enum. Pl. Jav. 191.1828; Clarke, Trans. Linn. Soc. Lond. II. 1.497. 1880; Bedd. Handb. Ferns Brit. India, 177. t.86.1883; Jamir & Rao, Ferns Nagaland, 308.1988. *Athyrium bentamense*(Bl.) Milde, Bot. Zeit.353. 1870; Baishya & Rao, Ferns & Fern-allies Meghalaya,138.1982. **Bhut paloi (B) .**

Terrestrial. Rhizome short creeping, forming sub-erect large caudex, scaly; scales linear-lanceolate, apex long acuminate, margin hooked, dark brown. Stipes 45 x 0.5 cm, scaly and blackish brown at base,glabrous and pale brown above; abaxially rounded, adaxially grooved. Lamina simple pinnate with a single apical pinna similar to lateral ones : lateral pinnae 3-7 pairs, sub-opposite or alternate, shortly stalked, lowest pair somewhat reduced. Largest pinnae about 20 x 4.5 cm, lanceolate, apex acuminate or caudate, base narrow, slightly unequal on the lower side, round, margin entire, veins distinct on both surfaces, free, forked near or at the costa; rachis glabrous, brownish; costae distinctly raised above and below, texture coriaceous. Lamina greenish, glabrous. Sori linear, confluent, irregular, starting from near the costa and extending nearly to the margin ; indusia linear ; spores brown, hyaline.

Habitat & Ecology : Found in moist , shady forest floor of the area .

Sporulation : July - February.

Specimen examined : Kamalpur, PSD 0075, dt. 8.2.04.

Economic utility :

Forms of use locally :

Parts used : Young fronds.

Uses : Extract obtained by crushing fronds applied locally for antiseptic action.

Established reports of utility : Not known so far .

Note: Reported as new medicinal utility.

2. D. esculentum. (Retz.) Sw. Schrad. Journ. Bot. 1801 (1).312. 1803; Dhir, Ferns N.W. Himalayas, 95.1980; Baishya & Rao, Ferns & Fern-allies of Meghalaya, 140. 1982; Jamir & Rao, Ferns of Nagaland, 311.1988; Manickam & Irudayaraj, Pterid. Fl. West. Ghats-S. India, 241. t.187. 1992. *Hemiontis esculenta* Retz. Obs. Bot. 6.38.1791. *Anisgonium esculentum* (Retz.) Presl. Tent. Pterid. 116. 1836; Bedd. Handb. Ferns Brit. India. 192.1883. *Callipteris esculentum*(Retz.) J. Sm.apud Houlst & Moore in Grad. Mag. Bot. 3.265.1851; Bedd. Ferns. South. India, t. 164. 1864. **Dekhi sak / Paloi sak (B).**

Terrestrial. Rhizome black, semi erect, covered with much fibrous, stiff roots; scales broad lanceolate, toothed, dark brown. Stipes 60-70 cm long, sparsely covered with deciduous scales, base flat, ridged. Fronds bipinnate, upto 2 cm tall, lamina spreading.Veins forked. Sori linear, short, parallel on both side of the veins. Sporangia sori stalked. Spores oval, dark, hyaline.

Habitat & Ecology : Very commonly found in moist , open places forming thickets.

Sporulation : July - Septebmer.

Specimen examined : Thana Road, Karimganj, PSD 0319, dt. 29.12.05.

Economic Utility:

Forms of use locally :

Parts used : Circinately coiled fronds.

Uses : Fresh and young circinate fronds are edible as vegetable for maintaining general health. and sold profusely in the markets. It is considered as laxative.

Established reports of utility : Decoction prepared from rhizome and young leaves are used for haemophtysis and cough.. It is used as laxative.In Assam tender fronds are sold in markets as vegetables **(Borthakur *et at.*, 2001) .**

25. TECTARIACEAE (Holtt.ex Nayar) Panigr.in. J. Orissa. Bot. Soc.8 (1): 41.1986

Key to genera:

1. Veins always anastomising; areoles with included vein lets. ***2. Tectaria.***

1′. Veins usally free, if anastomosing, areoles without included veinlets. ***1. Ctenitopsis.***

1. ***Ctenitopsis*** Ching in Bull.Fan.Mem.Inst.Biol.Bot.8;304.1938.

C. fusipes. (Wall.ex Bedd.) Ching, Bull. Fan. Mem. Inst. Biol. Bot. 8.313.1938; Jamir & Rao, Ferns Nagaland, 357. 1988. *Aspidium fuscipens* Wall. *Cat.* No.361.(*ex-parte*), 1827. (*nom.nud.*) ex.Bedd. Ferns Brit. India, Suppl 15. t.366. 1876. *Lastrea fuscipens* Moore, Ind. Fil. 82.1858: Bedd. Handb. Ferns Brit. India, 243.1883. (*pro parte.*) *Nephrodium membranifolium* Hook. Sp. Fil. 131. t.261.1862 (pro parte.); Clarke, Trans. Linn. Soc. Lond.II. Bot.1. 534. t.75 A.1880. *Aspidium membranifolium* Bedd. Handb. Ferns Brit. India, 225. 1883; Suppl. 48.1892 (*excl.syn.*). *Tectaria paradoxa* (Fee) Sledge in Kew Bull. 27.413. 1973; Baishya & Rao, Ferns & Fern-allies Meghalaya,135.1982.

Terrestrial. Rhizomes erect, short, stout. Stipes about 30-55 cm long, tufted, stramineous, dark brown, covered with scales; scales linear-lanceolate, apex

acuminate, black. Lamina bipinnate at base, pinnatifid at apex, deltoid-ovate, lateral pinnae 10-15 pairs, opposite to sub-opposite, sessile or shortly petiolate, margin of pinnae deeply lobed near to the costae; lowest basal pair of pinnae much larger; texture herbaceous, upper surface of lamina hairy; fertile lamina more contracted; rachis, costae densely short, hariy, brownish; veins free or forked, each basioscopic veinlets arising from the costa. Sori irregularly scattered throughout the segment, generally terminating on free veinlets; indusia reniform; sporangia stalked.

Habitat & Ecology : Commonly found in sandy, moist area along the edge of the forests.

Sporulation : October – November.

Specimen examined : Kamalpur, PSD 0411, dt. 25.12.05.

Economic utility :

Forms of use locally : Not available .

Established reports of utility : Not known so far.

2. Tectaria Cav. in. Anal. Hist. Nat.1(2):115.1799.

Key to the species:

1. Fronds tripinnate. ***2c. T.subconfluens.***

1′. Fronds not tripinnate.

2. Lamina densely hairy on both surfaces. ***2a. T.coadunata.***

2′ Lamina sparsely hairly on upper surface, glabrous below.

3. Costal and costular areoles with included free veinlets. ***2d. T.variolosa***

3′. Costal and costular areoles devoid of included free veinlets. ***2b. T.macrodonta.***

2a. T. coadunata (Wall.ex. Hook. et Gerv.) C.Chr. in Contr. U.S. Nat. Herb. 26.331. 1931; Manickam & Irudayaraj, Pterid. Fl. West. Ghats-S. India, 260. t.200.1992.

Aspidium coadunatum Wall.ex.Hook. et Grev. Icon. Fil. 2.202.1831 (non Kaulf., 1824) *Sagenia gigantean* Bedd. Ferns South. India, 28 t.81. 1864. *S.variolosa* Bedd. Ferns Brit. India, t.170. 1866. *Nephrodium cicutarium* Hook. et Bak. Syn. Fil. 299.1874; Clarke, Trans. Linn. Soc. Lond.II. Bot.1. 539.1880. *N.cicutarium var.coadunatum* Clarke, Trans. Linn. Soc. Lond.II. Bot. 1. 540.1880. **Bhut paloi (B).**

Terrestrial. Pinnae 45x28cm wide, tripinnatifid, oblong, caudate acute; costae grooved, hairy; pinnules subopposite, stipicellulus; secondary pinnules the largest on the basal acroscopic side, sessile, ovate-oblong, deeply pinnatifid; secondary costules ctenitis-hairy on both surfaces, not grooved; lobes broad ovate, shallowly lobed to entire, aeroles along secondary costules distinct; mid-vein distant and zig-zag, basal basiscopic vein springing from secondary costules; aeroles along mid-vein in one or 2-rows in large lobes; margin ciliate or long hairy, dry pale- brown, herbaceous. Sori round,closer to mid-vein,slightly sunk; indusium large, persistent reniform, thin, subentire, sporangium stalk with glandular hairs; spores reniform, monolete, brown, perispore folded and broad.

Habitat & Ecology : Found commonly inshaded areas in forests.

Sporulation : April – July.

Specimen examined : Duhalia Part I, PSD 0003, dt. 21.6.03.

Economic utility :

Forms of use locally :

Parts used : Tender fronds .

Uses : Tender fronds are edible.

Established reports of utility : Used in medicine in acute case of diarrhea in children and other stomach troubles. Fronds are eaten as salad **(Singh & Panigrahi., 2005).**

2b. T.macrodonta (Fee) C.Chr. Ind. Fil. Suppl. III. 181. 1934; Dhir. Ferns. N.W. Himalays. 75.1980; Jamir & Rao, Ferns. Nagaland. 362.1988. *Sagenia macrodonta* Fee, Gen. Fil. 313. t.24. A.m.1.1852.; Bedd. Ferns. Brit. Ind.220 1883. **Bhut paloi (B).**

Rhizome erect to sub erect short, 1 cm thick, densely scaly. Stipes tufted, abaxially rounded, adaxially grooved, scaly at base, glabrous above, brown. Lamina cordate to deltoid, bipinnate to tripinnate, apex pinnatifid, lateral pinnae 2-6 pairs, opposite or sub-opposite; seconday pinnae shortly stalked or sessile; opposite or sub-opposite linier-oblong apex bluntly acuminate, base truncate; main lateral veins conspicuous, rachis similar stipe, costae and costules puberulous or shortly hairly beneath; texture thin, herbaceous, sparsely hairy or glabrous above, lamina dark-green. Sori large globose, 0.2 cm. wide arrangen in two rows between the main veins; indusia reniform, brown.

Habitat & Ecology : Found commonly in moist, shady places of the area.

Sporulation : May --July .

Specimen examined : Churaibari, PSD 0432, dt. 11.6.05.

Economic utility :

Forms of use locally :

Parts used : Fronds.

Uses : Extract of fronds along with honey is taken in cough and cold .

Established reports of utility : Fronds are used medicinally to treat asthma, bronchitis and strings of honey-bee **(Borthakur *et al.*, 2001).**

2c. T. subconfluens. (Bedd.) Ching, Sinensia 2.27.1931. *Aspidium subconfluens* Bedd. Ferns Brit. India, Suppl. t. 364.1876; Handb. Ferns Brit. India. 215. t.109. 1883. *Nephrodium subconfluens* Clarke, Trans. Linn. Soc. Lond. II. Bot.1.536.1880. **Bhut paloi (B).**

Terrestrials. Rhizome erect, about 1 cm thick, densely scaly ; scales lanceolate, apex acuminate, base ovate, entire, dark brown. Stipes adaxially grooved, abaxially rounded, scaly at base, glabrous above, blackish brown. Lamina broader than long, triangular, tripartite, apex acuminate or acute, lateral pinnae opposite or sub-opposite, shortly stalked; costae distinctly raised below, veins prominent, anastomosing with few free included veinlets; texture firm, pinnae glabrous above, pubescent beneath on the veins, pale green. Sori numerous, small, scattered, variable in position; indusia variable, reniform,horse-shoe shaped or peltate, persistent.

Habitat & Ecology : Found in shady places of dense forest.

Sporulation : November – February.

Specimen examined : Kamalpur, PSD 0076, dt. 8.2.04.

Economic utility :

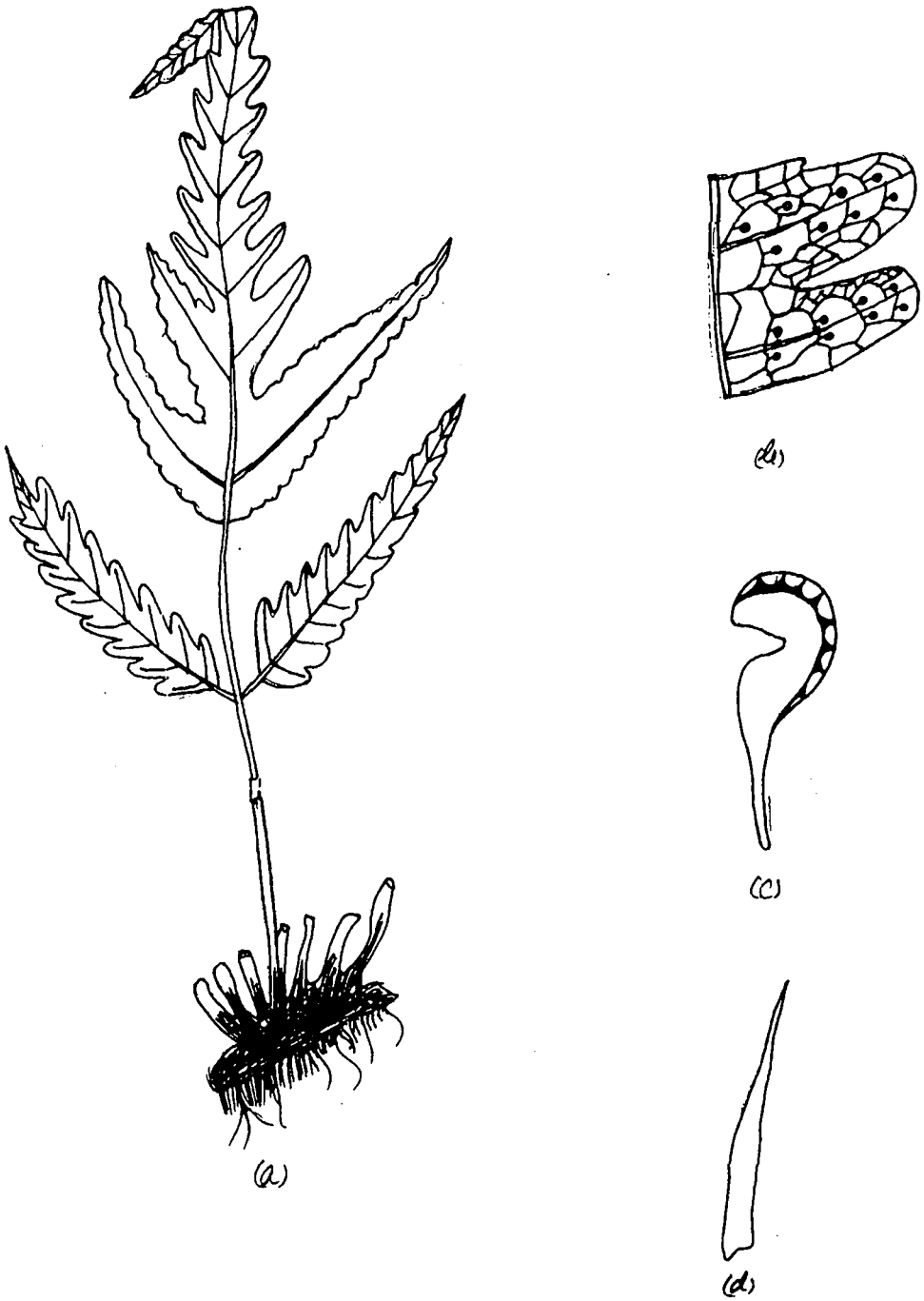
Forms of use locally : Not available .

Established reports of utility : Not known so far.

2d. T. variolosa. (Wall.ex. Hook.) C.Chr. in Contr. U.S. Nat. Herb. 26.289. 1931; Baishya & Rao, Ferns & Fern-allies, Meghalaya,136.1982; Jamir & Rao, Ferns Nagaland, 365.1988. *Aspidium variolosum* Wall.ex Hook. Sp. Fil. 4.51.1862. Bedd. Ferns Brit. India, Suppl. t.365. 1876; Handb. Ferns Brit. India, 216. t.111.1883; Suppl. 45.1892. *A.zollingerianum* Bedd. Ferns Brit. India, t.251.1866. **Bhut paloi (B).**

Terrestrial. Rhizome short, densely covered with black slender roots; scales lanceolate, entire, black, thick. Stipes 30-40 cm long, slender, densely covered with rhizome scales and hairs. Lamina bipinnate at base, pinnatifid at apex, membranous: basal pair of pinnae shortly stalked. Rachis, costae and costules densely covered with brown septate hairs. Veins forked, free or occasionally united with acroscopic veinlets. Sori biseriate, marginal along the pinnae lobes, reniform.

PLATE 27



Tectaria variolosa; (a) Habit (b) Lobes of pinna showing venation and sori (c) Sporangium (d) Scale

Habitat & Ecology : Found common in moist shady places in the forest.

Sporulation : April – July.

Specimen examined : Duhalia Part I, PSD 0004, dt. 21.6.03.

Economic utility :

Forms of use locally : Not available .

Established reports of utility : Not known so far.

26. PERANEMATACEAE (Presl.) Ching in Sunyatsenia 5:246.1940.

Peranema D.Don Prod. Fl. Nepal.12.1825

P. cyatheoides. D.Don Prod. Fl. Nepal. 12.1825; Bedd. Ferns South. India, t.73. 1864; Handb. Ferns Brit. India, 22.1883; Clarke, Trans. Linn. Soc. Lond.II. Bot.1. 433.1880; Dhir, Ferns N.W. Himalayas, 63.1980; Baishya & Rao, Ferns & Fern-allies Meghalaya, 129. 1982; Jamir & Rao, Ferns Nagaland, 320.1988.

Terrestrial. Rhizome massive, short, densely scaly; scales broad lanceolate, membranous, brown entire.Fronds 3-pinnate, spreading upto 165-70 cm at base; pinnules obovate. Indusium reniform, entire. Spores oval to round, dark brown, thick - walled.

Habitat & Ecology : Found in dense moist , shady places in forest.

Sporulation : April – September.

Specimen examined : Churaibari, PSD 0443, dt. 11.6.06.

Economic utility;

Forms of use locally : Not available .

Established reports of utility : Not known so far.

27. DRYOPTERIDACEAE Herter, Rev. Sudam. Bot. 9:15.1949

Dryopteris Adanson, Fam. Des. Pl. 2:20.551.1763.

D. chrysocoma (Christ) C.Chr. Ind. Fil. 257.1905. *Aspidium filix-mas* var. *chrysocoma* Christ, Bull. Boiss. 6: 966. 1898. *A.chrysocoma* Christ, Bull. Acad. Geogr. Bot. Mans. 1902: 253. 1902. **Bhut paloi (B).**

Terrestrial. Rhizome sub-erect, densely scaly; scales linear lanceolate, thin membranous, entire. Fronds bipinnatifid, paleaceous. Pinnae lanceolate, sessile, cut down to rachis giving pinnatifid appearance, apex sharply serrate, thin glabrous except the costae ; rachis and costae covered with light brown linear scales.Veins prominent, forked and free. Sori large, reniform-g lobose, dorsal, superficial on veins along either side of midrib. Spores oval, light brown, hyaline, exine smooth.

Habitat & Ecology : Found along fully exposed roadsides and forest clearings.

Sporulation : April – September.

Specimen examined : Railway colony, Karimganj, PSD 0292, dt. 16.6.05.

Economic utility :

Forms of use locally :

Parts used : Fronds.

Uses : Paste of fronds used in cuts and wounds.

Established reports of utility : Rhizomes are antihelmintic **(Borthakur *et al.*, 2001).**

Note : Additional utility is reported here .

28. BOLBITIDACEAE (Pic.Ser.) Ching Acta Phytotax. Sin.16(4):15.1978.

Key to the genera:

1. Veins anastomosing. ***1.Bolbitis.***

1′. Veins free. ***2.Egenolfia.***

1. Bolbitis Schott. Gen. Fil.3. t.14.1834.

B. heteroclita. (Presl.) Ching in C. Chr. Ind. Fil. Suppl. 3.48.1934; Baishya & Rao, Ferns & Fern-allies, Meghalaya, 121.1982; Jamir & Rao, Ferns Nagaland, 376.1988. *Acrostichum heteroclitum* Presl, Rel. Haenk.1.15. t.2.f.2. 1885. *Leptochilus heteroclitus* (Presl.) C.Chr.Ind. Fil.11.1906. **Am paloi (B).**

Terrestrial. Rhizome wiry creeping, with slender stiff roots projecting downwards; scales ovate-acuminate, attached above the base, deciduous. Fronds slender stipitate; stipes upto 25 cm long, sparsely covered by rhizome scales. Lamina variable, simple to pinnate, usually trifoliate, margin entire to undulating, glabrous, thin; terminal pinnae with apex terminating into a winged linear structure bearing proliferating vegetative buds, bend downwards giving rise to new shoots. Veins prominent, lateral veins raised, marginal veins free fertile lamina simple or pinnate, marginal smooth and shortly stalked. Sori covering the whole lower surface and brown.

Habitat & Ecology : Found along densely shaded forest beds at low elevation.

Sporulation : May – August.

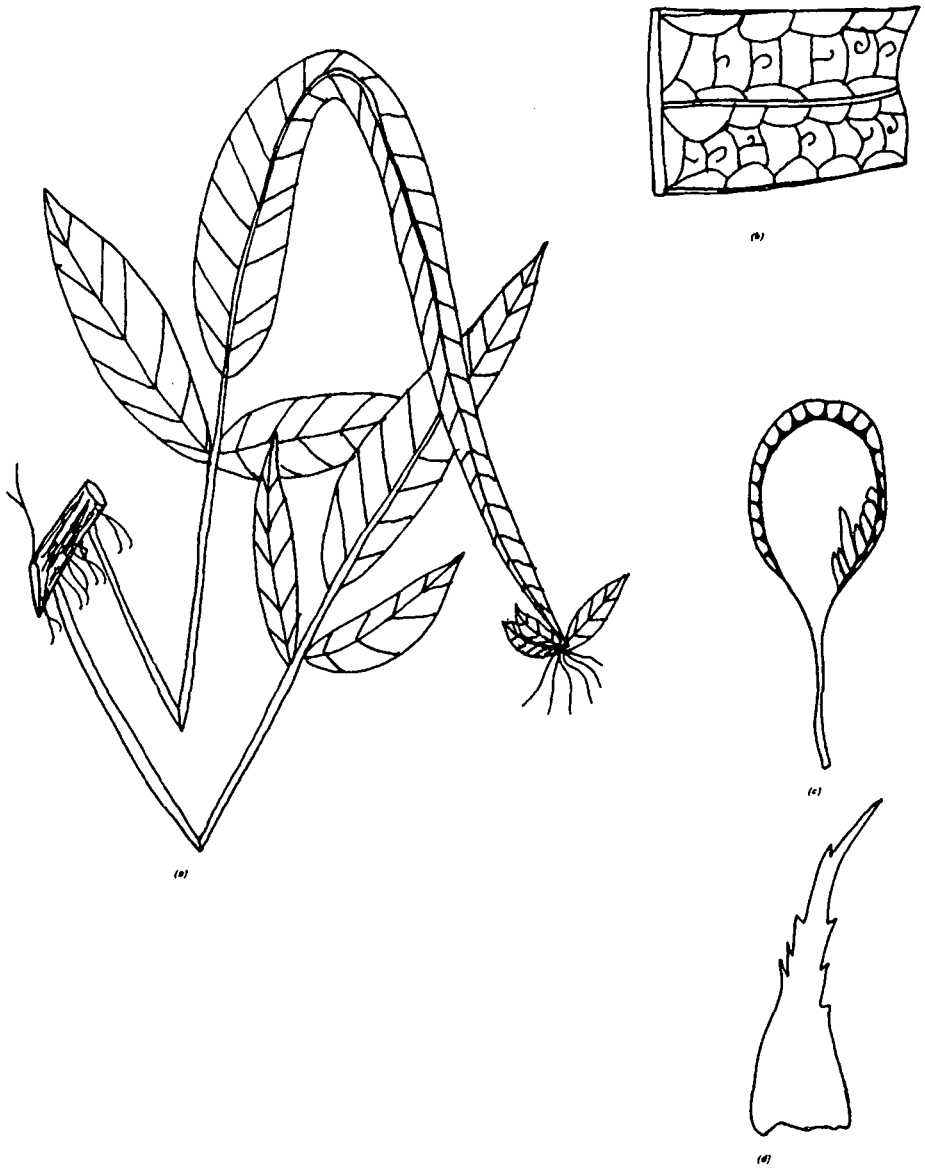
Specimen examined : Churaibari, PSD 0434, dt. 11.6.06.

Economic utility :

Forms of use locally : Not available .

Established reports of utility : Not known so far.

PLATE 28



Bolbitis heteroclita; (a) Habit (b) Portion of sterile pinna showing venation (c) Sporangium (d) Scale

2. Egenolfia Schott. Gen. Fil. 3.t.16.1834.

Key to the species:

1. Lamina simple, pinnate;veins free. ***2a. E.appendiculate.***

1′. Lamina bipinnatifid, one pair of basal veins anasmosing. ***2b. E.bipinnatifida.***

2a. E. appendiculata (Willd.) J. Sm. Ferns Brit. & For. 111.1886; Baishya & Rao, Ferns & Fern-allies Meghalaya, 121.1982; Jamir & Rao, Ferns Nagaland, 372.1988. *Acrostichum appendiculatum* Willd. Sp. Pl. 5.114.1810; Clarke, Trans. Linn. Soc. Lond.II. Bot. 1.577. 1880. *Polybotrya appendiculata* (Willd.) J. Sm. J. Bot. 4. 150.1841; Bedd. Ferns South. India, t.194.1864; Handb. FernsBrit. India, 424.1883. *Bolbitis appendiculata* (Willd.) K. Iwats. Acta Phytotax. Geobot. 18.48.1959; Manickam & Irudayaraj, Pterid. Fl. West. Ghats-S. India, 291. t.224.1992.

Terrestrial. Rhizome short creeping about 0.75 cm thick, soft, scaly at the apex; scales ovate lanceolate, apex acuminate, margin entire. Stipes about 18x0.25 cm, adaxially grooved, abaxially rounded, sparsely scaly at base, glabrous above, dark green. Lamina simple pinnate, dimorphic, sterile lamina lanceolate, gradually narrowed to ward the apex, which often rooting by a small vegetative bud. Veins not prominent, free forked; costae slightly raised below; texture herbaceous, firm; lamina dark green; small, toothed scales scattered all over the rachis of fertile and sterile lamina; stipe of fertile lamina longer than sterile ones, margin crenate. Sori acrostichoid, covering the lower surface; sporangia blackish brown. Spores monolete, pale brown.

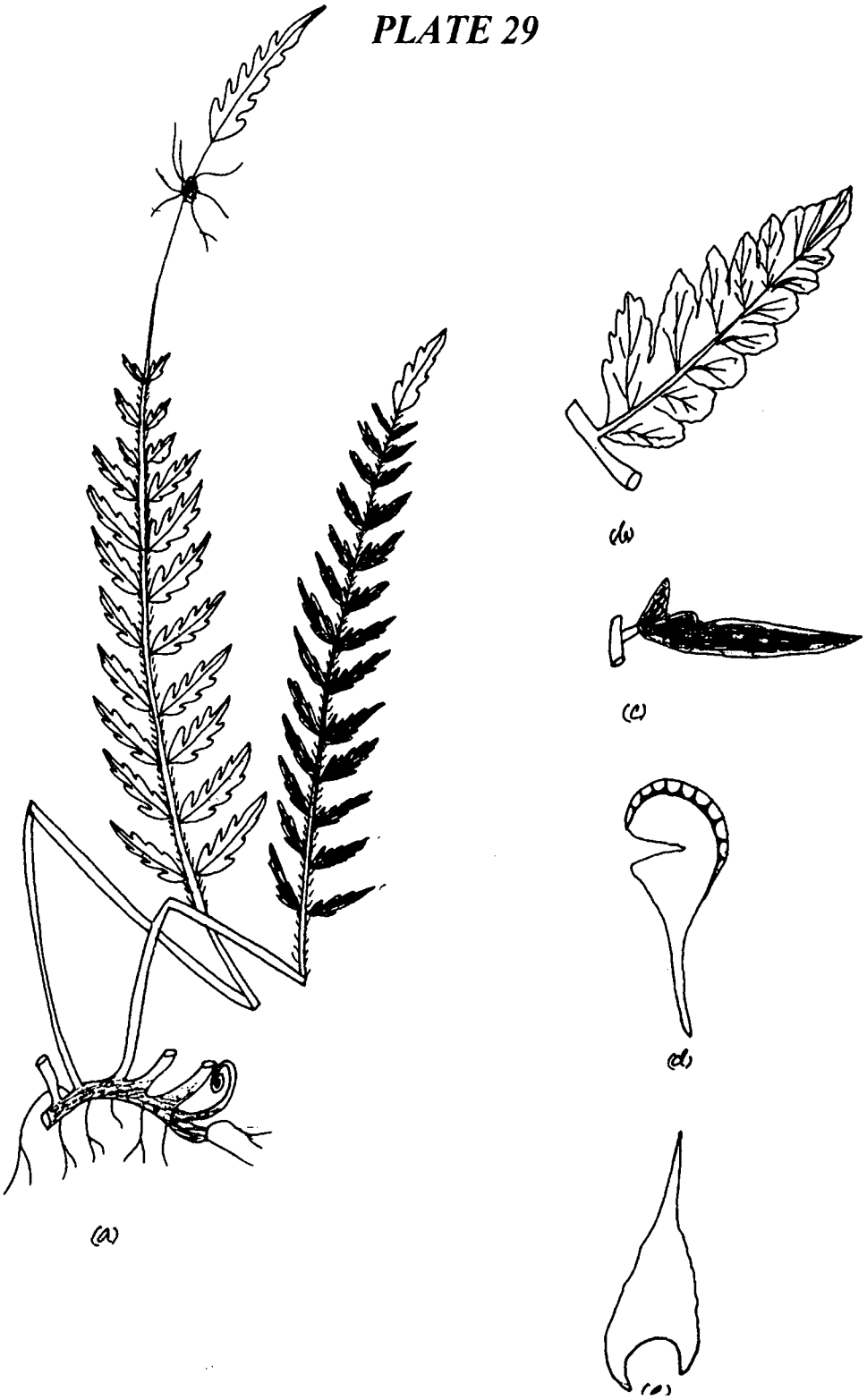
Habitat & Ecology : Found common along shaded rocks of stream banks.

Sporulation : October – February.

Specimen examined : Duhalia Part I, PSD 0045, dt. 25.12.03.

Economic utility :

PLATE 29



Egenolfia appendiculata; (a) Habit (b) Sterile pinna showing venation (c) Fertile pinna showing sori (d) Sporangium (e) Scale

Forms of use locally : Not available .

Established reports of utility : Not known so far.

2b. E. bipinnatifida. J. Sm. Hist. Fil.132.1875. *Acrostichum appendiculatum* var. *costulata* Hook. Sp. Fil. 4.252.1860; Bedd.Ferns Brit. India, t.110.1866. *Polybotrya appendiculata* var.*costulata* (Hook.) Bedd. Handb. Ferns Brit. India, 426. t.257. 1883. *Bolbitis bipinnatifida* (J.Sm.) K. Iwats. Acta Phytotax. Geobot. 18.49.1959; Baishya & Rao, Ferns & Fern-allies Meghalaya, 121.1982; Jamir & Rao. Ferns Nagaland, 376.1988.

Terrestrial. Rhizome creeping, densely scaly; scales broad acuminate, pale brown. Fronds simple pinnate, pinna deeply pinnatifid, basal pair of pinnae large, lanceolate, membranous; segments of pinnae with serrate margin. Stipe long, erect, ridged with sparse scales, rachis with cordate-peltate scales, more or less winged upwards. Veins reticulate no free included veinlets. Fertile fornds with simple, entire, linear pinnae. Lamina dark green, dark brown glandular haris scattered all over on both surfaces of the lamina; texture herbaceous. Sori entirely covering the lower surface except the costae, sporangia slender stalked, blackish brown.

Habitat & Ecology : Found along moist, shady places of forests.

Sporulation : July – November.

Specimen examined : Kotamoni, PSD 0120, dt. 18.12.04.

Economic utility :

Forms of use locally : Not available.

Established reports of utility : Not known so far.

29. NEPHROLEPIADACEAE Ponce de Leon ex Pin-Ser.in. Webbia 29:8.1975

Nephrolepis Scott. Gen. Fil.1. t.3.1834.

N. cordifolia. (L.) Presl, Tent. Pterid. 79.1836; Clarke, Trans. Linn. Soc. Lond.II. Bot.1. 541.1880; Bedd. Handb. Ferns Brit. India, 282. t.144.1883; Dhir, Ferns N.W. Himalayas, 59.1980; Baishya & Rao, Ferns & Fern-allies, Meghalaya, 105.1982; Jamir & Rao, Ferns Nagaland, 385.1988. *Polypodium cordifolium* L. Sp. Pl.2.1089. 1753. *Nephrolepis tuberose* Presl, Tent. Pterid. 79.1836; Bedd. Ferns South. India. t.92.1864. *N.auriculata* (L.) Trimen, J. Linn. Soc. Lond. Bot. 24.152.1887; Manickam & Irudayaraj, Pterid. Fl. West.Ghats –S. India, 140. t.108.1992. **Korat paloi (B).**

Terrestrial. Rhizome erect about 10 x 2.5 cm, densely covered with scales; scales linear lanceolate, acuminate, hair pointed, margin fimbriate, yellowish brown; roots bear spherical, fleshy tubers. Stipes about 14 x 0.35 cm, tough, shining, densely scaly below, glabrous or sparsely scaly above, dark olive brown when dry. Lamina about 65 x 7 cm, linear-oblong-lanceolate, gradually narrowed at both ends, simple pinnate; pinnae numerous, alternate, sessile, spreading; rachis grooved with small, drark brown scales; costae and veins distinct, veins simple or forked once, free, ending in hydathodes, not reaching the margin ; texture herbaceous; lamina pale green, glabrous above and below. Sori sub-marginal, arranged in a single row, rounded; indusia reniform, dark brown towards base, pale brown towards edge, margin entire, glabrous. Spores brown, translucent.

Habitat & Ecology : Found in moist , exposed area along forest margins.

Sporulation : July – October.

Specimen examined : Inatpur, PSD 0083, dt. 8.2.04.

Economic Utility:

Forms of use locally :

Parts used : Fronds.

Uses : Frond extract applied locally in fresh cuts and wounds for antiseptic action.

Established reports of utility : Tubers and tender leaves are used as vegetable in Garhwal, Darjeeling and Bhutan: decoction of fronds used for cough: people of Nagaland chew the washed tubers for sinus trouble, toothache and also for diseases of liver; juice of fresh green leaves check the bleeding of cuts and coagulates blood **(Borthakur *et al.*, 2001).**

30. DAVALLIACEAE. Mett . ex. Frank.in Leunis. 2, 3:1474.1877.

Key to the species:

1. Rhizome coveredby both scales and hairs. ***3.Leucostegia.***

1′. Rhizome coveredby scales only.

2. Rhizome scales brown to chestnut brown, ovate-lanceolate; lamina tripinnatifid. ***1.Davallia.***

2′. Rhizomes scales white to yellow, linear lanceolate; lamina tripinnate. ***2.Humata.***

1. Davallia Smith. Mem. Acad. Sci. Turin. 5:414. t.9(6).1793.

D. divaricata. Bl. Enum. Pl. Jav. 237.1828; Clarke, Trans. Linn. Soc. Lond. II. Bot.1. 445. 1880; Bedd. Handb. Ferns Brit. India, 60.1883; Jamir & Rao, Ferns Nagaland, 398.1988. *D.polyantha* Hook. Sp. Fil.1. 68. t.59.A.1846; Bedd. Ferns Brit. India, t.107.1866.

Terrestrial. Rhizome creeping about 1 cm thick, densely scaly all over, scales deltoid to ovate-lanceolate, apex long acuminate, base broad, thin transparent, brown. Stipes about 30 x 0.35 cm, firm, erect, scaly at base, glabrous above, chestnut brown.

Lamina about 50 x 25 cm. tripinnatifid, deltoid-lanceolate, apex acute or acuminate; primary pinnae numerous, alternate; veins not conspicuous, uniform, free, not reaching the margin; costae and costules slightly winged ; texture sub-coriaceous ; lamina dark reddish brown when dry, glabrous. Sori half cup shaped, obliquely placed as regards the central veins in the tooth, sub-marginal, brownish ; indusia tubular or half cup shaped.

Habitat & Ecology : Found on shady moist tree trunks of forests.

Sporulation : November – January.

Specimen examined : Duhalia Part II, PSD 0046, dt. 25.12.03.

Economic utility :

Forms of use locally : Not available.

Established reports of utility : Not known so far.

2. Humata Cav. Decs. Pl.1:272.1802.

H. repens. (L.f.) Diels, Nat. Pflanzenfam. 4:209.1889; C.Chr. in Contrib. U.S. Nation. Herb. 26: 293. 1931. *Adiantum repens* L.f., Suppl.: 446.1782. *Davallia pedata* J.E. Smith, Mem. Acad. Sci. Turin 5:415.1793. *D.serrata* Willd. Sp. Pl.5:467.1810. *Humata serrata* (Willd.) Desv. Prod.:323.1827. *H.pedata* (J.E.Smith) J.Smith in J.Bot. 3:416. 1841; Bedd. Handb. Ferns Brit. India: 48. pl.23.1883. *Davallia repens* (L.f.) Kuhn, Fil. Deck. 27. 1867, *non* Desv.(1827).

Terrestrials. Rhizome wiry creeping; scales broad acuminate, brown. Stipes long, sparsely covered with broad acuminate scales. Fronds deltoid, cut down to the costae giving a pinnatifid appearance; lower pair of segments larger than the rest, glabrous. Veins forked, and free at margin. Sori marginal, elongate. Indusium sub orbicular, margin entire, light brown, glabrous. Spores bean shaped, greenish-yellow, exine smooth.

Habitat & Ecology : Found in moist,shady and open tree trunks.

Sporulation : April- September.

Specimen examined : Dullabcherra, PSD 0209, dt. 5.9.05.

Economic utility :

Forms of use locally : Not available .

Established reports of utility : Not known so far.

3.Leucostegia Presl.Tent. Pterid. 94. t.4.f.11.1836.

L. immersa Wall.ex.Hook.) Presl, Tent. Pterid. 95.t.4.f.11. 1836; Bedd. Handb. Ferns Brit. India, 51.1883; Dhir, Ferns N.W. Himalayas, 58.1980; Baishya & Rao, Ferns & Fern-allies Meghalaya, 103.1982; Jamir & Rao, FernsNagaland, 389.1988; Manickam & Irudayaraj, Pterid. Fl. West. Ghats-S. India, 131. t.102. 1992. *Davallia immerse* Wall. ex. Hook. Sp. Fil.1.156.1846 Clarke, Trans. Linn. Soc. Lond.II. Soc. Bot. 1.443. 1880. *Acrophorus immersum* (Moore.) Bedd. Ferns South India, t.11.1864.

Epiphytes as well as terrestrials. Rhizomes stout, fleshy, wide creeping, scales broad, ovate acuminate; margin hooked. Stipes erect, 10-30cm long, glabrous pale brown, shining. Fronds tripinnate, triangular in outline, glabrous; pinnae much over-lapping, crowded, thin membranous, turning yellowish brown when mature, cut down to broad segments, obliquely truncate at base, rounded and crenate above.Sori large, marginal, impressed. Spores oblong to reniform, yellow, exine smooth.

Habitat & Ecology : Found in rocks of shady forest area.

Sporulation : April – September.

Specimen examined: Duhalia Part II, PSD 0005, dt. 21.6.03.

Economic utility :

Forms of use locally : Not available.

Established reports of utility : Young fronds are cooked with potato and eaten with rice in Darjeeling **(Borthakur *et al.*, 2001).**

31. BLECHNACEAE. (Presl.) Copel. Gen. Fil:115.1947.

Blechnum L, Sp. pl.2:1077.1753.

B. orientale. L.Sp. Pl. 2.1077. 1753; Bedd. Ferns South. India, t.89. 1864; Handb. Ferns. Brit. India, 132. t.86.1883; Clarke, Trans. Linn. Soc. Lond.II. Bot.1. 474.1880; Dhir, Ferns N.W. Himalayas, 114.1980; Baishya & Rao, Ferns & Fern-allies, Meghalaya,118.1982; Jamir & Rao, Ferns, Nagaland, 403,1988 ; Manickam & Irudayaraj, Pterid. Fl.West. Ghats-S. India, 299 t. 229.1992.

Terrestrial. Rhizome erect, stout, forming a massive trunk, covered with dense scales and mucilaginous hairs. Stipes symmetrical, erect. Fronds pinnately compound. Veins free. Sori exindusiate, linear, confluent along the costal region. Spores bilateral.

Habitat & Ecology : Very commonly found along moist and shady forest margins, often in patches.

Sporulation : April - September.

Specimen examined : Thana Road, Karimganj, PSD 0293, dt. 16.6.06.

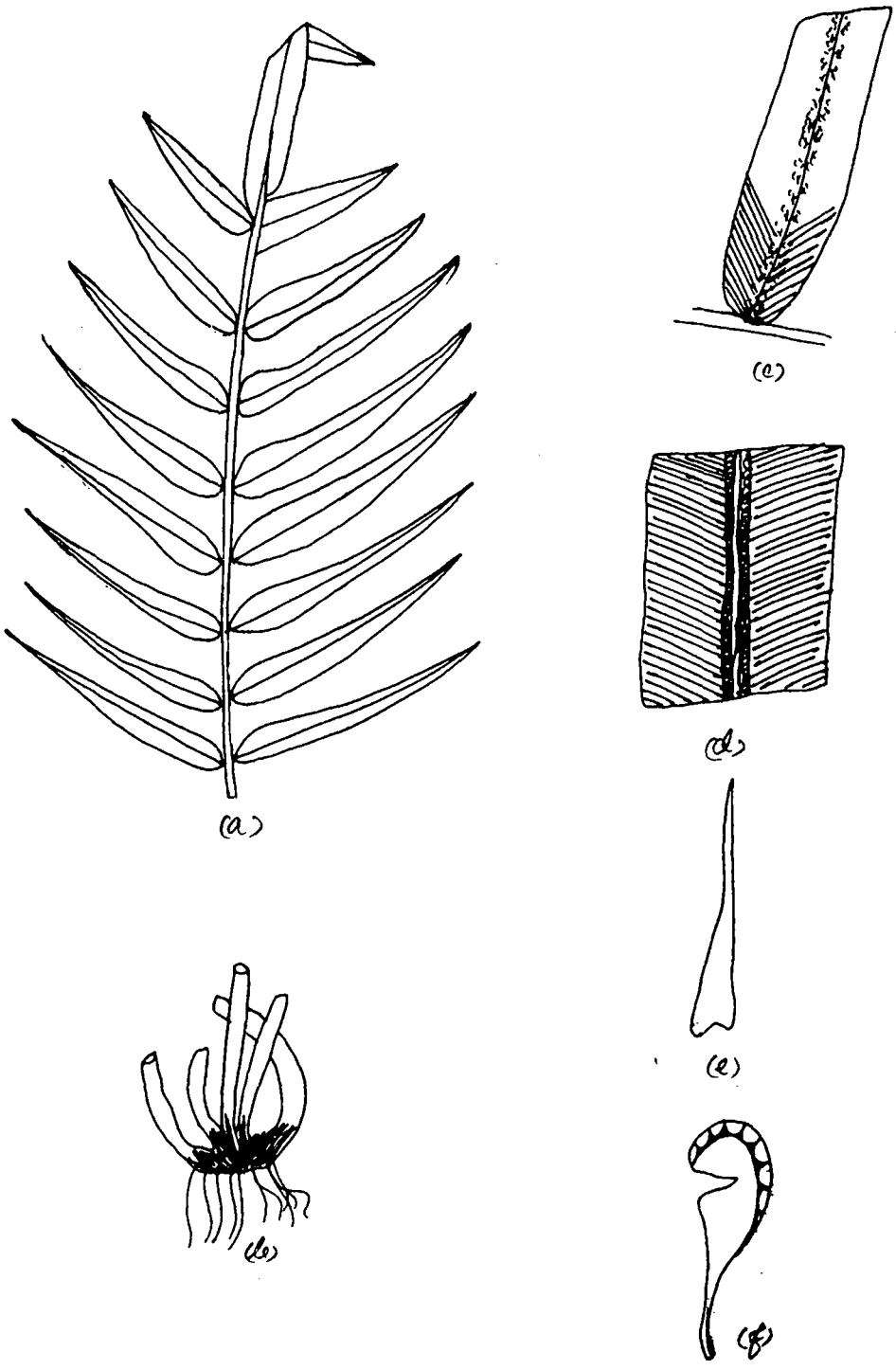
Economic Utility:

Forms of use locally :

Parts used : Pinnae.

Uses : Hot decoction of the pinnae applied externally over abscess to liberate pus and also for antiseptic action.

PLATE 30



Blechnum orientale; (a) Portion of lamina (b) Rhizome (c) Portion of pinna (d) Portion of pinna enlarged showing venation & sori (e) Scale (f) Sporangium

Established reports of utility : Fresh fronds are used as poultice for boils; rhizomes used as anthelmintic, as acure for intestinal worms, urinary troubles and as cure of delirium.**(Borthakur *et al.*, 2001).**

32. STENOCHLAENACEAE Ching. in. Acta. Phytotax. Sin.16(4):18.1978.

Stenochlaena Smith. in. J. Bot. (Hook.) 3:401.1841.

S.palustris (Burm.) Bedd. Ferns Brit. India. Suppl. 26.1876; Handb. Ferns. Brit. India, 421. t.253.1883; Jamir & Rao, Ferns Nagaland, 404.1988; Manickam & Irudayaraj, Pterid. Fl. West. Ghats-S. India, 303. t.232. 1992. *Polypodium palustre* Burm. Fl. Ind.234.1768. *Acrostichum palustre* (Burm.) Clarke, Trans. Linn. Soc. Lond.II. Bot. 1.577. 1880. *Stenochlaena scandens* (Sw.) J. Sn. in. Hook. Journ. Bot. 3.401.1841 ; Bedd. Ferns South. India, t.201. 1864. **Loti paloi (B).**

Terrestrial. Twiners, upto 7 m long; coverd with scales. scales cordate-lanceolate, attached above the base, thick, dark brown. Lamina upto 2 m tall, distant on rhizome; pinnae articulate on their axis, sterile pinnae lanceolate, acuminate at apex, cuneate at base, margin serrate-dentate, coriaceous, glabrous ; fertile pinnae linear, upto 20 x 0.4 cm. Veins simple with occasional forkings, free parallel.Sori acrostichoid. scattered throughout the surface of lamina ; sporangia slender stalked, oval; spores elliptical, light brown.

Habitat & Ecology : Very commonly found in tree trunks, covering densely.

Sporulation : April - September.

Specimen examined : Nivea, PSD 0210, dt. 5.9.05.

Economic utility :

Forms of use locally :

Parts used : Rhizomes and stipes.

Uses : The rhizomes and stipes are kept in salt water and then used as cordage in binding fish traps and as anchor ropes.

Established reports of utility : The decoction of leaves is taken in fever. Fronds are used to treat fever and skin diseases and leaves to treat throat and gastric ulcers. Tender shoot are edible. **(Borthakur *et al.*, 2001).**

33. AZOLLACEAE. Wett. Handb. Syst. Bot. 77. 1903.

Azolla Lam.et. Poit. Encycl. Meth. Bot.1:343.1783.

A.pinnata. R.Br. Prodr. Fl. Nov. Holl.167.1810; Dhir, Ferns N.W. Himalayas, 52.1980. Jamir & Rao, Ferns Nagaland, 405.1988; Manickam & Irudayaraj, Pterid. Fl. West. Ghats-S. India, 345. t.261.1992. **Pani pata(B).**

Aquatic. Plant about 2 x 1.5 cm with triangular stem. Stem horizontal, profusely branched. Roots 5 cm long, unbranched, densely covered by hairs. Leaves about 1x0.6 mm, sessile, alternate, dorsal lobe aerial, more or less rectangualar, margin entire with membraneous border, thick, grey-green, upper surface with dense, short, blunt trichomes; veins indistinct, ventral lobes submerged, ovate, apex blunt or rounded, base cuneate, margin entire, veins distinct, copiously anastomosing ; texture thin, membraneous glabrous and brown. Megasporocarp ovoid, smaller than microsporocarp, with a single mega sporangium; microsporocarp about 1 mm in diameter, glabrous, brown, containing numerous stalked micro sporangia. Spores small, round, translucent.

Habitat & Ecology : Found common in rice fields also in stagnant ponds, ditches etc.

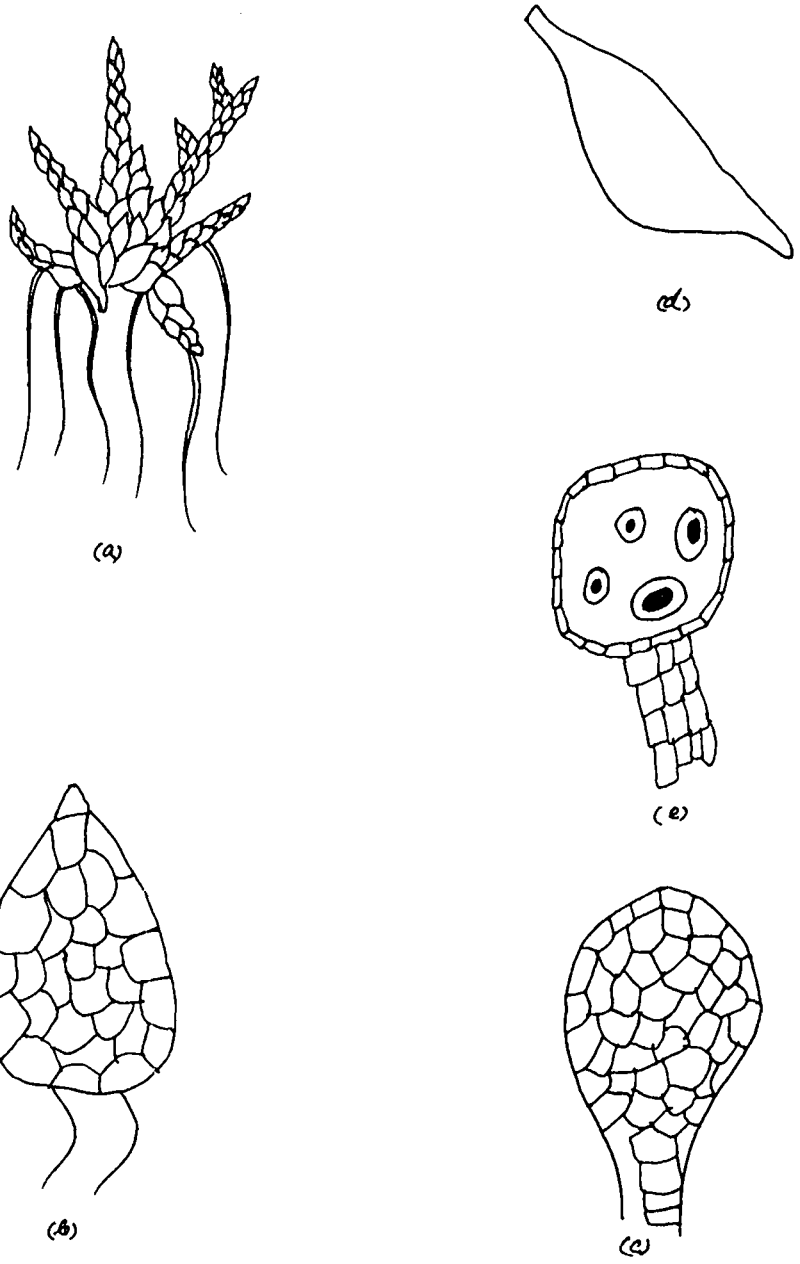
Sporulation : May - August.

Specimen examined : Kankalash, PSD 0268, dt. 20.4.06.

Economic utility :

Forms of use locally :

PLATE 31



Azolla pinnata; (a) Habit (b) Microcporocrop (c) Microsporangium (d) Megasporocrap (e) Megasporangium

Parts used : Whole plant.

Uses : Used as agood food for poultry and ducks. It also used as biofertiliser in rice fields.

Established reports of utility : It used as biofertilisers in rice crops and nowadays to other crops as well **(Borthakur *et al.*, 2001).**

34. SALVINIACEAE Dumor. Anal. Fam. Pl. 67.1829

Salvania Seguir. Fl. Venox. 3:52. 1754.

Key to the species:

1. Hairs on papillae on upper surface of floating leaves are in regular rows. ***2.S.natans.***

1'. Hairs on papillae on upper surface of floating leaves are not in row but irregularly scattered. ***1.S.cucullata.***

1.S.cucullata. Roxb. ex Bory, Bel.Voy. Bot.2.6.1833. **Pani pata(B).**

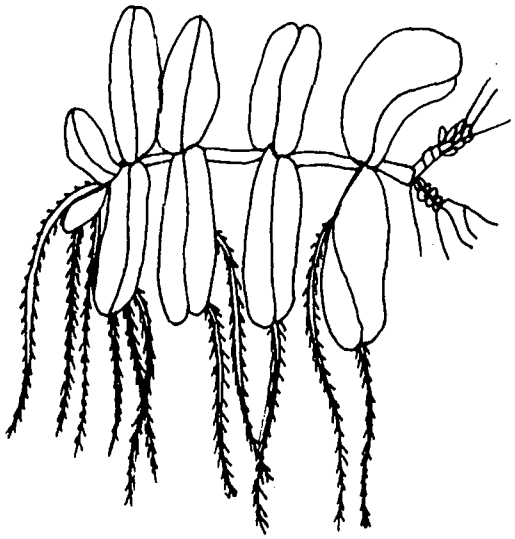
Aquatic, free floating plants. Stem about 3.5 mm thick, spongy, terete, branched with nodes and internodes, hairy. Floating leaves 1.5x1cm, sessile, opposite, horizontally spreading, oblong, rounded or slightly cordate at base, margin entire, upper surface tufted hairy; lower surface thinly matted like a stem with shining pellucid brown hairs ; veins anastomosing forming elongated areoles; texture soft herbaceous, pale green. submerged leaves root like, about 5 cm long, covered by hairs, brown. Sporocarps borne in clusters on sub-merged leaves, ovoid, sessile, 2 .5 mm in diameter, densely hairy, all alike but some containing microsporangia and others mega sporangia.

Habitat & Ecology : Found commonly in paddy fields, ponds etc.

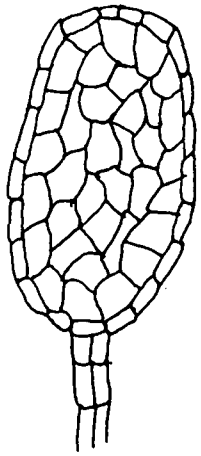
Sporulation : May - December.

Specimen examined : Railway colony, Karimganj, PSD 0299, dt. 16.6.06.

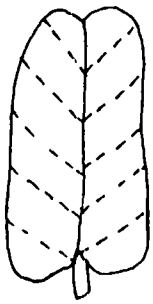
PLATE 32



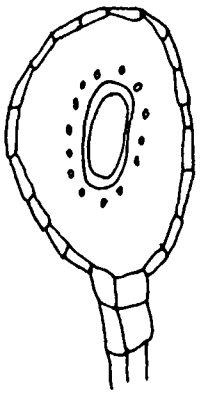
(a)



(c)



(b)



(d)

Salvinia cucullata; (a) Habit (b) Floating leaf showing venation (c) Microsporangium (d) Megasporangium

Economic Utility:

Forms of use locally :

Parts used : Whole plant.

Uses : Used as good food for poultry and also used as biofertiliser.

Established reports of utility : Used as good ration for ducks and also used as biofertiliser **(Borthakur *et al.*, 2001).**

2.S. natans. (L.) All. Fl. Pedem. 2.289.1785; Dhir, Ferns N.W. Himalayas, 51.1980; Jamir & Rao, Ferns Nagaland, 406.1988. *Marsilea natans* L.Sp. Pl.2.1099.1753. **Pani pata(B).**

Aquatic, free floating plants. Stem about 2.5 mm thick, horizontal, terete, branched with nodes and internodes. Floating leaves 1.5 x 1cm, borne at the nodes, opposite, sessile, slightly erect, crowded oval, apex rounded, base cuneate or cordate, margin entire, intercurved so that the leaves become funnel shaped, upper surface closely papillose, under surface nearly bare; veins anastomosing to form parallel, elongated areoles; texture soft herbaceous, pale green. Submerged leaves root like, 4-8 in a cluster,arising from the nodes of stem, 5cm long, covered by brown, septate hairs. Sporocarps quite alike in external appearance but some containing microsporangia and others mega sporangia; sporacarps ovoid or globose, covered by multi cellular hairs. Found common in ponds, fields and stagnant water bodies.

Habitat & Ecology : Found in paddy fields and ponds etc.

Sporulation : May - December.

Specimen examined : Jhumbasti, Badarpur, PSD 0277, dt. 21.4.06.

Economic Utility:

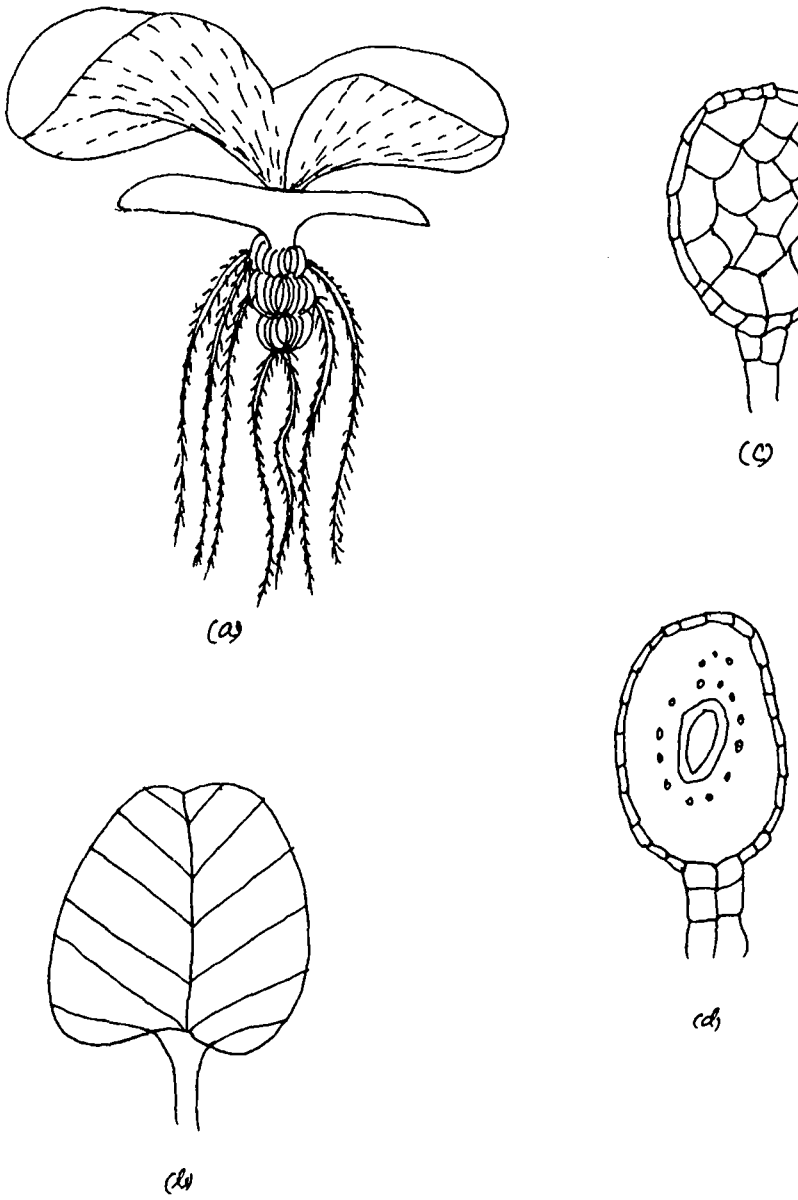
Forms of use locally :

Parts used : Whole plant.

Uses : Used as good food for ducks and also used as biofertiliser.

Established reports of utility : Used as good ration for poultry and also used as biofertiliser **(Borthakur *et al.*, 2001).**

PLATE 33



Salvinia natans; (a) Habit (b) Floating leaf showing venation (c) Microsporangium (d) Megasporangium

PHOTOGRAPHS
From 37 to 48

PHOTO 37

PHOTO

PHOTO 39

PHOTO 40

PHOTO 41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